AABC Commissioning Group

AIA Provider Number 50111116

Tracking Standards Developments and Best Practices in HVAC Air Distribution Systems

Course Number: CXENERGY1706

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April 26, 2017

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Course Description

This presentation reviews key updates to the ASHRAE 189.1 Standard impacting air duct performance, ASHRAE SPC 215's work to determine leakage airflow and fractional leakage of operating HVAC air distribution systems, a case study on resolving air duct leakage in Florida multi-family condo complexes, and reviews best practices related to ductwork testing, installation and repair.

Learning Objectives

At the end of the this course, participants will be able to:

1. Understand the implications of the updated ASHRAE 189.1, Standard for the design of High-Performance Green Buildings on air duct performance.

2. Understand how “fractional” measurement of duct leakage differs from current forms of measurement.

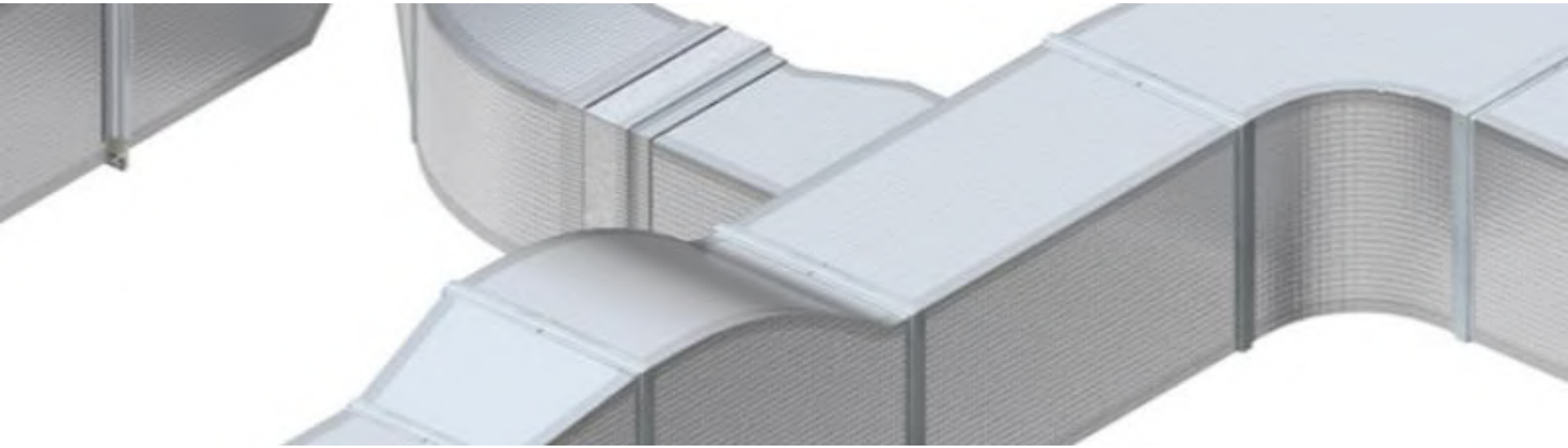
3. Learn methods and best practices associated with duct repair.

4. Understand the challenges associated with resolving air duct leakage problems in the multi-family condo environment.

Overview

1. Air duct tightness and testing standards
2. The “Hole Truth” about U.S. buildings
3. Best practices in air duct remediation

Air Duct Tightness And Commissioning

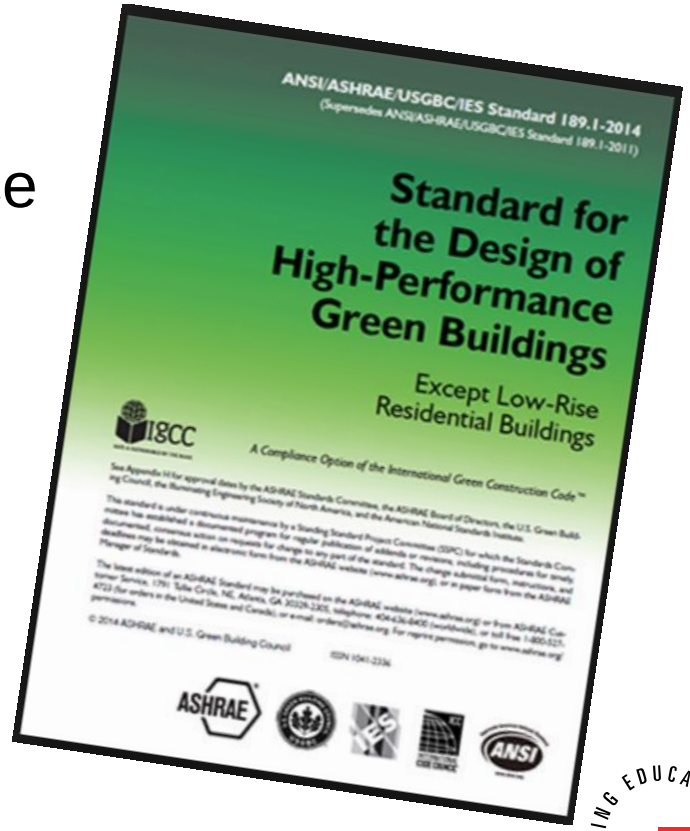


ASHRAE 90.1, IECC, IGCC And Duct Leakage

- Test ducts operating at >3 inWG
- Test no less than 25% of the surface of the duct
  - ✓ Retest 50%
  - ✓ Second test 100%

ASHRAE 189.1 And Duct Leakage

- Test ducts operating at >2 inWG
- Test no less than 25% of the surface of the duct
- Public review

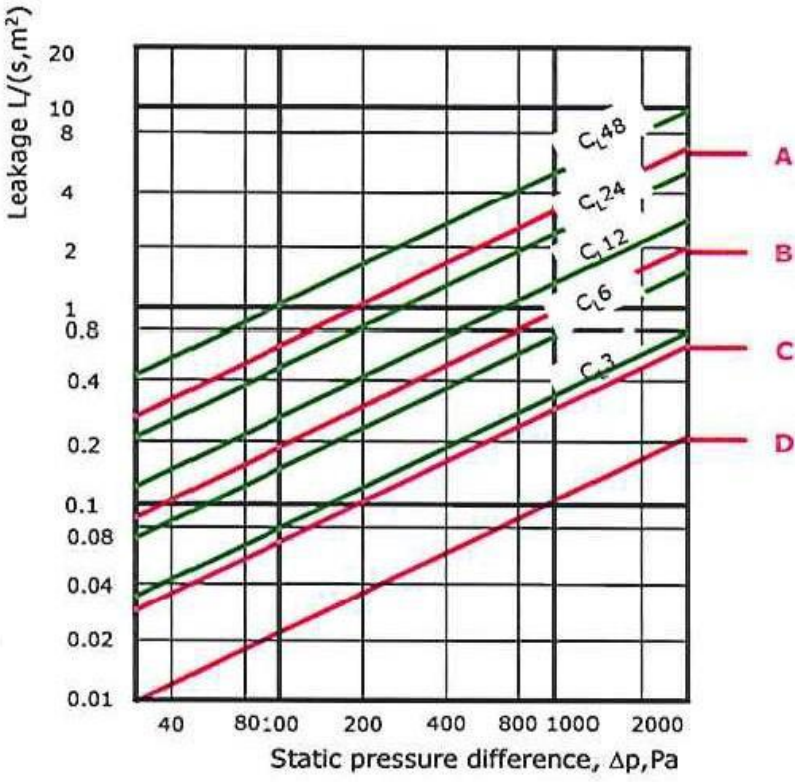


California Title 24

- Energy Commission's energy efficiency standards
- Proposal for future standards for commercial properties include duct leakage testing
- Possible outcomes:
  - Mandate maximum leakage rates
  - Incentives for exceeding min. levels
  - Credits for exceeding current leakage levels

Europe Test Criteria

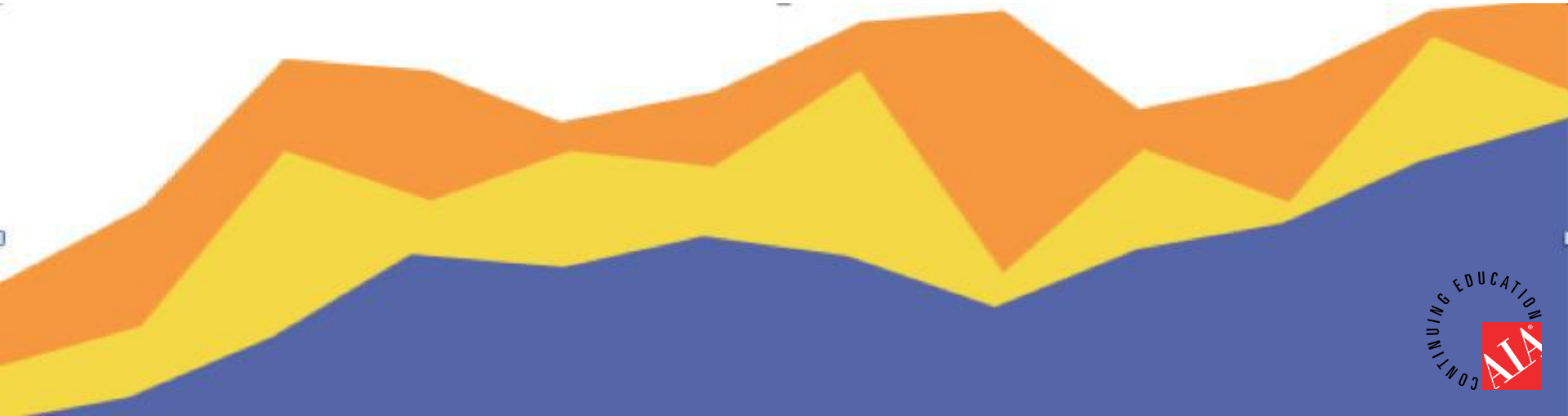
- Testing required on duct pressure classes above 0.8 inWG (200 Pa)
  - UK: no testing required on low and medium pressure ducts
- Test 10%
- Recommended procedure:
  - If fail: retest + additional 10%
  - If 2nd fail: 100% test



* EU 12337 Strength And Testing Of Circular Metal Ducts

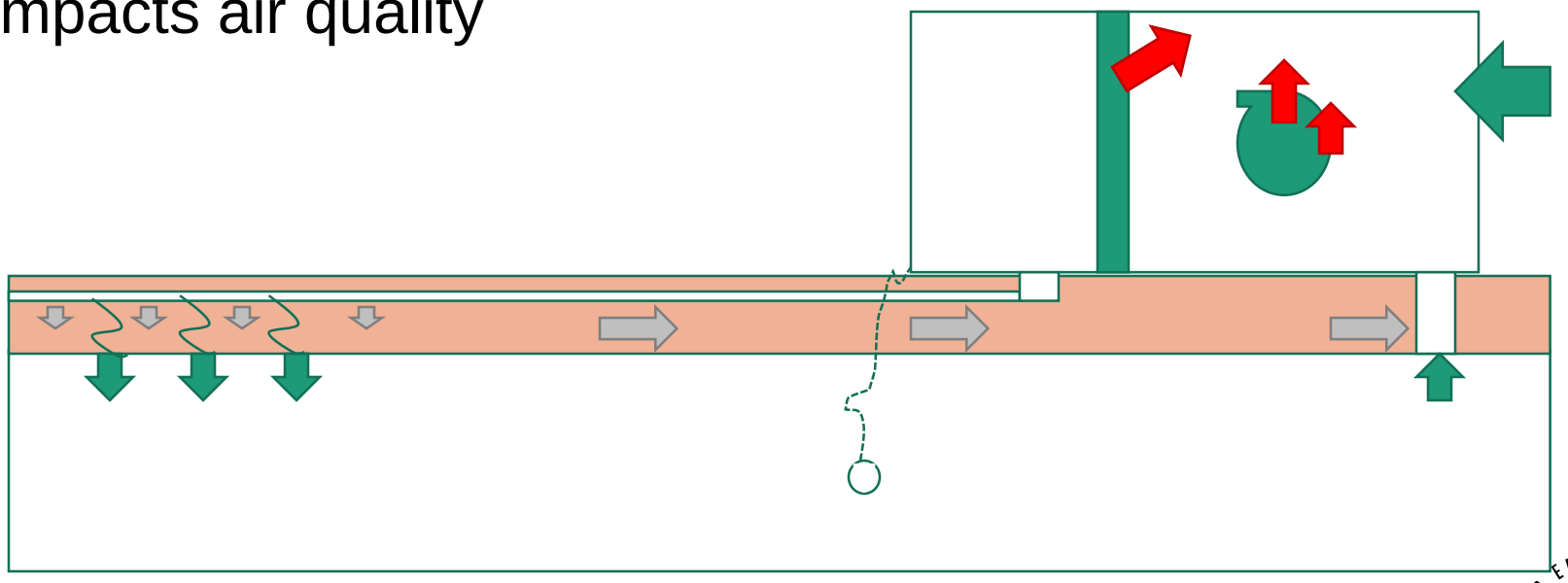
Emerging Trends

- Less allowable leakage
- Higher percentage of duct tested
  - Low and medium pressure testing
  - 25-50-100



What Happens When Ducts Leak

- Supply duct leakage short circuits system
- Longer to satisfy temp
- Building and zone pressurization impacts air quality



The Cost of Top 10 Building Faults

	Annual Cost
Duct Leakage	$2.9B
HVAC left on when unoccupied	$1.9
Lights left on when unoccupied	$1.7
Airflow not balanced	$0.7
Improper refrigerant charge	$0.7
Dampers not working properly	$0.5
Insufficient evaporator airflow	$0.3
Improper controls set up	$0.2
Control component failure	$0.2
Software programming errors	$0.1

Source: Building Commissioning: A Golden Case For Reducing Energy Costs , E Mills, 7/09

Leaks and Energy Waste

FEMP
Federal Energy Management Program

Top energy saving opportunities

Technologies	Score
Condensing Boilers	86
Commercial ground source heat pumps	66
Duct Sealants	63
Water Cooled Oil Free Magnetic Bearing Compressors	54

Fact: Air Ducts Leak

- Light commercial duct leakage is typically 30% or more [1]
- On average, 10-20% of air provided by supply fans does not reach the occupied space [2]
- 75% of commercial duct systems leak 10-25% [3]

Sources:

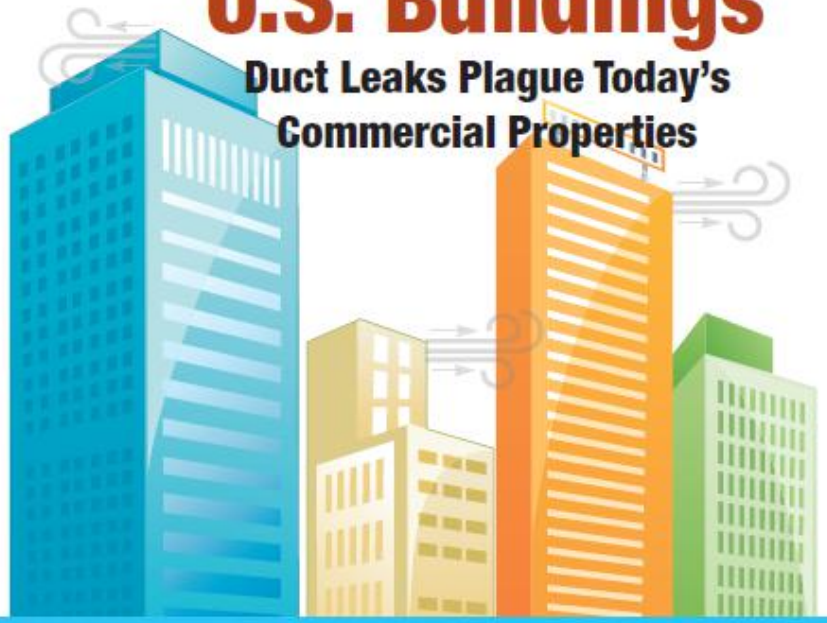
(1) Florida Solar Energy Center, California Energy Commission Studies

(2) Lawrence Berkeley Nat'l. Laboratory Studies

(3) ASHRAE Handbook, Duct Design Manual

The Hole Truth About U.S. Buildings

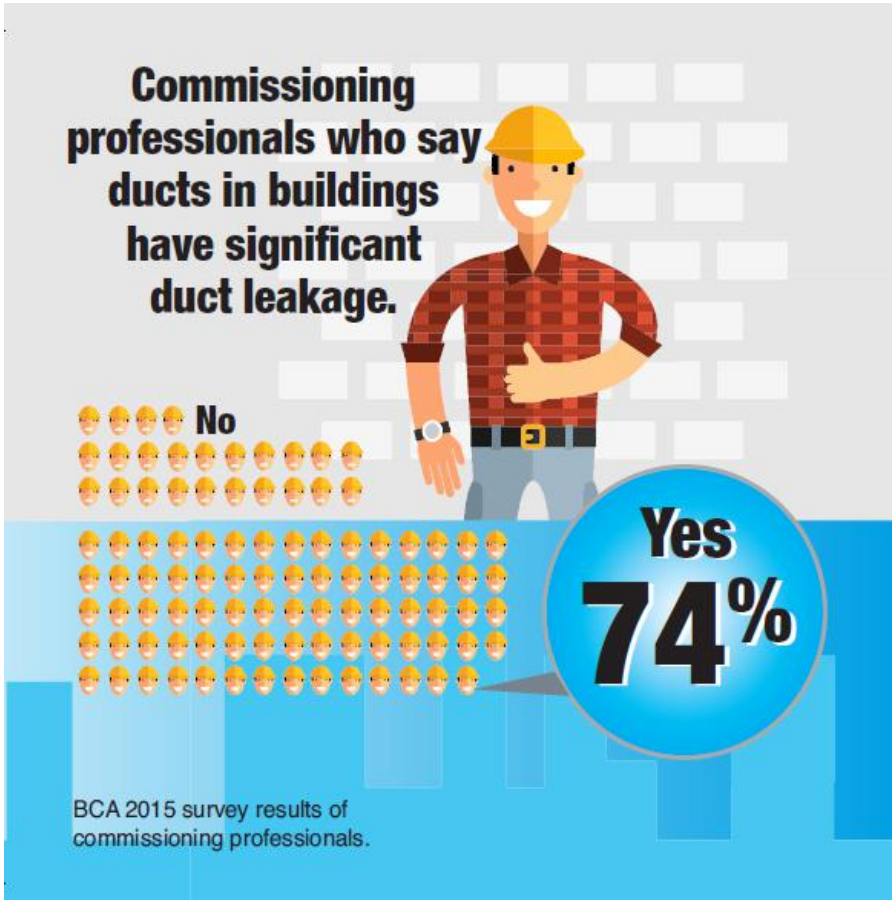
Duct Leaks Plague Today's Commercial Properties



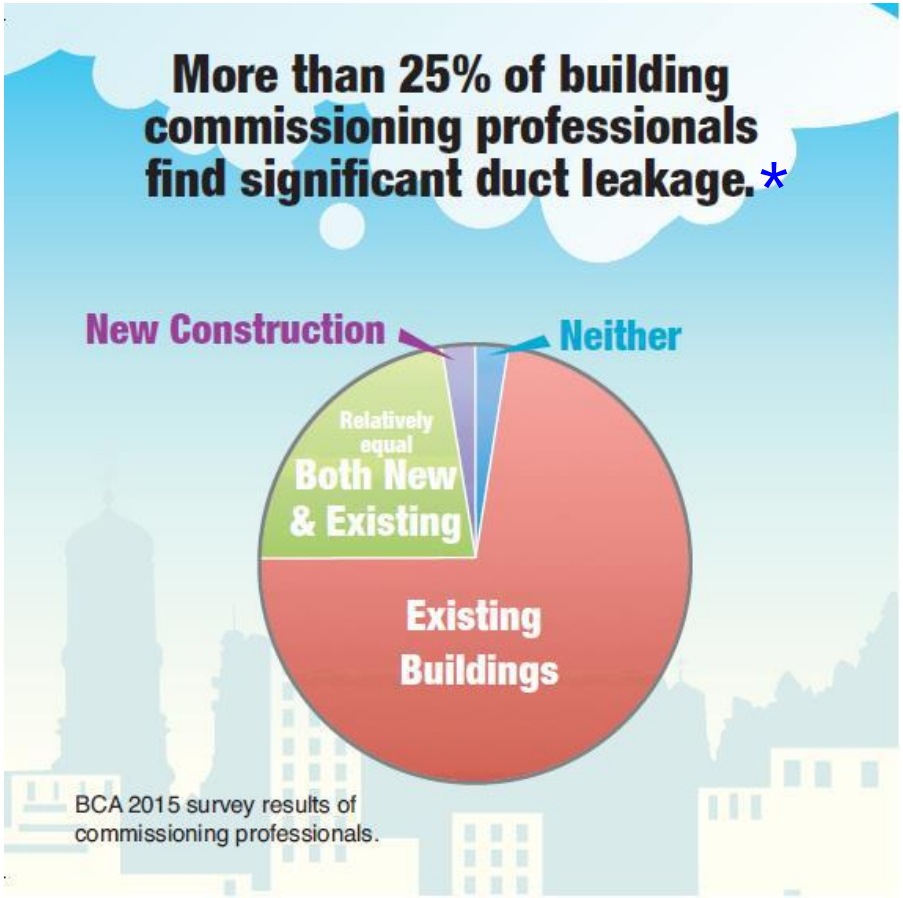
Survey results from building commissioning professionals nationwide conducted by the Building Commissioning Association (BCA)

The Hole Truth about U.S. Buildings

The Hole Truth about U.S. Buildings

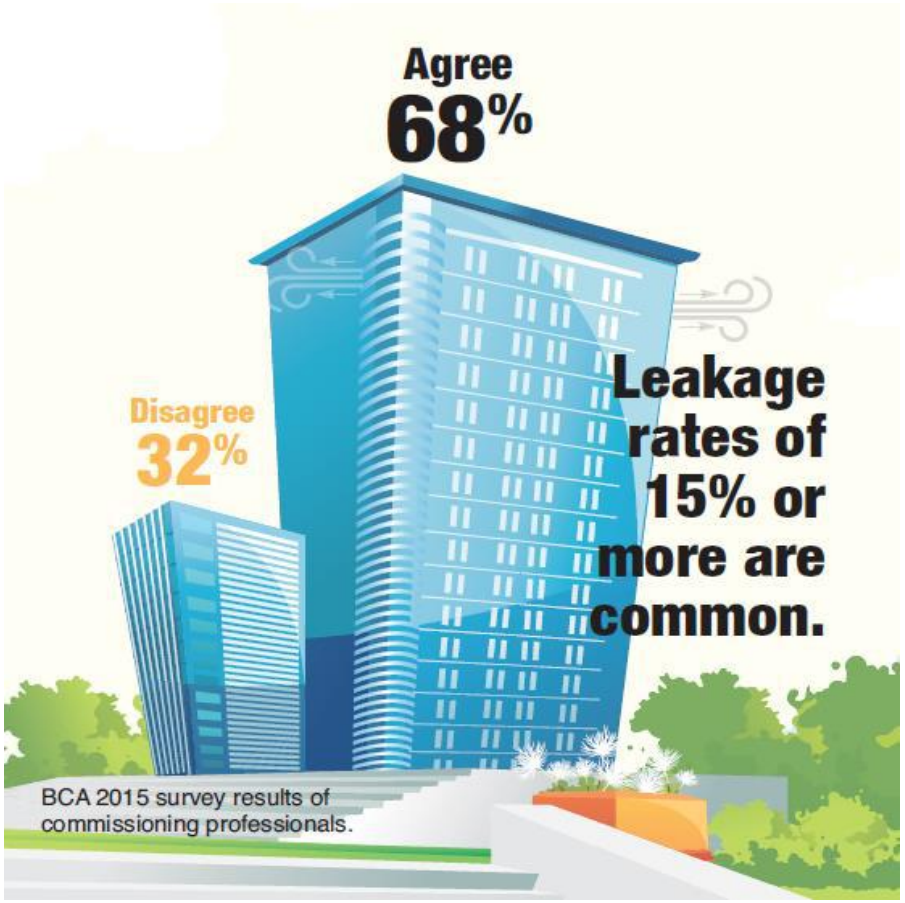


The Hole Truth about U.S. Buildings

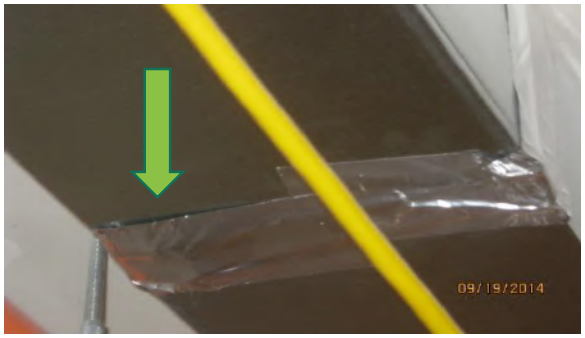


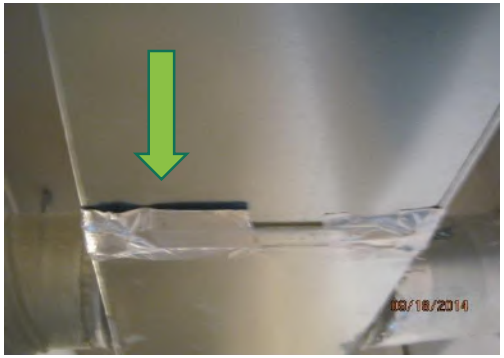
* 55% find leakage rates of 15%+ somewhat common

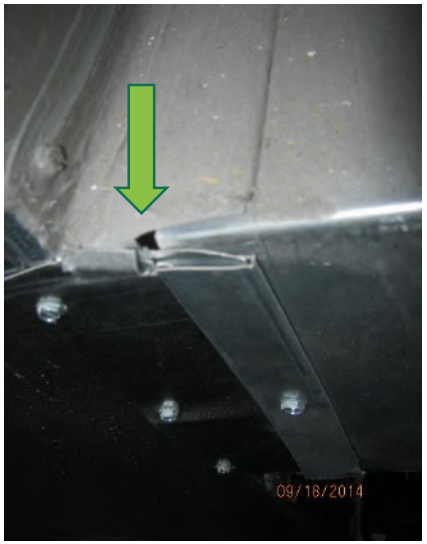
The Hole Truth about U.S. Buildings

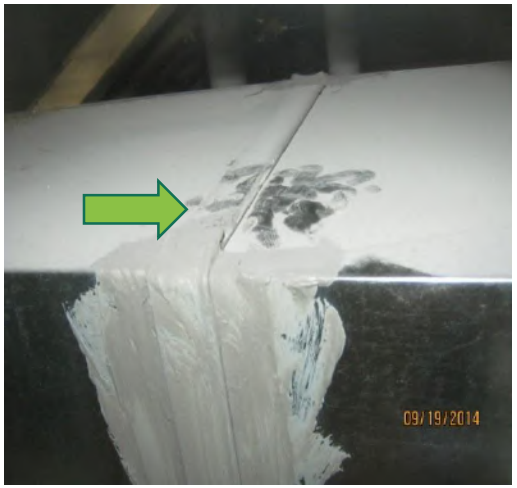


The Problem



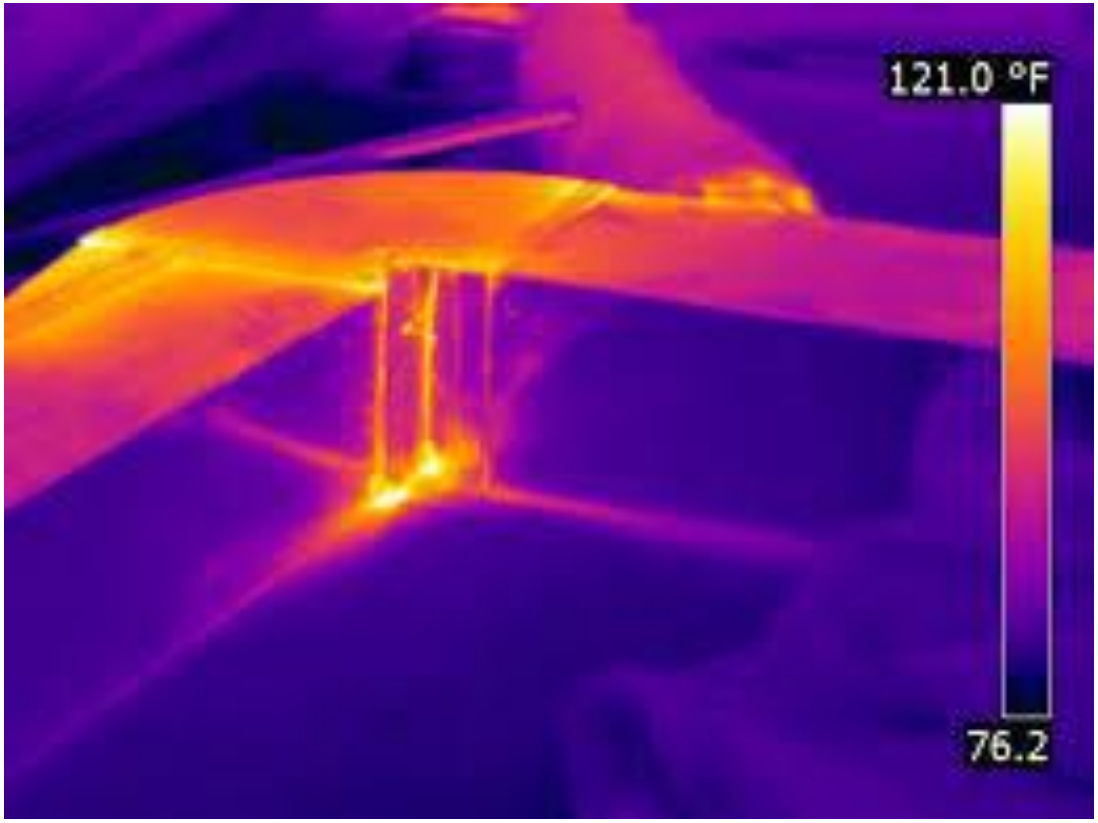






The Problem

Infrared photo of typical air duct



The Problem

Leaks are hard to find..

The Problem

Leaks are hard to find…and harder to access.

Expensive

Disruptive

Time / labor intensive

SO IT'S SIMPLY BEEN IGNORED

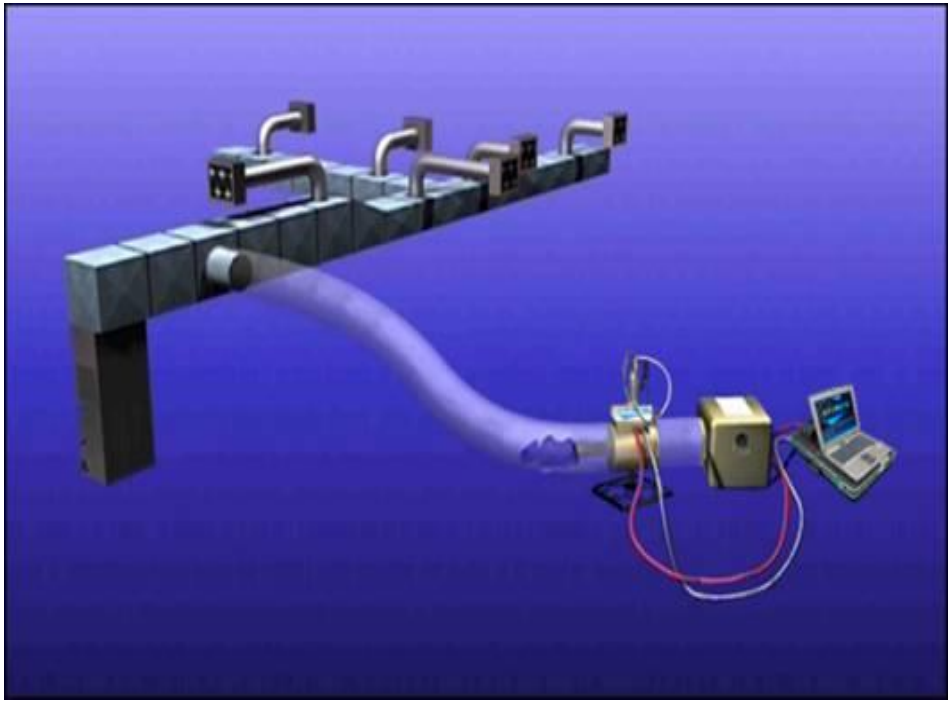
The Problem

Mission:

Easy access to entire duct system
Effective sealing / long lasting
Cost-effective / high ROI
Non-toxic
Ensure results

The Solution

Aerosol- based duct sealing

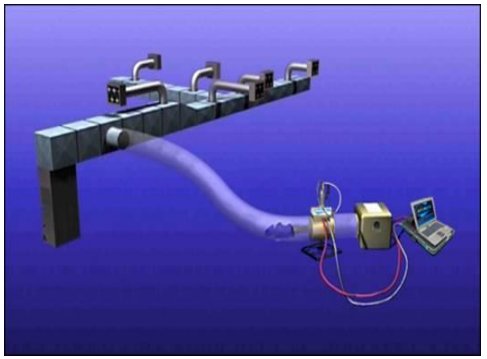


Sealing from the inside

The Solution

Aerosol-based duct sealing

- Works from the inside of the ducts
- Provides pre-seal leakage rate
- Automatically locates and seals leaks
- Computer-controlled
- Live monitoring of results
- Printout report documents pre/post results



Block – Connect – Seal

The Solution

Michael Lorion
President, AirMax
Miami Florida

AIRMAX is a contracting firm licensed by the State of Florida to provide unlimited air conditioning services in all aspects of the industry.

Finding a solution

Baltus House

New construction
Luxury condos
16 story

4 outside air handlers located on the roof

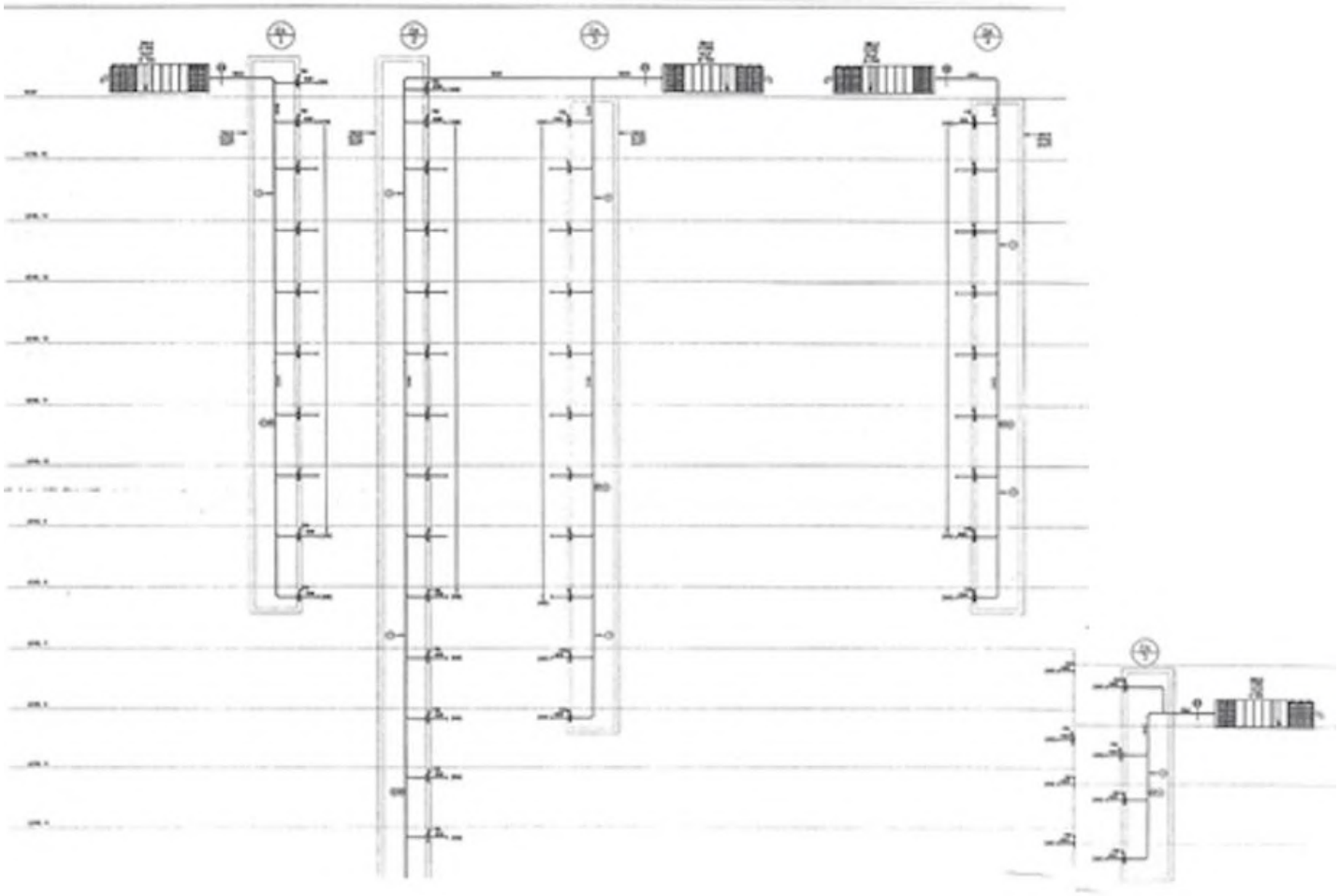
4 160ft vertical shafts serving all floors

Problem

Couldn’t pressurize ducts to test/balance
Limited air reaching bottom floors
Newly constructed walls limited access to ductwork

Finding a solution

Baltus House



Finding a solution

Baltus House

- Rooftop access
- 4 shafts

Pre test leakage
1,489 CFM
Post test leakage
300 CFM
Leak reduction
80%

- 2 days
- No demolition
- No disruption
- Met specifications

Finding a solution

Baltus House

- Rooftop access
- 4 shafts

Pre test leakage
1,489 CFM
Post test leakage
300 CFM
Leak reduction
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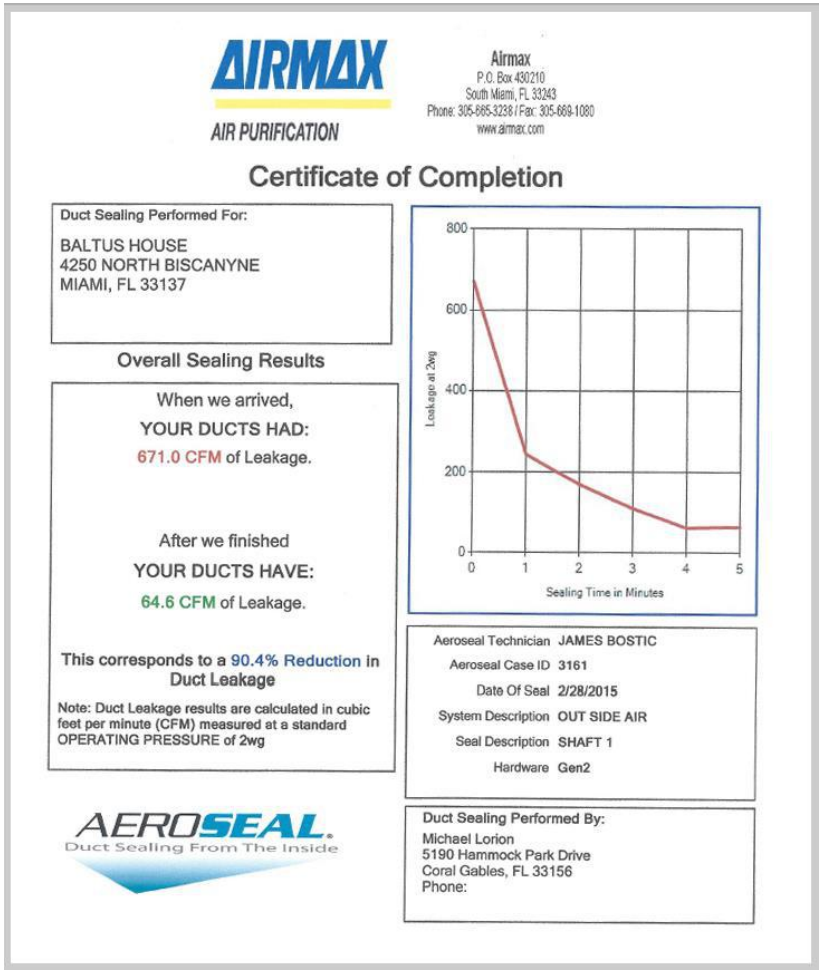


AIRMAX
AIR PURIFICATION

Airmax
P.O. Box 430210
South Miami, FL 33243
Phone: 305-665-3238 / Fax: 305-669-1080
www.airmax.com

Certificate of Completion

Duct Sealing Performed For:

BALTUS HOUSE
4250 NORTH BISCANYNE
MIAMI, FL 33137

Overall Sealing Results

When we arrived,
YOUR DUCTS HAD:
671.0 CFM of Leakage.

After we finished
YOUR DUCTS HAVE:
64.6 CFM of Leakage.

This corresponds to a 90.4% Reduction in Duct Leakage

Note: Duct Leakage results are calculated in cubic feet per minute (CFM) measured at a standard OPERATING PRESSURE of 2wg

Aeroseal Technician JAMES BOSTIC
Aeroseal Case ID 3161
Date Of Seal 2/28/2015
System Description OUT SIDE AIR
Seal Description SHAFT 1
Hardware Gen2

AEROSEAL
Duct Sealing From The Inside

Duct Sealing Performed By:
Michael Lorion
5190 Hammock Park Drive
Coral Gables, FL 33156
Phone:

Finding a solution

University of Miami

Cox Science Building
Building renovation

Problem

1. Insufficient exhaust from new laboratory fume hoods

1. Pass stringent code requirements

Finding a solution

University of Miami

20 fume / 9 ventilation shafts
5 days of sealing

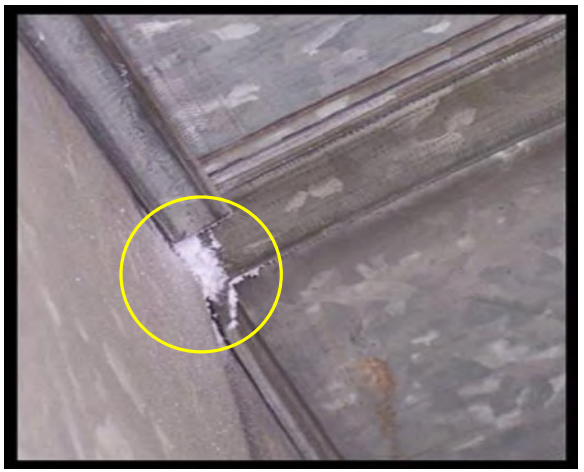
Pre test leakage
1,250 CFM
Post test leakage
215 CFM
Leak reduction
83%

No demolition
No disruption
100% code compliance

Aerosol duct sealing

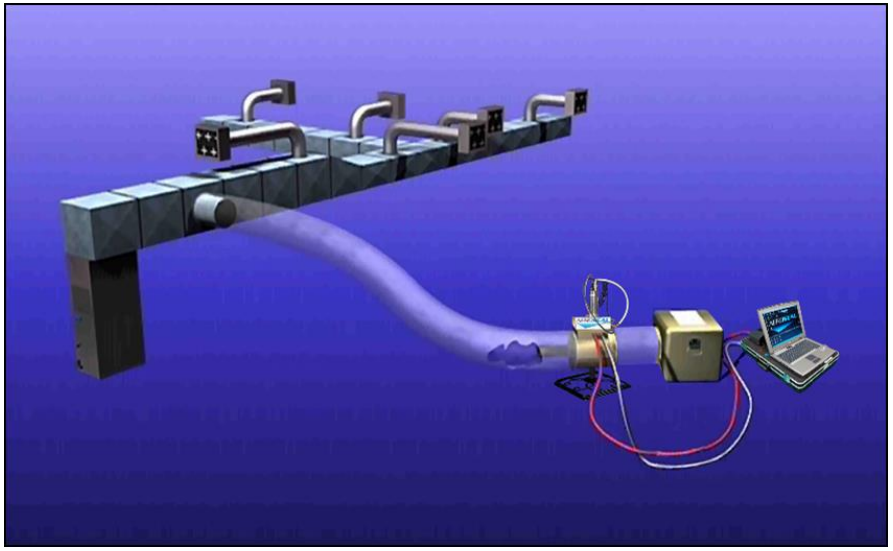
Overview

- **Proven, patented technology**
- **Seals ducts from the inside out**
- **Reduces 90% of leakage**
- **No access limitations**
- **Verifiable and guaranteed**



Aerosol duct sealing

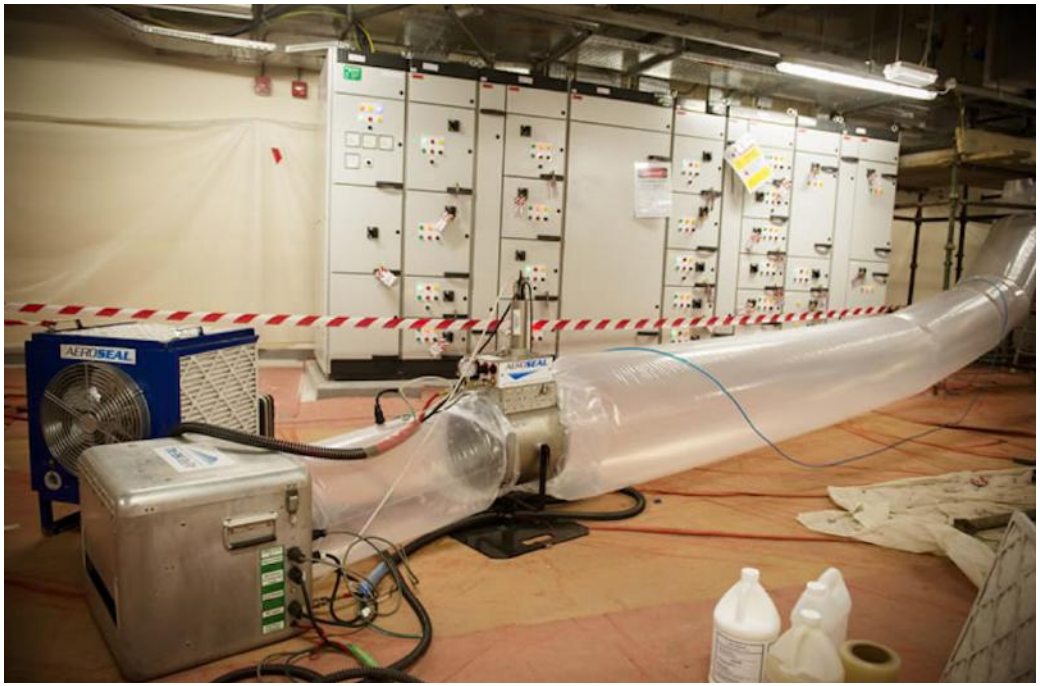
Overview



- Connect equipment
- Isolate AHU
- Block registers
- Pre-Seal: Benchmark
- Seal: Inject sealant
- Post-Seal: Measure final leakage
- Present certificate

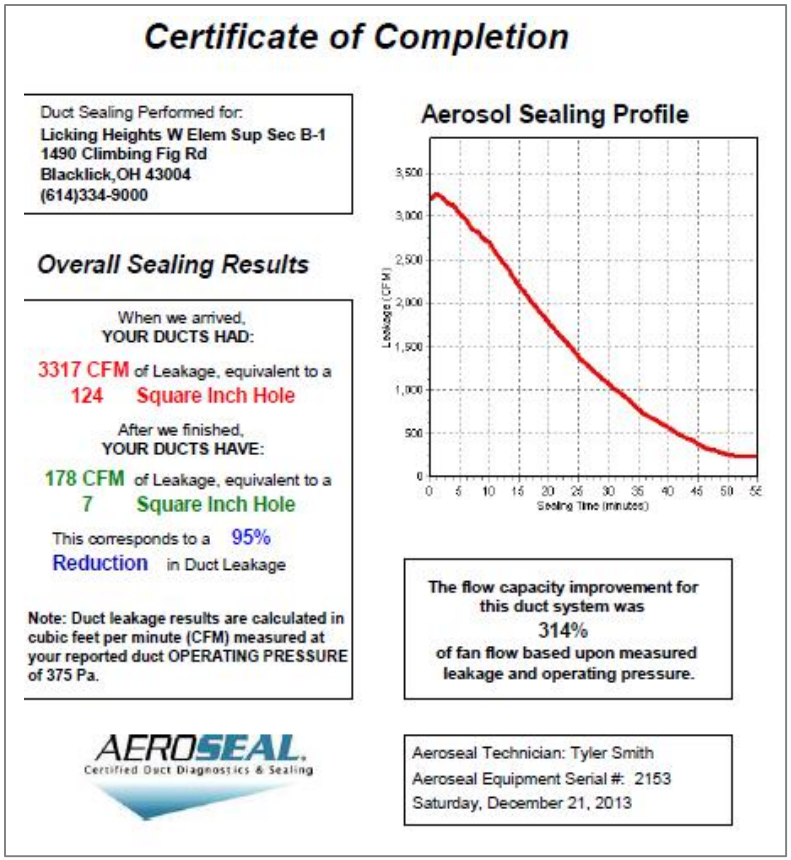
Aerosol duct sealing

Overview



Aerosol duct sealing

Overview



Certificate of Completion

Duct Sealing Performed for:
Licking Heights W Elem Sup Sec B-1
1490 Climbing Fig Rd
Blacklick,OH 43004
(614)334-9000

Aerosol Sealing Profile

Overall Sealing Results

When we arrived,
YOUR DUCTS HAD:
3317 CFM of Leakage, equivalent to a
124 Square Inch Hole

After we finished,
YOUR DUCTS HAVE:
178 CFM of Leakage, equivalent to a
7 Square Inch Hole

This corresponds to a 95%
Reduction in Duct Leakage

Note: Duct leakage results are calculated in cubic feet per minute (CFM) measured at your reported duct OPERATING PRESSURE of 375 Pa.

The flow capacity improvement for this duct system was
314%
of fan flow based upon measured leakage and operating pressure.

AEROSEAL
Certified Duct Diagnostics & Sealing

Aeroseal Technician: Tyler Smith
Aeroseal Equipment Serial #: 2153
Saturday, December 21, 2013

When we arrived
YOUR DUCTS HAD:
3,317 CFM of Leakage equivalent

After we finished
YOUR DUCTS HAVE
178 CFM of Leakage equivalent

This corresponds to a **95%**
Reduction in Duct Leakage

CONTINUING EDUCATION AIA

Aerosol duct sealing

Overview

Seals gaps up to 5.8”

No duct cleaning required – unless build up is > 1/8”

Lined, sheetrock or masonry ducts ok

No removal of dampers

Isolate coils and controls

Cover smoke detectors

Can be applied in occupied space

Aerosol duct sealing

Overview

- Tighter leakage standards coming
- Increasing testing and verification
- 75% of existing buildings have excessive leaks
- Duct leaks are a low-hanging opportunity
- Aerosol sealing is an efficient and effective method

This concludes The American Institute of Architects
Continuing Education Systems Course

Neal Walsh, Sr. Vice President

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Michael Lorion, President

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