WARNING!

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

Prefco Series 5000 Damper Motor Replacement with Belimo FS Series Actuators

Contents

UL® .................................................................................................................................................. 1
Code and Standard Issues .................................................................................................................. 2
NFPA 80 (Fire) & NFPA 105 (Smoke)............................................................................................ 3
Local Code Approval.......................................................................................................................... 4
Cross Reference ................................................................................................................................ 4
Prefco McCabe® Link ......................................................................................................................... 6
Prefco or PHL 5800, MB2, MB3, EM2X, & others ............................................................ 7
Cable-pully applications .................................................................................................................. 7
Prefco Series 5000 Dampers ........................................................................................................ 9
Mounting ...........................................................................................................................................10
Replacement Instructions Series 5000 and 5100 Dampers ............................................................ 11
Linkage mounting ............................................................................................................................ 15
Miscellaneous parts ....................................................................................................................... 16
Wiring ............................................................................................................................................... 17
Auxiliary Switches .......................................................................................................................... 20
Blade Position Indication Switches ............................................................................................... 21
Building Official / Fire Marshal Notification Form ...................................................................... 22

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WARNING!

Installer must be trained and experienced with repair of fire and smoke dampers and actuators.
**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 IFC “Smoke Control System” Dampers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated</td>
</tr>
<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 requires damper inspection and repair of dampers. See www.nfpa.org for Standards.

See NFPA 80 & NFPA 105 for details. The damper cleaning and examination check list here is based on them.

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

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

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

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

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

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

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

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

- **Temperature** – the replacement actuator shall have been UL555S tested at the same or better temperature as the original actuator. 250˚F or 350˚F are standard. (Code is 250˚F. However, in engineered smoke control systems the consulting engineer may have required 350˚F. Tunnels and 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. Las Vegas is 60 seconds. 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. (This is not a problem as Belimo actuators draw very low current.)
- **Final Testing** – actuated damper and associated devices shall be tested for proper operation. See Acceptance testing details below.

(Mnemonic device: TTT-VAT)

---

**WARNING!**

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

---

**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.
## Cross Reference

<table>
<thead>
<tr>
<th>Honeywell</th>
<th>VAC</th>
<th>Torque in-lb</th>
<th>Replacement</th>
<th>Notes</th>
</tr>
</thead>
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<tr>
<td>ML4105A1000</td>
<td>120</td>
<td>50</td>
<td>FSLF120</td>
<td>Any of these with</td>
</tr>
<tr>
<td>ML4105B1009</td>
<td>120</td>
<td>50</td>
<td>FSLF120*</td>
<td>32003532-002 auxiliary switch</td>
</tr>
<tr>
<td>M4105C, D</td>
<td>230</td>
<td>50</td>
<td>FSLF230*</td>
<td>package: add –S</td>
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<tr>
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<td>120</td>
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<td>To Belimo part number.</td>
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<td></td>
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<tr>
<td>ML4115C, D</td>
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<td>30</td>
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<td>ML4105 no longer made.</td>
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<tr>
<td>ML4202</td>
<td>120</td>
<td>20</td>
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<td></td>
</tr>
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<td>ML4302</td>
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<td>20</td>
<td>FSLF120</td>
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<td>ML8202</td>
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<td>20</td>
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<td>50</td>
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<td>ML8115B1004</td>
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<td>30</td>
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<td></td>
</tr>
<tr>
<td>MS4209F</td>
<td>120</td>
<td>80</td>
<td>FSNF120*</td>
<td></td>
</tr>
<tr>
<td>MS4309F</td>
<td>120</td>
<td>80</td>
<td>FSNF120*</td>
<td></td>
</tr>
<tr>
<td>MS8209F</td>
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<td>80</td>
<td>FSNF24*</td>
<td></td>
</tr>
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<td>MS8309F</td>
<td>24</td>
<td>80</td>
<td>FSNF24*</td>
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</tr>
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<td>MS4120F1006</td>
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</tr>
<tr>
<td>MS4120F1204</td>
<td>120</td>
<td>175</td>
<td>FSAF120-S*</td>
<td>2 SPST</td>
</tr>
<tr>
<td>MS8120F1002</td>
<td>24</td>
<td>175</td>
<td>FSAF24*</td>
<td>No aux</td>
</tr>
<tr>
<td>MS8120F1200</td>
<td>24</td>
<td>175</td>
<td>FSAF24-S*</td>
<td>2 SPST</td>
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</table>

### Ruskin Models Made by Honeywell

<table>
<thead>
<tr>
<th>Model</th>
<th>VAC</th>
<th>Torque in-lb</th>
<th>Replacement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2000A, B</td>
<td>120</td>
<td>20-50</td>
<td>FSLF</td>
<td>These are ML4105, ML4115, and ML4202 types.</td>
</tr>
<tr>
<td>H2024A, B</td>
<td>24</td>
<td>20-50</td>
<td>FSLF</td>
<td></td>
</tr>
</tbody>
</table>

### Nominal sq.ft. per UL555S testing.

<table>
<thead>
<tr>
<th>Sq.ft.</th>
<th>Temp</th>
<th>Actuator</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4</td>
<td>350°F</td>
<td>FSLF</td>
<td>Up to 30” x 30” and 36” x 24”. See NOTE below.</td>
</tr>
<tr>
<td>&lt;12</td>
<td>350°F</td>
<td>FSNF</td>
<td>Greenheck, Pottorff, Ruskin</td>
</tr>
<tr>
<td>&lt;16</td>
<td>250°F</td>
<td>FSNF</td>
<td>Pottorff, Greenheck</td>
</tr>
<tr>
<td>&lt;16</td>
<td>250°F</td>
<td>FSAF</td>
<td>Pottorff, Greenheck, Ruskin</td>
</tr>
</tbody>
</table>

* More important than the torque rating is the damper manufacturers’ UL555S testing. Each manufacturer tests Belimo separately and has different sizes UL555S listed.  

NOTE. Although an actuator may pass a larger sized damper use the UL listed sizing. See www.belimo.us/firesmoke “What’s New” for a cross reference by manufacturer.
### Barber Colman-Siebe—Invensys

<table>
<thead>
<tr>
<th>Model</th>
<th>Power</th>
<th>Torque-Stoke</th>
<th>Belimo Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA318</td>
<td>24</td>
<td>60-180 stroke</td>
<td>FSNF24</td>
</tr>
<tr>
<td>MA418</td>
<td>120</td>
<td>60-180 stroke</td>
<td>FSNF120</td>
</tr>
<tr>
<td>MA220</td>
<td>23VA</td>
<td>120</td>
<td>Remove external spring.</td>
</tr>
<tr>
<td>MA221</td>
<td>23VA</td>
<td>240</td>
<td>Remove external spring.</td>
</tr>
<tr>
<td>MA223</td>
<td>23VA</td>
<td>24</td>
<td>Remove external spring.</td>
</tr>
<tr>
<td>MA230</td>
<td>36VA</td>
<td>120</td>
<td>Remove external spring.</td>
</tr>
<tr>
<td>MA233</td>
<td>36VA</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>MA240</td>
<td>No direct replacement. 180 degree rotation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA250</td>
<td>Same as MA220/230 series.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the general rule of thumb:
- <4 sq. ft. FSLF
- <12 sq. ft. 350°F FSNF
- 12 to 16 sq. ft. 250°F FSNF, FSAF

### Prefco McCabe® Link

McCabe Link® dampers are covered in detail in a separate document.

Prefco or PHL 5800, MB2, MB3, EM2X, & others

Most Multiproducts motors 5800 and EM2X and the like are covered in other installation documents at

www.belimo.us/firesmoke or
http://www.belimo.us/cms/sh/firesmoke/retrofit.php

Cable-pully applications

www.belimo.us/firesmoke or
Installation Instructions for Retrofit Applications

Prefco_Internal_Pulley-Cable_Multiproducts_to_Belimo_FS_Actuator

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

Springs on old dampers may be under high torsion and may cause serious injury! If any external springs are present, exercise caution – wear face and hand protection.

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

Prefco was purchased by Metal Industries and has since been sold to Johnson Tech in Taiwan. http://www.prefco-hvac.com/ Technical support is available at 800-437-6653.

Notes:
Prefco Series 5000 Dampers

MODEL 5020-1 - 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.

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.

MODELS 5150/5151 - AIR/SMOKE/BALANCING
DAMPERS
– Smoke rated only.

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

**Mounting**
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
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.
   d. Trip thermal sensor. Actuator springs damper fully closed.

See Fire Marshal form for testing.
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.

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

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

FSAF mounts the same.

FSLF mounted on damper shaft with a plate extended for the anti-rotation strap.

Anti-rotation strap

Bend strap at perforations to adjust for necessary height

The heavier duty 11414 AF-P may be ordered when needed
WARNING!

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.

Short shaft mounting

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

Clamp

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 piece of U-channel.

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

See Belimo Mounting Methods Guide for more mounting drawings at www.belimo.us in the documentation tab.
Mounting

The Belimo Anti-rotation strap may be attached to the HW bracket or to the sleeve. Duct must be able to fall away; do not attach so that this is prevented. A 4” x 4” or larger electrical plate will serve as an anti-rotation mounting plate if old actuator is hung over free air.


Linkage mounting

WARNING!

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

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

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

| KH12 | KH-6. Zinc plated steel. For shafts 3/8" to 11/16" Uses KG6 ball joint. Slot width 1/4" |
| KH8  | KH-8. Zinc plated steel. For shafts 3/8" to 11/16" Uses KG8 (90 degree) or KG10A ball joint. Slot width 21/64" |
| KG8 3/8” | |
| KG6, KG10A ¼” |

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.

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.

Belimo linkage kits: [http://www.belimo.us/belimo/media//Technical_Documents/Accessories/Mechanical_Accessories.pdf](http://www.belimo.us/belimo/media//Technical_Documents/Accessories/Mechanical_Accessories.pdf)

Wiring

Thermoelectric Tripping Device 165 °F (with manual reset) BAE165 US

Application

The BAE165 US thermoelectric resettable tripping device operates in conjunction with a UL listed Belimo safety actuator for use in fire & smoke applications. The BAE drives a motorised fire damper to its safe position when the temperature at the damper (tripping temperature) exceeds the set value. The device is connected in series with the power supply of the fire & smoke control actuator.

Where a J-box is needed a chase nipple and 2x4 or 4x4 box can be attached to the actuator’s conduit connector.

Existing flex connector and incoming power wires

2 x 4 box and blank cover

Chase nipple

\( \frac{1}{2} \)” threaded connector

Anti-rotation strap

165°F

Thermodisc

FSLF

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

**TYPICAL FIRE - SMOKE COMBINATION DAMPER WIRING**

Electric thermal disc

Smoke Detector or Relay from area smoke detection system

**TYPICAL SENSOR TEMPERATURE**

165°F

BELIMO FSxx ACTUATOR

N or COM

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.

**Fusible link DAMPER ACTUATOR WIRING**

**McCabe™ link DAMPER ACTUATOR WIRING**

Smoke Detector or Relay from area smoke detection system

BELIMO FSxx ACTUATOR

N or COM

The wiring below is commonly connected to alarm or smoke control electronic modules in modern systems. The functional sequence is the same.
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.
Auxiliary Switches

Damper blade switch assembly

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, 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

Switch cable

Manual reset

165°F

H C
**Blade Position Indication Switches**

Dampers under 10" in height do not use a full 90° of rotation. If using the Belimo –S actuator and installed as noted on “U-10” dampers above, only the full open switch would be functional.

Use of Prefco blade indicator switches is recommended in that case.

---

**BLADE POSITION INDICATOR SWITCHES**
- Top Mounted, to Indicate Full Closed (2 wires)
- Bottom Mounted, to Indicate Full Open (2 Wires)

---

**WARNING!**

Read Data Sheet provided in box with each actuator for specific wiring details. Colors of wires and switch configurations vary.

---

On larger than 10" dampers, the Belimo FSxx -S models provide auxiliary switches that can replace existing switches as well as the actuator. See Belimo data sheets for information.
Building Official / Fire Marshal Notification Form

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

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

1. Single Sensor Combination Damper
   a. □ Open smoke detector or relay wire or contact to cut power. Damper springs closed.
   b. □ Reconnect power. Damper drives open.

   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 or alarm company.)

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 fully closed.

Move FSCS switch back to Auto position:
   a. □ Actuator springs damper closed if Primary sensor is still open.
   b. □ 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