Fire, Smoke, and Combination Fire Smoke Dampers

GREENHECK
Building Value in Air.
Mark Belke
Director Damper Products-Greenheck

- Chairman of Code Action Review Committee (CARC)-IBC 2009
- California Building Code work group
- NFPA 80A, 90A, 92B, 101, & 105
- California Energy Commission (PIER)
  Public Interest Energy Research
History of Design Guides & Building Codes

- 1913
  - NFPA 101, *Safety to Life from Fires in Buildings & Structures*

- 1915
  - BOCA Code

- 1927
  - UBC Code

- 1937
  - NFPA 90A, *Installation of Air Conditioning & Ventilating Systems*

- 1945
  - SBCCI
History of Design Guides & Building Codes

- 1985
  - NFPA 92A, Recommended Practice for Smoke Control Systems
  - NFPA 92B, Guide for Smoke Management Systems in Malls, & Large Areas
- 2000
  - IBC
2009 Building Code (IBC)

- IBC Adopted
- IBC Adopted, but not yet in effect
- Adopted at the Local Level
Introduction

- **Codes**
  - UL 555-standard for fire dampers
  - UL 555S-standard for smoke dampers

- Dampers must be tested in accordance with UL to gain approval
History of Fire & Smoke Damper Performance Standards

- **UL 555**
  - ‘68, 1st Ed.
  - ‘73, 2nd Ed.
  - ‘79, 3rd Ed.
  - ‘90, 4th Ed.
  - ‘95, 5th Ed.
  - ‘99, 6th Ed.
  - ‘06, 7th Ed.

- **UL 555S, Smoke Dampers**
  - ‘83, 1st Ed.
  - ‘93, 2nd Ed.
  - ‘96, 3rd Ed.
  - ‘99, 4th Ed.
NFPA 90A

- Inspection & Testing
  - Each damper shall be examined every 2 years to ensure that it is not rusted or blocked.
Inspection & Testing

Each damper shall be tested and inspected 1 year after installation then every 4 years after except in hospitals which is 6 years
The management of fire and smoke has served as the underpinnings of building codes in the United States for over 100 years. Nearly all buildings intended for human occupancy are required by today's building codes to be designed with an assurance that, even the life of the building, occupants will be reasonably safe from fire and smoke.

The building codes require the design of an integrated system of building features, such as walls, floors, ceilings, and structural members, and specific fire and smoke protection components, products, devices, and systems that reinforce one another and cover for one another in case of the failure of any one in the event of a fire. The overall intended building performance and the depth of the designed redundancy is based on the objectives of the building owner and the occupants.

Professionals, who properly install, inspect and maintain the dampers, make an important contribution to the execution of the fire protection design and overall building performance in the event of a fire.

Knowledge Areas of Expertise
Life Safety Systems Technician

- Design, Plans and Specifications

  SCORE: Level 1 competency in installation, inspection, and maintenance of fire, smoke, combination fire/smoke dampers, and cooling dampers in HVAC systems.

- Basic knowledge about the responsibilities of the architects, engineers and system designers:
  - Purpose of fire and smoke damper for life safety and protection of property
  - Terminology commonly used in conjunction with fire and smoke dampers
  - Symbols commonly used on plans for HVAC systems
  - Specifications for HVAC systems in Specific to or MasterSpec
  - Skill in reading plans and specifications

http://www.nemionline.org/certification/life_safety.html
Cleaning and Inspection

- Proper installation
  - Retaining angles

- Cycling
  - Remove fuse links/replace as needed
  - Use thermal reset switches
  - Cut power

- Cleaning
  - Mild detergent and damp cloth
  - Do not lubricate!
Damper Ratings

- **Closure Temperature**
  - 165° F (minimum)
  - Operational Temperature (maximum)

- **Operational Temperature**
  - 250° F (minimum)
  - 350 ° F (most common)
  - 100° F increments
Damper Ratings

- Operational Airflow Rating (400 fpm safety)
  - 2000 fpm
  - 3000 fpm
  - 4000 fpm

- Operational Closure Pressure Rating (.5 in. wg. Safety factor)
  - 4 in. wg.
  - 6 in. wg.
  - 8 in. wg.
Combination Fire Smoke & Fire Dampers - Ratings

IBC

716.3.1 Fire Protection rating. Fire dampers shall have the minimum fire protection rating specified in Table for the type of penetration

<table>
<thead>
<tr>
<th>Type of Penetration</th>
<th>Minimum Damper Rating (hours)</th>
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<tbody>
<tr>
<td>Less than 3-hour fire resistance rated assemblies</td>
<td>1.5</td>
</tr>
<tr>
<td>3-hour or greater fire resistance rated assemblies</td>
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</tbody>
</table>
UL 555 Classifications

- **Static**
  - for use in HVAC systems that shut off in case of a fire emergency

- **Dynamic**
  - for use in HVAC systems that continue running during a fire emergency
  - dynamic airflow test
  - increments of 1000 fpm
Fire Test
Fire Damper Installation

“Standard” Installation Requirements

1. The centerline of the damper must be within the plane of the wall.

2. The required thermal expansion clearances between the damper sleeve and wall/floor opening must be maintained. “Annular Space”
Fire Damper Installation

- **Annular Space**
  - space between damper and inside of barrier
  - 1/8” per linear foot
  - minimum: 1/4”
  - maximum: 3” on each side
Fire Damper Installation

- Greenheck tests dampers WITHOUT any sealant or caulk in annular space
- Sealant is acceptable but must be approved by local authority
Fire Damper Installation

- Installed with sleeves
  - factory or field mounted
  - extend no more than 6” beyond the edge of the wall (16” if access door in sleeve)

- Location
  - centerline within the plane of the barrier
Securing Damper/Sleeve

- Retaining angles
  - Retain
  - Prevent sight-through
- 1 in. overlap of barrier
Securing Damper/Sleeve

- Attach angles to sleeve only
- All four sides of sleeve
- Both sides of barrier is standard
Single Side Retaining Angle

Single Side Angle - Vertical or Horizontal mount

Vertical

Horizontal
Breakaway Connections

- UL allows a number of duct connections:
  - Traditional
  - Manufactured
  - Proprietary

- Also shown in SMACNA, Fire Damper Guide
Breakaway Connections

- Traditional - Transverse Joints

- Plain “S” Slip
- Hemmed “S” Slip
- Double “S” Slip
- Inside Slip Joint
- Standing “S”
- Standing “S” (Alt.)
- Standing “S” (Alt.) (Bar Reinforced)
- Standing “S” (Angle Reinforced)
Breakaway Connections

- Manufactured
  - Ductmate
  - Ward
  - Nexus

- Proprietary
  - TDC by Lockformer
  - TDF by Engle
Breakaway Connections

• Ductmate, Ward, or Nexus to TDC or TDF
Greenheck
Connect-All
Breakaway Test
True Round Series

- One Retaining Plate required
- Two Plates optional
- True Round Series
  - DFDR
  - FDR
  - FSDR
  - SMDR
Firestop Installation

- Combination Fire Smoke Dampers
- Multi-blade Fire Dampers
- Underfloor applications
- Max. size 72” W x 96” H
Incorrect Installations
Incorrect Installations
UL 555S: Smoke Dampers
NFPA 92A & 92B

- Inspection & Testing
  - Dedicated systems shall be tested at least semiannually
  - Non-dedicated systems shall be tested at least annually.
NFPA 105

- **Inspection & Testing**
  - Each damper shall be tested and inspected 1 year after installation then every 4 years after except in hospitals which is 6 years.
  - The damper shall be actuated and cycled as part of the associated smoke detector testing in accordance with NFPA 72.

- **Maintenance**
  - All maintenance shall be documented in accordance to section 6.5.10 & 6.5.11.
Installation Books
The management of fire and smoke has served as the underpinnings of building codes in the United States for over 100 years. Nearly all buildings intended for human occupancy are required by today’s building codes to be designed with an assurance that, over the life of the building, occupants will be reasonably safe from fire and smoke.

The building codes require the design of an integrated system of building features, such as walls, floors, ceilings, and structural members, and specific fire and smoke protection components, products, devices, and systems that reinforce one another and cover for one another in case of the failure of any one in the event of a fire. The overall intended building performance and the depth of the designed redundancy is based on the objectives of the building owner and the occupants.

Professionals who properly install, inspect and maintain the dampers, make an important contribution to the execution of the fire protection design and overall building performance in the event of a fire.

Knowledge Areas of Expertise
Life Safety Systems Technician

Design, Plans and Specifications

SCORE: Level 1 competency in installation, inspection, and maintenance of fire, smoke, combination fire/smoke dampers, and operating dampers in HVAC systems.

Basic knowledge about the responsibilities of the architects, engineers and system designers:

- Purpose of fire and smoke damper for life safety and protection of property
- Terminology commonly used in conjunction with fire and smoke dampers
- Symbols commonly used on plans for HVAC systems
- Specifications for HVAC systems in specFlash or MasterSpec
- Skill in reading plans and specifications
Smoke Damper Construction

- **Type**
  - multi-blade
  - 3-V or airfoil blade

- **Construction**
  - blade and jamb seals
  - *always* with a UL-approved actuator
UL 555S Classifications

- **Leakage Class**
  - I (8 cfm/sq. ft @ 4 in.wg)
  - II (20 cfm/sq. ft @ 4 in.wg)
  - III (80 cfm/sq. ft @ 4 in.wg)

- **Operational Temperature**
  - Maximum operating temperature for damper
  - 250° F
  - 350° F
Smoke Damper Rating

- IBC 716.3.2
  - Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall be less than 250°F (121°C)
Smoke Dampers

- **Passive smoke control**
  - Close and revent the circulation of air and smoke

- **Engineered smoke control**
  - Part of system designed to control spread of smoke using walls and floors as barriers along with the building’s HVAC system
Engineered Smoke Control
Smoke Damper Installation

- In Accordance with Manufacturer’s IOMs
- Sealing Damper
  - It is acceptable to seal damper frame and duct
  - GE1200 Silicone Construction Sealant
  - Dow Corning RTV 732 Sealant
- Actuator Requirements
  - Wire actuator in compliance with local wiring codes
  - Manufacturer offers wiring diagrams for each actuator
Incorrect Installations

- Garbage placed inside of damper.
Incorrect Installations
Combination Fire/Smoke Dampers
Purpose of Fire/Smoke Damper

- Provide the same level of protection as individual fire and smoke dampers
- Installation guidelines of fire and smoke dampers apply
What are the Requirements?

- 20,000 Cycles - to "age" actuators
- Modulating 20,000 Cycles plus 100,000 repositions
What are the Requirements?

- Actuator heated to 350°F at the same rate as the airstream temperature.
What are the Requirements?

- Operation against ducted airflow
- Ducted airstream heated to 350°F
Internal Mount Actuators

- External & Internal ratings not the same
Actuator Types

- **Electric**
  - 24 VAC
  - 120 VAC
    - Transformer required on 208V, 277V, 460V

- **Pneumatic**
  - 20-25 psi supply
  - 60-80 psi supply

- **Manual**
  - Quadrant type
  - Pull chain type
Fire/Smoke Damper Closure Devices

- **Electronic Link**
  - bi-metallic sensor
  - wired in series with actuator
  - cuts power to actuator when temperature is reached
  - Greenheck's “RRL”
Fire/Smoke Damper Options

- Control Modules
  - test the operation of damper from a remote location
Fire/Smoke Dampers Options

- Security Bars
  - Cross Bar
  - Punch Mid Bar
Life Safety Damper Selection and Application Manual

Life Safety Dampers
Selection and Application Manual

- Fire
- Smoke
- Combination Fire Smoke

GREENHECK
Building Value in Air
August 2010
DAMPERS

What's New in Dampers
- Frequently Asked Questions

UL Listings for All Manufacturers (Click on the "View Listing" link)
- AMCA Licensed Greenheck Dampers

Greenheck offers a complete and comprehensive line of damper products for fire and smoke control in life safety systems and for airflow control in commercial HVAC and industrial systems.

Downloadable Greenheck Literature
- Viewable with the Adobe Acrobat Reader
  (Click here for more information or to download the Acrobat reader)

- Damper All Products Brochure (549K)
- Dampers and Louvers: The Greenheck Advantage (2.5M)
- Severe Environment Dampers (775K)
## Where Do I Find the UL Listings?

### Online Certifications Directory

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<th>Category Name</th>
<th>Link to File</th>
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<td>Dampers for Fire Barrier and Smoke Applications</td>
<td>EMME.R16596</td>
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<tr>
<td>ACTION AIR USA, DIV OF TOMKINS</td>
<td>Dampers for Fire Barrier and Smoke Applications</td>
<td>EMME.R16693</td>
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<td>AIR BALANCE INC</td>
<td>Dampers for Fire Barrier and Smoke Applications</td>
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<td>AMERICAN WARMING &amp; VENTILATING</td>
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<td>GULF MECHANICAL ACOUSTIC MFG CO</td>
<td>Dampers for Fire Barrier and Smoke Applications</td>
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Greenheck Fan Corporation  
400 Ross Avenue  
PO Box 410

<table>
<thead>
<tr>
<th>Model</th>
<th>Hr Class</th>
<th>Damper Mounting Position</th>
<th>Single Section Damper Size In.</th>
<th>Multiple Section Damper Size In.</th>
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