

# HIGH-PERFORMANCE HVAC TODAY™

*If You Don't Measure, You're Just Guessing!™*

## BUILDING A TRAINING LEGACY



### **ALSO IN THIS ISSUE:**

- Working for the Future of HVAC Education and Community Building
- Diagnose Pressure Imbalances Before They Cause Trouble
- TODAY'S WORD — High-Performance Skills Matter More Than Ever

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# HIGH-PERFORMANCE HVAC TODAY™



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# Training That Sets You Apart: High-Performance Skills Matter More Than Ever



**Mike Weil** is editor-in-chief and director of communications and publications at National Comfort Institute, Inc. Contact him at [ncilink.com/ContactMe](mailto:ncilink.com/ContactMe).

**T**he HVAC industry is changing faster than most can keep up. Between new technologies, tighter efficiency standards, and rising customer expectations, it's not enough to just install and go. Homeowners and building owners want experts who can prove their systems perform safely, efficiently, and comfortably.

That's why **High-Performance HVAC™ training** isn't optional: it's essential. It separates contractors who just survive from those who lead.

## SAFETY IS FIRST AND MOST CRITICAL

Let's start with safety. Every system you touch has the potential to protect or endanger the people who live with it. Without the right training, it's easy to overlook hidden problems — **combustion issues** that lead to carbon monoxide (CO), poor ventilation, or airflow imbalances that can cause equipment failure or unsafe operation.

High-performance training gives technicians the tools and confidence to measure what's really happening inside an HVAC system. Through testing and diagnostics, you can identify conditions that are often invisible. When you measure, you can see what's happening and verify safety.

No assumptions here.

You can't protect what you don't understand, and you can't ensure safety if you don't measure what the system is really doing.

## COMFORT AND HEALTH: BEYOND THE THERMOSTAT

Most customers today expect more than "hot and cold." They want comfort, indoor air quality, and proof that they got what they paid for. Comfort isn't a thermostat setting — it's the result of balanced airflow, humidity control, clean air, and equipment performing to its rated capacity.

That's where training shines. By learning to measure static pressure, airflow, and temperature differentials, contractors can pinpoint the causes of uneven rooms or humidity complaints. Instead of guessing, they show data and solutions that homeowners can see and feel. Training builds more than skill — it builds confidence. And confident technicians solve problems others can't.

## BUILDING AN OFFERING NO COMPETITOR CAN COPY

The reality is, anyone can sell the same brand of equipment or advertise "quality service." What **no one can copy is your process** — especially when it's built on measurable, proven performance.

High-performance training teaches you to deliver something unique: a tested, verified system that performs to design. That's value your competitors can't touch. When you start talking in terms of measured results — not just price or tonnage — customers immediately recognize the difference.


Performance testing becomes your calling card. It's how you earn trust, justify your pricing, and create lifelong customers who understand the value of your work.

## THE FUTURE BELONGS TO THE TRAINED

Contractors who invest in training today will lead tomorrow's HVAC industry. High-performance skills don't just make systems better — they make businesses stronger.

Training isn't a cost; it's the foundation on which you and your team can provide safety, comfort, and differentiation.

In a market full of look-alike offerings, your knowledge and ability to measure performance are **what truly set you apart**.

In other words, when you master performance, you stop competing and start leading. 

## Written by HVAC Professionals for HVAC Professionals

### TESTO 860I WIRELESS THERMAL IMAGING FOR SMARTPHONES

HVAC technicians and salespeople looking to add a serious “wow” tool into your kit without breaking the bank, the **Testo 860i** is a smart choice.

This compact, smartphone-attached thermal imager turns your mobile device into a thermal camera in seconds. There are no large bulky rigs — just clip and connect, then open the free Testo app and you’re hunting down hot spots in homes.

The 860i has an impressive 256 x 192-pixel infrared sensor that provides great resolution, and you get top capabilities like the ability to measure differential temperature, thermal imaging, and more. It’s rugged enough for the trades. Dropping it won’t hurt it.



It is also small, lightweight, and easy to carry. I find it ideal for one-handed use. The carrying case makes it more practical for field work. It even has a documentation feature so you can share your findings with customers.

The 860i is affordable: many thermal

cameras cost thousands but the 860i is only a few hundred dollars. It is an inexpensive powerhouse for the seasoned tech or the first-year rookie. I believe it provides serious capability for building, electrical, and duct assessments.

If you’re inspecting the building, assessing the HVAC system, or performing a sales demo showing the hidden thermal issues, this instrument seals the deal and provides an “ah-ha!” moment for you and your customers.

What more can you ask for?

Check out the **Testo 860i thermal imaging** for smart phones at [TruTech Tools](#) or on the [Testo website](#).

Be sure to download the free Testo App from either the [Apple](#) or [Google Play](#) Stores. **NCI**

— by Casey Contreras, NCI Trainer

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**Arzel Zoning**

# Evolving Through Education: Building a Team of HVAC Heroes

**D**uring [the Great Recession \(2007-2009\)](#), our HVAC company faced a harsh reality: the new construction market we relied on was collapsing. Builders were going bankrupt, leaving us with hundreds of thousands of dollars in unpaid invoices. We had to pivot — and fast. That’s when we shifted our focus from wholesale-new construction to retail add-on/replacement services.

This wasn’t just a business decision; it was a philosophical shift. In new construction, the builder is your customer. In add-on/replacement, it’s the homeowner. That change gave us the opportunity to interact directly with the end user — to solve problems, build trust, and deliver comfort. And with that came accountability.

Builders care about cost. Homeowners care about performance. That difference allowed us to move from margins under 8% to over 30%. We were doing fewer systems but making more profit — and having more impact. We weren’t just installing equipment; we were designing solutions.

## TAKING RESPONSIBILITY FOR CUSTOMER COMFORT

But retail also meant responsibility. If the system didn’t perform, we’d hear about it. That pushed us to raise our standards and embrace testing as a core part of our process.

We already were on that road because in 2000, we invested in [Wrightsoft](#) to ensure every job had a proper [Manual J load calculation](#) and [Manual D duct design](#). No more rules of thumb.

We also purchased **Honeywell’s Analysis Machine** — a \$20,000 investment that let us test installed systems against design specs using flow hoods, pressure transducers, thermocouples, and psychrometrics. It was cutting-edge at the time, and it taught us a critical lesson: if you don’t test, you’re just guessing.

Today, we’ve transitioned to newer tools and software that deliver even more robust diagnostics at a fraction of the cost. Every technician now has access to the tools they need to do the job right. One standout application is [measureQuick®](#), which provides a complete system analysis that surpasses what the Analysis machine could deliver 25 years ago.

This approach, which today is known as high-performance testing, has elevated our entire team’s ability to verify, diagnose, and optimize systems in real time.

Tools like [measureQuick](#) and the [Digital TrueFlow®](#)

[Grid](#) allow us to achieve laboratory-grade accuracy in the field. With these technologies, we verify system sizing, assess real-time performance, and calculate true operating efficiency — whether we’re servicing, testing, or replacing a system. This level of precision gives us confidence that our designs are being executed properly and that our customers are receiving the comfort and savings they were promised.

## OUR APPROACH TODAY

- Every job starts with a test-in:
- Room-by-room load calculation
  - Duct leakage and airflow testing
  - TrueFlow Grid or flow hood measurements

“Learn the trade, own the tools, and earn the respect — that’s how you build a career worth sweating for.”



- Blower door test
- FLIR camera inspection
- Fenestration and envelope evaluation
- Psychrometric capacity test
- Watt draw and EER calculation (when conditions allow).

This takes two to three hours onsite and another hour to analyze. But it's worth it. We don't just replace equipment, we craft solutions. And when the installation is complete, we test out to prove performance gains.

### WHAT CHANGED FROM THE ANALYSIS DAYS?

- Readings had to be taken one at a time: airflow, temperature, pressure, electrical draw
- Each data point was recorded manually, often across multiple devices
- By the time all readings were collected, the system's operating conditions had already changed
- Diagnosing performance required hours of interpretation and guesswork.

Switching from Analysis to more modern tools like Smart Probes,

measureQuick, and The True Flow Grid means that we have:

- ◆ Real-time, system-wide diagnostics from a single interface
- ◆ Instant visibility into dynamic changes across airflow, refrigerant charge, electrical consumption, and capacity
- ◆ Automated calculations and visualizations eliminate guesswork
- ◆ Every technician can carry the lab in their pocket — and deliver precision on every job.

Testing and design are the backbone of High-Performance HVAC™ Contracting. But even the best plan fails without skilled execution. A poor installation can crush the promise of performance. That's why **training isn't optional — it's essential.**

### TRAINING IS ESSENTIAL

We train everyone: installers, techs, managers, even office staff. Everyone needs to understand the "why" behind what we do. It starts with culture — a belief that doing things right matters.

Our mottos say it all:  
 ✓ "We sweat so you don't have to."

✓ "Learn the trade, own the tools, and earn the respect — that's how you build a career worth sweating for."

But culture alone also isn't enough. You have to win hearts and minds. That's the hardest part. Employees need to believe in the mission — not just agree with it. They need to care about every job, every install, every customer.

Not all training is created equal. We've found that programs offering **industry-recognized certifications** — especially those requiring continuing education units (CEUs) — are the most effective.

CEU-based training ensures our team stays current with evolving technologies, techniques, and software that are reshaping the HVAC landscape. It's not just about learning once; it's about staying sharp. That ongoing commitment to mastery helps us deliver consistent, high-performance results.

### CHOOSE THE RIGHT TRAINING

Beyond staying current, choosing the right training pays off in measurable ways.

Programs that build both knowledge and hands-on skills directly translate to better serviced and installed systems — fewer callbacks, higher customer satisfaction, and improved system performance.

At our company, we've seen firsthand how much our team values this growth.

Many of our employees genuinely enjoy the training because it raises their confidence and skill level. And we reward that commitment: every time a technician earns a new certification, they receive a raise.

It's a win-win — they level up professionally, and our customers benefit from the results.

Carlos Garcia, one of our newer hires with four years of experience at another company, put it best: *“At my other job it was all about selling a part or a new system, sometimes whether they needed it or not.*

*“They never looked at ductwork, air-flow, or even considered if the system was sized properly for the home. They only cared about the sale. You guys care about the system and the customer — that what we install actually makes them comfortable and saves them money.”*

That kind of shift in mindset is exactly what the right training can achieve. It turns technicians into trusted advisors and transforms companies into performance leaders.

### LEARN FROM MISTAKES

Change isn't easy. Some techs resist

testing. Some think it's overkill. Others worry about time. But when they see the results — happier customers, fewer callbacks, and pride in their work — they come around.

Even trained employees can make mistakes. That's why we conduct a thorough test-out on every job, which includes critiquing the installation and commissioning of the system. When we find a problem, we take two steps.

First, the employee returns to the job site with a supervisor to correct the issue. The supervisor's role isn't just oversight — it's mentorship. They evaluate whether the mistake stemmed from carelessness, lack of training, rushing, or something else, and use that moment to reinforce best practices.

Second, we assess whether additional training is needed and schedule it — either in-house or through a trusted partner like [National Comfort Institute \(NCI\)](#).

### LEARNING BY TEACHING

We've also found that by assigning employees to attend training with the expectation that they'll teach others creates a powerful sense of ownership.

When someone knows they'll be responsible for passing on what they've learned, they absorb the material more deeply and take pride in becoming the go-to expert.


If you're committed to delivering true comfort, efficiency, and value to your customers, then training isn't just a tool — it's your foundation. The

systems we install are only as good as the people who design, commission, and maintain them. That's why investing in your team's education is one of the smartest moves you can make.

Choose training programs that challenge technicians, certify their skills, and require ongoing learning. Encourage them to teach what they learn. Reward their growth. Build a culture where mastery matters. Because when your team understands the “why” behind the work they don't just install systems—they deliver performance.

### BUILDING YOUR FUTURE

High-Performance HVAC training isn't just about better installs. It's about building your future by building a company that stands for something. It's about turning challenges into opportunities, and employees into advocates. It's about sweating the details, so your customers don't have to.

At Bailey's Air Heroes, we don't just install systems, we rescue comfort, restore efficiency, and train every technician to be a hero in the home! 



**Mitch Bailey** owns [Air Heroes](#) in Modesto, CA. He is a member of ACCA, RSES, and IHACI, and currently holds a number of different NATE certifications and much more. He is also part of the National Comfort Institute (NCI) training team in California with more than 38 years of on-the-job experience and has serviced and installed thousands of HVAC systems. If you have questions about this article, you can reach Mitch at [ncilink.com/ContactMe](mailto:ncilink.com/ContactMe).



# One Year in the Life of a High-Performance HVAC™ Contractor

**A**t the High-Performance HVAC™ Summit, held in September 2025 in Austin, TX, National Comfort Institute (NCI) Instructor Adam Mufich and Curriculum Manager Eric Palmer sat down with Contractor Anthony Woo to hear his powerful story of discovery and growth. Woo is president and co-owner of a Canadian firm called Climatisation ACG, Inc.

Anthony shares with our podcasting audience how he first connected with NCI, the impact it's had on his professional journey, and the lessons he's learned over the past year. From new skills to real-world successes, this conversation highlights how training and education can transform not just a career, but an entire approach to residential HVAC.

In fact, despite only being part of the high-performance community for slightly more than a year, Woo and his partner Kar Young were recognized at Summit, winning the NCI Small Contractor of the Year Award.

Learn more about his amazing journey and where he sees his future as a high-performance contractor.

**Catch These and Other Episodes at [hvactoday.com/podcast](https://hvactoday.com/podcast)**



### **Static-Pressure Sales Versus High-Pressure Sales**

In this episode, we unpack the difference between pushy, outdated sales tactics and data-driven conversations that build trust. **Al D'Ambola** shares highlights from his Summit presentation, including how to make measurements relatable for homeowners and a creative approach to following up with customers. Whether you're a contractor aiming to boost credibility or a homeowner tired of sales gimmicks, you'll see why high-performance sales isn't about high pressure, it's about delivering real solutions.

### **Furnace Safety: Correcting Hazardous Operation with Vince Lopez**

In this episode, **Vince Lopez** shares a real-world situation where another contractor claimed a furnace was safe, but testing revealed a dangerous situation. Vince walks us through how he identified the issue and provided a solution, and why education and proper testing are critical to protecting our customers.

### **Service That Stands Out**

In this episode, **Jim Ball** shares practical strategies for making your service department not only stand out but thrive as a profitable part of your business. From setting your team apart in a crowded market to implementing systems that boost efficiency and customer satisfaction. Whether you're an owner, manager, or technician looking for fresh ideas, you'll leave with actionable insights you can start using right away.

### **Defining Clean Air with John Ellis**

NCI's **Adam Mufich**, **Casey Contreras**, and **John Puryear** break down the often-overlooked side of indoor air quality—how some IAQ devices can actually create harmful byproducts in your home. They explore the pros and cons of different filtration types, when to use each, and why not all "clean air" products are created equal. If you care about what you're customers are breathing, this episode will help you make more thoughtful recommendations.

**Below the Beep: The CO Danger You're Missing** - NCI Hosts: Adam Mufich, Casey Contreras, and Mark Hunt

**Beyond Proper Equipment Sizing and Selection** - NCI Hosts: Adam Mufich, and David Richardson

**Lessons Learned Field Testing ComfortMaxx™** - NCI Hosts: Adam Mufich, and David Richardson

Listen or watch wherever you find your podcasts or visit [HVAC.com/Podcast](https://HVAC.com/Podcast)

# Working for the Future of HVAC Education and Community Building

**A**s the founder of HVAC School and the HVACR Training Symposium, I've seen firsthand how real education and community can transform our industry.

What started as a simple idea — to create a space where HVAC professionals could learn from one another — has grown into a movement focused on craftsmanship, curiosity, and connection.

## COMMUNITY OVER CONTENT

One thing I've learned is that **information is cheap, but community is priceless.**

You can find manuals, videos, and tutorials anywhere online, but information itself isn't what makes us better. What matters is context — connecting knowledge to the real-world experiences of technicians in the field.

That's been my goal with [HVAC School](#) from the start: to help technicians learn from technicians. The [HVACR Training Symposium](#) takes that same philosophy off the internet and into real life where people can shake hands, share stories, and build relationships that last far beyond a training session.

## HOW IT ALL BEGAN

The idea for the HVACR Training Symposium didn't come from within HVAC — it came from the [Westford Building Science Symposium](#), hosted by Joe Lstiburek and Betsy Pettit.

I loved how that event blurred the line between

presenters and attendees. Everyone there was both teacher and student, sharing insights in an open, collaborative atmosphere.

When the **AHR Expo** was coming to Orlando, I thought, *Why not do something like that for our industry?* A smaller, more personal event where we could focus on learning, collaboration, and connection. That's how the Symposium started, and it's grown from a handful of "HVAC nerds" into a must-attend event for people serious about craftsmanship and performance.

We even joke that it's the "*Woodstock of HVAC.*"

## WHAT MAKES SYMPOSIUM DIFFERENT

The Symposium isn't a trade show or a sales pitch. It's a space where people who love HVAC

come together to learn from one another.

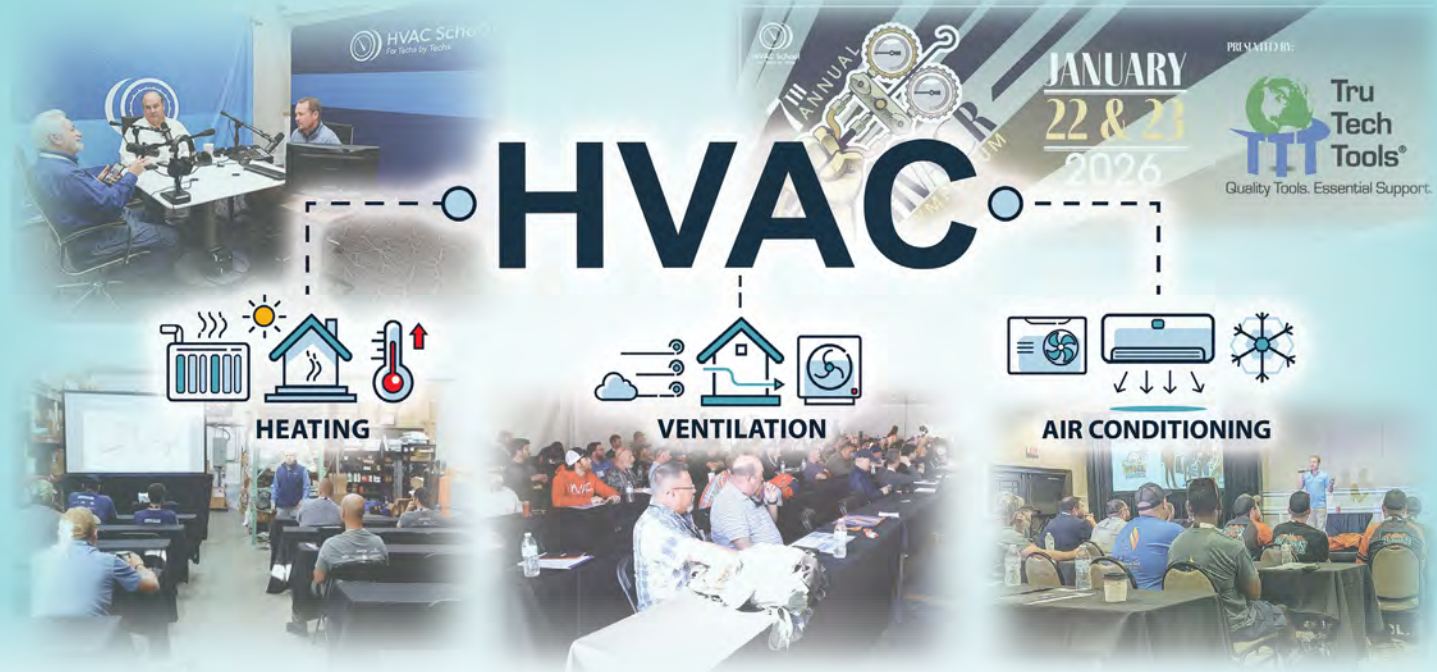
You'll see people like **Tim DeStasio**, **John Semelhack**, and **Allison Bailes** presenting — not because they're professional speakers, but because

they're practitioners who care deeply about their craft. They're out there in the field every day learning, testing, and sharing what works.

That authenticity — real people teaching real solutions — is what makes this event special. *It's about doing good work together.*

In my mind, the HVAC industry doesn't need more hype. There's already plenty of that. What we need is more humility, curiosity, and craftsmanship.





## DEFINING HIGH PERFORMANCE

One organization that I've always admired is [National Comfort Institute \(NCI\)](#) because of how they define and live out the [principles of High-Performance HVAC™](#). They've been setting the bar in that regard for a long time.

For me, high performance means approaching every job with **design thinking** — testing before and after installation, verifying that the system works as intended, and continually improving.

It's like fine-tuning a race car. You're not just installing boxes and wiring them up — you're crafting something to achieve a specific performance outcome. That's where true craftsman-ship lives.

## WHY TRAINING MAKES HOMES HEALTHIER AND SAFER

Good training leads to good outcomes for both technicians and customers. When we focus on fundamentals like airflow, filtration, and combustion testing, we make homes safer, healthier, and more comfortable.

People breathe better, experience fewer temperature swings, and their systems last longer and operate more

efficiently.

That's the ultimate goal for Symposium, for Kalos Services, and for the industry: comfort, health, and longevity for both people and equipment.

## GETTING ADDICTED TO DOING IT RIGHT

One of the coolest things to witness is when a technician gets hooked on testing.



You hand them a [TrueFlow® Grid](#) or a combustion analyzer, they take a few readings, and suddenly they see **what's really going on in a system**. That's when high-performance clicks for them. That is their "*ah-ha!*" moment.

Once they've experienced that, there's no going back.

I joke that contractors are "**the drug dealers of HVAC**" — except the addiction is based on testing, measuring, and verifying performance.

Once you feel that rush of doing great work and knowing it's right, you're hooked for life.

## BLENDING FUNDAMENTALS AND FIELD EXPERIENCE

There's no real divide between "fundamentals" and "advanced" topics once you're chasing excellence. They all connect.

To do great work, you must understand the first principles — airflow, heat transfer, and combustion — and then apply them consistently in the field. That's why the HVAC Symposium's sessions are taught by people who know what's really happening out there.

It's all about **real-world application**. No ivory towers. Just HVAC pros learning from each other.

## MAKING TIME FOR LEARNING

I know how hard it can be for contractors to carve out time for training. But it doesn't have to be complicated or expensive.

Do what you can with what you have.

Start with one hour a week. Use free resources — podcasts, YouTube, forums. When the slow season comes,

invest in live training from NCI or events like the Symposium.

Those small steps can ignite a life-long learning culture in your company. Training isn't a cost — it's an investment in craftsmanship, quality, and pride.

In other words, start small. Measure something. Learn something. Then share it.

### STAYING RELEVANT IN A CHANGING INDUSTRY

Technology constantly changes fast. Think about smart systems, variable-speed everything, data-driven service, and now artificial intelligence (AI).

But here's the thing: **the fundamentals don't change.**



The way to stay relevant isn't by memorizing data — it's by learning how to learn. As an industry, if we teach techs to stay curious, ask better questions, and use their resources wisely, they'll always stay ahead.

The humble, open-minded technician will always have a place in this trade.

### THE POWER OF PEER-TO-PEER LEARNING

Peer-to-peer learning might be the most powerful part of what we do.



In industries like medicine or law, peer review is a built-in part of growth. In HVAC, we've often worked in silos, and that's held us back. In other words, when we collaborate — argue even — we challenge assumptions and uncover better solutions.

That's why community matters so much. My job as an HVAC company owner or manager of the Symposium isn't to lead it — it's to steward it.

NCI, HVAC School, and hundreds of passionate contractors are all part of this growing network of professionals who simply want to do great work and help others do the same.

### LOOKING AHEAD: THE FUTURE OF HVAC EDUCATION

The next five years will bring massive change. As AI and big data evolve, every best practice and system quirk will be available to anyone who wants it. Information will be everywhere.

So, what will matter most?

**Community, craftsmanship, and connection.**

The easy stuff — data and procedures — will be automated. The hard stuff — human judgment, hands-on skill, empathy, and teamwork — will

matter more than ever.


That's why we need to stay grounded in our craft, focused on quality, and committed to each other. The future of HVAC education won't be about technology. It'll be about people.

The future belongs to those who stay curious, humble, and connected.

### START WHERE YOU ARE

Not everyone needs to go all-in on performance overnight. Start small. Measure static pressure. Do one combustion test. Take one airflow reading. Every small step forward matters.

Work with what you have. Learn something new. Share it with your team. Encourage curiosity.

That's how we raise the bar — one measurement, one conversation, one connection at a time. 



**Bryan Orr** is the founder of HVAC School, host of the HVAC School Podcast, and creator of the HVACR Training Symposium. With over two decades in the industry, Bryan is passionate about helping technicians and

contractors grow through practical training, community, and a shared commitment to craftsmanship and curiosity. If you have questions or want to learn more about HVAC School and/or Symposium, reach out to him at [ncilink.com/ContactMe](https://ncilink.com/ContactMe).

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## UPCOMING NCI TRAINING: NOVEMBER - DECEMBER 2025

### PUBLIC LIVE TRAINING

#### Combustion Performance and Carbon Monoxide Safety

November 4-6: White Plains, NY  
November 11-13: Austin, TX  
November 18-20: Lewisville, TX  
December 2-4: Centennial, CO  
December 2-4: Somerville, MA

#### Residential HVAC System Performance and Air Balancing

November 4-6: Green Valley, AZ  
November 18-20: New Castle, DE  
December 2-4: San Antonio, TX  
December 2-4: Philadelphia, PA  
December 9-11: Richmond, VA



\*NCI training sponsored/subsidized by Southern California Edison (SCE) for qualified local contractors.

### PUBLIC LIVE TRAINING (cont.)

#### Duct System Optimization and Residential Air Balancing

November 4-6: Kissimmee, FL  
November 4-6: Carrollton, TX  
November 11-13: Dayton, OH  
November 11-13: Albuquerque, NM  
December 9-11: Glen Burnie, MD  
December 9-11: Tampa, FL  
December 9-11: Mentor, OH  
December 16-18: Lawnside, NJ  
December 16-18: Phoenix, AZ

#### Commercial Air Balancing

November 18-20: Oxnard, CA

### PUBLIC ONLINE LIVE TRAINING

#### Airflow Testing & Diagnostics ONLINE LIVE

November 11-12

#### Commercial Air-Side Recertification ONLINE LIVE

December 16-17

### \*SCE SPONSORED LIVE TRAINING [ncilink.com/SCESchedule](http://ncilink.com/SCESchedule)

#### Hydronic Testing, Adjusting, & Balancing

November 4-5: Anaheim, CA **SOLD OUT**

#### Airflow Testing & Diagnostics

November 18: Anaheim, CA

#### Refrigerant-Side Performance

November 19-20: Anaheim, CA

#### Commercial Air Balancing

December 2-4: Anaheim, CA

#### Residential HVAC System Performance

December 9-10: Anaheim, CA  
December 9-10: Tulare, CA

#### High-Performance Heat Pump Retrofits

December 11: Anaheim, CA  
December 11: Tulare, CA

#### Combustion Performance and Carbon Monoxide Safety

December 16-18: Anaheim, CA

Visit [NCIlink.com/ClassSchedule](http://NCIlink.com/ClassSchedule) to view the latest schedule.

# Stop the Suck: Diagnose Imbalances Before They Cause Trouble

**W**hen we talk about home performance, pressure rarely gets top billing — but it should. Pressure imbalances quietly undermine comfort, efficiency, and safety.

They're often overlooked, especially in homes that “look fine” on the surface. But once you start measuring, you'll find that pressure tells a story — and sometimes, it's a scary one.

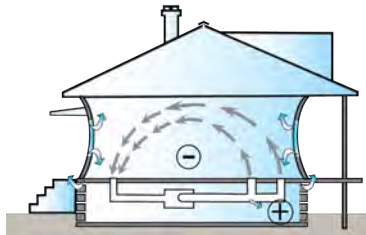
## WHAT DRIVES PRESSURE IN A HOME?

While wind and weather can nudge pressures, the biggest influencers of persistent problems are systems and appliances inside the home. HVAC duct leakage, exhaust fans, and combustion appliances all play a role — and the consequences range from minor discomfort to serious health and safety risks.

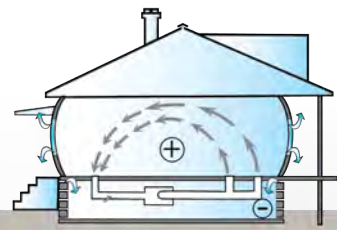
For example:

### ● **Supply-side leakage**

outside the thermal envelope usually depressurizes the home because conditioned air escapes before reaching living spaces. That draws replacement air from outside through cracks and openings, increasing infiltration and heating/cooling loads.

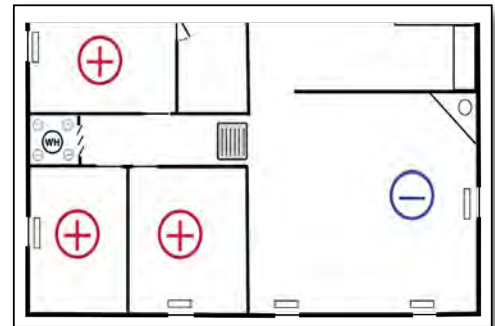


● **Return-side leakage** outside the envelope tends to pressurize the home by allowing air from outside the envelope to be pulled into the return system, reducing



the amount of air picked up at the return grilles. That drives exfiltration and wastes energy.

- **Exhaust devices** remove indoor air; without makeup air, they create negative whole-house pressure quickly. Modern kitchen hoods, with airflows from 500 to 1,000 CFM, are common culprits.



- **Room-to-room imbalances** occur when a room gets supply air but lacks a clear return path. That room pressurizes relative to the rest of the house, leaks to the outside from its shell, and reduces delivered supply flow.
- **Backdrafting:** Combustion appliances like furnaces, water heaters, and fireplaces can influence pressure depending on how they vent. If the home is under negative pressure, they may backdraft — pulling combustion gases into the living space instead of venting outside.

## WHY DEPRESSURIZATION IS DANGEROUS

Negative pressure does more than affect comfort. It can cause improper venting of fossil-fuel appliances — furnaces, water heaters, fireplaces — leading to back-drafting and carbon monoxide (CO) exposure. Even if the home lacks such appliances, depressurization can pull CO from an attached garage where a vehicle is running or where a gas appliance sits.



Conversely, over-pressurizing a mechanical room can force combustion products into living spaces. Pressure testing is therefore a safety check, not just a performance check.

## TOOLS THAT MATTER

You need the right tools to see what you can't feel. Here are a few to consider:



- A personal CO monitor. A house with pressure issues is a house with a potential CO poisoning hazard, especially when you're experimenting to see what might be creating larger pressure differences. A personal monitor helps keep you and the occupants safe during your testing and alerts you to a potentially unsafe situation before you even begin testing. In short, it can save lives.
- A digital micromanometer that reads in tenths of a Pascal. Typical manometers that only read to 0.01 in. w.c. aren't precise enough for room-to-room differentials or draft testing. One Pascal is approximately equal to 0.004 in. w.c.



- A Roomulator to convert a target Pascal difference into the required CFM and transfer opening dimensions.



## WHOLE-HOUSE DIAGNOSTIC BASICS

Start simple and systematic.

- 1. Baseline:** Turn everything off — HVAC, exhaust fans, combustion appliances. Connect a hose to the micromanometer negative port and route it outside. Then zero it and record the baseline whole-house pressure from inside.
- 2. HVAC on:** With only the HVAC running, note the pressure change. If pressure drops, suspect dominant supply leakage. If pressure rises, suspect return leakage. Record the magnitude in Pascals. If pressure stays about the same, significant overall leakage is still a possibility. It just means leakage is about the same on the supply and return.
- 3. Add loads:** Close all the interior doors, turn on the kitchen hood, then any bath fans, the clothes dryer, water heater, and furnace — one at a time and in combinations. High-capacity kitchen hoods will move the needle fast; a 600 CFM hood without makeup air can create double-digit negative pressures in a tight house.

**4. Identify worst-case:** document which combinations push the house into the most negative pressure.

**5. Simulate real life:** repeat tests with doors and windows in typical occupant positions to reflect real-time behavior.

This sequence converts the statement that “something feels off” into an actionable set of problems you can fix.

## ROOM-LEVEL TESTING AND THE THREE PASCAL RULE

If a homeowner tells you a specific room is too hot or too cold all the time, test it. With the HVAC running and the door closed, place your micromanometer hose under the door (or through a transfer opening).

If the room-to-room differential exceeds about three Pascals (Pa), the return path is insufficient, and you need to add a transfer path.

Above three Pa you'll need measurable CFM to balance a typical bedroom. Crack the door until you get down to three Pa and use the **Roomulator** to measure the door gap. Flip the card over to convert that opening into required CFM and then select a solution: door undercut, transfer grille, jumper duct, or ducted return. After installing the transfer, retest. If the differential drops and the comfort complaint clears, you fixed it.

Be mindful of noise and privacy when choosing solutions. A big undercut may solve flow but create noise transfer; a duct or grille can be quieter but cost more to install.



## COMBUSTION AND CO SAFETY TESTING: DON'T SKIP IT

Combustion and CO safety testing are essential whenever fossil-fuel appliances are present or when an attached garage could be a CO source.

The latter is especially important in a home with pressure issues. Combustion testing verifies that appliances vent safely under various scenarios and helps you identify the causes of any combustion or venting issues.

Even basic combustion safety testing requires a high degree of knowledge and skill and is well beyond the scope of a magazine article.

Before you take responsibility for the safe operation of combustion equipment, make sure you're adequately trained and certified, own the right tools, and know how to use them.

If you encounter CO while performing pressure diagnostics and you're not equipped to address the underlying issues, here are some guidelines on how to handle the situation:

- **At readings of 1 ppm to 9 ppm:** Perform your testing and let the customer know that you found some low-level CO in their home that could indicate a safety issue. Offer to refer them to an expert to evaluate further.
- **10 ppm to 35 ppm:** Perform your testing and advise customers of elevated CO levels. Ask if any children, elderly, or people with other health conditions have been experiencing symptoms. Advise that you will have an expert give them a call to set up an appointment.
- **36 ppm to 69 ppm:** Open windows and doors. Recommend occupants seek fresh air. Turn off appliances and offer to make an immediate

call to a knowledgeable combustion expert.

- **70 ppm+:** Immediately evacuate yourself and request occupants do the same. Call 911 if anyone is unresponsive or suddenly ill. Turn off gas to the house at the meter or tank. Immediately call an expert.

## PRACTICAL REMEDIATION STRATEGIES

Fixes are rarely exotic. Focus on high-impact work first.


- Seal supply ducts outside the conditioned envelope. Prioritize big seams, register boots, and supply plenums that cross unconditioned spaces. Big air leaks move numbers.
- Seal returns and return plenums. Return-side leakage outside the envelope often shows as whole-house positive pressure when the system runs; seal it to stop exfiltration.
- Address large exhausts with makeup air. For kitchen hoods with approximately more than 400 CFM, provide mechanical makeup air. For retrofit jobs consider passive or active makeup air solutions or recirculating hoods with filtration where allowed.
- Some owners with large kitchen hoods may want to consider a [Heat Recovery Ventilator](#) or [Energy Recovery Ventilator](#) (HRV or ERV). In humid climates, avoid HRVs and ERVs and opt for a dehumidifier on fresh air systems instead.
- Add return paths to pressurized rooms: transfer grilles, jumper ducts, or door undercuts sized to the measured need. Retest after each corrective action and document pre/post numbers.

## FIELD TIPS AND SAFETY CHECKS

- ✓ **Always wear a personal CO monitor** when performing pressure diagnostics. You could save your own life or the life of someone who lives in the home.
- ✓ **When testing hoods, run them at full speed** and note whether they have makeup air capability. If they don't, warn the homeowner about pressure when the hood runs on high.
- ✓ **Check attached garages.** A running car or a gas appliance in the garage is a CO poisoning risk when the house is negative.
- ✓ **Seal big holes first;** small leaks matter but by fixing the largest, easiest leaks you can provide the most immediate improvement.

## MAKE THE INVISIBLE, VISIBLE

Pressure imbalances are invisible until you measure them. Measurement turns an uncertain problem into a solvable job. With the right tools, you can identify supply or return leakage, quantify room pressurization, and identify potential CO hazards.

Fixes are practical: duct sealing, makeup air for large exhausts, and adding return or transfer paths. Test, document, and re-test under the same conditions you used to find the issue. That approach protects occupants, reduces callbacks, and gets systems behaving the way they should. 



**Ben Lipscomb, P.E.** has more than 17 years of experience in the HVAC industry. He is National Comfort Institute's Director of Utility Services and National Accounts. You can contact him at [ncilink.com/ContactMe](mailto:ncilink.com/ContactMe) with any questions or comments about this article.

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We look forward to hearing from each of these companies. Please look for regular member benefits updates here.

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**Editor-in-Chief**  
Mike Weil

**Art Director**  
Judy Marquardt

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# CO Awareness Month: A Reminder of a Year-Round Issue



**Dominick Guarino**  
is publisher of  
*High-Performance  
HVAC Today* magazine  
and CEO of National  
Comfort Institute, Inc.  
He can be reached at  
[ncilink.com/  
ContactMe](http://ncilink.com/ContactMe)

**N**ovember is **National Carbon Monoxide Awareness Month**. Many organizations including the [National Carbon Monoxide Awareness Association](#) (NCOAA), and National Comfort Institute (NCI), have been working tirelessly for years to increase public and industry awareness about this silent killer.

Equally important, for three decades NCI has brought attention to the severe health issues that stem from low-level CO poisoning. NCOAA has also driven this message since it started in 2015.

According to reported statistics, CO poisoning is responsible for more than a thousand recorded deaths and more than 100,000 emergency room visits. When you add in unreported cases, the real numbers are significantly higher!

## BECOME A PRE-RESPONDER

In October's **One More Thing** column I wrote about the NCI-coined term, "Pre-Responder" to describe how HVAC professionals can be a primary deterrent to CO poisonings.

While emergency "First Responders" also need better training and tools to deal with CO poisonings, by the time they get there it's often too late. Significant damage, permanent health issues, and even death may have already occurred.

You become a Pre-Responder by adopting a proactive approach to evaluate whether mechanical systems are either causing, or have the potential to cause CO to be generated and/or released into the homes and buildings you service.

Carbon Monoxide is colorless, odorless, and tasteless, and it can strike in any building or home where combustion appliances operate.

To detect existing CO issues, and help prevent potential CO incidents your technicians, installers — even your salespeople — need the training to keep both themselves and your customers safe.

## GET THE RIGHT TOOLS AND TRAINING

While equipping your field people with combustion analyzers is a good first step, it's not enough. Your employees' safety starts with wearing personal CO monitors to help ensure they are not exposed when they enter a home or building.

There are specific protocols that should be followed starting with before you enter a building, throughout the process of testing the conditioned space, and the combustion appliances within it.


National Comfort Institute has been training and certifying professionals on these processes for nearly 30 years. They have a deep understanding of the causes of CO, from building pressure imbalances, to improper combustion air, venting, and equipment installation, and so much more.

## A CALL TO ACTION THIS NOVEMBER

During National Carbon Monoxide Awareness Month, let's turn awareness into action. Plan and execute the following steps this fall, winter and year-round:

- 1. Review and update your company's CO safety protocols**
- 2. Ensure all of your field personnel have a personal CO monitor and a calibrated combustion analyzer**
- 3. Make sure all of your techs and installers are trained and certified in [Combustion Safety and Diagnostics](#).**
- 4. Discuss with your customers the differences between CO monitors and detectors. Explain the importance of regular maintenance and testing**

This November, start making CO safety and ongoing training part of your company's DNA.

The lives you save could belong to your customers — or your own employees. Become a Pre-Responder today! 

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