

Certified Duct Diagnostics & Sealing

Duct Sealing from the Inside! November 2017



Big Picture

How to identify buildings with leaky ducts Energy savings, turnkey solution & audits Why seal? Examples Technology & application

Who is Aeroseal?

Sealing



What is Aeroseal?

Duct Sealing from the Inside!

Certified Duct Diagnostics & Sealing

Proven, patented technology Seals ducts from the inside out

➢ Reduces 90% of leakage

Overcomes human shortfalls

- No access limitations
- Finds and seals all leaks

Payback usually 2 to 7 years

Verifiable & guaranteed





Video Demonstration

Duct Sealing from the Inside!







Duct Sealing from the Inside!





Typical ductwork lose 25-40% of heating & a/c energy New installed systems experience 10-30% of leakage

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According to ASHRAE, what is the % of increase in fan power required when there is a 20% leak in an exhaust system? 1.51% 2.73% 3.95%



Question?

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Answer: #3.95%



100% / (100%- 20%) = 125%

=> 25% increase is required for a 20% leak 125% x 125% x 125% = 195% - 100% = 95%





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Good & Bad Candidates

Duct Sealing from the Inside!

Should I think about duct sealing for this building?

"Good Candidates"

- Large buildings: greater than 8k sq ft / 20T
- High occupancy
- High outside air
- High static pressure
- Older buildings
- Dedicated exhausts (dorms, labs, multi-families)

"Bad Candidates" opposite of "good", plus

- Welded duct
- Open ceilings

Sealing



Is this building a likely candidate for duct sealing?

DO MY DUCTS LEAK? COMMON SENSE ANSWERS



Do my ducts leak excessively? Most likely. ASHRAE says that 75% of all ducts in commercial building leak 10-25%. (That is 200-700% higher than ASHRAE's recommended standard of 3%!)

To assess your situation, check those boxes which apply:

Evaluate ductwork construction:

- Do they use slip-and-drive connections on metal ducts?
- Do they use sheet rock, masonry for air distribution or ventilation shafts?
- Do they use gaskets which are getting old and rotting?
- Are there visible holes or gaps at corners, seams, connections or hangers?
- Is there pressurized external insulation aka "the air mattress effect"?

Look at the rooms at the end of the hall (ie, far away from fan):

- Is there poor air flow in these rooms?
- Are these rooms too cold in the winter or too hot in the summer?

Look for uneven air distribution / pressurization issues within the building:

- Do some areas have excess air flow, while others areas are insufficient?
- Does airflow delivered vary upon time of year (summer vs. winter)?
- Are there issues with doors being difficult to open or close?
- Does the bathroom exhaust grille fail the "two-ply toilet-paper test"?

Ask about occupant complaints:

- Are there heating or cooling complaints?
- Are there complaints about moisture, mold, odor, or air quality?

If practical, ask about the fans (the #1 sign of excess energy consumption):

- Are they unable to setback the air handler at night or weekends?
- Do fans operate at excessive speeds, ie greater than 80% of rpms?
- Have motors, pulleys, or sheaves been replaced to provide more airflow?

If you checked two or more boxes there is a 90% chance your ducts leak excessively, and cost you money. The US Department of Energy says that sealing ducts is the most cost effective way to reduce HVAC costs. You can save money, with a good payback, while addressing other issues at the same time.

Next steps - do a leakage test, and if leaky, seal a section of ductwork.

Duct Leakage Scorecard

Choose a value that best describes each situation. Write the value in the box. Add the values to determine your Duct Leakage Assessment, Complete one worksheet for each air distribution system.

Building Name

Building Address

Air Handler or Fan Tag Number(s)

grade audit?

Should I do an investment



Unsealed holes

at hangers

Tracing at door

Condensate leak at flange

Tracing at corners.

of flanges



1. Main air duct and riser construction:

Roand

0

Round

3. Variable air volume or terminal boxes:

0

Ne

0

Fiexble Duct Other*

Flaxible Duct Other

Unknown

0

40

30

OTKY

15

Other

10

0

No

Ó

5

5

Rectangle

10

Rectangle

5

Nes

5

2. Branch air duct construction:

Te.e., measury, pysoure)

12. New is duct	sealed:			-
Mastie	Motal Tapa	Cion Tape	None	1
0	15	50	50	
3. If sealed will	th mastic or met	al tape, how we	Il is it sealed:	~



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Turnkey Solution

Duct Sealing from the Inside!



Evaluation, contract & installation provided as a turnkey solution



Quick Pre-Audit Evaluation

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INFORMATION REQUEST General information

- 1. Occupancy hours
- 2. Energy costs, including demand charge
- 3. Summer and winter design conditions
- 4. Location

From Drawings and mechanical schedule

- 5. Fan design flow & external static pressure
- 6. Heating and cooling efficiency
- 7. Outside air percentage

Also provide list of air handling and exhaust systems

Unknown variable

8. Duct leakage

Known facts



- 1) On-site walk-through, with photos
- 2) Audit Report sent with energy models
- 3) Call to review models and report

Duct Sealing From The Inside
Visual Audit of Air Duct System Tightness
Sample
Performed for Optierza
Performed by Aeroseal, LLCa 7988 Bouch Substan Road Ceteral Substan Road 45453
April 1, 2016
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Level Three Audit (if needed)

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Determine buildings & systems for testing

Block ducts

Pressure test & read

Deliver_report



- Fan Operating Pressure: 0.75 inWG
- Fraction of Surface Area Tested: 60%, reference Appendix A

Test Section	Operating	Test	Leakage @ Test
	Pressure (inWG)	Pressure (inWG)	Pressure (CFM)
A	0.07	0.20	199.5
В	0.07	0.20	349.8
Total			549.3

- \odot Test Leakage Normalized to Design Pressure: 1,214 CFM
- Total Leakage Normalized to Design Pressure: 2,023 CFM
- Total Leakage Expressed as Fraction of Fan Design Flow: 34%







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Why Seal Ducts?

Duct Sealing from the Inside!

1. Energy conservation

- 2. Indoor air quality
- 3. Comfort
- 4. Avoid cost of replacing ducts
- 5. Eliminate unsightly mastic on architectural ducts

Familiar, Important Issues

- High energy costs: 20-40% loss
- Cold room at the end of the hall
- Complaints about odors and illnesses
- Renovation: need to buy new ducts
- Building ventilation does not meet spec
- Airborne contaminants close building?
- High fan speeds due to poor air flow
- New air handler due to poor air flow



Examples

Duct Sealing from the Inside!

Medical Center (Upstate NY)



90% of supply duct distribution system in 125 year old facility

Issues: Energy saving retrofit - performance contract

Result 97% leakage reduction (4% > great than model); \$23K in annual savings; good M&V plan; no disruption

IMF Building (DC)



12-story, 935,000 sq ft structure

Issues: Anemic airflow. Only 50% reaching end points

Result: 83% reduction in leakage; \$102K in annual savings; estimated payback of 1.5 years. Improved comfort.



Licking Heights School (OH)



5 school buildings - 7 years old; 4,000 students

Issues: Severe comfort issues; 20% higher energy cost vs peer

Result: 95% reduction; \$45K in annual savings; ended complaints; AHU VFD @ 65% in winter & 85% in summer

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Installation Examples

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Healthcare



University of Ottawa Heart Research Institute Roudebush VA Hospital Veteran's House Nemours Children Hospital (Orlando) California Pacific / Sutter Health

Multi-Family / Hospitality upon



HARBOR

City Center Condos - Las Vegas

Wynn Hotel - Las Vegas

Harbor Towers - Boston

North Gate II, Camden NJ

Military

Camp LeJeune, 8 Marine Barracks Orlando NavAir Navy Office Building Newport Naval Training School San Diego Navy Base

Higher Education

Ohio State University - Williams Hall

UC Davis - Mrak Hall



Syracuse University - Park Point Apartments

Indiana University - Briscoe Hall

Critical Applications

Cleveland Art Museum

UC Davis Storer Hall (Lab)



THE CLEVELAND MUSEUM OF ART

US House of Reps, Rayburn Office Building

Deep Panuke Oil Platform, Nova Scotia

Light Commercial

Low-rise office buildings

Restaurants and stores

Schools

Country clubs, churches, funeral homes +++



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Aeroseal Machine & Setup

Duct Sealing from the Inside!







Video Demonstration

Duct Sealing from the Inside!



Sealant

Duct Sealing from the Inside!

Vinyl Acetate Polymer:

- > Base for chewing gum, hair spray and water-based paints
- Keeps elasticity life expectancy over 30 years
- > No VOC off-gassing after curing 2 hours to cure

UL certified and in ASTM compliance for:

- Surface burning
- Mold growth and humidity
- Interior duct burning
- Leakage reduction
- Durability

Meets NFPA 90A standards

Uses only one gallon for every 2,000-3,000 CFM of leakage

3 year commercial application guarantee



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About Aeroseal LLC

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Location	Dayton, Ohio			
Owners	JMD Corporation, owned by UTC/Carrier, 2001 to 2010			
Service Providers 250+ residential in USA and 30+ commercial				
Employees	ployees ~40			
Management	Seasoned HVAC experience			
Invention	Lawrence Berkeley National Lab			
Original Funding	g Department of Energy			
	HARBOR Image: California Pacific Medical Center A Sutter Health Affiliate A Sutter Health Affiliate THE CLEVELAND MUSEUM OF ART Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate Image: Towers Image: California Pacific Medical Center A Sutter Health Affiliate			

Aeroseal Milestones



2013 "Best of Show"



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2016	"Product of the Year" AHR Expo (AHRI/ASHRAE)	
2014	100,000+ homes sealed Commercial: 30 million sq Independent sales reps	ft;
2012	Expansion in commercial sales & service	
2010	JMD acquires Aeroseal	C
2007	Patent issued for non-clogging nozzle	2(t
1999	Carrier acquires Aeroseal 10,000 homes sealed	Fede
1997	Aeroseal founded	
1994	Patent awarded to Lawrence Berkeley National Laboratory	ui 9ſ







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2011 EBie award

RNSEA

DOE/FEMP: #3 in HVAC

Department of Energy / Federal Energy Management Program Technology Deployment Matrix

FEMP - New Technologies for the Federal Buildings - by Category & Rank

* See Ranking Criteria Tab

HVAC			Ranking Criteria *			
Rank	Technology	Description	Overall Federal Building Energy Savings	Cost Effectiveness	Probability of Success	Weighted Score
2	Condensing Boilers	Commercial boilers that are high efficiency due to their design to extract heat from flue gas moisture	5.0	3	4.5	86
6	Commercial ground source heat pumps	A ground source heat pump with loops feeding multiple packaged heat pumps and having a single ground source water loop. Unit capacity is typically 1-10 tons and may be utilized in an array of multiple units to serve a large load.	2.8	4	3.5	66
8	Duct Sealants	Aerosol sealant is injected into the duct work to seal leaks. Can save on heating, cooling and fan energy, depending on building.	1.6	5	4.3	63
13	Water Cooled Oil Free Magnetic Bearing Compressors	Magnetic bearing, oil free 60 to 80 ton chiller compressor (also 150 tons). Onboard VFD and micro processor. Also small, light, quiet, low startup draw.	1.0	4	5.0	54



Goal 20% more energy efficient by 2020

Federal buildings energy efficiency initiative extended until 2016

120 partners: Corporations, municipalities, counties, multi-family residential, financial, utilities





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AEROSEAL CONTACTS

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