Belimo
Fire and Smoke

Retrofit Instruction Guide

BELIMO

Table of Contents

General Information

This document is intended to aid in the conversion and repair of an existing life safety damper. Please be aware that despite Belimo's best efforts, some information may not be accurate. This document should be used as a guide, all changes and system designs should still be reviewed by your local AHJ.

Life safety dampers must be in working order at all times. They ensure safety to everyone in the building. In order to ensure this, they need to be tested regularly and this is dictated by the Periodic Testing schedule (below). Depending on which application your damper is serving will determine how often it must get tested.

Chapter 7 IBC & IFC "Containment" Dampers
Testing required every 4 years, except in hospitals every 6 years

Chapter 9 IFC "Smoke Control System" Dampers	
Dedicated Testing required every 6 months	**Nondedicated** Testing required every year

Fire & smoke dampers are appliances and field replacement of components is required when failure of any component occurs.

The Authority Having Jurisdiction (AHJ) 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.

UL®

D. DAMPER ACTUATORS

... As such, 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 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."

UL Dampers for Fire and Smoke Protection Marking and Application Guide; May 2020. Section 5, D. by Underwriters Laboratories Inc.

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.**
- **Note that where any fire alarm wiring is touched, the fire department must be informed.**
- **Disconnect and lock out power before starting to disconnect old motor.**
- **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.**

Note on Alarm Systems or Smoke Control Systems

- **If any wiring to an alarm or smoke control has been touched, the Fire Marshal may require verification that the system remains functional**
- **In some cases the auxiliary switches of the actuator are used to signal status to a smoke control system. Function cannot be disturbed.**
- **In some cases the auxiliary switches power local indicator lights. These have only supervisory function and are not part of the fire alarm system.**

Verify requirements with AHJ – Fire Marshal or Building Official.

Definitions

Fire Dampers; Most Fire Dampers are gravity or spring loaded and released by a heat activated fusible link. However there are many benefits when an actuator is used including remote testing capabilities. New Fire Dampers are tested in accordance with UL555 (Figure 1.1).

Figure 1.1

Smoke Dampers do not have a high temperature limit. Older actuators without internal springs depended on a shaft or external spring to close the damper whenever the actuator power is removed. New Smoke Dampers are tested in accordance with UL555S (Figure 1.2).

Figure 1.2

Combination Fire & Smoke Dampers combines the smoke sealing capabilities of a standard smoke damper with the high temperature capability of a fire damper. Combination Fire & Smoke dampers are tested in accordance to UL555 and UL555S (Figure 1.3).

Figure 1.3

Photo Courtesy Pottorff

Standards and Codes

NFPA

Repair recommendations can be found in NFPA 80 Standard for Fire Doors and Other Opening Protectives, and NFPA 105 Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.

Fire & smoke dampers are considered to be appliances and field replacement of defective parts is required. NFPA also says "after discovering a failure repair should be performed as soon as possible."

Local Code Approval

The administrative section of codes state that all mechanical and electrical systems must be kept in working order and an individual code section may state that all life safety devices and systems must be operable. Codes rarely address replacement issues in any detail. Consult the Fire Marshal and/or Building Department for local requirements. A permit and inspection could be required if a large number of actuators are being repaired. Some jurisdictions place a limit on the number of devices to be replaced before a permit is required. If wiring to the fire alarm or smoke control system is touched, then the fire department must be informed. Some actuator auxiliary switches are used to signal the Fire Fighters Smoke Control System or Fire Alarm. If so, and an actuator with aux switches is replaced, the fire department should be informed.

In all cases, a record should be left on the premises when an actuator (or any other part of a damper) is replaced. See the Forms chapter for examples if no official form is available locally.

The important points that should be taken from this document are:

1. The same actuator can be applied several ways since fusible links, thermal sensors, and external springs can be applied different ways to achieve the same result.
2. Investigation of each damper should be performed to identify the right way to repair.
3. After determination of the repairs necessary, performance testing must be performed.

Replacement Issues

Change has obsoleted many combinations of products. Some actuators and dampers are no longer manufactured and no current UL555 listings exist. In lieu of other clearly defined replacement criteria, the following technical rules are recommended practice:

1. It is standard procedure for damper manufacturers to obtain UL555S listing with several actuators for the same damper. Where the actuator being installed is UL555S listed, no further requirements are necessary provided the temperature, time, torque, voltage, amperage are matched correctly and conformance testing is performed. That is, the correct model must be installed and the assembly tested.
2. Damper manufacturers have installation instructions for replacement of actuators on some dampers. These should be obtained and utilized. In the past UL allowed field installation of actuators and it was sufficient to use the instructions. UL no longer oversees field or replacement applications.
3. Where older dampers or actuators are involved and are no longer manufactured the following rules should apply:
   - **a. Check damper itself for proper operation.** Clean all components insure that shifting of ducts or damage to side seals has not restricted closure, or failure of mechanical parts has not occurred over time. Do not replace the actuator or any components if the entire assembly is not functional. The warning below appears in the instruction sheets.
   - **b. Temperature –** the replacement actuator shall have been UL555(S) tested at the same or better temperature as the original actuator. 250°F or 350°F are standard. Code is 250°F. However, some other applications require higher temperatures.
   - **c. 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. Consult the AHJ with any questions.
   - **d. Torque** – replacement actuator shall have equal or greater torque than the failed actuator.
   - **e. Voltage** – replacement actuator shall have the same voltage rating as the original.
   - **f. 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.
   - **g. Final Testing –** actuated damper and associated devices shall be tested for proper operation. See Acceptance testing details below.
   - h. Where any **structural modification** is made, a permit is required.
   - i. Where change from **pneumatic to electric** is performed, a permit is required. In addition,the damper manufacturer's instructions, wiring diagrams, and other components (e.g., elevated 250°F thermal disks for electrical interruption) must be used..
   - j. AHJ should be consulted to obtain local rules which do vary among jurisdictions.

Note that smoke dampers do not have high temperature limits, bimetals, or fusible links. Therefore, regardless of spring type, a Belimo with internal spring can be employed after disabling the old spring. The following applies to combination fire and smoke dampers.

WARNING!

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

Replacement Issues (Cont.)

External Single Spring with Fusible Link

It may be necessary to disable the old spring and primary sensor, install modern actuator, and install a modern thermal sensor.

Some dampers had a single spring that was tensioned when the actuator was driven open; the actuator held the damper open when powered. Pottorff and Accurate used this method on some dampers.

Then if the smoke detector or relay cut power to the actuator, the shaft spring drove the damper closed.

If the fusible link melted due to elevated temperature (165°F typically), then the connection between the damper and the actuator was separated. The spring then engaged and closed the damper. The actuator could not drive the damper back open until the fusible link was manually replaced and the connection remade.

There were several variations of this. One was a flat “negator’ spring that touched the damper blade itself. Another was a spring wrapped around the jackshaft. Another had a spring built into the crank arm. American Warming / Air Balance and Ruskin had several versions like this. Pottorff used this method also.

Dampers that used any of these methods require that the spring be removed or disconnected and the fusible link be removed or bypassed if a new actuator is to be installed. An electrical thermal sensor (thermodisc) must also be installed. An exception exists with Ruskin dampers less than 1 sq. ft.

The damper manufacturer’s instructions must be used for the repair since changes to the damper are being made. AHJ should be consulted regarding the need for witnessing the testing.

A Belimo actuator may be installed after making the proper damper modifications.

Dual Springs with Fusible Link

In most cases, simply installing a new actuator repairs the damper function.

Most companies used two springs. One was pretensioned and the fusible link held it ready. If the link melted, the damper slammed closed. This spring was not a load on the actuator. An external spring (example shown to right) was used to close the damper when the actuator was not powered. When the actuator drove open, it tensioned this spring.

The damper manufacturer's instructions must be used for the repair since changes to the damper are being made. AHJ should be consulted regarding the need for witnessing the testing.

A Belimo actuator may be installed after making the proper damper modifications.

This is similar to a modern damper actuator operation. When replacing the actuator, the second actuator spring must be removed – NOT THE FUSIBLE LINK SPRING. The new actuator would have to operate against its own internal spring and the external spring – a larger actuator would be required and that application is not UL Listed. A Belimo FS actuator may be installed after removing the defective actuator and external spring. Any assembly should be examined to see if a fusible link exists and how the fusible link is set up. This could be a smoke damper and no high limit exists. Different damper companies mounted and applied the same actuator in different ways.

The warning in Figure 1.5 is placed in instruction sheets. In addition, do not place hands between damper blades. Inadvertent release of actuator or springs can allow injury to occur.

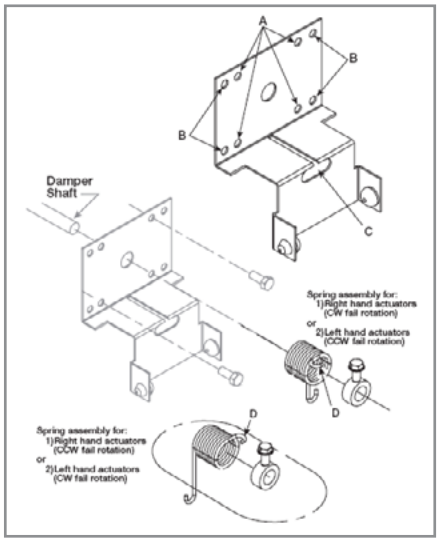


Figure 1.4

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.

Figure 1.5

2. Authority Having Jurisdiction (AHJ) Notification Forms

Building Official / Fire Marshal Notification Form for Dampers Without Fusible Links

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. 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_____

_____

_____

_____

Building Official / Fire Marshal Notification Form for Dampers With Fusible Links

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. Fusible Link Combination Damper

A. Open smoke detector or relay wire or contact to cut power. Damper springs closed.
B. Reconnect power. Damper drives open.
C. Unhook fusible link. Replace if broken. PROTECT HANDS. Damper springs closed.
D. Reopen damper and rehook fusible link.
E. Repeat steps a. and b. Damper drives open.

2. Reopenable Two Sensor Fire-Smoke Combination Damper

(Since this system involves the Firefighters' Smoke Control System, inform fire department in all cases.)
The sequence will be similar to that described below. After the above test perform the tests below.)

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_____

_____

_____

_____

3. Ruskin

Replacement of Ruskin Philips P150 to Belimo

Cross Reference

For greater detail, visit www.belimo.com/firesmoke or refer to the RetroFIT+ tool for Cross Reference.
https://www.belimo.com/us/en_US/products/retrofit-app/

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Ruskin has passed multiple sections with multiple Belimo 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 Jackshaft 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. (Figure 3.1)

Scan QR Code for more information on RetroFIT+

Figure 3.1 Typical existing installations

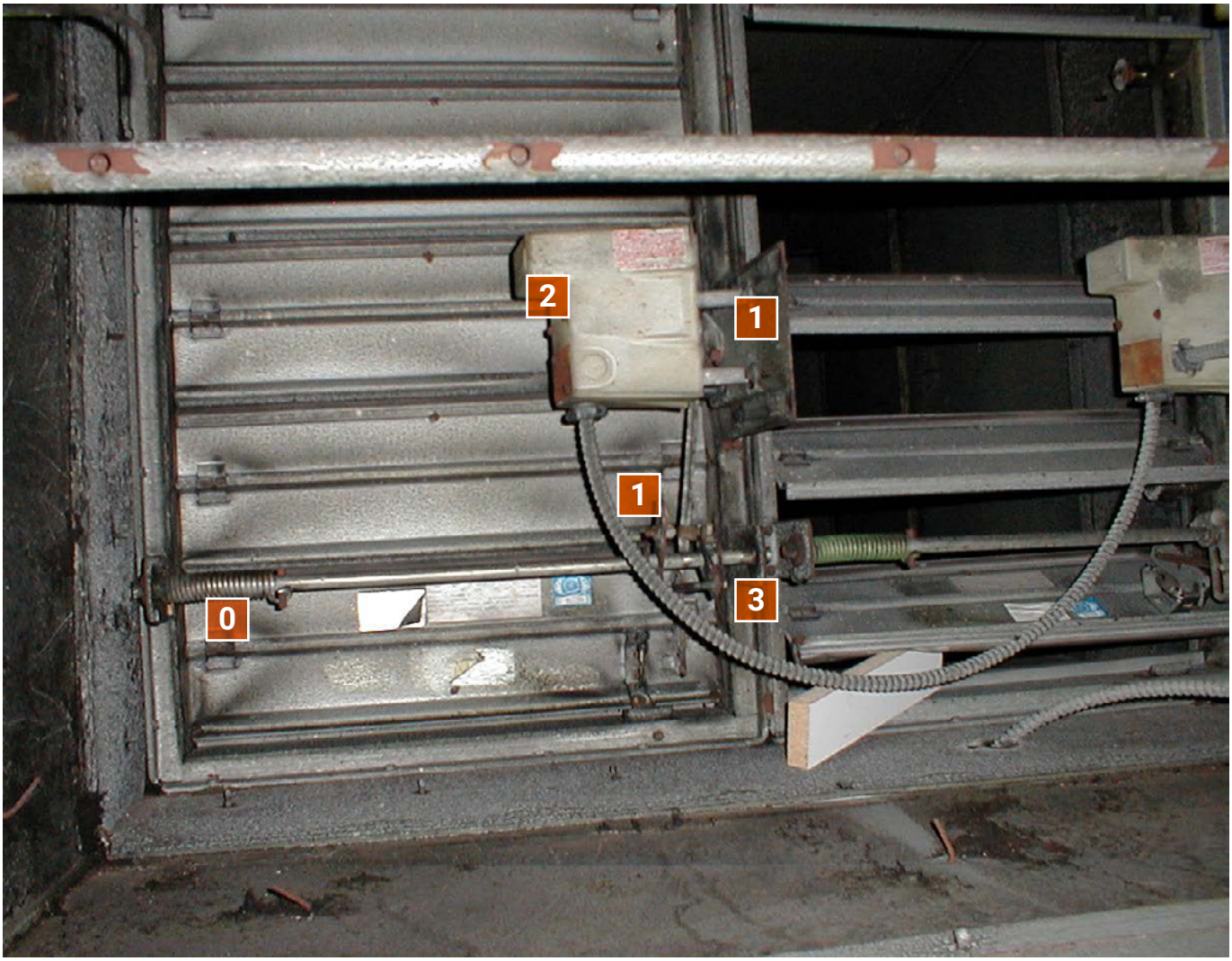


Figure 3.2

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

1.
Disconnect linkage and rod

2.
Remove motor

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.

Problem

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.

1. points at the primary thermal sensor.

2. 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.

Be sure to complete the notification form and submit it to your AHJ.

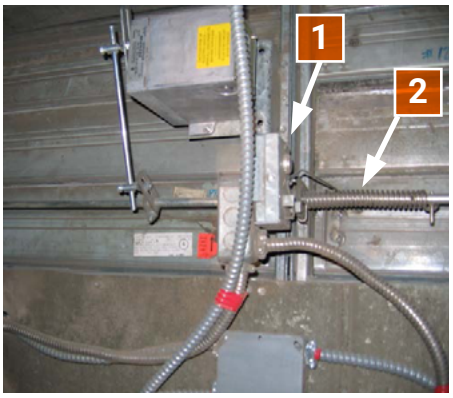


Figure 3.3

Figure 3.4

WARNING!

USE CAUTION

SPRING IS UNDER HIGH TORSION AND MAY CAUSE SERIOUS INJURY!

Replacement of Pneumatic Actuators on Ruskin Negator Spring Dampers with Belimo

Mounting a Belimo actuator is straightforward when replacing most pneumatic actuation. Mount over the shaft when the old actuators were external. For internal mount, contact Belimo, see the mounting chapter, view our PGPL damper accessories section, or view our product data sheets for a complete list of compatible accessories.

Most existing pneumatic smoke control systems used an EP relay to put air into the actuator to drive the damper open. They cut power to the EP relay (right) which dumps air out of the actuator. The old controls will have been wired similarly to the drawing below. In many cases one EP controlled multiple actuators. If that is the case, multiple relays from the smoke control system may be required. Contact Belimo should wiring assistance be required.

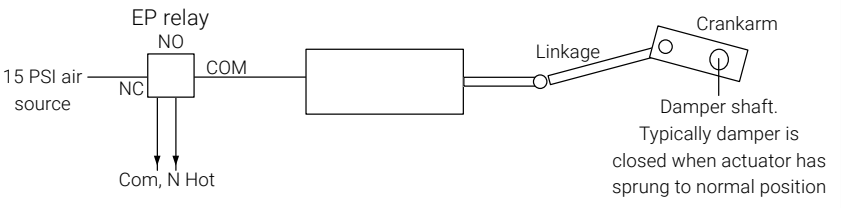


Figure 3.7 **Typical pneumatic actuation.** If smoke control system cuts power to EP relay then actuator has zero air pressure and springs damper closed.

Figure 3.5

Figure 3.6

WARNING!

USE CAUTION

Conversion of a pneumatic actuated fire and smoke damper is not a like for-like replacement. Consult with AHJ for any submittal, permit, inspection, and re-testing requirements.

Fusible-Rod Damper Actuator Wiring

Where the fusible-rod and negator spring(s) are present and functional, this is the typical wiring. There is no electrical thermal disk as the fire closing function is performed by the rod and negator spring.

See actuator replacement section for derated damper area recommendations on page 3.11.

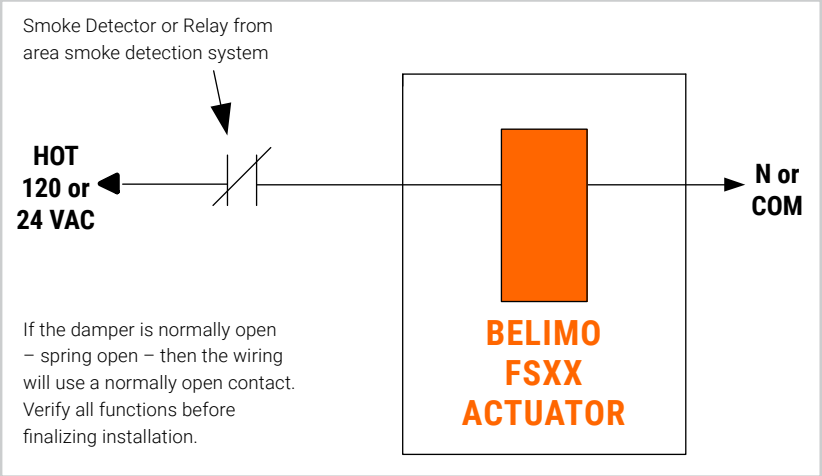


Figure 3.8

Actuator replacement begins with the damper, not the old motor

The negator damper design is unlike modern dampers. A negator spring attaches from a post on the damper frame to the blade. A fusible rod connects between the blade and the jackshaft. The rod melts at 165°F (74°C) disconnecting the crank arm and motor from the blade. The negator blade spring pulls the damper blades closed.

In normal operation if air pressure is cut from the actuator, both the negator spring and the actuator spring close the damper blades. The actuator no longer holds the damper blades open.

There is a fusible link on a bracket connected to the blade. The link melts at 165°F and allows the catch on the frame to hold the damper closed. It is not involved in the actuator replacement process. The fusible link should be replaced if broken.

See following pages for examples of the components discussed above.

Solution

Negator spring connecting post and damper blade can be seen in Figure 3.9.

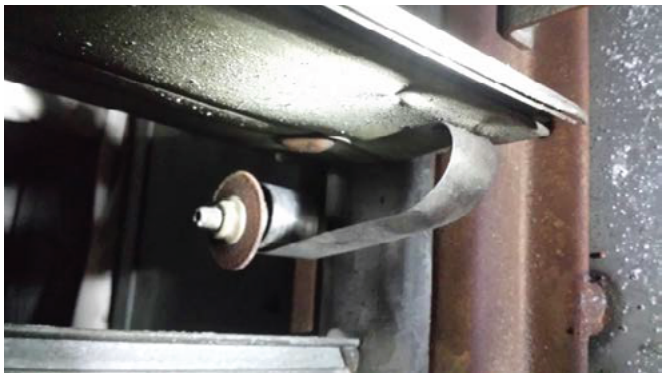


Figure 3.9

Problem

Negator spring separated between post and damper blade can be seen in Figure 3.10.

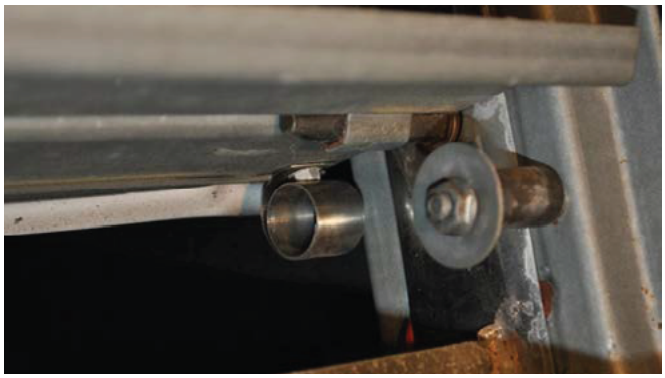


Figure 3.10

(Figure 3.11) From top – Jackshaft, crank arm, fusible rod, blade, negator spring. At the very bottom left is the spring catch latch plate.

(Figure 3.12) The fusible link and spring catch are seen on the blade.

Figure 3.11

Figure 3.12

Broken Fusible-Rod or Negator Spring

NEITHER THE FUSIBLE RODS OR NEGATOR SPRINGS ARE AVAILABLE.

If the damper is otherwise intact with functioning negator springs, fusible link and spring catch, and fusible rods, then if replacing pneumatic actuators with Belimo actuators, it is recommended to bring the damper up to modern methods. However, the actuators only may be replaced along with updated control wiring. See below for component replacement methods.

Intact negator springs should be removed to prevent possible obstruction. With a Belimo actuator with an internal spring, the damper will perform the same as modern dampers.

Note that the smoke control system cuts power to one or more actuators in addition to the local EFL or BAE control. Confirm all wiring performs the same function as the original or as the AHJ instructs.

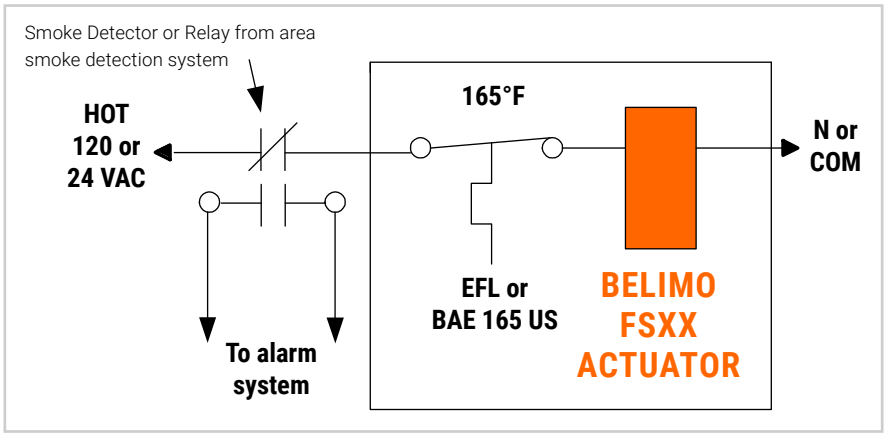


Figure 3.13

Replacing the Fusible Rod

The pieces of the fusible-rod must be removed and two 5/16” ball joints and a short push-rod installed to connect the damper blade to the jackshaft crank arm.

(Figure 3.14) The fusible rod connects in the same 5/16" holes on the damper blade bracket (#1) and crank arm (#2) as ball joints.

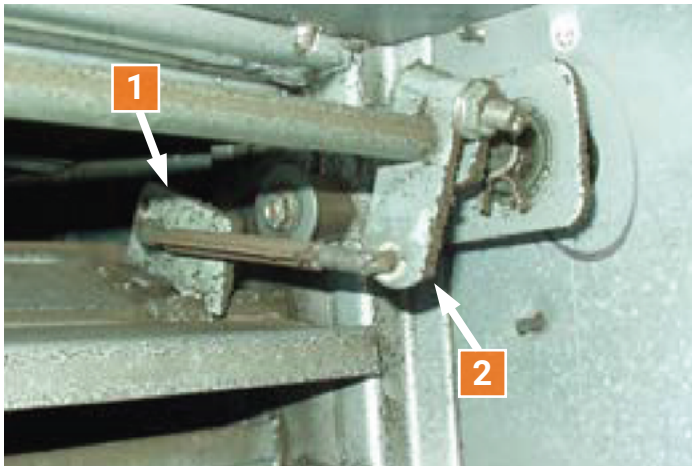


Figure 3.14

WARNING!

USE CAUTION

The damper's fire closing function will not operate unless the negator spring works or the damper is repaired per the instructions here or from Ruskin.

(Figure 3.15 - Fig. 3.16) The fusible rod is replaced by two ball joints and a short piece of push rod as shown here. A thermal sensor takes its place.

Figure 3.15

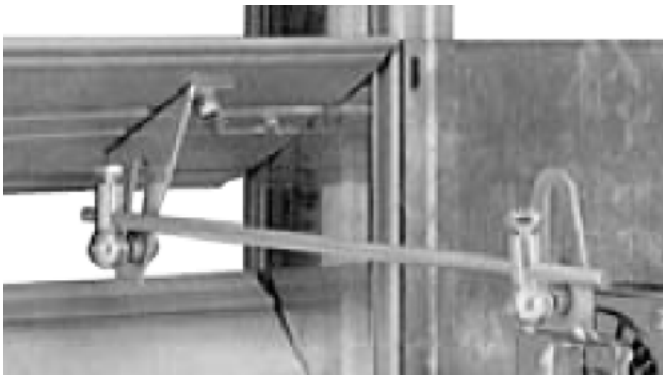


Figure 3.16

Actuator Replacement

Most pneumatic actuators were externally mounted to the damper shaft or jackshaft. Replacement is simple.

If the old damper's negator springs and fusible rod are intact, then use an FSLF 30 in-lb actuator for dampers with a single negator spring under 2 sq. ft. in total area. For dampers from 2 to 6 sq. ft. with 2 negator springs, use the FSNF 70 in-lb actuator.

If the old damper's negator spring has been removed and the fusible rod replaced with ball joints and a short push rod, then:

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Larger dampers should not exist, but unauthorized field modifications may have occurred.

Be sure to complete the notification form and submit it to your AHJ.

For Electric motor replacements and retrofits click here.

Replacement of MP1161B or MP2781 on Ruskin with Belimo

Examples of MP2781 or MP1161B Motors

Figure 3.17

Figure 3.18

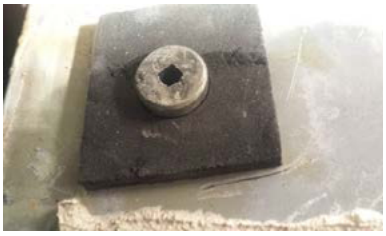


Figure 3.19

Figure 3.20: Detail of duct, hub, shaft, and motor

Figure 3.21: External view of motor attached to duct

Note that knowing the motor part number is insufficient for a proper retrofit.

Examination of the springs and fusible rods is necessary.

Complete re-control is recommended.

Figure 3.22: 1161B

Actuator Replacement Begins with the Damper, not the Old Motor

The negator damper design is unlike modern dampers.

A negator spring attaches from a post on the damper frame to the blade. A fusible rod connects between the blade and the jackshaft crank arm. The rod melts at 165°F (74°C) disconnecting the crank arm and motor from the blade. The negator blade spring pulls the damper closed. There is no external spring or spring in the motor. A fusible link and catch spring were used to hold the damper tightly closed.

The motor was returned to its starting position when the negator spring pulled the damper blades closed.

The fusible link used to hold a spring metal catch that latched to the damper frame is not involved in the actuator replacement process. It should be replaced if broken. [It was also 165°F (74°C)].

See following pages for examples.

Solution

Negator spring connecting post and damper blade.

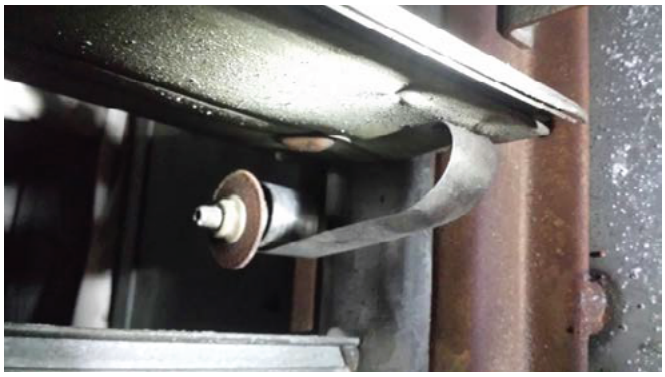


Figure 3.23

Problem

Negator spring separated between post and damper blade.

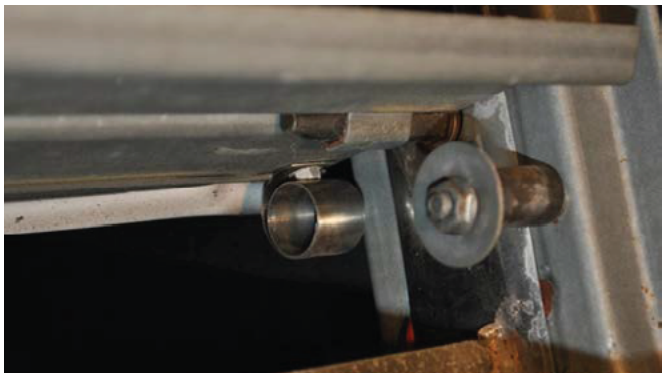


Figure 3.24

(Figure 3.25) From top – Jackshaft, crank arm, fusible rod, blade, negator spring. At the very bottom left is the spring catch latch plate.

(Figure 3.26) The fusible rod (#1) and fusible link (#2) with spring catch are shown by arrows.

Figure 3.25

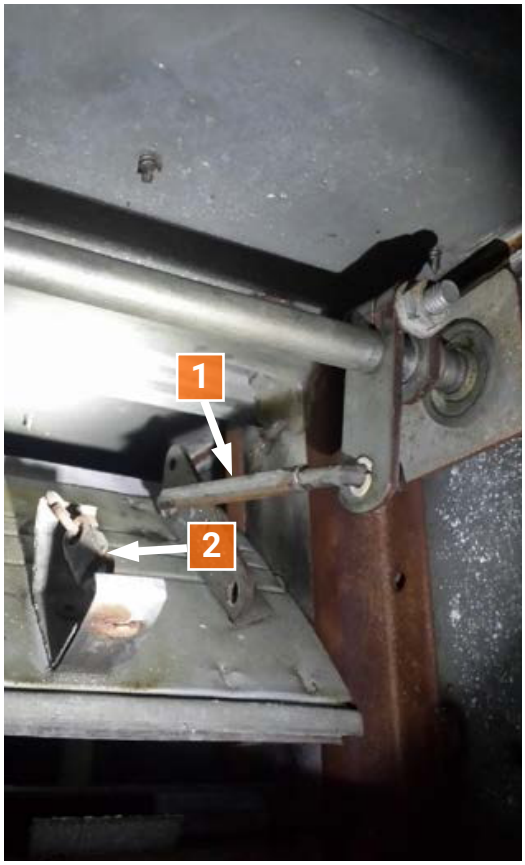


Figure 3.26

The MP2781 and MP1161B were used on the FSD60, FSD36, FSD35, FSD34, SD60, SD36, SD35, and SD34. FSD are fire and smoke dampers. SD are smoke only dampers.

Broken Fusible-Rod

The manufacturer has discontinued production of the fusible rods and Ruskin has no stock. If either a spring assembly or a rod are defective then re-control is necessary as described below. Fusible links are still available as of this writing.

Replacement rods and negator springs are not available.

Broken Negator Spring or Fusible Rod

If the negator spring is missing or disconnected then the damper must be re-controlled. The blades will not be pulled closed in case of fire. If the fusible rod is broken the damper will not open or close as the motor is not connected.

1. The old spring assembly must be removed to prevent possible obstruction and extra torque load on the Belimo actuator.
2. A modern spring return actuator must be installed. The FSLF is the recommended replacement.
3. The fusible-rod must be removed and replaced with two 5/16" ball joints and a length of 5/16" push rod. The holes in the crank arm and damper clip fit the 5/16" holes.
4. A new thermal switch must be installed to cut power and close the actuator by engaging its spring in case the ambient temperature in the duct rises to 165F. A Ruskin EFL (electronic fusible link) or a Belimo BAE165 US is inserted into the duct and wired per the drawing below.

With a Belimo actuator with an internal spring, the damper will perform the same as modern dampers.

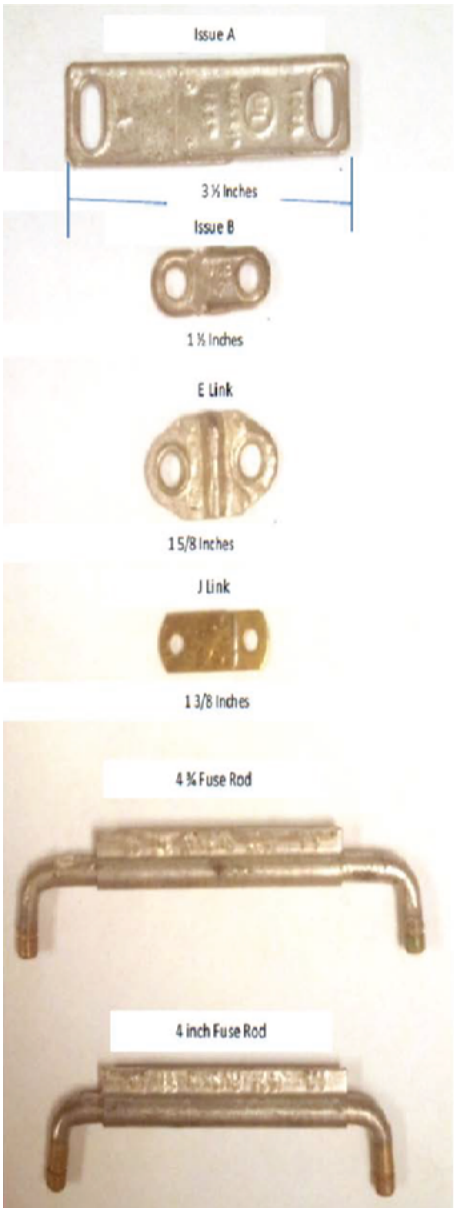


Figure 3.27

Replacing the Fusible-Rod

The pieces of the fusible-rod must be removed and two ball joints and a short push-rod installed to connect the damper blade to the jackshaft crank arm. The holes that the fusible rod fit into accept a 5/16" ball joint.

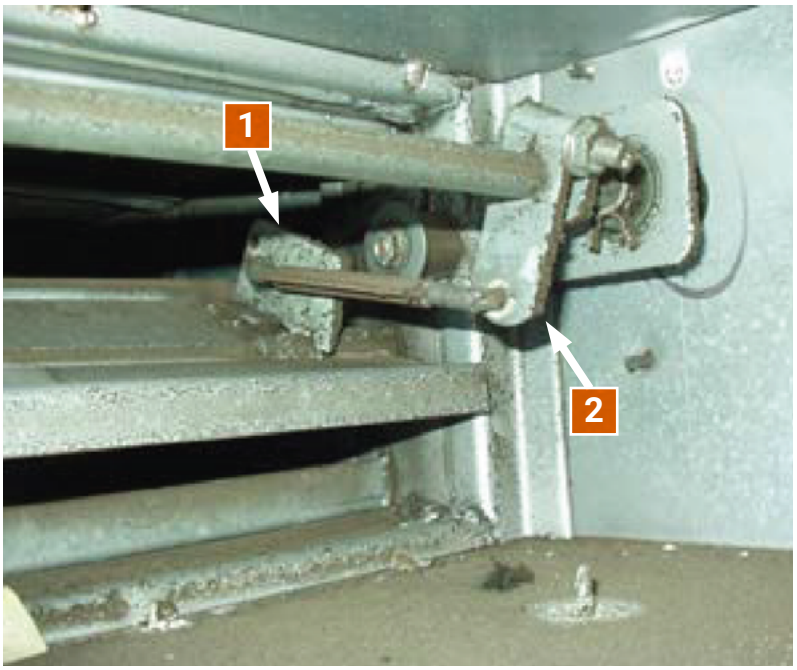


Figure 3.28

The holes into which the fusible rod connects are the same size needed for ball joints (Fig. 3.28).

1. the damper blade bracket
2. the crank arm as ball joints

Figure 3.29

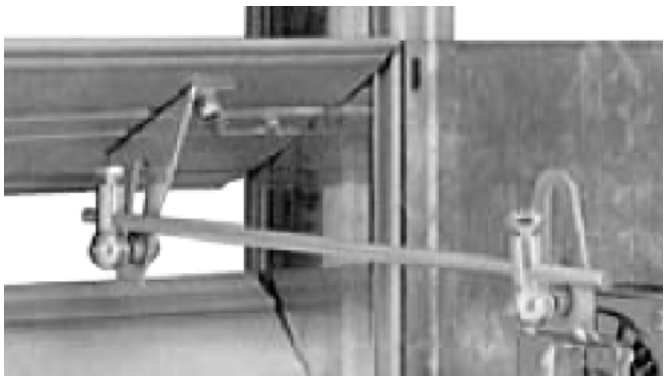


Figure 3.30

WARNING!

The damper's fire closing function will not operate unless the negator spring works and the rod between the crank arm and blade is intact.

Actuator Replacement

Ruskin makes a kit with the FSLF120 actuator and adapters.

Belimo does not supply a replacement kit for the MP2781. The FSLF120/MP kit discussed below is available from local Ruskin representatives. See http://www.ruskin.com/reps/

Belimo does have parts for replacement of pneumatic actuators. In this situation, you will need to:

- Size the required actuator torque to the damper. This is typically based on Sq. ft. of the Damper.
- Required Temperature rating
- Power requirement
- Additional features such as modulation, switch control, or Remote inspection capabilities.

Try the RetroFIT+ app for help

https://www.belimo.com/us/en_US/products/retrofit-app/

In order to adapt the old MP motor with its .2" square male shaft end, a female socket was welded onto the damper shaft. (See Figure 3.19) The welded piece must stay on the shaft. A shaft adapter insert and actuator with hold down bracket is contained in the Ruskin FSLF120/MP kit. These dampers were typically maximum 1 sq. ft. If large or multisection dampers are found with multiple negator springs, contact Belimo for assistance. The damper may not be a Ruskin.

Ruskin part number FSLF120/MP.
This must be ordered from the local Ruskin Representative or from Ruskin. Not available from Belimo

Scan QR Code for more information on RetroFIT+

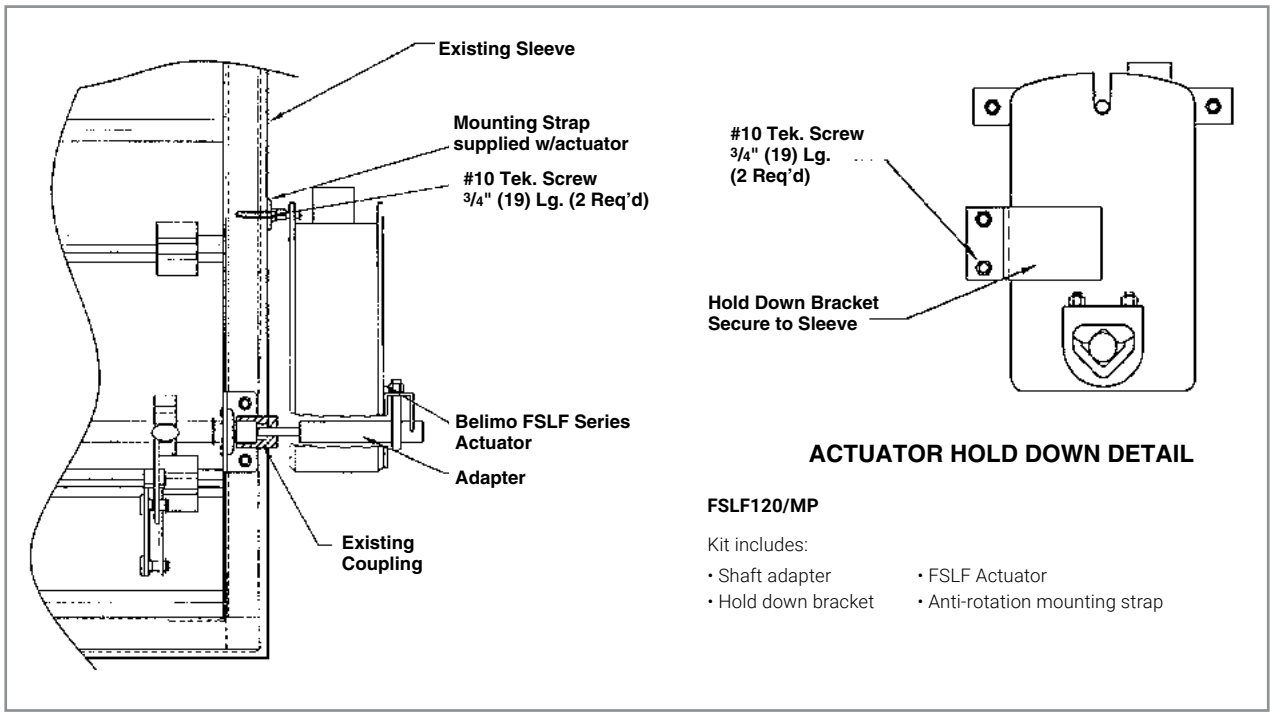


Figure 3.31

Summary

Defective negator spring, fusible rod, or motor.

The Ruskin FSLF120/MP kit must be purchased. Remove negator spring and replace fusible rod with 2 ball joints and a short section of push rod. Install Ruskin EFL or Belimo BAE.

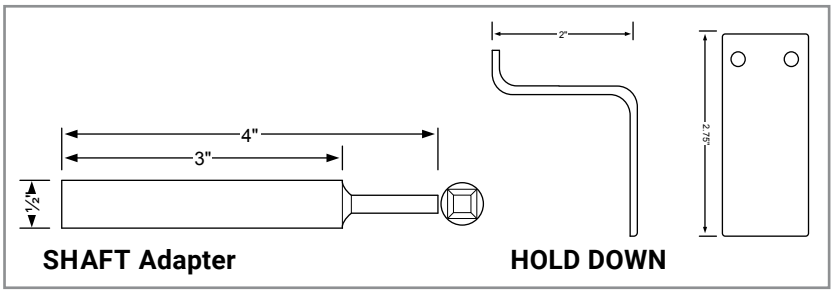


Figure 3.32

Notes:

1. Remove existing actuator, actuator mounting brackets, and all actuator hardware from damper.
2. Install mounting bracket with (2) #10 x 3/4" (19) lg. tek screws.
3. Install adapter.
4. Install actuator onto adapter (do not tighten set screws on actuator). Install Tru-Arc rings onto mounting bracket.
5. Install hold down bracket as shown in detail above.
6. Wire actuator per manufacturers instructions and per local code.
7. For the following operation hold adapter in place while cycling actuator until actuator clamp is tightened (to prevent adapter from walking outwards).
8. Fully open damper and energize actuator. Once actuator has reached the end of its rotation, tighten actuator clamp.
9. De-energize actuator, make certain damper reaches the fully closed position. Cycle actuator several times to ensure proper operation.
10. Clamp on actuator must engage round portion of shaft. If required square portion of adapter can be trimmed in field for proper fit.

Be sure to complete the notification form and submit it to your AHJ.

WARNING!

There was a model similar to the one above that had a shaft spring and fusible rod or link. One was made by Ruskin and one by Air Balance.

The link disconnected the actuator and the spring drove the damper closed. The actuator has to work against the external spring as well as its own internal spring.

The FSNF should be used for that application to ensure sufficient torque. Contact Belimo or damper manufacturer with model number of damper and actuator to obtain replacement instructions.

Replacement of Ruskin with MA2xx with Belimo

Cross Reference

For greater detail use our RetroFIT+ tool
https://www.belimo.com/us/en_US/products/retrofit-app/

Scan QR Code for more information on RetroFIT+

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24 S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	60	1	FSNF120S 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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Direct Coupling

Figure 3.35

Figure 3.36

WARNING!

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

Note that the actuator floats freely. The clamp cold welds when the teeth dig into the damper shaft. 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.

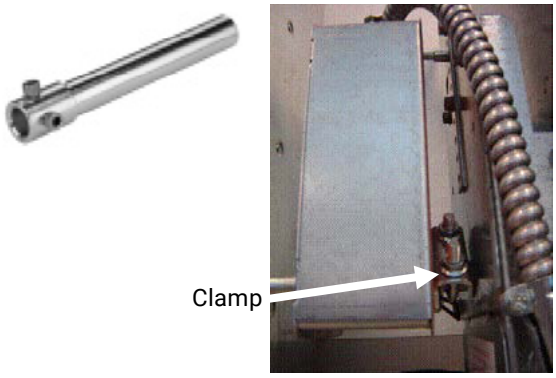


Figure 3.37

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 (Figure 3.38).

Typical Siebe MA220 Replacement

Existing Defective Motor

Disassembly - Open sensor electrical J-box, disconnect wire nuts and pull old wires out of box. Flex can be reused in most cases (Figure 3.39).

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

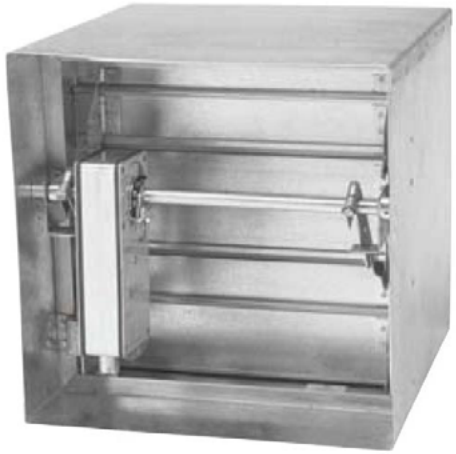


Figure 3.38

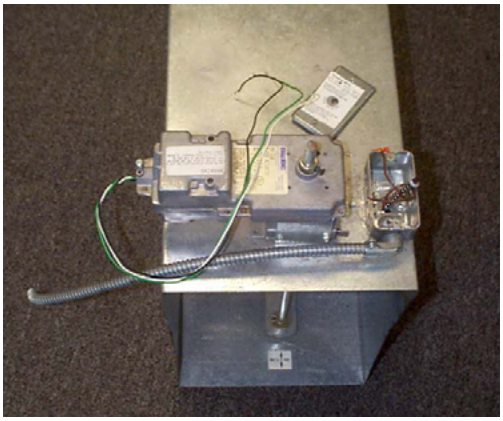


Figure 3.39

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 (Fig. 2.40)

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.

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

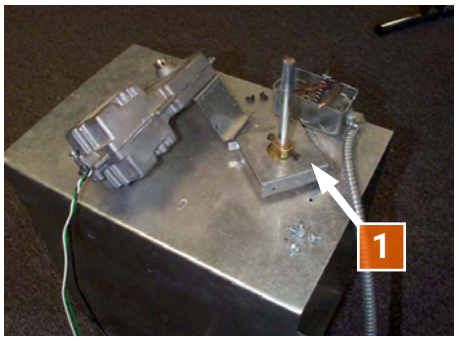


Figure 3.40

Disassembled (Fig. 3.41)

Orient Belimo FSLF or FSNF (Figure 3.42) 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.

Figure 3.41

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.

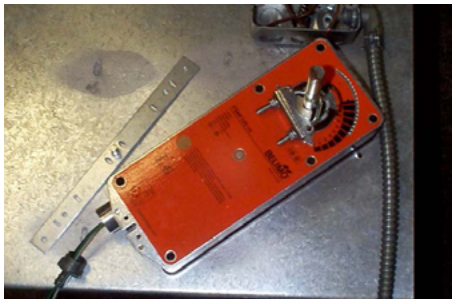


Figure 3.42

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

Standard clamp has insert for 1/2", 5/8" or remove for 1"

Mounting (Continued)

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. Operate open and closed 3 times.

G. Trip thermal sensor to be sure it is still functional.

H. Finished.

Mounting Trick

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

Be sure to complete the notification form and submit it to your AHJ.

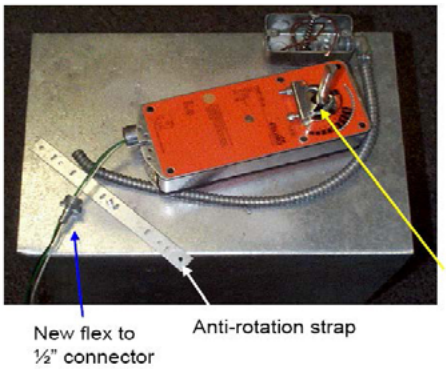


Figure 3.43

Figure 3.44

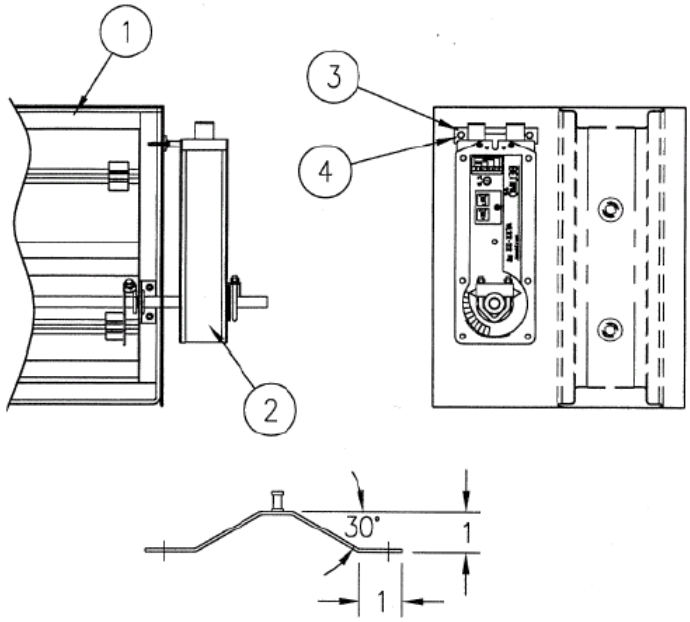
Figure 3.45

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.

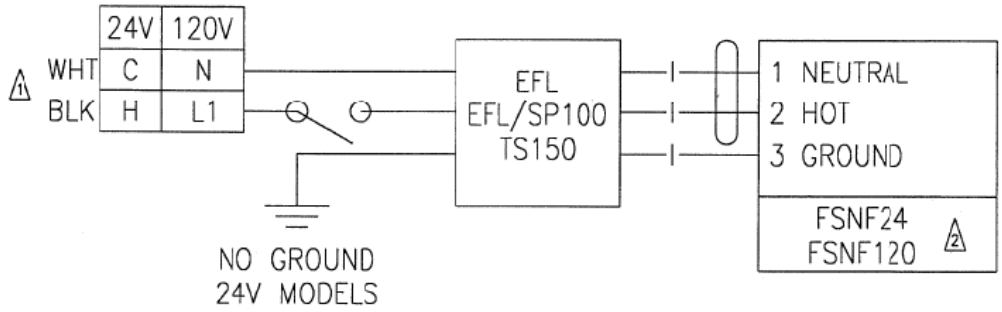
14-020906-00B SHEET 1 OF 2 04/24/06

Figure 3.46

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

Figure 3.47

Ruskin Honeywell ML & MS to Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

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.

Ruskin part #	Power		Belimo Replacement	
Model			**< 4 sq. ft.**	**> 4 sq. ft.**
H2000A/x	120	CCW	FSLF120	FSNF120
H2000B/x	120	CW	"	"
H2024A/x	24	CCW	FSLF24	FSNF24
H2024B/x	24	CW	"	"
H2230A/x	230	CCW	FSLF230	FSNF230
H2230B/x	230	CW	"	"
SPH2 Aux Switch				Use S model of proper voltage.
32003532002 Aux Switch				Use S model of proper voltage.

Siemens

Make & Model	Power	Belimo Replacement	
Model		**< 4 sq. ft.**	**> 4 sq. ft.**
GGD121	24 V	FSAF24A	FSNF24 US
GGD221	120 V	FSAF120A	FSNF120 US
GGD321	230 V	FSAF230A	FSNF230 US
GND12x.1x	24 V		FSLF24 US
GND22x.1x	120 V		FSLF120 US
GND32x.1x	230 V		FSLF230 US

Electronic Fuse Link (AC 24 V)

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

Optional	Two Auxiliary Switches Fixed 5° and 85°

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

Typical Installations

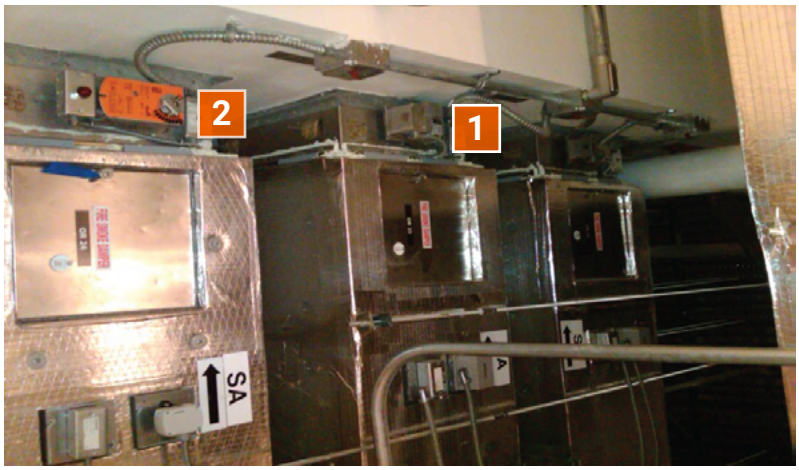


Figure 3.48

Typical replacement – #1 shows location of Honeywell and #2 shows replacement Belimo.

The Belimo mounts over the shaft as does the Honeywell. Space constraints are rare.

Be sure to complete the notification form and submit it to your AHJ.

Figure 3.49: Defective ML 4115

Figure 3.50: New Belimo FSNF120

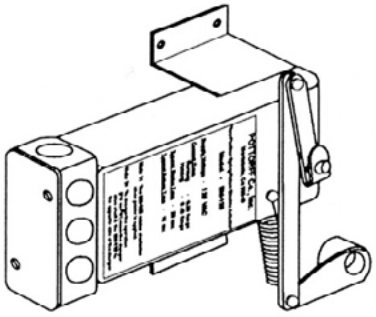
4. Pottorff

Replacement of Pottorff Dampers with EM24 or EM120 Motors with Belimo

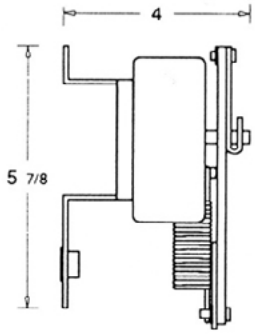
EMxx Motors

POTTORFF

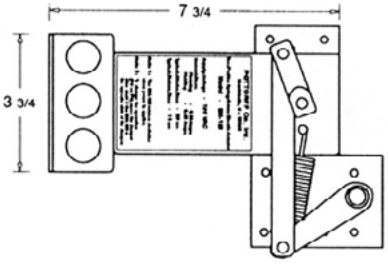
SERIES EM
model EM-24 & EM-120
damper actuator



Model EM-120
(EM-24 is similar)



Model EM-120 End View



Model EM-120 Side View

SPECIFICATIONS

Motor Type	-	UL listed shaded pole, two position spring return.
Electrical Req.	-	EM-24 Voltage: 24 volts ac, 60 HZ. Current: Running - 1.50 amps Holding - 2.30 amps EM-120 Voltage: 120 volts ac, 60 Hz. Current: Running - .30 amps Holding - .46 amps
Rated Torque	-	75 in. lbs. (at the damper shaft).
Shaft Rotaion	-	1.8 rpm, clockwise
Rotation Time	-	Stroke Time - 20 sec Return Time - 15 sec
Temperature	-	UL 555S rated to 350° F.
Construction	-	Die cast aluminum enclosure. - Semi-oiless bearings, maintenance free. - Precision, machine cut gears.
Motor Bracket	-	16 Ga. Galvanized steel with mounting holes and damper shaft bushing

OPTIONS

- Motor voltage: EM-24 ❑
  EM-120 ❑
- Damper action when power is applied to motor:
  PO (power open) ❑
  PC (power closed) ❑
- Factory mounted. ❑

8-26-93

POTTORFF COMPANY INC.

Figure 4.1

The drawings above show the EMxx motor and the external spring that is attached.

Typical linkage used with the EM24 or EM120 motor.

Note that the crank-arm partially visible on the right slid over the damper shaft.

When installing a Belimo, it is direct coupled over the damper shaft unless a space constraint exists.

Note that the spring that should be attached to the linkage is missing here.

Most applications follow the concept below. In some cases hybrids with electrical sensors were built. See the wiring setion for electrical thermodisc applications.

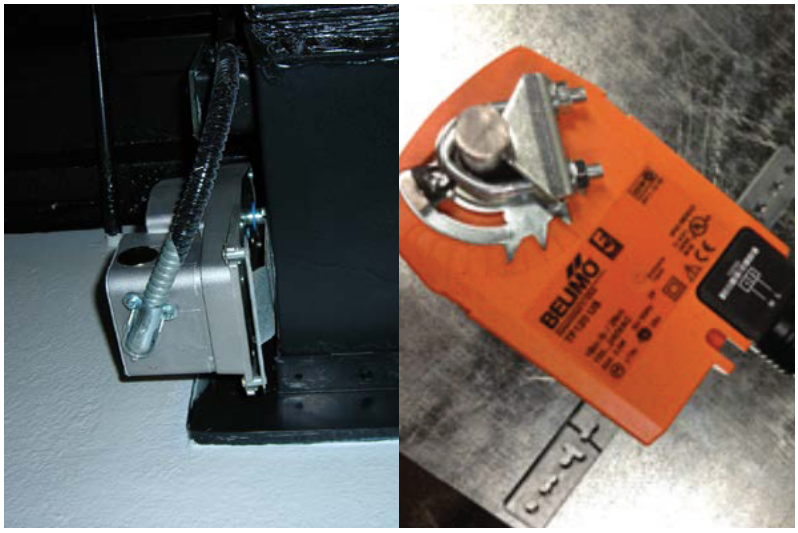


Figure 4.3

Figure 4.2

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

The EMxx motors required an ***external*** spring to drive the damper closed and the actuator back to its start position. The Belimo has an ***internal spring***.

The actuator is used only for the smoke function closing and opening. The fire closing function is provided by the shaft spring and fusible link.

Actuator Replacement

- FSTF for dampers 1.5 sq. ft. and smaller
- FSLF for dampers 4 sq. ft. and smaller.
- FSLF24 replaces the EM24, FSLF120 replaces the EM120.
- FSNF for dampers from 4 to 12 sq. ft.
- FSAF*A for dampers up to 16 sq. ft.

Be sure to complete the notification form and submit it to your AHJ.

Pottorff Siebe MA2xx Replacement with Belimo

Cross Reference

For greater detail use our RetroFIT+ tool
https://www.belimo.com/us/en_US/products/retrofit-app/

Scan QR Code for more information on RetroFIT+

Barber Coleman-Siebe-Invensys

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24 S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	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 UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

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 cross reference, use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

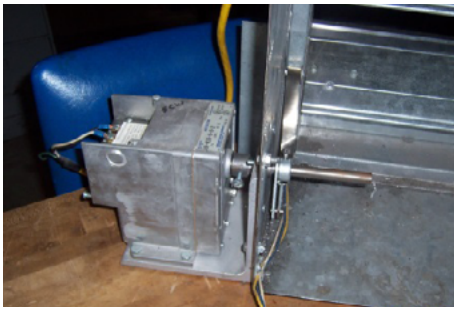


Figure 4.5

Figure 4.6

Figure 4.7

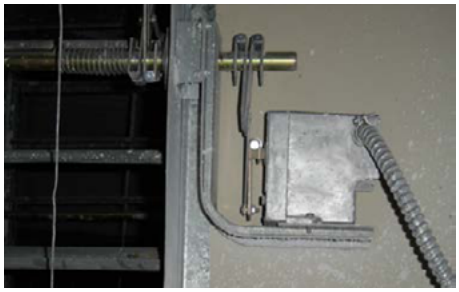


Figure 4.8

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.

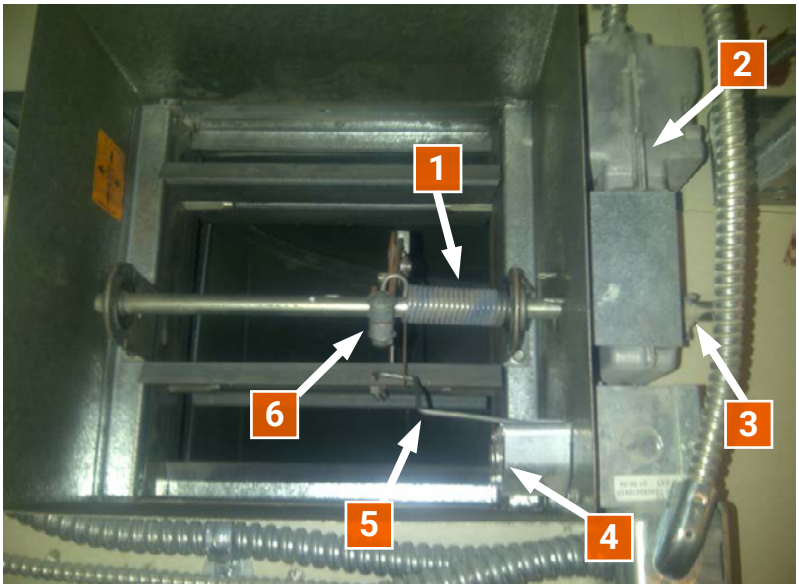


Figure 4.9

1. Shaft spring. This closes damper when the motor is unpowered.
2. MA230
3. On some models there was a spring on the outside instead of a shaft spring. Not shown here.
4. Blade indication switches.
5. Rod connects to two switches inside the wiring box. These are position indication for Fire Fighters' Smoke Control Panel.
6. Bolt holds spring. The fusible link releases the motor and slams damper blades closed.

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.

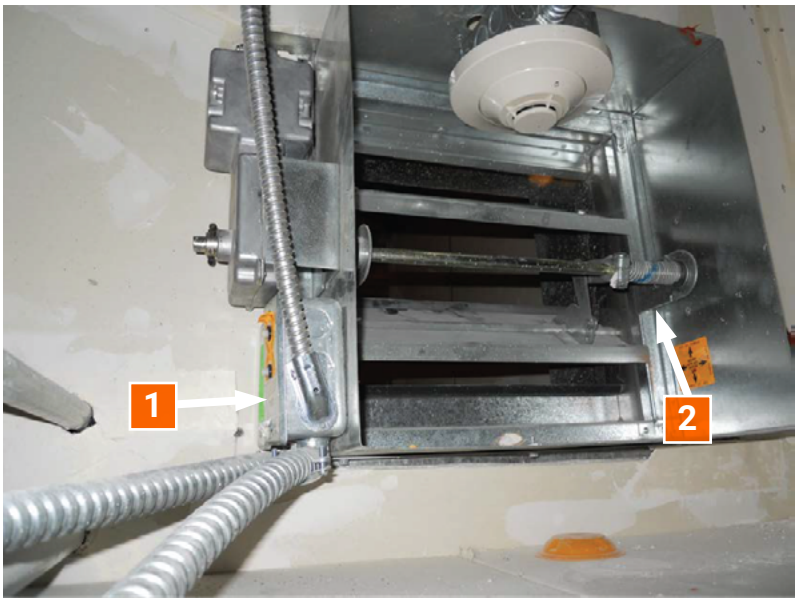


Figure 4.10

1. Dual Sensors
2. No fusible link

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:

- 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.
- 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. See Wiring chapter for details and more examples.

5. Restore incoming power.

6. Test all functions per Fire Marshal Form on in our forms section.

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

WARNING!

USE CAUTION!

- **Disconnect and lock out power before starting to disconnect old motor.**
- **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 (Figure 4.11)

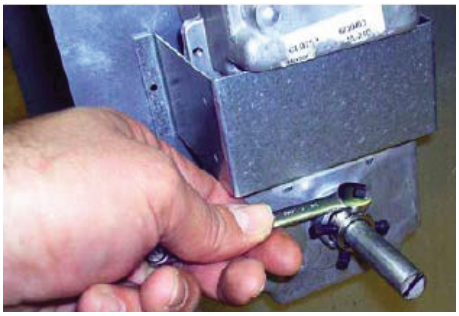


Figure 4.11

2. Remove the actuator-mounting bracket and loosen setscrews (Figure 4.12)

Figure 4.12

3. Remove old motor (Figure 4.13)

Figure 4.13

4. Remove the e-ring where knee lock attaches to the drive blade bracket (Figure 4.14)

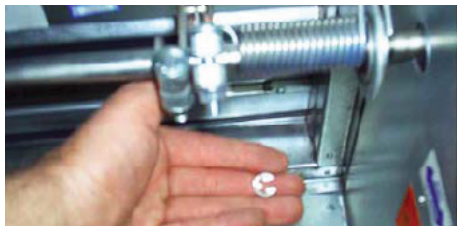


Figure 4.14

WARNING!

USE CAUTION!

SPRING IS UNDER HIGH TORSION AND MAY CAUSE SERIOUS INJURY!

5. Disconnect knee-lock (Figure 4.15)

Figure 4.15

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 (Figure 4.16)

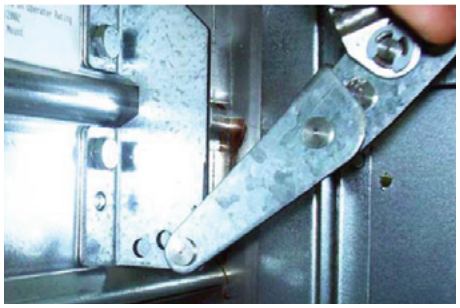


Figure 4.16

8. Secure knee lock to drive blade bracket with e-ring (Figure 4.17)

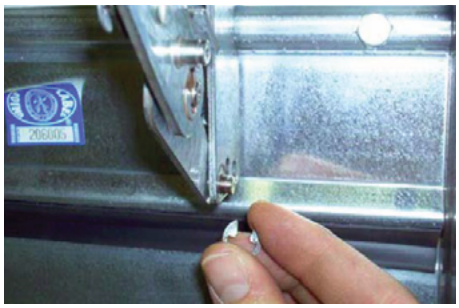


Figure 4.17

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.** (Figure 4.18)

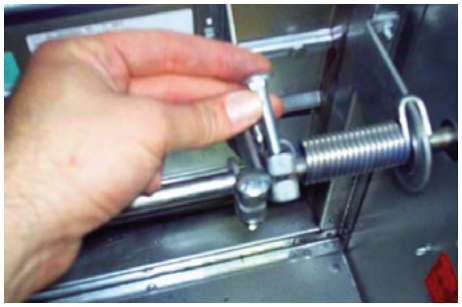


Figure 4.18

10. Shaft spring is disconnected. Actuator life span is shortened if it must drive against this unnecessary extra torque load. (Figure 4.19)

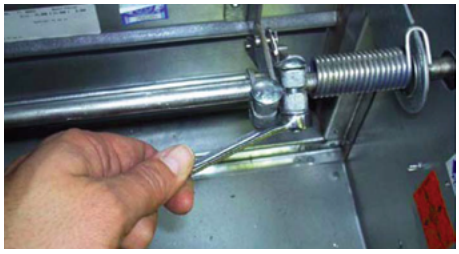


Figure 4.19

11. Inspect your actuator. The clamp must be on the CW side. Double check that actuator springs damper closed. (Figure 4.20)

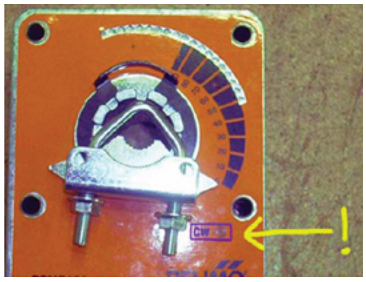


Figure 4.20

12. If the clamp is not on the CW side, remove the clamp and reinstall on the CW side. (Figure 4.21)

Figure 4.21

13. While reinstalling the clamp, line up the indicator to zero position marked on the actuator. (Figure 4.22)

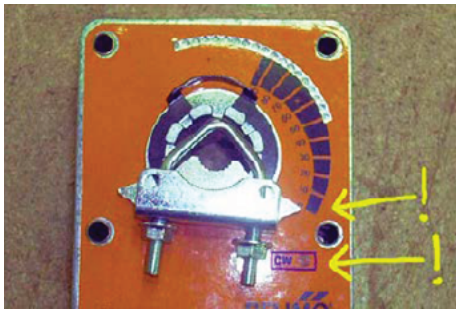


Figure 4.22

14. Slide the actuator over the jackshaft with the clamp outward. (Figure 4.23)

Figure 4.23

15. Finger tighten the nuts (Figure 4.24)

Figure 4.24

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. (Figure 4.25)

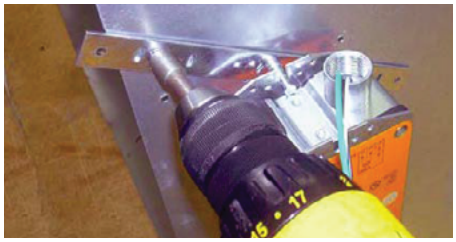


Figure 4.25

17. Tighten the bolts. Teeth in cold-weld clamp dig into shaft. (Figure 4.26)

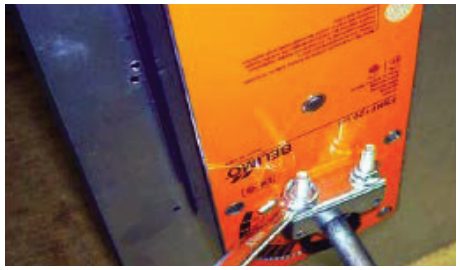


Figure 4.26

If convenient for wiring connections, attach a wiring box to the Belimo conduit connector with a ½" chase nipple.

Figure 4.27

18. Position the HS10 near the actuator and mark its location. (Figure 4.28)

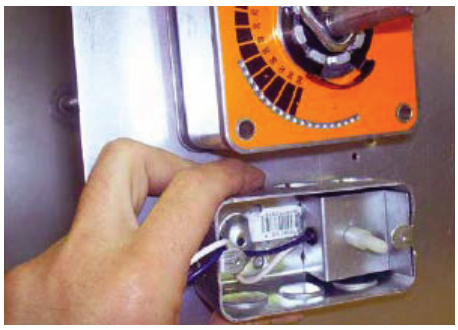


Figure 4.28

19. Make an 11/16" hole where the electronic link will be positioned (Figure 4.29)

Figure 4.29

20. Mount the HS10 onto sleeve by inserting the electronic link into the 11/16" hole. Secure with #10x1/2" screws. (Figure 4.30)

Figure 4.30

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.

Be sure to complete the notification form and submit it to your AHJ.

5. Nailor

Replacement of Nailor Multiproducts Motors to Belimo

Cross Reference

For greater detail see www.belimo.com/firesmoke or use our RetroFIT+ tool https://www.belimo.com/us/en_US/products/retrofit-app/

Scan QR Code for more information on RetroFIT+

All 120 V are replaced by the FSLF120.
All 24 V are replaced by the FSLF24.

Nailor	AC V
5953	120
5949	120
M12, MZRHM	120
6247	120
5186	120
5983	120

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

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

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

Typical Installations

Typical motor, spring, linkage, and damper shaft. is seen in Figure 5.1.

Figure 5.1

Fusible Link

Figure 5.2 and 5.3 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.

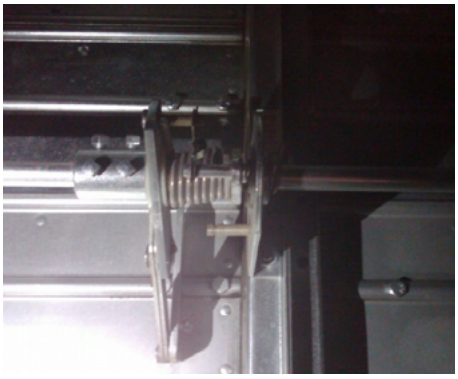


Figure 5.2

Pro Tip

The fusible link and shaft spring are necessary to close the damper in case of a fire.

DO NOT REMOVE OR MODIFY.

Other than testing and replacing old links, leave the fusible link alone. The second spring on the outside must be removed when the actuator is replaced.

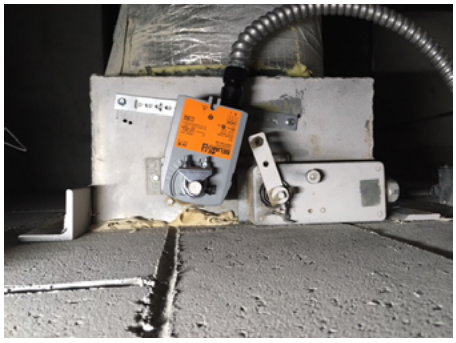
Figure 5.3

Nailor Damper Configurations with Multiproducts Motor

Example of mounting the Belimo directly to the jackshaft and ignoring old mounting.

Linkaged motor here is typical of many applications

Figure 5.4



Old motor and crankarm on right can be ignored. Belimo is direct coupled.

Figure 5.5

Another angle showing Belimo direct coupled to jackshaft with anti-rotation strap bent to adjust for needed height.

Figure 5.6

Typical damper and motor – notice the external "screen-door" spring.
The replacement will involve removing all of the motor linkage parts with the motor and direct coupling the Belimo FSLF120 to the damper shaft. (Figure 5.7)

Enlargement of 5.7 application. (Figure 5.8)

Detail of "screen door spring" and shaft attachment. (Figure 5.9)

Remove all parts and direct couple Belimo on the damper shaft.

Figure 5.7: NAILOR MP6247

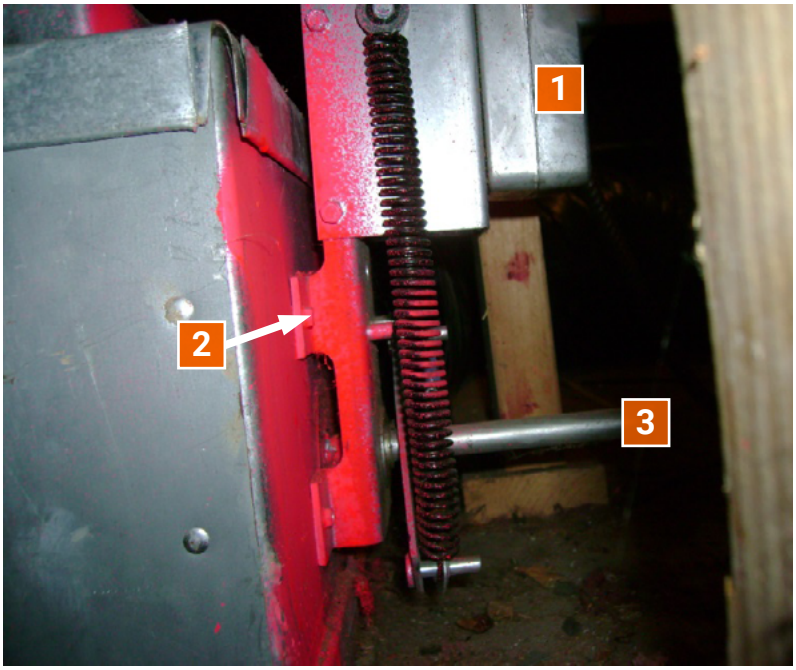


Figure 5.10

Figure 5.8

Figure 5.9

1. Motor and linkage
2. Mounting plate
3. Damper shaft

Remove motor, spring, rocker arm. Retain plate 2. Mount Belimo to the damper shaft 3.

WARNING!

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.

Shaft Spring and Fusible Link

The shaft spring and fusible link are NOT to be removed or modified.

If the fusible link melts due to temperatures over 165°F the shaft spring slams the damper closed.

This is the fire function.

Basic Replacement and Installation of Belimo

1. Remove old motor and linkage parts.
2. Retain see Figure 5.10.
3. Attach Belimo anti-rotation strap to the existing mounting plate.
4. Close damper tight
5. Mount Belimo FSLF120 to damper shaft, tighten anti-rotation strap and clamp.
6. To wire, see examples in the wiring section.
7. Test and complete the report form found in the AHJ forms chapter.

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. See the mounting section for more details and examples.

Be sure to complete the notification form and submit it to your AHJ.

Alternate views of existing installation.

Figure 5.11: Shaft spring and fusible link

Figure 5.12: Shaft spring and fusible link

WARNING!

USE CAUTION!

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.

Replacement of Nailor Dampers with Siebe MA2xx Motors to Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	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.

Typical Installations

Multisection Damper Assembly

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

Fusible Link

Figures 5.13 and 5.14 show 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.

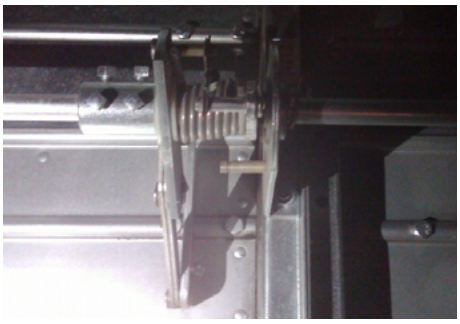


Figure 5.13

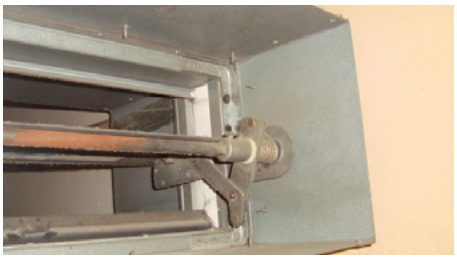


Figure 5.14

Nailor Damper with MA220 Motor

Motor is non-spring and the spring is inside the damper on the shaft.

Three views of an MA220 on a Nailor damper. (Figures 5.15, 5.16, and 5.17)

Figure 5.15

Figure 5.16

Figure 5.17

Figure 5.18
Nailor damper with fusible link and fire spring on left. Right spring is the motor spring and will be disabled.

Figure 5.18

1. **Number 1 pin points the same spring.** If the fusible link melts due to temperatures over 165°F the shaft spring slams the damper closed. This is the fire function. (Figure 5.19)

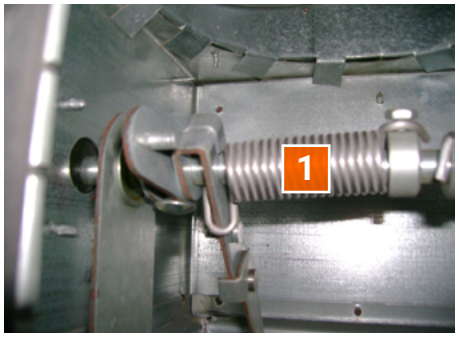


Figure 5.19

2. Right spring closes damper for actuator function only. This is typically a smoke detector function. **The right spring must be disconnected.** (Figure 5.20)

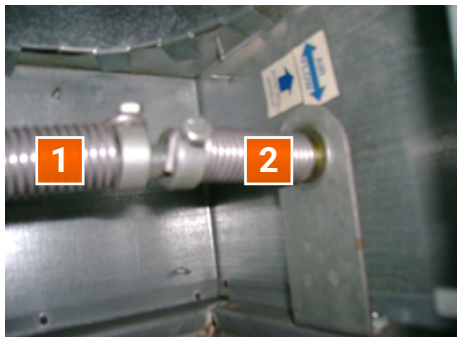


Figure 5.20

The left shaft spring and fusible link are NOT to be removed or modified. Note they could be on right side in some dampers.

Be sure to complete the notification form and submit it to your AHJ.

Replacement of Nailor Honeywell ML & MS Motors to Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Multisection Damper Assembly

When measuring damper size, add the area of multiple sections together if controlled by a single actuator. (Figure 5.21)

Fusible Link

Figures 5.22 and 5.23 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 of figure 5.24, 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 figure 5.25) if the shaft is short.

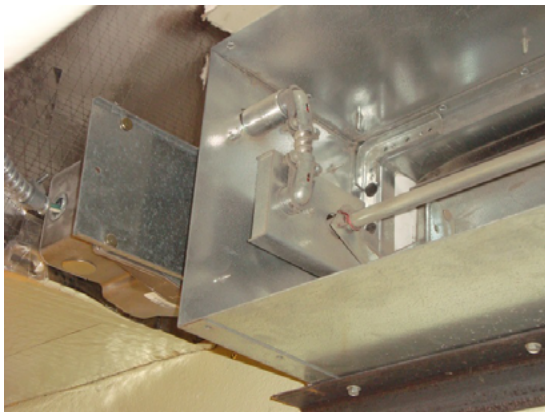


Figure 5.24: Typical damper and motor with auxiliary switch package

Figure 5.21

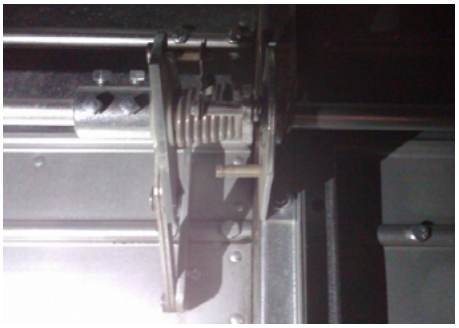


Figure 5.22

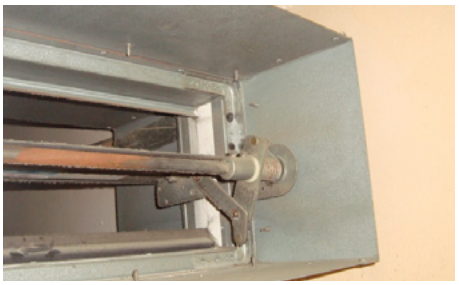


Figure 5.23

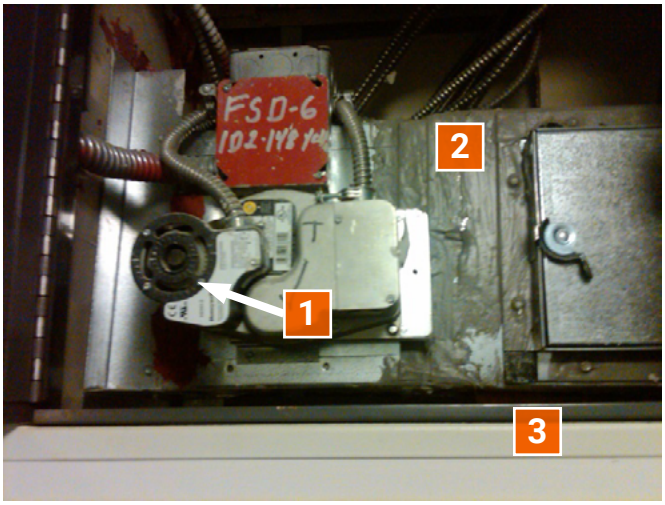


Figure 5.25

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. (Figure 5.28)

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 section for diagrams and alternate examples.

Be sure to complete the notification form and submit it to your AHJ.

Figure 5.26

Figure 5.27

Figure 5.28

6. Greenheck

Replacement of Greenheck MP2985 & 2986 Motors Belimo

Cross Reference

MultiProducts

There is no one to one replacement. Rather, all the old linkage parts, external spring, and motor are removed and the new actuator is direct coupled to the damper shaft. Double check that the fusible link and shaft spring are intact. See BAE 165 below if not.

MP2985E	115 V	24W	.335A Run	.36A Stall	Belimo FSLF120 US
MP2986A	24 V	19W	1.5A Run	1.6A Stall	Belimo FSLF24 US

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Siemens

Make & Model	Power	Belimo Replacement	
GGD121	24 V	FSAF24A	FSNF24 US
GGD221	120 V	FSAF120A	FSNF120 US
GGD321	230 V	FSAF230A	FSNF230 US
GND12x.1x	24 V		FSLF24 US
GND22x.1x	120 V		FSLF120 US
GND32x.1x	230 V		FSLF230 US

Electronic Fuse Link (AC 24 V)

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

Optional	Two Auxiliary Switches Fixed 5° and 85°

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

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

Application

Greenheck used a dual spring approach. The external spring closes the motor. A hidden internal spring is held back by a fusible link. It is not involved in the smoke function and should not be changed.

Below and right. #1 points to the 1/4" motor shaft and spring. #2 points to the damper shaft which is hidden.

Figure 6.1

The motors in figure 6.2 connected by linkage as shown in the photographs to the right. The Belimo FSLF can be direct coupled if space exists for mounting. A bracket may have to be fabricated from 16 ga. Sheet metal to hold the anti-rotation strap. The geometry of the situation determines the mounting. See the mounting chapter for more information.

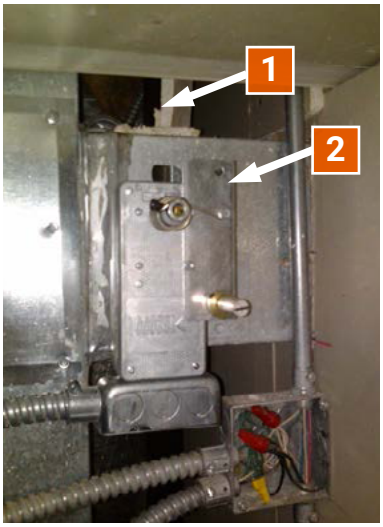


Figure 6.2

Figure 6.3

Figure 6.4: View of damper frame, blade, and shaft

Figure 6.5: Detail of spring, arm, and fusible link

Figure 6.6

Figure 6.7

☑ Correct

The Greenheck high temperature damper closing is accomplished with a fusible link and a shaft spring.

Replace the fusible link if necessary and test the closing function.

THIS SPRING AND FUSIBLE LINK MUST REMAIN IN PLACE.

☒ Incorrect

This spring has been disconnected from the linkage.

It must be repaired or the damper replaced.

Test when reattached to ensure the damper closes if fusible link melts.

Closeup view showing external shaft spring and part of the linkage. Both will be removed so that the Belimo can be mounted on the shaft. (Figure 6.8 & Figure 6.9)

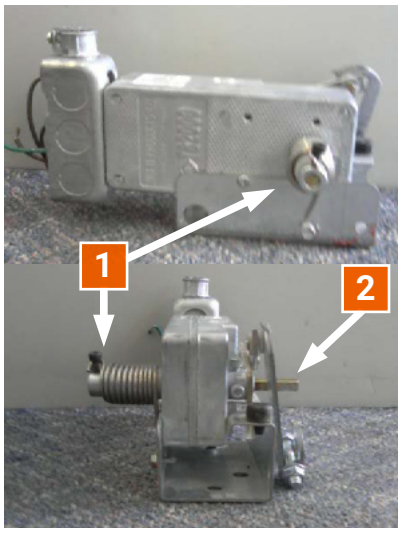


Figure 6.10

Figure 6.11

1. Spring. Motor is applied the same as any linkage application. Remove spring and actuator.
2. This shaft is not mounted to the damper.

In Figure 6.11 the crank arm is connected to the damper shaft. The Belimo may be direct coupled over the shaft. For short shaft mounting, place clamp of actuator between actuator and damper. See mounting section.

If a linkage is needed due to space constraints, use FSNF with ZG-AF or other linkage kit with rod. Find more information in the mounting chapter, our product data sheets and our PGPL (Price guide product list).

Figure 6.8

Figure 6.9

Disassembly of MP mounted motor

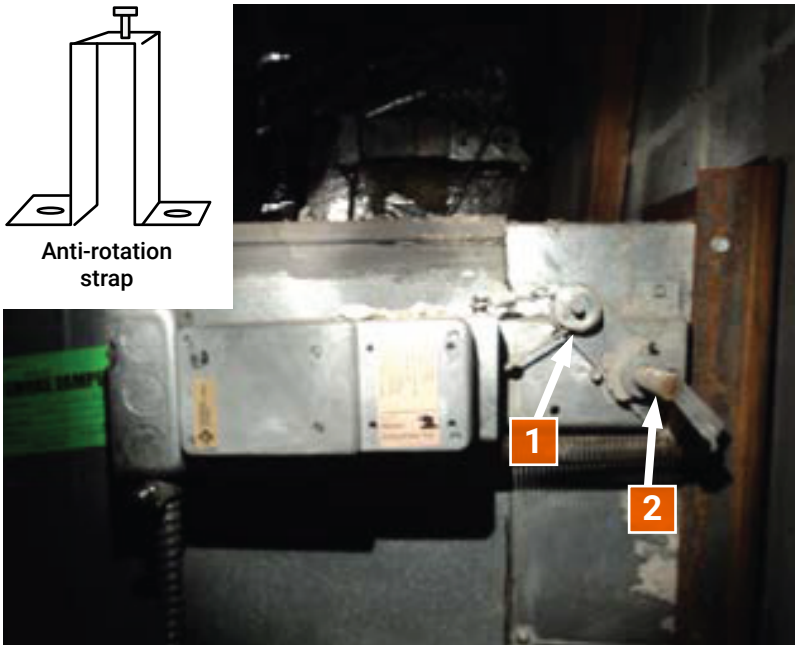


Figure 6.13

1. Shaft spring
2. Damper shaft

Remove linkage, spring, old motor. Direct couple on the damper shaft without linkages.

Support for anti-rotation strap may be made from 4 x 4 box with cover, unistrut, 16 ga flat plate.

Figure 6.12: View from below the damper and actuator

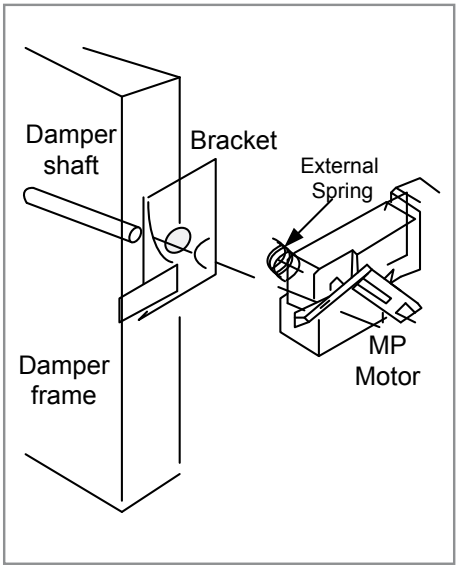


Figure 6.14

Damper shaft / Jackshaft extends out thru motor.

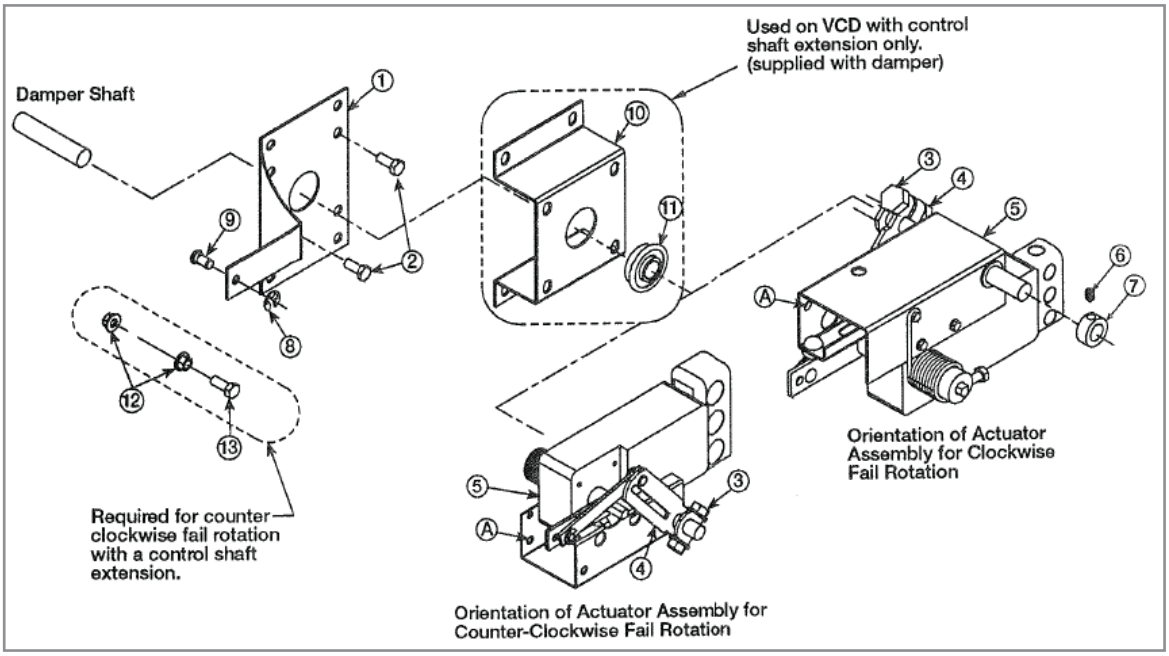


Figure 6.15

Remove spring, bracket and MP motor. Do not remove bearing or bracket. Jackshaft extends beyond the outboard bearing bracket and the Belimo FSLF can be direct coupled.

A plate will be needed to attach the anti-rotation strap. An alternate plate is available from Greenheck and is shown below.

Part No.	Qty.	Description
1	1	Anchor Bracket
2	4	1/4" - 20 x 1/2" Thread Cutting Screws
3	1	5/16" Bold with Nut
4	1	Linkage
5	1	Actuator Assembly
6	1	Set Screw
7	1	Shaft Collar
8	1	E-Ring
9	1	Knurl Pin
10	1	Stand Off Bracket (Used with Shaft Extension)
11	1	Ball Bearing (Used with Shaft Extension)
12	2	1/4" - 20 Spinlock Nut
13	1	1/4" - 20 x 1-1/4" Bolt

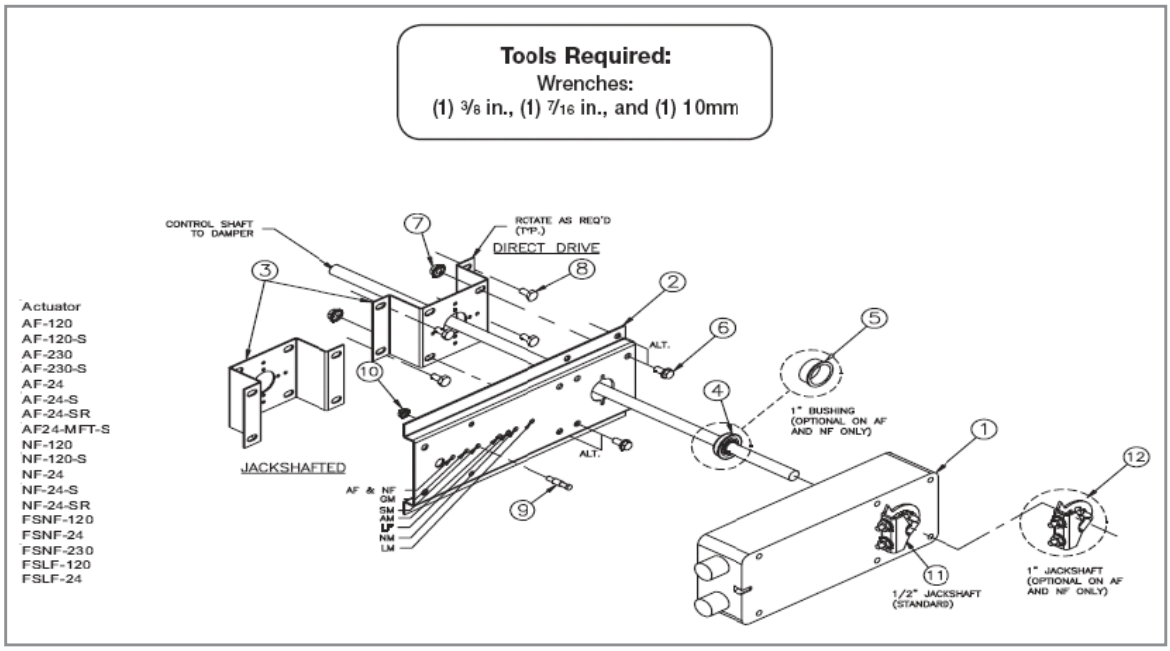


Figure 6.16

The FSTF is frequently the best solution for small dampers. While it has passed UL 555S on a 20" x 20" damper, we recommend 1.5 sq. ft. maximum for replacement on old dampers which may be corroded or racked and have a higher torque load than a new damper.

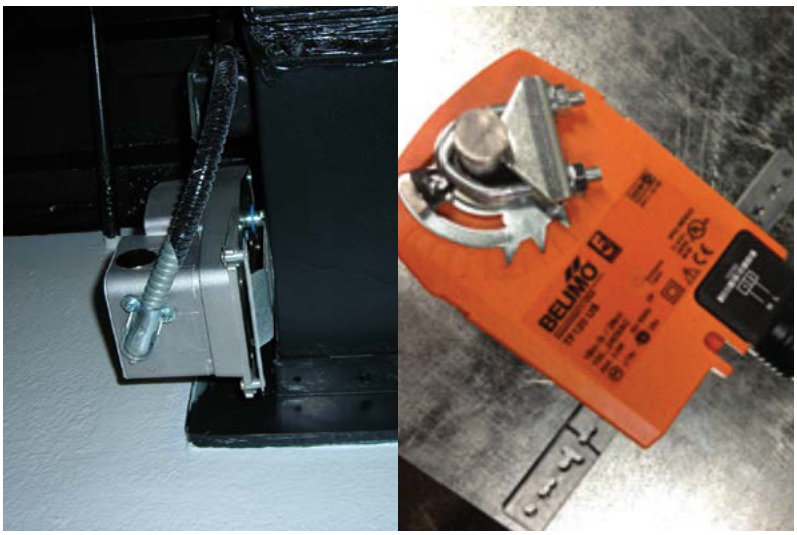


Figure 6.17

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

Be sure to complete the notification form and submit it to your AHJ.

Greenheck Dampers with ML or MS Type Honeywell Motors Replacement with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch						**
32003532002 Aux Switch						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

External mount

On earlier models, Greenheck used a two spring approach – external for the actuator and one on the jackshaft for the fire function. This makes replacement straightforward. Remove old motor, bracket, spring and nuts and bolts. Install Belimo per instructions below or add a plate to mount the Belimo anti-rotation strap.

Typical Greenheck damper with externally direct coupled HW motor. Bracket is shown below with Belimo anti-rotation strap extension mounted.

Figure 6.18

Instructions

Honeywell ML4105, ML4115, MS4209 series

Disconnect power, flex to motor, and tag wires. See wiring section for details and more examples. Loosen shaft connection and remove motor.

Place Belimo FSxx onto shaft and measure for location of anti-rotation strap.

Install flat 16ga or heavier plate (4X4 electrical plate works well) as support bracket if needed.

Screw anti-rotation strap onto support. Mount actuator with damper full closed and tighten clamp.

Wire per drawings in Wiring section below. Typically only 2 wires are disconnected and rewired. Note Belimo needs a ground for 120 V models.

In rare cases, a bracket may be needed. It is available from Greenheck to mount to their outboard bearing bracket. Install bracket if needed.

Mount Belimo direct coupled using anti-rotation strap on sleeve if space exists or use holes in bracket.

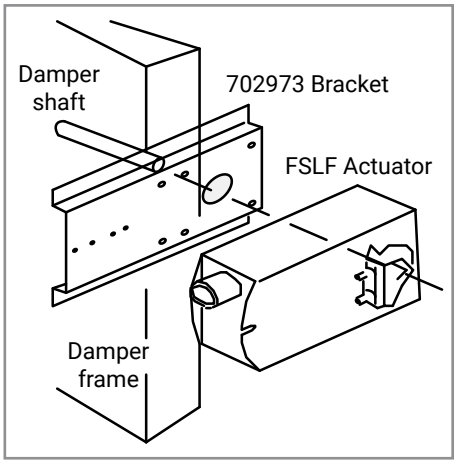


Figure 6.19

1. Shaft spring (Figure 6.20)
Typically used with Siebe MA2xx series or older MultiProducts. Do not disconnect. It is needed for the fusible link fire function.

Figure 6.20

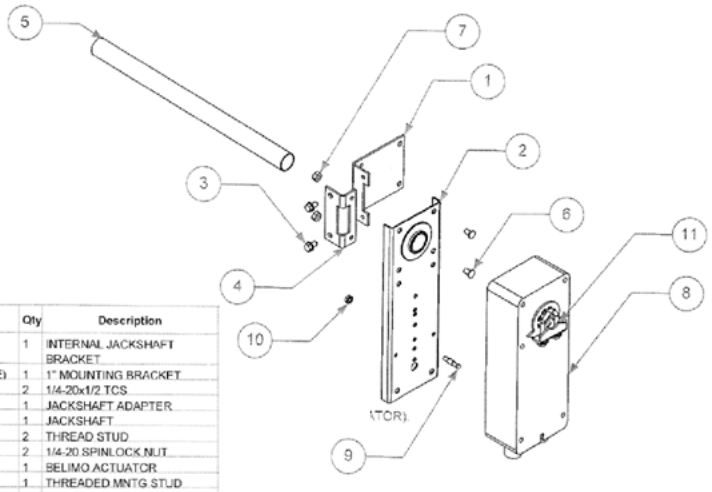
Internal mount

All Internal mounts

Jackshaft may have to be disassembled from within the ducts. Cut larger access door if necessary and replace with code compliant door.

Contact Belimo and send photograph of application for identification and specific instructions.

For replacement, jackshaft must be removed and actuator slid over shaft. For non-Fire & Smoke, a linkage can be used by mounting the actuator on one of the ZG-xxx Belimo brackets.



Item No.	Part Number	Qty	Description
1	659943	1	INTERNAL JACKSHAFT BRACKET
2	023980 (SEE NOTE)	1	1" MOUNTING BRACKET
3	415264	2	1/4-20x1/2 TCS
4	659942	1	JACKSHAFT ADAPTER
5		1	JACKSHAFT
6	415609	2	THREAD STUD
7	415455	2	1/4-20 SPINLOCK NUT
8		1	BELIMO ACTUATOR
9	416122	1	THREADED MNTG STUD
10	415385	1	KEPS HEX NUT ZP
11	455032 (SEE NOTE)	1	K4-1 CLAMP 1" JACKSHAFT

Figure 6.21

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

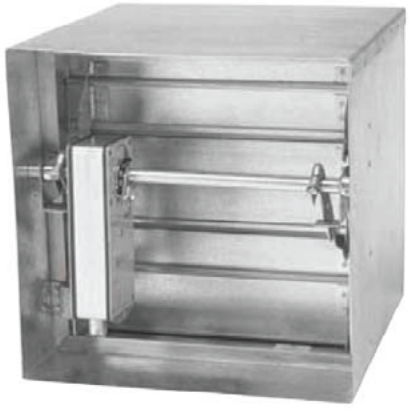


Figure 6.22

A Greenheck Bracket (#651815) may be used. Belimo fits on the same bracket.

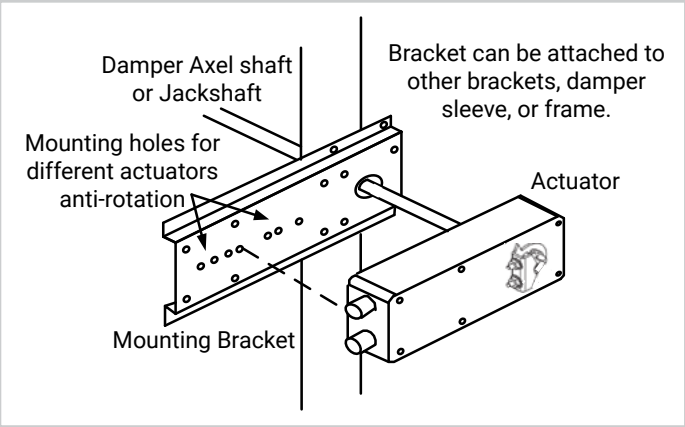


Figure 6.23

For short shaft mounting, the ZG-LMSA-1/2-5 can be used. (Figure 6.24) Alternately, the clamp can be installed between the actuator and sheet metal. (Figure 6.25)

FSLF mounted on the damper shaft. Two sheet metal screws hold the anti-rotation strap. Two nuts secure coldweld clamp onto shaft. (Figure 6.26)

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. See the mounting chapter for more examples and information.

Be sure to complete the notification form and submit it to your AHJ.

Figure 5.24

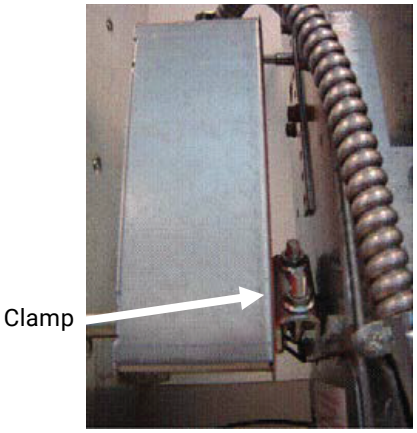


Figure 6.25

Figure 6.26

Greenheck Dampers MultiProducts, Siebe, Siemens, or Honeywell Motors Replacement with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

Multiproducts

Model	Power	Belimo < 4 sq. ft	>4 sq ft.
MP2985	120	FSLF120 US	FSNF120 US
MP2986	120	FSLF120 US	FSNF120 US

See 'Replacement of Greenheck MP2985 & 2986' section found earlier in this Greenheck chapter.

External mount

On earlier models, Greenheck used a two spring approach – external for the actuator and one on the jackshaft for the fire function. This makes replacement straightforward. Remove old motor, bracket, spring and nuts and bolts. Install Belimo per instructions below or add a plate to mount the Belimo anti-rotation strap.

Old motor mounted with external spring and bracket to damper frame. Actuator may attach to either jackshaft or axle shaft.

On modern dampers, Greenheck used a thermal sensor for fire function. See below.

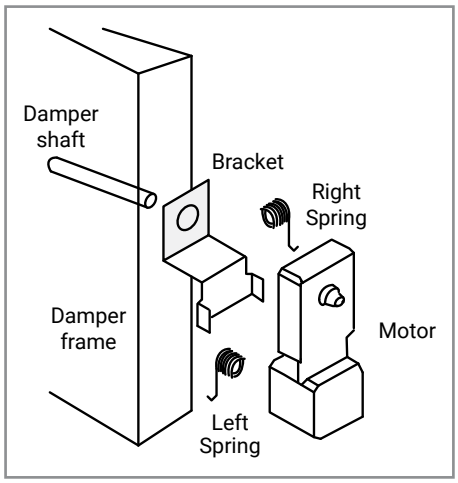


Figure 6.27

Instructions

Honeywell ML4105, ML4115, MS4209 series

Figure 6.28

- Disconnect power, flex to motor, and tag wires. See wiring section.
- Loosen shaft connection and remove motor.
- Place Belimo FSxx onto shaft and measure for location of anti-rotation strap.
- Install flat 16ga or heavier plate (4X4 electrical plate works well) as support bracket if needed.

Figure 6.28

Firgure 6.29

- Screw anti-rotation strap onto support. Mount actuator with damper full closed and tighten clamp.
- Wire per wiring section. Typically only 2 wires are disconnected and rewired. Note Belimo needs a ground for 120 V models.

Figure 6.29

MultiProducts

Internal shaft spring

Damper must be examined to determine spring methods. Many had two springs – one for the smoke actuator function on outside and a shaft spring and fusible link for the fire function. Replace external spring and motor. Do NOT modify internal shaft spring except to test. (Figure 6.30)

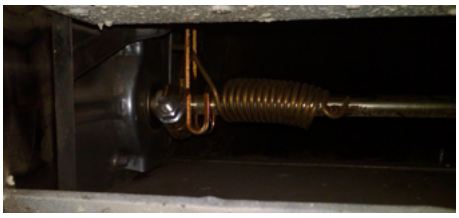


Figure 6.30

Siebe MA318, 418, and other gear train motors

Geartrain motor that was formerly linkaged, now direct coupled. (Figure 6.32)

These are very easy to replace. Simply remove the old motor and linkages. Then mount Belimo FSNF over shaft. Do not remove any bearings. (Figure 6.31 & Figure 6.32)

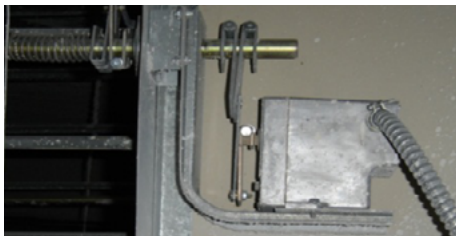


Figure 6.31

A wide variety of linkaged motors can be direct coupled when replaced.

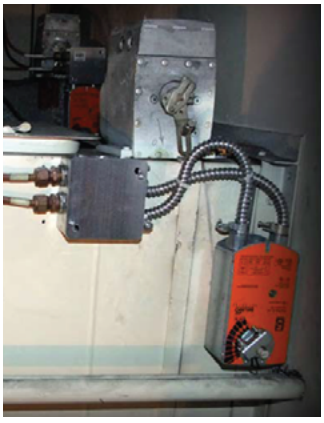


Figure 6.32

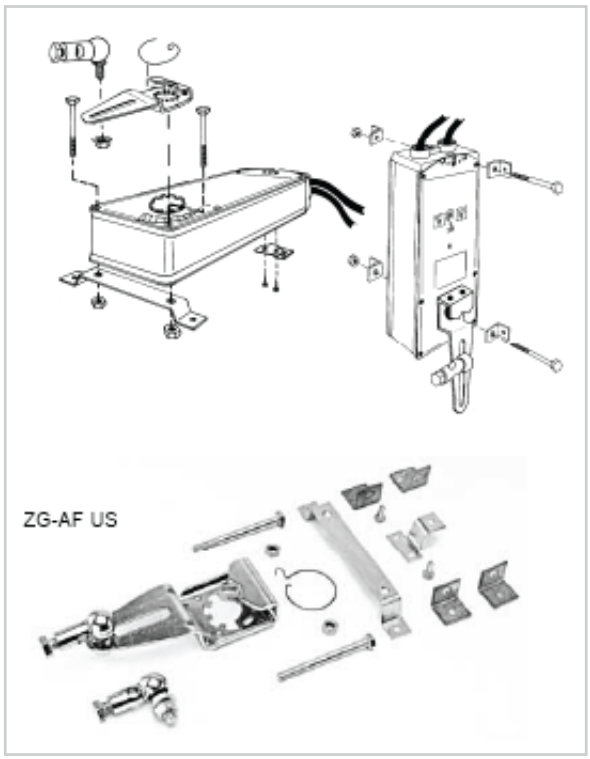


Figure 6.33

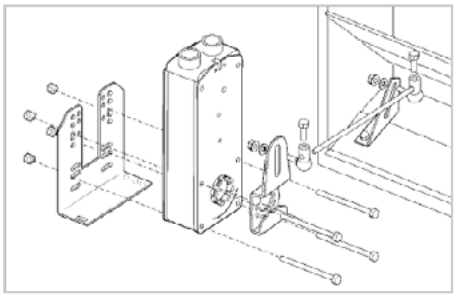


Figure 6.34

The Belimo ZG-AF kit is very flexible and other brackets are available. (Figure 6.33)

Figure 6.35

Siebe MA220, 230, 250 series

Figure 6.36

- Disconnect power, flex to motor, and tag wires. See wiring below. Remove spring bracket, spring, and motor.
- Do not remove housing below motor.
- There are several mechanically solid ways to mount the anti-rotation strap.
- Place Belimo FSxx onto shaft and measure for location of anti-rotation strap.
- Install flat 16ga or heavier plate as support bracket if needed. Bend existing U-support bracket to hold screws of Belimo.

Figure 6.37

- Use of AF-P NF size anti-rotation strap instead of LF-P which comes with actuator is recommended if anti-rotation strap must bridge U-bracket.
- Screw anti-rotation strap onto support. Mount actuator with damper full closed and tighten clamp.
- Wire per drawings below. Typically only 2 wires are disconnected and rewired. Note Belimo needs a ground for 120 V models.

MultiProducts Replacement

In rare cases, a bracket may be needed. It is available from Greenheck to mount to their outboard bearing bracket. Install bracket if needed.

Mount Belimo direct coupled using anti-rotation strap on sleeve if space exists or use holes in bracket. (Figure 6.38)

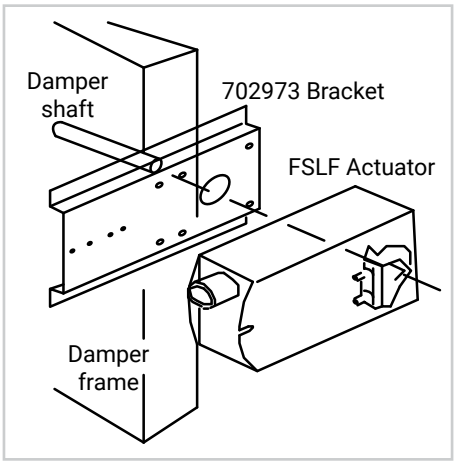


Figure 6.38

Multi Products MP2985-E

Remove old external spring, bracket, motor, and crank arm parts. (Figure 6.39)

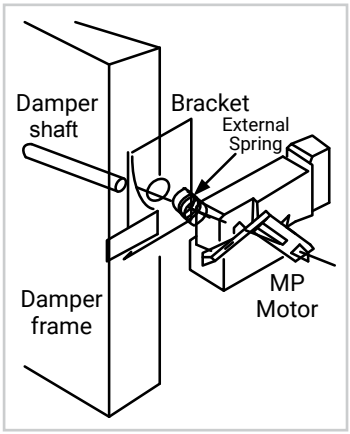


Figure 6.39

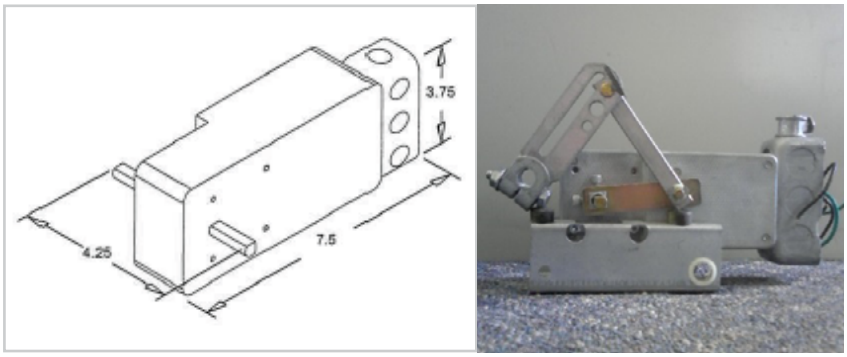


Figure 6.40

The motor shaft is linkaged to the damper shaft. Direct coupling of a Belimo over the damper shaft is the method used. The square actuator shaft is inconsequential.

Example of mounting the Belimo directly to the jackshaft and ignoring old mounting.

Linkaged motor here is typical of many applications.

Figure 6.41

Old motor and crankarm on right can be ignored. Belimo is direct coupled.

Figure 6.42

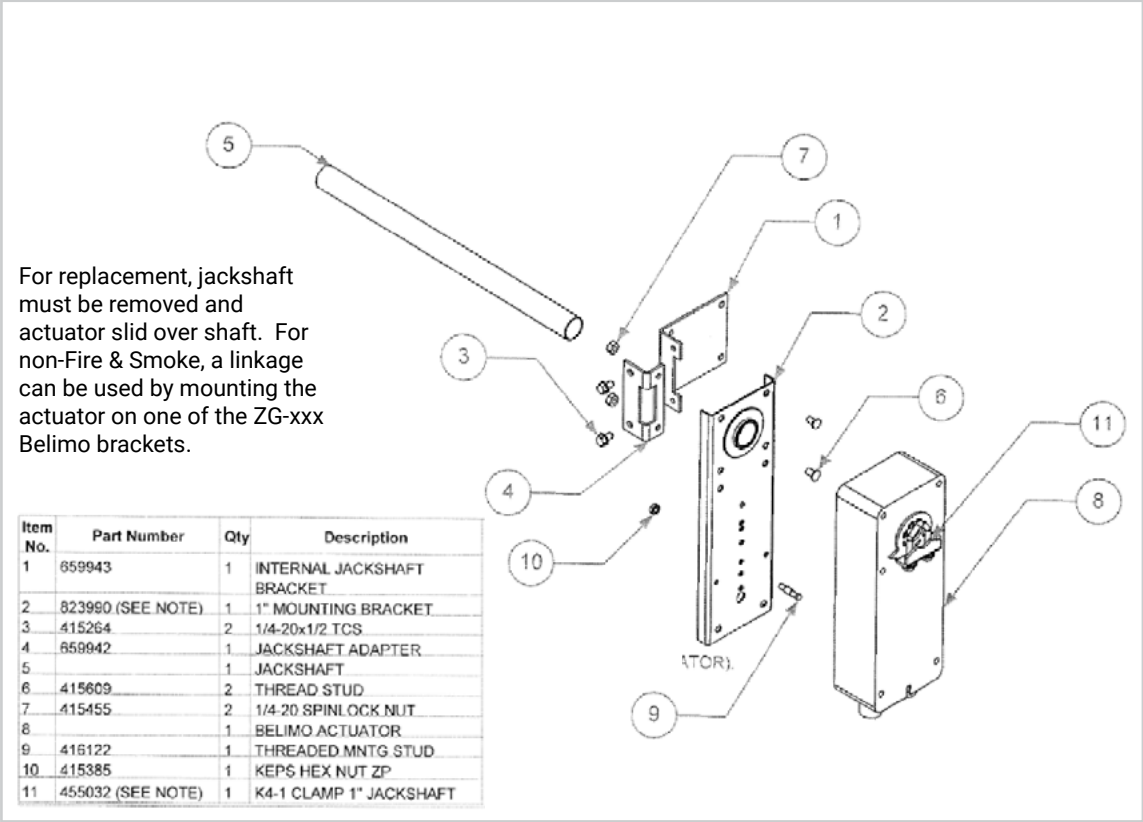
Another angle showing Belimo direct coupled to jackshaft with anti-rotation strap bent to adjust for needed height.

Figure 6.43

All Internal mounts

Jackshaft may have to be disassembled from within the ducts. Cut larger access door if necessary and replace with code compliant door.

Contact Belimo and send photograph of application for identification and specific instructions.



Item No.	Part Number	Qty	Description
1	659943	1	INTERNAL JACKSHAFT BRACKET
2	823990 (SEE NOTE)	1	1" MOUNTING BRACKET
3	415264	2	1/4-20x1/2 TCS
4	659942	1	JACKSHAFT ADAPTER
5		1	JACKSHAFT
6	415609	2	THREAD STUD
7	415455	2	1/4-20 SPINLOCK NUT
8		1	BELIMO ACTUATOR
9	416122	1	THREADED MNTG STUD
10	415385	1	KEPS HEX NUT ZP
11	455032 (SEE NOTE)	1	K4-1 CLAMP 1" JACKSHAFT

Figure 6.44

See the mounting chapter for more examples and information.

Be sure to complete the notification form and submit it to your AHJ.

7. Honeywell

Replacement of Honeywell ML & MS Motors to Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Thermal Sensor(s)

The picture below (Figure 7.1) shows a Honeywell that was removed along with part of the damper.

The sensor is not part of the actuator and should not be removed. The motor should be unbolted without removing the junction box, conduit, and thermal sensor.

The conduit connection to the motor must be connected to the Belimo FSxx and in some cases a new flex will be needed to reach the distance.

Figure 7.1

1. Four bolts hold actuator to the mounting plate.
2. Sheet metal holder bracket and mounting plate.

   This compartment does not have to be opened except to reset sensor during acceptance testing. The bracket does not have to be removed from damper.
3. 165°F (typical) sensor

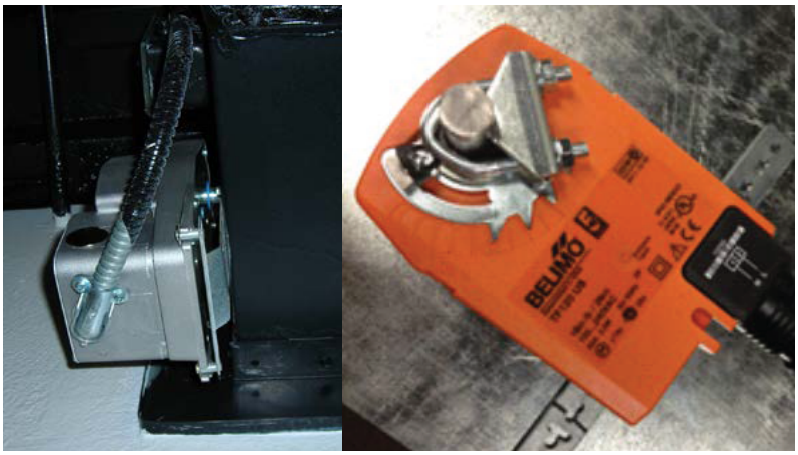


Figure 7.2

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

Basic Replacement and Installation of Belimo

Obsolete Honeywell motor mounted on a damper manufacturer base. (Figure 7.3)

The damper manufacturer base after the old motor is removed. (Figure 7.4)

Bare shaft after mounting plate is removed. **(Note holes should be sealed.)** (Figure 7.5)

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. (Figure 7.6 & 7.7)

Figure 7.6

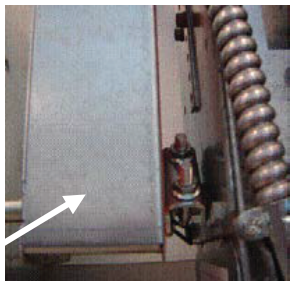


Figure 7.7

Figure 7.3

Figure 7.4

Figure 7.5

Special Mounting

Depending on the geometry, any number of mounting arrangements are correct. The most common are shown in the mounting chapter.

Alternately, the anti-rotation strap can be attached to any Belimo linkage, an electrical J-box cover plate, or to a pieced of U-channel. The mechanical integrity is the most important factor.

Refer to the mounting chapter or product Data sheets for a full list of compatible accessories.

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.

Mounting

The Belimo Anti-rotation strap may be attached to the HW bracket or to the sleeve. A 4" x 4" or larger electrical plate will serve as an anti-rotation mounting plate if old actuator is hung over free air.

When actuator bracket is hung out in air, the Belimo anti-rotation strap can be attached to bracket, 4 x 4 plate, or sheet metal bracket.

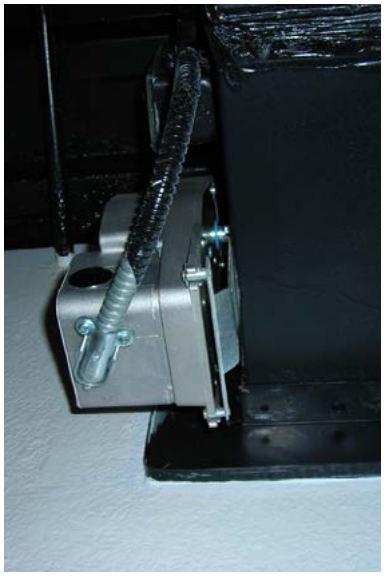


Figure 7.8

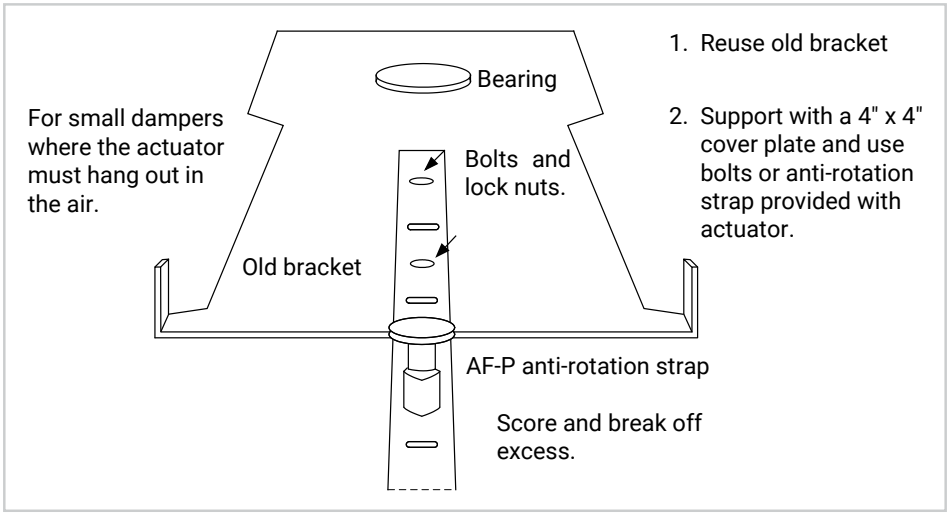


Figure 7.10

Best to mount the Belimo anti-rotation strap stud half-way within the U-slot of the actuator to allow for some movement with non-concentric shafts.

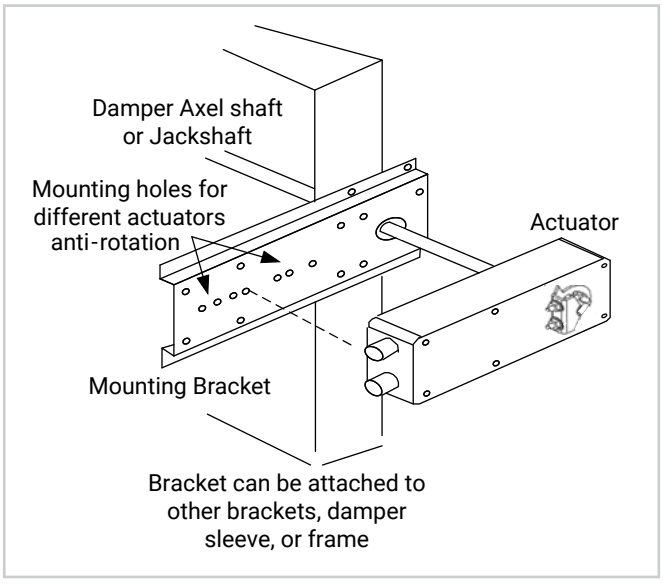


Figure 7.11

1. Actuator mounted to plate by damper manufacturer. (Figure 7.12)

Be sure to complete the notification form and submit it to your AHJ.

Figure 7.12

8. Safe-Air

Replacement of Safe-Air/Imperial Motors with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Siemens

Make & Model	Power	Belimo Replacement	
GGD121	24 V	FSAF24A	FSNF24 US
GGD221	120 V	FSAF120A	FSNF120 US
GGD321	230 V	FSAF230A	FSNF230 US
GND12x.1x	24 V		FSLF24 US
GND22x.1x	120 V		FSLF120 US
GND32x.1x	230 V		FSLF230 US

Electronic Fuse Link (24 Vac)

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

Optional	Two Auxiliary Switches Fixed 5° and 85°

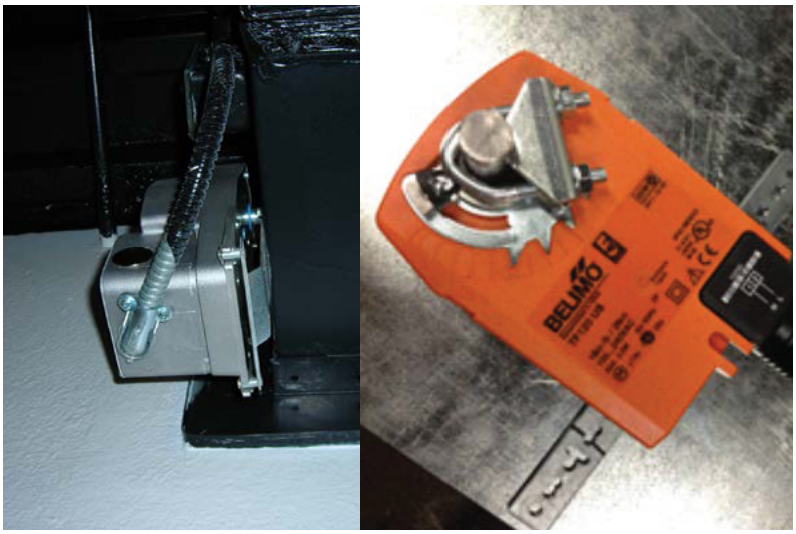


Figure 7.1

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

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

1 Square shaft inserted into damper sleeve with special crankarm. If a smoke damper, replacement may be possible and requires a new shaft and other linkage parts. If a combination fire and smoke damper, Belimo may not be capable of being used. See Air Balance with MP2553.

2 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

3 Safe-Air / Imperial. Typically linkaged. There was an internal spring and fusible link for the fire function.

4 Except in rare occasions where space constraints exist, simply remove all linkage parts and direct couple on damper shaft. Use old motor as a mounting platform for anti-rotation strap

5 Usually on a Negator Spring damper. For pneumatic, the FSLF120 will usually work. For electric, the Ruskin kit FSLF120/MP must be ordered from a Ruskin rep.

6 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary

7 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary.

8 Inside clamp mounting or a shaft extension required.

9 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

10 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft

11 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

12 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

13 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq.ft. and FSNF for dampers > 4 sq. ft.

14 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

15 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove spring and all linkage parts and direct couple to damper shaft.

The Siebe MA3xx and MA4xx motors were linkaged to the damper shaft. The replacement Belimo may be direct coupled or linkaged.

Figure 8.2

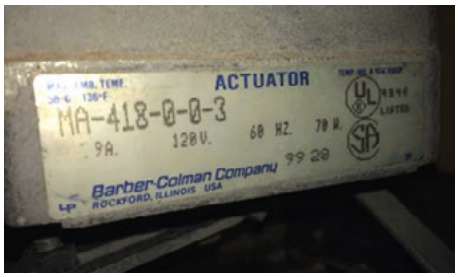


Figure 8.3

Be sure to complete the notification form and submit it to your AHJ.

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.

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

Replacement of Safe-Air ML & MS Motors with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Siemens

Make & Model	Power	Belimo Replacement	
GGD121	24 V	FSAF24A	FSNF24 US
GGD221	120 V	FSAF120A	FSNF120 US
GGD321	230 V	FSAF230A	FSNF230 US
GND12x.1x	24 V		FSLF24 US
GND22x.1x	120 V		FSLF120 US
GND32x.1x	230 V		FSLF230 US

Electronic Fuse Link (24 Vac)

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

Optional	Two Auxiliary Switches Fixed 5° and 85°

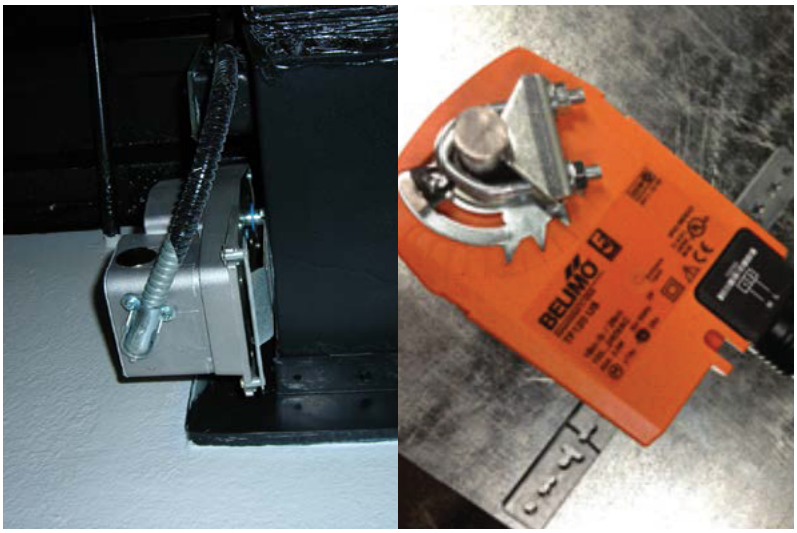


Figure 8.4

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

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

1 Square shaft inserted into damper sleeve with special crankarm. If a smoke damper, replacement may be possible and requires a new shaft and other linkage parts. If a combination fire and smoke damper, Belimo may not be capable of being used. See Air Balance with MP2553.

2 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

3 Safe-Air / Imperial. Typically linkaged. There was an internal spring and fusible link for the fire function.

4 Except in rare occasions where space constraints exist, simply remove all linkage parts and direct couple on damper shaft. Use old motor as a mounting platform for anti-rotation strap

5 Usually on a Negator Spring damper. For pneumatic, the FSLF120 will usually work. For electric, the Ruskin kit FSLF120/MP must be ordered from a Ruskin rep.

6 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary

7 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary.

8 Inside clamp mounting or a shaft extension required.

9 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

10 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft

11 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

12 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

13 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

14 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

15 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove spring and all linkage parts and direct couple to damper shaft.

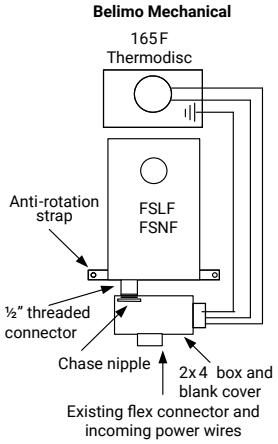
Safe-Air damper with Honeywell Motor

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

Figure 8.5

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

Figure 8.6



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

Figure 8.7

Be sure to complete the notification form and submit it to your AHJ.

9. Prefco/ McCabe Link

McCabe Link®

See figure 9.1.

Prefco manufacturing used a special bimetal assembly for the elevated temperature limit. Many dampers can accept a modern Belimo actuator and work perfectly.

The spring is tensioned when the actuator drives open the first time. For this reason, extra actuator torque is needed. Once pretensioned, the spring is no longer a load on the actuator. Instead of using 4 sq. ft. per FSLF, 18" X 18" is the maximum damper size. The FSNF may be used for dampers up to 12 sq. ft.

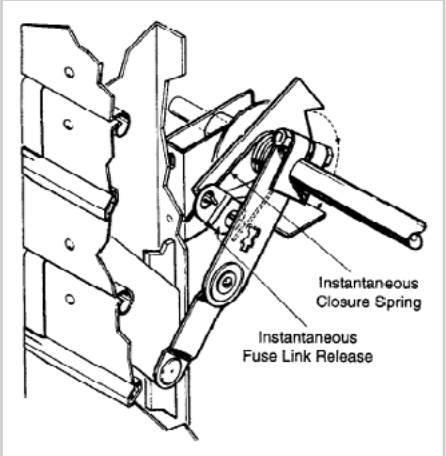


Figure 9.1

Other Prefco Dampers

Some models used a special pulley-cable and mount for the motor. There is no damper shaft available for either direct or linkage mounting. See 5800 EMB drawings. The Belimo FS Series actuators cannot be used with these. Call Belimo for information or see Belimo Dashboard for cross reference data. Each case needs to be examined to determine the correct method for installation. Some parts are available and the damper manufacturer needs to be contacted for information on modification to a UL approved version. In many cases, the whole damper must be replaced.

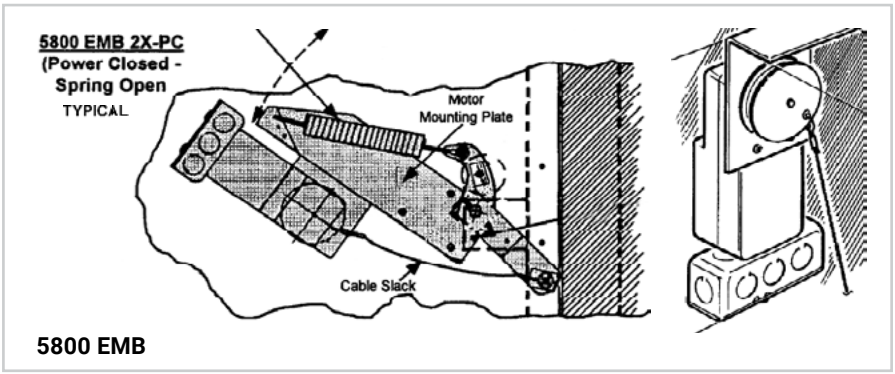


Figure 9.2

Belimo cannot be used to replace the above motors unless a ½" shaft is present.

Modern Prefco dampers use thermal sensors and spring return motors. Replacement is straightforward.

Replacement of Prefco McCabe Link Dampers with EMB2 MultiProducts Motor with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

The EMB2 and other motors were used on these dampers.

Multiproducts and Siebe motors do not cross reference directly to any Belimo as they did not have internal springs. Linkages or direct coupling of the Belimo will replace the application, not the motor. In general this brings the assembly up to present UL standards.

All Belimo Fire & Smoke actuators **(FSTF, FSLF, FSNF, FSAF_A, FSAFB)** are UL555S Listed The FSLF, FSNF, & FSAF_A meet requirements for 350°F operation and the others were tested at 250°F which is the minimum per codes.

All are also UL2043 listed for low smoke generation and may be installed in plenums per the International Mechanical Code Section 602 And the NEC 300.22 (C).

As the old Prefco dampers are no longer manufactured, the torque to area of damper is not clear.

Assuming the damper is in good condition and not binding or corroded, Belimo conservatively recommends:

The **FSTF** should be used for up to 1.5 sq. ft. at 2000fpm on the Prefco cable-pulley dampers. Testing one sample of a large number to ensure proper operation is necessary. This actuator passes 2 sq.ft. in the UL555S test on modern dampers. It should NOT be used on McCabe® Link dampers without special Belimo review.

The **FSLF** should be used for McCabe® Link dampers up to 18" x 18" – direct coupled only where damper shafts are available. Since the actuator must drive against the shaft spring the first time it operates to set the link, de-rating is recommended.

The **FSNF** should be used for larger dampers. It can be direct coupled or linkage connected. It is recommended that it be used for a maximum 36" x 45" section on retrofits.

The **FSAF** actuators have special features (modulation, balancing, manual override, 24 VDC capability) that may be employed, but normally an FSNF is sufficient.

Scan QR Code for more information on RetroFIT+

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

1 Square shaft inserted into damper sleeve with special crankarm. If a smoke damper, replacement may be possible and requires a new shaft and other linkage parts. If a combination fire and smoke damper, Belimo may not be capable of being used. See Air Balance with MP2553.

2 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

3 Safe-Air / Imperial. Typically linkaged. There was an internal spring and fusible link for the fire function.

4 Except in rare occasions where space constraints exist, simply remove all linkage parts and direct couple on damper shaft. Use old motor as a mounting platform for anti-rotation strap

5 Usually on a Negator Spring damper. For pneumatic, the FSLF120 will usually work. For electric, the Ruskin kit FSLF120/MP must be ordered from a Ruskin rep.

6 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary

7 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary.

8 Inside clamp mounting or a shaft extension required.

9 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

10 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft

11 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

12 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

13 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq.ft. and FSNF for dampers > 4 sq. ft.

14 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

15 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove spring and all linkage parts and direct couple to damper shaft.

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

Applications

MultiProducts motors were used in a variety of ways. Two examples are shown below.

Replace Damper.
While the Belimo FSNF can replace the motor here, the damper should be replaced. The broken drywall ruins the fire protection. CODE VIOLATION. (Figure 9.3)

Figure 9.3

Figure 9.4

EMB2X MultiProducts type motor. A number of variations were made. (Figure 9.4)

Figure 9.5

Some internal mounts are very difficult to modify. See example to the right.

The Belimo jackshaft adapter may be considered.

Figure 9.6

Motors were nonspring and many used a “screen door” spring was tensioned when the motor drove the damper open.

The essential point about replacing old Prefco or PHL motors is that one removes all the linkage components, not simply the motor.

Then the Belimo actuator is direct coupled to the damper shaft like modern fire and smoke dampers.

Note the damper shaft here is quite adequate for direct coupled mounting. (Figure 9.7)

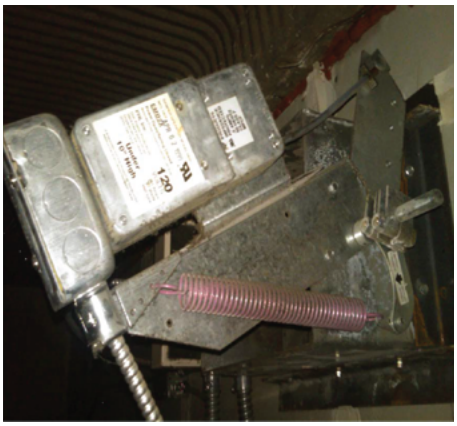


Figure 9.7

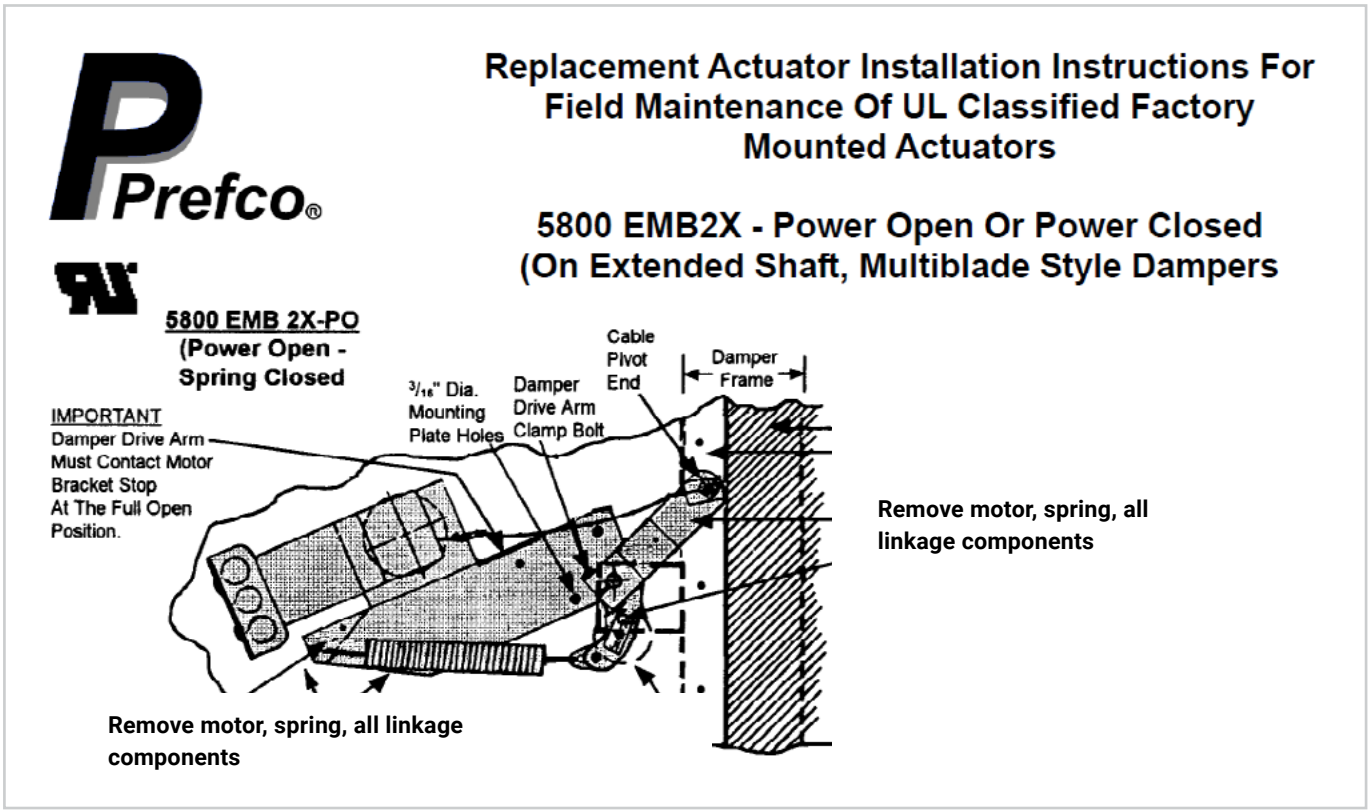


Figure 9.8

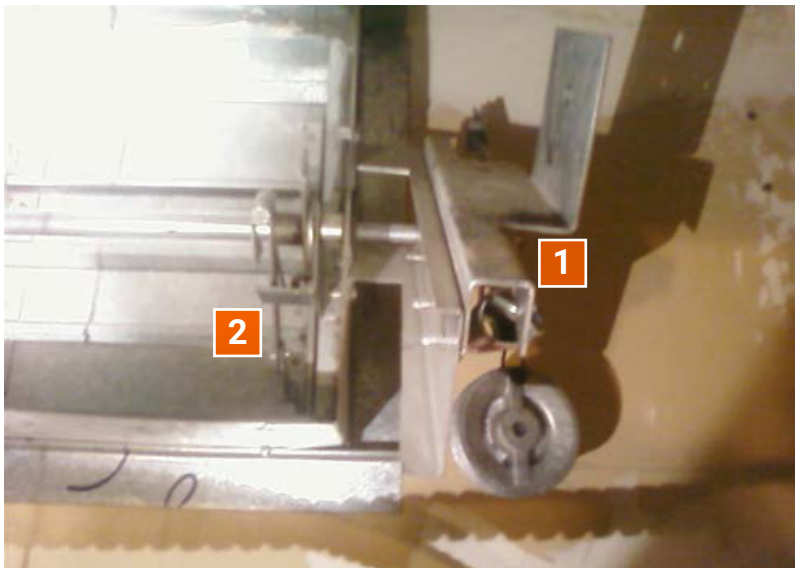


Figure 9.9

1. External spring and bracket parts that will be removed.

   Note that the short ½" shaft is available for mounting Belimo. When too short for direct coupling, see linkages below.

2. McCabe Link and shaft spring.

   These are not to be modified as they perform the fire damper closing function.

Regardless of what motor was used, this application can be replaced with a Belimo by removing the linkage parts and **mounting the Belimo on the damper shaft.** The spring must be removed unless it is part of the fire closing function. The bracket may be used in some cases to mount the Belimo anti-rotation strap. See the Mounting chapter for more details.

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.

Prefco McCabe® Link Operation with Belimo FSxx Series

Figure 9.10

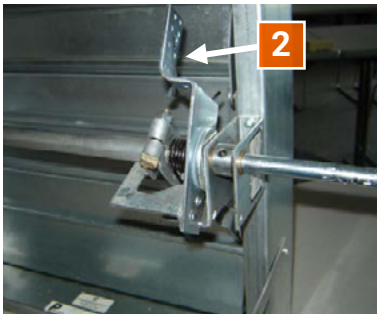


Figure 9.11

The motor arm is not engaged in the McCabe® Link above.

1. McCabe Link.

   Shaft spring has slammed damper

2. Motor Arm

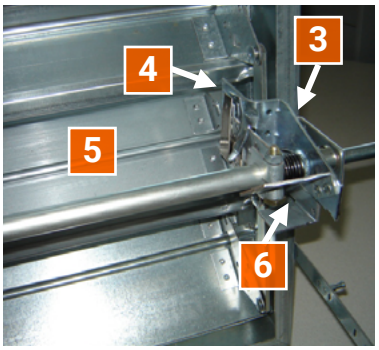


Figure 9.12

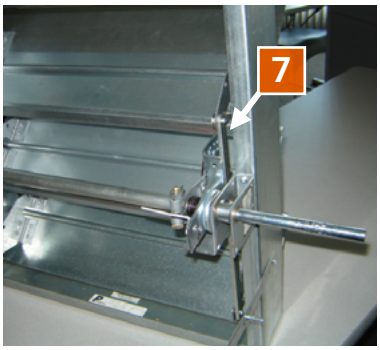


Figure 9.13

The motor arm is engaged in the McCabe® Link above. (Figure 9.12)

Alternate view. (Figure 9.13)

3. Motor Arm Engaged in Link
4. McCabe Link Bimetal
5. Jackshaft
6. Spring
7. Blade pivot lever arm with kneelock action.

When the actuator turns (here clockwise from the shaft side of damper), it moves the motor arm down and tensions the jackshaft spring. The arm catches in the Link and holds.

WARNING!

CAUTION!!!!

The shaft spring closes the damper in < 1 second.

Do not put hands inside damper due to risk of injury.

Replacement Instructions McCabe™ link damper models

Mounting actuators on dampers less than 10" in height (U10)

If the damper is less than 10" in height (U-10), the drive rod requires less than 90º of rotation (varies from 43-48º). As the drive mode delivers substantially more torque than the spring return it is preferred to have the actuator at full open when the damper is open. Therefore, for U-10 dampers the suggested method of installation is to power the actuator open, hold the damper open and then tighten the actuator to the shaft. Installing the actuator when de-energized on a closed damper could cause damage to the damper linkage as the actuator continues to attempt to drive the damper open after rotation has ceased.

1. Disconnect incoming power and wiring at junction box or actuator. Tag all wires.
2. Remove old actuator and mounting bracket. Attach shaft extension if required.
3. Mount Belimo FSLF or FSNF.
4. Reconnect wiring per original drawing. Typical wiring shown below.
5. Restore incoming power.
6. **Test all functions.**
    a. Open smoke detector or relay contacts. Actuator springs damper fully closed.
    b. Re-close contacts. Actuator drives damper open.
    c. Trip McCabe™ link with long screwdriver. Actuator is disconnected and the damper spring engages to **fully** close damper. CAUTION <1 SECOND CLOSING.
    d. After link release on a McCabe link operated damper, the best method of reset is to open the electrical circuit and allow the return spring of the actuator to unwind to the closed position – this resets the McCabe link. Then restore power and the actuator/damper assembly should wind back to open.

Replacement of old motors.

1. Remove old motor and external spring. A number of different discontinued motors were used.
2. Clean damper. Test McCabe® Link, open and close blades to ensure operation. Engage motor arm in McCabe® Link.
3. Close damper and place Belimo on shaft in sprung closed direction. (See 10" note above.)
4. Mark holes and install anti-rotation strap.
5. If damper requires, install Belimo on jackshaft with 5° preload. Set anti-rotation strap with one screw and rotate out of way of U-slot in actuator.
6. Close tight. Then insert anti-rotation stud and second screw.

Test functions after installation of Belimo

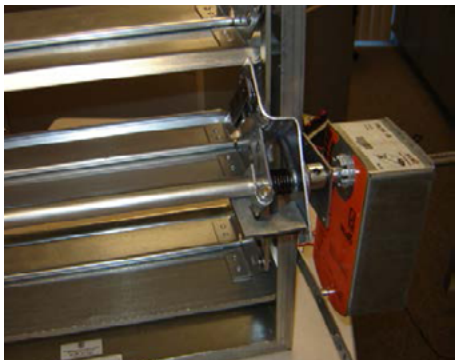


Figure 9.14

Actuator has opened the damper. McCabe® Link must be engaged for actuator to move damper. (Figure 9.14)

Figure 9.15

1. Power actuator. Damper opens. McCabe® Link is engaged in order to operate.

Actuator has sprung damper closed. (Figure 9.15)

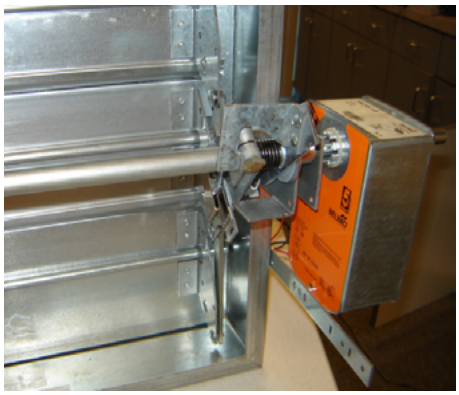


Figure 9.16

2. Cut power to actuator. Actuator spring closes damper. McCabe® Link is engaged.

Another view of actuator sprung closed. (Figure 9.16)

The actuator must wind up the spring the first time it drives. That one time requires extra torque. For that reason the actuators cannot operate as much damper area and require derating:

McCabe® Link dampers:

Up to 18" x 18"	FSLF (30 in-lb)
Up to 36" x 45"	FSNF (70 in-lb)

Be sure to complete the notification form and submit it to your AHJ.

Prefco Internal Pulley-Cable with MultiProducts Motor and Damper Blade Springs – Replacement with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Multiproducts and Siebe motors do not cross reference directly to any Belimo as they did not have internal springs. Linkages or direct coupling of the Belimo will replace the ***application***, not the ***motor***. In general this brings the assembly up to present UL standards.

All Belimo Fire & Smoke actuators (FSTF, FSLF, FSNF, FSAFA, FSAFB) are UL 555S Listed with the various damper manufacturers. The FSLF & FSNF meet requirements for 350°F operation and the others were tested at 250°F which is the minimum per codes.

All are also UL2043 listed for low smoke generation and may be installed in plenums per the International Mechanical Code Section 602 And the NEC 300.22 (C).

As the old Prefco dampers are no longer manufactured, the torque to area of damper is not specifically defined. Therefore conservative sizing is followed here.

Assuming the damper is in good condition and not binding or corroded, Belimo conservatively recommends:

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Note: 3 sq. ft. with McCabe® Link

Scan QR Code for more information on RetroFIT+

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

1 Square shaft inserted into damper sleeve with special crankarm. If a smoke damper, replacement may be possible and requires a new shaft and other linkage parts. If a combination fire and smoke damper, Belimo may not be capable of being used. See Air Balance with MP2553.

2 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

3 Safe-Air / Imperial. Typically linkaged. There was an internal spring and fusible link for the fire function.

4 Except in rare occasions where space constraints exist, simply remove all linkage parts and direct couple on damper shaft. Use old motor as a mounting platform for anti-rotation strap

5 Usually on a Negator Spring damper. For pneumatic, the FSLF120 will usually work. For electric, the Ruskin kit FSLF120/MP must be ordered from a Ruskin rep.

6 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary

7 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary.

8 Inside clamp mounting or a shaft extension required.

9 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

10 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft

11 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

12 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

13 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq.ft. and FSNF for dampers > 4 sq. ft.

14 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

15 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove spring and all linkage parts and direct couple to damper shaft.

Examples

Several variations like the one below were made. Direct couple where external shaft exists. Linkages and FSNF may be used for some. Contact Belimo.

Motors were nonspring and a "screen door" spring was tensioned when the motor drove the damper open. (Figure 9.17)

Figure 9.17

A bracket held the motor and often a pulley which connected to a crank arm.

All these parts will be removed in order to direct couple a Belimo. (Figure 9.18)

Figure 9.18

View from the top of the motor. Note the damper shaft is available for mounting like modern damper-actuators. (Figure 9.19)

Figure 9.19

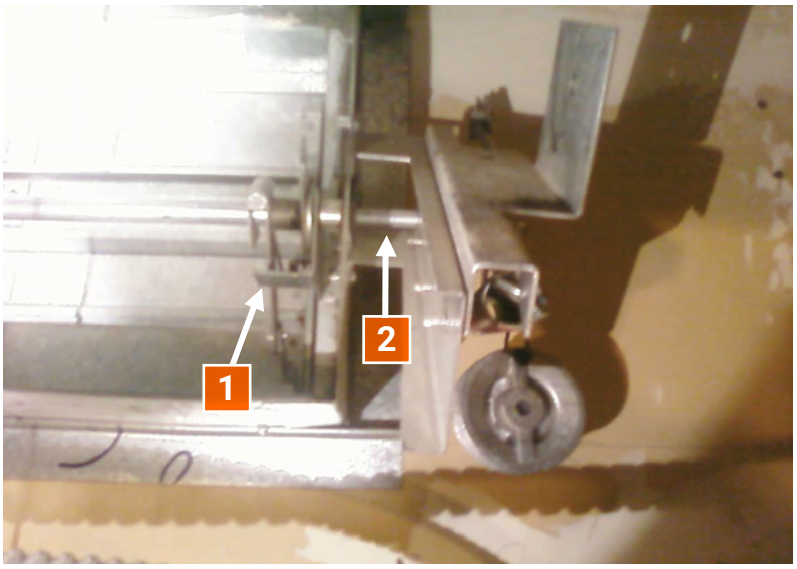


Figure 9.20

1. McCabe Link
2. Damper shaft

Numbers in the photograph above shows the McCabe Link and the damper shaft. All the linkage parts are removed and the actuator will be direct coupled as shown below.

The four photographs below show a multisection damper an motor connection. There is a cable running from a pulley on the motor that operates the damper. This is a special case.

Examination of the possibilities will be necessary. A linkage arrangement with the FSNF actuator is most likely required after removing the old parts. See the Mounting Chapter for more examples and information.

Figure 9.21

Figure 9.22

Figure 9.23

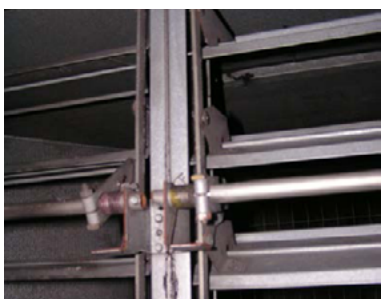


Figure 9.24

Direct Coupling Methods

Standard Mounting

Figure 9.25
Standard shaft mounting with anti-rotation strap.

Figure 9.26
Actuator is mounted straight on the damper shaft.

Figure 9.25

Figure 9.26

McCabe Link®

For more details, visit www.belimo.com/firesmoke

McCabe Link FSNF used to be sure that there is enough torque to operate the link. (Figure 9.27)

In general the McCabe Link handles the fire closing function of the damper. It should be left alone when replacing actuators.

The actuator handles the smoke damper function. It springs closed and drives open per the wiring diagrams below.

The McCabe link operates independently of the actuator. This makes electric actuator replacement and testing a straightforward process.

Note that in figure 9.27 that the damper shaft extends outside the duct. All the old linkage components are disconnected and the actuator is direct couple mounted.

The McCabe™ link mechanism operates independently of the actuator.

After mounting and wiring of the actuator, it is necessary to test all operations.

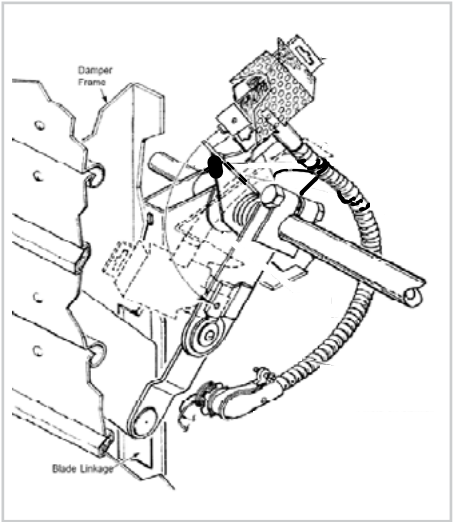


Figure 9.27

It is important that the damper still seals properly. This damper (Figure 9.28) appears to need new seals or complete replacement.

See NFPA 80 & NFPA 105.

Detail of linkage and springs.
These springs must be disabled and removed so that they do not interfere with blade rotation when old motor is replaced.

See arrows in figures 9.29 and 9.30 for springs.

Figure 9.30

Figure 9.28: Prefco damper viewed from front

Figure 9.29: View from motor side

Replacement Instructions

1. Disconnect incoming power and wiring to thermal sensor (if used) at actuator. Tag wires. (Sensor may be inside the damper sleeve and only accessible from inside. Most of this assembly used fusible links or had none at all.)
2. Disconnect and remove frame-to-blade springs. Discard. Modern motors have internal springs and the old springs are an added torque load.
3. Remove old actuator and mounting bracket. This includes the cable connection and pulley.
4. Attach either ZG-DC1 or ZG-DC2 or equal damper attachment clip to blade. (See mounting chapter)
5. Select linkage assembly (See mounting chapter) and connect to actuator.
6. Depending on the geometry of the damper, use one of the mounting methods described in mounting section to assemble actuator and linkage.
7. Close damper. Mount Belimo actuator. Check that actuator springs in closed direction unless (rarely) damper is fail open.
8. Reconnect wiring.
9. Restore incoming power.
10. Ensure easy movement of damper, linkage, and actuator by operating several times open to close.
11. **Test all functions.**
    a. Power actuator. Press sensor or smoke detector reset if necessary. Damper drives open.
    b. Open smoke detector or relay contacts. Actuator springs damper closed.
    c. Reclose contacts. Actuator drives damper open.
    d. Trip thermal sensor if used. Actuator springs damper closed.
    e. Test smoke detector or relay if present. Check fusible link if present. Reset any controls as necessary. Actuator drives damper open.

The precise sequence for testing depends on the architecture of the damper and controls. Call Belimo with questions.

See Fire Marshal or Building Official Form in the AHJ Forms chapter.

Be sure to complete the notification form and submit it to your AHJ.

WARNING!

Linkage brackets may not be attached to the ducts. 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.

Prefco Series 5000 Damper Motor Replacement with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S US	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch **						**
32003532002 Aux Switch **						**

* Use FSNF series if damper is > 4 sq. ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Barber ColmanSiebe—Invensys

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

Prefco McCabe® Link

McCabe Link® dampers are covered in detail in this document and can be found at Belimo.com

Figure 9.31

Siemens

Make & Model	Power	Belimo Replacement	
GGD121	24 V	FSAF24A	FSNF24 US
GGD221	120 V	FSAF120A	FSNF120 US
GGD321	230 V	FSAF230A	FSNF230 US
GND12x.1x	24 V		FSLF24 US
GND22x.1x	120 V		FSLF120 US
GND32x.1x	230 V		FSLF230 US

Electronic Fuse Link (AC 24 V)

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

Optional	Two Auxiliary Switches Fixed 5° and 85°

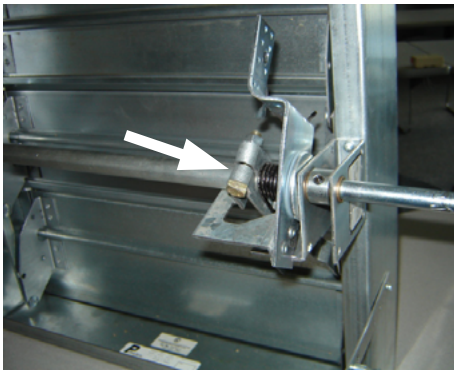


Figure 9.32

Prefco or PHL 5800, MB2, MB3, EM2X, & others
In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

Most Multiproducts motors 5800 and EM2X and the like are covered in several other chapters within in this document, based on your damper.

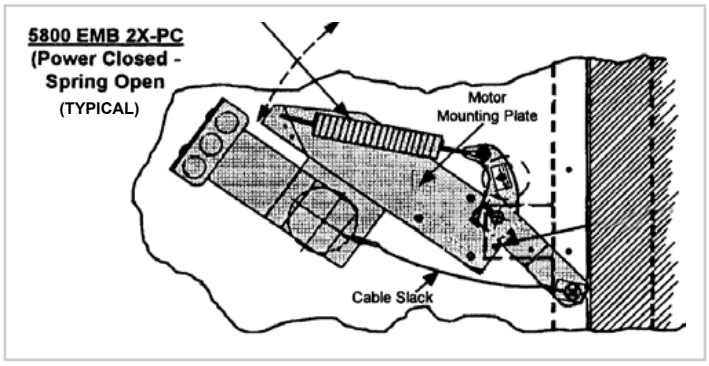


Figure 9.33

Use of the FSTF and linkage is shown for replacement on dampers less than 2 sq. ft. Larger dampers require the FSNF and linkage.

Cable-pulley Applications

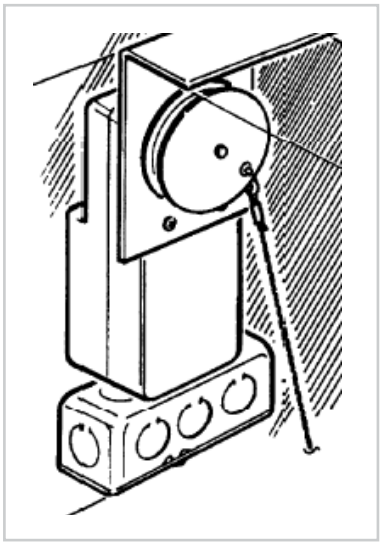


Figure 9.34

Figure 9.35

Call Belimo for information about other actuators or applications. Photographs aid in identification to ensure accuracy.

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.

Prefco Series 5000 Dampers

Model 50201 – Resettable combination air/smoke/fire damper with McCabe link.
The operation of the actuator open (or closed) resets the temperature link if the duct temperature drops below its setpoint.

Model 5020 – Fusible link operated air/smoke/fire damper
This incorporates the standard one time fusible link to respond to a rise in duct temperature. It is reopenable only up to the chosen link-disconnect temperature.

McCabe Link

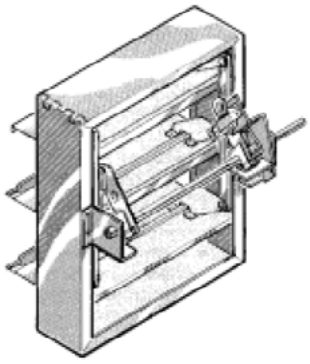


Figure 9.36

Model 5010 – Electrically signalable combination air/smoke/fire damper

Similar to the 5020-1 above. It incorporates an electrically energized heating element laminated directly to the bimetallic McCabe™ link on the damper's operator. This (or an elevated temperature condition) releases the damper blades and physically disconnects them from the actuator drive shaft. Therefore, an actuator is only needed for automatic reset/reopen.

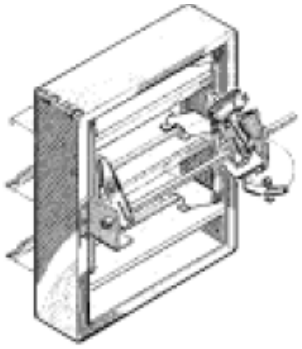


Figure 9.37

Models 5150/5151 – Air/smoke/balancing dampers

– Smoke rated only.

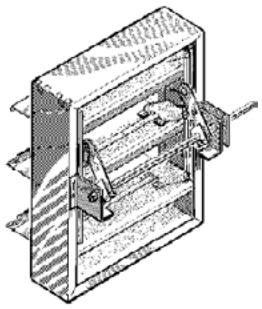


Figure 9.38

The extended shaft extends outside the duct. Direct coupling is the preferred method.

Crank arm linkage is possible where space or other constraints exist.

The McCabe™ link mechanism operates independently of the actuator.

After mounting and wiring of the actuator, it is necessary to test all operations.

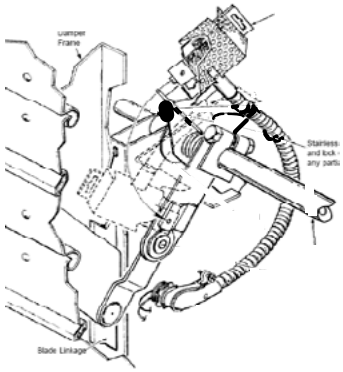


Figure 9.39

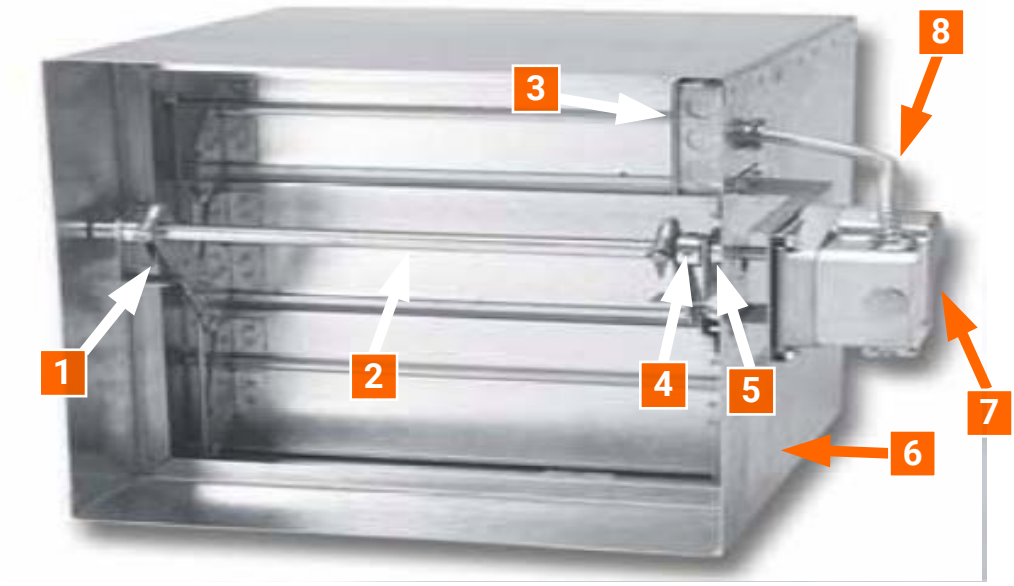


Figure 9.40

1. Knee Lock
2. Jackshaft
3. Thermal Sensor
4. Coupler
5. Shaft
6. Sleeve
7. Existing Motor
8. Flex Conduit

Above shows typical Model 5050/5150 damper with a Honeywell motor Below shows Belimo mounted to jackshaft with the damper sleeve removed.

Mounting

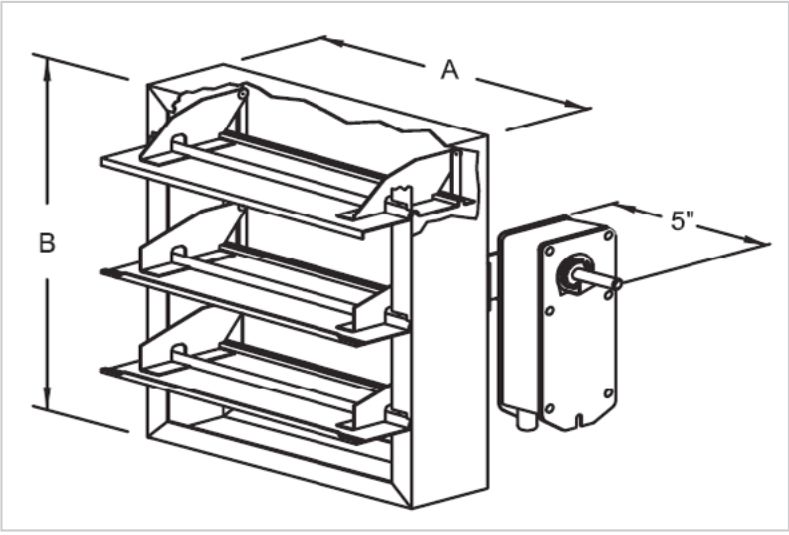


Figure 9.41

Replacement Instructions Series 5000 and 5100 Dampers

Replacement Instructions – Thermal Sensor Version

1. Disconnect incoming power and wiring to thermal sensor at actuator. Tag all wires. (Sensor may be inside the damper sleeve and only accessible from inside.
2. Remove old actuator and mounting bracket
3. Close damper. Mount Belimo actuator. Check that actuator springs in closed direction.
4. Reconnect wiring per original drawing. Typical wiring shown below.
5. Restore incoming power.
6. Test all functions.
    a. Power sensor and actuator. Press reset if necessary.
    b. Open smoke detector or relay contacts. Actuator springs damper ***fully*** closed.
    c. Reclose contacts. Actuator drives damper open.
    d. Trip thermal sensor. Actuator springs damper ***fully*** closed.
    e. Press manual reset. Actuator drives damper open.

Found in the AHJ Notification Form chapter.

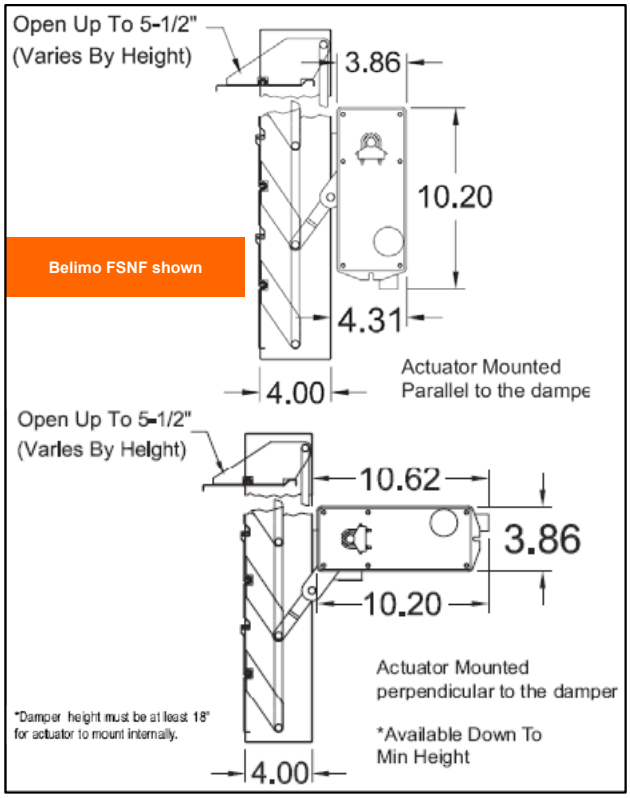


Figure 9.42

Internal mount

Internally mounted actuators are prevented from rotating by a stud or screw on a bracket. Do not jam the stud hard into the U-slot of the actuator. Let actuator have slight up and down movement.

To replace actuator remove jackshaft and slide actuator off. Reverse process to put new actuator on jackshaft.

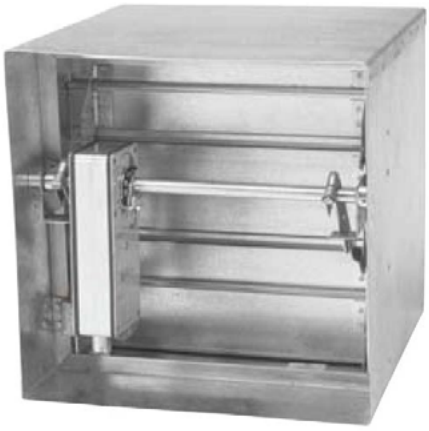


Figure 9.43

Knee-lock adjustment

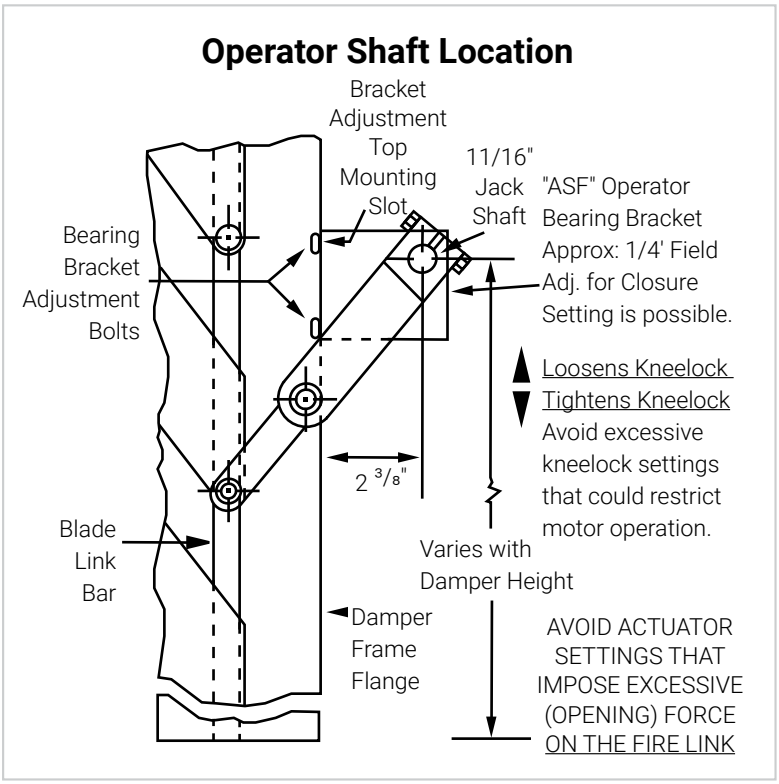


Figure 9.44

Be sure to complete the notification form and submit it to your AHJ.

10. Air Balance

Negator Spring – Ruskin and Air Balance-American Warming

Some negator spring dampers used thermal sensors, some used fusible links or rods. Check application before replacing actuator.

The **black arrow** points to the spring. The **white arrow** points to the fusible link. (Figure 10.1)

Instructions from Air Balance are available for modification of the damper to modern methods. A thermodisc, new linkages, external shaft to actuator bracket, and new actuator are required as well as formal testing.

If access permits, a new damper may be the best technical solution.

Instead of a fusible link, a fusible rod is used here.

Black arrows point to springs and the **white arrow** to the fusible rod. (Figure 10.2)

These applications require special factory contact for repair and retrofit of actuators. Some kits exist already and some may need to be put together.

Obtain make and model of damper and actuator for replacement information.
Careful use of instructions required as well as AHJ approval.

Instead of leaving the old negator spring, which makes the actuator work extra holding it open, install a Belimo BAE165 and an actuator while bypassing the old mechanical parts. Approval from the AHJ must be obtained before making these changes. Replacing the damper itself is recommended when extensive changes are necessary to bring it up to modern control methods.

Figure 10.1

Figure 10.2

External Spring

In the vast majority of cases, removing the old spring and motor and installing a new actuator repairs the damper function.

Single spring with thermodisc. (Method used by Ruskin for many years.) There was an external spring that was tensioned when the actuator drove open. There was no fusible link or shaft spring. This functioned like a modern internal spring actuator. See photograph below.

A thermodisc was used initially and cut power if the temperature rose. Both linkages and direct coupled methods were used and both have passed UL555(S).

The external spring and non-spring actuator function identically to a modern actuator with an internal spring.

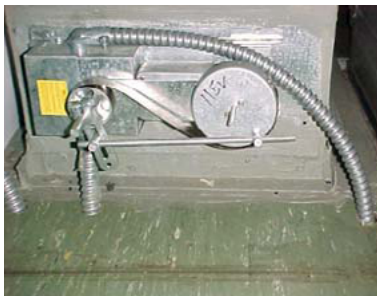


Figure 10.4

Figure 10.5

These functioned like a modern internal spring actuator. Check the fusible link operation in case some modifications have been made and function needs to be reestablished.

The linkage and actuator are removed and the Belimo FS actuator mounts on the shaft.

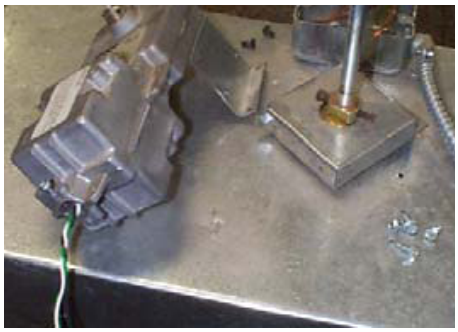


Figure 10.3: The old motor and spring are disassembled and removed. Then a Belimo can be direct coupled in the old motor's place.

Typical Installation of Internal Spring Actuators

Modern (fire & smoke) damper actuators have internal springs.

1. **Shaft spring with fusible link.** Some dampers have the fusible link and shaft spring and a spring return actuator. The damper functions as the dual spring method detailed above.

   The actuator can be replaced without modifying the damper, shaft, spring, or link. This is because the shaft spring only functions with the fusible link and is not required to close the damper if power is removed from the actuator. The actuator's internal spring accomplishes that function in response to the smoke detector or smoke relay controlled from the area smoke detectors.

2. **Standard actuator and thermodisc(s) – actuator spring only.** The smoke detector or smoke relay or thermodisc cuts power to the actuator and it springs the damper closed. Other than basic technical specifications – torque, voltage, current draw, speed, and mounting - actuators are interchangeable.

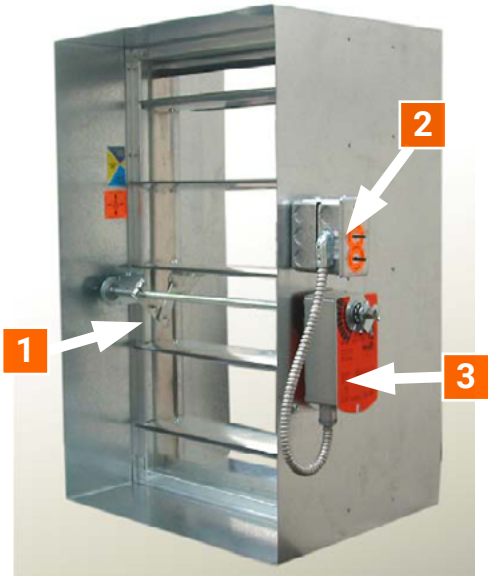


Figure 10.6

Photograph courtesy Pottorff Division of PCI

Figure 9.6

1. Jackshaft and arm to damper blade
2. Dual thermodisc manual reset sensors
3. FSLF120 Actuator

Summary

Smoke dampers had no high temperature limit and are simpler to repair in general. There are three general methods for controlling combination fire and smoke dampers:

1. Single spring with motors without springs. Damper must be rebuilt with manufacturer assistance and/or instructions. Contact Belimo for more information.
2. Two springs – one for the fusible link, one for the actuator. Remove defective motor and spring; mount Belimo.
3. Modern method with spring inside actuator. Remove defective and replace.

Mounting Methods and Typical Accessories

Mounting of replacement actuators is dependent upon individual applications, site requirements, and type of equipment being replaced. A selection of accessories and mounting kits are available. Refer to the mounting chapter or product Data sheets for a full list of compatible accessories.

Typical example illustrated below:
When needed, use a chase nipple to connect electrical J-box to the Belimo ½" conduit connector. A 4" x 4" box can be used when the auxiliary switch wiring goes into a conduit.

Figure 10.7

Figure 10.8

Check damper manually for smooth operation before mounting actuator. Good installation includes mounting the actuator straight and level. Bend the anti-rotation strap at the slots to clear the actuator's splines and any obstructions. Mount in correct spring return direction. Drive open and closed three times to ensure proper operation.

See the mounting chapter for more details.

Be sure to complete the notification form and submit it to your AHJ.

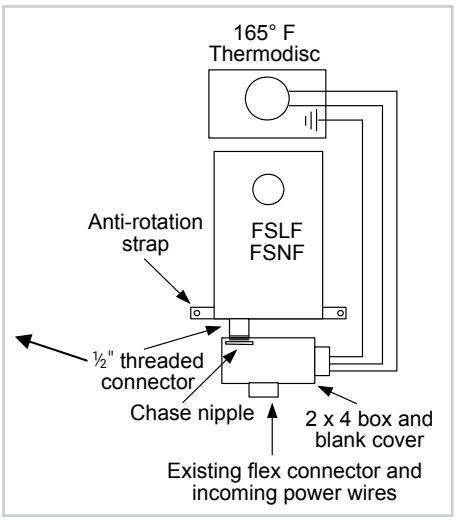


Figure 10.9

Replacement of Air Balance MultiProducts Jackshafted Motor with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq.ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S US	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch						**
32003532002 Aux Switch						**

* Use FSNF series if damper is > 4 sq.ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Siemens

Make & Model	Power	Belimo Replacement	
GGD121	24 V	FSAF24	FSNF24
GGD221	120 V	FSAF120	FSNF120
GGD321	230 V	FSAF230	FSNF230
GND12x.1x	24 V	FSLF24	
GND22x.1x	120 V	FSLF120	
GND32x.1x	230 V	FSLF230	

Electronic Fuse Link (AC 24 V)

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

Optional	Two Auxiliary Switches Fixed 5° and 85°

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24-S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

WARNING!

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

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

1 Square shaft inserted into damper sleeve with special crankarm. If a smoke damper, replacement may be possible and requires a new shaft and other linkage parts. If a combination fire and smoke damper, Belimo may not be capable of being used. See Air Balance with MP2553.

2 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

3 Safe-Air / Imperial. Typically linkaged. There was an internal spring and fusible link for the fire function.

4 Except in rare occasions where space constraints exist, simply remove all linkage parts and direct couple on damper shaft. Use old motor as a mounting platform for anti-rotation strap

5 Usually on a Negator Spring damper. For pneumatic, the FSLF120 will usually work. For electric, the Ruskin kit FSLF120/MP must be ordered from a Ruskin rep.

6 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary

7 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary.

8 Inside clamp mounting or a shaft extension required.

9 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

10 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft

11 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

12 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

13 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

14 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

15 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove spring and all linkage parts and direct couple to damper shaft.

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. (Figure 10.10)

FSLF mounted on the damper shaft. Two sheet metal screws hold the anti-rotation strap. Two nuts secure coldweld clamp onto shaft. (Figure 10.11 & 10.12)

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.

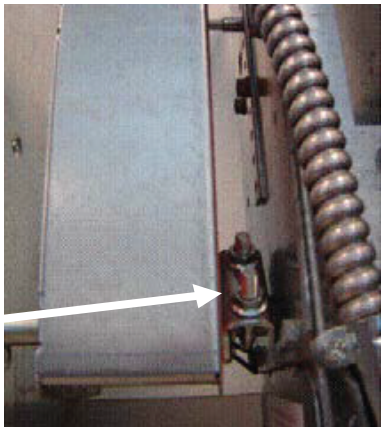


Figure 10.11

Figure 10.12

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.

Figure 10.10

Replacement Instructions

State Fire Marshal approved replacement. Local fire department was informed since it was first replacement at the location.

Figure 10.13
About 20 years old. Three dampers and actuators with separate electric thermal sensors. None of the actuators are working. Bottom actuator and jackshaft have been removed; damper repair parts are on site.

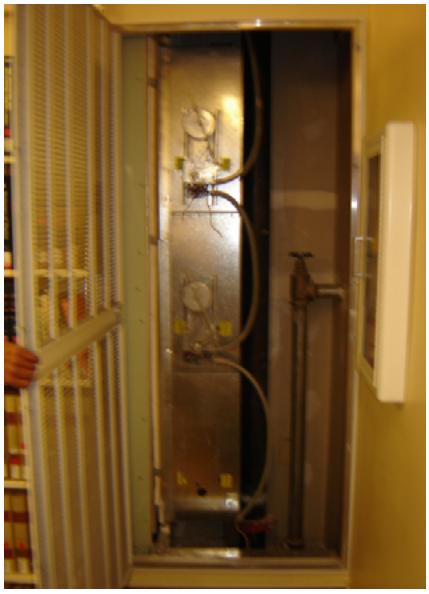


Figure 10.14
Jackshaft, crank arm to blade, and linkage from blade to blade are shown here. Clean! Damper moves freely and seals well.

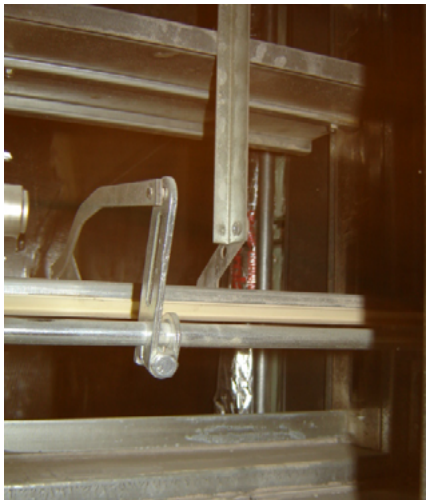


Figure 10.15
Single thermal sensor is shown (white arrow) although wiring diagram may show two sensors.

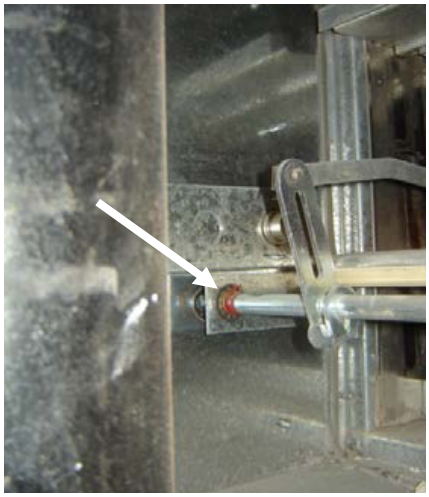


Figure 10.16 & 10.17
Close-up views of old motor set-up.

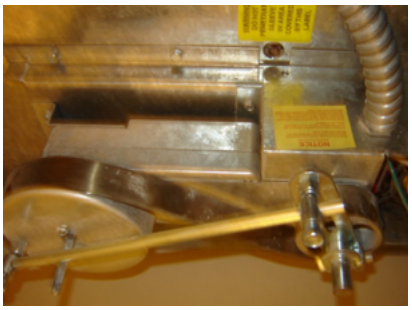


Figure 10.18
Electrical wiring with cover removed. Damper indication blade switches are present although not wired or used.

Figure 10.19
Remove spring housings, ball joints and rod to expose damper shaft, plate and motor beneath it.

Figure 10.20
Rats' nest of wires can be cleaned up. Remove shaft indication switches and wires if not used.

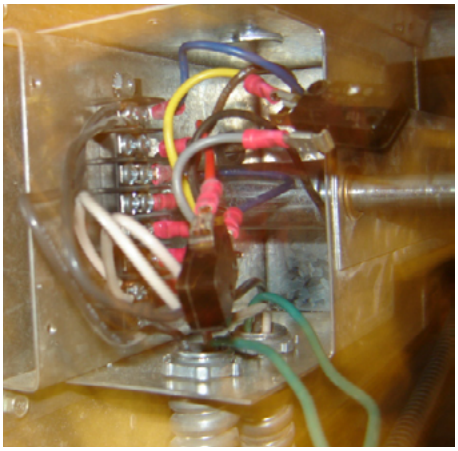


Figure 10.21
Clean wiring after pulling out unused wires. See wiring diagram below.

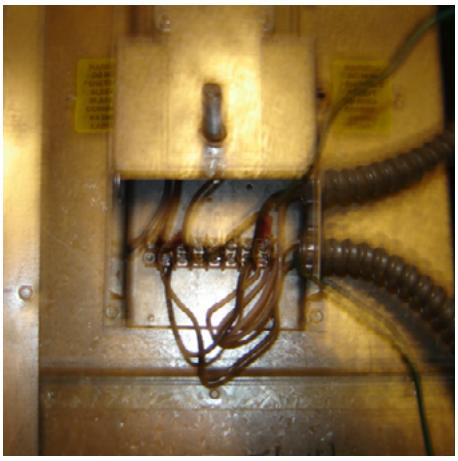
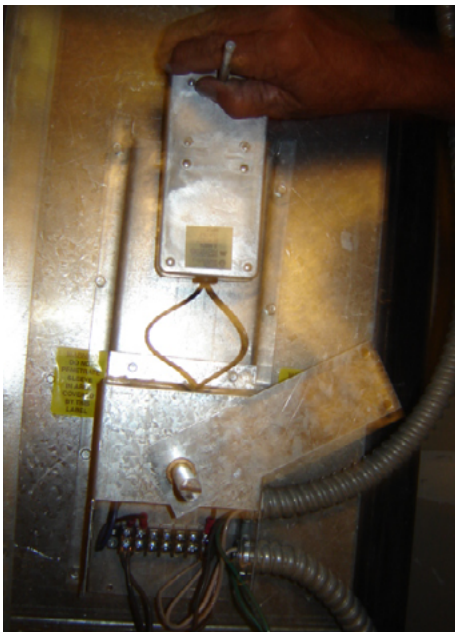


Figure 10.22
Unscrew and lift motor out. Cut the motor wires as close to the motor as possible. Tag and pull wires out to reuse to connect to the Belimo. Alternately, use new 16ga. Wires.



Details Will Vary.
This is the wiring shown on the inside of the wiring compartment cover. It is set up for a Fire Fighters Smoke Control System panel application. In most cases, all the wiring is not used. (Figure 10.23)

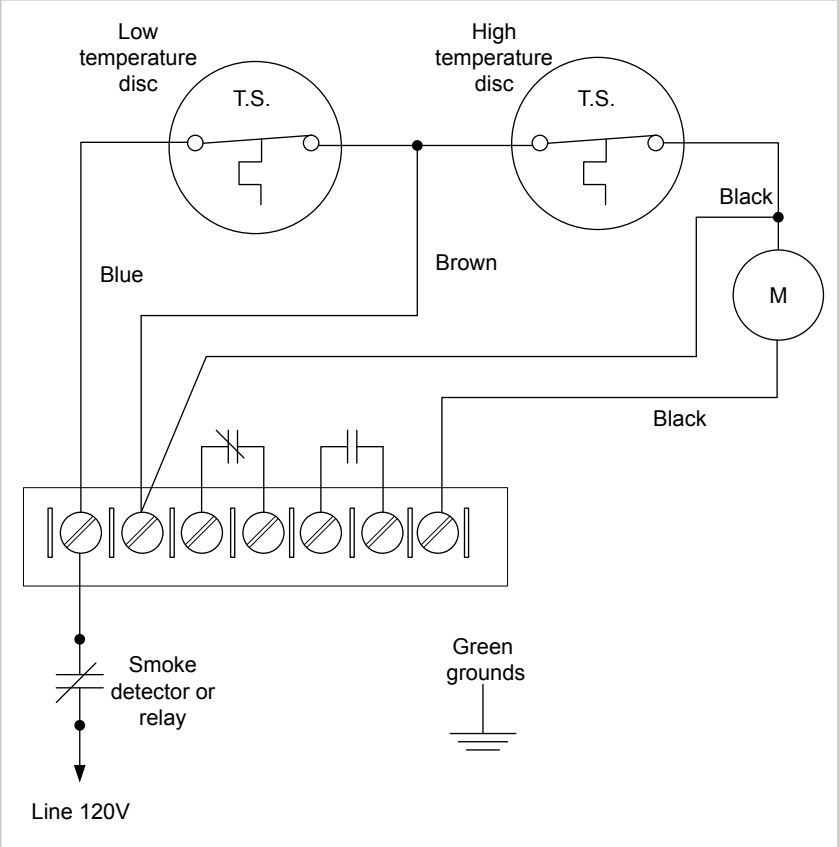


Figure 10.23

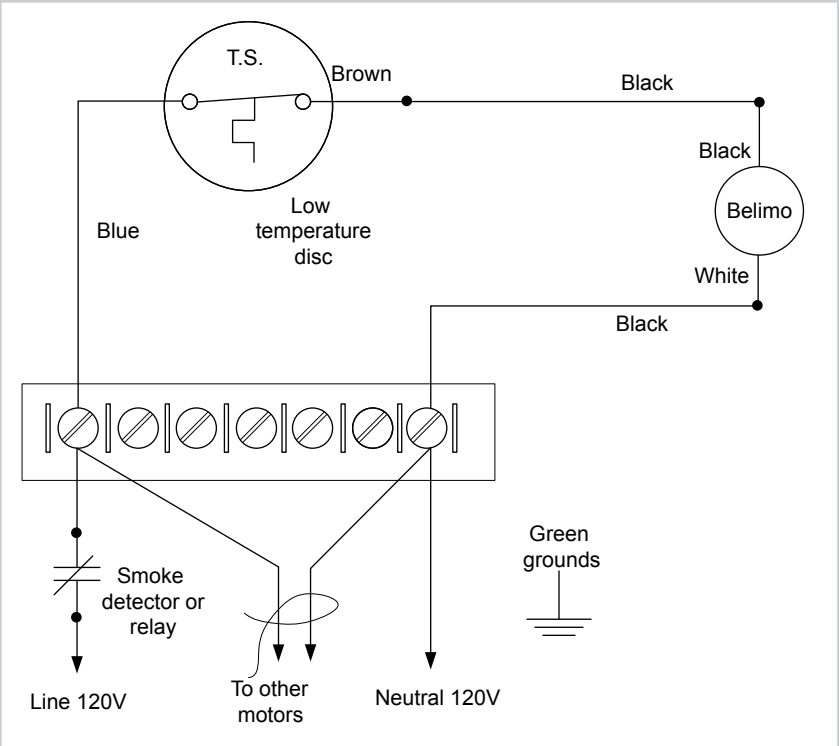


Figure 10.24: Essential wiring for a containment damper

Figure 10.25
Old motor can serve as a foundation for the new actuator. Mount actuator. Anti-rotation strap may be screwed into the front of the old motor, as here into the side (arrow), or on a fabricated plate. A 4"x4" box cover would serve to hold anti-rotation plate if needed.

See Mounting chapter for details.
Be sure the actuator is firmly mounted on the shaft and the anti-rotation strap is firmly attached to a base. The thin plate is insufficient by itself. It cannot be removed since it is held on by the shaft bearing. The motor shaft does not have to be cut off if an FSLF is mounted. If an FSNF is mounted, the shaft should be cut off. A plate, such as a 4" x 4" electrical plate can be screwed into the wiring box if preferred and the anti-rotation strap screwed to it. If any vibration exists, bolts with lock nuts should be used instead of screws. Space constraints can dictate the best method of attachment.

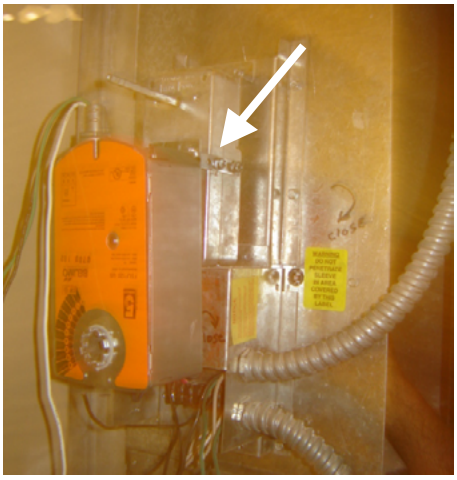


Figure 10.25

Figure 10.26
The shaft on the old damper is too short to mount the Belimo clamp on the outside. It is just as secure on the inside. A thin-walled, deep-well, ¼" drive 10mm socket is easiest to use.

Figure 10.26

Figure 10.27
Pull the wires of the Belimo thru flex and attach to the K.O. of the wiring compartment box. Here, the left side is most convenient.

Check voltage after repowering the system. Voltage must be as specified – typically 120 V or 24 V. With the high current draw of the old motors, a breaker could be weak and a voltage drop occur. Corrosion at connections can cause voltage drops or hot connections.

The thermal disc could be corroded or stuck closed. Open and then reset using an appropriate heat source.

Test smoke detector or fire alarm system relay per manufacturer's instructions.

See AHJ Notification form Chapter for the Fire Marshal form with a list of final checks.

Figure 10.27

Figure 10.28
Completed installation.

Test 3 full cycles open to closed. While this is not required in codes, it is a good practice and simulates the UL 555S test which cycles dampers 3 times.

Complete Fire Marshal form (found in the AHJ Notification form Chapter). Retain on premises.

Figure 10.28

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. (Figure 10.29 & 10.30)

Special Mounting

Depending on the geometry, any number of mounting arrangements are correct. The most common is shown at left.

Alternately, the anti-rotation strap can be attached to any Belimo linkage, an electrical J-box cover plate, or to a pieced 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 Mounting chapter for more details.

Be sure to complete the notification form and submit it to your AHJ.

Figure 10.29

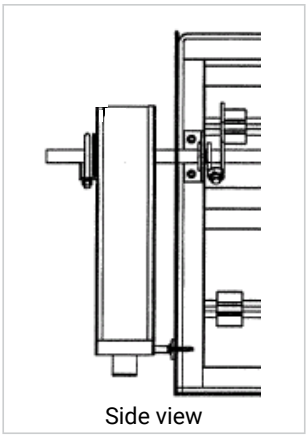


Figure 10.30

Replacement of Air Balance Honeywell ML & MS with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq.ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch						**
32003532002 Aux Switch						**

* Use FSNF series if damper is > 4 sq.ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24 S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	60	1	FSNF120S 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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

Fire & Smoke Damper Technical Details

A number of different brackets have been used. All allow mounting of Belimo.

Figure 10.31

Figure 10.32: Small bracket

WARNING!

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

Large bracket

Figure 10.33

Figure 10.34

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.

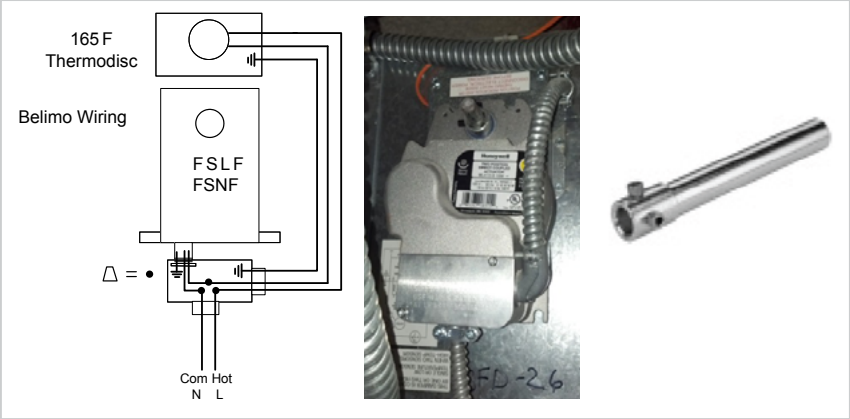


Figure 10.35

Figure 10.36

1. Four bolts hold actuator to the mounting plate.
2. Sheet metal holder bracket and mounting plate.

   This compartment does not have to be opened except to reset sensor during acceptance testing. The bracket does not have to be removed from damper.

   Shown here for instruction.
3. 165°F (typical) sensor

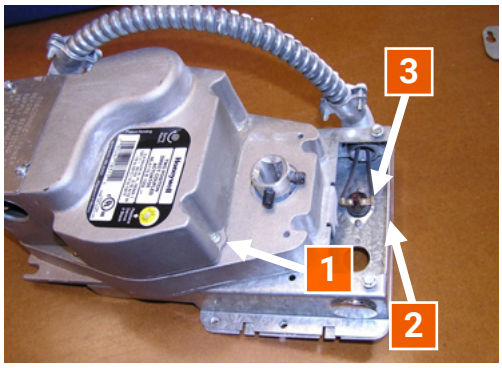


Figure 10.36

Replacement Instructions

1. Disconnect power and wires from motor in wiring compartment.
2. Disconnect flex connection from actuator to mounting base.
3. Loosen set screws on shaft and 4 screws holding motor to base. Remove motor.
4. Several anti-rotation mounting scenarios are possible. See Mounting chapter.
5. Mount Belimo FSLF or FSNF over shaft.
6. Connect anti-rotation strap.
7. Close damper tightly, tighten nuts on clamp.
8. Pull out old wires and pull Belimo wires thru flex. Cut off excess. Wire nut Belimo wires to existing sensor wires.
9. Connect green ground on 120V models. Connect hot and neutral (or common if 24VAC). See Wiring Methods below.

Conformance test required. See AHJ Notification form Chapter for the Fire Marshal form.

Be sure to complete the notification form and submit it to your AHJ.

Replacement of Air Balance Siebe MAx18 Direct Coupled & Jackshafted Motor with Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Scan QR Code for more information on RetroFIT+

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	AC 120 V	On/Off	30		FSLF120 US	*
ML4105B1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4105C1008	AC 230 V	On/Off	30		FSLF230 US	*
ML4105D1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115A1009	AC 120 V	On/Off	30		FSLF120 US	*
ML4115A1017	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1008	AC 120 V	On/Off	30		FSLF120 US	*
ML4115B1016	AC 120 V	On/Off	30		FSLF120 US	*
ML4115C1007	AC 230 V	On/Off	30		FSLF230 US	*
ML4115C1015	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1006	AC 230 V	On/Off	30		FSLF230 US	*
ML4115D1014	AC 230 V	On/Off	30		FSLF230 US	*
ML4115H1002	AC 120 V	On/Off	30		FSLF120 US	*
ML4115J1019	AC 120 V	On/Off	30		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4202F1000	AC 120 V	On/Off	20		FSLF120 US	*
ML4302F1008	AC 120 V	On/Off	20		FSLF120 US	*
ML8105A1006	AC 24 V	On/Off	30		FSLF24 US	*
ML8105B1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1005	AC 24 V	On/Off	30		FSLF24 US	*
ML8115A1013	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1004	AC 24 V	On/Off	30		FSLF24 US	*
ML8115B1012	AC 24 V	On/Off	30		FSLF24 US	*
ML8115H	AC 24 V	On/Off	30		FSLF24 US	*
ML8115J	AC 24 V	On/Off	30		FSLF24 US	*
ML8202	AC 24 V	On/Off	20		FSLF24 US	*
ML8302	AC 24 V	On/Off	20		FSLF24 US	*
MS4104F1010	AC 120 V	On/Off	30		FSLF120 US	*
MS4104F1210	AC 120 V	On/Off	30	2	FSLF120-S US	*
MS4109F1010	AC 120 V	On/Off	80		FSNF120 US	
MS4109F1210	AC 120 V	On/Off	80	2	FSNF120-S	
MS4120F1006	AC 120 V	On/Off	175		FSAF120A	
MS4120F1204	AC 120 V	On/Off	175	2	FSAF120A-S	
MS4209F1007	AC 120 V	On/Off	80		FSNF120 US	
MS4309F1005	AC 120 V	On/Off	80		FSNF120 US	

* Use FSNF series if damper is > 4 sq.ft.
** Use -S model of proper voltage.

Honeywell	Voltage	Control	Torque	Aux	Replacement	
MS4604F1010	AC 230 V	On/Off	30		FSLF230 US	*
MS4604F1210	AC 230 V	On/Off	30	2	FSLF230-S US	*
MS4609F1010	AC 230 V	On/Off	80		FSNF230 US	
MS4609F1210	AC 230 V	On/Off	80	2	FSNF230-S US	
MS4620F1005	AC 230 V	On/Off	175		FSAF230A	
MS4620F1203	AC 230 V	On/Off	175	2	FSAF230A-S	
MS4709F1014	AC 230 V	On/Off	80		FSNF230 US	
MS4809F1012	AC 230 V	On/Off	80		FSNF230 US	
MS7520A2015	AC 24 V	210 V, 420mA	175		FSAFB24-SR US	
MS8104F1010	AC 24 V	On/Off	30		FSLF24 US	*
MS8104F1210	AC 24 V	On/Off	30		FSLF24 US	*
MS8109F1010	AC 24 V	On/Off	80		FSNF24 US	
MS8109F1210	AC 24 V	On/Off	80	2	FSNF24-S	
MS8120F1002	AC 24 V	On/Off	175		FSAF24A	
MS8120F1200	AC 24 V	On/Off	175	2	FSAF24A-S	
MS8209F1003	AC 24 V	On/Off	80		FSNF24 US	
MS8309F1001	AC 24 V	On/Off	80		FSNF24 US	
S20230F	AC 230 V	On/Off	175		FSAF230A	
S20230FSW2	AC 230 V	On/Off	175	2	FSAF230A-S	
S2024F	AC 24 V	On/Off	175		FSAF24A	
S2024FSW2	AC 24 V	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch						**
32003532002 Aux Switch						**

* Use FSNF series if damper is > 4 sq.ft.
** Use -S model of proper voltage.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	AC 120 V	30		FSLF120 US	1, 2
MA221	AC 240 V	30		FSLF230 US	1, 2
MA223	AC 24 V	30		FSLF24 US	1, 2
MA230	AC 120 V	50		FSNF120 US	1, 2, 3
MA231	AC 240 V	50		FSNF230 US	1, 2, 3
MA233	AC 24 V	50		FSNF24 US	1, 2, 3
MA240	AC 120 V	50			4,5
MA250	AC 120 V	50		FSNF120 US	1, 2, 3
MA251	AC 230 V	50		FSNF230 US	1, 2, 3
MA253	AC 24 V	50		FSNF24 US	1, 2, 3
MA318	AC 24 V	60		FSNF24 US	1, 3
MA318500	AC 24 V	60	1	FSNF24 S US	1, 3
MA418	AC 120 V	60		FSNF120 US	1, 3
MA418500	AC 120 V	60	1	FSNF120S 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	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.
5	Provide photos. Motor, linkage, blades, fusible link, McCabe© Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

1 Square shaft inserted into damper sleeve with special crankarm. If a smoke damper, replacement may be possible and requires a new shaft and other linkage parts. If a combination fire and smoke damper, Belimo may not be capable of being used. See Air Balance with MP2553.

2 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

3 Safe-Air / Imperial. Typically linkaged. There was an internal spring and fusible link for the fire function.

4 Except in rare occasions where space constraints exist, simply remove all linkage parts and direct couple on damper shaft. Use old motor as a mounting platform for anti-rotation strap

5 Usually on a Negator Spring damper. For pneumatic, the FSLF120 will usually work. For electric, the Ruskin kit FSLF120/MP must be ordered from a Ruskin rep.

6 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary

7 10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary.

8 Inside clamp mounting or a shaft extension required.

9 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.

10 See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft

11 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

12 Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.

13 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq.ft. and FSNF for dampers > 4 sq. ft.

14 Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq. ft. and FSNF for dampers > 4 sq. ft.

15 Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove spring and all linkage parts and direct couple to damper shaft.

A large number of applications can be solved for MultiProducts and ECM or pneumatic. Here are some images of what you might find in the field.
For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Figure 10.37

Existing Installation

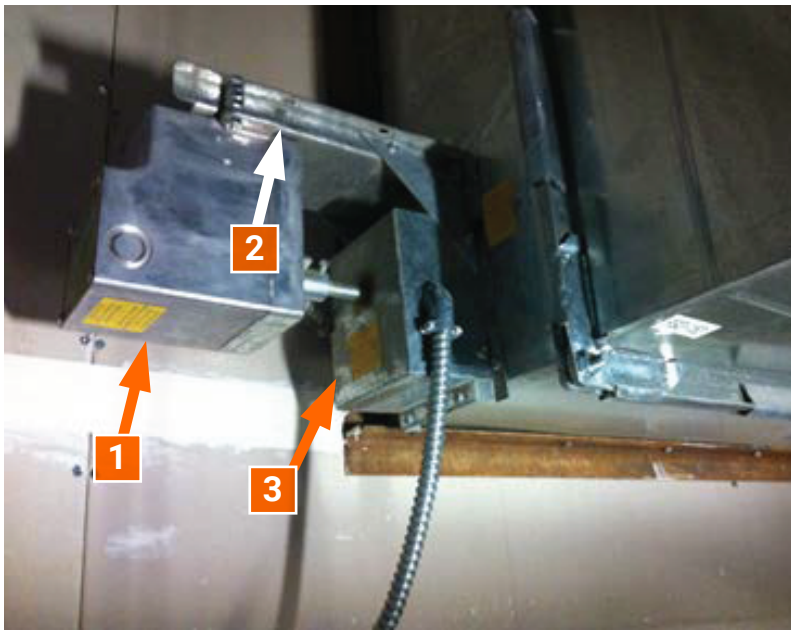


Figure 10.38 Typical outside view

Figure 10.38

1. Motor
2. Mounting Bracket
3. Auxiliary switches and cover for thermal sensors

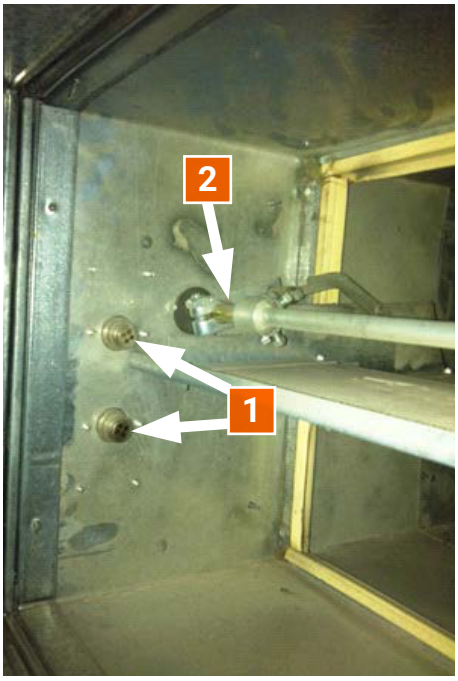


Figure 10.39 View from inside damper

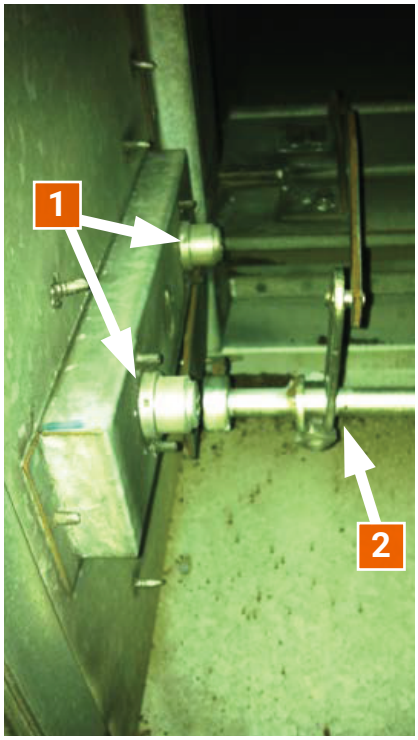


Figure 10.40 another angle of figure 9.39

Figure 10.39 & 10.40

1. Primary and secondary sensors
2. Inside coupler and arm to blade

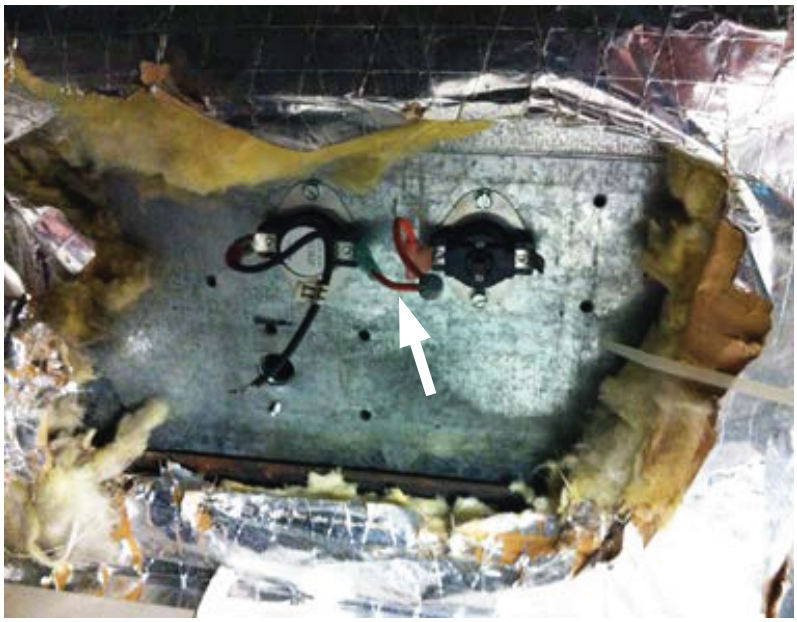


Figure 10.41 Primary and secondary sensors

Sensors should be checked for operation. If defective replace with Thermodisc, Klixon, or equal as recommended by Air Balance. If only one sensor is used, the Belimo BAE 165 US may be used.

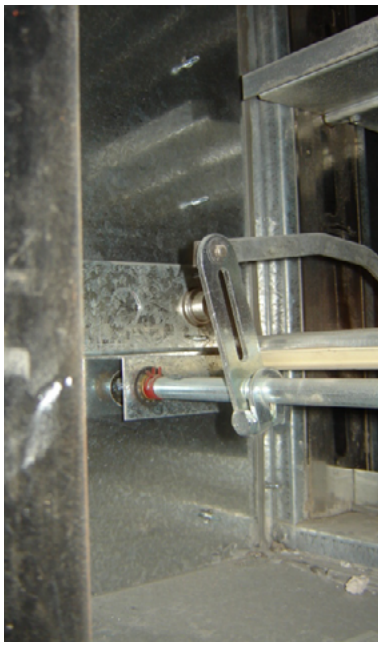


Figure 10.42 Variation in connection method

Figure 10.43 Detail of external coupling between motor and damper jackshaft

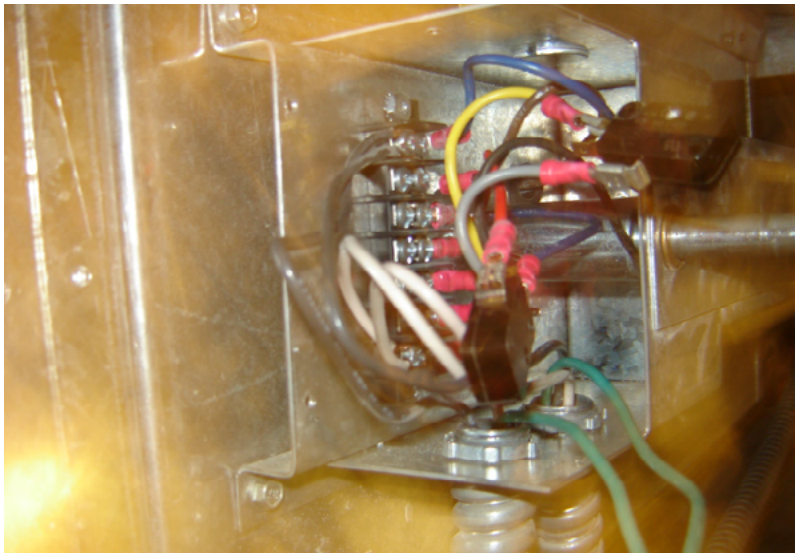


Figure 10.44 Variation in wiring compartment

WARNING!

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

Replacement Instructions

MP3150C Remove spring retainer, spring, and old motor. Direct couple Belimo FSLF.

Figure 10.45

For short shaft mounting, the ZG-LMSA-1/2-5 can be used. (Figure 10.46) Alternately, the clamp can be installed between the actuator and sheet metal. (Figure 10.47)

Figure 10.46

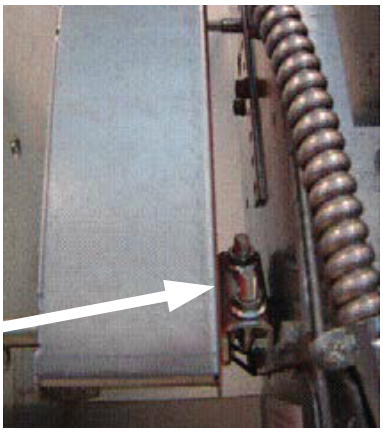


Figure 10.47

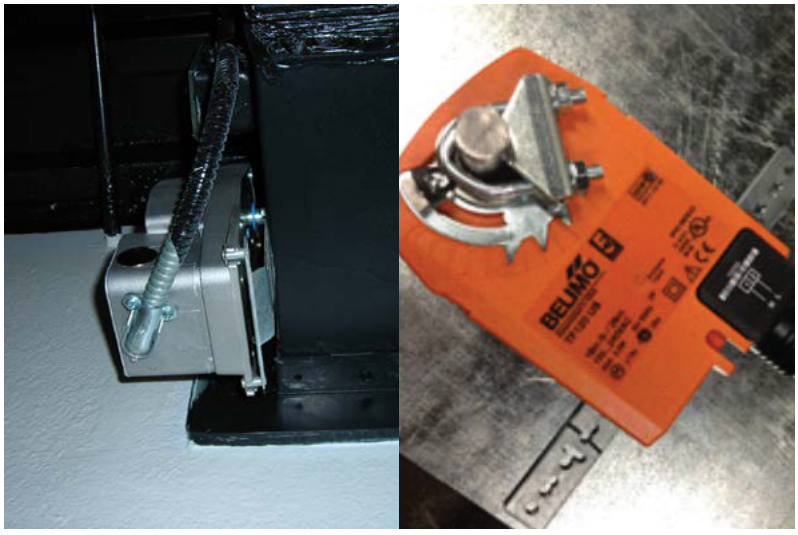


Figure 10.48

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

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.

Old motor mounted with coupler and short shaft

Figure 10.49

Remove power. Lock and tag out

Disconnect conduit from motor and tag wires. Disconnect the coupler between the jackshaft and the motor. Unbolt motor from the motor bracket and remove motor.

Figure 10.50

Picture with motor removed.

Figure 10.51

Using ½" round rod, cut per length needed in drawings below and attach to the existing coupler.

Attach Belimo ZG-108 angle bracket to the existing motor mounting bracket.

Figure 10.52

Attach actuator to ZG-108 using 4 bolts supplied.

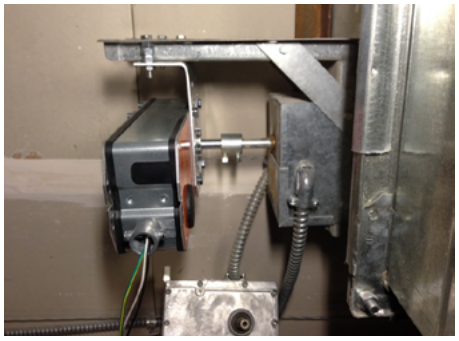


Figure 10.53

Close damper tightly (not shown) and tighten clamp.

View from front.

Reconnect conduit connector and flex. J-box not shown.

Figure 10.54

Be sure to complete the notification form and submit it to your AHJ.

11. Pneumatic

Pneumatic to Electric Conversions – Local Code Approval

The conversion of a damper from pneumatic to electric operation entails a number of steps not required in normal replacement of electric actuators.

Power must be brought to the dampers. Depending on the jurisdiction, life safety devices must usually be powered from a circuit with a secondary, back-up power source. This may not apply to containment dampers installed per Chapter 7 of the IBC, but does apply to actuators on dampers in an engineered smoke control system per Chapter 9 with wiring to the fire fighters' smoke control panel. Contact AHJ for local variations requiring back-up power.

While it is not detailed in codes, the following rules should be followed for selecting Belimo actuators for replacement:

- **Temperature** – the replacement actuator shall have been UL555(S) tested at the same or better temperature as the original actuator. 250°F or 350°F are standard. Code is 250°F. However, 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. 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.
- **Final Testing** – actuated damper and associated devices shall be tested for proper operation. See Acceptance testing details below.

NOTICE

Conversion of old dampers from pneumatic to electric may require approval from the local AHJ. Most older dampers are different from modern dampers and cannot be recertified since no UL555S procedure for listing exists.

Typically, installing a new actuator and electrical thermal sensor bring part of the damper up to current standards as the new parts are UL Listed and have been tested to the present UL 555 and UL 555S whereas the old damper's parts are not tested to the present standard.

Old motor mounted with coupler and short shaft

No specific pneumatic to electric cross reference is possible. Rather use of the UL 555S listings for the damper sizes is applied.

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

Based on UL 555S at 2000 fpm, the following chart covers sizing. Various sizes and configurations of Multisection dampers have been UL tested also.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

Note that in new installations, which meet UL 555S, larger damper sections have passed with some manufacturers. The recommendations in the table above are conservative as older installations may have corrosion adding to the required torque load.

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.

Scan QR Code for more information on RetroFIT+

Installation examples and Belimo mounting

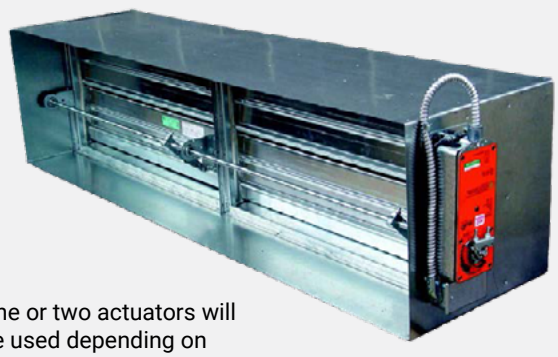
Figure 11.1

Figure 11.2

Where axle shafts are used for the pneumatic actuators, direct coupling is possible.

Figure 11.3

Proposed Belimo Solution



One or two actuators will be used depending on torque requirements

Figure 11.4

Refer to the mounting chapter or product Data sheets for a full list of compatible accessories.

Figure 11.5

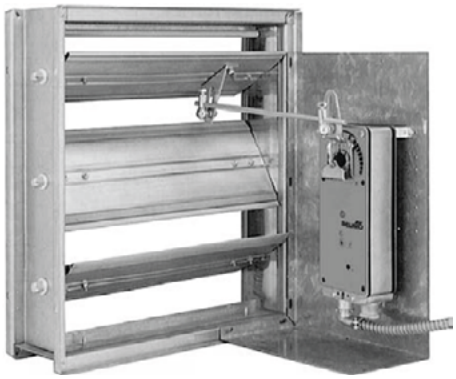


Figure 11.6 Belimo actuators may be mounted using linkage kits where necessary.

Figure 11.6

Figure 11.7 Typical pneumatic actuation. If smoke control system cuts power to EP relay then actuator has zero air pressure and springs damper closed.

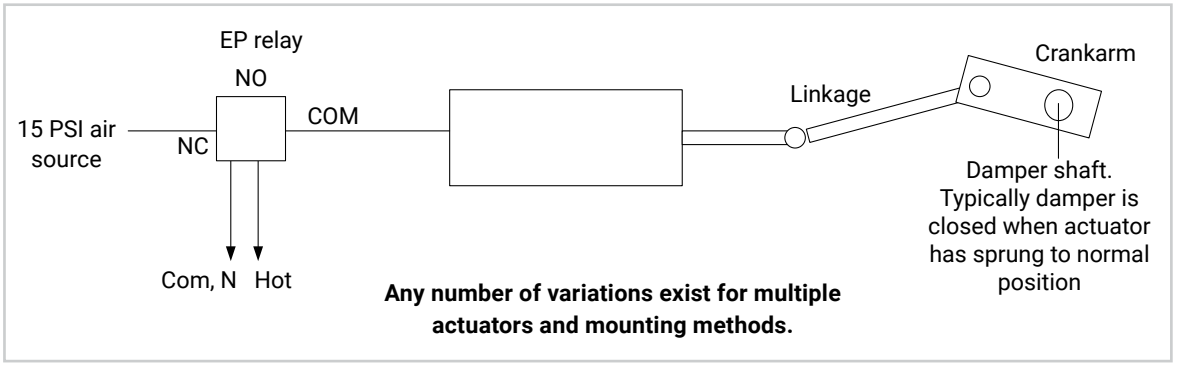


Figure 11.7

Figure 11.8

1. Remove tubing and actuator.

2. Disconnect and remove linkage.

Belimo FSNF required for the two sections. Direct couple and wire.

A clue that it is a Smoke damper is that it has no high temperature sensor.

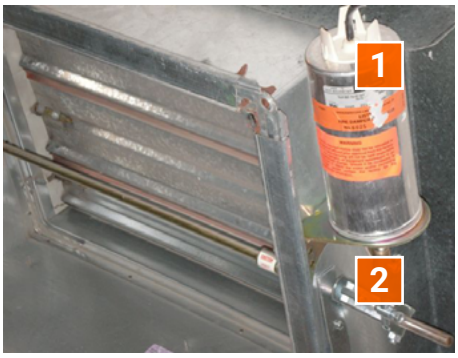


Figure 11.8

Figure 10.9

Remove tubing and actuator. Disconnect and remove linkage. Retain the outboard bracket as it contains the shaft bearing.

Belimo FSLF required for the small damper. Direct couple and wire.

A clue that it is a Smoke damper is that it is mounted outside the plane of the wall. (Figure 11.10)

Figure 11.9

Remove tubing and actuator. Disconnect and remove linkage. **Do not remove bearing bracket.**

Belimo FSLF required for the small smoke damper. Direct couple and wire.

Access may be tight in which case an FSNF with linkage may be used.

See the mounting chapter for more information.

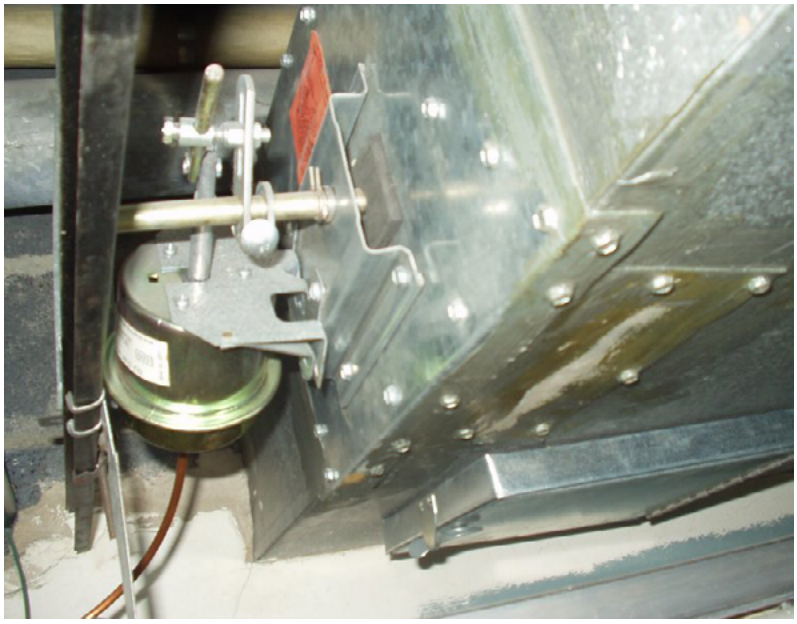


Figure 11.10

Figure 11.11

Figure 11.11 An FSLF actuator can be direct coupled. The FSNF or FSAF can be direct coupled or linkage connected if space constraints dictate.

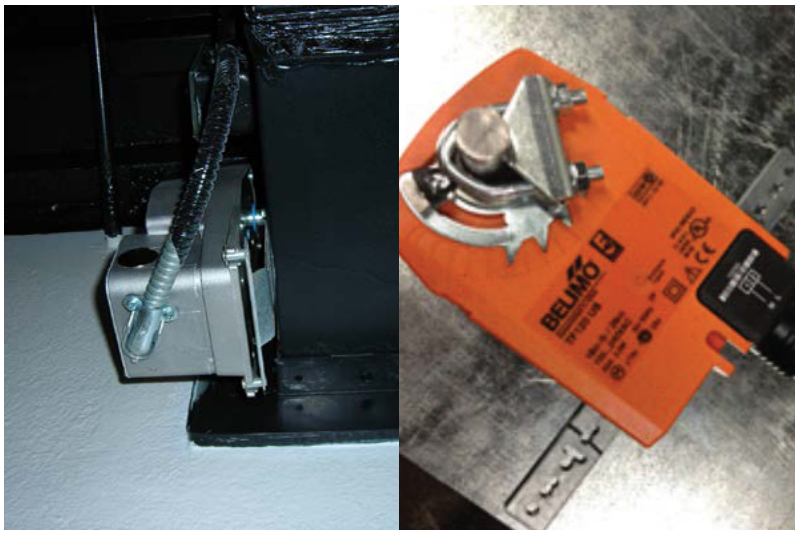


Figure 11.12

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

Figure 11.13
Remove tubing and actuator. Disconnect and remove linkage. Retain the outboard bracket as it contains the shaft bearing.

Belimo FSLF required for the small damper. Direct couple and wire.

Figure 11.13

Figure 11.14 FSLF mounted in place of pneumatic actuator.

Figure 11.15 Standard FSNF mounting.

Fusible link fire damper function

In some cases a fusible link and shaft spring on the inside of the damper perform the closing function in case of fire. In that case, the external actuator is controlled by the smoke detector or a relay only.

Investigation of what method is being used is always necessary. Then the replacement method becomes clear.

Below: two details of a shaft spring and fusible link on damper arms.

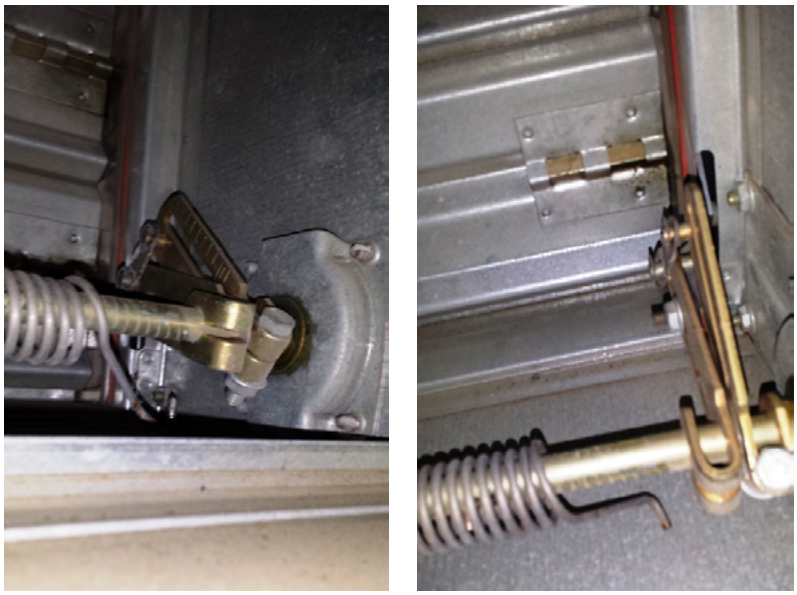


Figure 11.16

EP Relays and shaft switches

Remove air line and EP relay, tagging 24 V or 120 V wires. Remove old actuator and linkage parts.

Figure 11.17

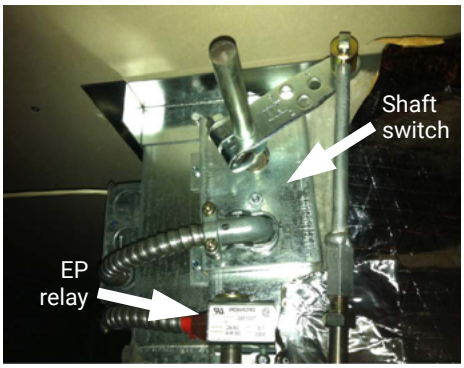


Figure 11.18 Switch package attached to the damper shaft. It may be reused or a -S model of the Belimo may be installed.

Pneumatic control

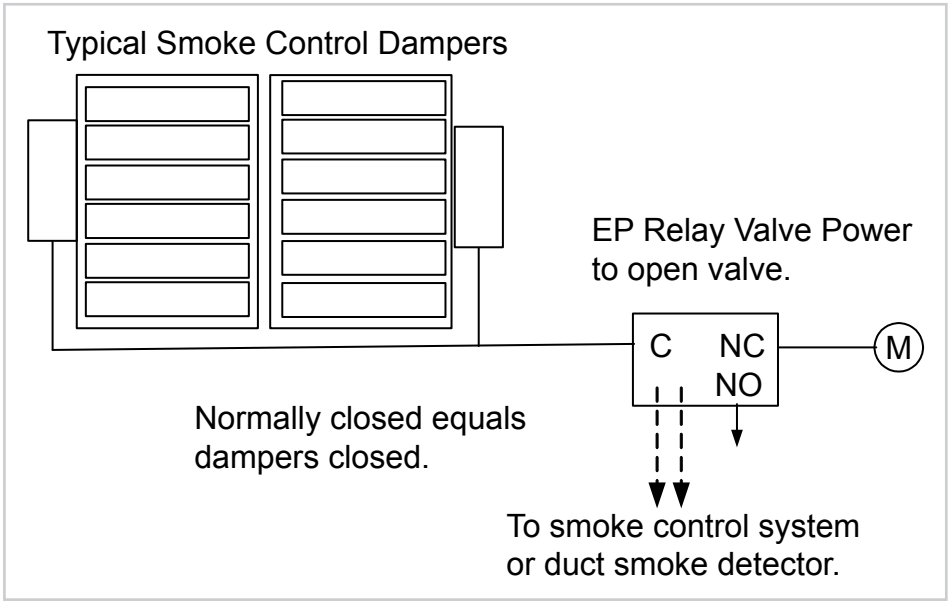


Figure 11.19

One typical method was that the pneumatic actuator failed closed – no air pressure – and closed the damper. The EP shown above was operated from a fire alarm or smoke control panel.

Another typical method is shown below. A local fusible link air valve(s) will open upon sensing high temperature (>165°F typically). That will dump the air out of the actuators and close the dampers.

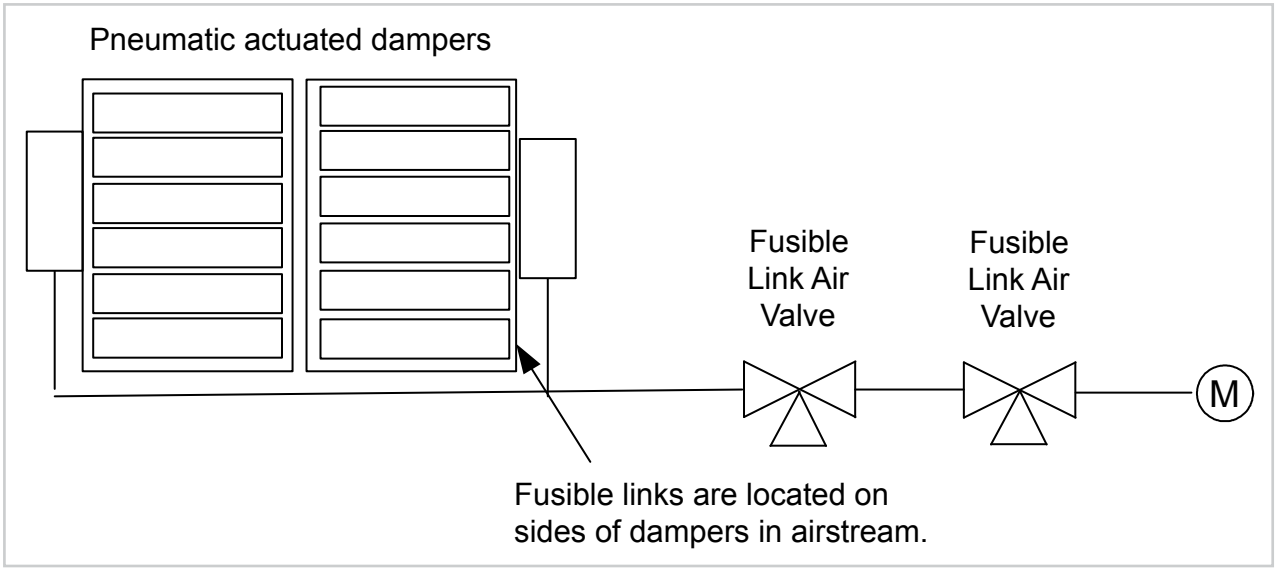


Figure 11.20

Sensors

There are a number of variations possible. Precise drawings require that the primary sensor method and damper make be identified. These are typical.

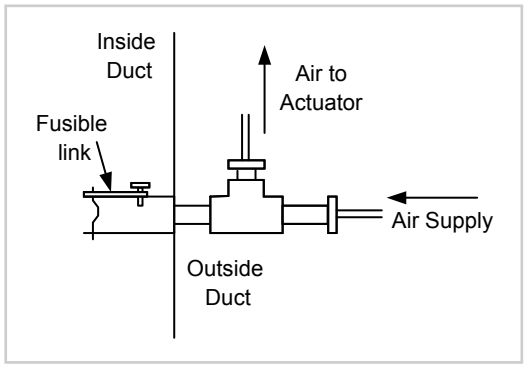


Figure 11.21

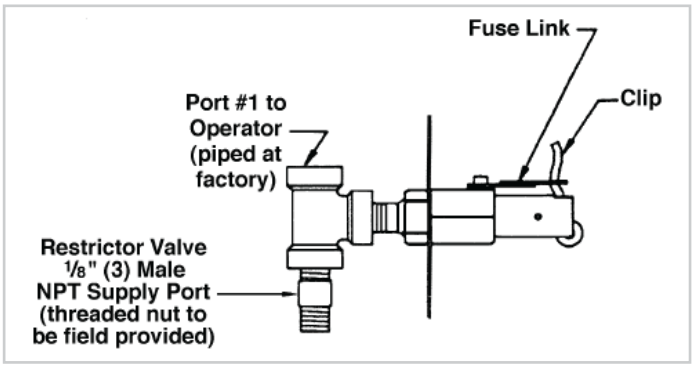


Figure 11.22

Various methods were used to control dampers This is typical. If fusible link melted, then air to actuator was relieved and damper sprang closed. (Figure 11.18)

Wiring

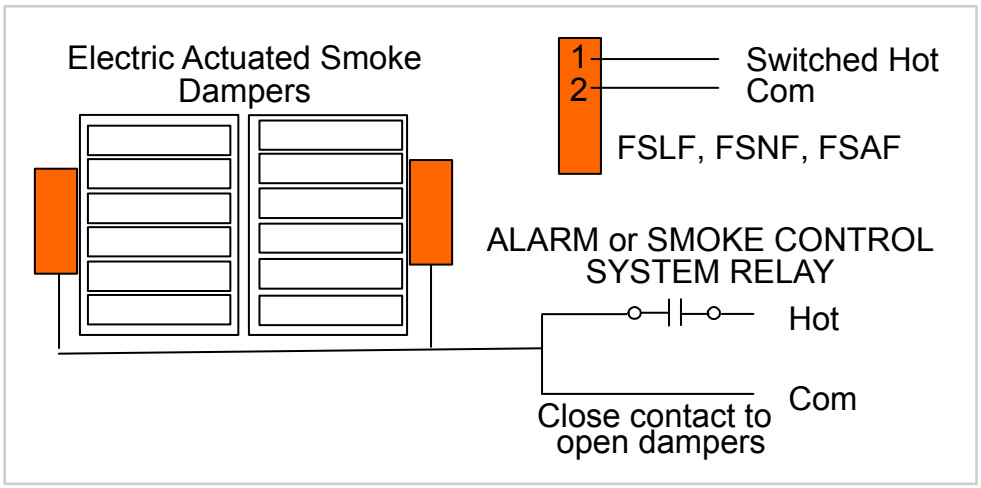


Figure 11.23

The drawing above shows a typical smoke – not fire – damper control arrangement. The actuators are powered to drive the dampers open. A relay contact in the hot wire going to the actuators cuts power to spring them closed.

Be sure to complete the notification form and submit it to your AHJ.

12. MultiProducts

Replacement of MultiProducts Motors to Belimo

Cross Reference

For greater details use our RetroFIT+ App:
https://www.belimo.com/us/en_US/products/retrofit-app/FireAndSmoke

One is not replacing the Multiproducts motor per se, but rather installing a new actuator on the damper shaft. In most cases the new installation is the same as the modern UL555S listed method. There were many models of Multiproducts used and no complete cross reference exists. Some are listed below. Most were 120V, but verifying voltage is necessary.

Scan QR Code for more information on RetroFIT+

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

The table provides a general rule of thumb however, with age and corrosion, it is best to be conservative.

The Multiproducts motors varied in torque, CW or CCW rotation, length of shaft, shaft shape, electrical mounting, and voltage. All of these except voltage may be ignored with focus on the damper itself.

It is recommenced to remove the old motor and replace using the methods shown below. This also produces an installation that is closest to the present UL mounting methods.

There are a large number of different MultiProducts motors and approaches to spring return.

MultiProducts

Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe© Link. Verify damper functions after replacement by testing damper open and spring closed.

Use of FSLF is recommended for dampers less than 4 sq.ft.
For linkage applications all FSTF & FSNF parts can be used.

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

While direct coupling is preferable, some applications require linkages. More about Linkages can be found in the Mounting chapter.

Nominal sq. ft per UL555(S) testing		
Sq. ft.	Temp	Belimo Actuator
16 Sq. ft. or less	350°F	FSAF*A
12 Sq. ft. or less	350°F	FSNF
4 Sq. ft. or less	350°F	FSLF
1.5 Sq. ft. or less	250°F	FSTF

All 120 V, FSLF120

Nailor
5953
5949
M12, MZRHM
6247
5186

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

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

Typical Multiproducts Replacement Concepts

The non-spring motor is assisted by linkage and spring assembly. (Figure 12.1 & 12.2)

Figure 12.1

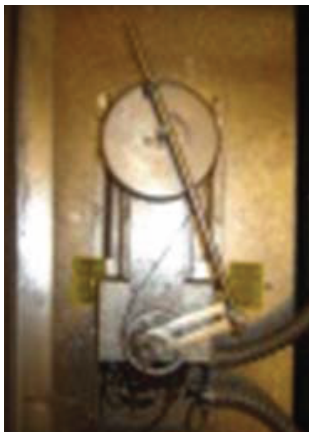


Figure 12.2

Figure 12.3

After removing the extraneous parts, the damper shaft is available for direct coupling.

Note that the old motor has been left in this case as it provides a good base for the Belimo anti-rotation strap. (Figure 12.3)

Figure 12.4

The Belimo is mounted on the shaft with no linkages or external spring.

Test by cycling and tripping thermal sensor. Reset and completed. (Figure 12.4)

Figure 12.5 Arrow points to the spring.

Figure 12.6 Arrow points to the damper shaft.

Figure 12.7

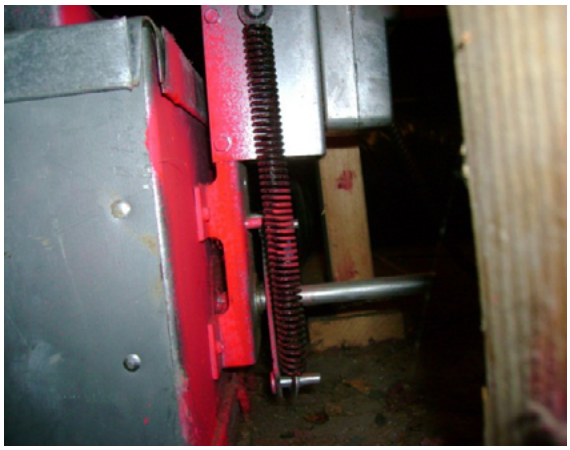


Figure 12.8

Figures 12.7 and 12.8 show views of an external “screen door” spring return application. The spring is missing in figure 12.9.

Remove the old motor, linkage and spring. Mount the Belimo over the shaft.

In figure 12.10 The arrow points at the spring, It is removed along with the motor.

Figure 12.9

Figure 12.10

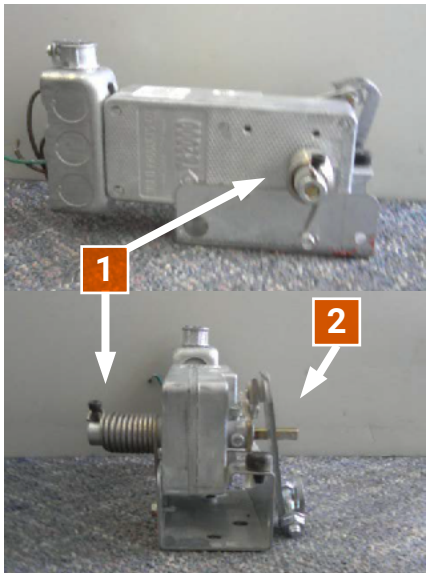


Figure 12.11

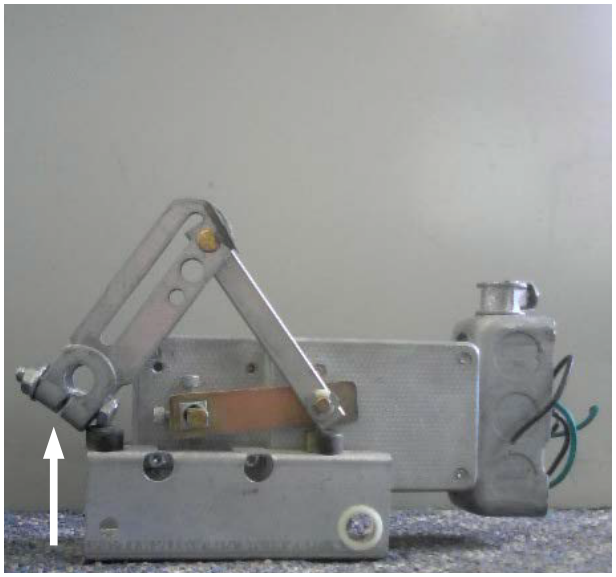


Figure 12.12

Figure 12.11

1. Spring. Motor is applied the same as any linkage application. Remove spring and actuator.
2. This shaft is not mounted to the damper.

Figure 12.12

Crank arm is connected to the damper shaft. The Belimo may be direct coupled over the shaft. For short shaft mounting, place clamp of actuator between actuator and damper. See mounting chapter.

If a linkage is needed due to space constraints, use FSNF with ZG-AF or other linkage kit with rod. Refer to the mounting chapter or product data sheets for a full list of compatible accessories.

Figure 12.13

Figure 12.14

In above examples, the extraneous parts are removed and the Belimo dropped onto the damper shaft.

Repair of drywall penetrated during linkage installation

Figure 12.15

Figure 12.16

Unless the Building Official or Fire Marshal specifically approves motor replacement, the damper should be replaced. The cut drywall violates the code as it impairs the fire protection. (Figure 12.15)

EMB2X Multiproducts type motor. A number of variations were made. (Figure 12.16)

Figure 12.17

Figure 12.18

A number of ways to repair the cuts into the drywall exist. Here we see sheetmetal and firestopping used to seal the holes.

Figure 12.15 An EMB2X motor with linkage is shown. A detail of the drywall and linkage is shown in figure 12.17.

Figures 12.18, 12.19, and 12.20 show details of how the repairs were made.

This should be approved by the fire marshal or building official before applying.

Figure 12.19

Installation of the Belimo was easy – simply mount to the damper shaft (Figure 12.20).

Figure 12.20 Detail of drywall repair.

Shaft Springs and Fusible Links

In the examples below there is a spring wrapped around the damper shaft with a fusible link holding it (arrows). The link prevents the spring from slamming the damper blades closed. When it melts at 165°F the spring is released.

This is the fire damper function.

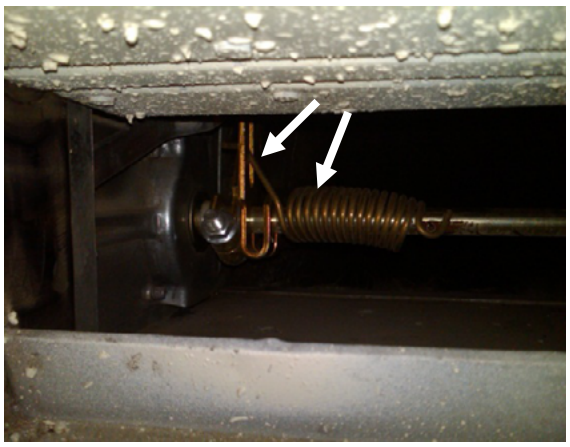


Figure 12.21

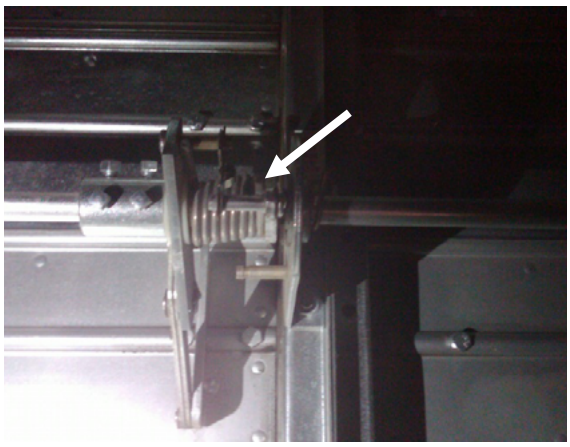


Figure 12.22

The shaft spring and fusible link (arrow) are NOT to be removed or modified.

If the fusible link melts due to temperatures over 165°F the shaft spring slams the damper closed.

This is the fire function.

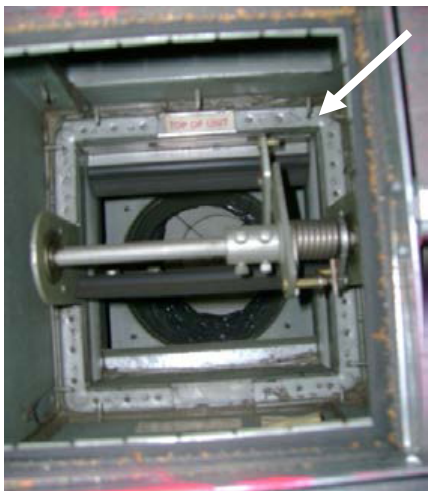


Figure 12.23

Example of mounting the Belimo directly to the jackshaft and ignoring old mounting

Old motor and crankarm can be ignored as far as function is concerned. Old motor should be removed to maintain a mechanically conventional appearance.

Belimo is simply direct coupled to the damper shaft.

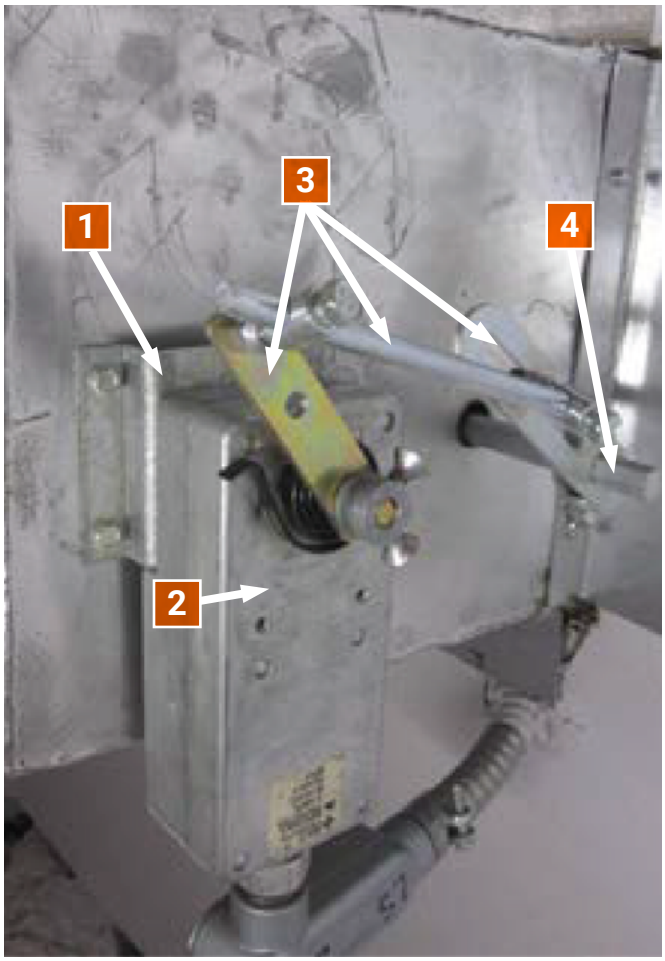


Figure 12.24

1. Depending on exact geometry, old bracket may be used to hold anti-rotation strap.
2. Disassemble spring and remove it and motor.
3. Remove all linkage parts to expose dampler shaft
4. Once shaft is exposed, direct couple Belimo actuator.

Figure 12.25 Linkaged motor here is typical of many applications.

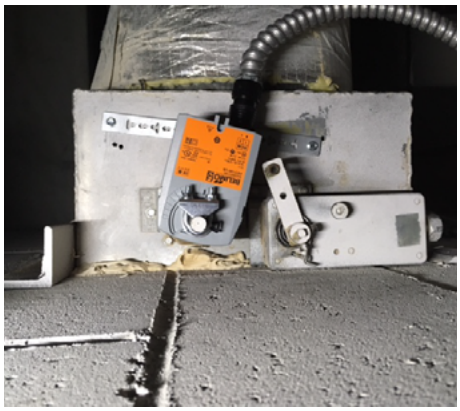


Figure 12.26 Belimo Replacement, the old motor remains disconnected.

Negator Spring Applications – Ruskin and Air Balance

Typical Fusible Rod and Negator Spring (Figure 12.27)

1. Fusible Rod
2. Negator Spring

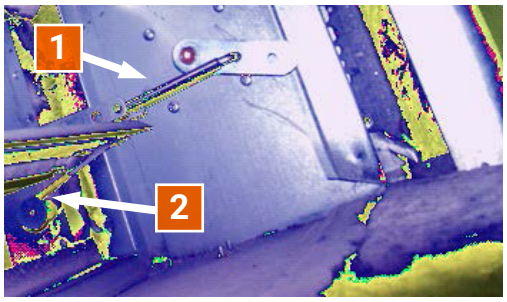


Figure 12.27

The springs are attached to the damper blades and instead of a fusible link, there is a fusible rod that connects the blades to the motor via a crankarm. Replacement springs and rods are NOT available.

If the springs and rod are intact then an actuator kit is available from Ruskin. See Ruskin chapter.

If the springs or rod are not intact, then the rod can be replaced with ball joints and a 5/16" rod. A Ruskin or Air Balance heat responsive device or a Belimo BAE 165 US sensor can be installed. This upgrades the damper to modern standards.

Ruskin makes a kit with a shaft adapter, hold down, and Belimo FSLF120 actuator.

Fusible rods are no longer available from Ruskin.

Where springs are defective, ball joints, rod, and a BAE 165 or Ruskin EFL are necessary.

Rewiring is necessary. (Figure 12.28)

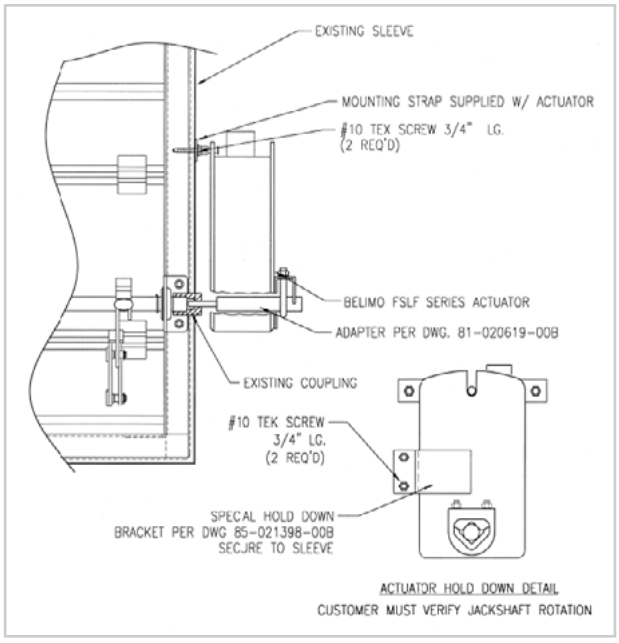


Figure 12.28

McCabe® Link Bimetal

As with most of this type of application, remove the motor, spring, cable, and linkage. Mount Belimo over the damper shaft.

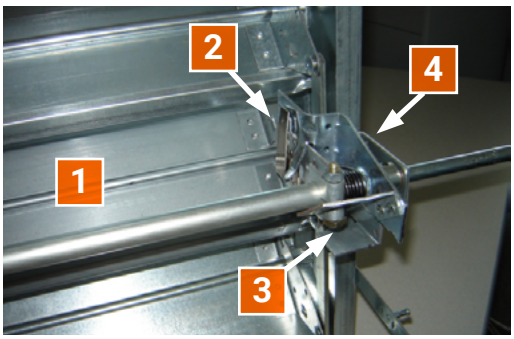


Figure 12.29

1. Jackshaft

2. McCabe® Link Bimetal

3. Spring

4. Motor Arm Engaged in Link

Figure 12.30

Figure 12.31

Other applications

Most Multiproducts motors along with their linkages and springs can be removed and a Belimo direct coupled to the damper shaft.

Figure 12.32

Some examples of dampers that should be replaced

Multiproducts with pulley and cable

Figure 12.33

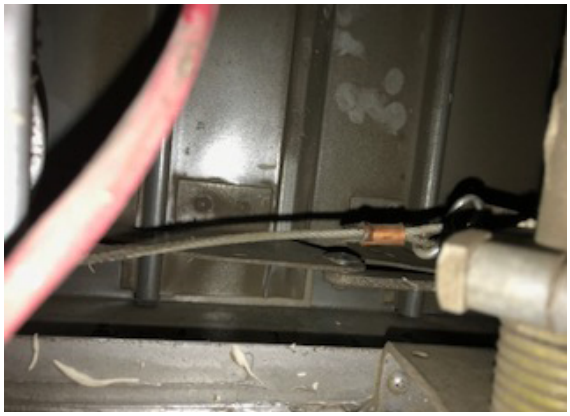


Figure 12.34

Figure 12.35 Guillotine damper

Figure 12.36 Rope connected damper

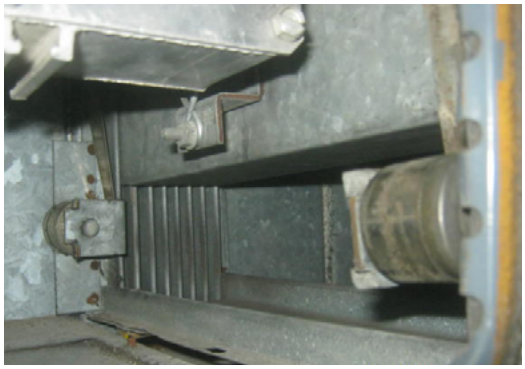


Figure 12.37 Accordion damper

Figure 12.38 Cable connected curtain damper

Prefco Internally Mounted Actuator

Figure 12.39

Figure 12.40

Some internally mounted motors on small dampers may require linkage mounted actuators. Call for information.

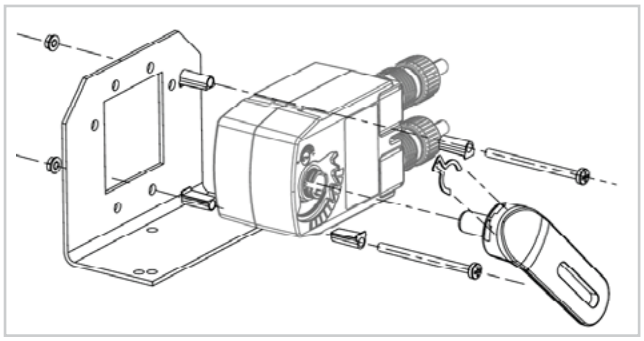


Figure 12.41

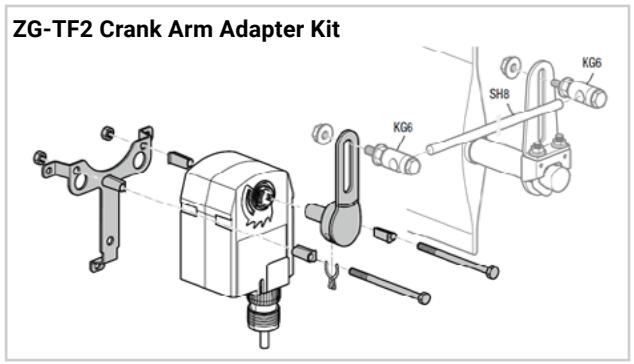


Figure 12.42

ZG-TF112 Crank Arm Adapter Kit includes:

It is assumed that the bracket here will be installed on an existing sleeve or the Prefco mounting plate shown in the full damper pictures below. Belimo brackets and parts are shown in our Mounting Accessories Guide.

Instructions

An FSLF120 has sufficient torque to handle almost any damper that had a Multiproducts motor. Only if a leg kit is required should an FSNF120 be used. In some cases where the Multiproducts had insufficient torque initially, the FSNF is preferred.

1. Disconnect power to damper.
2. Disconnect wiring from motor to thermal sensor wiring box if present.
3. Remove spring, linkage parts, and motor from damper.

4. Test damper to ensure it moves easily from open to closed and back again. Clean, lubricate (food grade silicone spray or equal – NOT WD40).
5. The Belimo is slightly wider than the old MultiProducts. If the Belimo does not fit in the space available, then any thermal sensor sheet metal enclosure can be removed and a 4" x 2" electrical box with open back installed. The box covers the thermal sensors. This is typically necessary on small dampers.
6. Most applications had shaft springs and fusible links. Some had modern electrical thermal sensors. See drawings. Negator spring, internal pully, or other irregular arrangements do exist. Some are field modifications. Take photographs and send to Belimo for analysis.

NOTE: If the damper shaft bearing does not hold the shaft firmly, then a Belimo FSNF should be used with a leg kit, ZG-AF. The actuator then serves to hold the jackshaft steady. On small dampers, it may be necessary to extend a flat plate out in the air in order to mount leg kit.

7. Check direction of rotation of damper and jackshaft. Place clamp of Belimo FSLF120 on CW or CCW side as necessary.
8. Place Belimo FSLF120 onto the shaft.
9. At this point, any jackshaft drive blade bracket connecting bar closer to blade axle will need to be adjusted.
10. 90 to 95 degrees of jackshaft rotation must be 90 degrees of blade rotation.
11. Actuator rotates 95 degrees and this must achieve full closed and near open. Typically 93 degrees of actuator rotation gives 90 degrees of damper rotation after adjusting.
12. Mount anti-rotation bracket of Belimo to sleeve.
13. Tighten clamp nuts.
14. Wire actuator per drawings below.
15. Cycle 3 times to insure proper cycling. If not perfect, readjust linkage, flip actuator over, or troubleshoot to identify problem.
16. Thermal sensor must be checked to ensure it opens upon detection of heat. See Fire Marshal form for steps with single and dual sensors. If sensor is defective, replacements must be obtained from local damper manufacturer rep.
17. Press manual reset and cycle again to ensure operation.
18. Fill out Fire Marshal form found in the AHJ Notification form Chapter.

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!

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.

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. (Figure 12.43)

Figure 12.43

Ruskin Damper with MultiProducts Motor to Belimo FSLF120

In order to adapt the old MP motor with its .2" square male shaft end, a female socket was welded onto the damper shaft. The welded piece must stay on the shaft. A shaft adapter insert and actuator with hold down bracket is available from Ruskin.

MP2781 was used on FSD60, FSD36, FSD35, FSD34, SD60, SD36, SD35 and SD34. FSD is Fire & Smoke Damper. SD is Smoke Damper. (Figure 12.44)

Retrofit kit for converting a defective MP2781 to FSLF series actuator.

Ruskin part number FSLF120/MP. This must be ordered from Ruskin Manufacturing.

Kit contains actuator, shaft adapter, hold-down, and instruction sheet. (Figure 12.45)

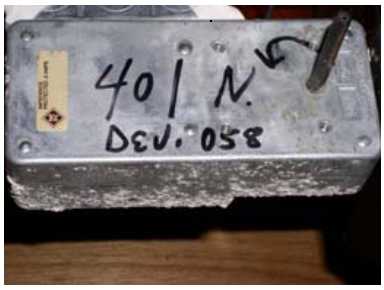


Figure 12.44

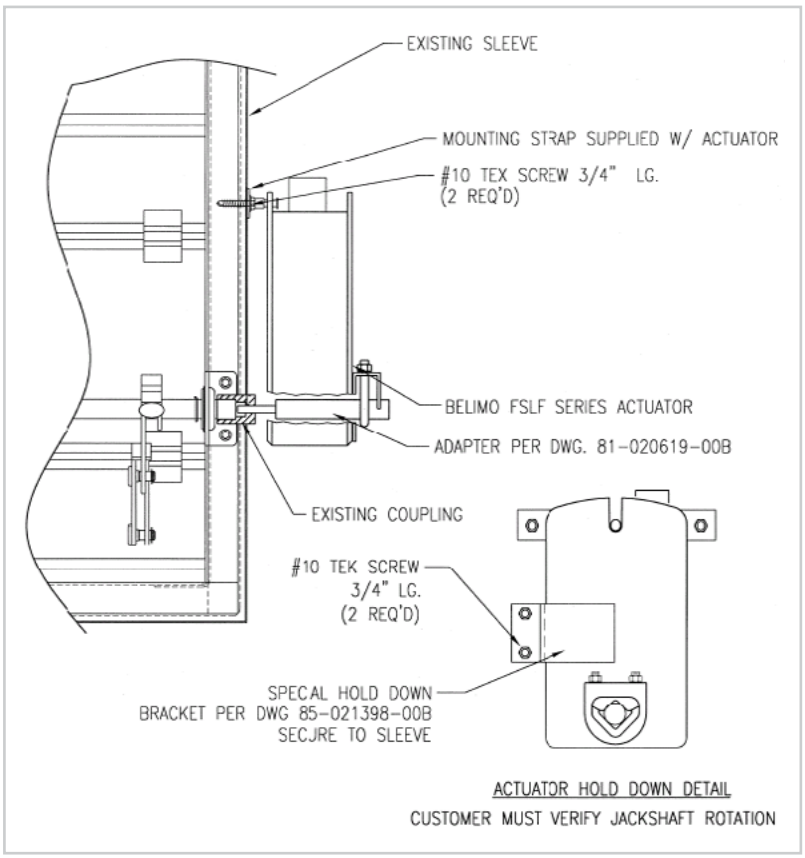


Figure 12.45

This was a negator spring and fusible link application. As long as the damper is 1 sq.ft. or less, Ruskin allows a FSLF actuator to replace the old MultiProducts. If the negator spring is broken, replace the damper.

Be sure to complete the notification form and submit it to your AHJ.

WARNING!

There was a model similar to the one above that had a shaft spring and fusible rod or link. One was made by Ruskin and one by Air Balance.

The link disconnected the actuator and the spring drove the damper closed. The actuator has to work against the external spring as well as its own internal spring.

THE FSNF SHOULD BE USED FOR THAT APPLICATION TO ENSURE SUFFICIENT TORQUE. Contact Belimo or damper manufacturer with model number of damper and actuator to obtain replacement instructions.

13. Mounting

Mounting Hardware

When appropriately installed, anti-rotation bracketing should allow some actuator float (or play.) The pin should not be buried into the slot, preventing movement or failure can occur. The anti-rotation pin is to be centered in the anti-rotation slot. The actuator base should also be parallel to the mounting surface. It is imperative that trade best practices are upheld to ensure connecting components and bracketing remain straight and true, maintaining alignment and proper product performance. Mechanical tuning may be required.

Figure 13.1: Anti-rotation strap

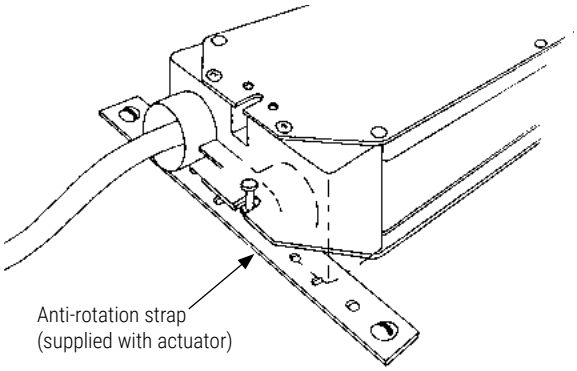


Figure 13.2: Anti-rotation strap shown mounted on an angle

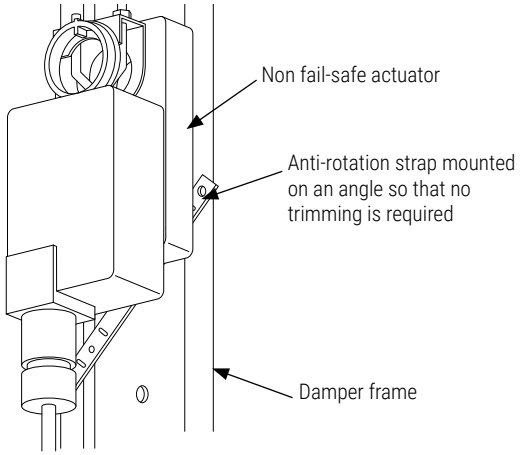
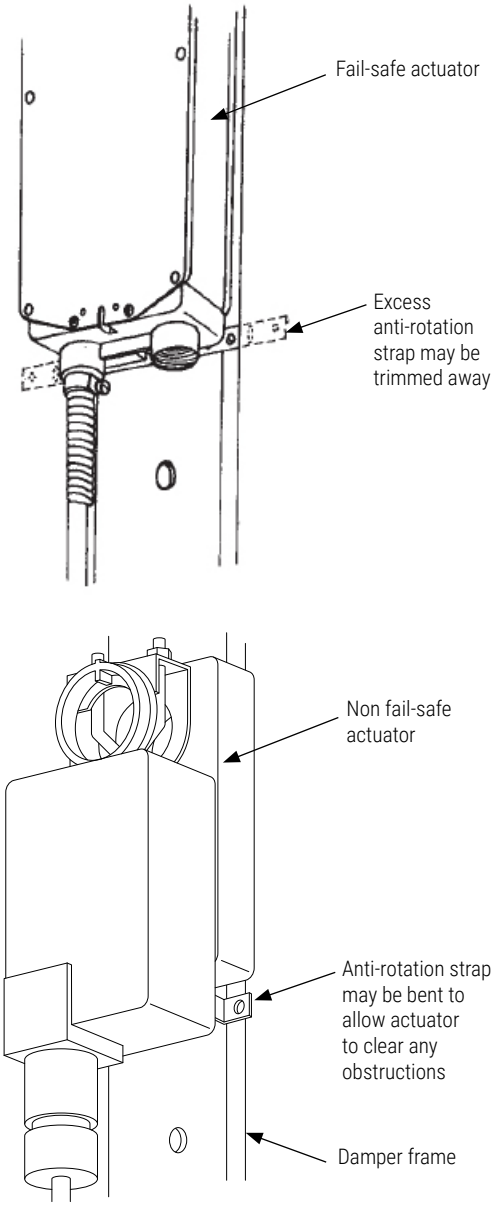


Figure 13.3: ZG-JSL linkage

Designed to facilitate the attachment of select Belimo actuators to a damper's jackshaft. The unique open ended design allows the linkage to clamp on to any part of a jackshaft measuring from ½" to 1.05" in diameter.

Figure 13.4: Modification of the anti-rotation strap



Additional options available depending on application requirements:

- AV8-25 (5/16" to 1" diameter shafts)
- ZG-JSA-1
- ZG-JSA-2
- ZG-JSA-3
- ZG-JSL
- ZG-NMSA-1
- ZG-LMSA
- ZG-LMSA-1

Figure 13.5: Identifying the major components of Belimo direct coupled actuators

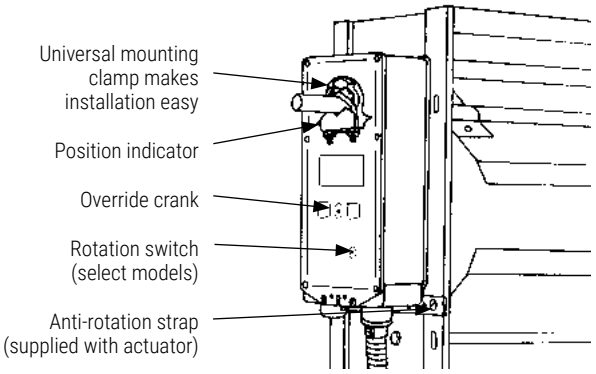


Figure 13.6: mounting brackets; for use when direct coupling is impossible

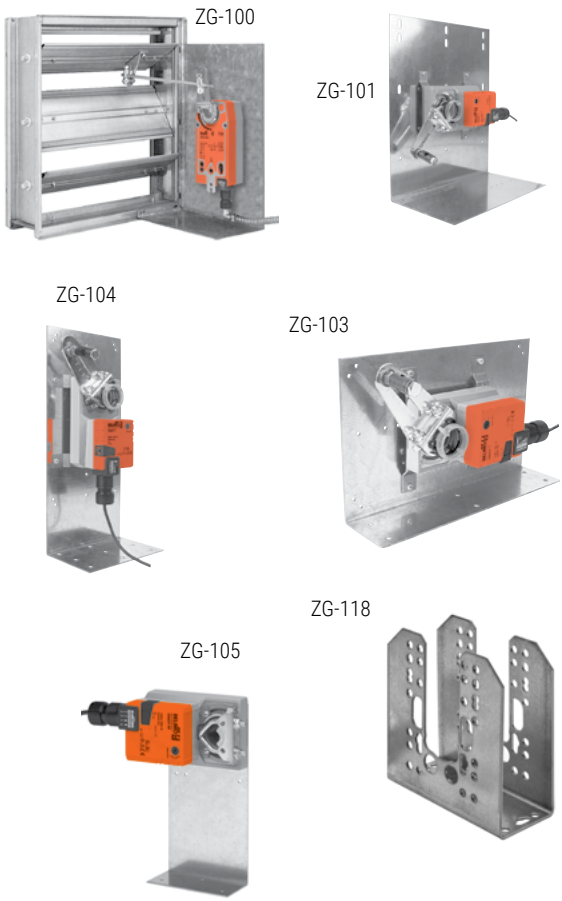


Figure 13.7: KH universal crank arms are shown with available ball joints

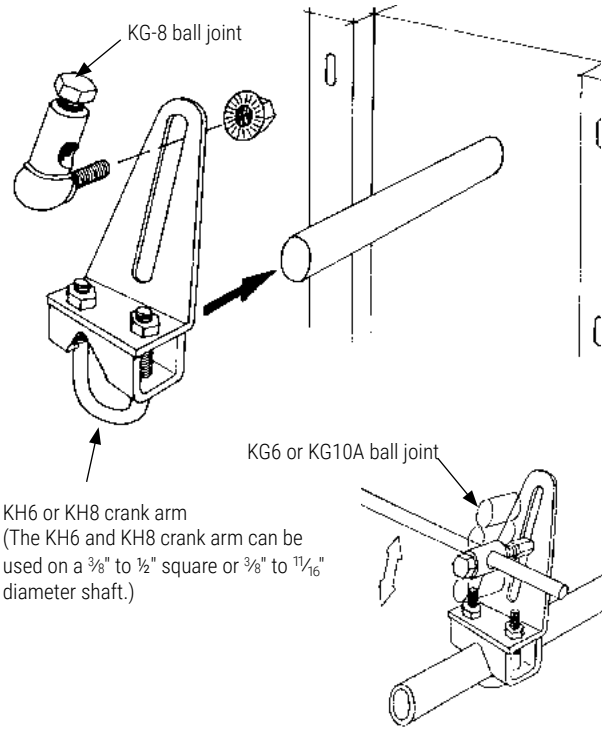
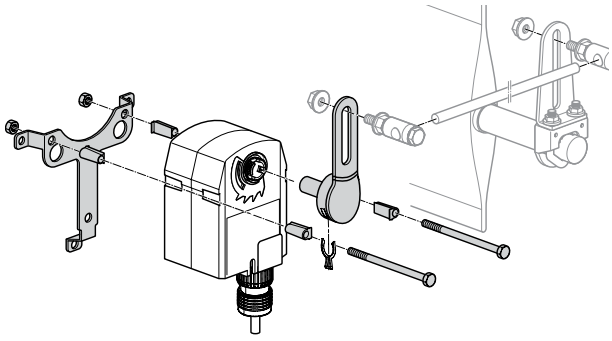


Figure 13.8: ZG-TF2 damper linkage kit

Damper linkage kits are available for all product series.



Be sure to complete the notification form and submit it to your AHJ.

Direct Coupling

Direct Coupled Applications

Direct coupled mounting

Belimo actuators can be mounted in any position.

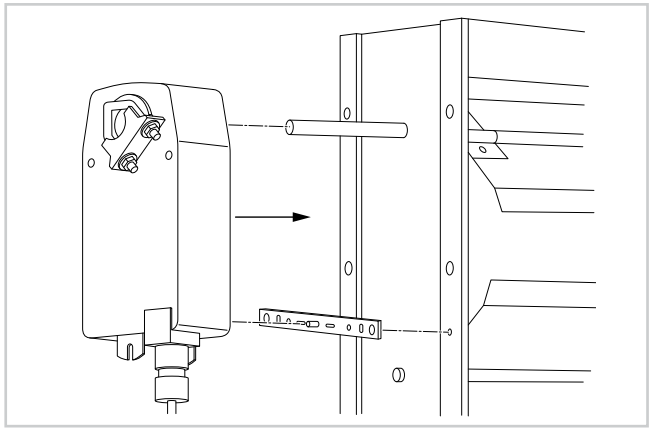


Figure 13.9: Standard mounting

The clamp is most often mounted on the front of the actuator body but can be installed on the back for short shaft installations.

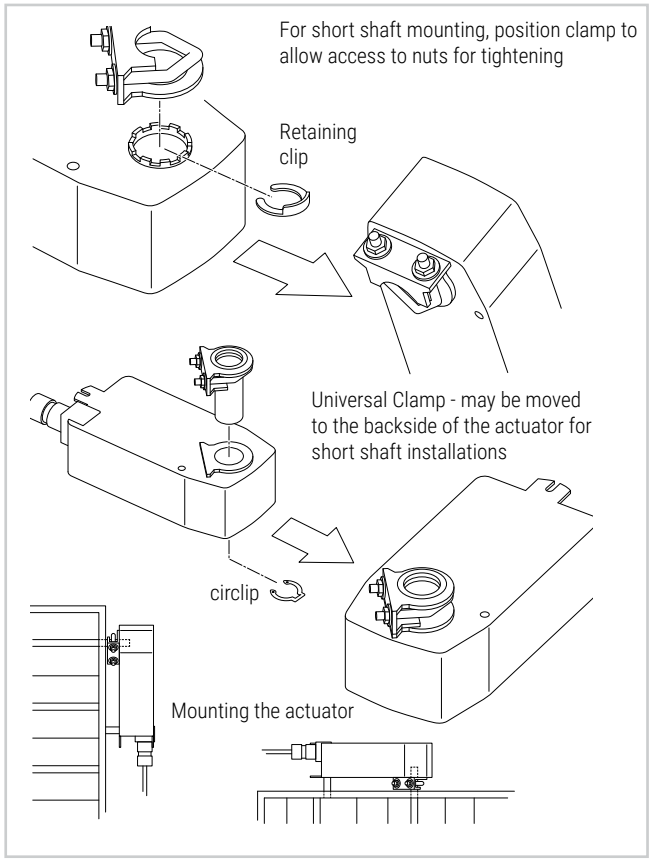


Figure 13.10: Universal mounting clamp

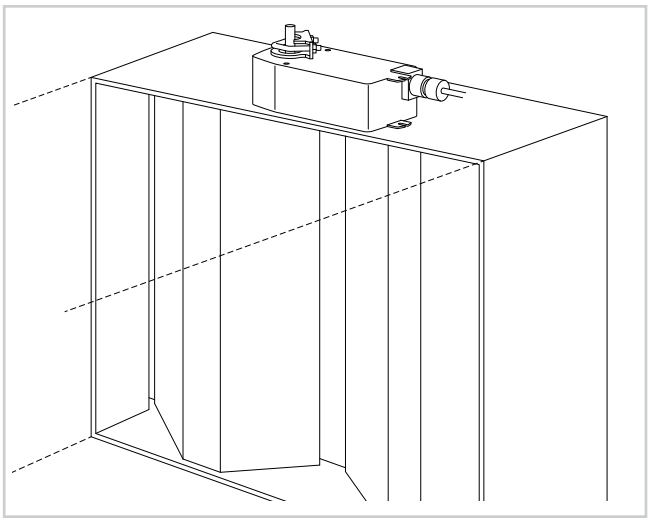


Figure 13.11: Fastened directly to the duct work

It is imperative that standard trade practices are upheld to ensure connecting components and bracketing remain straight and true, maintaining alignment and proper product performance.

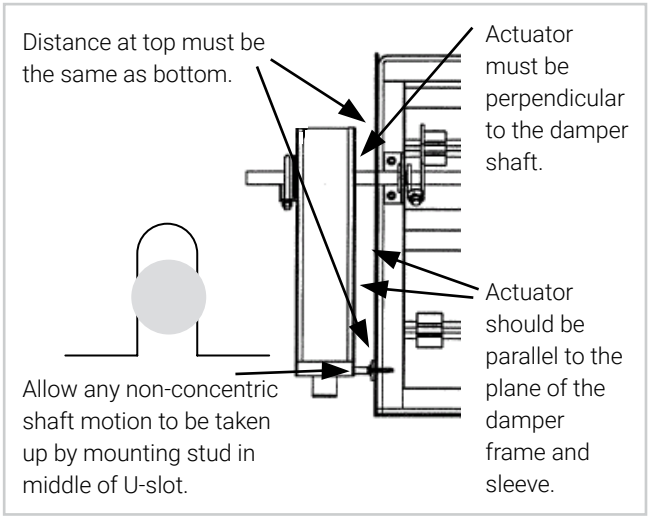
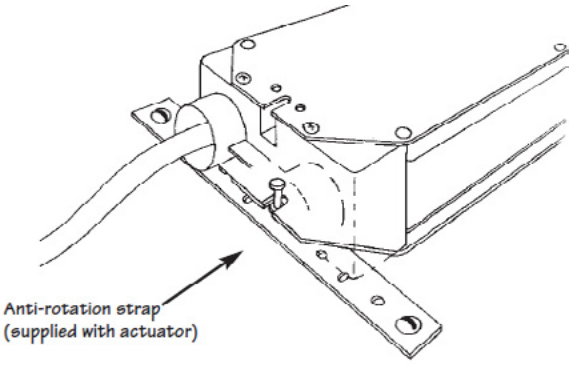
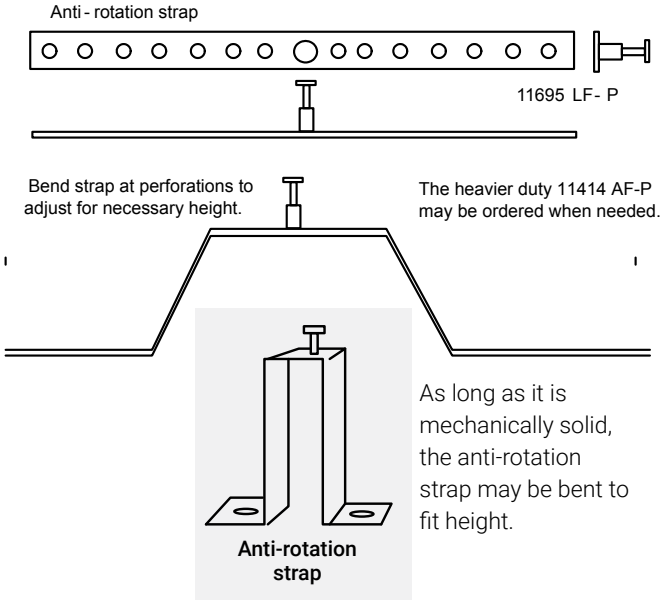


Figure 13.12



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

Figure 13.13



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

Figure 13.14

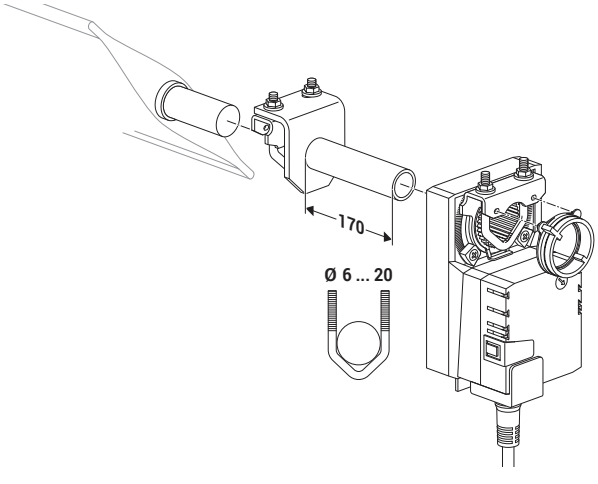


Figure 13.15: Mounting to angular ductwork use the AV6-20 or AV8-25 shaft extension and a field fabricated bracket

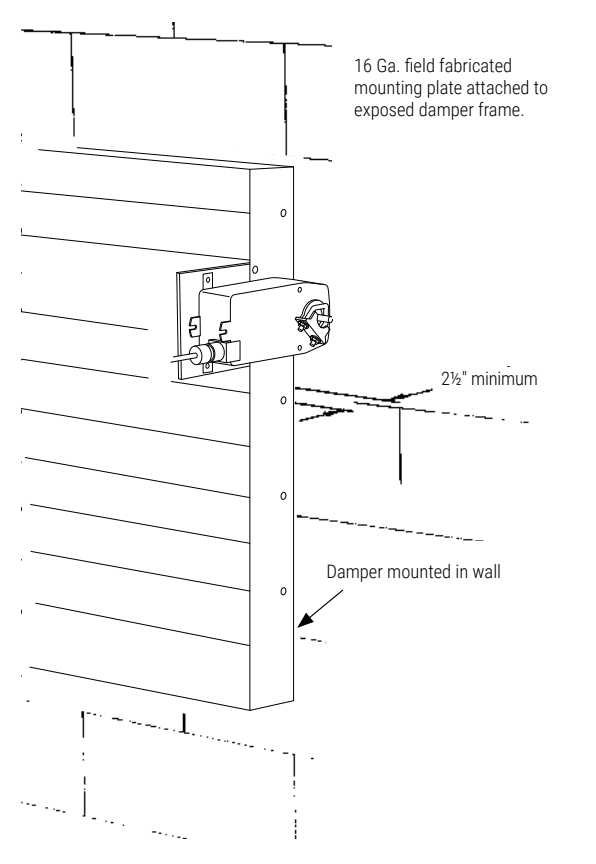


Figure 13.16: Field fabricated mounting plate

Used to attach actuator to exposed damper frame when there is not enough clearance from the wall to mount the actuator in the standard configuration.

Figure 13.17: Multiple actuators mounting using the fully adjustable ZG-102 mounting bracket

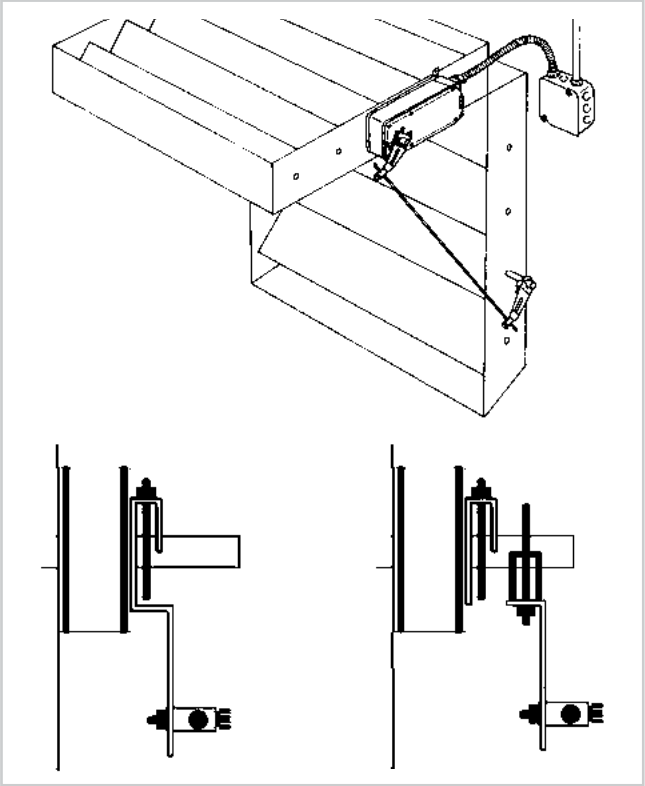


Figure 13.18: Multiple dampers directly connected to one actuator with linkage to operate the both dampers

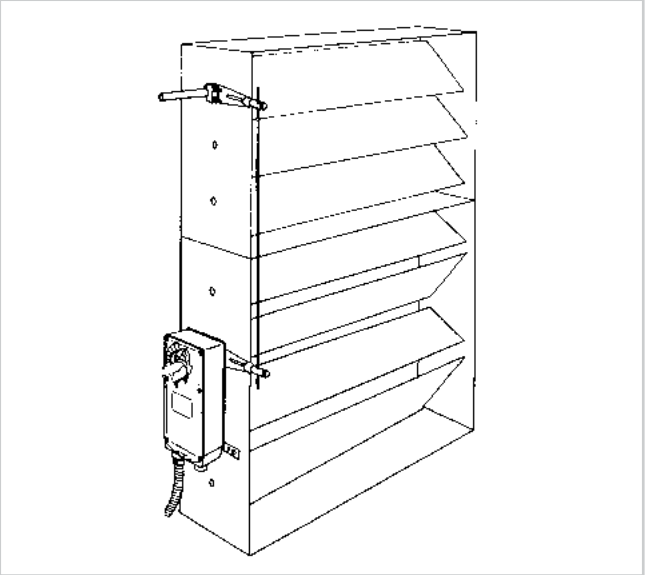
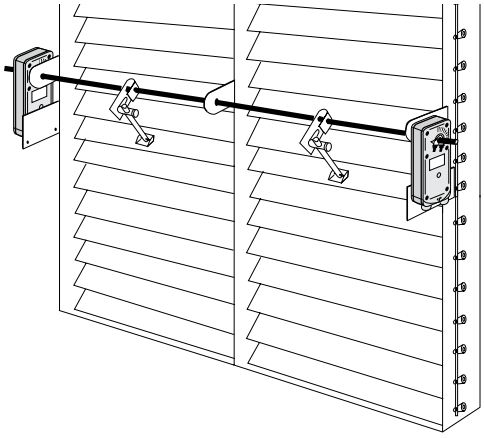
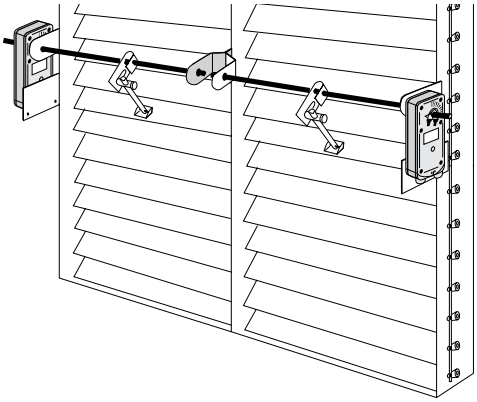


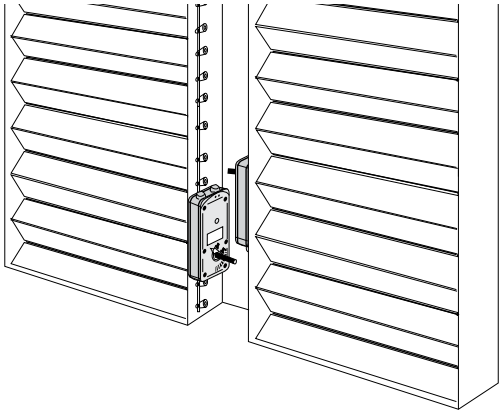
Figure 13.19: Multiple stacked dampers connected to one actuator with linkage to operate both dampers



A. Multiple dampers side by side connected to one actuator with linkage to operate both dampers.



B. Multiple dampers side by side with separate shafts and actuators.



C. Multiple dampers side by side with individual mounted actuators in close proximity with no jackshaft.

Figure 13.20: Controlling multiple damper assemblies

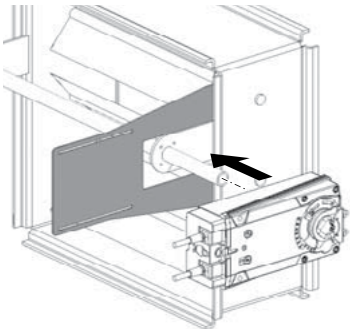


Figure 13.21: Actuator mounted to a jackshaft

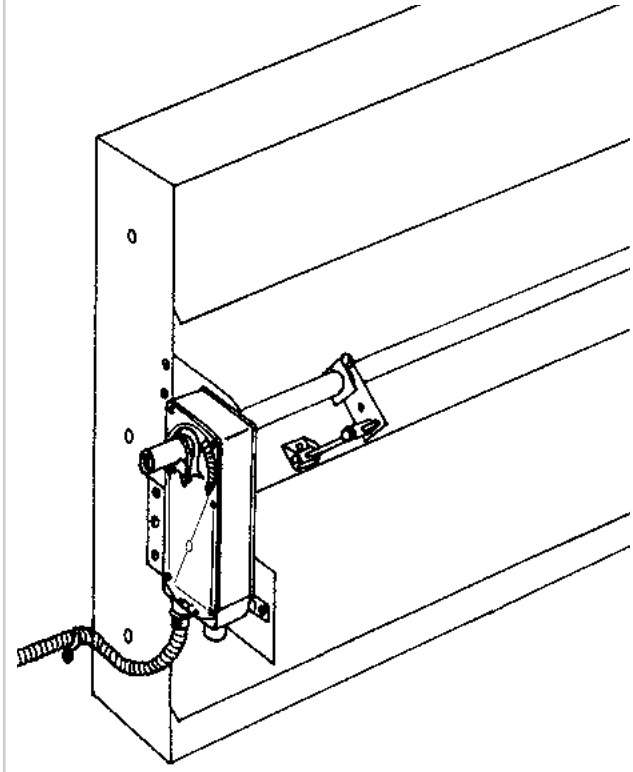
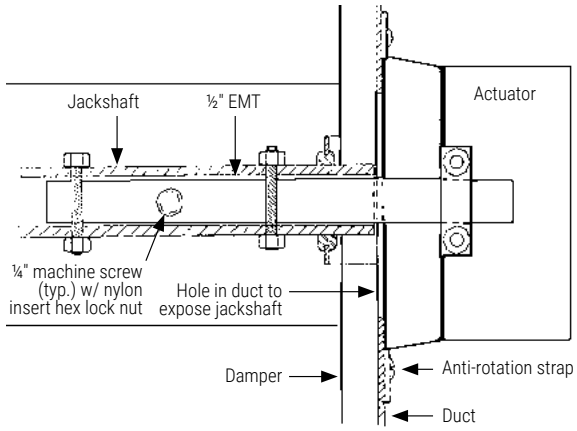
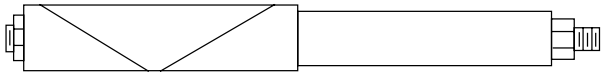
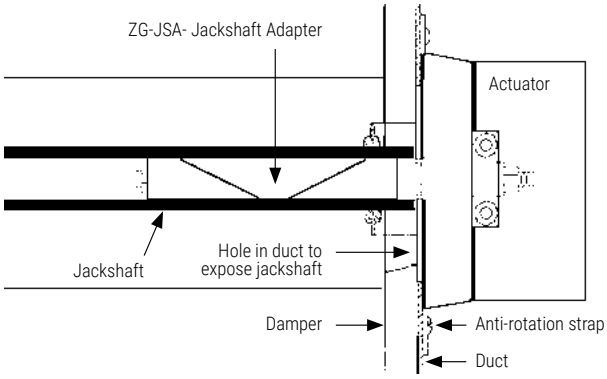


Figure 13.22: Actuator mounted to ductwork and jackshaft



Belimo ZG-JSA-. Jackshaft Adapter



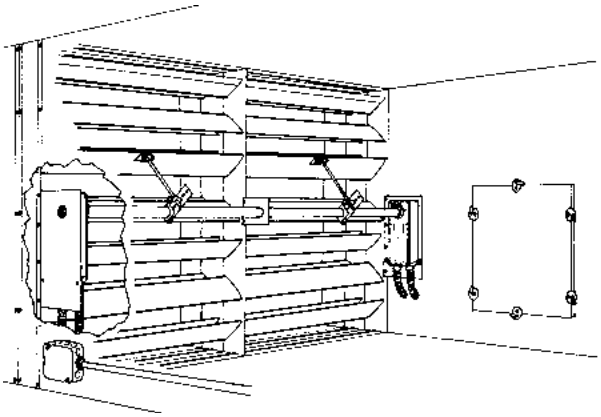


Mounting of actuators inside ductwork. If the jackshaft diameter is larger than the actuator will accept, use either EMT tubing or a JSA shaft adapter.

Two solutions:
For a 13/16" I.D. jackshaft, slide the ½" EMT into jackshaft and secure by bolting through with ¼" -20 machine screws. For jackshafts that have a larger I.D. use EMT or similar tubing with a maximum I.D. difference of no more than 1/16" . Use nylon insert hex lock nut to keep bolts from loosening up. Secure the actuator.

Less time consuming method preferred by installers use ZG-JSA-1, ZG-JSA-2, or ZG-JSA-3 jackshaft adapter designed to be inserted into the hollow jackshafts. Placed into the jackshaft and tightened the tension nut to expand against the inner shaft. Secure the actuator.

Figure 13.23: Jackshaft inside ductwork



Before mounting the actuator, check for clearance between the damper blades in the fully open position.
One actuator per section is the best way to drive this type of damper assembly.

Figure 13.24: Multiple actuators mounted to the same jackshaft

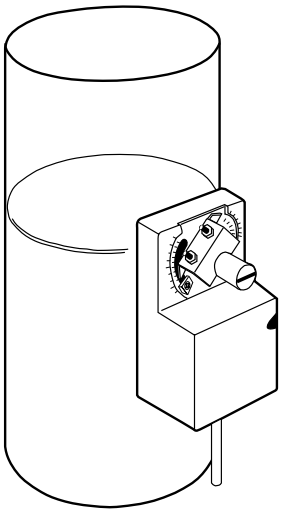


Figure 13.25: Actuator mounted on a round damper

Be sure to complete the notification form and submit it to your AHJ.

Non Direct Coupled Applications

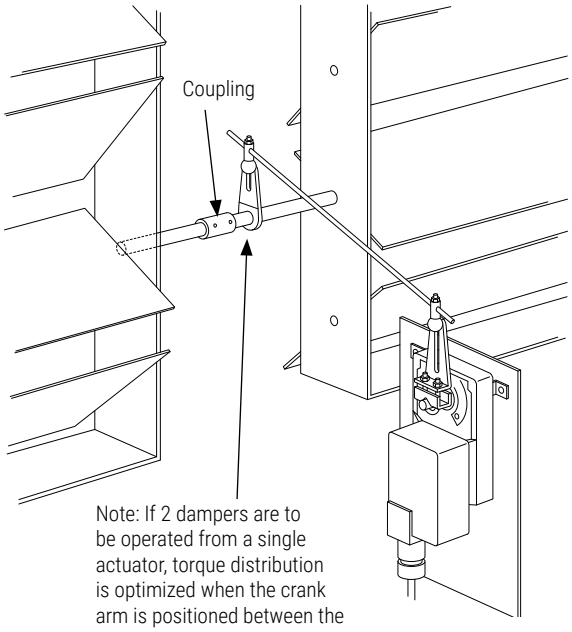


Figure 13.26: Two dampers that share the same shaft operated by one actuator with the crank arm position between the dampers for optimized distribution

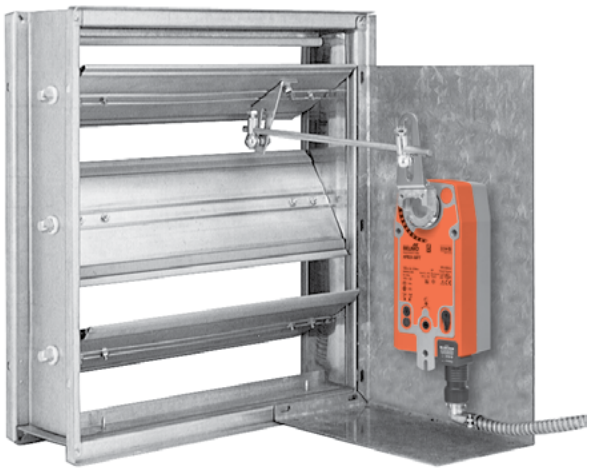
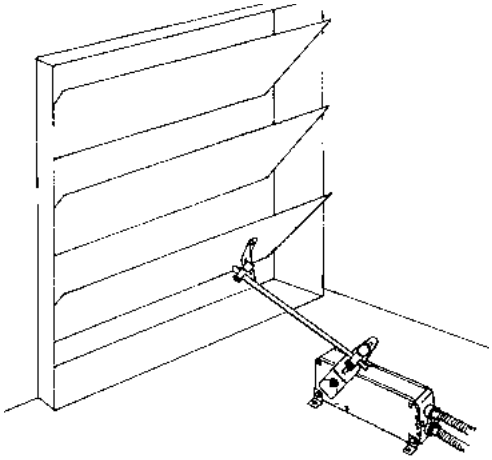


Figure 13.27: Universal mounting bracket is attached to the damper assembly



The pre punched hole pattern on the ZG-118 linkage allows for a variety of actuator mounting positions (i.e. sideways, upside down, right side up).

Figure 13.28: Actuator and ZG-118 linkage attached to ductwork with push rod, and damper clip to dampers

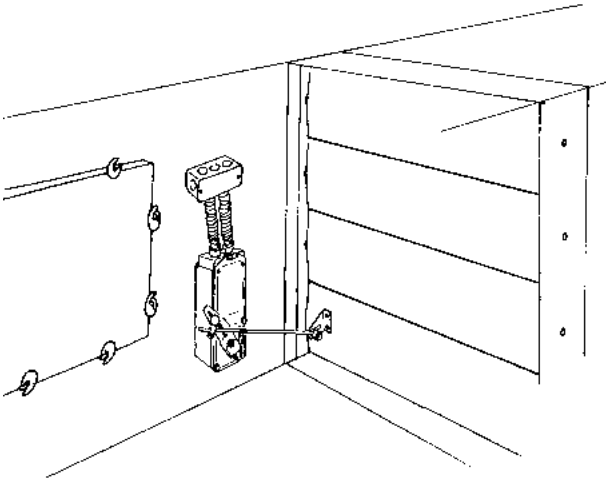


Figure 13.29: Actuator with linkage mounted in the airstream using ZG-AFB crank arm adapter kit

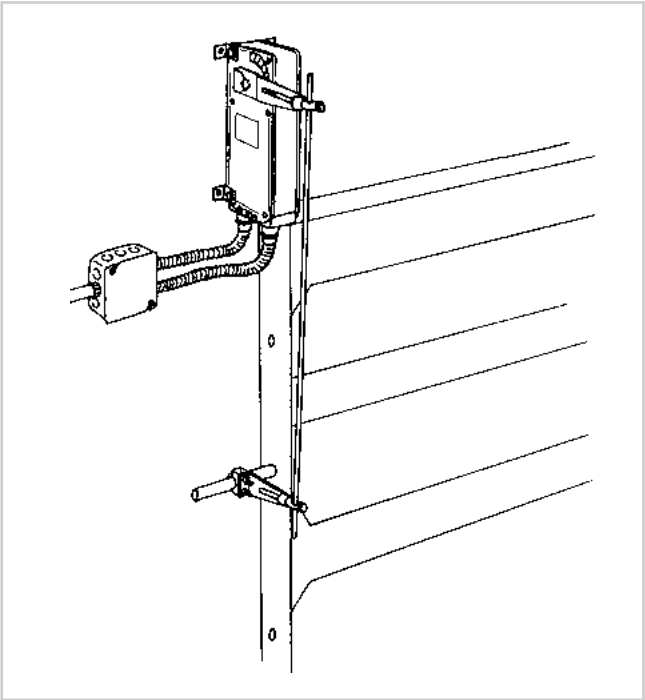


Figure 13.30: Mounting to the side of the damper with use of the ZG-AFB crank arm kit

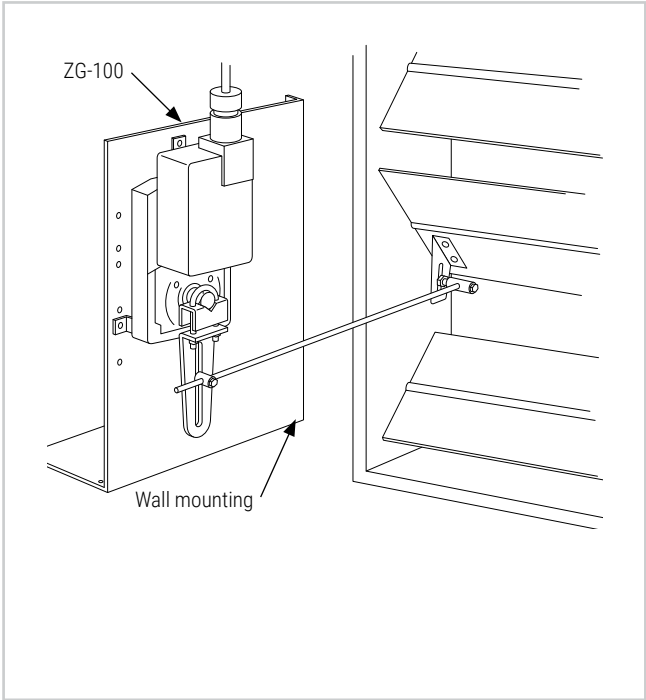


Figure 13.32: ZG-100 universal mounting bracket with crank arm, ball joints, and push rod for connecting the actuator to damper louvers

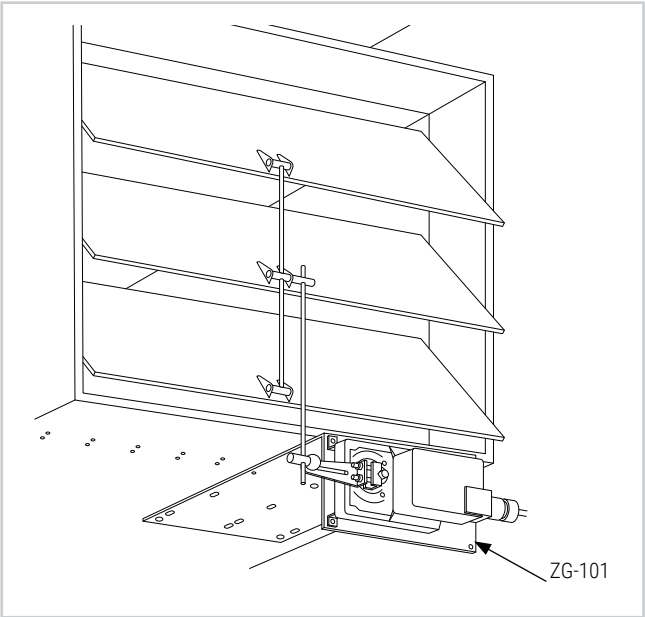
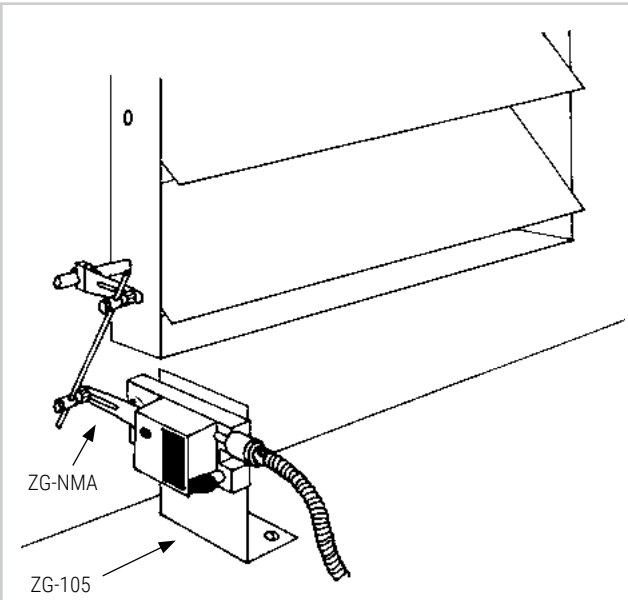
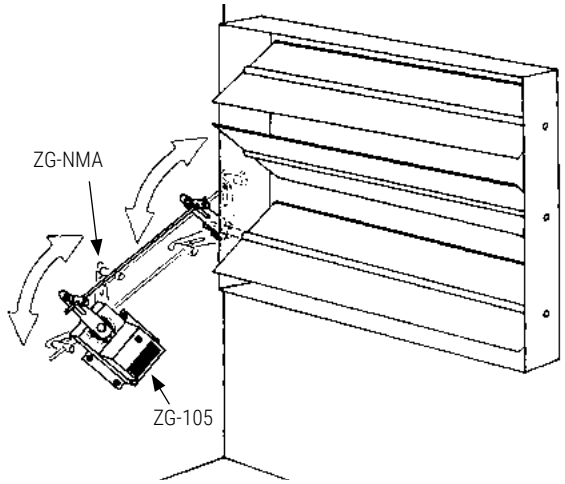


Figure 13.31: Actuator is mounted on the ZG-101 universal mounting bracket or field fabricated plate with crank arm, ball joints, and push rod for connecting the actuator to the damper louvers



Used when little clearance between the damper shaft and the wall along with ZG-NMA crank arm adapter kit for use with AM and NM series actuators.

Figure 13.33: ZG-105 universal mounting bracket or a field fabricated plate



With little clearance between the damper shaft and the wall. Mount the actuator at a 45° angle with the ZG-105 universal mount bracket using the ZG-NMA crank arm kit will allow for a full 90° rotation. Crank arm final position must be vertical when damper is fully open.

Figure 13.34: ZG-105 universal mounting bracket and ZG-NMA crank arm kit

Jackshafts

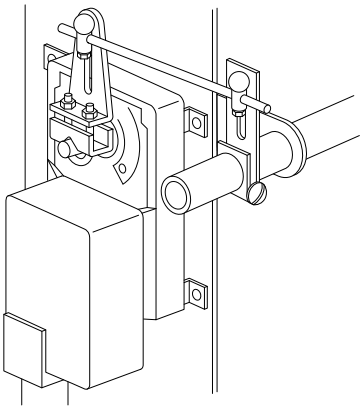
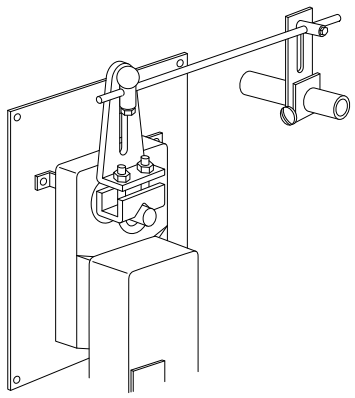
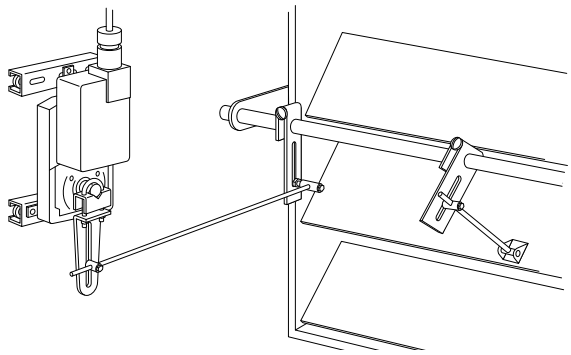


Figure 13.35: Actuator is mounted to the damper assembly connected to the jackshaft with a crank arm kit



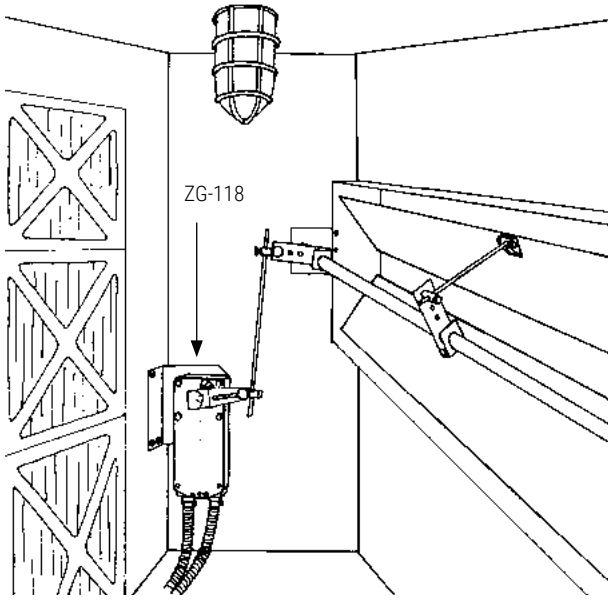
For large actuators, it is recommended to use an 18-20 gauge field fabricated mounting plate.

Figure 13.36: Actuator is mounted to the ductwork and connected to the jackshaft with crank arm kit



Actuator is mounted adjacent to the wall and is connected to the jackshaft with crank arm kit.

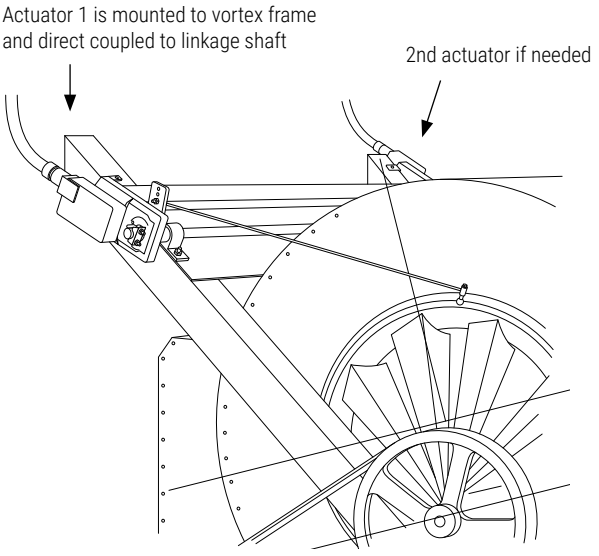
Figure 13.37: Common channel iron is used to allow spacing of the actuator away from the wall



Used to mount the actuator to the ductwork connected to the jackshaft with a crank arm kit.

Figure 13.38: ZG-118 universal mounting bracket

Inlet Vanes



A second actuator can be mounted on the opposite side of the frame if needed.

Figure 13.39: Actuator is mounted to the framework and connected to the inlet vanes with crank arm kit

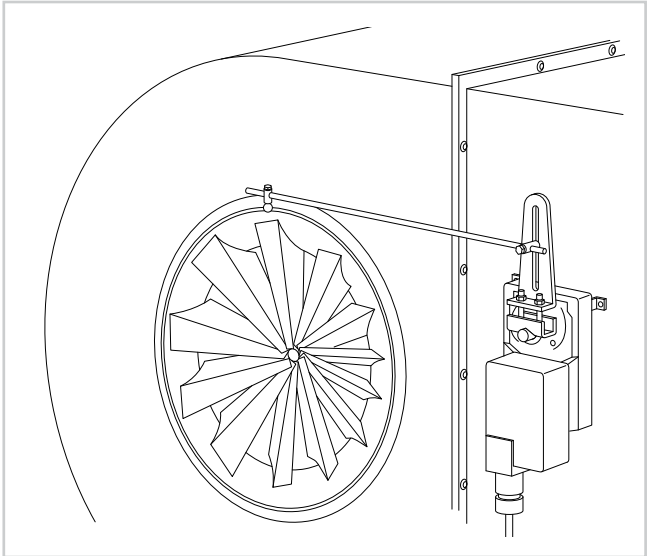


Figure 13.40: Actuator is mounted to the ductwork and connected to the inlet vanes with a crank arm kit

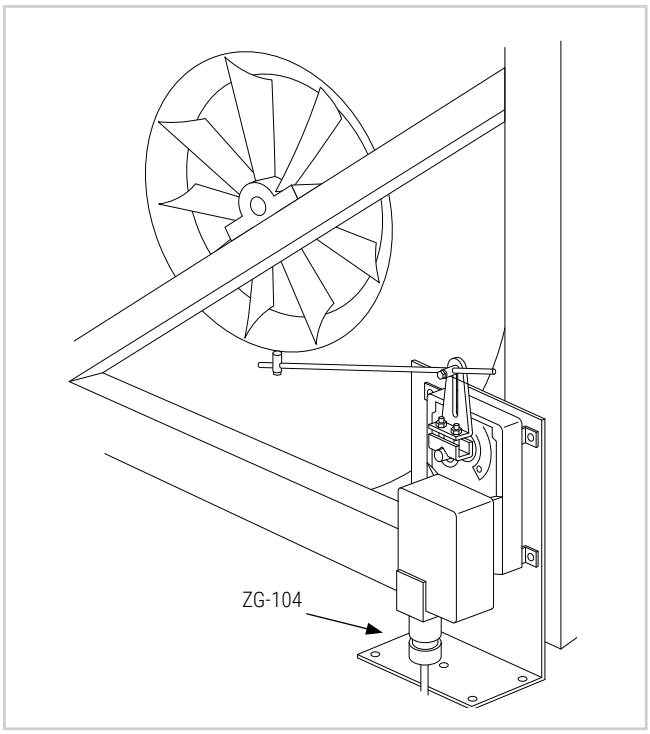


Figure 13.41: Actuator is mounted to the ZG-104 universal mounting bracket or to a field fabricated bracket and connected to the inlet vanes with a crank arm kit

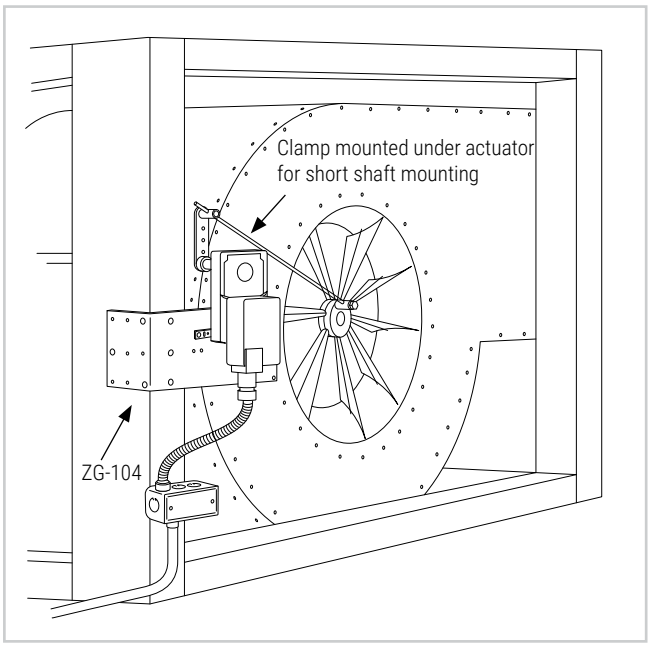


Figure 13.42: Actuator is mounted to the ZG-104 universal mounting bracket or a field fabricated bracket and connected to the inlet vanes with the crank arm kit

Be sure to complete the notification form and submit it to your AHJ.

Conduit Connections

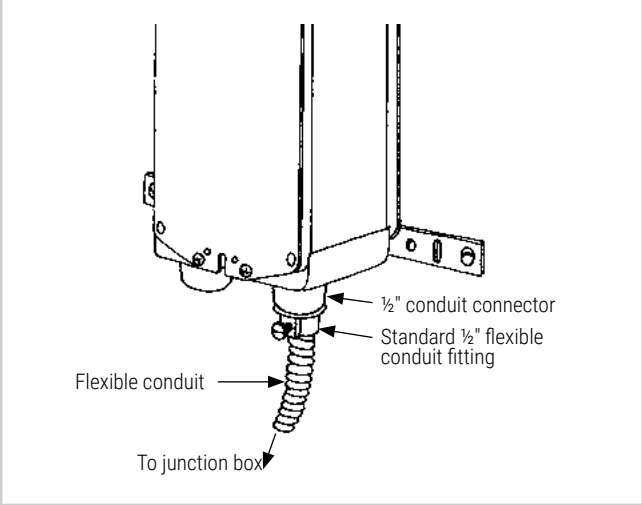


Figure 13.43: Standard electrical configuration

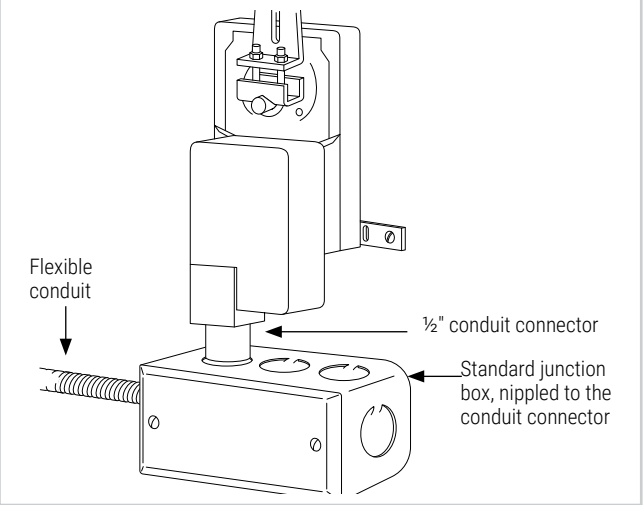


Figure 13.45: Connecting directly to the junction box

Note: Always use flexible conduit at the actuator.

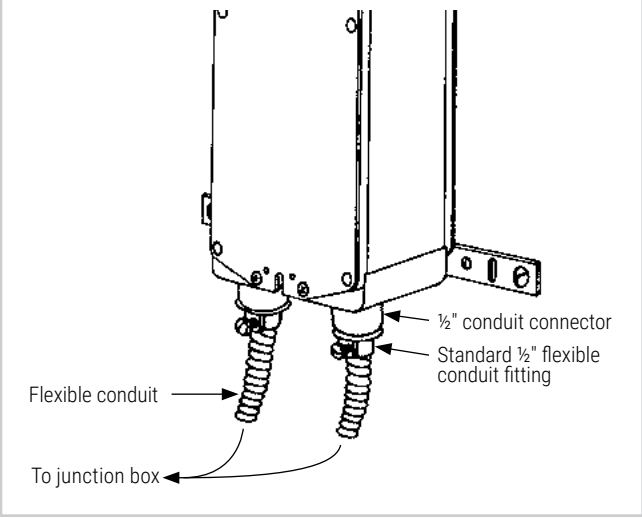


Figure 13.44: Fail-safe actuator with standard electrical configuration

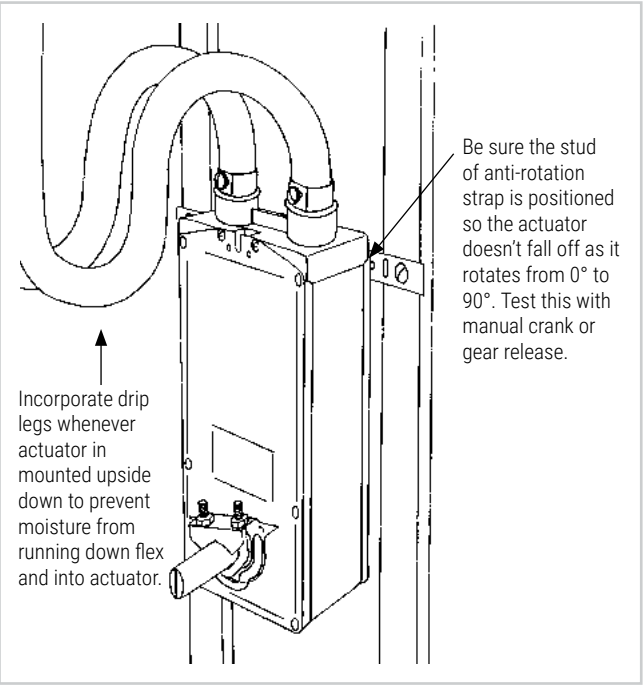


Figure 13.46: Fail-safe actuator connected directly to the junction box

Be sure to complete the notification form and submit it to your AHJ.

Linkages

Damper Linkages

General Information

Please note: Full available torque may not be realized due to inherent mechanical transfer.

The direct coupled method is the most effective way of mounting an actuator to a damper. However, there are some applications where a linkage must be used along with or in place of the direct coupled.

When using any linkage setup, it is essential that the proper geometry is used. If the geometry is not correct, several problems can occur; such as a risk of binding, incorrect rotation at the damper, the full available torque may not be utilized, or excessive wear to the linkage parts or actuator.

It is possible to arrange the linkage in such a way that special functions can be provided. For example, the torque provided to the damper can be modified so that less torque is provided in the open position of a damper, but more torque would be available for tight close off. The speed of rotation can be changed. The angle of damper rotation can be limited.

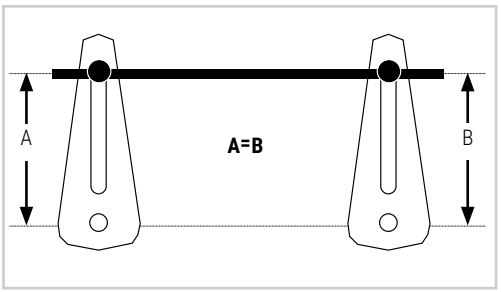


Figure 13.47

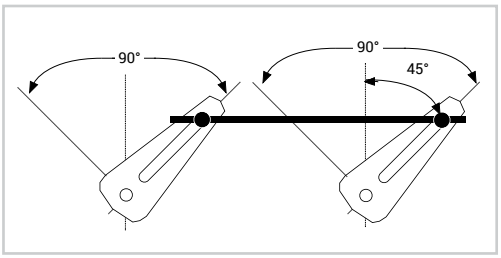


Figure 13.48

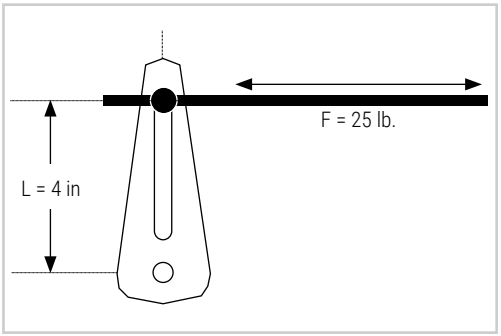


Figure 13.49

General Guidelines

1. The ball joints should be placed as close to the end of the crank arm as possible. This will minimize the forces acting on the linkage parts and reduce any hysteresis in the linkage assembly. Refer to figure 12.45.
2. The distance from the center of rotation of the crank arm to the ball joint should be the same for both crank arms. This provides uniform rotation at both crank arms. Refer to figure 12.45.
3. The push rod and crank arms should be set up so the crank arms on both the actuator and damper rotate 45° from a line perpendicular from the rod to the center of the crank arm rotation. This provides a balanced torque load to the damper and minimizes any chance of the linkage binding. Refer to figure 12.46.
4. Always use the full rotation of the actuator. If the damper rotation is complete and the actuator is still rotating, the linkage may bind up.
5. Always check the operation of the linkage assembly to make sure it operates the damper properly between the fully open and fully closed damper position.

Technical Information

The definition of torque is that it is a turning force. When talking about torque from an engineering standpoint, it is about a force (F), acting on the length of an arm (L) producing a turning force (T) given in a unit which incorporates both a unit of length and force in its description. This equation would be:

> **T = L x F;** where in common applications L would be in inches, F would be in pounds, and T would
> be shown as inch-pounds or pound-inches

Figure 12.47 shows a crank arm with a length between the pivot point to the ball joint attachment of 4". At the ball joint it shows we are applying a force of 25 pounds. The resulting torque would be 100 in-lbs.

> **T = L x F = 4 in x 25 lbs = 100 in-lbs**

When using this equation with actuators it is more common to see it in the following forms:

F = T/L or L = T/F

The rating of most electronic actuators is given in torque and it is usually required to find either the force from the crank arm or the length of the crank arm for the application. In figure 12.47, if we said the actuator had a torque of 100 in-lbs, and needed a force of 25 lbs, we would need a 4" crank arm.

L = T/F = 100 in-lbs/25 lbs = 4 in

Unfortunately, the equation T = L x F is only correct when the force acts upon the crank arm at a 90° angle. At any angle other than 90° the resultant torque or force is dependent on the crank arm effective radius. The effective radius (R), shown in figure 12.48, is the distance between the point on the push rod which is perpendicular to the center of rotation of the crank arm and the center of rotation. We now have to substitute the effective radius (R) in place of the crank arm length (L) in the torque equation.

T = R x F or F = T/R

Note: R has its greatest value at the point where the crank arm is perpendicular to the push rod. At this point R equals L. Figure 12.48 shows the same torque and crank arm as figure 12.47; however, the crank arm is now not perpendicular to the push rod. At this point in the crank arm rotation we show an R of 2". With the output torque of 100 in-lbs, the resulting force at this point is 50 lbs.

F = T/R = 100 in-lbs/2 in = 50 lbs

As the effective radius (R) changes during the crank arm rotation, the relationship between torque, force, and even rotational speed changes. By analyzing the crank arm orientation between the actuator and damper, special set ups can be made to optimize certain damper applications.

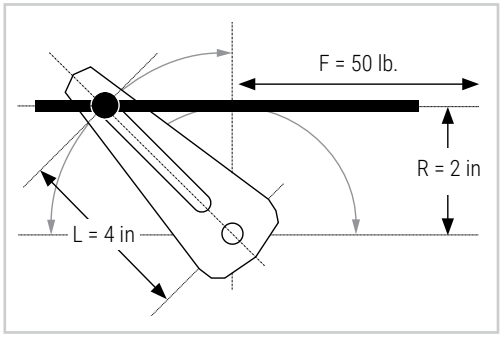


Figure 13.50

Special Applications

High Close-Off Torque

Low leakage dampers with blade seals require a greater close-off torque than the normal operating torque. By setting up the linkage correctly, the torque provided to the damper at close-off can be multiplied. Figure 12.49 shows a linkage arrangement where, when the damper is in the closed position, the angle between the actuator crank arm and push rod is relatively large. This angle makes the resulting effective radius at the actuator (R_a) small; this in turn causes a higher force to act on the push rod. When the damper is at close-off, the damper crank arm is adjusted so it is at an angle creating a relatively large effective radius (R_d) at the damper. The large force from the push rod is multiplied by the effective radius (R_d) at the damper and the result is a higher torque at the close off position. The torque from the actuator is actually multiplied at this point by a factor M which is equal to R_d/R_a.

$$M = R_d/R_a$$

One important thing to remember is that at the opposite end of rotation the torque can be reduced to a point where minor binding or friction could lock up the damper.

Faster Response Time at Damper

Figure 12.50 shows an application where the actuator crank arm is approximately twice as long as the damper crank arm. This results in a rotation at the damper shaft of 90° with only 45° of rotation at the actuator. Using only 45° of the actuator's rotation gives the advantage of the damper operating at twice the actuator's normal speed. A draw back is that the actuator torque is cut in half. It is recommended that the actuator be limited to only 45° of rotation either mechanically (preferred) or electrically. If this is not done, it is possible that the linkage or the damper may be damaged as the actuator continues to rotate. Figure 12.51 shows an application where we are limiting the degree of rotation while still using the full 90° rotation of the actuator. The crank arm shown of the actuator is shorter than the arm on the damper. Because of the smaller arc produced at the actuator arm, the push rod travel cannot rotate the damper arm through a full 90° rotation.

General Comments

The use of a linkage assembly can be advantageous if a solution to a special need is required. However, great care must be taken in planning the linkage geometry. Any change made to the linkage has an effect on more than one condition. As an example, if you adjust the linkage for more torque, you will at the same time effect the damper rotational speed and the angle of the damper rotation. In any special application it is necessary to use a trial-and-error, back-and-forth method to set the required parameters. This can be a very time consuming process, but it should be done.

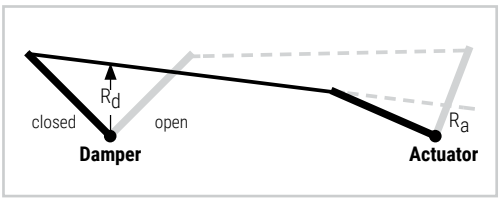


Figure 13.51

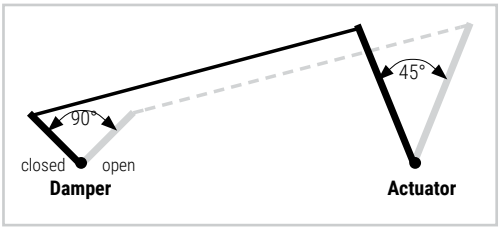


Figure 13.52

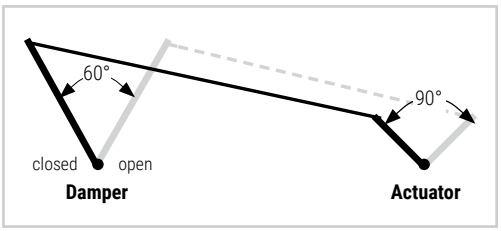
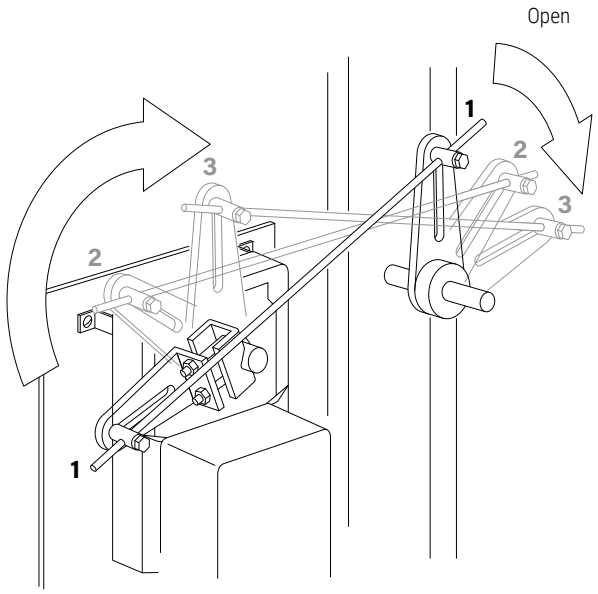
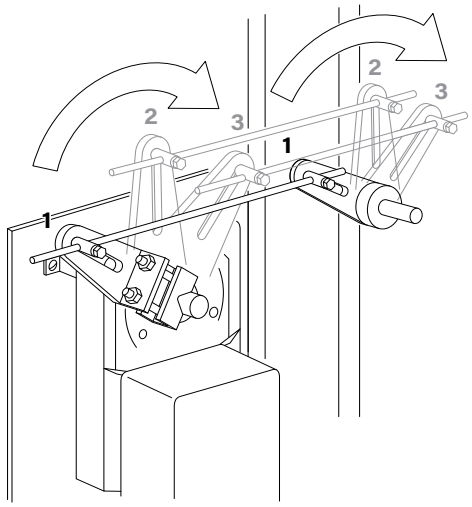


Figure 13.53



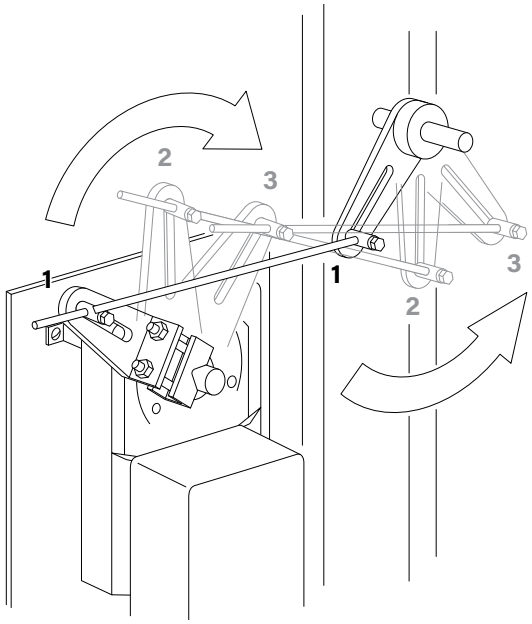
Point 1 is the start point, and 3 is the end point. Damper movement is slows from positions 1 to 2 and increases speed to position 3. For example, if a 90 in-lbs actuator is used the torque at 1 is approximately 180 in-lbs and at location 3 is 45 in-lbs. The highest torque is supplied where it is most needed, which is at the beginning of the movement of the damper to assure breakaway from the side seals.

Figure 13.54: Back-to-back method of increasing breakaway torque



Most common methods where both crank arms remain parallel throughout the whole movement, ensuring consistent torque at all times.

Figure 13.55: Typical parallel crank arm operation



The crank arms are set in opposite directions. This is used in areas where space is limited.

Figure 13.56: Over-and-under method

Linkage Mounting

Apply the most appropriate linkage mounting method for the geometric arrangement.

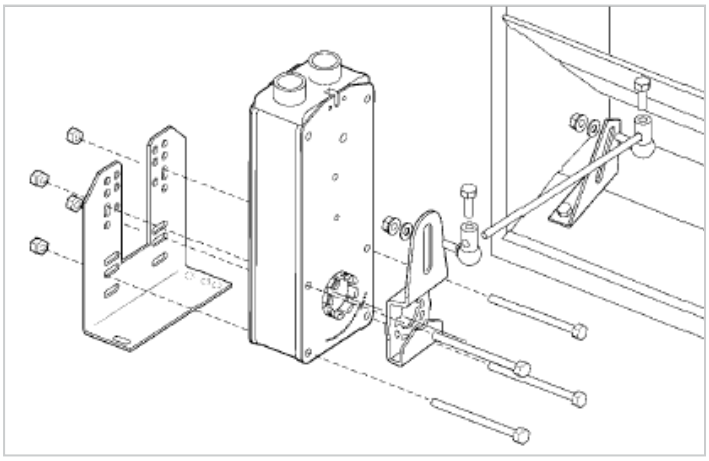


Figure 13.57

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.

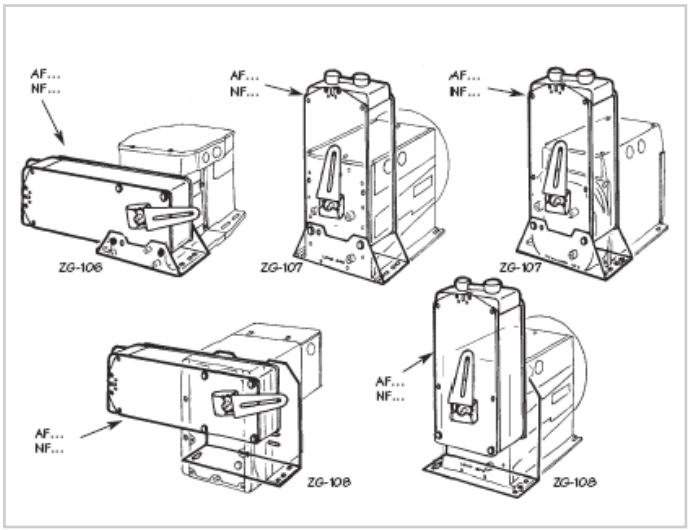


Figure 13.58

Figure 13.59

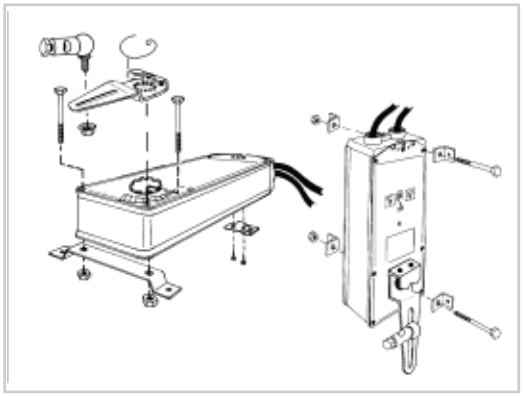


Figure 13.60

Figure 13.61

Use of ZG-106 bracket with crank arm and ball joints to connect to two damper arms. (Figure 13.62)

Figure 13.62

MA418 that was formerly linkaged, now direct coupled

These are very easy to replace. Simply remove the old motor and linkages. Then mount Belimo FSNF over shaft. Do not remove any bearings. (Figure 13.63)

Figure 13.63

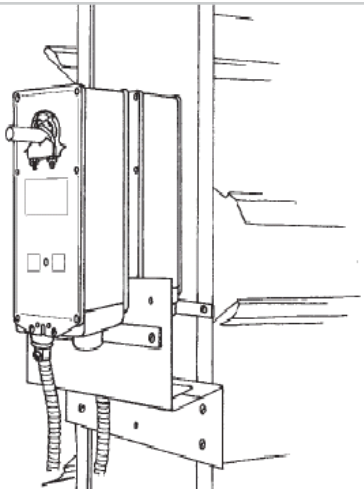
With no space to direct couple, the ZG-AF Leg kit has been used. Note the legs between actuator and duct. (Figure 13.64)

Figure 13.64

Above are some ways in which Belimo linkages are used. Figure 13.65 is of an FSTF with ZG-TF112. This actuator is not generally used for retrofits as it is only 18 in-lb of torque, but in special circumstances, it is quite useful.

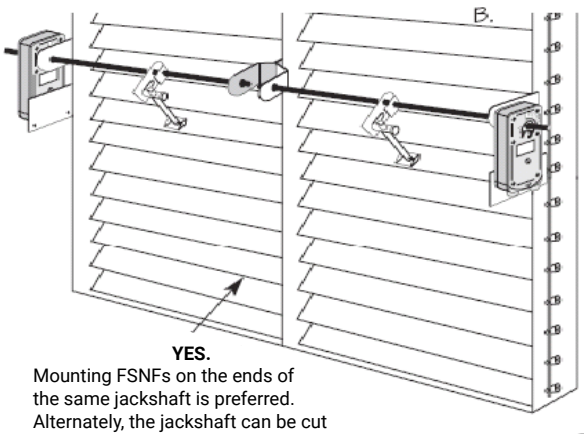
Figure 13.65

The FSAF*A and FSNF series may be mounted using the ZG-102 (Figure 13.66). However, it is recommended that they be mounted on the ends of the jackshaft (Figure 13.67). Derate torque to 80% of the combination of multiple actuators.



NO.
Use of the ZG-102 for mounting 2 FSNF is not recommended in general. The fast speed and high torque loads will damage gears if actuators are cycled more than once a day.

Figure 13.66



YES.
Mounting FSNFs on the ends of the same jackshaft is preferred. Alternately, the jackshaft can be cut and the one actuator, one damper section approach taken.

Figure 13.67

Example of linkage that can be replaced by direct coupling.

Figure 13.68

The motor in Figure 13.68 can be replaced by direct coupling over the shaft.
Use of linkages is not needed.

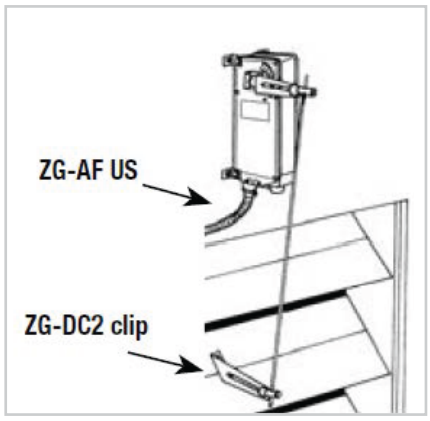


Figure 13.69

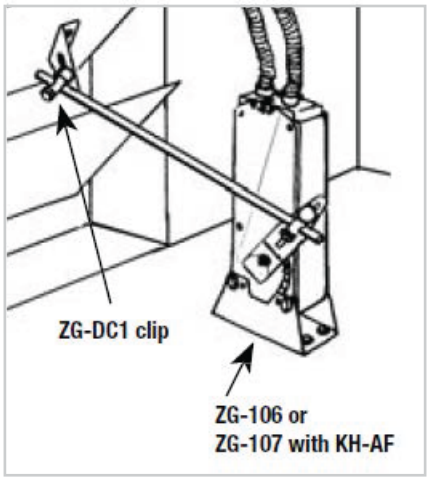


Figure 13.70

Figure 13.71

Figure 13.72

Figure 13.73

Figure 13.74

Figure 13.75

Figure 13.76

FSLF

The FSLF has no linkages except for a custom one supplied in a kit by Ruskin.

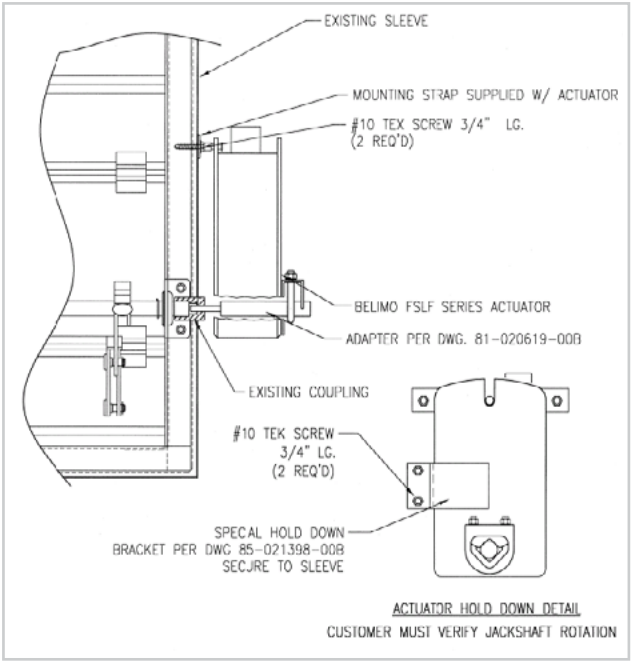


Figure 13.77

Ruskin makes a kit with a shaft adapter, hold down, and Belimo FSLF120 actuator.

Fusible rods are no longer available from Ruskin.

Where springs are defective, ball joints, rod, and a BAE 165 or Ruskin EFL are necessary.

Rewiring is necessary.

FSTF mounting

Figure 13.78

Figure 13.79

Given the typical space constraints of installed dampers, it is likely that all the actuator and linkage parts will need to be assembled as much as possible and then installed as an assembly.

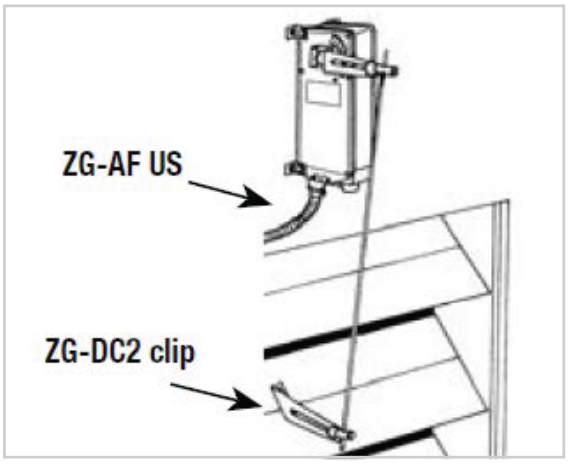


Figure 13.80

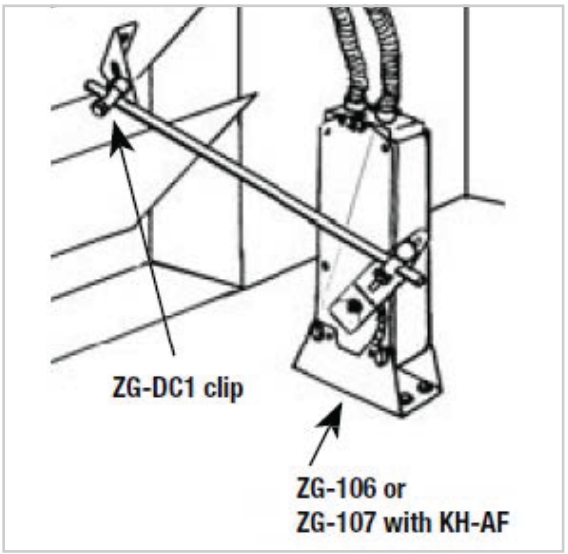


Figure 13.81

Possible alternate arrangements for damper clip. (FSNF, FSAF actuators shown.)
Be sure to complete the notification form and submit it to your AHJ.

Gear Train Motor Conversion

Examples of various gear train motors and mounting

In general, oil-filled spring return motors like the MA418 are straight-forward 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.

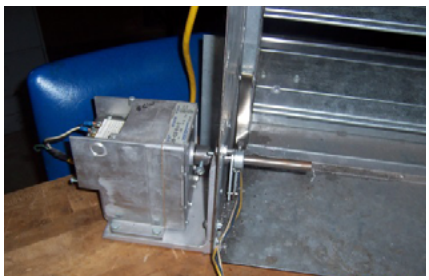


Figure 13.82

Figure 13.83

Figure 13.84

Figure 13.85

Figure 13.86

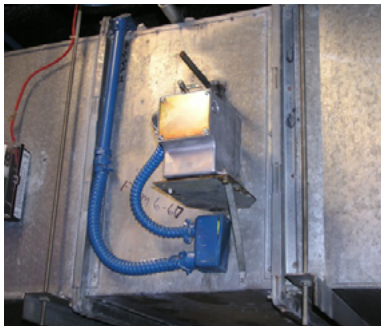


Figure 13.87

Figure 13.88

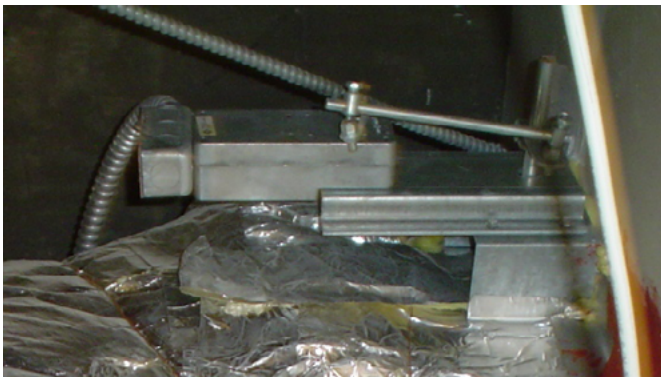


Figure 13.89

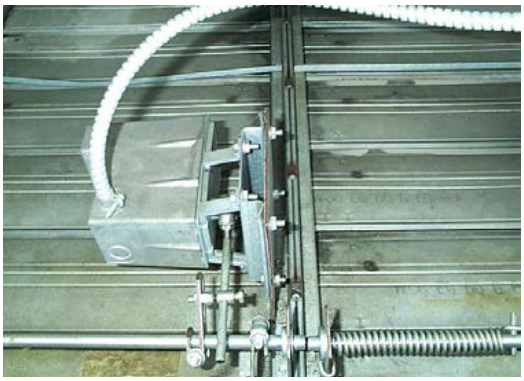


Figure 13.90

Figure 13.91

Figure 13.92

The above applications will need linkages due to space constraints or accessibility.

ZG-AF US kit. This contains parts for several different ways to linkage the FSAF and FSNF series of actuators. (Figure 13.93)

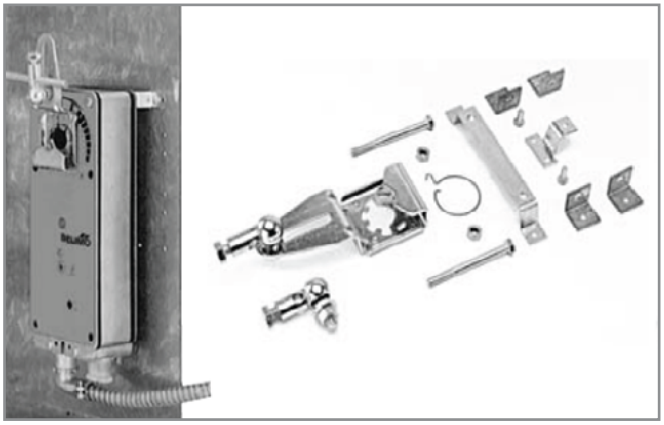


Figure 13.93

FSTF linkage kit mounting

The crank arm material is Duroplast Vyncolit® (phenolic compound similar to Bakelite). Smoldering temp is 500°F; auto-ignition temp is 900°F.

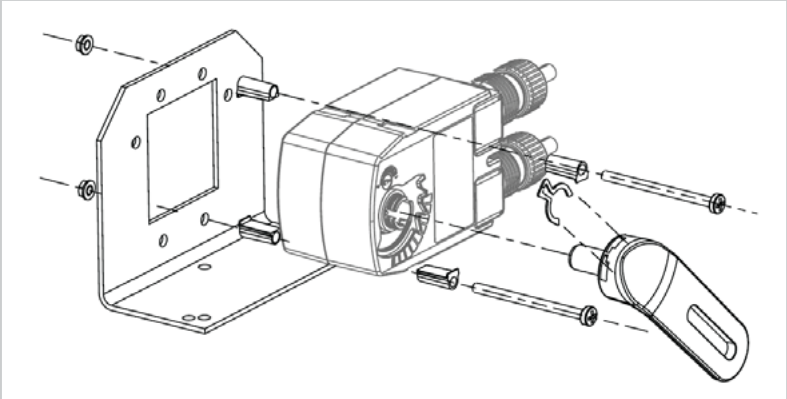


Figure 13.94

The ZG-TF112 Crank Arm Adapter Kit includes:

1 ZG-113 Mounting Bracket

1 KH-TF-1 Crank arm with Retaining Clip

2 Bolts with Nuts

Ball joints and 5/16" Rod not included

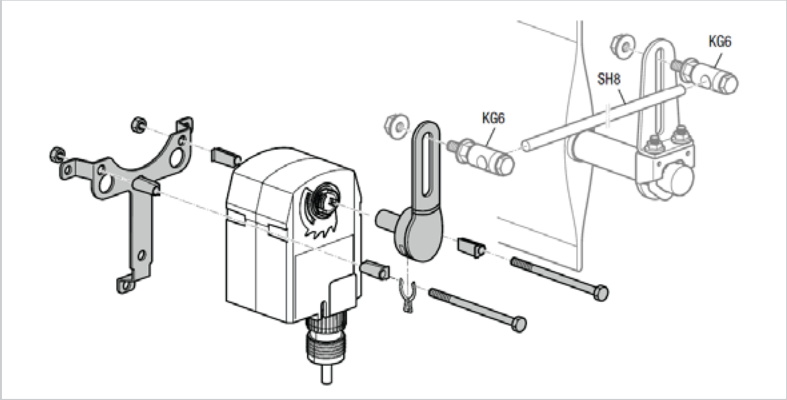


Figure 13.95

The ZG-TF2 Crank Arm Adapter Kit includes:

1 Mounting Bracket

1 KH-TF-1 Crank Arm with Retaining Clip

3 Bolts with Nuts

Ball joints and 5/16" Rod not included

It is assumed that the bracket here will be installed on an existing sleeve or mounting plate.

Be sure to complete the notification form and submit it to your AHJ.

14. Wiring

Wiring 14.1

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.

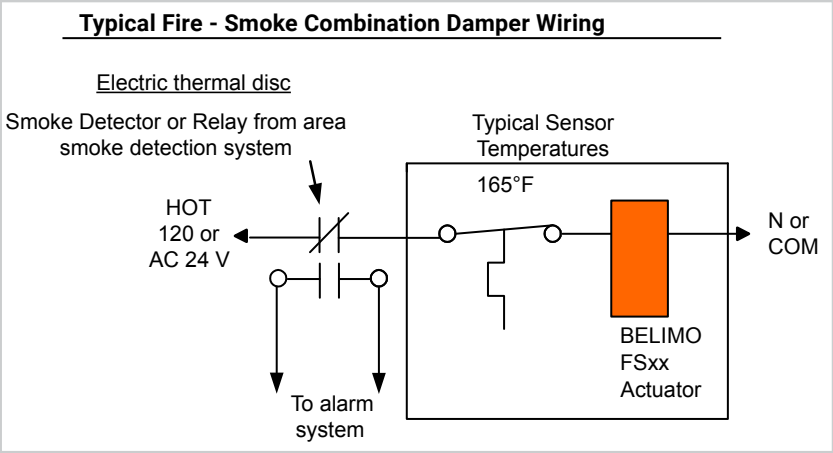


Figure 14.1

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.

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

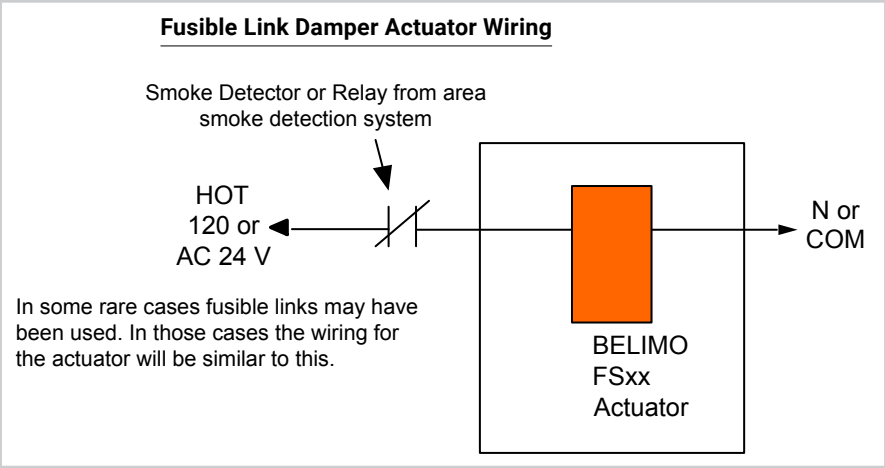


Figure 14.2

WARNING!

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

Typical Reopenable Damper with FSCS Belimo Auxiliary Switches for position indication to FSCS

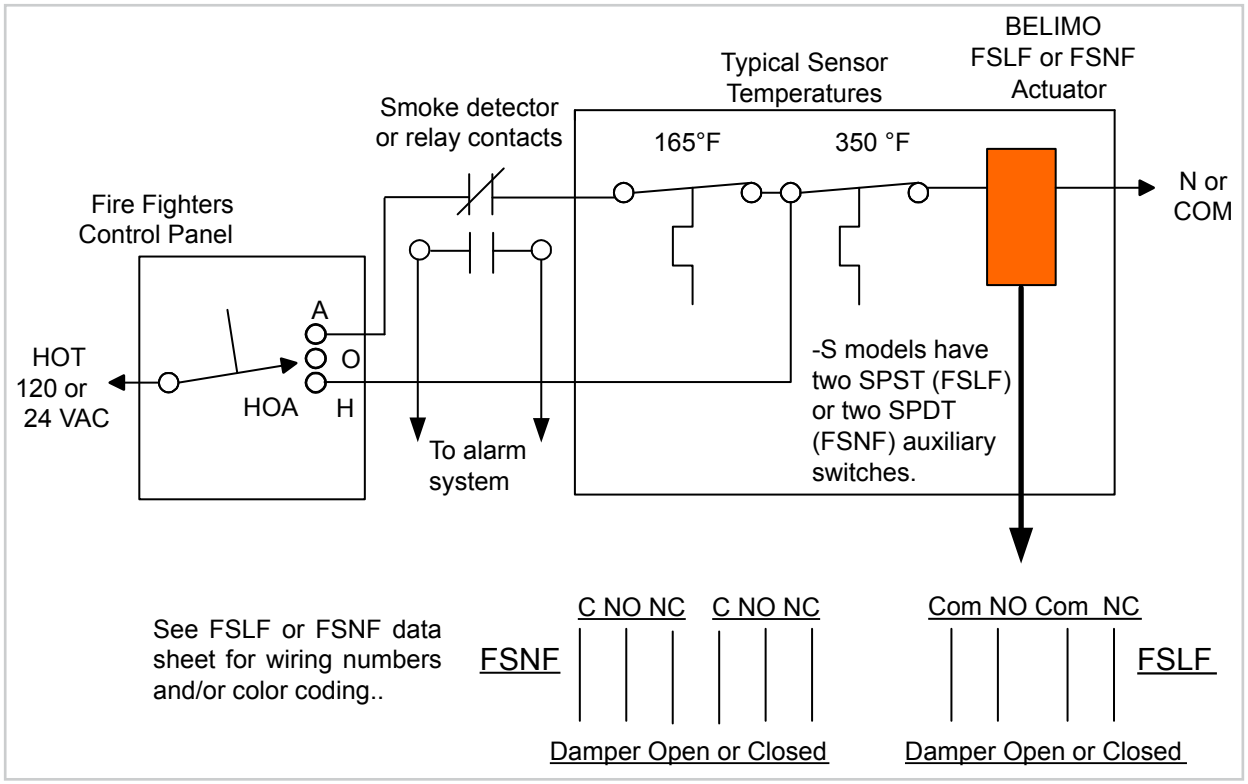
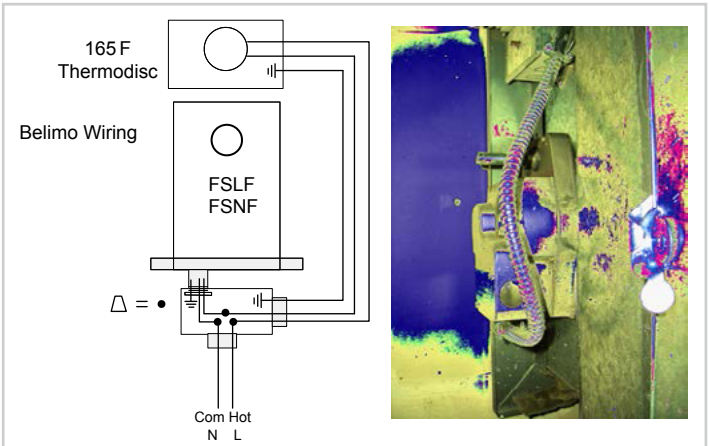


Figure 14.3

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.



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

Figure 14.6

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.**

Example

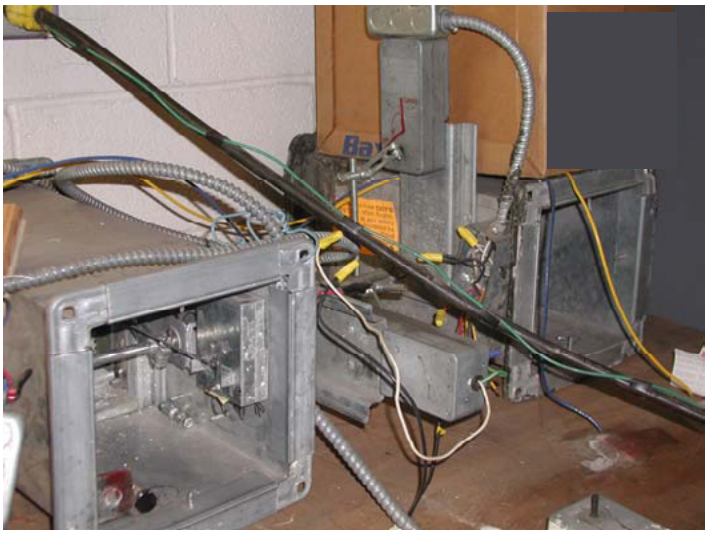


Figure 14.7

Two old motors can be seen. The procedure for replacement was:

1. Disconnect and tag all wiring.
2. Remove old linkage, external spring, & motors.
3. Check and clean dampers. Exercise open and close manually.
4. Damper shafts were available so existing brackets were relocated and used to mount FSNF120 actuators and anti-rotation straps. (FSLF was sufficient for torque; however linkage convenience of FSNF was desired.)
5. Thermal sensors were present and tested.
6. Wiring was cleaned up and connected.
7. Testing to assure operation per check list was performed.

Be sure to complete the notification form and submit it to your AHJ.

15. Thermal Sensor Replacements

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.

Figure 15.1

Belimo BAE165 US
Where existing sensor is defective or one must be added, the 165°F primary sensor may be used.

Be sure to complete the notification form and submit it to your AHJ.

16. Auxillary Switches

Auxiliary Switches 16.1

Auxiliary Switches

Figure 16.1: Damper blade switch assembly

Figure 16.2: 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, FSAF actuators can use the add on switch package.

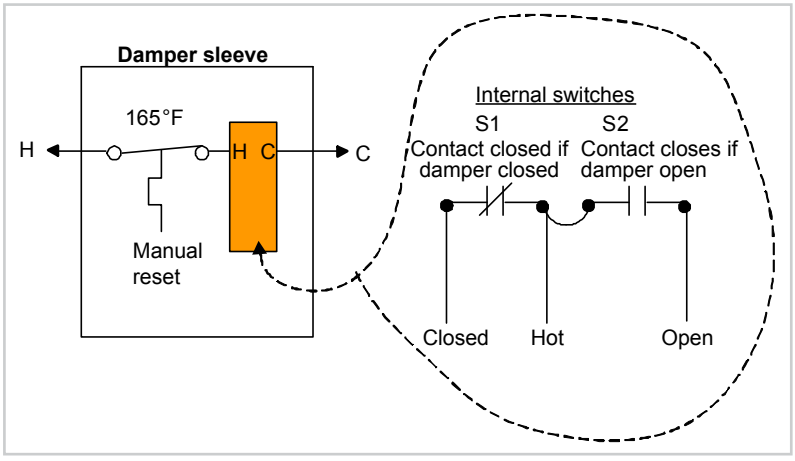


Figure 16.4

Figure 16.3

-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. (Figure 16.5)

Be sure to complete the notification form and submit it to your AHJ.

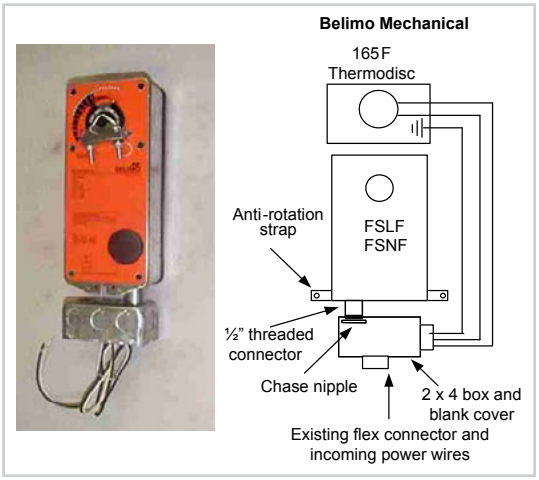


Figure 16.5

17. Remote Testing

Introduction - Fire and Smoke Dampers

Figure 17.1 shows the most common combination fire & smoke damper installation and wiring. This is a containment damper required by Chapter 7 of the International Building Code in the US and other codes such as the National Building Code of Canada.

The actuator is powered continuously under normal conditions. If the smoke detector or a relay from an area smoke detection system opens its contact, power is removed from the actuator and it springs the damper closed. Likewise, if the bimetal temperature limit (primary heat responsive device in UL 555's terminology) senses elevated temperature, power is removed from the actuator and it springs the damper closed. Some fire dampers have fusible links and a jackshaft spring instead of the electrical limit.

Most containment dampers do not have switches for position indication.

Some containment applications require only smoke dampers and if so, the bimetal switch is not present. These are containment dampers, not smoke control system dampers. The distinction should be made. Actuated fire dampers are not common. They would not have the smoke detector in series with the power connections.

Combination Fire & Smoke Damper

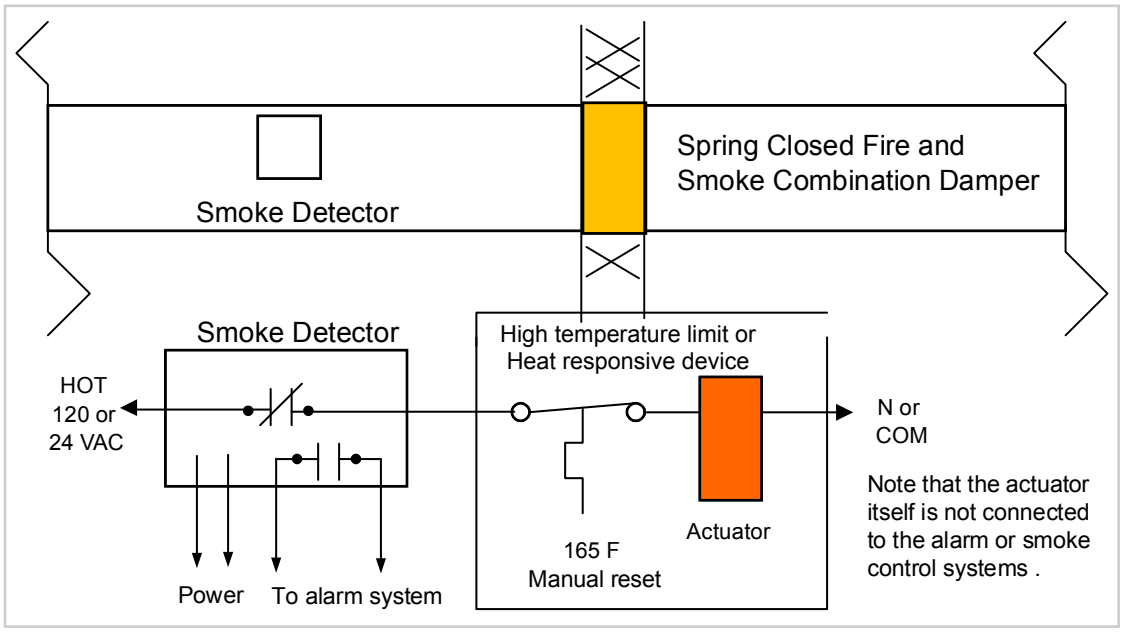


Figure 17.1 Basic application

Figure 17.2 shows a manual test station that is sold by damper manufacturers and can be factory or field installed. Functionally, it is the same as the FSKN except cannot be connected to a network and must be tested locally. The switches are either actuator auxiliary switches or damper blade switches. Infrequently, magnetic or whisker blade switches are installed.

The test station has lights that indicate position – open or closed. The FSKN uses the same concept but instead of giving local indication, BACnet records the results.

Fire & Smoke Damper with manual test station

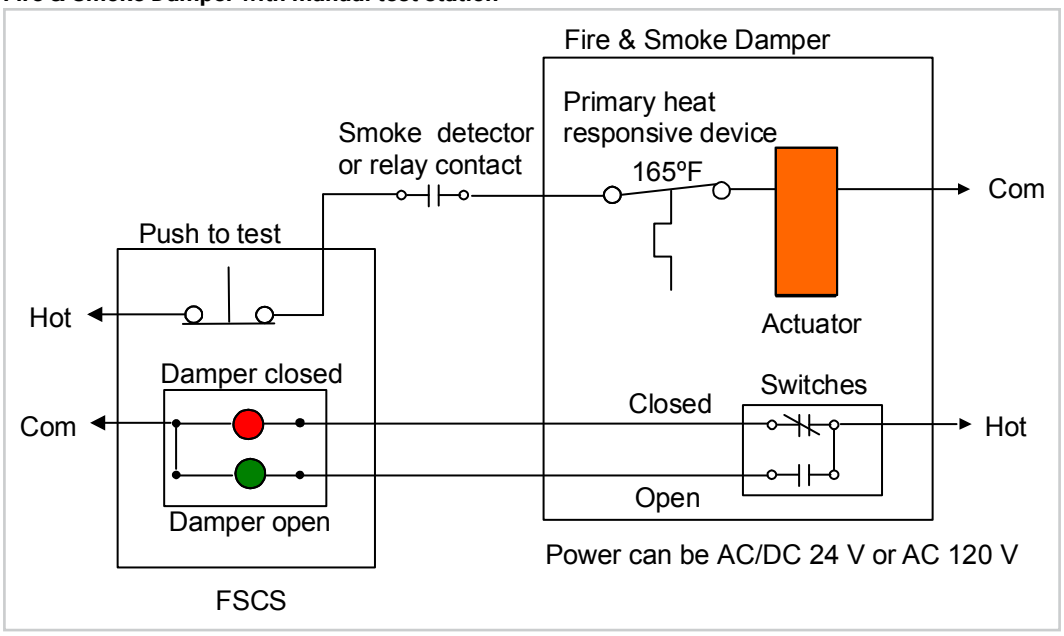


Figure 17.2 Typical manual test station and wiring to combination damper.

Roughly 90% of actuated life safety dampers are installed to maintain compartmentation (containment, Chapter 7 of the IBC). About 10% are installed in smoke control systems (Chapter 9). The FSKN is for use only with IBC Chapter 7 containment dampers. Smoke control dampers are controlled by proprietary fire alarm or smoke control panels with modules dedicated to the purpose.

The FSKN is not a safety control. It is a testing module only. A large number of variations in Chapter 7 dampers exist.

AC/DC 24 V, AC 120 V, and AC 230 V models are available.

The wiring diagrams here are typical and do not always distinguish among the voltages as the applications are identical as long as all voltages within a system are consistently coordinated.

Consult local codes for any other restrictions or requirements. Local fusing and backup power are not required by Belimo or UL standards for dampers. If employed observe fuse or breaker ampacity restrictions in the specific actuator data sheet.

Installation Instructions

FSKN120 BAC & FSKN24 BAC

Installation

The enclosure is a standard NEMA 1 electrical box. It is surface mounted remotely or on the damper sleeve. If mounted on the damper sleeve the connected ducts must be free to fall away if necessary. Do not bridge the sleeve and duct. Four mounting holes are inside the enclosure.

Ground all conduits entering the box either using bonding connectors or normal conduit connections per NFPA 70 NEC and local codes. The life safety code requires flex or hard conduit for both 24 V and 120 V circuits. Only the 120 V model requires a grounding screw connection.

Figure 17.3

FSKN mounted in its enclosure

Surface mount the FSKNxxBAC using the 4 holes on the base of the enclosure. Do not drill inside of enclosure. Mark holes, drill, and then mount the enclosure. Use bolts with lock washers inside damper sleeve or on any vibrating surface like ductwork.

The enclosure has a standard screw cover, cULus. 6" x 6" x 3" ANSI 61 polyester finish. 3 lbs. 16 ga. carbon steel. ½" and ¾" KOs. Enclosure: JB3954KO (Bud Industries).

Run the BACnet RS485 cable through an approved squeeze connector. The shields are to be grounded at one location only, typically at the originating controller. See the BACnet standard for RS485 wiring options.

Dimensional drawings

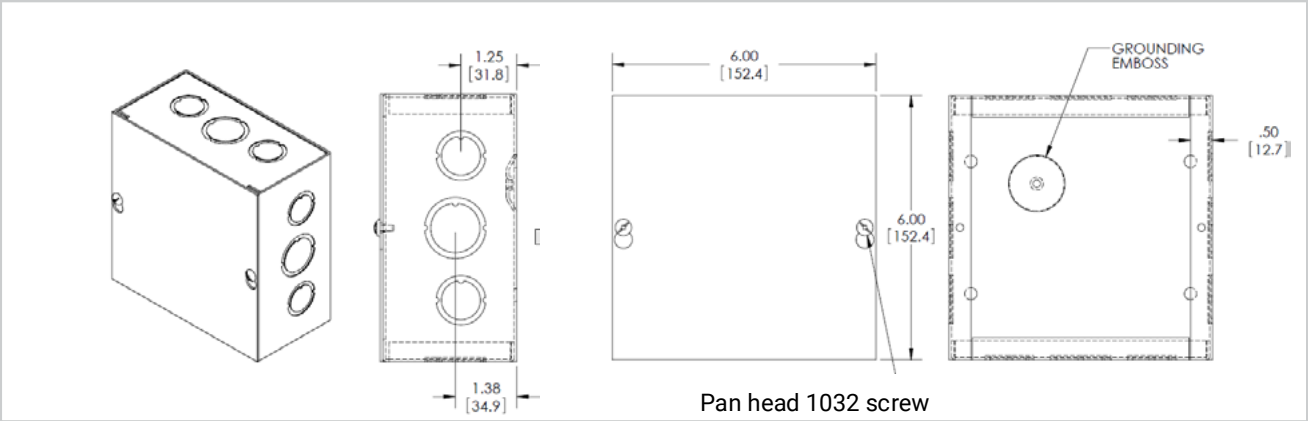


Figure 17.4

Initial Setup

Network wiring connections

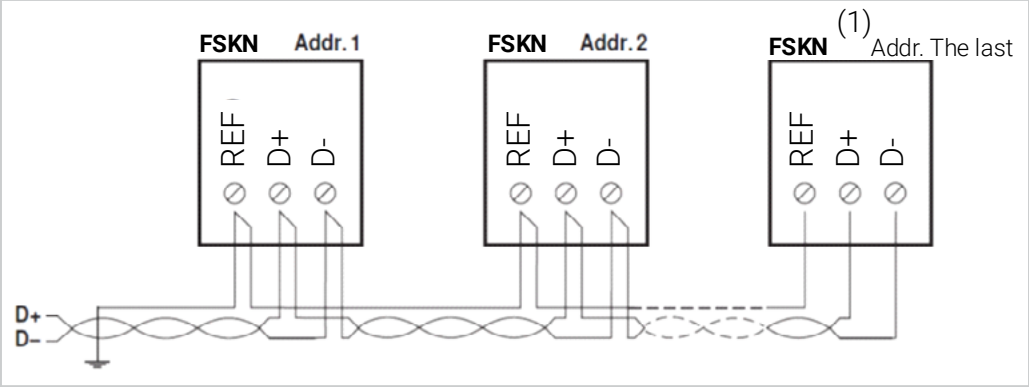


Figure 17.5

The wiring of the line for BACnet MS/TP or Modbus RTU must be carried out in accordance with applicable RS 485 standards.

If connected to a network with a mix of 2wire (nonisolated) and 3wire (isolated) devices, refer to the ASHRAE BACnet Standard or Modbus controller installation instructions for wiring and grounding information.

3wire networks are recommended to avoid problems.

Basic FSKN120BAC wiring

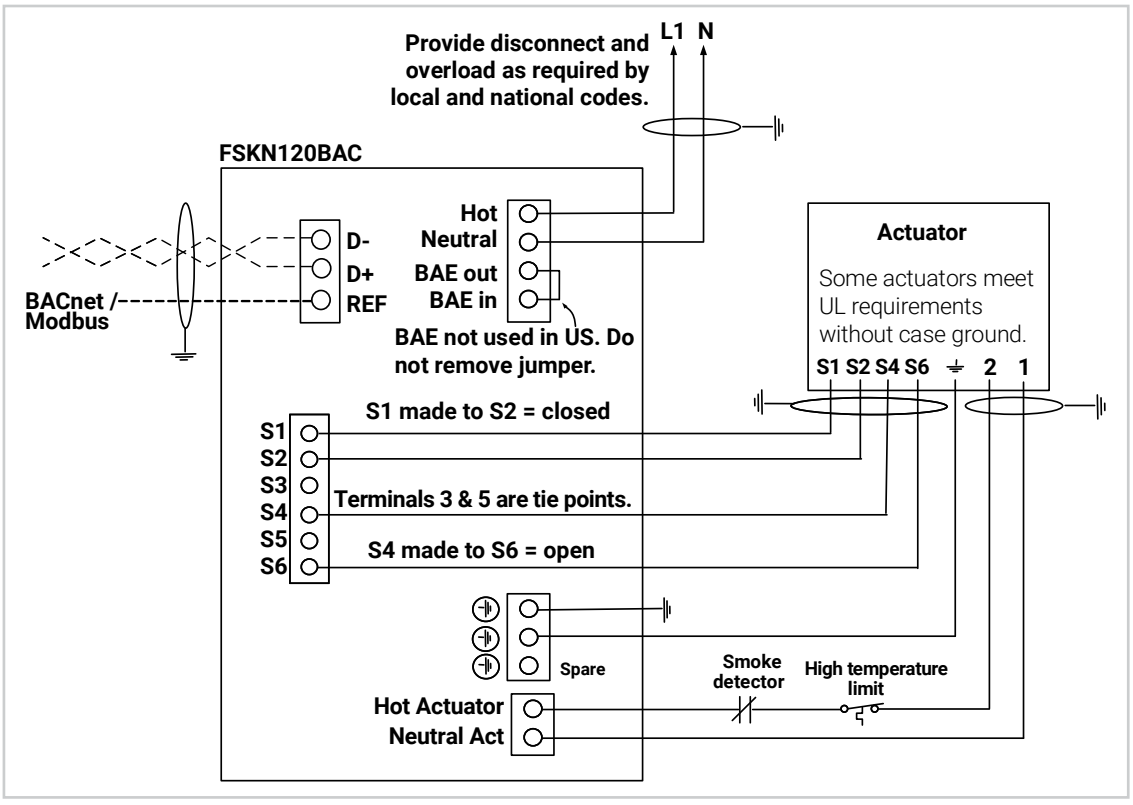


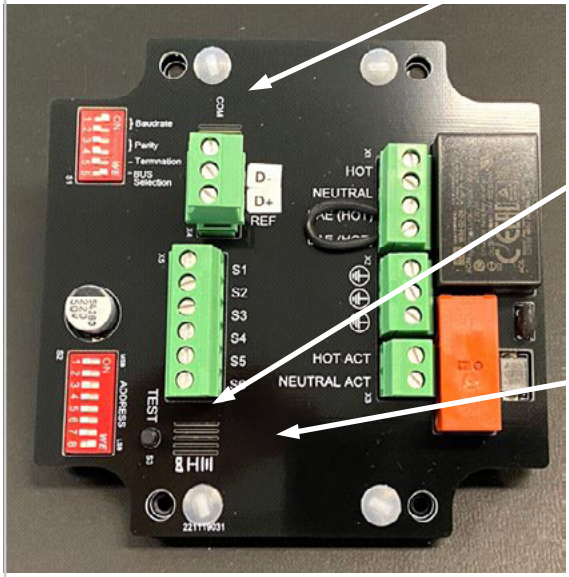
Figure 17.6

FSKN120BAC

LED description

Communications status

Yellow flickering = communications established



Reset Button

Press the button for longer than one second to reset an error message

Press and hold button until actuator springs closed to perform a manual test

LEDs status signalisation BELIMO damper actuator:

Green	on	Upper limit switch (damper open)
	blinking	Damper opens (motor is actuated)
Yellow	on	Lower limit switch (damper closed)
	blinking	Damper closes (motor is not actuated)
Red	on	Internal device fault (BKN)
	blinking	External fault = smoke detector triggered, nominal position not reached
	flashing	External fault = If an error is stored (i.e. no longer pending, but not yet acknowledged), then this is displayed on the device by a periodic flash of the red LED.

Figure 17.7

Basic FSKN24BAC wiring

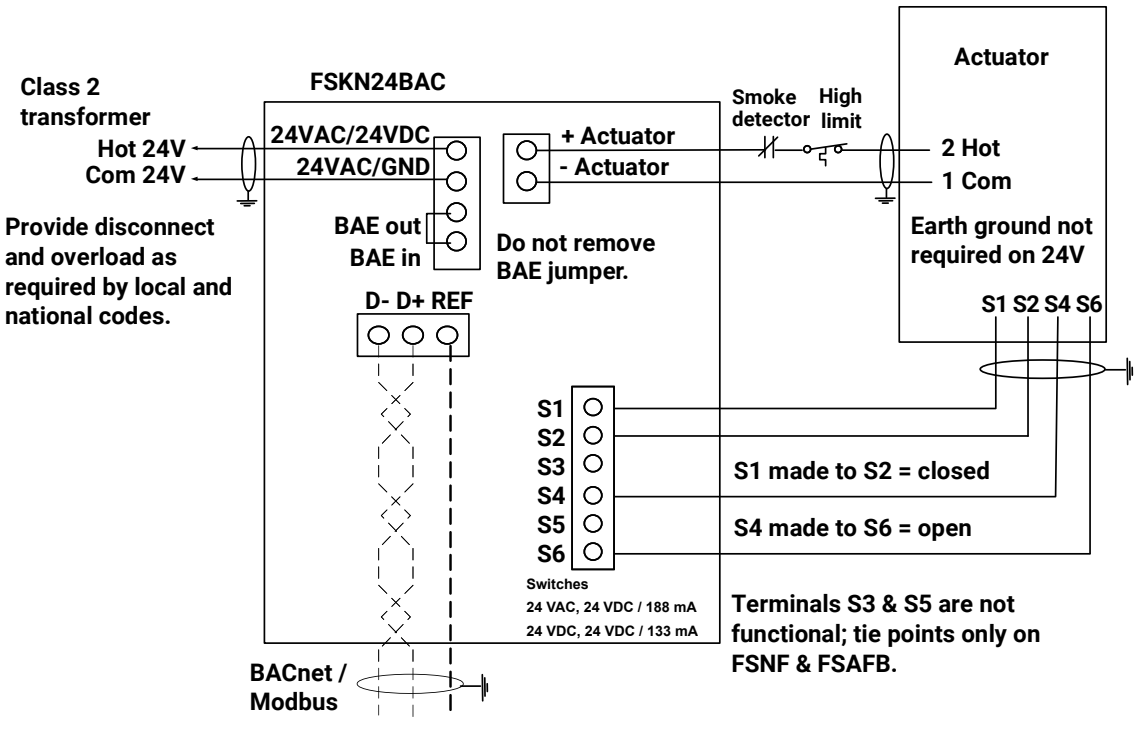
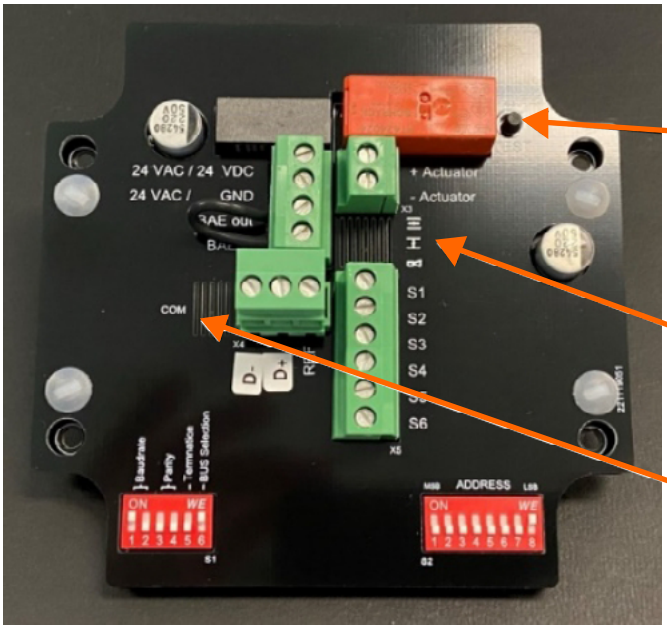


Figure 17.8

FSKN24BAC



Reset Button

- Press the button for longer than one second to reset an error message.
- Press and hold button until actuator springs closed to perform a manual test

Red, Yellow, & Green LEDS

See Signalization

Communications status

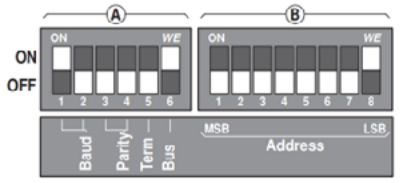
Yellow flickering communications established

Blink = ½ second on, ½ second off. Flash = ½ second off, ¼ second on.

Figure 17.9

BACnet dip switch settings

A BACnet & Modbus guide can be found at Belimo.com



Baud rate	1	2
9'600	OFF	OFF
19'200	OFF	ON
38'400	ON	OFF
76'800	ON	ON

Parity	3	4
1 8 N 2	OFF	OFF
1 8 N 1	OFF	ON
1-8-E-1	ON	OFF
1-8-O-1	ON	ON

Termination	5
with 150 Ω	ON
OFF	OFF

Bus	6
BACnet	ON
Modbus	OFF

BACnet address	1	2	3	4	5	6	7	8
0		OFF	OFF	OFF	OFF	OFF	OFF	OFF
1		OFF	OFF	OFF	OFF	OFF	OFF	ON
2		OFF	OFF	OFF	OFF	OFF	ON	OFF
...								
127		ON	ON	ON	ON	ON	ON	ON

the end of line FSKN Dip Switch 5, Term, is set to ON while others are always set to OFF.

Figure 17.10

Command OPEN / upper position not reached:

LED green	blinking	
LED yellow	on	Damper is in CLOSED position
LED yellow	off	Damper blade is between CLOSE and OPEN
LED red		
error message after 60 seconds		

Command CLOSE / lower position not reached:

LED green	on	Damper is in OPEN position
LED green	off	Damper blade is between OPEN and CLOSE
LED yellow	blinking	
LED red	blinking	
error message after 60 seconds		

Initial startup

Token passing by devices on a MSTP network is specified in the BACnet standard. The status indication LEDs are illuminated as soon as power is applied. The FSKN activates the test sequence with the first power on and expects input on the switch terminals, Closed or open in correct sequence. If nothing is connected to a switch terminal, an error will occur with associated blinking patterns. The error message can be removed by connecting the switch wires and then pressing the Test button or using the Command MV120 4 Reset command.

The green LED blinks when power is applied and the actuator is driving open. The green LED is on continuously after the S2 switch makes.

A blinking red LED indicates a failure.

A blinking yellow LED is a transition indication.

Normal operation

The FSKN relay is closed and the smoke detector and “primary heat responsive device,” manual reset high temperature limit, operate normally.

During normal operation if a test command is issued to an FSKN:

1. The FSKN relay is energized which opens its NC contacts and power is removed from the actuator which then springs the damper closed.
2. The position switch (FSKN terminals S1 & S2, wires S1 & S2 on the actuator) makes (closes) indicating the damper is closed. Damper blade switches may also be employed.
3. After 80 seconds the FSKN relay is deenergized which again powers the actuator and drives the damper open. The switch between terminals S1 & S2 opens. The yellow and green LEDs blink until the damper is reopened fully.
4. When the actuator has driven the damper open either the actuator open switch (wires S4 & S6) or the damper blade open switch again makes and the test is complete.
5. The FSKN then indicates no failure and the information is available to the BACnet controller.
6. If the sequence is incorrect (either the closed switch or the open switch not making or breaking in correct sequence then a Failure message is recorded.
7. Both the Red and Green LEDS will flash while the actuator is opening.
8. After correcting any problem either pressing the Test switch on the FSKN or entering MV120 4 Reset command will change the FSKN Actuator status to normal.

Be sure to complete the notification form and submit it to your AHJ.

All inclusive.

At Belimo, we continually invest in new technologies that increase customer value by improving occupant comfort, energy efficiency, simplified installation, and maintenance-free operation. Our sales team is available to consult and provide insight and advice on how to achieve the best solution to help increase your system performance.

Belimo will continue to focus on providing you with exceptional product availability, fast delivery times, and world-class customer service and technical support. We remain dedicated to continuously improve our standards and are committed to providing you with the highest value possible.

Whatever your HVAC application, our global network of support experts are on hand and ready to assist.

- 5-year warranty
- On site around the globe
- Complete product range
- Tested quality
- Short delivery times
- Comprehensive support

BELIMO Americas
USA Locations
33 Turner Road, Danbury, CT 06810
1049 Fortunato Loop, Sparks, NV 89436
Tel. 800-543-9038, customerservice@us.belimo.com

Canada Location
2495 Meadowpine Blvd., Unit #2 Mississauga, Ontario L5N 6C3
Tel. 866-805-7089, orders.ca@ca.belimo.com

BELIMO Brasil Comércio de Automação Ltda.
Rua Barbalha, 251, São Paulo/SP, Brazil
Tel: 55 11 3643-5656, atendimentoaocliente@br.belimo.com

BELIMO Mexico
Av. Insurgentes Sur 1602, Col. Credito Constructor, Del. Benito Juarez, Mexico City 03940
Tel: 55 4125 7890, servicioalcliente@mx.belimo.com

Latin America and the Caribbean Customer Service
Tel. +1 905-712-3118, Orders.LatAm@us.belimo.com

www.belimo.com