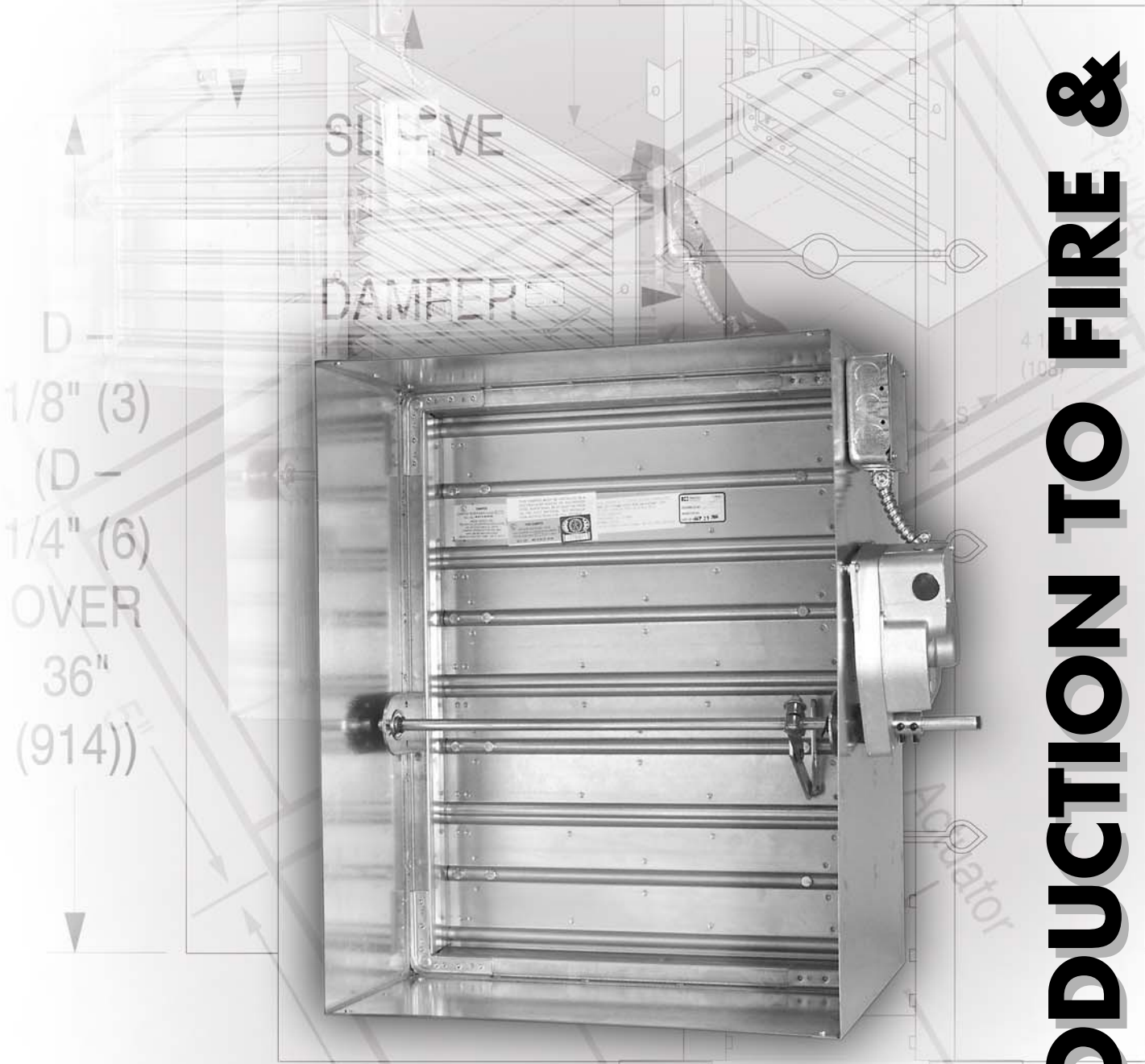


'C' ENCLOSURE BOTH ENDS



# INTRODUCTION TO FIRE & SMOKE DAMPERS / ACTUATORS

**Nailor**  
Industries Inc.

16" (406) STANDARD

## Contents

	Page No.
<b>Testing With Underwriter's Laboratories Inc.</b>	<b>C3</b>
UL 555 Safety Standard for Fire Dampers	<b>C3</b>
UL 555S Safety Standard for Smoke Dampers	<b>C4</b>
<b>Controlled Closure with Nailor Combination Fire/Smoke Dampers</b>	<b>C5</b>
<b>Quick Select Guide For Fire And Smoke Dampers</b>	<b>C7</b>
<b>Actuator Selection Guide For Fire/Smoke Dampers</b>	<b>C9</b>
<b>Actuator And Accessory Space Envelope Requirements and Sleeve Dimensional Data For Combination Fire/Smoke Dampers</b>	<b>C11</b>
<b>Internal Actuator Mounting Minimum Size Requirements</b>	<b>C12</b>
<b>Actuator Replacement/Field Modifications of UL Classified Dampers</b>	<b>C13</b>

## Testing With Underwriter's Laboratories

Established in 1894, Underwriter's Laboratories Inc. is a recognized testing facility referred to by the National Fire Protection Association (NFPA) and BOCA, SBCCI, UBC and IBC building codes as well as associated building codes throughout the country. UL Standards 555 for Fire Dampers and 555S for Smoke Dampers provide strict testing criteria, drawing upon past investigations and determinations in cooperation with such agencies as NFPA and other life-safety minded organizations.

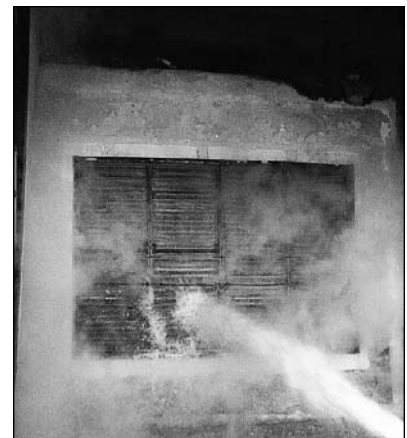
### UL 555 Safety Standard For Fire Dampers

First published in 1968, UL 555 Safety Standard for Fire Dampers provides testing standards and follow-up service guidelines in order to ensure that fire dampers perform as intended during a fire emergency. The most recent edition (Sixth Edition, June 1, 1999) relates the latest requirements for evaluating fire dampers for use as either:

- 1) **Fire Dampers for Static Systems** - For HVAC systems that are automatically shut down in the event of a fire.
- 2) **Fire Dampers for Dynamic Systems** - For HVAC systems that remain operational in the event of a fire.
- 3) **Combination Fire & Smoke Dampers** - For locations in HVAC systems where a fire damper and a smoke damper are required. Combination Fire & Smoke Dampers must also comply with UL 555S requirements for Smoke Dampers.

All fire dampers must undergo the following UL 555 testing procedures (effective July 1, 2002):

Test	Fire Damper Type		
	Static Fire Dampers	Dynamic Fire Dampers	Combination Fire & Smoke
1. Fire Endurance and Hose Stream	✓	✓	✓
2. Cycling	✓	✓	✓
3. Salt-Spray Exposure	✓	✓	✓
4. Spring Closing Force	✓	N/A	N/A
5. Dynamic Closure	N/A	✓	✓
6. Operation (UL 555S)	N/A	N/A	✓
7. Leakage (UL 555S)	N/A	N/A	✓



UL 555 Hose Stream Test

Note: N/A - Not applicable

**UL 555 Sixth Edition, June 1999**, contains changes that are designed to meet the latest requirements put forth by NFPA Standard 90A and BOCA, SBCCI, UBC and IBC building codes.

#### Revised criteria include:

- **Temperature ratings of heat responsive devices** (Effective July 1, 2002):  
 Static Fire Dampers: min. 160°F (71°C)/max. 212°F (100°C)  
 Dynamic Fire Dampers: min. 160°F (71°C)/max. 350°F (177°C)  
 Combination Fire/Smoke Dampers: min. 160°F (71°C)/max. 350°F (177°C)  
 Reopenable Combination Fire/Smoke Dampers: Primary Device: min. 160°F (71°C) / max. 212°F (100°C).  
 Secondary Device: minimum to be greater than primary device temp./max. not to exceed 350°F (177°C) or Elevated Temp. rating of damper.
- **Actuators** are to be factory mounted (Effective June 1, 2000).
- **Dynamic Closure Test** (Effective July 1, 2002): Replaces the former Operation Test for Fire Dampers and includes minimum airflow rating of 2000 fpm (10.2 m/s) and minimum closure pressure of 4 in. w.g. (1 kPa).
- **Cycling Test** (Effective July 1, 2002): Fire Dampers intended for use with an actuator shall be cycled 20,000 full strokes (supercedes 1000 full strokes), or 100,000 full-strokes if intended for use as a volume control (modulating) damper.

**Nailor Fire Dampers have been subjected to the rigorous testing procedures of UL 555 and are UL Classified under Category EMNO.**



## UL 555S Safety Standard for Smoke Dampers

For all the damage fire can subject structures and occupants to, it is the products of incomplete combustion, or smoke, which has the most devastating effect on human life. Approximately eighty percent of all deaths resulting from fires can be attributed to the effects of toxic smoke on the human body. First published in 1983, **UL 555S** was developed to provide criteria for smoke damper performance, including leakage, as part of an ongoing industry wide undertaking to reduce the number of fatalities caused by smoke/fire. Today's HVAC/building designs utilize smoke dampers twofold: to impede the spreading of smoke within HVAC systems that are designed to automatically shut down should a fire occur; and to help control pressure differentials across smoke barriers in buildings that utilize the HVAC system as part of an engineered smoke management system. The most recent edition (Fourth Edition, June 1, 1999) relates the latest criteria for evaluating smoke dampers for use as either:

- 1) **Smoke Dampers** - For use where HVAC ducts pass through smoke barriers.
- 2) **Combination Fire & Smoke Dampers** - For locations in HVAC systems where a fire damper and smoke damper are required. Combination Fire & Smoke Dampers must also comply with UL 555 requirements for Fire Dampers. Smoke Dampers must undergo the following UL 555S testing procedures:
  - **Salt-Spray Exposure Test:** This test exhibits the damper's capabilities to operate after exposure to harsher fouling conditions than may normally be encountered.
  - **Cycling Test:** The damper/actuator is cycled (opened/closed) 20,000 times to ensure the damper can function properly after repeated operation.
  - **Operation Test:** This test determines that the damper and actuator operate properly under conditions of maximum specified airflow and closed pressure differential. For dampers/actuators with an Elevated Temperature rating, heated air is introduced to the test system to ensure the damper functions at the elevated temperature of 250°F (121°C) or higher, as specified. Externally mounted actuators are also exposed to the elevated temperature inside a heated enclosure. This ensures that the damper and more importantly the actuator can still function properly as surrounding temperatures increase due to fire conditions. In most cases, it is the actuator that limits the assembly's ability to function as intended due to increased electrical resistance.
  - **Leakage Test:** This test determines the amount of leakage through the closed smoke damper and therefore the leakage classification at specified pressure differential. Smoke Dampers are tested for leakage following the Operation Test. Combination Fire & Smoke Dampers are subjected to the UL 555 Dynamic Closure Test and are tested for leakage following the Dynamic Closure Test. Leakage Classification is determined as shown in the following chart:

### UL 555S Leakage Classifications (Effective June 1/2000):

Leakage Class	Leakage in CFM per sq. ft. (m <sup>3</sup> /s/m <sup>2</sup> )			
	@ 1 in. w.g. (0.25 kPa)	@ 4 in. w.g. (1.0 kPa)	@ 8 in. w.g. (2.0 kPa)	@ 12 in. w.g. (3.0 kPa)
I	4 (.0204)	8 (.0408)	11 (0.0561)	14 (0.0714)
II	10 (.0510)	20 (0.1020)	28 (0.1428)	35 (0.1785)
III	40 (.2041)	80 (0.4081)	112 (0.5714)	140 (0.7142)

**UL 555S Fourth Edition, June 1999**, contains changes developed to further ensure the effective performance of smoke dampers and are designed to meet the latest requirements of NFPA Standard 90A and BOCA, SBCCI, UBC and IBC building codes.

### Revised criteria include:

- **Actuators** must be factory mounted (Effective June 1/2000).
- **Cycling Test** (Effective July 1/2002): Dampers intended for use with an actuator shall be cycled 20,000 full strokes (supercedes 5000 full strokes), or 100,000 full strokes if intended for use as a volume control (modulating) damper.
- **Operation Test** (Effective July 1/2002): Minimum airflow and closed damper pressure rating are 2000 fpm (10.2 m/s) and 4 in. w.g. (1.0 kPa). Also, effective July 1, 2002, damper/actuators with temperature ratings above ambient are subjected to the **Heated Air** test during which heated air is introduced to the system, raising the temperature to the selected elevated temperature rating (min. 250°F (121°C)) for a min. of 15 minutes. The damper must then close within 75 seconds. Heat input is then discontinued and the damper must reopen within 75 seconds. External mount actuators are heated within an external enclosure for this test.
- **Leakage Test** (Effective July 1/2002): Minimum airflow and closed damper pressure rating is 2000 fpm (10.2 m/s) and 4 in. w.g. (1.0 kPa). Higher airflow ratings must be in increments of 1000 fpm, and higher pressure ratings must be in increments of 2 in. w.g.. For Elevated Temperature rated dampers, Leakage Test is conducted under **Heated Air** conditions.

**Nailor Smoke Dampers have been subjected to the rigorous testing procedures of UL 555S and are UL Classified under Category EMQI.**

## CONTROLLED CLOSURE WITH NAILOR COMBINATION FIRE/SMOKE DAMPERS

### WHAT IS CONTROLLED CLOSURE?

Controlled closure is a term used when a damper is caused to close in a non-abrupt, or non-instantaneous fashion via the return spring that is commonly built into today's fire/smoke damper actuators. Under normal (non-emergency) HVAC system operation power is applied to the actuator circuit to open the damper and hold it open. The actuator is wired in series with a heat responsive device that "trips" at a pre-set high temperature (fire condition) and cuts power to the actuator allowing the actuator return spring to close the damper in a "controlled" manner. A smoke detector or alarm system (by others) that cuts the power to the actuator circuit may also be incorporated into the system.

### WHY CONTROLLED CLOSURE?

Traditionally, combination fire/smoke dampers have utilized a fusible link that melts under fire conditions, separating the actuator from the blades, allowing an independent spring mounted on the damper jackshaft to "snap" the damper closed instantaneously. This instantaneous closure, under certain conditions, can result in costly damage to the ductwork as the inertia of the air in motion creates extreme pressures, both negative and positive, not normally encountered or designed for in the HVAC system. With controlled closure via the actuator return spring, the damper closes in a regulated or controlled manner, usually within 15 seconds to meet common building code criteria. This permits time for upstream and downstream duct pressures to equalize more, providing a more gradual change in pressure as the damper closes, eliminating any potentially damaging instantaneous pressure differentials.



### HOW DOES IT WORK?

#### Electric Actuator with ERL (Electric Resettable Link):

**Fire Conditions:** Nailor's ERL (Electric Resettable Link) detects an abnormally high temperature, 250°F (121°C) standard (165°F (74°C), 212°F (100°C) or 350°F (177°C) available), and interrupts power to the actuator allowing the actuator return spring to close the damper (controlled closure). An over-center knee-lock linkage locks the damper closed as required by NFPA 90A and UL 555. Upon a return to normal conditions, the damper may be reopened by pressing the ERL manual reset button located on the damper sleeve.

**Smoke, Testing or Power Failure Conditions:** If smoke is detected or during system testing or if there is a power failure, power is interrupted to the actuator, allowing the actuator return spring to close the damper (controlled closure). Upon a return to normal conditions, power is restored to the actuator and the damper automatically reopens.



**CONTROLLED CLOSURE WITH NAILOR COMBINATION FIRE/SMOKE DAMPERS****Pneumatic Actuator with PRL (Pneumatic Replaceable Link):**

**Fire Conditions:** Nailor's PRL (Pneumatic Replaceable Link) detects an abnormally high temperature, 250°F (121°C) standard (165°F (74°C) or 212°F (100°C) available), and allows the pneumatic actuator return spring to close the damper (controlled closure). An over-center knee-lock linkage locks the damper closed as required by NFPA 90A and UL 555. Upon a return to normal conditions, the damper may be reopened by replacing the fusible link on the PRL located on the damper sleeve.

**Smoke, Testing or Power Failure Conditions:** An EP (Electro-Pneumatic) switch (by others) must be utilized to interconnect the smoke detector with the pneumatic actuator. If smoke is detected or when system testing or if there is a power failure, the EP switch allows the pneumatic actuator return spring to close the damper (controlled closure). Upon a return to normal conditions, air pressure is restored to the actuator and the damper automatically reopens.

**MLS-400 Reopenable Control System with Electric Actuator:**

**Fire Conditions:** A three position master control switch (by others) must be utilized for reopenability. With the master control switch in "normal" position, Nailor's primary (low limit) heat sensor detects an abnormally high temperature, 165°F (74°C), and cuts power to the actuator allowing the actuator return spring to close the damper (controlled closure). The primary heat sensor can be bypassed to reopen the damper for smoke management purposes by placing the master control switch to the "reopen" position. The damper remains operational until the secondary (high limit) heat sensor's temperature is reached (250°F (121°C) standard, 350°F (177°C) optional) at which time power is cut to the actuator allowing the actuator return spring to close the damper (controlled closure) and lock it closed as required by NFPA 90A and UL 555. Upon a return to normal conditions, the damper may be reopened by pressing the sensor manual reset button located on the damper sleeve.

**Smoke, Testing or Power Failure Conditions:** If smoke is detected or during system testing or if there is a power failure, power is interrupted to the actuator, allowing the actuator return spring to close the damper (controlled closure). Upon a return to normal conditions, power is restored to the actuator and the damper automatically reopens. To close the damper for smoke management purposes place the master control switch (by others) to the "closed" position.

*Nailor Combination Fire/Smoke Dampers...Are you comfortable specifying anything else?*

## FIRE & SMOKE DAMPERS QUICK SELECT GUIDE

Nailor Industries offers a full line of damper products dedicated to both fire protection and smoke protection/management. All models shown have been tested by Underwriter's Laboratories and are listed or classified for use as indicated. Each model meets the requirements of the National Fire Protection Association (NFPA) Standards as well as the requirements put forth by the Building Officials and Code Administrators (BOCA), Southern Building Code Congress International Code (SBCCI), Universal Building Code (UBC), International Building Code (IBC), National Building Code of Canada (NBC) and associated local building codes. In addition, many products are approved for use by the California State Fire Marshall and the City of New York Board of Standards and Appeals.

Nailor products have been tested and listed or classified in accordance with the following UL Safety Standard procedures and each damper bears a relative label identifying same:

Dynamic Fire Dampers	UL 555
Static Fire Dampers	UL 555
Smoke Dampers	UL 555S
Combination Fire & Smoke Dampers	UL 555 & UL 555S
Actuators	UL 555 & UL 555S
Ceiling Fire Dampers	UL 555C

MODEL SERIES	DAMPER TYPE	UL CLASSIFICATION	UL FILE #	CITY OF NEW YORK MEA OR BSA #	CALIFORNIA STATE FIRE MARSHAL LISTING #
<b>DYNAMIC FIRE DAMPERS</b>					
D0100	Curtain type, std. frame	1 1/2 hour label for walls & floors	R9492	-	3225-0935:113
D0114	Curtain type, with integral sleeve	1 1/2 hour label for walls & floors	R9492	-	3225-0935:113
D0100G	Curtain type with integral grille mounting sleeve	1 1/2 hour label for walls & floors	R9492	-	3225-0935:113
D0110GOW	Curtain type, Out of Wall w/integral grille mounting sleeve	1 1/2 hour label for walls & floors	R9492	-	3225-0935:113
D0500	Curtain type, std. frame	3 hour label for walls & floors	R9492	-	3225-0935:113
1200	Multi-blade, airfoil style	1 1/2 hour label for walls & floors	R9492	-	3225-0935:101
1200-3	Multi-blade, airfoil style	3 hour label for walls & floors	R9492	-	3225-0935:101
1201-OW	Multi-blade, Out of Wall w/integral grille mounting sleeve	1 1/2 hour label for walls & floors	R9492	-	3225-0935:101
1250	Multi-blade, vee-style	1 1/2 hour label for walls & floors	R9492	-	3225-0935:101
<b>STATIC FIRE DAMPERS</b>					
0100	Curtain type, std. frame	1 1/2 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0114	Curtain type, with integral sleeve	1 1/2 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0100G	Curtain type, with integral grille mounting sleeve	1 1/2 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0110GOW	Curtain type, Out of Wall w/integral grille mounting sleeve	1 1/2 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0200	Curtain type, thinline frame	1 1/2 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0200G	Thinline curtain type with integral grille mounting sleeve	1 1/2 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0310	Curtain type, wide frame	1 1/2 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0500	Curtain type, std. frame	3 hour label for walls & floors	R9492	460-88-SA	3225-0935:100
0570	Curtain type, thinline frame	3 hour label for walls	R9492	460-88-SA	3225-0935:100
0540	Curtain type, wide frame	3 hour label for walls	R9492	460-88-SA	3225-0935:100
0130GC	Curtain type, for garbage chute	1 1/2 hour label for floors	R9492	460-88-SA	3225-0935:100
1290F	True round, single blade	1 1/2 hour label for walls & floors	R9492	366-03-M	3225-0935:101
<b>SMOKE DAMPERS</b>					
1210	Multi-blade, steel airfoil blades	Leakage Class I or II @ 250°F or 350°F	R9492	366-03-M	3230-0935:107
1280	Multi-blade, alum. airfoil blades	Leakage Class I or II @ 250°F or 350°F	R9492	366-03-M	3230-0935:107
1260	Multi-blade, steel vee-style blades	Leakage Class II or III @ 250°F or 350°F	R9492	460-88-SA	3230-0935:107
1290S	True round, single blade	Leakage Class I @ 350°F	R9492	366-03-M	3230-0935:107



INTRO TO FIRE & SMOKE DAMPERS/ACTUATORS



MODEL SERIES	DAMPER TYPE	UL CLASSIFICATION	UL FILE #	CITY OF NEW YORK MEA OR BSA #	CALIFORNIA STATE FIRE MARSHAL LISTING #
<b>COMBINATION FIRE &amp; SMOKE DAMPERS</b>					
1220	Multi-blade, airfoil style	<ul style="list-style-type: none"> <li>• 1 1/2 hour label for walls and floors</li> <li>• Leakage Class I or II @ 350°F</li> </ul>	R9492	366-03-M	3225-0936:106
1220-3	Multi-blade, airfoil style	<ul style="list-style-type: none"> <li>• 3 hour label for walls and floors</li> <li>• Leakage Class I or II @ 350°F</li> </ul>	R9492	366-03-M	3225-0936:106
1221-OW	Multi-blade, airfoil style, out-of-wall mounting	<ul style="list-style-type: none"> <li>• 1 1/2 hour label for walls and floors</li> <li>• Leakage Class I or II @ 350°F</li> </ul>	R9492	366-03-M	3225-0935:106
1221C-1	Multi-blade, airfoil style, for corridor ceiling, grille	<ul style="list-style-type: none"> <li>• 1 hour label for Corridor ceilings</li> <li>• Leakage Class I @ 250°F or 350°F</li> </ul>	R9492	–	3226-0935:106
1221C-2	Multi-blade, airfoil style, for corridor ceiling, continuous duct	<ul style="list-style-type: none"> <li>• 1 hour label for Corridor ceilings</li> <li>• Leakage Class I @ 250°F or 350°F</li> </ul>	R9492	–	3226-0935:106
1221G	Multi-blade, airfoil style, with integral grille mounting sleeve	<ul style="list-style-type: none"> <li>• 1 1/2 hour label for walls and floors</li> <li>• Leakage Class I or II @ 250°F or 350°F</li> </ul>	R9492	–	3225-0935:106
1270	Multi-blade, vee style	<ul style="list-style-type: none"> <li>• 1 1/2 hour label for walls and floors</li> <li>• Leakage Class II or III @ 250°F or 350°F</li> </ul>	R9492	460-88-SA	3225-0935:106
1271C-1	Multi-blade, vee style, for corridor ceiling, grille	<ul style="list-style-type: none"> <li>• 1 hour label for Corridor ceilings</li> <li>• Leakage Class II or III @ 250°F or 350°F</li> </ul>	R9492	–	3225-0935:106
1271C-2	Multi-blade, vee style, for corridor ceiling, continuous duct	<ul style="list-style-type: none"> <li>• 1 1/2 hour label for walls and floors</li> <li>• Leakage Class II or III @ 250°F or 350°F</li> </ul>	R9492	–	3225-0935:106
1290FS	True round, single blade	<ul style="list-style-type: none"> <li>• 1 1/2 hour label for walls and floors</li> <li>• Leakage Class I @ 250°F or 350°F</li> </ul>	R9492	366-03-M	3225-0935:106
<b>CEILING DAMPERS</b>					
0714	Rectangular, single hinged blade	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0716	Rectangular, butterfly blade style	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0716-4	Rectangular, low profile butterfly blade style	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0722	Round, butterfly blade style	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0722-LE 0722-SE	Round, butterfly blade style, extended frame	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0716A	Rectangular, adjustable butterfly blade style	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0716-4A	Rectangular, adjustable low-profile butterfly blade style	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0722A	Round, adjustable butterfly blade style	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0722A-LE 0722A-SE	Round, adjustable butterfly blades, extended frame	3 hour ceiling damper	R9660	460-88-SA	3226-0935:102
0720	Rectangular, low-profile blanket type blade	3 hour ceiling damper	R9660	366-03-M	3226-0935:102
0725/0726	Thermal Blanket for round/square neck diffusers	3 hour accessory thermal blanket	R9660	–	–
0755/ 0756/ 0757	For specific wood truss ceiling assemblies	1 hour ceiling damper for use in UL design # L550/L562/P531/P538	R9660	366-03-M	3226-0935:114
0755A/ 0756A/ 0757A	Adjustable, for specific wood truss ceiling assemblies	1 hour ceiling damper for use in UL design # L550/L562/P531/P538	R9660	366-03-M	3226-0935:114
0758/0759 0760/0761 0762	Register boxes for specific wood truss ceiling assemblies	1 hour ceiling damper for use in UL design # L550/L562/P531/P538	R9660	–	–

## ACTUATOR SELECTION FOR NAILOR FIRE/SMOKE DAMPERS

Nailor smoke and combination fire/smoke dampers utilize electric or pneumatic actuators to open and close. Combination fire/smoke dampers utilize a heat sensor that, when subjected to an elevated temperature (usually due to fire), interrupts power to the actuator allowing the actuator return spring to close the damper to prevent the passage of flame and smoke. Smoke dampers do not utilize a heat sensor and simply open and close in response to an alarm signal and/or a signal from the Fire Fighters Control Station (F.F.C.S.) in order to prevent smoke from passing through smoke barrier openings or to control smoke spread by creating pressure differentials within the building or to exhaust smoke from the building. Combination fire/smoke dampers can also be opened or closed from an alarm signal or the F.F.C.S. but will lock closed when the sensor is exposed to its closure temperature rating. Smoke control system design requires the use of 'spring return' type actuators so that dampers fail to the desired position upon interruption of power. The majority of applications generally require dampers that fail closed when the power is interrupted. This is a normally closed (NC) actuator connection. Occasionally, an application may require the damper to open upon interruption of power to the actuator. This is a normally open (NO) actuator connection. Nailor smoke dampers can be ordered with either fail closed or fail open operation but combination fire/smoke dampers must fail closed upon interruption of power.

### FACTORY MOUNTING OF ACTUATORS:

As of June 1, 2000, **all actuators must be factory mounted** as per the latest editions of UL Standards 555 (Sixth Edition, 1999) and 555S (Fourth Edition, 1999). This ensures correct actuator selection (meeting damper performance requirements) and installation that is in accordance with UL procedures and requirements. All damper/actuator assemblies are cycled in the factory to ensure correct operation and therefore minimize the likelihood of problems in the field.

### ACTUATOR MOUNTING CONFIGURATIONS:

Damper actuators can be factory mounted using a choice of different methods, or on larger multi-section dampers, a combination of methods:

- A) **Externally mounted on a damper sleeve:** This is the preferred and most functional choice due to ease of electrical connection, testing and service. Combination fire & smoke dampers are required to be installed in a sleeve regardless. Standard Nailor sleeve is 16" (406) in length.
- B) **Externally mounted on a damper side plate (SMP):** As smoke dampers generally are not required to be mounted in a sleeve, a side mounting plate is an effective yet economical method of factory mounting the actuator externally. See SMP OPTION for further details.
- C) **Internally mounted with a jackshaft:** Internal mounting should only be used where dictated by space constraints and cannot be avoided. There are limitations on smaller damper sizes (See Actuator Space Envelopes: Internal Mounting). It should also be realized that internal actuator mounting on smaller size dampers may significantly reduce the duct free area and therefore, increase pressure drop.

### ACTUATOR MODEL SELECTIONS:

Dampers and actuators are tested and qualified together under UL 555 and UL 555S to ensure proper operation. Accordingly, the appropriate actuator must be chosen from the selection of UL tested and listed actuators available from Nailor for the particular damper model being used. **Consult the VARIABLES/ACCESSORIES page of the selected damper model for each list of acceptable actuators.**

All Nailor damper/actuator assemblies have been qualified at a minimum velocity of 2000 fpm (10 m/s) @ 4" w.g. (1kPa) and at an elevated temperature of 250°F (121°C) or 350°F (171°C), depending upon mounting configuration. This is the maximum operational temperature of the damper/actuator assembly.

## ACTUATOR MODEL SELECTIONS (continued):

Nailor has tested and qualified actuators from major manufacturers such as Honeywell, Belimo and Siemens for use with smoke and combination fire/smoke dampers. The following is a partial list of Nailor's UL qualified actuators for use in a) 2 position applications (open/closed) where the damper commonly remains in one position until de-energized due to fire or smoke detection or b) for use where a secondary 'dual function' capability for open/closed volume control or a modulation capability as part of the daily HVAC operation is required.

### ACTUATOR MODEL SELECTION GUIDE:

#### 2 Position: Power Open/Fail Closed (Damper Normally Closed)

	Model	Voltage/ Air Pressure
	ELECTRIC	
For Low Torque Applications	ML4X02 Honeywell	120 VAC
	ML8X02 Honeywell	24 VAC
	ML4115 Honeywell	120 VAC
	ML8115 Honeywell	24 VAC
For Medium Torque Applications	MS4X09 Honeywell	120 VAC
	MS8X09 Honeywell	24 VAC
	FSNF120 Belimo	120 VAC
	FSNF24 Belimo	24 VAC
For High Torque Applications	MS4120 Honeywell	120 VAC
	MS8120 Honeywell	24 VAC
	GGD221 Siemens	120 VAC
	GGD121 Siemens	24 VAC
	PNEUMATIC	
For Low/Med. Torque Applications	331-2961 Siemens	25 psi
For High Torque Applications	331-3060 Siemens	25 psi

#### Modulating/Fail Closed (Damper Normally Closed)

	Model	Voltage/ Air Pressure
	ELECTRIC	
For All Applications	MS7510A Honeywell	24 VAC
	PNEUMATIC	
For All Applications	331-2961PR Siemens	25 psi

#### Smoke Dampers Only: 2 Position: Power Closed/Fail Open (Damper Normally Open)

	Model	Voltage
	ELECTRIC	
For All Applications	MS4120 Honeywell	120 VAC
	MS8120 Honeywell	24 VAC

All actuators listed here have been approved for specific damper sizes and an airflow velocity of 2000 fpm @ 4" w.g. (4000 fpm @ 8" w.g. with size and model restrictions). Nailor will select the optimum damper / actuator combination based upon damper size and system design airflow velocities.

Nailor is constantly expanding its list of UL qualified actuators. For additional availability, consult Nailor.

#### ACTUATOR SELECTION CHECK LIST:

- Type of Actuator:** Electric or Pneumatic.
- Operation Type:** 2 Position (Open/Closed) or Modulating (Volume Control).
- Power Requirements:** 24 or 120 Volt (Electric) or 25 psi Air Pressure (Pneumatic).
- Application (Smoke dampers only):** Damper to Fail Closed (NC) or Damper to Fail Open (NO).
- UL Limitations:** Confirm damper size, airflow velocity, pressure rating and elevated temperature requirements. Nailor will select optimum actuator.
- Mounting Position:** External Mount (LH or RH) with sleeve or side mounting plate or Internal Mount (Consult Actuator Space Envelope requirements).
- Accessories:** MLS-300 Position Indicator Switch pack or MLS-400 Fire Sensor/Switch Pack if required.

## ACTUATOR AND ACCESSORY SPACE ENVELOPE REQUIREMENTS AND SLEEVE DIMENSIONAL DATA FOR COMBINATION FIRE/SMOKE DAMPERS:

Nailor recommends that actuators are externally mounted whenever possible. Internal actuator mounting (in the airstream) should be avoided if possible as actuators are more difficult to access for field power connection, testing and service. Externally mounted actuators require space outside of the damper sleeve.

Nailor mounts all actuators in the horizontal plane as standard. This is done for two reasons:

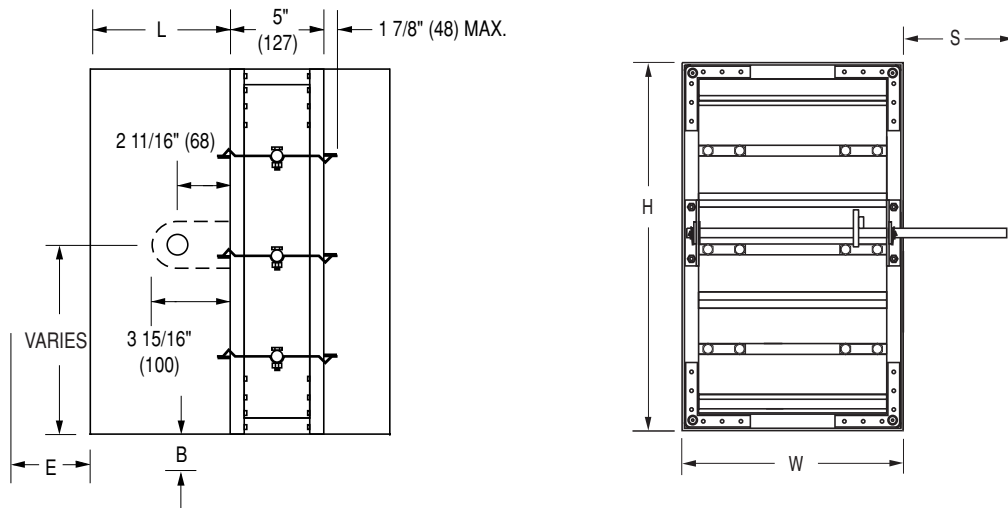
1. To provide maximum clearance for installation of retaining angles.
2. To eliminate the overhang of actuators either above or below the damper sleeve on smaller sizes, which may impede field installation where space is limited. For this reason, actuators extend ahead of the damper sleeve end, in the direction of the connecting ductwork.

The 'S' and 'E' dimensions illustrate the clearance requirements for the various available actuators and accessories.

On dampers 12" (305) in height and under, the ERL heat sensor junction box is mounted on the underside of the damper sleeve as standard, represented by the 'B' dimension. On dampers over 12" (305) in height, the ERL heat sensor junction box is normally located on the side of the sleeve, above the actuator.

For non-standard mounting arrangements, contact your Nailor representative.

The standard location of a damper mounted in a factory sleeve (dimension 'L') is 8" (203). The damper can be positioned at other locations within a range of 8" to 11" (203 to 279) for the 'L' dimension (for standard 16" (406) length sleeve).



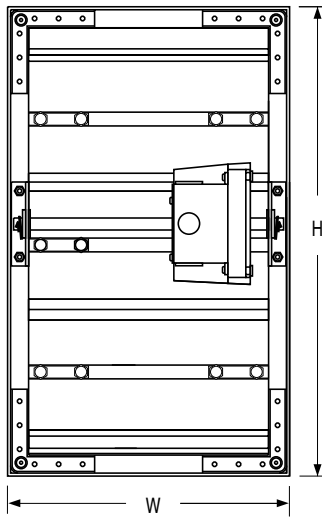
Actuator Type/Model	S Dimension	E Dimension	B Dimension	
			H > 12" (305)	H ≤ 12" (305)
<b>Electric</b>				
ML4115/8115 Honeywell	5 3/4" (146)	1 1/2" (38)	0	1 3/4" (44)
MS4X09/8X09 Honeywell	5 3/4" (146)	1 1/2" (38)	0	1 3/4" (44)
MS4120/8120 Honeywell	5 3/4" (146)	3 3/4" (95)	0	1 3/4" (44)
GGD221/121 Siemens	5 3/4" (146)	3 3/4" (95)	0	1 3/4" (44)
FSNF120/24 Belimo	5 3/4" (146)	3 1/2" (89)	0	1 3/4" (44)
<b>Pneumatic</b>				
331-2961 Seimens	7" (178)	11 1/2" (292)	0	1 3/4" (44)
331-3060 Seimens	9 1/4" (235)	15 1/2" (394)	0	1 3/4" (44)



## INTERNAL ACTUATOR MOUNTING MINIMUM SIZE REQUIREMENTS:

Internal (in the airstream) actuator mounting should only be specified where space constraints dictate. There are limitations on smaller sizes and with the MLS-300 and MLS-400 accessories. Damper free area is also greatly reduced and hence pressure drop will increase significantly on smaller sizes. A general guideline for internal actuator mounting on traditional combination fire/smoke dampers is as follows:

Actuator Type	Minimum Size	
	Without accessories	With MLS-300 or 400
Electric (direct drive)	10" W x 8" H (254 x 203)	10" W x 12" H (254 x 305)
Pneumatic (crank arm)	10" W x 12" H (254 x 305)	10" W x 12" H (254 x 305)



For further guidance and application on a job specific basis, contact your Nailor representative.



**ACTUATOR REPLACEMENT/FIELD MODIFICATIONS OF UL CLASSIFIED DAMPERS****FIELD MODIFICATIONS OR REPAIRS:**

UL Classified dampers are manufactured in accordance with UL Follow-Up Procedures (as part of their Follow-Up Services program) which include arbitrary visits by UL representatives to the manufacturing facilities in order to verify that the classified products are being manufactured correctly. As long as the manufacturer adheres to the Follow-Up Procedures stringent production guidelines, it can continue to apply UL labels to the product.

However, once a UL Classified damper assembly leaves the manufacturer's factory it no longer falls under the scrutiny of the UL Follow-Up Services and any modification or repair work performed on the classified product is subject to the approval of the local Authority Having Jurisdiction (AHJ). Typically, the AHJ is a local authoritative body familiar with local fire and building codes, authorized to approve proper application and installation of building construction products. The AHJ may consult with the certification organization (i.e. UL) or the manufacturer of the product or other information sources for advice or assistance in determining the acceptability of the product, installation or repair. If a modification is significant enough in the AHJ's opinion, he may request, at a cost, a UL Field Evaluation to determine if it meets UL safety requirements before he gives approval.

**ACTUATOR REPLACEMENT IN THE FIELD:**

Although UL Classified damper/actuator assemblies are designed and rigorously tested to provide many years of service, occasionally field reparation by replacing a non-functioning actuator may become necessary. Electric actuators, being electronic devices, are susceptible to damage from incorrect field wiring, accidental voltage spikes and a variety of other abuses that can cause them to fail. Pneumatic actuators, by inherent design, are less likely to fail due to abuse, but none the less, can fail due to exposure to extreme temperatures or line pressures etc.

Although fire/smoke damper actuators are required to be factory mounted, when an actuator fails the assembly need not be returned to the manufacturer for repair. Replacement actuators may be field installed by anyone acceptable to the AHJ. It is the responsibility of the AHJ to determine that the correct actuator is used and that it is installed properly in accordance with the manufacturer's installation instructions. A UL Field Inspection or Evaluation is not required in order to approve the installation of a replacement actuator.

**NAILOR INDUSTRIES....YOUR AUTHORIZED REPLACEMENT ACTUATOR SOURCE**

Contact Nailor for guidance in ordering the correct replacement actuator for your specific damper. Nailor can provide manufacturer's installation instructions for all types of dampers.

**Notes:**

