AMCA ASET Webinar Series

Update on Codes, Standards and Certifications for Severe-Duty Louvers and Fire/Smoke Dampers

Scott Arnold

Content Manager, AMCA International

Webinar Moderator

- Joined AMCA in 2017
- Leads development and publication of technical articles, white papers and educational materials.
- Editor-in-chief of the award-winning *AMCA inmotion* magazine.

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Introductions & Guidelines

- Participation Guidelines:
  - Audience will be muted during the webinar.
  - Questions can be submitted anytime via the Go24 webinar platform and will be addressed at the end of the presentation.
  - Reminder: This webinar is being recorded!
  - To earn PDH credit for today, please stay clicked onto the webinar for the entire hour.
  - A post-webinar evaluation will be emailed to everyone and must be completed to qualify for today's PDH credit.
  - Every person that wants to receive PDH credit must be individually registered. If individuals watching in a group want credit, please contact Lisa Cherney (*lcherney@amca.org*) for a group sign-in sheet.

Q & A

To submit questions:

- From the webinar screen, select Q&A at the bottom.
- Type your question in the box and click “Submit”.
- Start your question by naming the presenter who your question is for.

AMCA International has met the standards and requirements of the Registered Continuing Education Program. Credit earned on completion of this program will be reported to RCEP at RCEP.net. A certificate of completion will be issued to each participant. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the RCEP.

Attendance for the entire webinar & a completed evaluation is required for PDH credit to be issued. Partial credit will not be given if you leave the webinar early or do not submit the evaluation.

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Update on Codes, Standards and Certifications for Severe-Duty Louvers and Fire/Smoke Dampers

Purpose and Learning Objectives

The purpose of this webinar is to inform HVAC-industry professionals about changes in codes, standards and technologies involving severe-duty louvers and fire/smoke dampers.

At the end of this presentation you will be able to:

1. Describe the different types of life-safety dampers.
2. Explain the damper-testing requirements outlined in NFPA 80 & 105.
3. Compare the visual and remote test method for life-safety dampers and explain the benefits of remote testing.
4. Explain how AMCA & other key agencies participate in certifying severe-duty louvers.
5. Describe the louver testing requirements established in AMCA 540 & 550.
6. Compare the four building risk categories outlined by IBC in 2012.

Josh Parent

Associate Director, Business Development, AMCA International

AMCA Introduction & CRP

- Joined AMCA in 2001
- Has served AMCA as a lab technician, quality manager and lab manager.
- Responsible for outreach, business development and education, specification review and the AMCA Speakers Network.

The AMCA Mission:

To advance the knowledge of air systems and uphold industry integrity on behalf of AMCA members worldwide.

Advocate

Certify

Educate

Advocacy

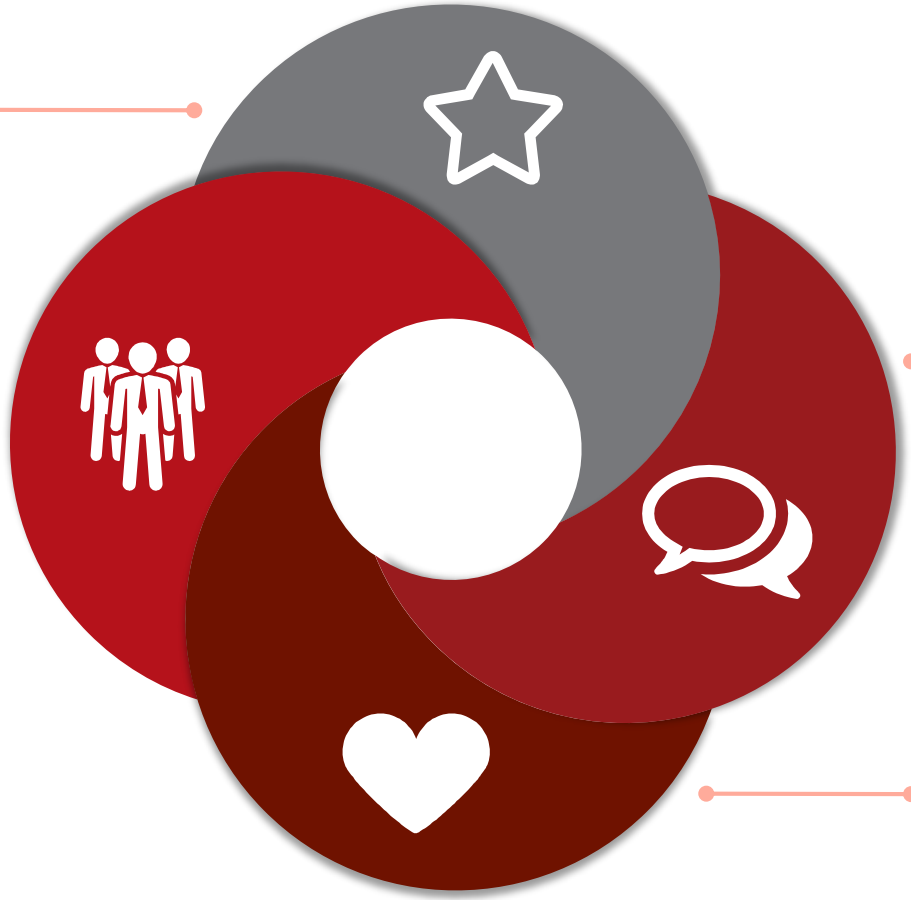
1. Legislative & regulatory
2. Standards development
3. Publications
4. Industry relations

Education

Internally and externally promoting knowledge of air-systems and certification

Curricula development

Tools & conferences



Industry education

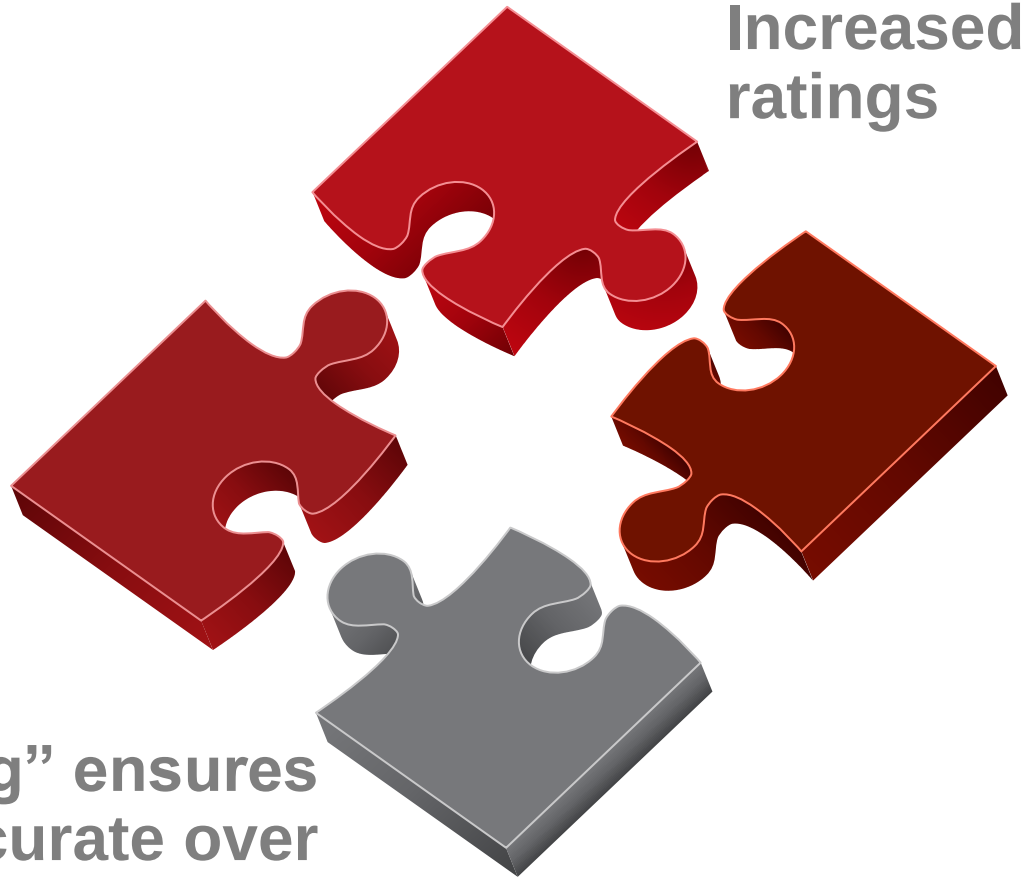
Credits & credentials

Certification

Why specify certified products?

Increased reliability of ratings

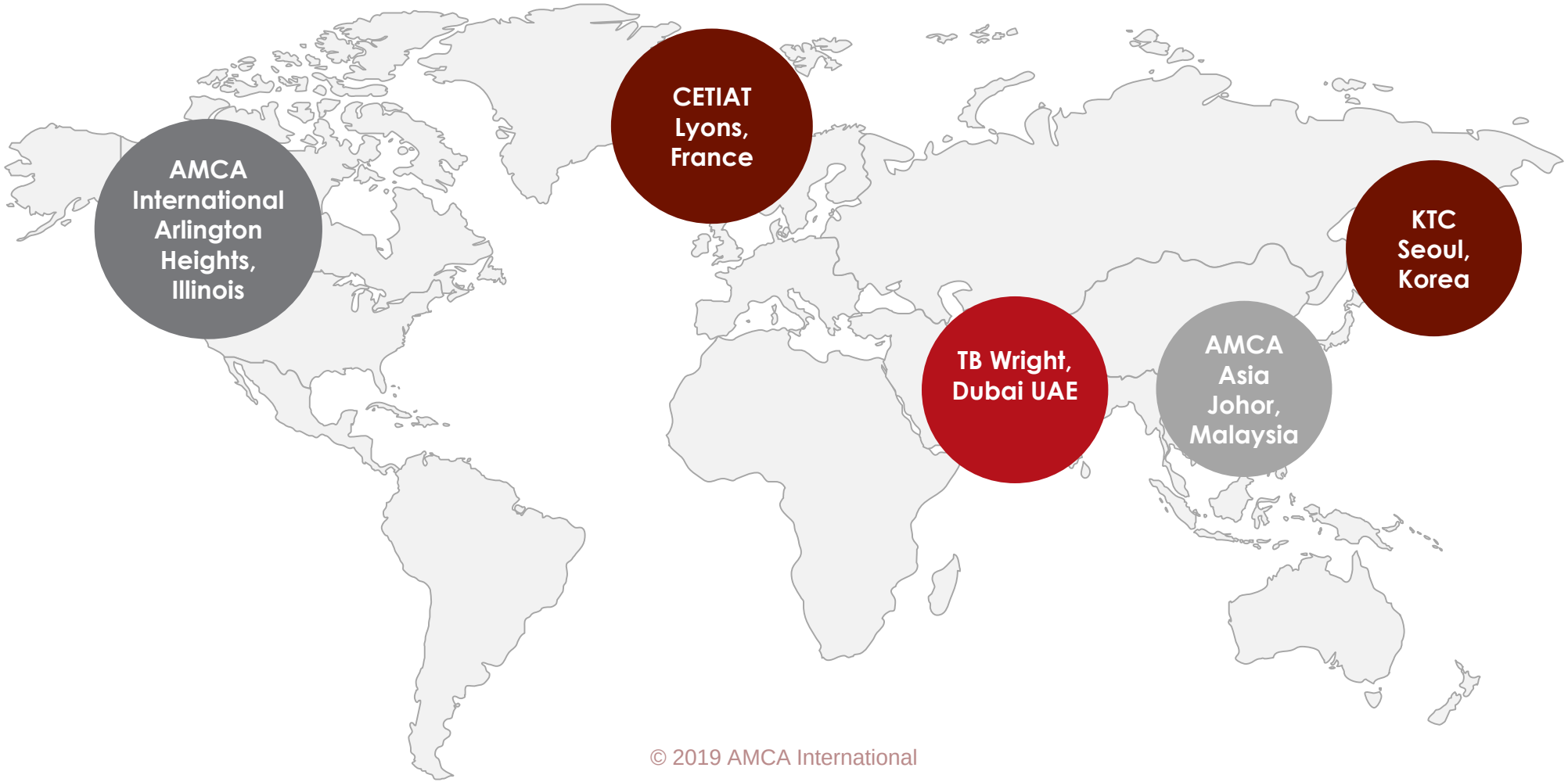
Catalogs are up to date and accurate



Apples-to-apples comparisons

“Check testing” ensures ratings are accurate over time.

AMCA certifying test labs



If you think good design is expensive,
you should look at the cost of bad design.”
–Ralf Speth

Marty Gissel

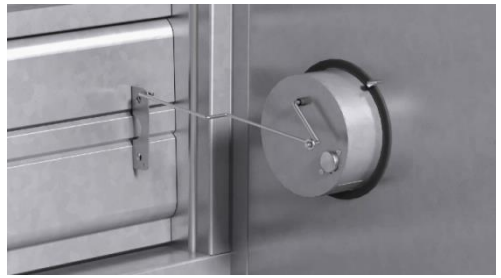
Member, AMCA Fire & Smoke Damper Subcommittee

Remote Testing of Fire/Smoke Dampers

- 22 years of experience in the damper industry
- Member of UL 555 Standards Technical Panel (STP)
- Member of NFPA 80 & 105 Committee
- Member of many AMCA committees: Damper Engineering Committee, ACCARC, Fire Smoke Damper Task Force, AMCA 511, Airflow Measurement Engineering Committee

Presentation Overview

- To understand the different types of life-safety dampers
- To review the codes and standards that are applicable to periodic testing of life-safety dampers
- To understand the requirements of NFPA 80 & 105
- To understand the visual test method
- To understand the remote test method
- To explain the benefits of the remote test method



Fire Dampers

Construction Types

- Curtain
- Multi-blade

Typical Operation

- Fusible Links
- Non-Motorized

Listing Requirements

- To the requirements of UL 555

UL 555

STANDARD FOR SAFETY

Fire Dampers

Smoke Dampers

Construction Types

- Multi-blade

Operation

- Smoke Detector
- No Temperature Response Device
- Actuated

Listing Requirements

- To the requirements of UL 555S

UL 555S

STANDARD FOR SAFETY

Smoke Dampers

Combination Fire Smoke Dampers

Construction Types

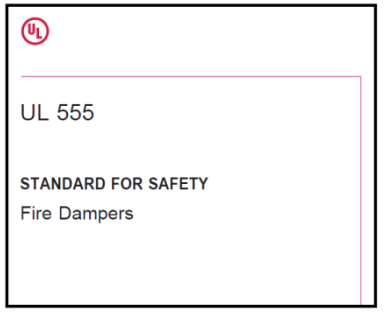
- Multi-blade

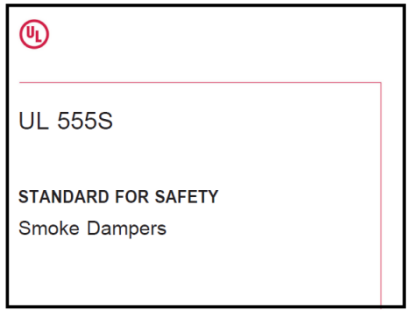
Operation

- Smoke Detector
- Bi-Metallic Disc Thermostat (or fusible link - rare)
- Actuated

Listing Requirements

- To the requirements of UL 555 and UL 555S





Applicable Codes and Standards

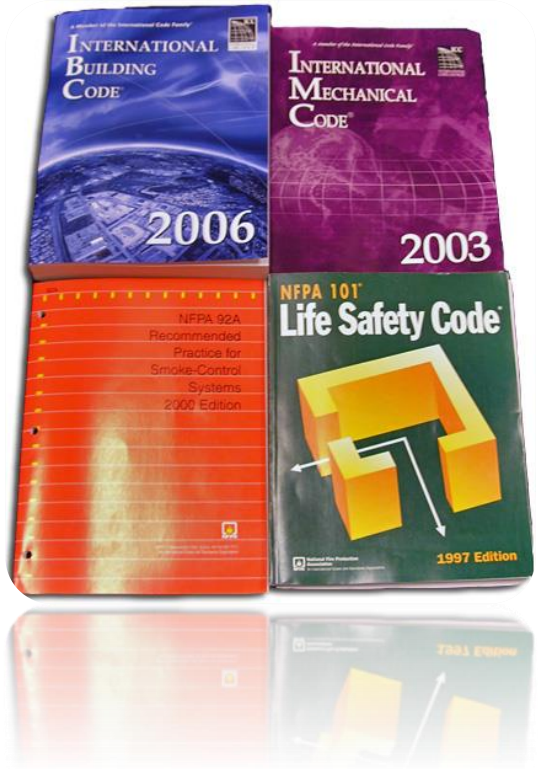
IBC
INTERNATIONAL BUILDING CODE

amca INTERNATIONAL

NFPA
NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

UL
Underwriters Laboratories

IFC

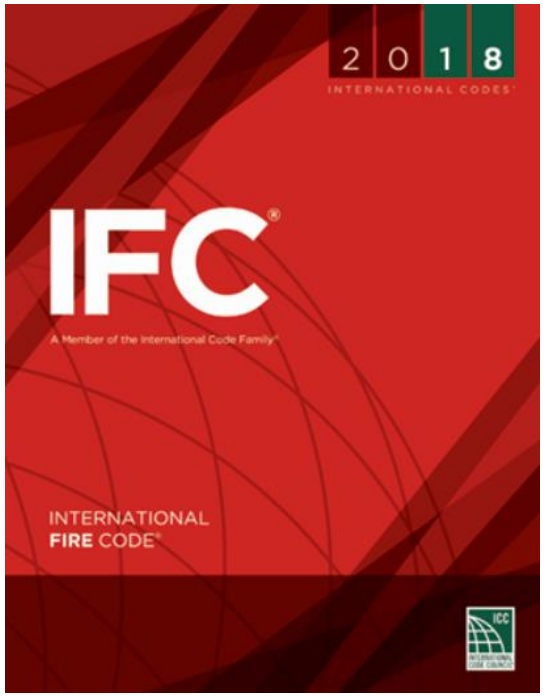


International Fire Code - IFC

International Fire Code (Chapter 7)

"Smoke Dampers shall be maintained in Accordance with NFPA 105"

"Fire Dampers shall be maintained in Accordance with NFPA 80"



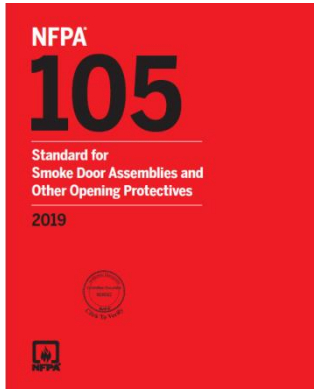
National Fire Protection Association- NFPA

NFPA 80 - Standard for Fire Doors and Other Opening Protectives

- Chapter 19: Installation, Testing, and Maintenance of Fire Dampers

NFPA 105 – Standard for Smoke door Assemblies and Other Opening Protectives

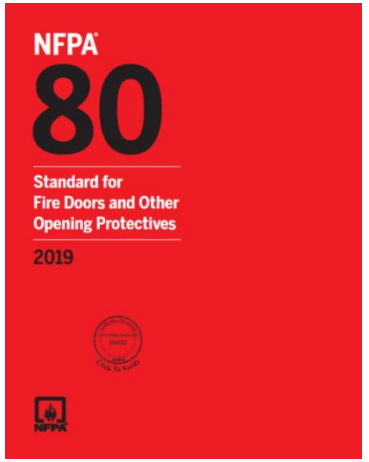
- Chapter 7: Installation, Testing, and Maintenance of Smoke Dampers



NFPA 80 & 105

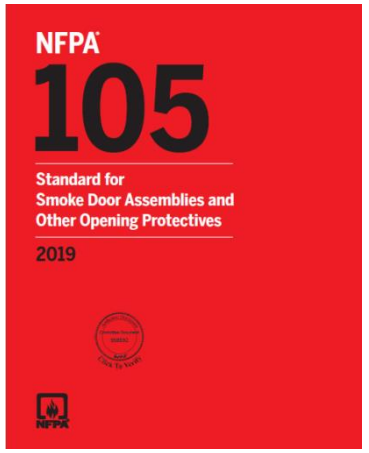
Operational Testing of Life-Safety Dampers

- Conducted after installation
- Verifies that there is unobstructed access to the damper
- Verifies that the damper operates as designed



Acceptance Test of Life-Safety Dampers

- Conducted after construction and balancing of the HVAC system is complete (just prior to turning the building over)
- Confirms proper operation of damper under maximum airflow conditions (for actuated dampers)



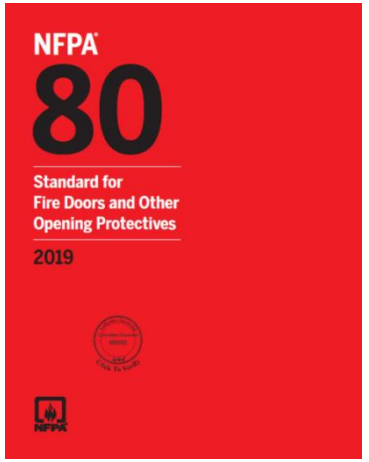
NFPA 80 & 105

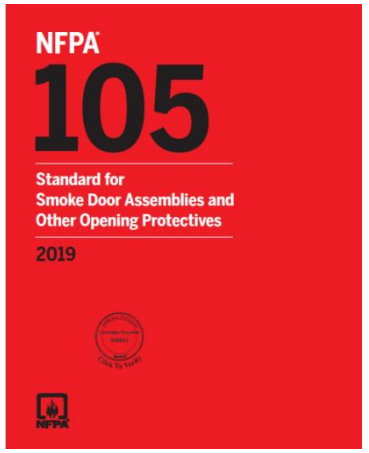
Periodic Testing of Life-Safety Dampers

Frequency

- Each damper shall be tested 1 year after acceptance testing.

- After that the frequency shall be every 4 years, except in buildings containing a hospital, where the frequency shall be every 6 years.



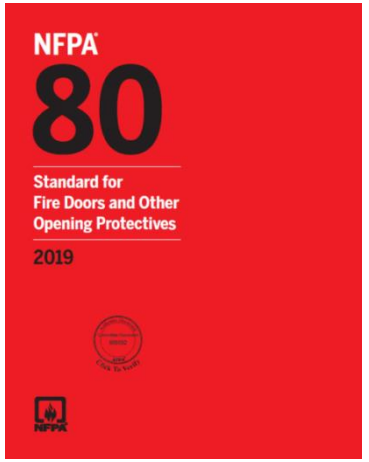


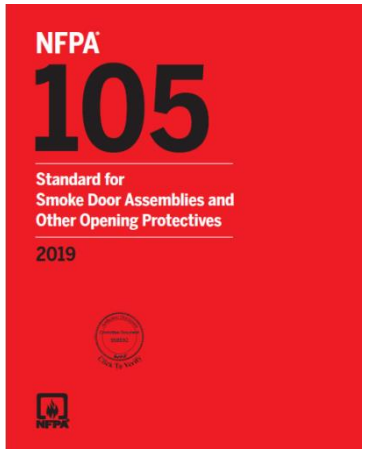
NFPA 80 & 105

Periodic Testing of Life-Safety Dampers

Visual Method

- May be used on all life-safety dampers.
- Is the only option for dampers with a fusible link.
- Requires visual confirmation that the damper closes, and latches (if applicable) as designed.
- For motorized dampers this method requires visual confirmation that the damper reopens as designed.



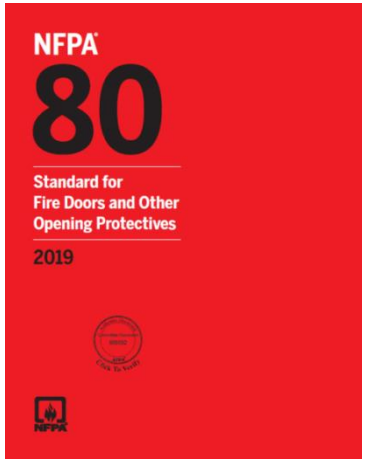


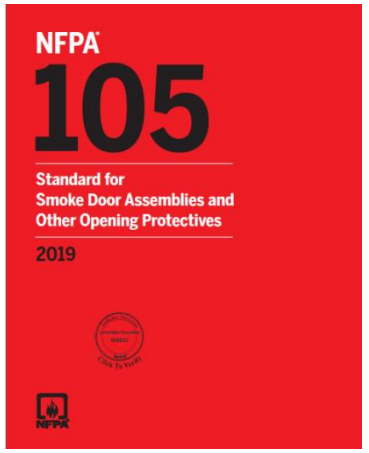
NFPA 80 & 105

Periodic Testing of Life-Safety Dampers

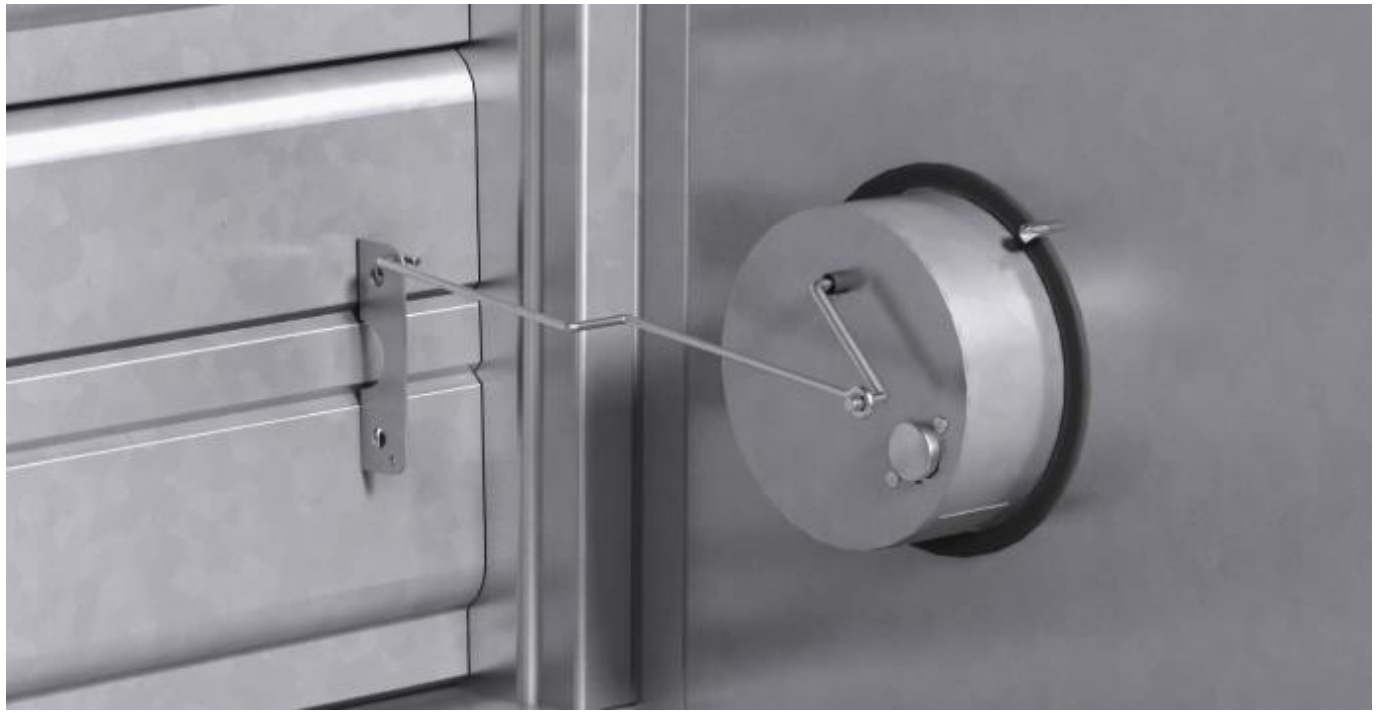
Remote Method

- Can only be used on dampers without fusible links.
- Preconditions for using the remote method:
  - The damper shall have the ability to positively indicate when the damper is fully open and fully closed.
  - Prior to using the remote method a visual inspection must be conducted.
  - The visual inspection must confirm that the position indication method accurately reflects the full-open and closed position of the damper.





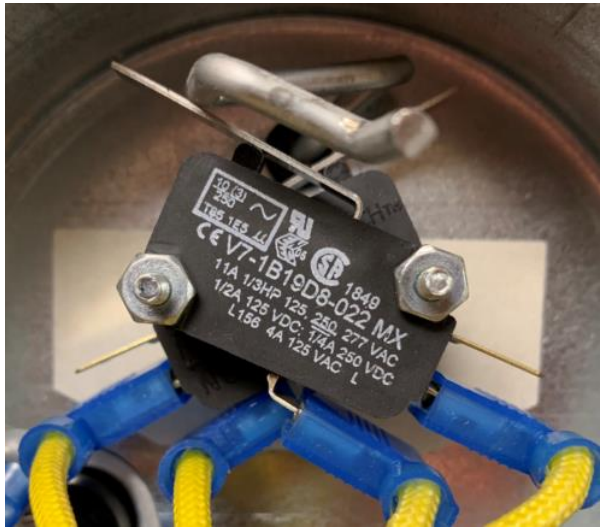
Typical Position Indication Device



Remote Test Method

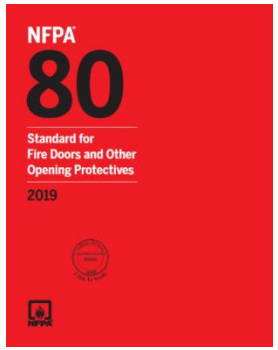
Position Indication Device

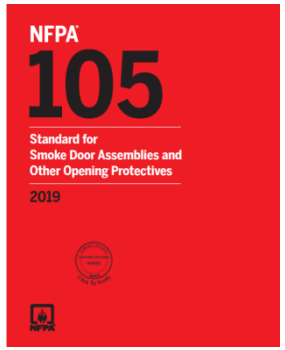
- Most position indication devices use electro-mechanical switches (one to confirm the open position and one to confirm the close position).



NFPA 80 & 105

Periodic Testing of Life-Safety Dampers



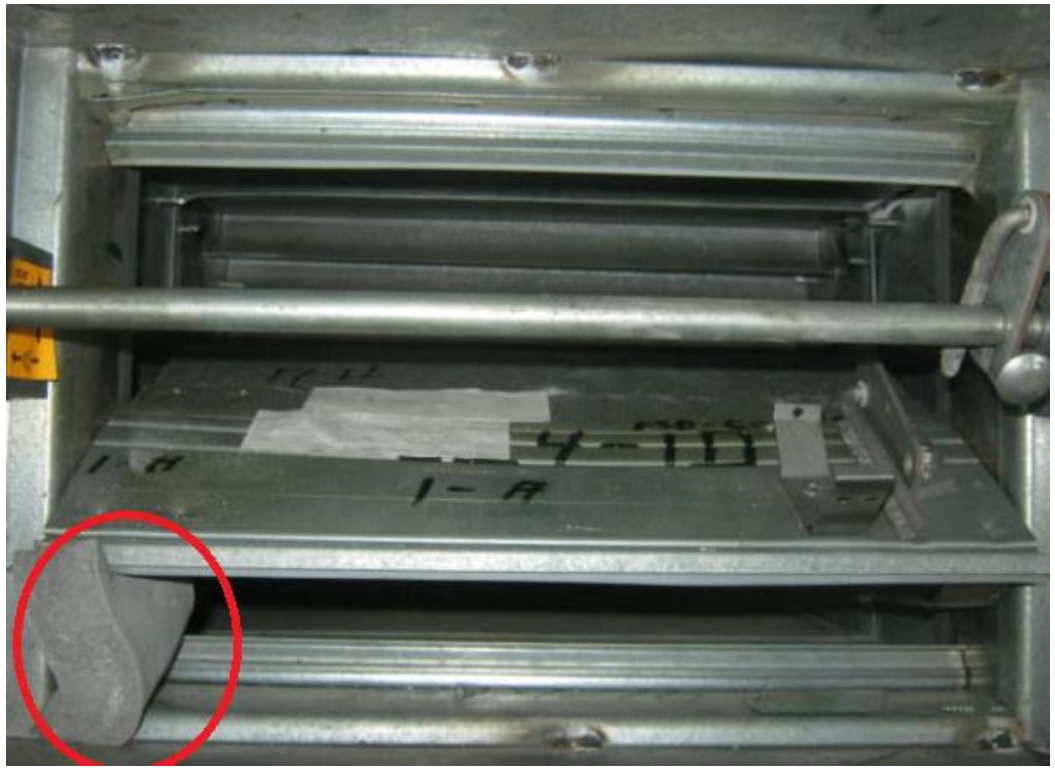


Remote Method

- Use the position indication device to confirm that the damper is fully open.
- Command the damper to the close position and use the position indication device to confirm that the damper reaches the fully closed position.
- Command the damper back to the fully open position and use the position indication device to confirm that the damper returns to the fully open position.
- If any of those steps can not be successfully completed a visual inspection shall be conducted.

Remote Test Method

Example of Typical Obstruction



Remote Test Method

Position Indication

Remote Communication

The damper's position indication device can communicate the damper's position to any one of several devices or system:

Local Indicator Lights

Smoke Control Systems

BACnet™

Building Automation Systems

Remote Test Method

Benefits of the Remote Test Method

Difficult Accessibility

Many life-safety dampers are installed in locations that are difficult to physically get to and can be very difficult to visually see once you do get there.

Remote Test Method

Benefits of the Remote Test Method

Reduced Cost

Accessing life-safety dampers for visual inspections can be very time consuming and can require areas of a building to be unusable during the inspection.

Remote Test Method

Benefits of the Remote Test Method

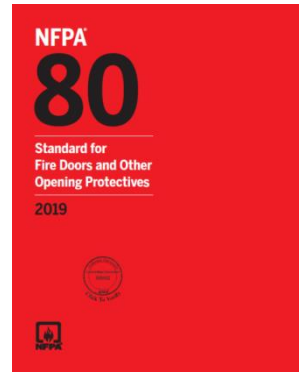
Increased Compliance

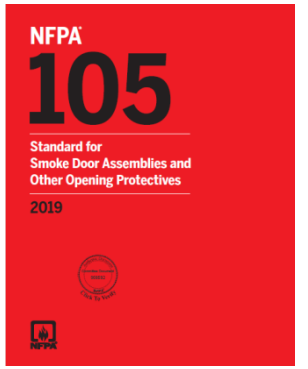
Due to difficult accessibility, high cost and lack of enforcement today code mandated periodic testing is not conducted on many life-safety dampers. The simplicity of the remote test method will result in increased compliance and thus safer buildings.

Periodic Testing of Life-Safety Dampers

Presentation Recap

- Periodic testing of life-safety dampers is mandated by codes.
- NFPA 80 and 105 required periodic testing must be conducted 1 year after acceptance testing then every 4 years except in hospitals where the frequency is every 6 years.
- The visual test method in NFPA 80 and 105 may be used on any life-safety damper.
- As of the 2019 edition of NFPA 80 and 105 dampers without fusible links that have a position indication device may utilize the remote test method.
- The remote test method is especially attractive for dampers in difficult to access locations.





Jim Smardo

Chair, AMCA Louver Marketing Task Force

Severe-Duty Louvers: Rain & Hurricane Resistant

- Held positions in engineering, sales, marketing, estimating, and new-product development since1994, all in louver architecture.
- Has expertly covered all phases of louvers, driving specifications and design-build.
- Actively involved in several AMCA committees.

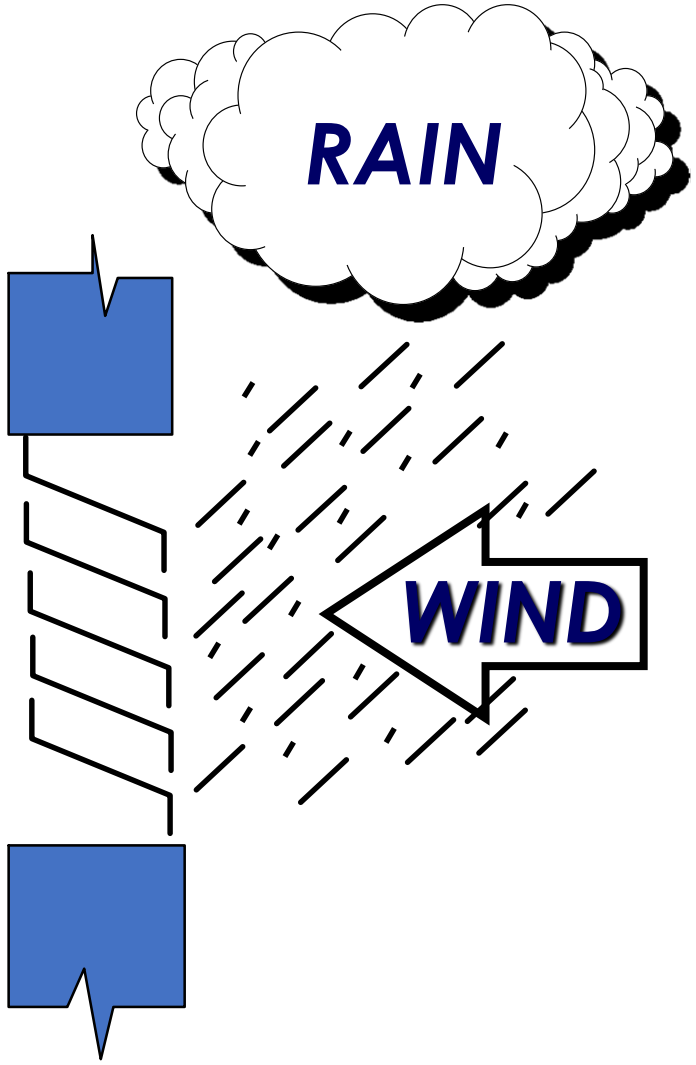
AMCA 500-L

- 500-L consists of five different testing protocols for testing louvers:
  - Pressure Drop
  - Airflow Leakage
  - Water Penetration
  - Wind-Driven Rain
  - Wind-Driven Sand

AMCA 500-L gives you the testing parameters for testing louvers and confirms performance, AMCA 511 was written to give guidance on how to certify the louvers that are tested.

Rain Penetration

- Problems:
  - Generators
  - Electrical
  - Switchgear
  - Mold Growth
  - Ceilings, Drywall
  - Slick Floors
  - Standing water



Traditional Louver Technology

- Design Characteristics:
  - Wide Blade Spacing
  - High Free Area
  - Low Cost
  - Low Pressure Drop
  - Not Effective In Storms

Wind Driven Rain Louver Technology

- Design Characteristics:
  - Close Blade Spacing
  - Lower Free Area
  - Greater Velocities
  - Higher Pressure Drop
  - Effective water rejection in storm conditions

Still Air Test

- Test Conditions:
  - 4” per hour rain - light vertical rain
  - 1250 fpm max free area velocity
  - Approx. 14 mph
  - Tested for beginning point of water penetration based on free area velocity
  - 48” x 48” sample size
  - No screen

AMCA 500-L Wind Driven Rain Test

WIND-DRIVEN RAIN PERFORMANCE – AMCA 500-L WIND-DRIVEN RAIN TEST

Test size is 1m x 1m (39" x 39") core area, 1.05m x 1.08m (41 1/4" x 42 5/16") nominal. Free Area of test louver is 4.86 ft² (.45m²).

Wind Velocity mph (kph)	Rain Fall Rate In./hr. (mm/hr.)	Core Velocity[1] fpm (m/s)	Airflow cfm (m³/min)	Free Area Velocity[2] fpm (m/sec.)	Effectiveness Ratio	Class[3,4]	Discharge Loss Class[5] Intake
29 (46.4)	3 (76)	970 (5)	10,444 (295)	2,149 (10.9)	99.9%	A	2
50 (80.5)	8 (203)	982 (5)	10,570 (298)	2,175 (11.0)	99.8%	A	2

NOTES

1. Core area is the open area of the louver face (face area less louver frames).
   Core Velocity is the airflow velocity through the Core Area of the louver (1m x 1m). 5 m/s is the maximum core velocity utilized in this test.
2. Free Area of test size is calculated per AMCA standard 500-L.
3. Wind Driven Rain Penetration Classes:

Class	Effectiveness
A	1 to .99
B	0.989 to 0.95
C	0.949 to 0.80
D	Below 0.8

4. The EME6625 provides class A performance at all velocities up to and including 5 m/s core velocity.
5. Discharge Loss Coefficient is calculated by dividing a louvers' actual airflow rate vs. a theoretical airflow for the opening. It provides an indication of the louvers' airflow characteristics.

Class	Discharge Loss Coefficient
1	0.4 and above
2	0.3 to 0.399
3	0.2 to 0.299
4	0.199 and below

(The higher the coefficient, the less resistance to airflow.)

6. The AMCA Wind Driven Rain Test is performed in a laboratory environment and incorporates controlled wind, water and system airflow effects. In actual field installations, storms may create conditions not considered by the AMCA test. Penthouse and similar applications where wind can pass through multiple louvers in an enclosure is another condition that is not simulated by AMCA tests. These applications can create elevated water penetration rates through any louver. Because of these uncontrolled situations it is recommended that provisions to manage water penetration through louvers be included in the building design.

amca CERTIFIED RATINGS AIR WIND AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

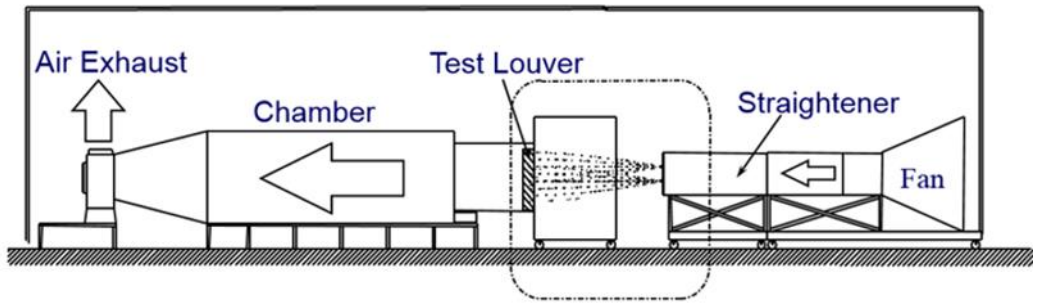
Ruskin Company certifies that the Louver shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings and wind driven rain ratings only.

Class A – 99% to 100% effective

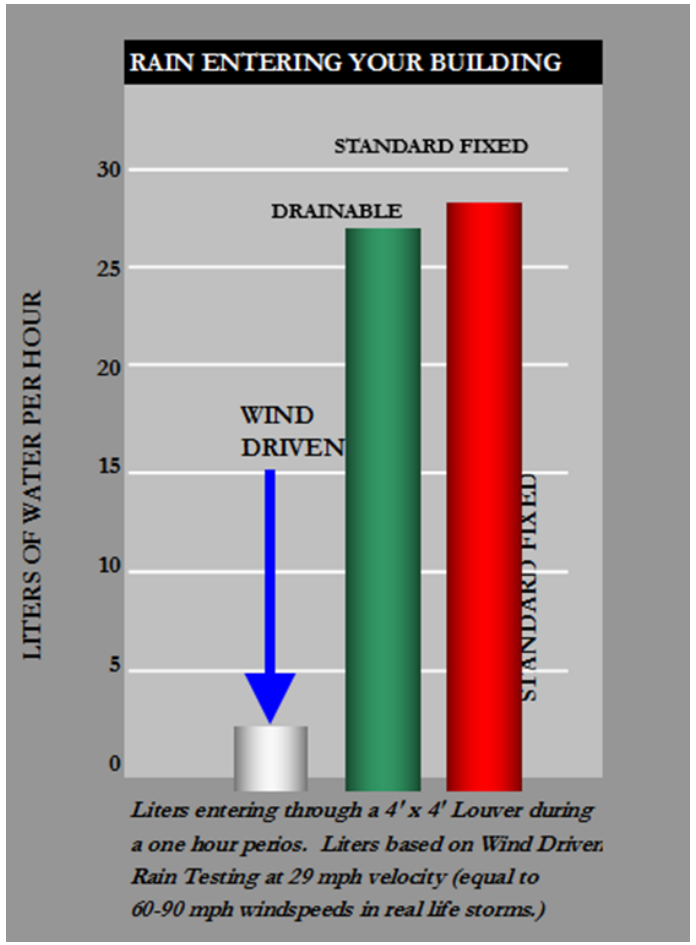
Class B – 95% to 98.9% effective

Class C – 80% to 94.9% effective

Class D – Anything below 80% effective



Still Air vs. Wind Driven Rain (WDR)



AMCA Wind Driven Rain Test

***Based on* Wind Driven Rain test- 3" per hour at 29 mph wind velocity, wind tunnel pulling 1300 FPM**

29 liters = Approximately 7 gallons

Sizing Tips

- Free area not necessarily the most important characteristic.
- Pressure drop generally becomes the limiting factor.
  - Low free area can be offset by low pressure drop.
  - Still air louvers require a 15% to 25% safety factor – WDR louvers do not.
  - At 10,000 CFM a 6" still air louver with 860 fpm fav requires a 48" x 60" louver – A 6" vertical WDR with 2019 fpm fav requires a 42" x 42" louver.
  - A difference of 7.75 sq. ft. face area.

Sizing Louvers – 48" Sq.

6" Horizontal Still Air

- Free Area: 9.08 ft² - 57%
- F.A. Vel.: 870 fpm
- Volume: 7,900 cfm
- .13" Δp
- No WDR resistance
- Best Still Air 65% @ 3" 29 mph

6" Vertical WDR

- Free Area: 6.80 ft² - 43%
- F.A. Vel.: 2175 fpm
- Volume: 14,790 cfm
- .35" Δp
- 99.8% Rain Resistance (50 mph/8" hr.)
- *87% More Volume!*

Organizations associated with Florida & Coastal codes for louvers

Miami-Dade
http://www.miamidade.gov/building

ICC
http://www.iccsafe.org/

AMCA
https://www.amca.org/

Florida Building Code
https://floridabuilding.org

Texas Department of Insurance
https://www.tdi.texas.gov

What Started the Code Requirements in Florida?

- Hurricane Andrew made landfall in South Florida in August of 1992.
- Only one of three hurricanes to hit land while still a Category 5 Hurricane.
- 165 mph winds sustained/over 200 mph wind gusts.
- $26.5 Billion in damage –$50 Billion in Today's Dollars!

International Code Council (ICC)

- Standards for construction:
  - No testing protocols
  - Does reference AMCA 540/550 for coastal regions along the Atlantic and gulf coast

IBC 2012 Building Code Language

IBC 2012 Building Code

Chapter 16: Structural Design

1609.1.2.1 Louvers. (*as it pertains to the Wind-Borne Debris Region*)

"Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144mm) of grade shall meet the requirements of **AMCA 540**."

AMCA Testing Standards - 540

- AMCA 540
- Pass/Fail Criteria
- No penetration of the blade material by the excepting fragments
- Fragments produced by the missile shall not exceed five percent of the missile's weight.
- Louver must remain attached to adjacent parts or components.

AMCA Testing Standards - 540

- AMCA 540
  - Minimum of three specimens impacted
    - Requires the minimum and maximum sections to be tested
    - Can be one single-section and one multi-section

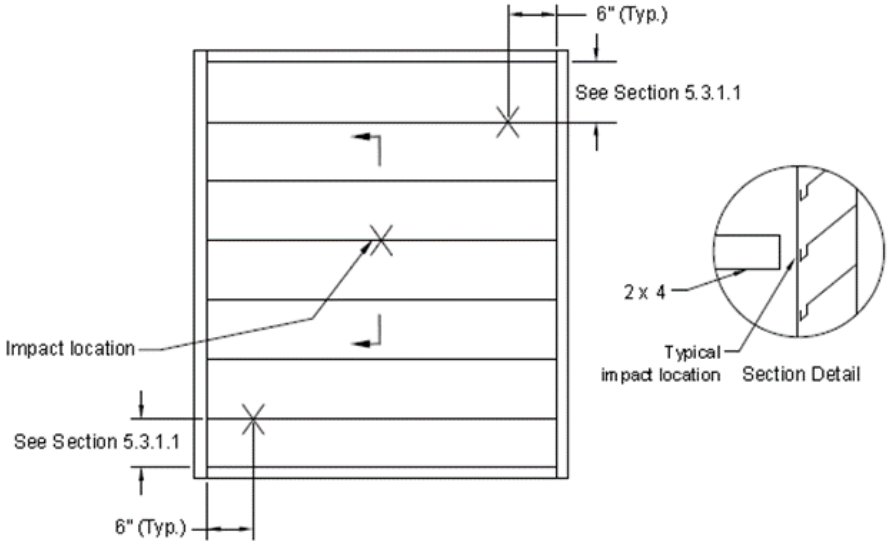


Figure 1
Impact Locations for Testing Single Section, Horizontal Blade Louver

Horizontal

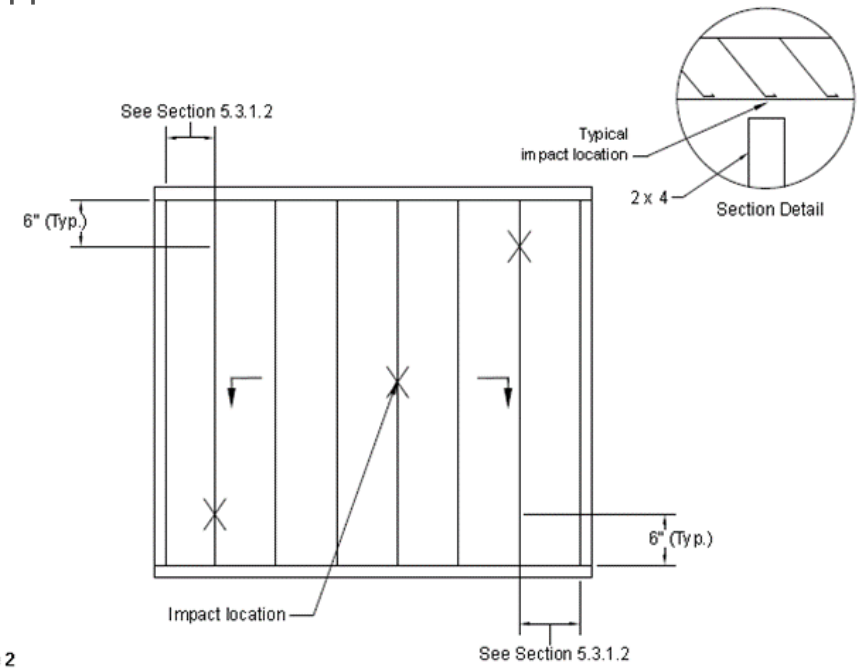
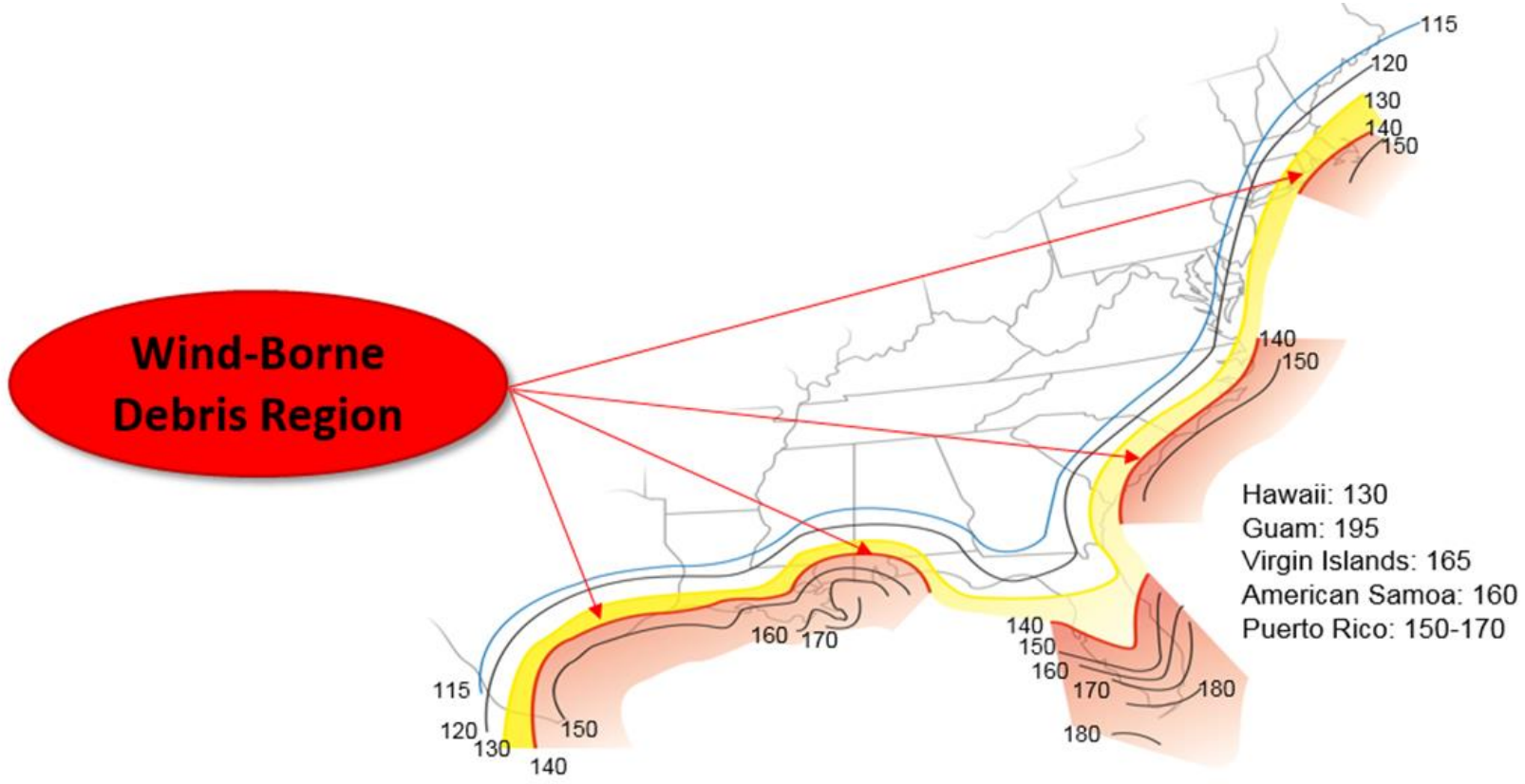


Figure 2
Impact Locations for Testing Single Section, Vertical Blade Louver

Vertical

IBC 2012

- Building Risk category I & II



Risk Categories of Buildings and Other Structures

- **Category I**
  - Buildings and structures that represent a low hazard to human life in the event of failure.
  - Wind velocity (3-second gusts) used in calculations are 165 mph (Miami-Dade) and 156 mph (Broward).
  - Examples include, but are not limited to:
    - Agricultural facilities
    - Certain temporary facilities
    - Minor storage facilities
    - Screen enclosures

Risk Categories of Buildings and Other Structures

- **Category II**
  - Buildings and other structures except those listed in Risk Categories I, III, and IV.
  - Wind velocity (3-second gusts used in calculations are 175 mph (Miami-Dade) and 170 (Broward).
  - Examples:
    - Typical business with occupancy load less than 300
    - Non-essential facilities

Risk Categories of Buildings and Other Structures

- **Category III**
  - Buildings and other structures that represent a hazard to human life in the event of failure.
  - Wind velocity (3-second gusts) used in calculations are 186 mph (Miami-Dade) and 180 mph (Broward).
  - Examples include, but are not limited to:
    - Buildings or structures whose primary occupancy is public assembly with an occupant load greater than 300
    - Buildings or structures containing elementary schools, secondary schools or day care facilities with an occupant load greater than 250
    - Adult education facilities such as colleges and universities with an occupant load of greater than 500
    - Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities, and other public utility facilities not covered by Category IV
    - Occupancies with occupant loads of 50 or more resident patients but not having surgery or emergency treatment facilities

Risk Categories of Buildings and Other Structures

- **Category IV**
  - Buildings and other structures designated as **essential facilities**.
  - Wind velocity (3-second gusts) used in calculations are 186 mph (Miami-Dade) and 180 mph (Broward).
  - Examples include, but are not limited to:
    - Fire, rescue, ambulance and police stations
    - Emergency treatment facilities
    - Designated earthquake, hurricane or other emergency shelters
    - Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures
    - Aviation control towers, air traffic control centers, and emergency aircraft hangers
    - Buildings critical for national defense
    - Water storage facilities and pump structures required to maintain water pressure for fire suppression

IMC 2012 Building Code Language

2012 International Mechanical Code

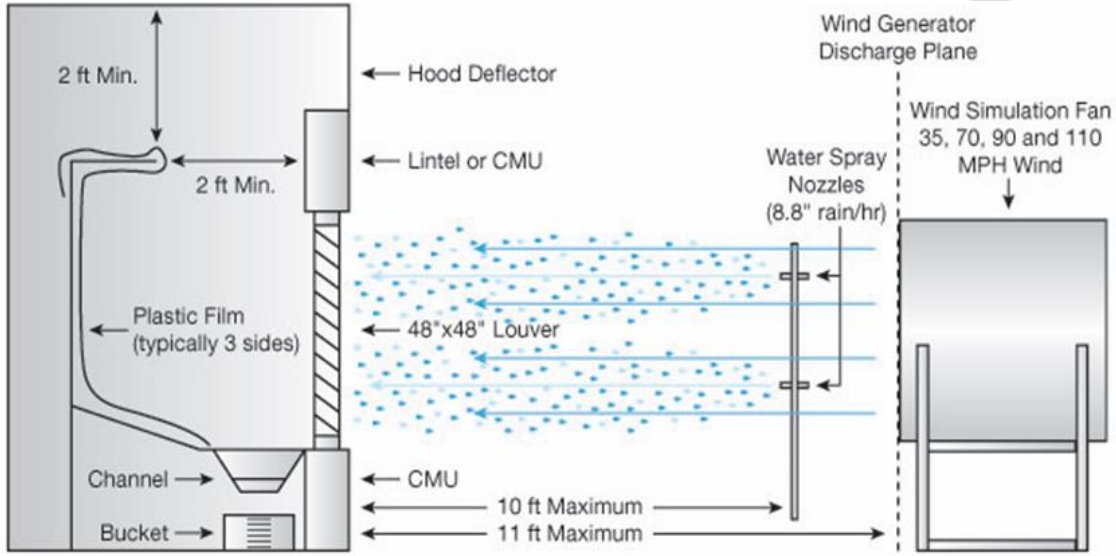
Chapter 4: Ventilation

401.5 Intake opening protection

"Louvers that protect air intake openings in structures located in the hurricane-prone regions, as defined in the International Mechanical Code, shall comply with **AMCA 550**."

AMCA 550 Test Method for Hurricane Louvers

- AMCA 550
  - Water shall be supplied to the wind stream using a sprinkle pipe system simulating a uniform 8.8 inches/hour (223.5 mm/hour) over the test specimen.
  - Eight intervals of testing:
    - Five to fifteen minutes
    - Wind Speeds from 0 mph to 110 mph
  - Pass/Fail is determined by whether or not the louver exhibits water infiltration in excess of 1% of the total water sprayed.



Interval	Wind Speed	Duration	Water Spray
1	35 mph	15 min	On
2	0 mph	5 min	Off
3	70 mph	15 min	On
4	0 mph	5 min	Off
5	90 mph	15 min	On
6	0 mph	5 min	Off
7	110 mph	5 min	On
8	0 mph	5 min	Off

amca INTERNATIONAL LISTED
550 HIGH VELOCITY
RAIN RESISTANT
WITH BLADES FULLY OPEN
See www.AMCA.org for all certified or listed products
This label does not signify AMCA airflow performance certification.

How do I identify louvers that are AMCA 540/550 listed?

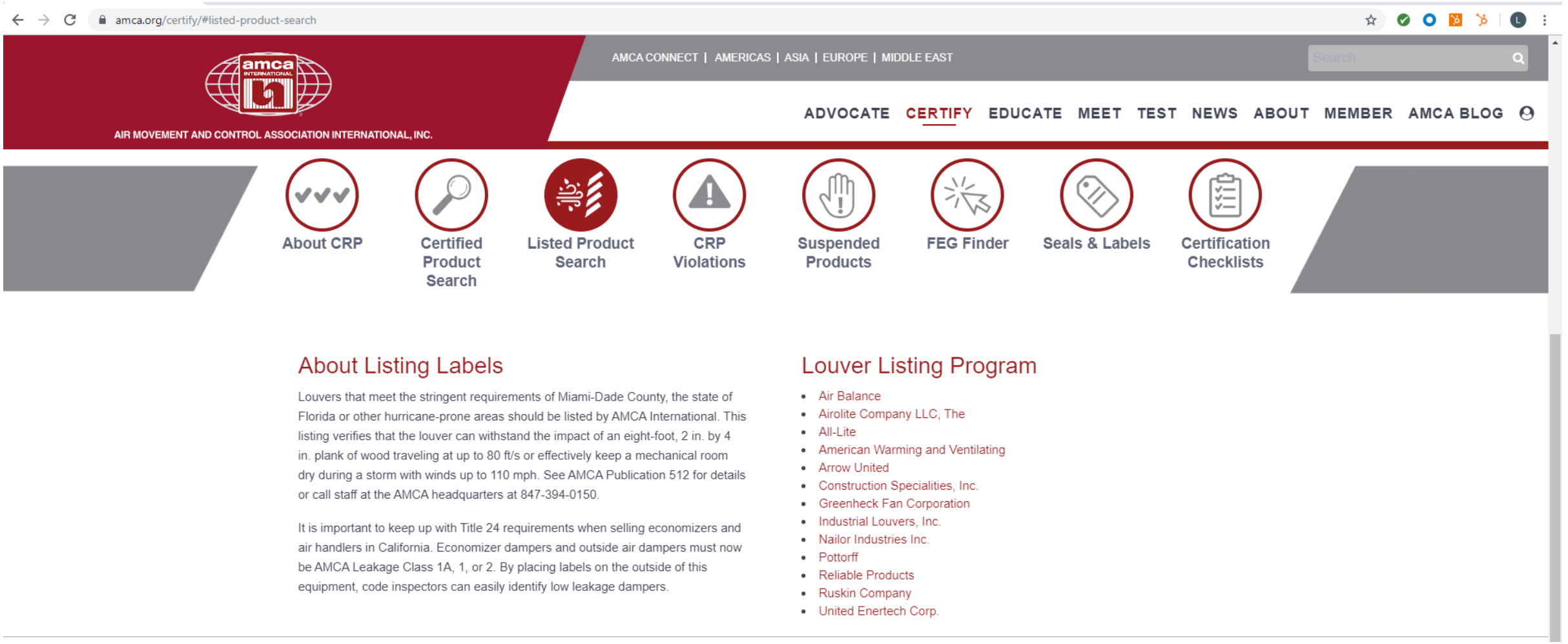
Cat I, II, and III buildings and structures

Cat IV buildings and structures

Cat I, II, III, and IV buildings and structures

- **Not a requirement for Miami-Dade for FBC 2014**
- **Listing adds credibility to the testing conducted on the louver**

Searching for AMCA 540/550 Louvers



Source: https://www.amca.org/certify/#listed-product-search

Summary

- Traditional louver's offer high FA and low pressure drop but do not provide WDR performance.
- WDR louvers stop water penetration and allow greater FA velocities.
- WDR allows for smaller footprint of louver sizes.
- WRD louvers do not require a safety factor.
- ICC is a guideline for building codes but does not mandate testing.
- Agencies such as AMCA, FBC, and Miami-Dade all participate in certifying louvers.
  - Miami Dade
    - NOA for acceptable louver products
      - Based on calculations supplied and testing data
  - AMCA
    - 540 (basic and enhanced impact test)
    - 550 High velocity wind driven rain test
  - FBC – 2017
    - AMCA 540
    - AMCA 550

Resources

- **AMCA International:** *www.amca.org*
- **2019 *AMCA inmotion*:** *http://bit.ly/AMCAinmotion2019*
  - > Remote Periodic Testing of Life-Safety Dampers
  - > Improving Building Resilience with Severe-Duty Louvers
- **AMCA White Paper**: *Understanding the ANSI/AMCA Standard 500-L Tests*
- **AMCA 511 Publication**– *Certified Ratings Program- Product Rating Manual for Air Control Devices* (free PDF download): *www.amca.org/store*
- **AMCA 540 & 550 Standards**– Available for purchase: *www.amca.org/store*

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If you viewed the webinar as a group and only one person registered for the webinar link, please email Lisa Cherney (lcherney@amca.org) for a group sign-in sheet today. Completed sheets must be returned to her by tomorrow, October 24.

PDH credits and participation certificates will be issued electronically within 30 days, once all attendance records are checked and online evaluations are received.

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