WARNING!

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

Replacement of Nailor MultiProducts motors to Belimo FS series

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800 543-9038

WARNING!

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

www.belimo.us/firesmoke

Nailor MultiProducts motors to Belimo FS series

March 2018
In the “Marking & Application Guide, Dampers for Fire Barrier and Smoke Applications & Ceiling Dampers” April 2013 by Underwriters Laboratories Inc.®, page 6 they state:

**DAMPER ACTUATORS**

“… field mounting or substitution of actuators is not covered within the scope of the UL certification of the product. However, this does not necessarily preclude replacement of actuators in the field. Like any appliance, field servicing of these products is not covered under the scope of the UL certification and factory follow-up service program. As with any part of the damper, it is expected that replacement of actuators in the field be done in accordance with the damper manufacturer’s normal field servicing program.”

**Code and Standard Issues**

In general, the administrative section of codes state that all mechanical and electrical systems must be kept in working order and an individual section may state that all life safety devices and systems must be operable. NFPA 80 (Fire) & NFPA 105 (Smoke) require periodic testing and repair of dampers as soon as possible after any deficiency is uncovered.

<table>
<thead>
<tr>
<th>Chapter 7 IBC &amp; IFC “Containment” Dampers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commissioning</td>
</tr>
<tr>
<td>End of first year</td>
</tr>
<tr>
<td>Every 4 years except in hospitals every 6 years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 9 IBC &amp; IFC “Smoke Control System” Dampers</th>
</tr>
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<tbody>
<tr>
<td>Dedicated</td>
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<tr>
<td>Commissioning</td>
</tr>
<tr>
<td>Semi-annually</td>
</tr>
<tr>
<td>Non-dedicated</td>
</tr>
<tr>
<td>Commissioning</td>
</tr>
<tr>
<td>Annually</td>
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</table>

<table>
<thead>
<tr>
<th>Chapter 9 IBC &amp; IFC Fire detection &amp; Smoke control systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated</td>
</tr>
<tr>
<td>Weekly self-test</td>
</tr>
<tr>
<td>Non-dedicated</td>
</tr>
<tr>
<td>Not required</td>
</tr>
</tbody>
</table>

Fire & smoke dampers are appliances and field replacement of components is required when failure of any component occurs. The Authority Having Jurisdiction (local Fire Marshal and/or Building Official) must be consulted if any blade or auxiliary switches are employed and are connected to the fire alarm system or to a Fire Fighters Smoke Control System (FSCS) panel. Retesting is required. A permit and inspection may be required since connections to an alarm system have been touched.
NFPA 80 (Fire) & NFPA 105 (Smoke)

NFPA 80 (Fire) & NFPA 105 (Smoke) &
NFPA 80 & NFPA 105 for details. The damper cleaning and examination check list here is based on them.

Damper installation shall meet code requirements. Fire stopping and drywall integrity shall be confirmed. Damper blades shall be in plane of wall. Duct shall be fall away with no fasteners connected to damper sleeve.

a. Dampers and ducts shall be cleaned of all foreign debris and dust build-up.
b. All exposed moving parts of the damper shall be dry lubricated as required by the manufacturer. Do not use oil as it draws dirt.
c. Damper shall be examined without defective old motor or new actuator to determine:
   i. The damper shall fully close from the open position.
   ii. Damper shall fully open from the closed position.
   iii. There are no obstructions to the operation of the damper. The damper shall not be blocked from closure in any way due to rusted, bent, misaligned, or damaged frame or blades. The damper shall not have defective hinges, side &/or blade seals, or other moving parts. The damper frame shall not be penetrated by any foreign objects that would affect operation.
d. If the damper is equipped with a fusible link, the link shall be removed for testing to ensure full closure and lock-in-place if so equipped. If the link is damaged or painted, it shall be replaced with a link of the same size, temperature, and load rating.
e. The fusible link shall be reinstalled after testing is complete.

After installation and wiring of new actuator it shall be tested.

a. The checklist may be customized using material here and in NFPA Standards. Multiple geometric configurations of springs, fusible link, thermal sensor(s), and actuation are possible. Confirm with AHJ if any additional requirements exist.
b. Electric thermal sensors, if present, must be tested and replaced if defective.
c. The test shall be conducted with normal HVAC airflow.
d. When equipped with smoke detection activation, the smoke detector shall be activated and damper operation observed.

For the Air Movement and Control Association manual go to:

Test voltage input to actuators and repair as necessary if voltage is not correct. Old breakers often deliver below 115V and failed motors may be due to power supply problems or the motors may have damaged breakers.

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

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

Check the technical specifications to ensure an “equal or better” actuator is used.

- **Temperature** – the replacement actuator shall have been UL555S tested at the same or better temperature as the original actuator. 250°F or 350°F are standard.
- **Time** – the replacement actuator shall drive open and spring closed at a speed equal or faster than presently required by codes. (The AHJ may grant an exception and “grandfather” slower actuators where the original actuator was slower.)
- **Torque** – replacement actuator shall have equal or greater torque than the failed actuator.
- **Voltage** – replacement actuator shall have the same voltage rating as the original.
- **Amperage** – the replacement actuator(s) shall not draw more amperage than the original(s) and cause the total connected amp draw on a circuit breaker to be greater than allowed by electrical code.
- **Final Testing** – actuated damper and associated devices shall be tested for proper operation. See Acceptance testing details below in Fire Marshal Notification Form.

(Mnemonic device: TTT-VAT)

**WARNING!**

In all cases, installation must comply with any and all local electrical and life safety codes. Operation of the system after installation must be performed to verify proper damper cycling. Final checkout requires verifying correct function.

**WARNING!**

Note that where any fire alarm wiring is touched, the fire department or fire alarm company must be informed.
Cross Reference
For greater detail see www.belimo.us/firesmoke RETROFIT or download from https://www.belimo.us/mam/americas/technical_documents/pdf-web/fire_and_smoke_doc/fire_smoke_competitive Replacement_data_reference.pdf

All 120V, FSLF120 – check for 24V motors which would be replaced by FSLF24

<table>
<thead>
<tr>
<th>Nailor</th>
<th>VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>5953</td>
<td>120</td>
</tr>
<tr>
<td>5949</td>
<td>120</td>
</tr>
<tr>
<td>M12, MZRHM</td>
<td>120</td>
</tr>
<tr>
<td>6247</td>
<td>120</td>
</tr>
<tr>
<td>5186</td>
<td>120</td>
</tr>
<tr>
<td>5983</td>
<td>120</td>
</tr>
</tbody>
</table>

Nominal sq.ft. per UL555S testing. Temp Actuator
<4 350°F FSLF 36" w x 24" h also.
<12 350°F FSNF Multisections also.
<16 250°F FSNF Multisections also.
<18 350°F FSAF*A Multisections also.

The FSTF series actuators were introduced in 2013. They are 18 in-lb and designed for under 1.5 sq.ft. of fire and smoke damper. Use on larger dampers only when replacing an existing FSTF on a fire and smoke damper.

The FSLF is recommended for small dampers.

| Belimo actuators pass UL555S at the same damper sizes as the Honeywell. | NOTE. Although an actuator may operate a larger sized damper use the UL listed sizing. Call for assistance. |
Other 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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5800EMB2XPO</td>
<td>FSLF120</td>
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<tr>
<td>5800EMB2XPC</td>
<td>FSLF120</td>
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<tr>
<td>5800EMB7</td>
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<td>5800EMB5</td>
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<td>5800EMB8</td>
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<td></td>
</tr>
<tr>
<td>5800EMB9</td>
<td>FSLF120</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2430</td>
<td>120VAC</td>
<td></td>
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<td>2553A</td>
<td>120VAC</td>
<td>1</td>
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<tr>
<td>2585</td>
<td>120VAC</td>
<td>2</td>
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<tr>
<td>2659</td>
<td>120VAC</td>
<td>3</td>
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<tr>
<td>2724</td>
<td>120VAC</td>
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<tr>
<td>2814A-SQ</td>
<td>120VAC</td>
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<td>2814-SQ</td>
<td>120VAC</td>
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<tr>
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<td>2985</td>
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<td>MZRHM</td>
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</tr>
<tr>
<td>TB2000/1</td>
<td>120VAC</td>
<td>16</td>
</tr>
</tbody>
</table>

While direct coupling is preferable, some applications require linkages. See Linkages below for an example of a FSTF linked to a Prefco internally.
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 linked. 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.


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

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

16 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.
**Typical Installations**

The photograph below shows a shaft spring held by a fusible link. If the link melts due to 165°F 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.

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.

**Fusible Link**

Typical motor, spring, linkage, and damper shaft.
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.

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

Another angle showing Belimo direct coupled to jackshaft with anti-rotation strap bent to adjust for needed height.
Typical damper and motor – note 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.

For wiring see below.

Left. Enlargement of above application.

Below. Detail of “screen door spring” and shaft attachment.

Remove all parts and direct couple Belimo on the damper shaft.
Remove motor, spring, rocker arm. Retain plate 2. Mount Belimo to the damper shaft 3.

Alternate view of existing installation.

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 mounting plate.
3. For picture of mounting plate see page 7 item 2.
4. Attach Belimo anti-rotation strap to the existing mounting plate.
5. Close damper tight
6. Mount Belimo FSLF120 to damper shaft, tighten anti-rotation strap and clamp.
7. Wire per drawings in next section.
8. Test and complete report form on last page.

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 best.

**WARNING!**

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

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

**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.
Direct coupling

While the old motor needed external linkage and spring, the Belimo needs only the damper shaft and an antirotation strap. In the picture above, all the parts are removed and the Belimo drops over the shaft. The strap is installed where it best fits. Additional plates are rarely needed depending on the geometry of the installation.

- Existing plate or any adaptor may be used to hold the anti-rotation strap.
- Actuator is free to move up and down slightly to compensate for any non-concentric movement of the damper shaft.

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

Anti-rotation strap

Bend strap at perforations to adjust for necessary height

The heavier duty AF-P may be ordered when needed

Best to mount the Belimo anti-rotation strap stud halfway within the U-slot of the actuator to allow for some movement with non-concentric shafts.
**Figure 1**

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

Distance at top must be the same as at bottom

- Actuator must be perpendicular to the damper shaft.
- Actuator should be parallel to the plane of the damper frame and sleeve.

Allow any non-concentric shaft motion to be taken up by mounting stud in middle of U-slot.
As long as it is mechanically solid, the anti-rotation strap may be bent to fit height.

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.

Note how the pin of the anti-rotation strap is mounted in middle of actuator U-slot.
**FSTF**
Best solution for small dampers where the HW bracket has been hung out into the air is to use an FSTF actuator.

**Multisection dampers**

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

Linkages may more often be necessary with multisection dampers.
Linkage mounting

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


**Miscellaneous parts**

Should they be needed, Belimo carries a range of parts. Ball joints and 5/16” rods are available from most distributors.

Where the crank arm on the jackshaft is broken or not of the type needed, the KH12 fits over the shaft without removing it. Zinc plated steel. Slot is for the KG10A ball joint. V-bolt fits ¾” to 1” (20 to 25mm) shafts.

KH-6. Zinc plated steel. For shafts 3/8” to 11/16”
Uses KG6 ball joint. Slot width 1/4”

KH-8. Zinc plated steel. For shafts 3/8” to 11/16”
Uses KG8 (90 degree) or KG10A ball joint. Slot width 21/64”

SH8 (not shown – see picture page 9). Push-rod for KG6 & KG8 ball joints. 5/16” 36” long
Use SH10 3/8” rods for GMB and dual FSAF or FSNF linkages. 5/16” can bend under heavy loads.

**ZG-DC1** Damper blade clip and ball joints for blades typically 3.5” in width. Typically the actuator or rod to shaft is in front of blade.

**ZG-DC2** Damper blade clip and ball joints – typically used for 6” wide blade control dampers. Typically the actuator or rod to shaft is above or below the damper.
**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.

**WARNING!**

Various field modifications may have occurred over time. If any question about proper wiring exists, contact Belimo.

**Wiring**

**WARNING!**

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

**WARNING!**

Disconnect and lock out power before starting to disconnect old motor.
J-box replacement

- J-box
- Belimo Mechanical
- FSLF
- FSNF
- strap
- ½" threaded connector
- Chase nipple 2x 4 box and blank cover
- Existing flex connector and incoming power wires

165F Thermodisc

Anti-rotation strap

½" threaded connector

Chase nipple

2x4 box and blank cover

Existing flex connector and incoming power wires

Nailor MultiProducts motors to Belimo FS series  March 2018
Auxiliary Switches

Damper blade switch assembly

Where the original switches for signaling position to a Fire Fighters' Smoke Control Panel or to local indicator lights must be replaced or are inoperative, the Belimo –S model actuators may be used or a S2A-F may be installed.

Belimo S2A-F

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

-S models

Some models are SPDT. Check data sheets.

Internal switches

S1
Contact closed if damper closed

S2
Contact closes if damper open

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

The drawing below shows the wiring when there is a fusible link and separate spring on the damper shaft. The same wiring is used when the damper is smoke only since then there is no temperature sensor. The actuator performs the smoke closing function. The shaft fusible link and shaft spring perform the fire closing function. They must not be removed.

**Fusible link Fire Damper or Smoke Damper**

![Fusible link Fire Damper or Smoke Damper Diagram](image)

**TYPICAL FIRE - SMOKE COMBINATION DAMPER WIRING**

**Electric thermal disc**

![Electric thermal disc Diagram](image)

The drawing above shows the wiring when the primary sensor is an electrical thermal disk. Note that the alarm connections are not touched when replacing an actuator. This is a major concern for Fire Marshals. If the alarm wiring is touched, a retest of the system is expected.
TYPICAL REOPENABLE DAMPER with FSCS

Belimo Auxiliary Switches for position indication to FSCS

The auxiliary switches are used to provide status indication to the fire fighters’ smoke control panel. Typically there are two or three status lights or LEDs. This wiring is the responsibility of the fire alarm company. If it is touched, they must retest to verify proper operation.

WARNING!

- Damper must be free to move from open to closed without undue stress.
- Damper and duct must be clean and free of all debris.
- Test damper and controls per Fire Marshal’s checklist below.
- Fire alarm company may need to be present to verify proper status indication at FSCS panel.
Building Official / Fire Marshal Notification Form

Retain this portion of checklist at premises for inspection. See local AHJ or Fire Marshal for other information and requirements regarding conformance with NFPA 80 & NFPA 105.

☐ Test Checklist (Smoke dampers do not have sensors. Only steps a & b apply.)

1. Single Sensor Combination Damper
   a. ☐ Open smoke detector or relay wire or contact to cut power. Damper springs closed.
   b. ☐ Reconnect power. Damper drives open.
   c. ☐ Open thermal sensor using heat gun or disconnect fusible link. Damper springs closed.
   d2. ☐ Open damper and reinstall fusible link or replacement.

2. Reopenable Two Sensor Fire-Smoke Combination Damper
   (Since this system involves the Firefighters’ Smoke Control System, inform fire department.)

   With FSCS switch in Auto position:
   a. ☐ Disconnect power from smoke detector or relay contacts. Actuator springs damper closed.
   b. ☐ Reconnect power. Actuator drives damper open.
   c. ☐ Trip thermal sensor. Actuator springs damper fully closed.

   Test FSCS switch functions
   a. ☐ Move FSCS switch to Off position. Actuator springs damper fully closed.
   c. ☐ Trip secondary (higher temperature) thermal sensor. Actuator springs damper closed.

   Move FSCS switch back to Auto position:
   ☐ Actuator springs damper closed if Primary sensor is still open.
   ☐ Actuator stays open if Primary sensor has re-closed.

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

☐ When completed, ensure sensors are reset and smoke detector is in normal state and FSCS switch is in Auto. Damper is normally Open; check sequence of operation.

   Damper Numbers or Location Identifying Numbers ..............................................................
   Date........................................
   Contractor..........................................................................................................................
   Service Technician (Print).................................................................................................
   Service Technician (Signed)............................................................................................
   Phone number (………) ........................................
   Notes.................................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................

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