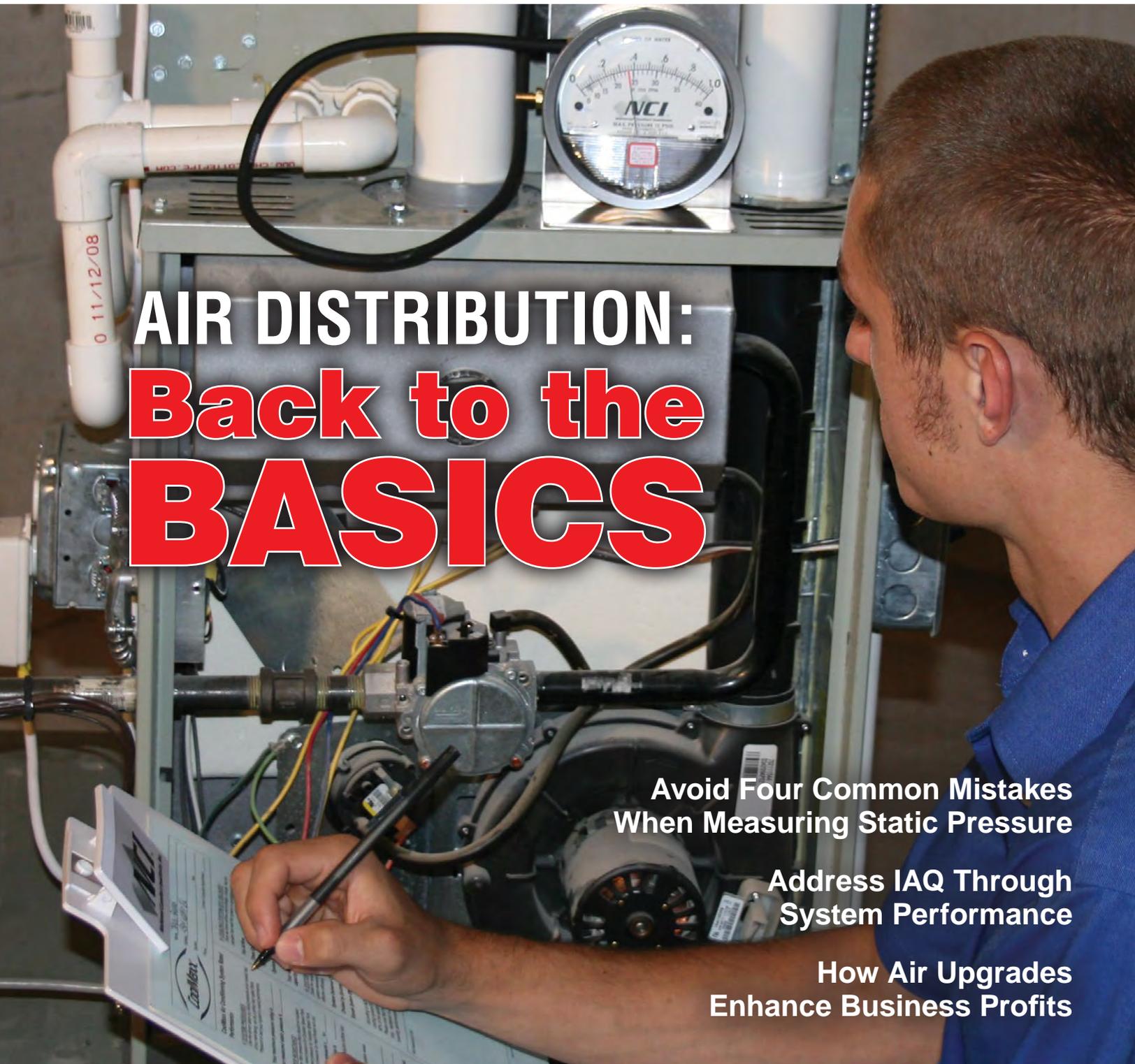


HIGH PERFORMANCE HVAC TODAY™

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



AIR DISTRIBUTION: Back to the BASICS

**Avoid Four Common Mistakes
When Measuring Static Pressure**

**Address IAQ Through
System Performance**

**How Air Upgrades
Enhance Business Profits**

FREE!

AirMaxx™

a *ComfortMaxx* app

LITE

NCI's new AirMaxx Lite™ app is available for both Android and iOS phones!

- Features easy-to-use data entry and easy-to-display reports.
- Download this free app onto your phone or tablet, and immediately start using it to display an airflow 'grade' for your customers.

Three Simple Steps:

1. Choose Heating or Cooling mode.
2. Collect and input some basic nameplate information.
3. Measure two static pressures and input your readings.

That's it! The results are instantly shown in graphs and wording even your customers can understand.

Bonus: AirMaxx Lite includes links to free videos, tools and articles to help you perform static pressure measurements and diagnose airflow issues today.

Get started on the path to High-Performance HVAC™ today by downloading the app for FREE!



Find AirMaxx Lite in your phone's App Store or Google Play, or scan the QR code below.



Apple App Store
ncilink.com/AML1A

Google Play
ncilink.com/AML1D

HIGH PERFORMANCE HVAC TODAY™

TECHNICAL:

Making the Case for Better Equipment Performance Data

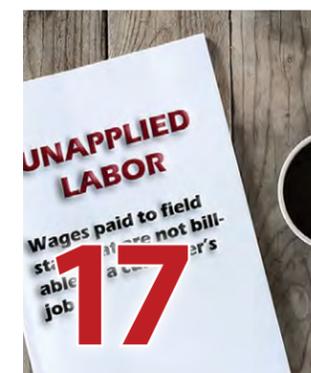


Did you know that most manufacturers do not share the bulk of the data they have on their equipment? Ben Lipscomb makes a case for the need to share that data with HVAC field service technicians.

MANAGEMENT:

How Air Upgrades Enhance Business Profits

Unapplied labor is the enemy of every HVAC contractor. David Holt highlights how adding the Air Upgrade to your service offerings helps to defeat that enemy and fund the continuing success of your Performance-Based business.



MANAGEMENT:

Address IAQ Through System Performance

21

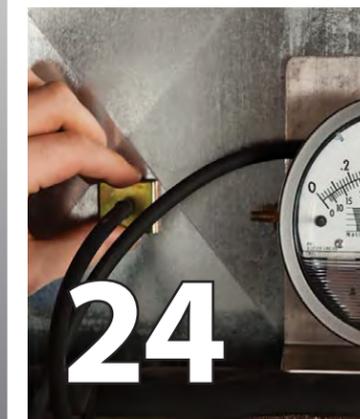
Performance-Based contractor John Ellis -- So Cal Air Dynamics -- discusses how poorly performing HVAC systems impact Indoor Air Quality and why.



TECHNICAL:

Avoid 4 Mistakes When Measuring Static Pressure

Most questionable static pressure readings start with forgetting and/or ignoring measurement basics. David Richardson examines four common mistakes made when measuring static pressure, and how to avoid them.



24

SERVICE:

It's Time to Phase Out 'Rules of Thumb'

Sadly, when it comes to air conditioning equipment sizing, the HVAC community, in general, falls woefully behind. Contractor Paul Wieboldt says most don't measure -- they rely on Rules of Thumb. He believes this needs to change, right away.



27

DEPARTMENTS

Online Content.....	4
Editor's Page: Today's Word	7
High Performance News.....	8
High Performance Products.....	9
Utility Spotlight: Austin Energy	10

Photo of the Month	31
Member Update	32
Ad Index.....	33
Publisher's Page: One More Thing	34

NCI Member or ComfortMaxx™ Subscriber?

Access to the full version of the app is INCLUDED for you.

Search for "AirMaxx" on your phone's app store. Once installed, follow the instructions on how to get your unique access key to unlock the app.

Monthly Download

A micromanometer measures pressure, and calculates velocity and volumetric flow rate. It can be used with Pitot tubes to measure velocity and then calculate flow rates with user-input duct size and shape. This month's download is a 14-point checklist on how to set up the micromanometer and use it correctly when performing duct traverses.

Keep this Tech Tip handy as a printout or on your phone as a reference tool out in the field. Go to ncilink.com/md0318 to download this Tech Tip item.

By registering for free on NCI's website, access this download and many more. Be sure to register today.



Online University

Featured this month is the *Introduction to Carbon Monoxide (CO) module* of the Online University's Advanced Technical training.



This course will help you to better understand the characteristics of carbon monoxide and the symptoms of CO poisoning? Do you know at what levels does carbon monoxide

become life threatening and what you should do if you encounter it?

Find out the answers to these questions and many more in this introductory program.

Read more here: ncilink.com/ou0318.



BLOG POSTS

HVAC ETHICS AND CUSTOMER RELATIONS



Rob Falke always talks about the importance of adhering to the laws of physics when designing, installing, and servicing HVAC systems. In this post, he discusses the laws of ethics that also have a large impact on your HVAC business.

Read his blog here: ncilink.com/FalkeOnEthics

VISUAL CLUES OF DISCOMFORT

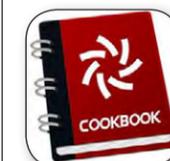


Many homeowners across the U.S. live in uncomfortable conditions. As an HVAC contractor, there are some common steps you can take to help make conditions much more bearable.

David Richardson explains that if you know what to look for, you can easily see the signs. Here's his opinion on the most common visual clues of discomfort and how you can help customers resolve them.

Read it here: ncilink.com/DRClues.

THERE'S AN APP FOR THAT ...



There are so many mobile apps for HVAC contractors. The question is, which ones are worth your time? Answer: Not all of them for sure.

NCI's David Richardson has found several that make great sense for the Performance-Based Contracting™ community and we present those here.

The March 2018 app is the **Loren Cook Engineering Cookbook**. It is a free reference guide for HVAC designers.



It provides fast access to often-needed information, including: Fan Basics, System Design, Duct Design, Motors & Drives, Heating & Refrigeration, and Formulas & Conversion Factors.

Loren-Cook Co. designs and manufactures fans, blowers, vents, laboratory exhaust systems, and energy recovery ventilators. This app is available in both **iOS** and **Android** formats.



NO BYPASS REQUIRED!

The **NEW** 6-zone ESP panel eliminates the need for bypass dampers by using a built-in Electronic Static Pressure controller.

- LCD and slide switch configuration
- Single-stage, multi-stage, heat pump or dual fuel with up to 4H/2C
- 6 zones expandable up to 9 or 12
- For use with standard 3 wire dampers

Stop by and see us in Austin at the NCI Summit!



888.652.9663 • www.jacksonsystems.com



The leading training organizations in the HVAC industry are teaming up to form a new alliance that will deliver unparalleled value to HVAC contractors and change the industry forever.

STAY TUNED FOR MORE DETAILS!



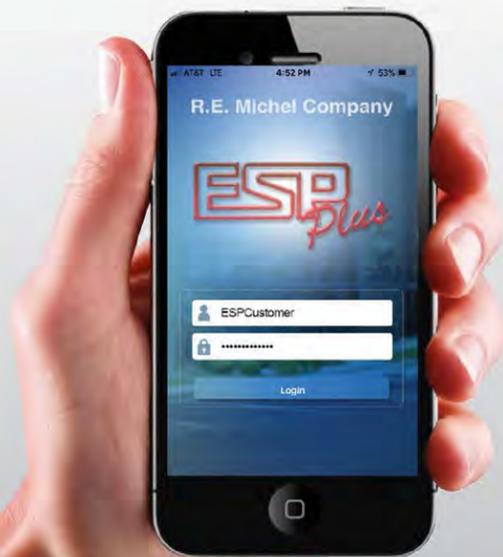
R.E. MICHEL COMPANY

WHOLESALE DISTRIBUTORS • AIR CONDITIONING • HEATING • REFRIGERATION
EQUIPMENT • PARTS • SUPPLIES

www.remichel.com | make the connection™

2 Companies, 1 Common Goal... GROWING TOGETHER!

- Preferred Vendor
- Qualifying purchases eligible for REBATES
- Free Local Delivery to your Business or Job Site
- Free 24 Hour Emergency Service
- Over 280 Convenient Locations Nationwide
- Fully Stocked Branches with the Product you need
- No Hassle Warranty
- Dedicated Sales Associate
- Superior Service along with Knowledgeable staff
- Vendor Assisted Inventory Management Programs
- Specific Product Training upon Request



Check out the **NEW** ESP Plus App!

Available for iOS

Inventory Management SIMPLIFIED!

The Long, Strange Trip: A Milestone for HVAC and Building Performance



Mike Weil is editor-in-chief and director of Communications and Publications at National Comfort Institute, Inc.

What a long, strange trip it's been. The Grateful Dead's Jerry Garcia sang that back in 1970 in the song, *Truckin'*. It was a cry for the acceptance of banality and the drive to continue searching for epiphany.

Banality? Think about that whirlwind of headlines last year that shot past us at the speed of Twitter. Add in the crazy ups and downs of the U.S. economy, and it's no wonder I had no idea what to expect as I stepped onto the floor at McCormick Place in Chicago for the 2018 AHR Exposition.

The epiphany was the re-energized HVAC Industry I saw. It was as if all the craziness of the previous year didn't happen. By all accounts, this year's expo shattered every previous attendance and exhibitor record and the atmosphere was electric. The sheer magnitude of products and technology on display was mind-boggling.

And it was the first time in my 38-year journey in the HVAC Industry that the buzz about home and building performance was so intense.

The show was awash in a mad array of tools and instruments targeted to testing and measuring

net of Things," (IoT) the interconnection via the Internet of computing devices embedded in equipment and components, enabling them to send and receive data. The IoT race has also heated up in the instrument market via the movement to wireless data communications.

In that light, there are two main wireless approaches being used:

- **Bluetooth** that sends data directly from the instrument to apps on mobile devices

- **Radio frequency (RF)** that sends data from the instrument to a receiver, which can then broadcast the data to different devices: mobile, tablet, laptop, website, and more.

There are pros and cons to both approaches.

Bluetooth's upside: it is simple and easy to use. Its downside is the data can only be sent a short distance to a single device.

RF-based instruments can broadcast data long distances to many devices. Its downside: a multi-step process to use that can be fraught with potential technical difficulties.

What does this mean for Performance-Based Contractors™? Many choices. Maybe too many.

IT WAS THE FIRST TIME IN MY 38-YEAR JOURNEY IN THE HVAC INDUSTRY THAT THE BUZZ ABOUT HOME AND BUILDING PERFORMANCE WAS SO INTENSE.

system and building performance. It is amazing to think that just 15 years ago the test instrument segment was tiny. There weren't a lot of instrument manufacturers, and the tools in the market were very limited compared to today.

Now there are vast catalogs for probes and multi-meters, manometers and micromanometers, voltage testers, Wattage meters, and so much more.

Another buzz at AHR surrounded the "Inter-

That's why it's imperative for contractors to choose the right tool for the right application. Be careful when it comes to buying instruments for residential versus commercial applications. Typically those meant for residential systems are NOT strong enough. Commercial instruments can be overkill in terms of features and cost for residential use.

So choose your instruments carefully. And always choose quality over price. Because measurement accuracy is the key to providing customers the most comfort, best efficiency, and the healthiest and safest living and working environments.

This is my epiphany.

Welcome to the long, strange trip.

2018 AHR Exposition Breaks ALL the Records

Chicago is the grand poo-bah of cities, especially when it comes to the HVAC Industry's annual meeting place – the AHR Exposition (AHR Expo). This year saw the event breaking six all-time records, including total attendance of 72,000 souls with nearly 50,000 registered visitors.

The Expo, which began in 1930, pro-

vides a unique forum for the entire HVAC industry: OEMs; engineers; contractors; manufacturers; distributors; commercial, industrial, and institutional facility operators; and educators.

vides a unique forum for the entire HVAC industry: OEMs; engineers; contractors; manufacturers; distributors; commercial, industrial, and institutional facility operators; and educators.



This year it ran from January 22-24 at the McCormick Place convention center. The 70th consecutive showing of the expo was celebrated by Show Manager Clay Stevens, who said, this year's excitement was "palpable from the show floor to the training sessions."

By the way, the 2018 show had more training sessions than ever before! The educational sessions also drew very healthy crowds both in the convention center and at the ASHRAE headquarters

some of which had standing room only. The classes were:

- Easily Quantify HVAC System Efficiency Loss Caused by Poor Installation
- Solve Hidden Maintenance Issues Using Testing and Balancing
- From Estimate to Occupancy; Critical Documentation for Every Test and Balance Project
- Why Residential Air Balance is being Required by Code.

For more details on their classes, please follow this link: ncilink.com/AHRClasses.

So What Was There? You name it – every product and service know for HVACR and sheet metal contractors were on display. In fact, there were 2,155 com-

panies exhibiting this year, up from the 2,118 exhibitors last year. Always amazing are the number of countries represented at AHR: this year 169 were there, just slightly up from last year's totals.

For the Performance-Based Contractor, the expo was a cornucopia of test instruments and products. We saw the latest airflow hoods, air velocity meters, hydronic manometers and more from TSI, Inc. Diversitech's fans and filters stood out. Ultra-Aire's humidity controls, dehumidifiers, and IAQ equipment were on display. There was something for every one.

Next year AHR Expo will land in Atlanta, GA. NCI and NBC will once again be presenting classes and will continue as an endorsing partner of the event.

THE FEBRUARY PHOTO OF THE MONTH WINNER IS ...

In our February issue, Andrew Ferrell, of DM Select in Burke, VA took home the "Bad" title in our monthly photo contest for his image titled, "Pure Idiots."

He found that someone replaced a 90% AFUE furnace with an 80% AFUE furnace. The problem? They reused the same PVC flue pipe. Thus his headline.

Congratulations to Andrew! He received a \$50 gift card.

You can be a winner too! We always welcome submissions. Just point your browser to ncilink.com/potm and fill out the information requested.

Photos fit into one of three categories:

- The Good
- The Bad
- or The WTH (What the Heck)!

We'll need a title for the image as well as a brief description.

We look forward to seeing your submissions and wish you all the best of luck in our next contest.

FIELDPIECE SDMN6 DUAL PORT MANOMETER / PRESSURE SWITCH

The SDMN6 dual-port manometer measures gas and static pressure. It accurately tests pressure switches by simulating a draft using an internal pump.

The SDMN6 tests the pressure switch to determine if it is working properly, or if it is starting to fail which can cause the furnace to run unsafely.



Plus, with the SDMN6 you can easily calibrate any adjustable pressure switch to manufacturers' specification, so there's no need to carry a large variety of pres-

sure switches on your truck.

The SDMN6 comes with a four-pocket carrying case, static pressure probes, pressure tubes, quick connect leads, hoses, and Y-splitter, as well as hoses with brass screw fittings.

For more information or to order, go to ncilink.com/0318FieldPiece, or call 800-633-7058.

SENSI™ TOUCH WI-FI® THERMOSTAT

Emerson's new Sensi Touch Wi-Fi Thermostat -- along with an updated version of the classic Sensi™ Wi-Fi® Thermostat—is now compatible with the Apple HomeKit™ smarhome management platform.

Customers can use the new geofencing proximity detection feature for flexible scheduling options to achieve



energy savings without compromising comfort. Other features include:

- Smart alert -- notifies customers of extreme temperature/humidity levels
- The Sensi mobile app has been updated, including a new dashboard with individual thermostat cards
- Both thermostats are also compatible with Amazon Alexa and Wink.

The products were introduced during the AHR Exposition in January and will be available in early summer.

For more information, go to sensicomfort.com or connect with Sensi thermostat on [Facebook](https://www.facebook.com/sensicomfort) or [Twitter](https://twitter.com/sensicomfort).

Upcoming NCI Training & Event Schedule

Performance-Based Selling
Apr 17-19: Los Alamitos, CA*

Commercial Air Balancing Certification Program
Mar 13-15: Kansas City, KS
Mar 27-29: South Plainfield, NJ
Apr 10-12: Dallas, TX
Apr 24-26: Middletown, CT
May 8-10: Nashville, TN
May 15-17: Boston, MA

Duct System Optimization & Residential Air Balancing Certification Program
Mar 27-29: Columbus, OH
Mar 27-28: Los Alamitos, CA*
Apr 3-5: Baltimore, MD
Apr 10-12: Rochester, NY
Apr 17-19: Cleveland, OH
Apr 24-26: Austin, TX

NBC Commercial Balancing with Certification
Mar 19-23: Cleveland, OH

Combustion Performance & Carbon Monoxide Safety Certification Program
Apr 3-5: Omaha, NE
Apr 10-12: Chicago, IL

Commercial HVAC System Performance
Mar 13-14: Tulare, CA*
Apr 3-4: Louisville, KY
Apr 24-25: Los Alamitos, CA*

Optimize Economizer Performance with Certification
Mar 15: Tulare, CA
Apr 26: Los Alamitos, CA

Residential HVAC System Performance & Air Balancing Certification Program
Mar 20-22: Mobile, AL
Mar 20-22: Washington, DC
Mar 27-29: Nashville, TN
Apr 3-5: Lansing, MI
Apr 10-12: Los Alamitos, CA*
Apr 10-12: Tulare, CA*
Apr 17-19: Denver, CO
May 1-3: Portland, OR
May 1-3: Philadelphia, PA
May 8-10: Northern, NJ
May 15-17: Minneapolis, MN

Introduction to Hydronic Testing, Adjusting, & Balancing
Apr 10-11: Cleveland, OH
May 8-9: Los Alamitos, CA*

*Subsidized NCI training offered by Southern California Edison.



Austin Energy: Yesterday, Today, and Tomorrow

This month we shine our spotlight on a different entity in the HVAC universe. Our focus is on a publicly-owned utility – Austin Energy – that serves the city of Austin, TX and surrounding areas. Austin Energy (AE) was first established in 1895 and today is the eighth largest public utility in the U.S.

Why this focus on a public utility?

First, for the past 40 years, Austin Energy has operated energy efficiency programs for customers and was one of the first utilities to do so. The program includes a contracting group that offers an “energy audit” to identify ways customers can reduce energy use. Austin Energy also provides rebates of up to 20% of improvement costs.

According to Terry Moore, Residential Conservation Energy Manager, the utility has a portfolio of energy efficiency programs spanning three markets: residential, multi-family, and commercial.

“My focus is the residential world,” he explains. “Our foundational program in residential is Home Performance with Energy Star. That program addresses the needs of the entire home rather than piecemeal enhancements.”

He adds that the Home Performance program assists roughly 1,000 homes a year.

“Austin Energy also has a “Weatherization Assistance Program” that assists qualifying low income rate payers with improvements that mirror the ‘Home Performance Program’. This program reaches between 850-900 homes a year.

Says, Moore, “What’s unique about our Weatherization program is that it’s evolved beyond the traditional weatherization model of weather-stripping doors and windows, adding attic insulation, patching holes, repairing windows, leaks, and

plumbing, to taking a whole house approach.

“We have really dialed into energy efficiency improvements. That means our low-income customers, who may not be able to go through Home Performance with Energy Star Program, can still get many of those benefits from within our Weatherization program.”

The “Weatherization Assistance Program” covers up to \$7,500 in cost to qualifying customers with an average cost in the program of \$3,500 per home. Moore says home performance results in savings of around 1,975 kWh per home annually and the Weatherization Assistance Program nets about 1,100 kWh per home.

THE DIFFERENTIATION FACTOR

The second major differentiator between Austin Energy and many other public utilities is their a focus on training. Austin Energy helps their participating HVAC contractors with training to help them better serve consumers to achieve lower energy bills. According to Tom Turner, AE’s Environmental Program Coordinator for Field Services, “In the early 2000s we were one of the first utilities to embrace new technology that helped push blower door and duct blower testing to the forefront.

“The program was titled *Duct Diagnostics*.”

Turner says they realized the futility of sealing leaky duct systems without establishing a plan to correct deficient air flow.

“More than diagnosing leaky ducts and homes, the program established the fact that old homes needed duct improvements to address comfort, performance, and prolong HVAC equipment life. This was unheard of for most other public utilities of the time.”

Turner says that “to raise energy efficiency, and make systems Energy Star compliant and beyond,

requires high quality HVAC installations, repairs, and quality inspections.”

“One of the tasks we’ve set for ourselves is to help our participating contractors set themselves apart from the rest of the contracting community. It is our goal to increase our number of participating contractors and get them “on board” with Home Performance through training.

“Once they see what we are doing, they understand how performance sets them apart, and that goes along way for helping them stay on board.”

Moore adds that it isn’t easy. “Change is difficult for everyone and some contractors really struggle with this. It is a fundamentally different approach for them. However, many of our Home Performance contractors have been “open minded” about the changes we have made and have found that they can be successful with them. The results are higher customer satisfaction.”

He continues, “What makes the Austin Energy approach so different is our focus on the air delivery system.

“HVAC contractors have mostly focused on equipment to achieve efficiency and don’t address the duct system. We preach it is about sealing the

home envelope, installing high efficiency air conditioning systems, and optimizing the ducts. Over the last three to five years, we’ve really zeroed in on air delivery systems as part of our residential energy efficiency programs.”

VERIFICATION IS KEY

Austin Energy conducts a “test out” on every installation done as part of their two programs. The utility maintains an inspection staff that performs a visual assessment for each Home Performance and Weatherization Assistance job. Once the job is complete AE provides a final inspection and requires a test-out. This includes room-by-room air flow and static pressure measurements on “Home Performance” jobs and duct leakage on “Weatherization Assistance” jobs.

According to Turner, they also have third-party (testing) contractors who validate test data and perform visual inspections on 10-15% of completed jobs.

He says this summer, they will begin conducting both test in and test out on a statistical sample of jobs.

“This will help us validate our savings from year to year and also get a better picture of how the program is

performing on a measure by measure basis. What this means is that Austin Energy will, as Moore says it, ‘test this scientific sample every summer.’ They will test in and test out to actually validate savings levels, which will either move up or down depending on the data gathered.

OVERCOMING OBSTACLES

Tom Turner says he thinks the HVAC industry faces a major overall problem. “Contractors install systems that outlast technological advances which typically drive consumers to the next model. It’s not just equipment and control technology that advances.

“It’s also the technology used to measure, test, and diagnose mechanical and air delivery systems that advances. Ten-year-old equipment and methodologies are mostly out of date,” he says.

“Replacing HVAC equipment without addressing other home issues such as; air delivery, insulation, solar screens, and the home envelope; may result in lower than expected efficiency and performance. Making all of those changes is costly and consumers are sometimes cautious about spending the additional money.



Tom Turner (left) is the Environmental Program Coordinator for Field Services and **Terry Moore**, the Residential Energy Conservation Manager for Austin Energy.



Duct System Air Handler Trainer: As part of their efforts to help HVAC contractors understand the airside of a system, Austin Energy created a training tool they call the Duct System Air Handler Trainer. According to Tom Turner, they were seeking a way to demonstrate to contractors the impact of what happens in a duct system. The training station has a watt meter and static pressure gauges on it. It enables contractors to “play” with the filters and different media with different surface areas. Turner says they can make that watt meter run at about six times what it should to demonstrate the impact of bad ducting on air flow. This provides a visual most technicians don’t get in the field.

Because of the added cost and reluctance of the customer, contractors may not “up-sell” to a “whole house” project,” adds Terry Moore.

So how do you overcome such obstacles? Both Moore and Turner say it’s done by slowly providing the training contractors need. “We initially looked at Home Performance with Energy Star as a two-dimensional solution: sealing the home envelope and duct system and then installing a high efficiency HVAC system,” says Moore.

“But in the last few years we added a third component -- optimizing the air delivery system. Our Home Performance with Energy Star Program now includes optimizing the air delivery system to make sure it is designed and sized to deliver the air it is supposed to deliver.”

Moore continues, “That means we

now require our participating contractors to measure static pressure and properly size plenums and branch ducts. This was a significant change in our program. After two or three years of training contractors, who then actually perform the work in the field, many will now say this process has completely changed their outlook.”

TRAINING THE NCI WAY

Though Austin Energy has the wherewithal to do much of their own training, they use outside experts well-known for technical prowess when it comes to measuring, testing, and diagnosing air conditioning and air delivery systems. Turner and Moore explain that National Comfort Institute, Inc. (NCI) is a big part of that.

“It’s not just teaching contractors

how to measure things,” Turner says. “NCI teaches them WHY it is important and HOW it affects everything they are trying to deliver.”

Moore says AE not only uses NCI to train their contractor base, but also to help train their own internal staff. “We keep our staff NCI-certified in air balancing as well as in combustion because 75% of our market here is natural gas. We work diligently to keep those certifications updated not only for our guys, but for our contractors who participate in the program as well,” he says.

Internal training? Indeed. According to Turner, AE holds internal meetings on the first and third Tuesday of each month. They review past work and train on topics relevant to the current inspection trends.

“Our inspection staff must maintain

NCI credentials in combustion and carbon monoxide, and at least one certification related to residential airflow provided by NCI. We encourage certifications in all areas NCI provides training,” he says.

Contractors who participate in the AE Home Performance and Energy Star program are also required to maintain airflow certifications from NCI. Says Turner, “Our goal is to have certified personnel on every job site.”

To help with that goal, AE co-ops 25% of the training cost. For those contractors who participate in the Austin Energy programs, not only do they have a keen market advantage over their competition, but they also have part of the cost of the training covered by the utility.

Moore adds that their objective with

all the training and certification requirements is to “take quality to a higher level.” Just as importantly, it provides Austin Energy with another layer of customer service. Moore calls it face-to-face with customers about AE’s programs.

THE CHANGING MARKETPLACE

Both Turner and Moore say that Austin is an area with a fairly high turnover in housing. They say homes change hands almost every decade.

“People don’t stay long in their houses here,” Turner says. “We find that once someone buys another house, they call us to enroll in our Home Performance program.”

From an HVAC contractor perspective, Austin Energy is a unique public utility in its approach to the marketplace. That provides an opportunity

for contractors to stand out, to differentiate themselves, and to better keep up with advancements in the industry.

Turner says that whether they are in the Austin market or anywhere across the U.S., “HVAC contractors need to keep up with advances in technology and best practices. It’s more important than ever to embrace innovation and methodology.”

Terry Moore concurs. “The impact of ignoring duct systems is huge. If you don’t address air delivery issues, you will come up short in terms of the comfort and efficiency you promise your customers.”

Performance. It is the secret sauce to a bright future. Congratulations to Austin Energy for its unique focus and for being the March 2018 *High Performance HVAC Today* Spotlight. 

Save 25-50% on HVACR EQUIPMENT purchases.

TURN YOUR SURPLUS HVACR EQUIPMENT, COMPRESSORS, AND CONTROLS INTO WORKING CAPITAL



LAZCO CORP. Buys and Sells surplus HVACR equipment, chillers, boilers, rooftops, generators, transformers and other equipment.

For a Prompt Purchase Quote Please Send Your Surplus List to Lazcocorp@gmail.com

Steve Lazar • 480-265-9980 • www.lazcocorp.com

Send equipment requests to Lazcocorp@gmail.com

LAZCO **HARDI**
Proud Member



Job Link® System Wireless Probes

350' Wireless Range
• Strong signal goes through walk-ins

JL3 Psychrometers
• Flexible wand with heavy duty magnet

JL3 Pressures
• Fits in tight spaces with 45° angled fitting

JL3 Pipe Clamps
• Extremely accurate and fast reacting

2 Kits available JL3KR4 and JL3KH6
www.fieldpiece.com



Job Link
Free Mobile App

Fieldpiece

Making the Case for Better Equipment Performance Data

HVAC equipment manufacturers have in their possession a wealth of information about how their equipment should operate under a wide range of conditions. This data is derived from laboratory testing, as well as thermodynamic simulations. However, the lion's share of this data is not made publicly available.

The data provided in published product specifications, engineering handbooks, and service

Referencing and recording manufacturer documentation and specifications is the best-practice approach for maintenance, diagnostics, and service.



manuals is a small and inadequate subset of the data that could be immensely valuable not only to engineers, but also to technicians in the field. If manufacturers have an interest in keeping their equipment operating properly, it's time to consider today's more sophisticated technicians when determining the type, format, and accessibility of performance data.

It's well-documented that the appropriate way to maintain, diagnose, and verify HVAC equipment performance is to use manufacturer instructions and specifications for reference and comparison of actual operation. ASHRAE Standard 180 lists manufacturer technical material as a source of performance objectives for equipment maintenance. A 2012 evaluation of HVAC maintenance programs in California recommends that utility programs use manufacturer maintenance and diagnostic protocols or compare program methods to them for reference. The advice is also espoused internationally.

For example, the Australian government repeatedly provides direction to consult manufacturer documentation in its Guide to Best Practice Maintenance & Operation, and states that, "Easy access to O&M manuals is essential for Maintenance Service Providers to obtain the necessary information." The list goes on. However, if you try to put these best-practice recommendations into actual practice, you quickly encounter many hurdles that make it difficult to do so efficiently and correctly.

When I've spoken with the engineering staff at various manufacturers regarding the data they make public, they tend to have some common rationalizations for providing only limited data. Here are some ways they excuse themselves from the responsibility of publishing more use-

ful performance data:

- "The data we publish is only intended for preliminary design"
- "We have additional data available through our system selection software"
- "Our data is intended to be used by engineers, not by technicians in the field"
- "We only provide our data to authorized dealers"
- "We don't provide data for obsolete products. Check with one of our distributors."

The truth of the matter is, in the past HVAC technicians often operated on rules of thumb, and most wouldn't have made use of the data even if manufacturers provided it. We've all heard, and maybe some of us have used rules of thumb like these:

- "If the suction line is "beer can cold," the system is properly charged"
- "A 20°F drop across the evaporator means airflow is good"
- "A 30°F rise through the condenser means capacity is ok"
- "If the flame is blue, it's burning efficiently."

For systems to operate properly, manufacturer data deficiencies and technician rules of thumb both need to be put in their proper place – behind us! Both groups have a vested interest in coming together to improve field performance evaluation and diagnostics.

Manufacturers want to keep customers comfortable to create brand loyalty. They also want to minimize warranty costs due to improperly installed or adjusted equipment.



Modern technology should ideally provide field technicians with easy access to the most up to date and relevant equipment data and specifications.

On the extreme end of their concern spectrum, manufacturers want to minimize liability due to catastrophic equipment failure, carbon-monoxide poisoning, or other high-profile health and safety-related issues arising from a misunderstanding of proper operation.

Contractors and technicians also want to build customer loyalty and differentiate themselves from their competition. To do that in a commoditized market like the HVAC industry, contractors must demonstrate value to their customers.

One way to do that is to take measurements and compare their results to manufacturer data, showing that the system is operating correctly. Or, if it's not operating correctly, justifying the recommended course of action (and the price tag that goes with it).

That's not possible if a tech doesn't

have access to the right data. A high-quality invoice or bid that's supported by real data goes a long way toward improving a customer's perception of a contractor compared to competitors.

Today's instrumentation -- as well as access to the internet through computers, tablets, and smartphones -- lay the groundwork for a new generation of sophisticated technicians who can provide a level of service far beyond what was typical in the past.

To realize the many benefits of such technicians using manufacturer data appropriately, a broad range of issues need to be addressed.

Here are some common barriers for technicians trying to access and use data in the field:

- Access to data is restricted only to authorized distributors or dealers
- Data is unavailable for older equipment, or it's unclear which equipment generation(s) the data applies to
- Published data is incomplete, or is fragmented, unorganized, and difficult to find
- Data on equipment (e.g. charging charts) are too faded to read, and are unavailable electronically
- Performance data covers a very narrow range of conditions
- Blower performance data applies to specific situation (e.g. "wet coil"), with limited or no instruction for interpretation in other scenarios
- Data for individual components, such as coils, is not published for packaged equipment

- Data formats are not standardized, even across different models from the same manufacturer

- Data for field-installed accessories is not provided in equipment specifications, and is not readily available elsewhere

- Data is intended and laid out for use in system design and equipment selection, not field service and diagnostics

- Data is incorrect or inaccurate.

In this article we've examined the benefits of referencing manufacturer's performance data in the field. Using manufacturer data is a commonly cited best practice -- manufacturers, contractors, technicians, and customers could all benefit from the industry applying it.

We've also listed many of the com-

mon barriers that prevent technicians from properly applying manufacturer's data in their daily work. Issues range from inaccessibility, inapplicability, or even inaccuracy.

Today's technology provides us with the perfect vehicle for delivering the right information in the right format to the right person at the right time.

Let's recognize that one of these "right people" is the technician on the roof, and deliver the necessary data in a format intended specifically for his use. 

1. ANSI/ASHRAE/ACCA 2012, Standard 180-2012 Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems, In-

formative Appendix A

2. California Public Utilities Commission, DNV GL 2014, HVAC Impact Evaluation Final Report WO32 HVAC – Volume 1: Report, Commercial Quality Maintenance Conclusions and Recommendations

3. Australian Department of Climate Change and Energy Efficiency, 2012, Guide to Best Practice Maintenance & Operation of HVAC Systems for Energy Efficiency



Ben Lipscomb is a Professional Engineer based in Whitefish, Montana. He serves as NCI's Engineering Manager, where he draws on experience in HVAC lab testing, field research, and utility program design to provide technical leadership for consulting services for clients. Ben can be contacted via email at ben@ncihvac.com.

How Air Upgrades Enhance Business Profits

When you pay a technician for eight hours, but you can only charge four hours to the customer, that's a losing proposition for the company. To improve business profits, you should do everything you can to reduce unapplied labor.

According to a study conducted by Carrier Corporation, "unapplied labor" is one of the biggest profit-killers in the HVAC industry. In fact, this is true in every labor-intensive service industry that hires technicians to repair or replace all types of equipment.

When properly implemented, National Comfort Institute's (NCI) Air Upgrade process helps you attack this common profit-destroyer. While that's reason enough to adopt this innovative process, here are 10 HVAC system truths made better by Air Upgrades that will motivate you and your team to take immediate action:

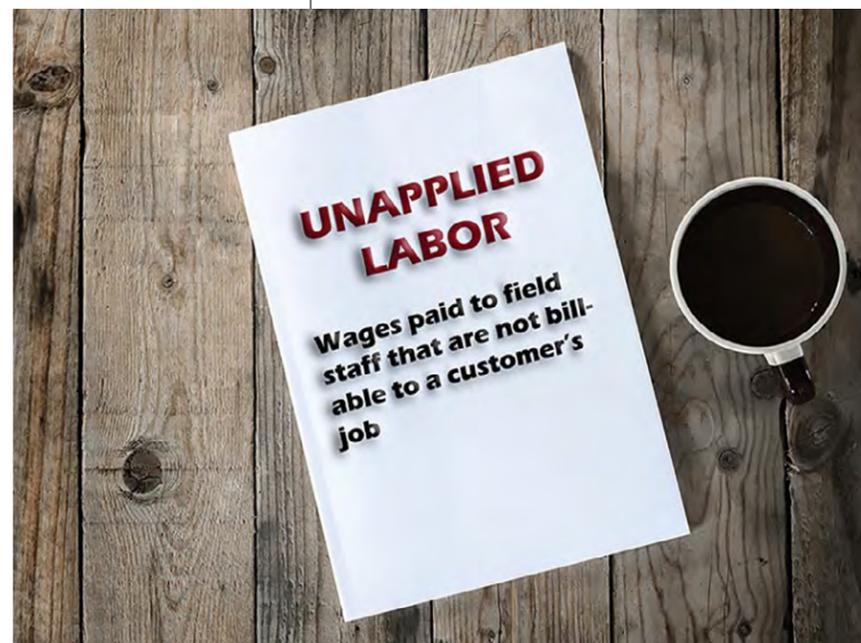
10 HVAC SYSTEM TRUTHS TO MOTIVATE AIR UPGRADE IMPLEMENTATION

1. You can't properly charge a refrigerant system without the required airflow moving across the evaporator coil.
2. Low superheat and high head pressure readings are common with improper fan airflow.
3. Compressor failure due to refrigerant flood-back happens with inadequate airflow across evaporator coil.
4. Heat stress cracks in furnaces and frozen evaporator coils can occur when fan airflow is too low.
5. ECM motor hunting and motor controller failures occur when static pressures are too high.
6. Erratic thermal expansion valve operation happens when ECM motors are hunting for programmed airflow.
7. Customers complain of high noise levels when variable-speed motors try to overcome high static pressures.
8. Low fan airflow causes furnaces to cycle on high-limit switches instead of thermostats.
9. You won't achieve appropriate heating, cooling, and humidity control if fan airflow is way off.
10. You can't deliver proper levels of conditioned air to each room in a structure unless the equipment produces enough conditioned air to satisfy all the rooms.

PLEASE NOTE: For this article, we'll assume the installed equipment is sized properly for the structure.

If not properly sized, a more thorough technical analysis and design procedure is in order.

What's the common culprit? Inappropriate fan settings and airflow restrictions that cause high static pressure.



ACCURATE. DEPENDABLE. VERSATILE.

TSI provides the most accurate, dependable and versatile ventilation and indoor air quality measurement instruments on the market today. www.tsi.com/comfort

TSI UNDERSTANDING, ACCELERATED

CUC Software, Inc.

Software you can trust, from people you know

EssentialsPro[®] and EssentialsPro Mobile[®]

Fully integrated... for the office and the field

Consistency, reliability, and one call when you need help

For more information: 800-272-9908 sales@cucsoft.com www.cucsoft.com

NCI National Comfort Institute, Inc. PREFERRED PARTNER

What's the solution? NCI's "Air Upgrade" process makes sure the equipment is operating with the appropriate fan airflow levels. The air upgrade process attacks common equipment setup issues and airflow restrictions primarily found at the furnace or air handler. The process focuses on achieving proper fan airflow at the equipment, so it can operate as the manufacturer intends.

However, there is no guarantee that an Air Upgrade will get the air to where it must go. That would involve more substantial work to optimize the duct system through testing, redesign, renovation, and balancing. A fully optimized and balanced duct system is the only way to ensure every room in the building is comfortable.



Static pressure testing is a key component off the Air upgrade process.

SIX WAYS AIR UPGRADES ENHANCE BUSINESS PROFITS

Here are six ways that adding Air Upgrades to your product offerings will enhance profits:

- Creates non-emergency work all year long
- Adds more billable installation hours
- Increases self-generated sales opportunities
- Provides higher average sale prices
- Enhances customer delight
- Enables positive customer reviews, testimonials, and referrals.

Let's take a quick look at how each of these benefits enhance business profits.

CREATING NON-EMERGENCY WORK ALL YEAR LONG

Much HVAC work relies on extreme-weather conditions. When it's very hot or cold outside, you usually have more work on your plate than you can handle. The urgency in your customer's voice is loud and clear as they declare their situation a dire emergency. This "wait until it breaks" customer service strategy makes it tough to keep crews busy year-round since equipment doesn't break during mild-weather months.

UNAPPLIED LABOR OCCURS WHEN YOUR TEAM MEMBERS SIT ON THE BENCH, JUST WAITING TO GET IN THE GAME.

The mild-weather months find your most valuable resource, your trained field staff, washing trucks, sweeping warehouses, painting walls, and "staying busy" while producing no billable time. The Air Upgrade pro-

cess identifies plenty of non-emergency work you can perform regardless of weather conditions. This additional work keeps your team on the field and off the bench, reducing unapplied labor and producing revenue all year long.

ADDING MORE BILLABLE INSTALLATION HOURS

Some of the work associated with the Air Upgrade process is time consuming and is therefore avoided by many contractors. I can't tell you how many times I've heard "working on duct systems is too labor intensive" from contractors struggling to make ends meet.

HERE'S A TIP: "LABOR INTENSIVE" TRANSLATES INTO MORE BILLABLE INSTALLATION HOURS!

Keeping your team productive (reducing unapplied labor hours) is key to your business profitability. The key to success is ensuring that this type of work is priced and managed properly so "the juice is worth the squeeze." Increasing billable hours for your installation team is never a bad thing, as long as it is profitable.

INCREASING SELF-GENERATED SALES OPPORTUNITIES

Self-generated (proactive) leads are always better than emergency (reactive) leads. Why is that? Consider this truth: "He who identifies the problem, resolves the problem." Think about that and let it sink in for a minute. The person who identifies the problem is typically the person who resolves it.



Don't you want to be that person?

In the case of your customer determining their HVAC system no longer works (usually on the hottest or coldest day of the year), they are in control of resolving the problem. They may decide to call you, or they may decide to call your competitors. They decide, not you. If they choose to call you, your team must react promptly to the emergency or face the consequences.

CONTRACTOR-AVAILABILITY TRUMPS CUSTOMER-LOYALTY IN AN EMERGENCY

THE WORK IS YOURS

What if you were the one identifying the problem? Does that mean you get to resolve it? Most of the time, it does. Think about a typical service call. When you diagnose the problem and present your recommended repairs, don't you get that job most of

the time? Sure, you do.

The Air Upgrade process is a 100% proactive self-generated sales opportunity machine that you can turn on and off as needed. It all begins with a simple set of static pressure measurements that help you and your customer understand the current operational status of their HVAC system. Based on this simple testing process, your self-generated sales opportunities are guaranteed to increase.

GENERATING HIGHER AVERAGE SALE PRICES

Experience has proven that most installed HVAC equipment does not operate as designed by the manufacturer. Consumers have learned to "live with" the consequences and believe that "ultimate indoor comfort" is unattainable. This provides a great opportunity to offer more value to your customers.

WHEN YOU OFFER MORE VALUE TO YOUR CUSTOMER, YOU EARN MORE MONEY.

Installing test ports make taking static pressure measurements faster and safer.

The typical HVAC contractor focuses more on "swapping boxes" without considering how well the rest of the system is functioning. Through the simple static pressure testing associated with the Air Upgrade, you demonstrate your commitment to ensure the customer gets everything they're paying for. This added value always results in higher average job prices.

ENHANCING CUSTOMER DELIGHT

Customer satisfaction used to be a good goal, but no more. Your customers are much more demanding today. Thanks to Mr. Google, they know even more about what's available to solve their problems than some contractors. In addition, the new HVAC equipment you install is much more demanding. You must install it properly to deliver the benefits promised by the manufacturers.

WHEN YOUR CUSTOMERS ARE 'MORE THAN SATISFIED,' THEY'RE DELIGHTED.

A large base of delighted customers is one of the most powerful ways to enhance business profitability. Delighted customers don't shop around for better deals because they're pleased with their relationship with your company. When you employ the "measure, don't guess" Air Upgrade approach, your customer continues to be delighted with their indoor comfort system and the company that's maintaining it!

ENCOURAGING MORE POSITIVE REVIEWS, TESTIMONIALS, AND REFERRALS

Your growing base of delighted customers will help expand your business if you just ask them. When customers acknowledge that real value has been delivered through the Air Upgrade process (you reduced their long-standing dust problem, or solved their high electric bill issues, or made the master bedroom more comfortable, or reduced the noisy fan operation...) it's your signal to ask for their help.

WHEN YOU HELP SOMEONE GET WHAT THEY WANT, THEY'LL HELP YOU GET WHAT YOU WANT.

If you proactively measure the performance of your Air Upgrade enhancements by looking through the eyes of your customer, they'll happily post positive online reviews, write glowing testimonials, and refer your business to their friends, family, and acquaintances. The key is to be intentional about it – don't let it "just happen." Be proactive and the results will follow. Those positive reviews, shining testimonials, and referrals are the best fuel for your sales engine.

AIR UPGRADES CAN CHANGE YOUR LIFE

Sometimes, the simplest things are the most powerful. That's truly the case when it comes to Air Upgrades. When you can create non-emergency

work all year long, add more billable installation hours, increase self-generated sales opportunities, enjoy higher average sale prices, enhance customer delight, all while garnering more positive reviews, testimonials, and referrals, why wouldn't you?

To learn how to implement the Air Upgrade process in your business, attend NCI's [Airflow Testing & Diagnostics Implementation Workshop](#). 



David Holt is Director of Business Training and Coaching for National Comfort Institute, Inc. He can be reached at DavidH@nationalcomfortinstitute.com

Addressing Indoor Air Quality Through System Performance

As weather conditions become dryer and colder, our homes and businesses become a refuge from the harsh conditions. Maintaining proper Indoor Air Quality (IAQ) begins with a well-performing and balanced system that controls unwanted infiltration.

A well-performing system must have sealed ductwork to decrease pressure imbalances in the building. Pressure imbalances lead to uncontrolled infiltration of air from wall cavities, crawl spaces, attics, and outdoors.

So, what is the impact on IAQ when the system isn't performing as it should? During a recent home inspection, we found that a contractor had installed a bolt-on air purification device (a Merv 16 filter rack) in the return plenum but did

not properly seal it to the duct. This was a missed opportunity to improve IAQ.

By installing additional devices without resolving the underlying duct leakage issues, the contractor created a source for poor IAQ instead of improving it. This is NOT how you attain system performance.

WHERE DOES IAQ MEET SYSTEM PERFORMANCE?

Using smoke demonstrated that the newly installed filter rack was creating more problems than it solved. Because the duct leakage was not addressed, all the contractor did was add to the energy load.

Harmful pollutants are often found in the air we breathe. Indoor pollutants can affect the

Goodman

Air Conditioning & Heating

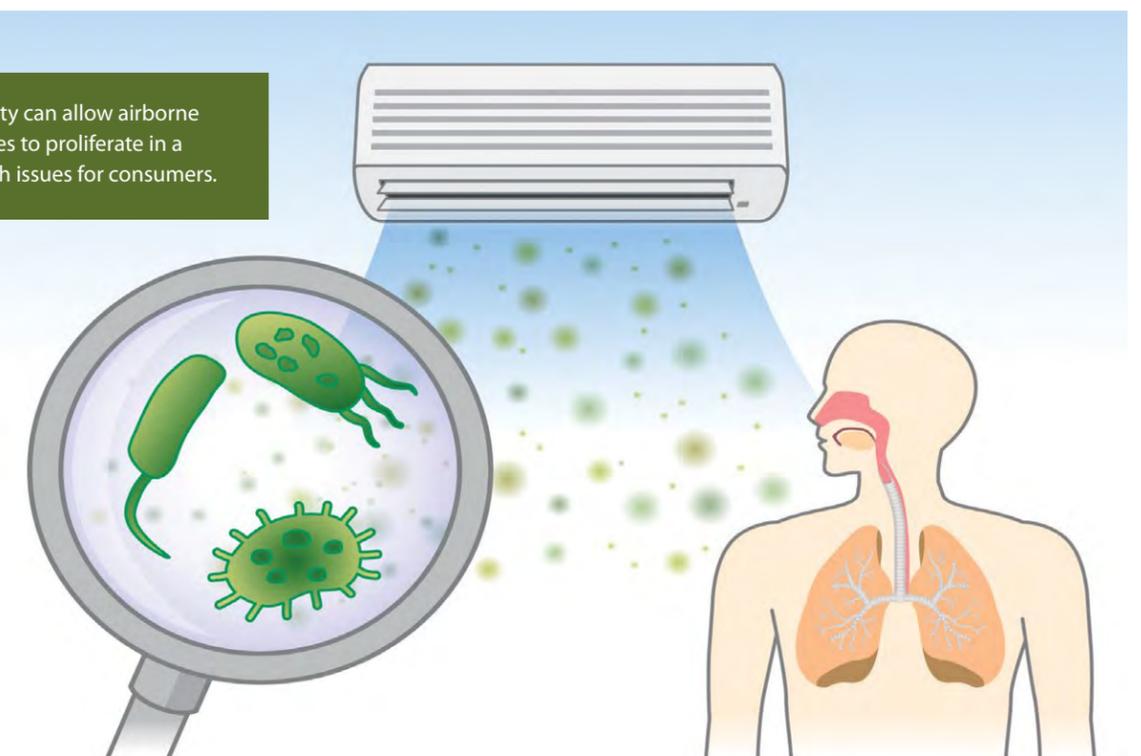
At Goodman, we believe in American dependability. Units are designed, engineered and assembled in the U.S.A.



Thank goodness for Goodman.

Our continuing commitment to quality products may mean a change in specifications without notice.
© 2017 Goodman Manufacturing Company, L.P. · Houston, Texas · USA
www.goodmanmfg.com

Poor indoor air quality can allow airborne pollutants and viruses to proliferate in a home, causing health issues for consumers.





Using smoke showed that the newly installed filter rack created more problems than it solved.

health of every household member. In fact, nine out of 10 homes have unhealthy air quality.

Studies show we spend as much as 90% of the day indoors. The quality of the indoor air we breathe has a direct effect on our health.

Also, 90% of the airborne particles in a typical household are smaller than 0.3 microns in size. Many of these airborne particles and allergens are so small that if you inhale

them, they enter the lungs and absorb into the bloodstream. Small children are especially affected by these ultra-fine particles.

As you can see, air filtration is very important. We want the air the HVAC equipment conditions to stay in the house. Let's keep inside air in, and outside air out!

AIR IS A FLUID

Filtration must be based on a sealed airflow system. Air moving through openings and gaps accounts for more than 98% of all water vapor/mois-

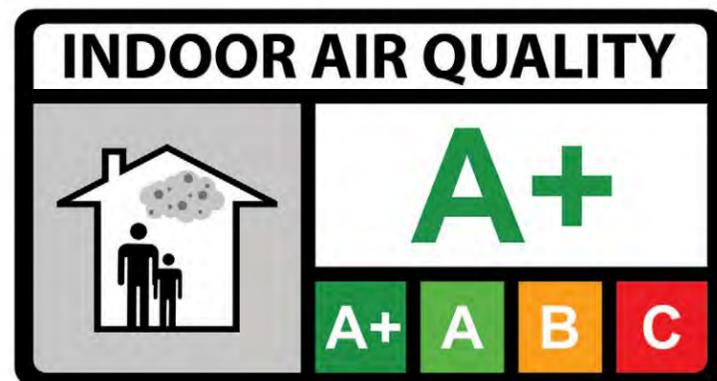
ture movement into building cavities. Where there is moisture, there is potential for microbial growth and mold.

Consider this: Air is a fluid that moves into and out of conditioned space. It is the medium on which all things travel. Liquids and gases are both fluids. A fluid is a substance that has no shape of its own; it takes the shape of the container it's in.

Both a duct system and the building are containers, albeit leaky ones. The secret is to find and seal the leaks to control the air within.

THE NEXT APPROACH

Once you contain air within a properly-sized and sealed duct system,



turn your focus to balancing airflow. That manages the pressure balance of the building. You accomplish this by sealing the structure, replacing windows, increasing or replacing insulation, replacing recessed ceiling lighting with ICAT-rated LED lighting, and then downsizing and upgrading the existing HVAC equipment.

However, only a small percentage of residential customers can afford to take this approach.

Fortunately, there are alternative methods to regain control of building pressure. Most installed sys-

tems are dramatically oversized and underused. Bringing in outside air serves several beneficial IAQ functions. Outside air dilutes potentially harmful Volatile Organic Compounds (VOCs) given off by building materials and cleaning products. VOCs also include pleasant fragrances and potentially fatal pollutants like carbon monoxide.

The second benefit for bringing in outside air through the system is to gain control of infiltration. When you bring in and condition outside air through a controlled system opening, you minimize uncontrolled leakage through the envelope of the building. If a concern arises as to the impact of

excessively hot or cold air degrading system performance, you can resolve it by adding a temperature or enthalpy sensor with an automated damper.

THEN THERE IS HUMIDITY

Humidity leads to mold and mold leads to IAQ issues. Control the humidity and indoor air quality improves.

Controlling indoor humidity levels is critical. The year-round ideal hu-



Humidity leads to mold and mold leads to IAQ issues. Control the humidity and indoor air quality improves.

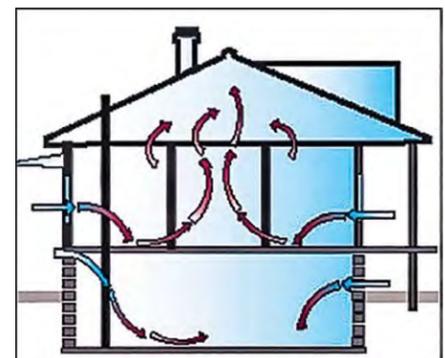


John Ellis: Featured Speaker at NCI Summit 2018

High Performance HVAC Summit 2018 is happening March 4-6 in Austin, TX. John Ellis is one of six Performance-Based Contractors™ presenting how they Blaze A Trail to High Performance. Ellis, who is president of So Cal Air Dynamics in Northridge, CA, will discuss how his team has built a reputation for solving indoor air quality issues using Performance-Based Contracting™ best practices.

Be sure to seek John out and discuss his processes for getting it done. Also take the opportunity to network with your peers in Austin. Learn more about the Summit 2018 program at GoToSummit.com.

midity range for customers is 40 to 60% Relative Humidity (RH). If RH falls below 40%, virus survivability increases, especially for those viruses



The diagram shows many points for air infiltration and exfiltration in a building.

associated with the common cold and influenza. An RH above 60% is ideal for fungal growth.

When you set fan airflow correctly in the cooling mode, you can alter the Sensible Heat Ratio (SHR). That balances the sensible cooling performance versus the dehumidification performance. When you move into the heating season, local weather conditions may require you to add

moisture to the building with devices such as a humidifier.

SOLUTIONS FOR WHAT'S GOING ON IN THE HOUSE

The key to taking care of IAQ issues is identifying pressure problems that create air exchange between inside and outside. How much exhaust air do you really need? How much airflow, for how long, and what are the properties of the air? What can you do to alleviate the pressure differences between inside and outside, thereby decreasing INFILTRATION?

The best filtration in the world isn't effective if it can't keep up with INFILTRATION.

An HVAC system can have a com-

plex zoning system, economizers, advanced controls, and staging, which may or may not improve comfort and efficiency. You must have a system capable of delivering equipment-rated capacity into the space before more advanced measures can perform properly. The same is true with IAQ. The principals of delivered system performance must be met before more advanced IAQ devices will have an impact on air quality within the building.

CONCLUSION

System Performance is a set of measurements and tests we should all be accustomed to. This allows us to gather data, and properly evaluate any system. These measurements, whether for determining static pressure, Btu delivery, air balance, combustion performance, air changes per hour, or latent and sensible Btus, are all directly related to indoor air quality.

Learning to collect and diagnose this data takes some practice. But once you start applying these measurements to your clients' indoor air quality concerns, it allows you to make a difference in their lives. You will be equipped to assure your clients have the most safe, healthy, and efficient homes or business environments possible. 



John Ellis is President of So Cal Air Dynamics, Northridge, CA. He has over 35 years in the HVAC industry, and is very active in several trade organizations, including NCI. John has spent the last eight years perfecting and implementing a high standard protocol for creating clean and healthy indoor environments for clients with acute respiratory issues.

He got his start in performance contracting 15 years ago after attending a class with Scott Johnson. His vans say "Performance Contracting" on them. At So Cal Air Dynamics, they apply a good blend of building science and best practices from NCI in their everyday business.

Avoid Four Common Mistakes When Measuring Static Pressure

If you talk to anyone experienced in measuring static pressure, they will admit they've dealt with inconclusive and goofy readings that didn't make sense. This typically results in a frustrating, but rewarding day, because they learned something they won't forget.

It's true that most questionable readings start with forgetting and/or ignoring static pressure measurement basics. To refresh your memory, I thought it would be fun to look at four common mistakes the best in our industry make when measuring static pressure.

MISTAKE #1 – OVERLOOKING BLOWER WHEEL CONDITION

In the daily grind, it's easy to kick into cruise control and get complacent. You install test ports, take pressure measurements, record them on the invoice, and the static pressure portion of the call is complete. If this is the rut you occasionally find yourself in, you've probably overlooked a dirty blower wheel.

One top mistake made when measuring static pressure is to assume the condition of the blower wheel. A dirty blower wheel makes static pressure readings look awesome, because the fan isn't moving the proper airflow. Experts estimate that

a 1/8" coating of dust on the blower wheel vanes reduces fan capacity as much as 30%. As airflow is reduced through the equipment, so is static pressure.

Remember this the next time you see static pressure readings that look great, but the furnace you're testing is tripping on its high-limit switch. If you're dealing with a condensing gas furnace, the secondary heat exchanger is probably dirty too. Prevent these headaches with a quick inspection of the blower. If it's dirty, clean it. Otherwise, your readings are suspect.

MISTAKE #2 – MEASURING IN THE WRONG LOCATION

This is the second most common mistake. There are multiple ways to measure static pressure incorrectly. While measuring filter and coil pressure drop is straight-forward, total external static pressure (TESP) often adds a layer of confusion.

So to better help technicians understand where to measure TESP, Trainer Scott Johnson introduced the "As-Shipped" concept to NCI. To apply this term, think about how air-moving equipment comes from the factory as-shipped in the box. When you unpackage it, what's included? These are the components included in the TESP measurement by the manufacturer – everything else is external.

Consider a gas furnace unpackaged on the jobsite. The only thing included in the box is the furnace. In other words, the indoor coil, air filter, and duct system are all external to the as-shipped furnace. This is why TESP on a gas furnace is measured after the filter (as air enters the equipment) and before the coil (as air leaves the equipment). When you remem-

ber this, it makes the TESP measurement much clearer.

If you're in doubt about test locations, record multiple pressures. Aim to measure and record four pressures on each system. On gas furnace systems, these four pressures are typically before the filter, after the filter, after the coil, and in the supply duct.

If you document pressures, you can go back and find any mistakes if there is a question or dispute. Remember, NCI has static pressure test location diagrams for common equipment types to help keep you straight. Send me an email to request your copy.

MISTAKE #3 – IMPROPER EQUIPMENT SETUP

Another common mistake is failing to pay attention to equipment setup details before measuring. This issue is often tied to rushing through the call or not understanding the equipment's operation sequence. Some common mistakes are:

- Using the fan on-switch on the thermostat
- Not letting the fan ramp up on variable-speed equipment
- Testing in first stage on two-stage equipment
- Not letting a coil get fully wet in cooling mode
- Not paying attention to the fan speed taps being used.

The fan should operate at its highest airflow and the coil should be fully wet to see how the system operates at its highest load. Testing static pressure as mentioned above could result in pres-

ures that look much better than they really are.

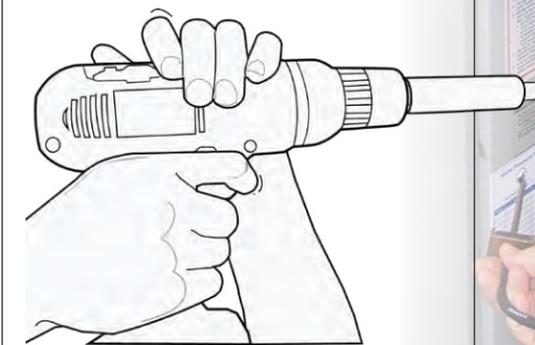
You can correct this by knowing the operation sequence for the equipment you're testing and by slowing yourself down. If unsure of the equipment's blower delays and staging, wait about 15 minutes after it turns on to take measurements.

MISTAKE #4 – INCORRECT TEST INSTRUMENT USE

The final mistake we'll look at is incorrect use of test instruments. This follows the same pattern as improper equipment setup. Both result from an unfamiliarity with the test equipment or just not having the right accessories to properly test.

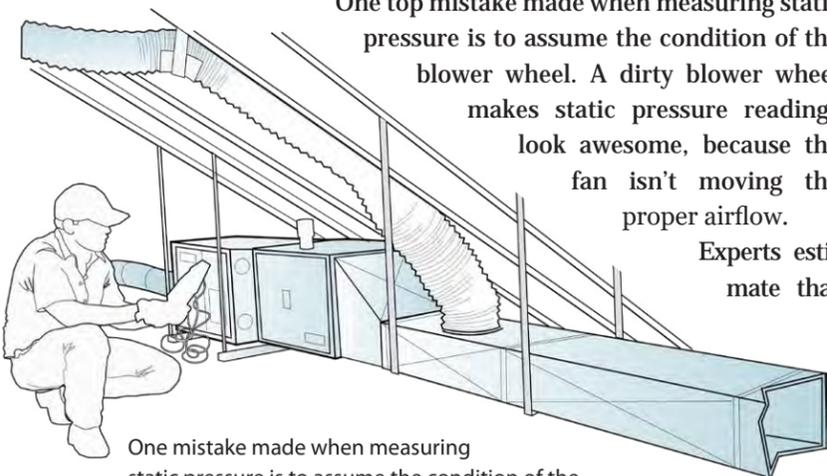
It is surprising how many technicians don't have a drill bit sheath when installing test ports.

The first place to start is test port installation. Because of this, they're afraid to drill into the equipment cabinet to test pressure near the coil. They



It is surprising how many technicians don't have a drill bit sheath when installing test ports.

should be! One misplaced test port makes for a long day repairing a subsequent refrigerant leak or cracked drain. To deal with this, many technicians test in the wrong location or assume coil pressure drop. Both lead



One mistake made when measuring static pressure is to assume the condition of the blower wheel. A dirty blower wheel makes static pressure readings look awesome, because the fan isn't moving the proper airflow.

to misdiagnosis. The best solution is to have the right accessories for doing the job correctly.

Holding an analog manometer (Magnehelic™) in your hand instead of leveling and zeroing it is another common mistake leading to measurement errors. Holding a digital manometer in your hand is fine, but your measurement techniques must be modified as soon as you use a Magnehelic.

Digital manometers also have their issues, the most common is using the wrong scale. If your pressure readings don't make sense, check the manometer's pressure unit setting. It's common to find pascals, psi, or inches of mercury on the manometer display once the batteries have been

changed. Adjust it to inches of water column for best results.

PREVENTING THESE MISTAKES

Now you might think that this is common-sense stuff. It is. This is why it's so easy to fix. You can get everyone on the same page with some attention to detail and a little bit of enthusiasm.

We forget so quickly that it isn't funny. Begin with re-emphasizing the fundamentals. With all the other responsibilities technicians have, reminders of the fundamentals keep us focused on getting accurate measurements. Also, technicians need access to documents that promote measurement consistency and proper documentation. You can help them by assuring they have the right materials.

If you run into trouble, don't forget to contact NCI technical support -- it's what we're here for. You're not alone in measuring static pressure. We have all faced similar challenges. The difference is how you respond to them. 

If you're an HVAC contractor or technician interested in learning more about adding static pressure testing to your services, contact David at davidr@ncihvac.com or call him at 800-633-7058. NCI's website www.nationalcomfortinstitute.com is full of free technical articles and downloads to help you improve your professionalism and strengthen your company.



David Richardson serves the HVAC industry as a curriculum developer and trainer at National Comfort Institute, Inc. (NCI). NCI specializes in training focused on improving, measuring, and verifying HVAC and Building Performance.

Time to Phase Out 'Rules of Thumb'

I have something to confess when it comes to air conditioning equipment sizing: As a community, we don't measure. We just guess. Probably 95% of us don't use the right tools for calculating heat loads. We use rules-of-thumb instead.

For example, we have a one-size-fits-all rule: 500 sq. ft. per ton. I call it "Manual J 500." No complicated math here; divide once, multiply once, and you have your equipment sizing and job pricing done in one shot.

But new energy efficient homes are messing up our game and I don't mind telling you how.

What happens when a thoroughly entrenched HVAC contractor meets a thermally enhanced building envelope? The answer is the same as when an irresistible force meets an immovable object. It's usually not pretty. If we don't change how we design HVAC systems, we might find our trade splat up against a wall someday. That wall will consist of regulators and even third-party engineers taking control and oversight of the residential HVAC industry.

How did Manual J design go from a best practice to a code-enforced regulation? We'll start with a look back over 40 years of our industry and where our design assumptions have gotten us.

THE GOOD OLD DAYS SIZING METHOD

For starters, those of us who have been servicing and installing residential air conditioning systems for the last two or three decades pretty much had it figured out that if we sized systems at the ratio of one ton for every five hundred square feet, it generally worked. No difficult load calculations were necessary.

Bids were easy to figure. It was as easy as one, two, three. All we needed to do was (1) estimate the square footage of the house, (2) divide that by 500 and (3) multiply by our price per ton and we were done.

For example: *Total home size is 1500 sq. ft. × 500 = 3 tons. Next, multiply 3 tons × \$1200 = \$3600.*

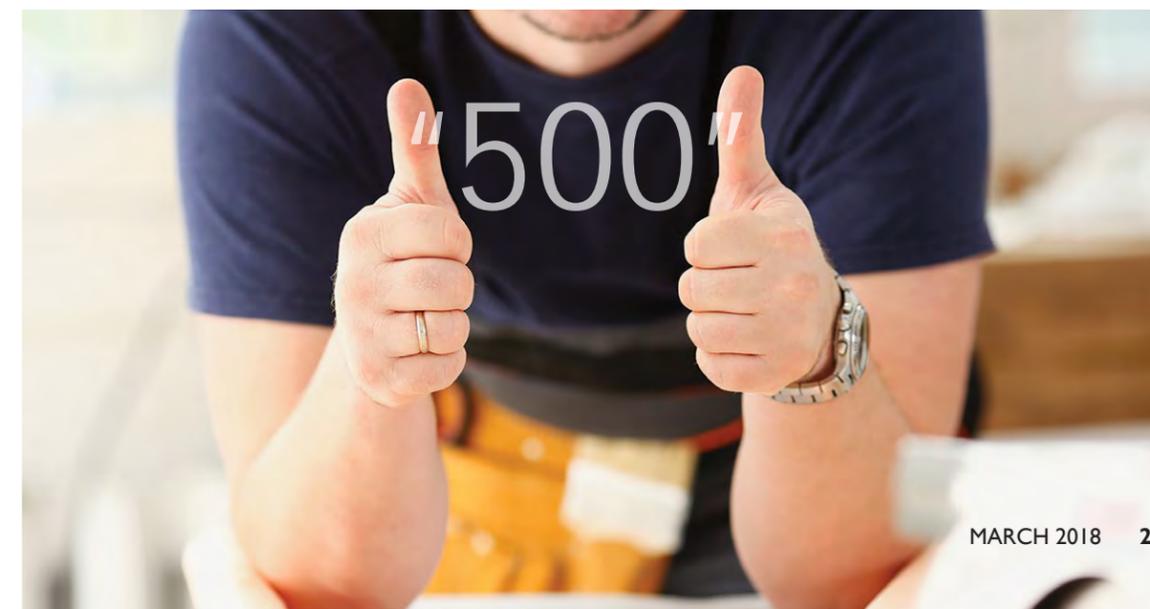
We did it this way for years and everybody was happy. Well, not everybody.

THE VENERABLE VENTILATION METHOD

In the trades, we are responsible for properly ventilating homes. That's why they call us Heating, Ventilation and Air Conditioning Contractors. For decades, builders built leaky houses that could breathe on their own. Our biggest ventilation issue concerned arguing with builders about who was responsible for bath fans.

In reality, other trades did the grunt work in

As an industry, we've been taught from the outset of our careers that sizing HVAC systems is a matter of using the "500" rule of thumb.



GREET YOUR CUSTOMER **DIAGNOSE** **CHOOSE A PAGE** **PRESENT THE MENU!**

Customers report an average service ticket increase of \$246!

Offer 5 options on every service repair and on equipment replacements.

Have your company up and running in two weeks!

SCHEDULE A FREE DEMO TODAY!

THE NEW FLAT RATE 706.259.8892
 info@menupricing.com
 www.menupricing.com

Dwyer **A BETTER WAY TO BALANCE**

SMART AIR HOOD™ SERIES SAH

- Quad Flow Design
- Improved Accuracy
- Predictive Balancing
- Lightweight/Easy to Maneuver

HYDRONIC METER KIT SERIES 490A

- Digital Dampening & Improved Resolution
- Controlled Purge
- Rugged Valve Assembly
- Pipe Strap Mounting
- Magnetic Mounting

TO LEARN MORE:
 800-872-9141 | dwyer-inst.com

terms of providing accidental building ventilation. I am talking about the plumbers and electricians who blasted their right of way for pipes and wires through the building envelope, leaving plenty of room for outside air to move into and out of the house.

There wasn't much need for us to intentionally ventilate a house. If it were up to us the story would end there. They lived happily ever after. THE END.

LET'S HAVE A WAR

But the story didn't end there. The way I heard it, some government bureaucrat asked some university professor how to save energy. The professor had a theory and the government had some money, so they decided to fight a war -- the *War of Energy Independence*.

As usual, this was planned as a short, inexpensive skirmish that "in theory" would fix our global energy problems so well and so fast that the oil producing countries would have to find a way to put their excess oil back in the ground. That was in 1974.

For over 40 years now, we have watched the building industry go through numerous energy crises and government fixes. They come like earthquakes and hurricanes; you never know when to expect them, but you know they will come.

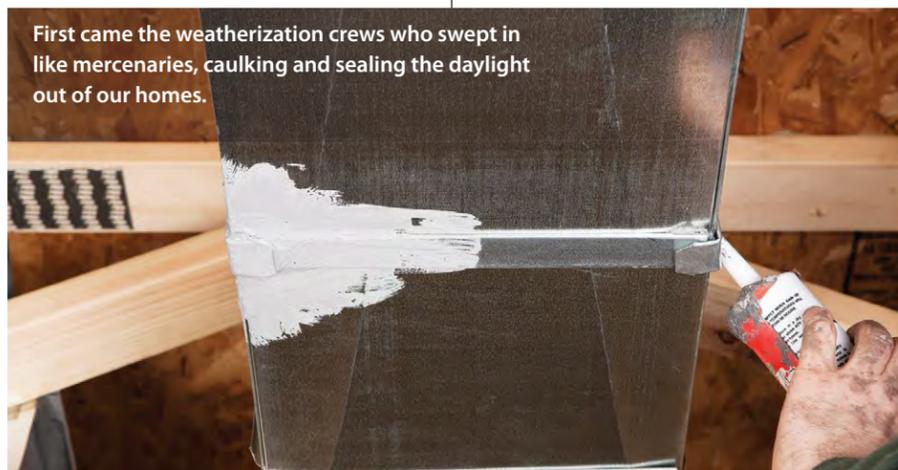
THE CAULKERS INVADE DURING THE 1970s AND 1980s

First came the weatherization crews of the seventies. They swept in like mercenaries, caulking and sealing the daylight (no joke) out of our homes. They fiercely attacked leaky houses, the enemy of energy independence. But it was like fighting a war with

broomsticks and baseball bats.

Miles of weather-stripping went up like a Maginot Line. Plumbing and electrical penetration leaks were blasted out of existence with carloads of canned foam. Caulk guns were fired at every crack where the enemy, "outside air," could infiltrate.

When the battle was over, experts came to assess the battlefield. Shockingly, they found the leaks that were



First came the weatherization crews who swept in like mercenaries, caulking and sealing the daylight out of our homes.

left fought twice as hard as before to let outside air in. The weatherized energy efficient houses of the 1970s and 1980s were just as leaky as before the Caulker Invasion.

THE COLD WAR

The experts mentioned above were some meddling building scientists with research money and nothing better to do. They figured out that HVAC ducts were making houses just as leaky as before! In fact, they found supply ducts leaked so badly outside the conditioned space that they caused the house air pressure to go negative relative to the outdoors.

The pressure difference caused small holes to leak more air. Infiltration was just as much a problem as

before. The average duct leakage rate was estimated at 30%! Now WE were wasting precious energy resources. It's not a good feeling to wake up and find that you are the Benedict Arnold in the War of Energy Independence.

UNINTENDED CONSEQUENCES OF DUCT SEALING IN THE 1990s

Out came the tape and pookey brushes, duct blasters, and legions

of duct leakage commandos (Seal Teams?) to the rescue. Ten years of this and then some building science guy figured out there were some serious unintended consequences related to Duct Sealing Battle.

Basically, they found that ducts were undersized. As an industry, we got away with this for years, because there was always enough leakage for the blower to work under normal pressure. Now fans were acting like they were blowing air through a drinking straw. Poor airflow from undersized SEALED ducts meant that fan motors and compressors became collateral damage.

Typical fans failed when subjected to higher-than-tolerable static pressure. Even powerful ECM motors bit

the dust when the amp draw went sky high as "silver bullet solution" fans tried to overcome the new restricted air flow in tight undersized ducts.

The resulting lower air flow across the evaporator meant compressors suffered frequent refrigerant flood-back. Bearing wash out and compressor slugging created a slow compressor death spiral. It could take two to three seasons but sure enough one day another compressor becomes a boat anchor.

500 SQ. FT. PER TON NO LONGER APPLIES

Contractors got along unscathed for 30 years until the foam guys came along and messed everything up. We stuck to our 500 sq. ft. per ton sizing rule, but things didn't work the same any more. Like Detroit autoworkers, our air conditioners sat idle for long periods with nothing to do.

We put in the same old thermostats that were too dumb to notice rising humidity while the air conditioners sat idle. Even when the air conditioning went to work, they quit early, leaving more humidity hanging around.

Of course, everybody knew enough to blame the insulation contractors for all the problems that arose as a result. Obviously, since we haven't done anything different for 30 years, how could we be blamed for causing the clammy feeling people were now experiencing. It would be crazy to change the way we do things just because somebody came up with a new insulation.

Now people say the 500 sq.ft. per ton rule no longer works. That's like

telling people Clorox doesn't kill mold on wood (Another myth. It doesn't, according to the EPA and many other sources)!

TIME TO RANT...

So here we are with the big mess made for us by "those insulation" people. Now we must do load calculations for these new super-insulated homes to figure out what we need to do differently with comfort system design.

The average home in the U.S. is maybe 2500 sq. ft. We used to sell five-ton systems to cool that space. Now our calculations tell us we only need half that. So, are we supposed to believe that?



Worse yet, the rated R-value per inch for the typical 1/2 pound SPF product is the same as fiberglass batts. So, what gives?

Nothing else in 30 years ever came close to a 1000 sq. ft. per ton. Basically, insulators sold their product

and put a big sign on ours, "Air Conditioning Systems 50% Off."

Most HVAC contractors are not ready for this. They are in denial. Too many years of habit and rules of thumb are causing them to react and misinform customers.

To make it worse the Manual J load calculation method is so misunderstood and abused that most contractors don't trust the results.

...AND RAVE

In my HVAC business, we design air conditioning systems for a living. We also test the performance of those sys-

tems. We do a lot of them. In fact, in the last few years, since we bought our own spray foam rig (now retired), we have designed air conditioning systems for more houses with spray foam insulation than anything else.

Foam is hard to beat -- if properly installed -- when it comes to making buildings tight and efficient. I must design mechanical ventilation for every home I foam insulate.

What amazes me is that most contractors I meet don't install whole house ventilation even though they are VENTILATION contractors. They don't believe in it. Have you ever met a masonry contractor who didn't believe in installing concrete? Or a plumber who only provides hot and cold-water supply piping, but no drain waste and VENT piping?

WHAT HAS CHANGED?

Here is what I have discovered:

- Manual J is building science. The building shell is a shield from weather. The effectiveness of that shield is what we are measuring
- You can insulate a house so well that it needs as little as half the air conditioning that a comparable house needed 30 or 40 years ago
- HVAC contractors can lower the attic temperature in a cathedralized foam application by more than 50 F, essentially bringing air conditioning ducts back into the same thermal boundary as the occupied conditioned space
- We can virtually eliminate the stack effect that robs so much comfort from the typical home.
- Here is what we can do:**
- Provide comfortable, efficient air conditioning systems in super-insu-

lated homes that will cost half as much to operate and be more comfortable than ever before

- Downsize the air conditioning systems we install in homes that are properly insulated
- Use a blower door to test the building envelope integrity and to establish the correct amount of fresh, cleaned, conditioned outside air to bring into the house
- Consider adding whole house dehumidifiers to maintain comfortable indoor relative humidity in the off-season when air conditioning systems take a prolonged vacation
- Become strategic allies with good insulation contractors so together we can produce the most efficient, affordable air-conditioned

housing available.

Together we might just win this war! Do the math yourself for an existing home. If the house is well insulated and the windows are low-e high efficiency, then add up the conditioned floor space, divide the conditioned space square footage by the tons of air conditioning installed.

If you come up with 500 as an answer, then you have a house designed

by the ancient rule of thumb and you need to perform a good Manual J calculation without any fudge factors added.

Don't have the confidence to do a Manual J you can trust? Find a responsible third-party professional to correctly estimate the tremendous load savings your product brings to the table and use the information to help sell your job. 



Paul Wieboldt is a licensed independent HVAC contractor with 25 years' experience. He teaches HVAC diagnostics and home performance for National Comfort Institute and is a certified testing and balancing supervisor. He is also a NATE-certified technician and proctor. Paul holds certification as a BPI Building Analyst.

His company, Tradewinds Appropriate Technologies, (www.tradewinds-at.com) created Manual J Design Studio (www.manualjdesign.com) to serve the industry by providing nationwide independent third-party load calculations. Tradewinds also conducts Manual J 8 Design software classes. You can email Paul at paul@tradewinds-at.com or call his office at 254.799. 1326.



“Where is My Inhaler”

— Mac Ludin, Cropp Metcalfe Services, Madison, VA

This month's winner fits into the “WTH (What the Heck)” category. The condensing unit is SO close to the wall, and for no good reason. Plenty of room. As Mac Ludin writes, “Somehow the installer managed to get the cover screwed in.”

Mac Ludin from Cropp Metcalfe Services is the March 2018 winner of our Photo-of-the-Month contest, as voted on by the subscribers to the High Performance HVAC Today magazine and visitors to the website. He will receive a \$50 gift card.

You can too – submissions are always welcome. If you'd like to submit a photo for consideration in our Photo-of-the-Month contest, click here and fill out the information requested.

THE APRIL CONTEST OPENS ON MARCH 9, 2018.

That gives you plenty of time to submit something in any of our three categories: **The Good , The Bad , WTH (What the heck).**

Building an Arzel Zoning System Is As Easy As

1 2 3

Step 1: Choose a Panel

Step 2: Choose a Damper



Customer Retention made easy.

VISIT US AT THE TRADESHOW



TO YOUR Success

WWW.TOYOURSUCCESS.COM



Special ServiceTitan Incentives For NCI Members!

Streamline operations, deliver an amazing customer experience and increase your sales with the only home services software built for high-performance HVAC contractors.

Visit servicetitan.com/nci now!



Fyrite® **INTECH**®

P/N: 0024-8523



- + Direct measurement of O₂, stack, combustion air & ambient temperature
- + 6 Pre-programmed fuel calibration profiles
- + High CO shutoff protection to prolong sensor lifetime
- + Reporting app saves up to 100 test results to smart device



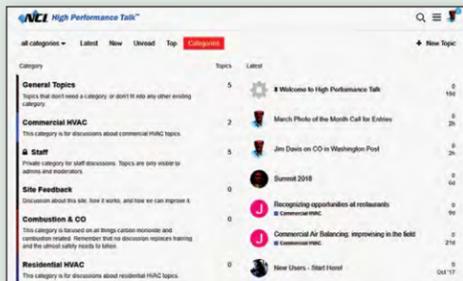
Visit www.mybacharach.com

or call 1(800)736-4666 to learn more about Bacharach's combustion analysis solutions for residential, commercial and light industrial applications.

Member Benefits Continue to Grow!

NEW! HIGH PERFORMANCE TALK WEBSITE

This month National Comfort Institute, Inc. (NCI) introduced an upgrade to our PerformanceTalk email discussion system. It is called **High Performance Talk**.



As with all new things, there is some change involved, but all the new features are well worth it. In fact, one of its new key features is the ability to interact not only through email, but through a new website (HighPerformanceTalk.com) as well.

So, you can choose – you can continue to interact with each other through email or go to the website whenever you wish and read all the discussion threads there. You can also start discussions on the website that will be seen by everyone who subscribes.

HighPerformanceTalk.com is a website for NCI members only.

Some other new features include:

- **Conversations will all stay on one page**, plus the ability to jump around the conversation easily by using a friendly smart scroll bar
- **The ability to tag people** by using "@(and their username)"
- **Mobile friendly**. HighPerformanceTalk.com is completely mobile friendly on your smart phone or tablet.
- **Now you have access to Badges**

and Emoji. Go ahead, you know you want to post those little smiley faces :-).

Unfortunately, we can't bring over your log in information from NationalComfortInstitute.com, so you must sign up. It's simple and is all part of your membership.

Call Nick Guarino, our Member Support Manager at 800-633-7058 if you need help.

COMFORTMAXX AIR™ IS FREE WITH YOUR MEMBERSHIP

ComfortMaxx Air™ is NCI's cloud-based professional lead generation and sales tool and it's included in your monthly membership dues? This is a \$95/month value (that is what non-members pay to subscribe to it).

It helps you record and calculate system air-flow information based on static pressure measurements for virtually any type of residential or light commercial HVAC system. It also provides high-quality customer-facing reports that add credibility to your findings and recommendations. And the best part is that ComfortMaxx Air is included in your NCI membership dues. To access, all you have to do is register.



If you haven't done so, register today. Just call Nick Guarino at 800/633-7058 or email him today at nickg@ncihvac.com.

NCI STORE OFFERS MORE PRODUCTS, MORE MEMBER BENEFITS

LATE BREAKING NEWS: National Comfort Institute, Inc. (NCI) recently added several Fieldpiece Instruments products to their online store's repertoire of approved test instruments for their Performance-Based Contracting™ members. These new products include anemometers, manometers, as well as static pressure probes.

In addition, the company announced that more than 40 items are now on sale. Members get even



bigger price breaks because they can take NCI's Member Discount of 5% in addition to the sale price. Don't forget that NCI also offers members the ability to use their NCI Bucks to pay for up to 50% of their tool and/or instrument orders. There are financing options as well.

PLUS, the company provides Free Shipping on all orders over \$200 (excluding resale and oversized products).

Membership certainly pays. Be sure to visit the store today: <http://ncilink.com/store>. Or call the Customer Care line at 800-633-7058 and ask for Nick Guarino.

Advertiser Index

Arzel Zoning Technology, Inc. www.ArzelZoning.com	30
Bacharach www.MyBacharach.com	31
CUC Software www.CUCSoft.com	16
Dwyer www.Dwyer-inst.com	26
EGIA www.egia.org	5
Fieldpiece www.Fieldpiece.com	13
Goodman Manufacturing www.GoodmanMFG.com	20
Jackson Systems www.JacksonSystems.com	4
Lazco Corp. www.LazcoCorp.com	12
R.E. Michel Company, Inc. www.REMichel.com	6
Service Titan www.ServiceTitan.com	31
The New Flat Rate www.TheNewFlatRate.com	26
To Your Success www.ToYourSuccess.com	30
TSI, Inc. www.TSI.com	16

To Subscribe to High-Performance HVAC Today:

ONLINE: Visit HVACToday.com/subscribe for a FREE digital subscription.
PRINT: 1 year/\$72; single copy \$7. Canada: 1 year/\$92; single copy \$9. Payable in advance with U.S. funds. Prepaid subscriptions may be sent to: High-Performance HVAC Today, PO Box 147, Avon Lake, OH 44012. Phone: 440-949-1850; toll free 800-633-7058; FAX 440-949-1851, or visit HVACToday.com/subscribe.



HIGH PERFORMANCE HVAC TODAY

Publisher
Dominick Guarino

Editor-in-Chief
Mike Weil

Art Director
Connie Conklin

Online Development Director
Brian Roseman

Sales Manager
Dave Kenney

Circulation Manager
Andrea Begany- Garsed

Editorial Assistant
Marge Smith

Email us at contactus@hvactoday.com with your comments and questions.

Subscribe to High Performance HVAC Today

High-Performance HVAC Today magazine highlights news, commentary, and technologies that impact performance-based HVAC contractors and their customers.

Visit our website to sign up for a FREE digital subscription or to order a printed subscription for one year (12 issues).
\$72.00 US, \$92 CA



Go to <http://ncilink.com/subscribe> or scan this QR code to sign up online



1-800-633-7058 • www.NationalComfortInstitute.com

Build A High-Performance HVAC Business!



Dominick Guarino is publisher of HVAC Today magazine and CEO of National Comfort Institute, Inc. He can be reached at domg@ncihvac.com

It's no secret this magazine was created for HVAC professionals who are committed to measuring and improving the performance of the HVAC systems they install and service.

Month after month we faithfully provide you with articles written by industry leaders and coaches to help you sell and deliver verified, highly performing systems. We are committed to continue to bring you the very best this industry has to offer.

But there's another side to performance: Business Performance. NCI's motto, "If you don't measure you're just guessing," applies just as much to how you lead and manage your organization as it does to the quality of the products and services you deliver.

NEW CONTENT

In the months ahead, you'll see an increasing focus on this "other side" of performance, with articles on leadership and accountability, and

OUR ULTIMATE GOAL IS TO HELP YOU – AS A "WHOLE" PERFORMANCE-BASED CONTRACTOR – SUCCEED AND THRIVE IN AN INDUSTRY THAT IS UNFORTUNATELY STILL PLAGUED WITH A LOW-PRICE BOX SELLING MENTALITY.

how to create systems to monitor and improve your business performance.

We will discuss management tools for typical residential and commercial HVAC businesses like Key Performance Indicators (KPIs), including how to develop and track them, and so much more.

In addition to its cutting-edge technical content,

High Performance HVAC Today will publish business articles written by your most successful peers, industry instructors, and coaches.

Along with content on how to deliver high quality HVAC systems, we will publish how-to articles, profiles, and success stories covering the following eight key areas of your service and contracting business:

- **Leadership**
- **Strategic Planning**
- **Business Management**
- **Finance**
- **Human Resources**
- **Operations**
- **Sales**
- **Marketing.**

Our ultimate goal is to help you -- as a "Whole" Performance-Based contractor -- to succeed and thrive in an industry that is, unfortunately, still plagued with a low-price box-selling mentality.

Sadly this approach is still the most common, but we are heartened by the rapidly growing renaissance emerging from the low-price swamp of our industry.

While we may not be able to drain the swamp, we can build islands of performance, and bridges to connect the contractors out there who know there is a better way.

These are companies that just need a good support system to help pull themselves out of the alligator-infested waters they have been battling in for years, even decades.

As you build systems to train your team to improve and track your company's technical and business performance, you will become unstoppable. You'll wow your customers, retain the best employees, grow your company profitably, and build its value with each passing day.

NCI Membership

Let NCI be Your Support Team on Your High Performance Contracting™ Journey



Your key to success in Performance-Based Contracting™ is a strong support network – always there when you need it. NCI helps its members overcome the typical hurdles associated with implementing the measured performance approach.

Call NCI Customer Care to learn how NCI Membership can take your HVAC business to the next level!

Looking to get even more out of your NCI Membership? Consider upgrading.

Upgrades will turbocharge your membership with added learning opportunities and financial incentives. There are three options available, and they all include the basic membership benefits.

	NCI Membership	With Learning Excellence Online Package	With Learning Excellence Live Package	With Learning Excellence Premium Package
Unlimited Toll-Free Support	●	●	●	●
High Performance Talk Discussion Forum	●	●	●	●
Find-A-Certified Professional Lead Generator	●	●	●	●
i-NCI - Mobile Friendly Technical & Sales Tools	●	●	●	●
Hundreds of Technical & Marketing Downloads	●	●	●	●
Members-Only Newsletter	●	●	●	●
Article Library Featuring 100's of Technical & Business Articles	●	●	●	●
Live & Online Training and Conference Discounts	●	●	●	●
Member Rewards NCI Training Bucks on Purchases	5%	15%	15%	15%
NCI Online Store Discounts	●	●	●	●
ComfortMaxx Air™ - Airflow Testing Software	●	●	●	●
Unlimited Online Course Access		●	●	●
Unlimited Webinar Access		●	●	●
ComfortMaxx Pulse™ - Air & BTU Testing Software		●	●	●
Maximum Training Incentive Partner Program Dollars		●	●	●
Bonus Annual NCI Training Bucks Earned		\$1200	\$4200	\$4200
ComfortMaxx Verify™ - Full System Testing Software				●
Monthly Investment	\$100	\$450	\$450	\$750



Join NCI Today!



1-800-633-7058 • www.NationalComfortInstitute.com

NOW AVAILABLE

Free Shipping

FOR ORDERS OVER \$200

(excludes resale & oversized products)

NCI now offers **FREE** shipping and handling on all tool, instrument and support material orders that total more than \$200. If your order is under \$200, a standard \$15 shipping charge will apply. Oversized items may be subject to additional shipping costs.



Start Shopping Today! Go to ncilink.com/store or call 1-800-633-7058



And BIGGER Benefits for NCI Members!

NCI members can now apply NCI Bucks to pay for up to **50%** of your tool and/or instrument order! This benefit is **ONLY** for NCI members! *Resale products excluded.*

NCI has also increased the **member discount** from **2% to 5%** on all the tools, instruments and support materials you buy. *Resale products excluded.*



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