Regarding Obsolete and Defective Fire & Smoke
Damper Actuator Replacement

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History

Smoke and combination fire & smoke dampers have been controlled using a number of different manufacturers’ actuators in the last 20 years.

Change has obsoleted many combinations of products. Some dampers and some motor manufacturers are no longer in the business and some companies do not have current UL555S listing. Some damper models are no longer made and no existing actuator has been tested with it using the UL 555S Standard. Some actuators are no longer made and newer actuators have not been tested on the older damper models.

Exact replacement is not possible for those no longer manufactured. Where lower quality motors were used, exact replacement is not the best technical practice in any case.

Better quality and easier to install actuators (less field errors) are now available. The Belimo concept of direct coupling has been copied by most manufacturers.

As a result, local inspectors may have to decide what rules are to be applied for repair and replacement. The codes do not clearly spell out rules for any repair, for example gas valves which fail and for which there is no exact replacement.

UL

In the “Marking & Application Guide, Dampers for Fire Barrier and Smoke Applications & Ceiling Dampers” April 2003 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 manufacture’s normal field servicing program.”
**Code and Standard Issues**

In general, the administrative section of any code states 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.

Fire & smoke dampers are considered to be appliances and field replacement is expected. Just as with gas valves, replacement permits are not required if nothing else is affected except the damper and actuator.

**Local Code Approval**

While the manufacturing and assembly of new installation smoke and combination fire and smoke dampers and actuators are well regulated by local codes and UL Standards 555 and 555S, the replacement of obsolete and defective actuators is a matter for the local Authority Having Jurisdiction (AHJ).

The regulations vary in different jurisdictions and different inspectors may apply different criteria. In general, permits and inspections are not required. Consult local AHJ – typically the Fire Marshal or Building / Mechanical Inspection Department.

While the Fire Marshal may have overall jurisdiction requiring actuated dampers, the mechanical inspector is more familiar with technical details. If any doubt about a repair exists, the mechanical department should be consulted.

The AHJ has final say on all replacement issues. Some examples:

1. A letter from the damper manufacturer recommending the use of the Belimo actuator was required. No permit or inspection.
2. Use of field mounting instructions from the damper manufacturer was required.
3. The installing contractor takes responsibility for any repair and the methods used must meet current codes. (This requires that UL555S 75 second actuators be replaced with UBC required 15 second actuators in some geographic regions.)
4. Each replacement damper actuator must be tested to ensure it opens and closes properly.
5. Replacement actuator must be UL555S listed with the damper manufacturer.

While it is not mandated in codes, Belimo requests that the following rules be applied when using Belimo actuators for replacement:

A. For a first time replacement in a jurisdiction, check with local code officials or fire marshal for general rules and any special requirements.
B. If Belimo is UL555S Listed with the damper, replacement is permitted. Damper manufacturer instructions are available. See Belimo UL555S Damper Listings list below. (Where the existing damper or motor is no longer made, obtain approval from the AHJ.)

C. Where damper manufacturer instructions exist, obtain either from them or Belimo and follow procedures.

D. Check the technical specifications to ensure an “equal or better” actuator is used. See Technical Details below.

E. Test the operation of the controls, damper, and actuator according to the requirements of local codes, damper manufacturer, and the Belimo list below under Recommended Acceptance Testing. For a large retrofit project, the AHJ may need to be present to observe and confirm.

Belimo FS series actuators are UL555S listed with ten of the eleven US and Canadian damper manufacturers. This is the number one criteria for use in replacement.

**Technical Details**

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** for the damper, no further requirements are necessary provided the torque, voltage, amperage, and speed are matched correctly – that is, the correct model is employed.

2. Where older dampers or actuators are involved and are no longer manufactured the following rules shall apply:
   a. **Check damper** for proper operation. Without actuator mounted, the damper must open and close smoothly and without any binding. Inspect all components; repair of damper requires damper manufacturer instructions. 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.
   b. **Test** the electric thermal disc or fusible link. Older version of NFPA recommends changing the link every 4 years. Newer version requires check at one year old and then every 6 years. (In state of flux at this time of writing.)
c. **Torque** – replacement actuator shall have equal or greater torque than the failed actuator.
d. **Voltage** – replacement actuator shall have the same voltage rating as the original.
e. **Amperage** – the replacement actuator(s) shall not draw more amperage than the original(s) and cause the total amperage to rise above that which the electrical circuit breaker is designed to carry.
f. **Speed** – the replacement actuator shall drive open and spring closed at the speed presently required by codes. (15 seconds is the present UBC and California requirement. 75 seconds is the ICC, UL555S requirement. The AHJ may grant an exception and “grandfather” slower actuators where the original actuator was slower.)
g. **Temperature** – the replacement actuator shall operate at the rating of the original actuator (250°F or 350°F are standard).
h. **Final Testing** – actuated damper and associated devices shall be tested for proper operation. Release power to spring closed. Drive back open. Check fusible links and test thermal disk (heat or pressure depending on make).
i. Where any **structural modification** to building is required, a permit is required.
j. Where change from **pneumatic to electric** is performed, a permit is required. In addition, the damper manufacturer shall provide instructions, wiring diagrams, and other components (e.g., elevated 250°F thermal disks for electrical interruption).
k. If the actuator auxiliary switches themselves are connected to the fire alarm panel or to the Fire Smoke Control System (fire fighters control panel switches), then the wiring is probably supervised and the AHJ must be advised to see if conformance testing is needed.

This is uncommon, but could occur. More commonly, damper blade switches are used, but both are technically possible.

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**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 operation of damper for UL555S functions including sensors or fusible link.

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**WARNING**

INSTALLER MUST BE A TRAINED AND EXPERIENCED SERVICE TECHNICIAN.
Typically, the original actuator was tested at the maximum area and temperature that would pass UL555S. As such, the torque requirement of an old damper may be higher due to corrosion, dirt, or movement of the ductwork. If any doubt exists, apply the next higher torque actuator for replacement.

For mounting concepts and wiring information see Belimo Retrofit FS Tech Guide.doc and individual Specification Data Sheets.

**Belimo UL555S Damper Listings**

Testing is ongoing. Call for new information. The use of a Belimo is not limited to the following. Check with local AHJ for variations.

<table>
<thead>
<tr>
<th>Air Balance <em>(Associated with American Warming, Cesco, Louvers &amp; Dampers, Reed Air, Mestek)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single thickness blade, 3-Vee type fire/smoke and smoke dampers.</td>
</tr>
<tr>
<td>FSNF24, 120 @ 250 degrees F = 48 W by 24 H or 36 by 36 Class 1</td>
</tr>
<tr>
<td>@ 350 degrees F = 36 by 36. Class 1</td>
</tr>
<tr>
<td>Galvanized airfoil blade, fire/smoke and smoke dampers.</td>
</tr>
<tr>
<td>FSLF24, 120 @ 250 degrees F = 16 W by 18 H</td>
</tr>
<tr>
<td>FSNF24, 120 @ 250 degrees F = 24 by 36 or 36 by 24. The 122 fire/smoke damper has been replaced by the FS-style single-thickness blade damper.</td>
</tr>
<tr>
<td>The 124 fire/smoke damper has been replaced by the FA-style airfoil blade damper.</td>
</tr>
</tbody>
</table>
E.H.Price, Canada
See NCA. Same dampers.

Greenheck
FSNF
Belimo is on every model other than round.
12 sq. ft on 3V at 250F internal and external
9 sq. ft. for 350F dampers. 36w x 48h maximum
Airfoil is 32 x 50 at 250F
FSLF
4 sq.ft. at 350F all dampers
36" W x 24" H at 250F all dampers.
The Belimo FSNF120 is listed at 350F on all the Greenheck dampers.
This is the FSD200 series and the SMD 200 series. These are 3V blades.
Also on the FSD and SMD300 series which is an airfoil.
The SMD401 series is only 250F since it is aluminum. Not an actuator barrier.
Section sizes vary, but max for one actuator is 32" x 50." They can do up to 8 sections with 8 actuators for a max size of 128" x 120."

Today Greenheck uses electrical switches to release the damper by cutting power to the actuator. In the past, they used the actuator to do smoke only function with an external spring and a fusible link to release a jackshaft spring for the fire functions.
There are internal mount actuators that slide over the jackshaft. Replacement requires the jackshaft be disconnected, actuator slid off, new one slid on. All this while the spring mechanism is still attached to the jackshaft. Obtain instructions from Greenheck.
Small access doors make this difficult.
Replace damper is first choice for internal mount.
External mount is simple.

http://www.greenheck.com/

Leader

Lloyd
FSNF UL555S listed.

Nailor
FSNF 36X36 @350F
36X48 damper 250deg internal mount actuator. 144" x 96" 8 sections
Models 1210 smoke and 1220 combination, 36" x 48" at 250F.
FSLF
http://nailor.com/contact_nailor.htm
NCA  (Arlan in New York, E.H.Price in Canada)
FSNF  12 sq.ft
FSLF  4 sq.ft.

Pottorff  (Accurate Specialty Metal in New York City), PCI Industries
FSLF
   4 sq.ft. at 350F
   36" x 24" at 350F

FSNF
   Maximum 16.5 sq.ft. at 250F
   12 sq.ft. at 350F

140=3V
FSD-150
150 = Air Foil
170 = Corridor

   Minimum Internal: 9x10 or 10x11 w/ accessories  FSD140,170,340
   Minimum External:  6x6 or 6x8 w/ accessories
   Max Section size: 36x48 at 350F or 72x33 at 250F (2 sections, one actuator)
   Max Section size:  30x48  FSD150

16 sq. ft. max at 250F, 140 only
141,2,3 = Class 1, 2, or 3
141=1st digit = time, 1= 1.5 hr.

http://www.pottorff-hvac.com/

Prefco division Perfect Air / Metalair (Hugh Richards in New York City)

FSNF
   Model 5010, 5020, 5020-1, 5050, & 5015 - Fire/Smoke
   Model 1175-1, 2 & 3 - Control Dampers
   Model 5150 & 5151- Smoke Dampers
   Model 5050 - Fire/Smoke Damper
   36" w x 48" h down to 6" x 6" at 350F Class 1 leakage

   Some older Prefco dampers employed external pulleys, cables, and springs. No longer used. Belimo is not recommended for the old dampers unless a shaft is available.

FSLF

http://www.prefco-inc.com/index.html
**Ruskin (ALD in New York City)**

FSNF 350F
- FSD60 64W x 48H. 8 sq. ft max
- FSD36 72W x 48H. 8 sq. ft. max
  Where necessary, 2 sections wide with one actuator = 72W x 16H
  Multisections and multiple actuators used as necessary.
  No 250F tested separately. When done, damper sizes will increase.
  Belimo is default on 4-8 sq. ft. 24V; option on others.

FSLF 350F
- Same dampers. 4 sq ft. 36” W x 24” H
  Corridor dampers.
  All rectangular combo and smoke.
  Not ceiling and not round.


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**Safe-Air Dowco (Imperial in New York City)**

- 4 sq. ft. 24” x 24” 350F Class I leakage
- 4 sq. ft. 24” x 24” 250F Internal


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**Replacement Information by Actuator (Not inclusive).**

Where any modification of damper or structure is required, permit should be obtained.

Contact Larry Felker at Belimo for more information:
775-857-4243 x 5205

<table>
<thead>
<tr>
<th>Make &amp; Model</th>
<th>Power</th>
<th>Torque-Stroke</th>
<th>Belimo Replacement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Siebe-Barber Colman</strong></td>
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<tr>
<td>MA318</td>
<td>24</td>
<td>60-180 stroke</td>
<td>FSNF24 -500 is aux switch.</td>
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<td>MA418</td>
<td>120</td>
<td>60-180 stroke</td>
<td>FSNF120 Use -S Belimo</td>
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<td>MA220</td>
<td>120</td>
<td>Remove external spring.</td>
<td>FSNF120</td>
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<td>MA230</td>
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<td>Remove external spring.</td>
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<td>MA240</td>
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<td>No direct replacement</td>
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<td>180 degree rotation. Linkage kit may be possible depending on mounting geometry.</td>
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<td><strong>Honeywell</strong></td>
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<td>ML4115C</td>
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<td>CCW 30</td>
<td>FSLF230 FSNF230</td>
<td>FSLF is sufficient.</td>
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<tr>
<td>Model</td>
<td>Voltage</td>
<td>Rotation</td>
<td>Position</td>
<td>FSLF</td>
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<td>FSLF24</td>
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</table>

**32003532-002 Aux Switch Package**

Use -S model.

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<th>Voltage</th>
<th>Rotation</th>
<th>Position</th>
<th>FSLF</th>
<th>FSNF</th>
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<td>FSNF24</td>
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<tr>
<td>MS4120F1006</td>
<td>120</td>
<td>No aux 2</td>
<td>FSAF within 2</td>
<td>May require 2 FSNF at 350F.</td>
<td></td>
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<td>MS4120F1204</td>
<td>120</td>
<td>SPST</td>
<td>UL555 listing parameters.</td>
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<tr>
<td>MS4620F1005</td>
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<tr>
<td>MS4620F1203</td>
<td>230</td>
<td>SPST</td>
<td>16 sq.ft. to 20 sq.ft.</td>
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<td>MS8120F1002</td>
<td>24</td>
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<td>MS8120F1200</td>
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<td>SPST</td>
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</tbody>
</table>

**S2024-F**

24 No aux 175 in-#

**S20230-F**

230 No aux 2

**S2024-F-SW2**

24 SPDT

**SO230-F-SW2**

230 SPDT

**Ruskin Models**

Made by Honeywell

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Rotation</th>
<th>Position</th>
<th>FSLF</th>
<th>FSNF</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2000A</td>
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<td>H2024B</td>
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<td>H2230A</td>
<td>230</td>
<td>CCW</td>
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<td>FSNF230</td>
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<td>H2230B</td>
<td>230</td>
<td>CW</td>
<td>30</td>
<td></td>
<td>FSNF230</td>
</tr>
</tbody>
</table>

32003532-002 Aux Switch Package

Use -S model of proper voltage.
Siemens
| GGD221 24 100 FSAF24 250F FSNF24 350F |
| GGD221 120 100 FSAF120 250F FSNF120 350F |
| GGD321 230 100 FSAF230 250F FSNF230 350F |

Siebe. MA220, etc. FSLF and FSNF can be used. DISCONTINUED. MA418. 1 Amp draw. FSNF is .23A (120V).

Multiproducts.
Typically crank arm mounted. Some cannot be replaced. Call for information.

ECM - Out of business.

### Comparison of Belimo FS & Competitive Actuators (Specs from 2005.)

<table>
<thead>
<tr>
<th>BELIMO (at 250F)</th>
<th>Honeywell</th>
<th>Siemens</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSLF120</td>
<td>FSNF120</td>
<td>ML4115</td>
</tr>
<tr>
<td>Rated Torque (in-#)</td>
<td>30</td>
<td>70</td>
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<tr>
<td>Actual</td>
<td>45 run</td>
<td>110 run</td>
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<tr>
<td>Noise level</td>
<td>Holding</td>
<td>10</td>
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<tr>
<td>Running</td>
<td>55 dB</td>
<td>55 dB</td>
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<tr>
<td>Controller</td>
<td>Micro</td>
<td>Micro</td>
</tr>
<tr>
<td>Current draw</td>
<td>24V</td>
<td>120V</td>
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<tr>
<td>Drive</td>
<td>18VA</td>
<td>5VA</td>
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<tr>
<td>Hold</td>
<td>6.5VA</td>
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<td>Temperature</td>
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<td>350F</td>
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<tr>
<td>Time drive open</td>
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<tr>
<td>Ambient</td>
<td>&lt;15 sec</td>
<td>&lt;15</td>
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<tr>
<td>Elevated 250F/350F</td>
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<tr>
<td>Clamp</td>
<td>Steel</td>
<td>Steel</td>
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<tr>
<td>Direction of rotation:</td>
<td>Flip over</td>
<td>Flip over</td>
</tr>
<tr>
<td>Housing material</td>
<td>Zinc coated steel</td>
<td>Zinc coated steel</td>
</tr>
<tr>
<td>Overload protection:</td>
<td>Electronic 0 to 95° rotation</td>
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</tr>
</tbody>
</table>
Note that individual dampers have some variations. Shaft springs were used by some manufacturers with the old motors that did not have internal springs. When using the modern Belimo with an internal spring, the old spring must be removed or disconnected.

### Shaft spring

The older dampers employed a fusible link to release a shaft spring. The typical actuator used was non-spring and is no longer made. The current practice is to use a spring actuator and an electronic high temperature limit to cut power.

Damper manufacturer instructions are required to ensure proper procedures.

### Knee lock

Manufacturers' instructions guide in the proper sequence for removing shaft mounted springs. In the picture to the left, the kneelock is released before the spring torsion can be eased for mounting external actuator and an electronic high temperature limit installed.

Photographs courtesy PCI - Pottorff

**Note: kneelock must be reconnected.**

External Shaft Spring Type - Ruskin

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External spring mechanism and housing.

A. Loosen square head bolts to remove spring mechanism.
**Installation Notes & Recommended Acceptance Testing**

**Fusible link type damper**

1. Examine damper seals, fusible link or equivalent, and blades to ensure integrity.
2. Disconnect incoming power and wiring at junction box or actuator.
3. Tag all wires.
4. Remove old actuator and mounting bracket. (If shaft spring must be bypassed, see damper manufacturer specific instructions.)
5. Ensure damper opens and closes smoothly.
6. Attach shaft adaptor if required by damper manufacturer and tighten.
7. Mount Belimo FSNF or FSLF depending on torque or function required
8. Reconnect wiring per original drawing. Typical wiring shown below.
9. Restore incoming power.
10. Test all functions including:
   a. Open smoke detector or relay contacts. Actuator springs damper fully closed.
   c. Disconnect fusible link if present. Actuator is disconnected and the damper spring engages to fully close damper. (If a McCabe™ link is used, trip and reset it instead of the fusible link.)
   d. Reconnect fusible link. Actuator holds damper open.

**Typical fusible link or McCabe™ link DAMPER ACTUATOR WIRING**

![Diagram of typical fusible link or McCabe™ link damper actuator wiring]

Note that the actuator itself is not connected to the alarm system.

**In this application, the fusible link disengages the actuator and the fire spring closes the damper for fire. The actuator is used for the smoke function.**
Electric thermal disc type damper

1. Disconnect incoming power and wiring to thermal sensor at 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. 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 thermal sensor. Actuator springs damper fully closed.

**TYPICAL FIRE - SMOKE COMBINATION DAMPER WIRING**

**Electric thermal disc**

Note that the actuator itself is not connected to the alarm system.

**WARNING**

ANY STRUCTURAL CHANGE TO BUILDING OR DAMPER ITSELF WOULD REQUIRE A PERMIT AND INSPECTION.

IF THERE ARE ANY CONNECTIONS FROM ACTUATOR TO FIRE OR SMOKE ALARM SYSTEM, THEN MOST AHJ’s WOULD REQUIRE A PERMIT AND INSPECTION.
Re-openable Two Sensor Fire-Smoke Combination Damper Wiring.

With FFCP switch in Auto position:
1. Open smoke detector or relay contacts. Actuator springs damper fully closed.
3. Trip thermal sensor. Actuator springs damper fully closed.

Move FFCP switch to Off position:
Actuator springs damper fully closed.

Move FFCP switch to Hand position:
Actuator drives damper back open.

1. Open smoke detector or relay contacts. Damper stays open.
2. Trip primary (lower temperature) thermal sensor. Damper stays open.
3. Trip secondary (higher temperature) thermal sensor. Actuator springs damper fully closed.

Move FFCP 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 FFCP switch is in Auto.

**TYPICAL REOPENABLE DAMPER with FFCP**

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**Diagram**

- Smoke Detector or Relay from area smoke detection system
- FIRE FIGHTERS CONTROL PANEL
- HOT 120 or 24 VAC
- To alarm system
- Note that the actuator itself is not connected to the alarm system

**FFCP Switch**
- 16°F
- 350°F

**BELIMO FSLF or FSNF ACTUATOR**
- FSAF actuators are 250°F only