National Comfort Institute, Inc.

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HIGH-PERFORMANCE HVAC TODAY™

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

ALSO IN THIS ISSUE:

Creating a Culture of Carbon Monoxide Safety

A New ANSI/ASHRAE Standard Creates a NEW Contractor Product

The PATH to Performance Part Three - Airflow Is the Second Step to Airside Performance

NCI National Comfort Institute, Inc.

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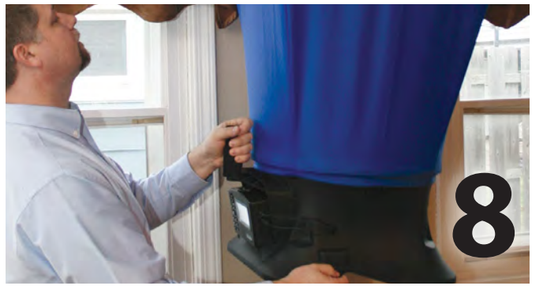

TECHNICAL:

Airflow: The Second Step to Airside Performance

This is the third in a series of articles by David Richardson discussing the PATH to Performance.

MANAGEMENT:

Creating a Culture of CO Safety

Contractor Vic Updike and his team at Masterworks Mechanical provide a most unique service that truly sets them apart.

MARKETING:

Consciously Promote Your Own Brand

You are the brand. Contractor Steve Miles says the key is making sure you consciously present a consistent message.

TECHNICAL:

New ANSI/ASHRAE Standard Creates Contractor Opportunity

NCI President Rob Falke discusses the new ANSI/ASHRAE Standard that is geared to field technicians and creates a new sales opportunity for HVAC contractors.

DEPARTMENTS

By Mike Weil

Did You Know that Networking is *A Small Business Owner's Best Friend?*

As I write this column, it's a gorgeous Fall day here in Cleveland. The sun is out, the temperatures are comfortable, and there is a fragrance in the air that marks the season change.

In the midst of all this, the first presidential debate is looming, the country remains very divided, and the COVID-19 pandemic is still impacting the public in general, small businesses in particular.

But, on such a pretty Fall day, it seems like a shame to paint the world in colors of doom and gloom. Especially since so many HVAC contractors I have talked to recently have made the decision NOT to partipate in all the sourness. Instead, they are working hard to find ways to better serve their customers.

Many of them are using their entrepreneurial spirit to get creative in how they approach their brand and market their products and services. Others are taking advantage of the trend for online live seminars, webinars, and conferences to learn more on how to operate successfully in a COVID world.

Most are excited about what they are doing and it shows. They say their numbers are up — both in terms of sales and gross profits. Current industry shipment figures bear this out.

Others turn to their peers for advice, ideas, and support. The most powerful aspect of any business is peer-to-peer networking which can help drive you and make you more confident in the things you do.

Some of these peer contacts come in the form of official or non-official advisory boards. Do you have an advisory board? This is a group of people who don't compete with you but who you can confide in. They can help you think outside the box and keep you on the positive side of worry and fear. I have an unofficial advisory board of contractors and industry people who I touch base with, run ideas past, and who bring information, humor, and much needed advice into my world.

You can and should have this too.

If you are a member of National Comfort Institute (NCI), there are a number of networking opportunities available. Consider all the other members of NCI, most of whom are open and willing to help if they can. Some of them participate in things like our live online training where they meet, train together, and connect.

Some members particpate in our **Trailblazer Coaching** program which is a guided networking opportunity.

Many participate in live online events like the **2020 Virtual High-Performance HVAC Summit** that provides a lot of opportunities to network and make connections — with other contractors as well as vendors.

If you're a member of trade associations such as the Air Conditioning Contractors of America (ACCA), you have access to potential advisory boards, via their MIX® (Management Information Exchange) Group program. To learn more, just go to **www.acca.org/members/mix**.

Also, don't forget to consider local choices for a similar type of advisory group through Lions, Rotary, city clubs, and so on.

There is even an independent national organization called The Alternative Board (**thealternativeboard.com**) that can help get you into a local peer advisory board.

No matter how you put together an advisory board, the result can be no-holds-barred feedback and a sounding board for your business. Add that to peer-to-peer networking, and you cannot lose.

By the way, neworking also means you share and help your peers. It's a win-win any way you look at it. NCI

Mike Weil is editor-in-chief and director of communications and publications at National Comfort Institute, Inc. He can be reached at **ncilink.com/ContactMe**.

Written By HVAC Professionals for HVAC Professionals

SM480V REFRIGERANT MANIFOLD AND MICRON GAUGE

Fieldpiece has done it again, the new 480V refrigerant gauges have been infused with the attitude of Vin Diesel, strength of Dwayne Johnson, and the beauty of Paul Walker.

The four-port 480Vs are built to withstand the abuse that every day HVAC field work brings. These instruments have a sleeker design that keeps thermocouple jacks tucked out of the way. They include a third thermocouple jack to measure outdoor temperatures.

Fieldpiece upgraded the exterior of the gauges which are now both impact and water resistant.

This new version comes with wired K-type temperature clamps but can also accept the wireless temperature clamps (JL3PC). Another addition is that the 480Vs can now receive a signal from the new single-wand psychrometers (JL3RH) and display the measurements on the screen.

By toggling down you can switch between dry bulb, wet bulb, relative humidity, and most importantly, enthalpy. Calculating target superheat and charging systems hasn't been easier. These devices even communicate with the Fieldpiece refrigerant scale (SRS3).

The 480Vs still have the 3/8" vacuum port and ¼" refrigerant port, along with a built-in micron gauge. In my opinion, the

micron gauge is the best feature of the 480V manifold.

One of the newest and coolest add-ons is the ability to data log a system's operation for up to seven days continuously! The 480V has a built-in USB port so you can extract the data and view it on a laptop.

There is so much more the 480V will do to make your life easier. Check them out and decide for yourself. You won't be disappointed.

For more information or to order, go to **ncilink.com/FP-SM480V**.

– by Casey Contreras, NCI Field Coach

By David Richardson

The PATH to Performance: Part 3

Airflow: *The Second Step to Airside Performance*

THIS IS THE THIRD IN A SERIES OF ARTICLES BY DAVID RICHARDSON DISCUSSING THE PATH TO PERFORMANCE: PRESSURE, AIRFLOW, TEMPERATURE, AND HEAT.

Airflow is the second step on the path to performance. It is the lifeblood of a forced-air HVAC system, and when it is outside specified parameters, the entire system and every component suffer. You would think since airflow is so important, more HVAC professionals would pay attention to it. Unfortunately, airflow is the most misunderstood and ignored part of our industry.

The path to performance can get confusing once you get to the airflow step. There are so many variables to consider. Follow the same pattern described in the previous article with static pressure measurement and keep it simple. Otherwise, you will quickly get lost in the weeds.

AIRFLOW PRINCIPLES

Airflow is a general term that's easy to misinterpret. Our industry measures airflow in cubic feet per minute (cfm). To visualize one cfm, imagine a single 12 x 12 x 12 cardboard box of air. This represents a cubic foot. The number of cubic feet per minute is known as airflow.

As you learn airflow principles, it helps to associate it with three rules. You'll find that many of the complicated issues you regularly encounter tie to one or more of these rules.

1. Airflow Takes the Path of Least Resistance. When you study how air circulates inside a duct system, it takes the largest path as it moves away from the fan. Since air pressure is near the fan, it's much easier for air to pass through a large duct leak (or multiple small leaks) there than travel through the duct system to a supply register or return grille. Also, consider poorly installed filter racks. This condition allows unfiltered air to go around the air filter instead of going through it. As this unfiltered air goes around the air filter, it leads to indoor air quality (IAQ) and prolonged equipment maintenance issues.

2. One CFM In = One CFM Out of the HVAC system blower. For every cfm of air that goes into the blower wheel, one cfm of air must also come out. Let's say you have a four-ton system operating in cooling mode. You measure airflow at the air-handling equipment and determine that you're circulating 1600 cfm through the blower. This means you have 1600 cfm of air pulled into the blower and 1600 cfm of air discharged from it.

3. Airflow Is Always Highest at the Air-Handling Equipment just as static pressure is. Most duct systems leak and as air moves toward the registers, the total air volume in the duct system decreases. There is only so much air to move from the air-handling equipment, through the duct system, and to individual rooms. When a duct system loses airflow through duct leakage, you'll never be able to deliver full comfort to your customers.

TEST INSTRUMENTS

Before you can measure airflow, you will need two additional test instruments for your static pressure testing kit. They include:

- **Air balancing hood** – the quickest and easiest way to measure airflow from a register or grille.
- **Anemometer** (Hot-wire, thermal, or rotating vane) – for measuring inside a duct or hard-to-access registers and grilles.

The addition of these test instruments will round out your airflow measurement arsenal and allow you to expand where and how you measure the system.

DIFFERENT AIRFLOW MEASUREMENTS

As you measure airflow, it helps to classify it into four categories. We name each based on the measurement location or source of the airflow reading. Once you understand the four airflow types, you can see how they work together.

1. Required Airflow is the amount of airflow a system needs. It establishes a target to aim for. There are many applications for required airflow, the most common of which is fan airflow. Other applications include individual room airflow and outside air. These values act as a baseline that you will compare all your measurements against. Comparing design airflow to measured airflow enables you and your customers to quickly understand the meaning of each reading.

David Richardson demonstrating how to use an air balancing hood to measure airflow.

2. Fan Airflow is what happens at the air-handling equipment and is the foundation of proper system operation. The quickest and easiest way to determine fan airflow is to plot it on the manufacturer fan tables (found in most installation instructions). The fan speed setting and measured total external static pressure (TESP) are two pieces of information you'll need. Find these two points on the fan table and intersect them to determine fan airflow. It's important to note that the blower must be clean. If it is dirty, clean it first, and then proceed with your tests.

3. Delivered Airflow delivers comfort and efficiency into the living space and determines true system performance. The air balancing hood is the main test instrument necessary to measure it. The anemometer measures grilles and registers you can't access with the hood. This measurement moves you beyond your competition and allows you to see hidden defects that you can show to your customers. If you want to see how HVAC systems work in the real world, measure airflow into the living space.

4. Outside Air provides for HVAC system ventilation needs. It should enter a system intentionally, such as through a dedicated outside air duct, economizer, energy recovery ventilator (ERV), heat recovery ventilator (HRV), or ventilating dehumidifier.

You can measure outside air with a **traverse** (ncilink.com/Traverse-Tools). The source will determine if you need to traverse with a thermal or a rotating vane anemometer – each application is different. You can traverse a dedicated duct with a thermal anemometer or traverse an economizer inlet with a rotating vane anemometer.

DIAGNOSE AIRFLOW READINGS

Since airflow measurement is rarely perfect, there is usually a tolerance most standards allow. The most common value is ±10% of the design or required airflow. When you diagnose your readings, you're trying to get as close to the required airflow as possible. However, sometimes this isn't possible. The percentage allows you some cushion in those situations.

The PATH to Performance: A Six-Part Series

Over the next several months we will feature articles detailing the **PATH** (**P**ressure, **A**irflow, **T**emperature, and **H**eat). In the first two installments, David Richardson provided an overview of PATH and detailed Step 1: Pressure.

- Read Part 1 here: ncilink.com/PATH1 (Overview)
- Read Part 2 here: ncilink.com/PATH2 (Step 1: Pressure).

Remember, practice makes perfect. So, as Richardson explains, become proficient in each step before proceeding to the next. In the end, you will be able to deliver the greatest value in service and performance that your customers have ever seen. And that will help you deliver the most well-deserved profits to your bottom line.

In his next article, Richardson will address more details on the third step in the PATH: Temperature. Stay tuned!

REMEMBER, AIRFLOW IS THE MOST IMPORTANT BUT MISUNDERSTOOD ASPECT OF THE HVAC INDUSTRY.

If you know your required room airflow values, you can compare the design airflow to measured airflow – what it truly delivered. If measured airflow isn't within ±10% of design, you have some work to do.

After you measure all supply registers, add all their airflow together to determine total delivered supply airflow into the living space. It should be within ±10% of the required and measured fan airflow. You can follow the same process for return grille measurements.

It's common to notice a slight difference in fan airflow and total delivered airflow. The variance is because of different measurement methods and test instruments. Don't assume a discrepancy in airflow readings is because of duct leakage – it might be variations in your readings.

WHERE TO DRAW THE LINE?

How do you know how far to take airflow testing? Most Performance-Based Contractors typically draw the line between fan airflow and delivered airflow testing.

Or they consider just measuring supply airflow in the most uncomfortable room. It's important to establish a rule that you don't turn your testing into a science project. Each test must have a reason and an intended outcome for taking them.

By the way, full airflow diagnostics demand an additional fee due to the time and specialized skills involved in the procedures. Your job is to look beyond the equipment at the entire duct system and determine how well it performs from an airflow standpoint.

To keep it simple, many companies limit airflow measurement to fan airflow for the following job titles:

- Installers doing a first-time system startup
- Service technicians running emergency calls
- Maintenance technicians on maintenance agreements, and
- Salespeople on sales calls.

Companies usually reserve delivered airflow for more specialized testing and diagnostics. These include:

- ▼ Duct system renovation and installation verification
- ▼ Customer education and discovery on a sales call
- ▼ Airflow diagnostics for comfort troubleshooting, and
- ▼ Air balancing.

OBSTACLES IN THE PATH

As you continue down the Performance PATH, you will meet airflow obstacles just like you did with static pressure. For some, these are too great to overcome, and they quit before they reach the gold at the end of the path.

Two common obstacles are:

- Plotted fan airflow that makes little sense.
- Air balancing hood readings that don't add up.

Both situations are learning opportunities in disguise if you have the persistence to stick with airside performance.

OUR NEXT STOP

Temperature is the next stop on the performance path. When you add temperature to airflow, you see the HVAC system in a new light.

You understand how it performs in a way that very few HVAC professionals can. Before you look at temperature, be sure you've got a good handle on airflow.

Look at airflow as a fork in the path. You may stick with the fan airflow pathway, or you may venture down the delivered airflow path.

Both will improve your installations and opportunities, however only one can take you to the highest level of airside performance.

If you take advantage of fan airflow, you will see a significant improvement in reducing callbacks, warranty costs, and customer complaints. Add in delivered airflow and outside air to round out your offerings and your services will be unmatched. NCI

David Richardson serves the HVAC industry as a curriculum developer and trainer for National Comfort Institute, Inc. (NCI).

If you're an HVAC contractor or technician interested in learning more about airside performance, contact David at **ncilink.com/ContactMe** 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.

For many, the idea behind branding your business is a mystery. Or at least it's intimidating. The fact is you create a brand every single day you are in business, whether you realize it or not. It is a state-of-mind, a visual cue of what you and your company represent, and it's largely part of what I call your 'self-fulfilling prophesy.' There are a lot of variables here and this is what can be overwhelming.

But it doesn't have to be. Simply stated, the brand is everything customers see, hear, and feel about your company.

That includes your marketing, how your people answer and talk on the phones, how the service techs look when they visit customer homes, and how the installers look and act when doing their jobs. It includes how your team leaves a customer's house when the job is done to how they come into the house beforehand. All of that is your brand.

At Jerry Kelly Heating and Air Conditioning, we choose to consciously direct how that brand looks, sounds, and feels.

We've been in business for 43 years and the owners have been intentional about our branding since day one. Over the years we just got a little more sophisticated in our approach and our marketing.

Much of that is because of our membership in and participation with organizations like National Comfort Institute, Service Roundtable, and trade associations like Air Conditioning Contractors of America (ACCA).

It also comes from our attending and participating in industry events, including tradeshows. This is where we began learning how to sharpen our branding and marketing skills and bring a different consistency to our marketing and branding process.

HOW TO GET STARTED

From the very beginning, we determined how our field technicians had to look. They had to be clean-shaven and wear sharp uniforms with our logo prominently displayed, for example. We created methods and scripts so that our office personnel had the tools and training to answer the phone differently and hopefully, more professionally than competitors.

Branding and marketing go hand-in-hand. The key is making sure that the brand and marketing are sending the same message

Besides our physical presentation, we purposefully market our brand as well. Branding and marketing go hand-in-hand. The key is making sure that the brand and marketing are sending the same message. You absolutely don't want to be contradictory because that just confuses the customer and frankly, turns them off. They aren't sure who you are.

In other words, whatever you 'say' about your company in your marketing, must match how your company looks, sounds, and behaves in the eyes of the customer.

The first step is deciding who you are. For Jerry Kelly, we are 100% residential repair and replacement. As such, we are in-home retailers. We have a retail mentality and that means we sell inside the home.

If you look at any good retailers – clothing stores, brew pubs, restaurants, and so on – branding and marketing is everything.

By comparison, contractors in the new construction market provide a component (the HVAC equipment) to something someone else sells (the house). That is not retail. That is wholesale.

WRITE EVERYTHING DOWN - SERIOUSLY

Our marketing guidelines are written down and dictates how our truck wraps must look, what our color schemes are, how and where we use our logo, and so on. That is key to the psychology to help people remember who you are. What I've found is that in HVAC it's really hard to drive demand. Especially when the weather can impact how people feel.

What can anyone say to a consumer to compel them to have an HVAC person interrupt their life?

The answer is, 'Not much.' So, you must find ways to become Top-of-Mind when consumers need you. It also means finding ways to drive phone calls during the off season - like offering discounted maintenance. You need to provide enticements that help get your people inside the house.

In other words, marketing is about finding ways to get inside the house and make additional sales. Branding is where the consumer remembers you and keeps your company top-of-mind.

SELLING UNIQUE SERVICES VERSUS SELLING EQUIPMENT

Think about this: If you compare almost any piece of manufactured equipment to any other (no matter who manufactures them) by stripping off their sheet metal wrappers and laying out their components on the floor side-by-side, you almost wouldn't know which piece of equipment those components came from. Why? Almost all equipment have components from the same component manufacturers – Copeland compressors, White Rogers circuit boards, Honeywell circuit boards, and so on.

Sure, there may be some differences in how those components are assembled within the equipment, but the true difference comes from the contracting firm installing it. Each contractor is a unique entity that brings its brand, skillset, and ability to resolve customer pain-points through how they design, install, and service the entire HVAC system (not just the equipment).

At Jerry Kelly, we want our uniqueness to be consistently applied and "branded" so not only our customers, but our employees as well, understand who we are and how we work. That means having written processes and procedures to make sure the equipment is consistently installed and is operating correctly.

I like to think about it this way:

Jerry Kelly's brand is readily recognized by the unique color scheme of their truck wraps and logo. At night, the green and white logo glows in the dark.

Manufacturers are marketing companies that promote products and equipment. Contractors should be marketing companies that promote systems and services. At Jerry Kelly, we private-label our equipment. We sell the Emerald Heating and Air Conditioning brand equipment. We promote our unique abilities to resolve customer comfort issues. We back up everything we do. And all of that is part of our brand identity.

MANAGING THE BRAND

Managing your brand is a three-step process. First, you must **define what your brand is**. Start with your brand statement. How do you want your team to look or not? Either way, you are defining the brand. Then you have to **implement it**, roll it out. Teach everyone inside the company what you want and how you want it done. And finally, you have to **hold people accountable** to it.

Accountability is important. If you don't hold your team accountable to the brand, then your brand will not be what you envision. We sometimes do field checks where salespeople, when not busy, drop in on our techs to check and see if they are following our branding standards. And they might

even generate a lead while there. They look at how the techs look, whether they are wearing shoe coverings, or if they are using our procedures for installing or servicing the systems. This approach works well for us.

NO ONE IS PERFECT

Are we perfect? Not by any means. But we work towards continuous improvement. When things get off track, we hold the team accountable and help them get back on track.

The obvious, but very important method for managing the brand is to find out from customers what they think. We use brief surveys called **Net Promoter® Scores** (**ncilink.com/NPS**) as well as reputation management through the Internet. Net Promoter Score (NPS®) is one of the most common customer experience metrics used by companies around the world. We ask customers what we did right, where we can improve, and we ask if they would recommend us.

We also use **Google Reviews (ncilink.com/GoogleRev)**. We actively ask for reviews and we manage those, making sure to answer problems right away.

This can be a little tricky. You have to keep in mind that if you are responding to a review, ***you are writing to the entire audience, not just the person***.

You want that response to be as even-toned and fair-sounding as possible. Take responsibility for all blame. DO NOT point the finger at the customer ever. Do everything you can to make sure the customer feels like they were treated fairly.

Everyone who reads an answer written like that will think you are a fair company that stands behind their work. That is gold when it comes to building a top-of-mind reputation.

FIVE TIPS FOR MANAGING YOUR BRAND

Here are five things I strongly recommend you do to help manage your brand:

1. Keep your website up-to-date. Be sure it not only shows all your service options and highlights all your credentials (including training and certifications), but also current consumer feedback quotes that are updated regularly.

2. Consider writing a blog and keep it current as well. Here is a link to my blog page so you can see the kinds of things I write about: **jerrykelly.com/blog**. By the way, you can choose to write the blog yourself, OR you can hire someone to do it for you. Here is another link that can help get you started with other Social Media marketing ideas: **ncilink.com/OnlineMktg**.

3. Become "Google Guaranteed," where you offer a money-back guarantee if a customer complains to Google. Learn more at **ncilink.com/GoogleGuarantee**.

4. Be unique. For example, Jerry Kelly doesn't do traditional door hangers – we give away recyclable grocery bags with our logo on it. We also usually include at least one "tchotchke" inside – a service coupon, a jar opener, a pen, whatever. People remember this.

5. Then track everything. Without the data, you can't see what works and what doesn't. In addition, you need to educate yourself. Understand that whether you think so or not, you are a marketing company that happens to be in the HVAC industry.

Become proficient at the art of marketing. Attend HVAC Industry events to keep yourself up-to-date and take advantage of membership organizations like NCI, Service Roundtable, ACCA, and others. They have great databases full of content that can help you in all aspects of branding, marketing, and more.

Remember: everyone has a brand, whether they are conscious of it or not. Be conscious of it. Nurture it. Get your people on board with it. Then watch good things happen. NCI

Steve Miles is the vice president and CEO of Jerry Kelly Heating and Air Conditioning in St. Peters, MO. He has been with the company since 1994. Jerry Kelly is an $11.5 million residential repair and replacement business with 65 employees and an unmistakable brand identity in their marketplace. Contact him at **ncilink.com/ContactMe**.

By Vic Updike

Creating a Culture of **Carbon Monoxide Safety**

In 2015, my wife and I were fortunate enough to buy the company where I was employed for five years. From a training and certification standpoint, the company, Masterworks Mechanical of Craig, CO had already taken steps with National Comfort Institute (NCI) to certify our field staff in combustion and carbon monoxide safety. As part of those initial steps, I attended my first training class taught by NCI's Jim Davis in our hometown.

At the time I had 20+ years of experience in the HVAC trade. After the first day of class, my wife asked how it was. My answer was "They found the craziest guy in the nation and had him teaching about carbon monoxide (CO)!"

The second day, Jim proved all his knowledge to be true! The other side of this is that he proved I had spent 20+ years in the dark. I have since humbly apologized to Jim whenever I see him.

On the third day, he showed us how to put the practices he developed into play to provide safety for our customers.

His closing statement was that if we used what he had taught, we would be calling him to tell a success story about someone's life we had saved. I felt like this was a pretty bold statement.

Not all failures are as easy to identify as this one. This furnace was still running. CO readings were insanely high!

THE TRUTH WILL SET YOU FREE

But then, 14 days after attending class, I did that very thing. I had used his training and our company's tools to identify a boiler spilling CO to the point that the hallways in a two-story hotel were at 40 ppm.

Who knows how long this was happening?

When cold weather arrived and the boiler ran longer cycles, (probably in the night) would someone be harmed? The point is, before my training I would have used a lighter in the draft hood to prove "the boiler was drafting well" and gone on my way.

This was when I realized how training provided the opportunity to identify life-threatening hazards on service calls. If I allowed shortcuts to move me to the next "no heat" call, I may not get another chance to use my ability to prevent something terrible from happening.

The truth will set you free!

During the next few years, a contractor friend of mine, Tom Johnson, spent a lot of time explaining to me how his company does combustion tests on every service call.

Today this is more commonplace than not, but I had to visualize how it looked in practice before I could affect a change where there is no differentiation between what we do individually as technicians and collectively as a company.

WHAT WE DO TODAY

Today our company has 28 full-time employees, 19 of whom are field staff, and four are project/service management staff. We service and install HVAC, hydronics, plumbing, refrigeration, and water treatment systems.

Our 'Combustion Safety' culture is used by everyone on every call. Up until the pandemic struck, each of our field techs held a CO Certification, including apprentices. We'll get back to this when travel becomes the norm once more.

Our success in doing this isn't from our requiring it. It comes from assuring that everyone gets the chance to hear the stories firsthand from each teammate who saves the day for another customer. There is no better win, and everyone wants to be part of that.

GETTING STARTED

Implementation starts with a policy and procedure. I feel this is the easy part. You must first determine your commitment level.

Initially, I thought testing every unit we serviced was adequate. In discussions with Tom Johnson and the results coming in from the field, I discovered that many major safety events were being found in other equipment in the mechanical room besides the unit being repaired.

Our policy now is to combustion test every gas-burning appliance in sight. If we change a failed ignitor on a furnace, the water heater will be combustion and draft-tested as well. Our plumbers test combustion on the water heaters they replace.

Each annual service agreement has a form for our techs to record combustion analysis for the customer's gas-burning appliances. We keep track of these readings for five years.

The final thing our installers do after each replacement or installation of a gas-burning unit is install an NSI low-level CO monitor (**ncilink.com/NSI3000**).

The number of times installing these monitors resulted in calls to identify issues has made this our biggest gold star. The NSI 3000s are our companies' night watchman.

ADVANTAGES OF THE NSI 3000 CO MONITOR

Here are two examples showing how this monitor helps identify and prevent life-threatening hazards like:

CO Infiltration from Attached Garages. We replaced a failed furnace in a house and was called the next day because their new monitor was alarming.

In troubleshooting the issue, we discovered car exhaust from the garage was leaking directly into the return air to the furnace through holes in the sheetrock ceiling and a poor seal in the return panning.

This caused CO symptoms in the family every winter for years.

Blockages from Snow. After installing a new tankless water heater, the new monitor we provided alarmed during mid-winter. During troubleshooting, we discovered that a pileup of snow had created a barrier.

This forced the condensing heating boiler to re-circulate combustion products into its combustion air.

The boiler was creating 2500 ppm of CO that was spilling into the room. The monitor indicated 35 ppm upstairs. It would have been much higher if this unit did not alarm at early levels.

After five years, I have an extensive list of examples just like these.

CULTURE CREATION

High-Performance testing and diagnostics policies and procedures provide the scaffolding to build the culture. The heavy lifting is done by your co-workers who commit to consistently performing them.

For Masterworks, implementation began with our service crew. When an individual identified a CO-related problem, we spent time at our morning meeting explaining the call, talking about why and how the issue was identified, and how it was corrected.

One of our practices is in cases where we "Red Tag" a unit. If we replaced it, we bring the old unit back to the shop.

We remove the heat exchanger from the red-tagged furnace and prove to all staff the validity of the tag. This builds confidence in the techs that when their analyzers and tools indicate a problem, the problem usually exists.

We spend a lot of time talking about the fact that in a 100-mile radius from our shop, there are nearly no other companies with staff who are trained and certified to do this. Your staff is how you successfully demonstrate your commitment to the community.

I would offer a few examples of what a Carbon Monoxide safety culture has provided us:

- One of our newer maintenance techs was able to save a person's life by listening to staff reports of CO and how we address those issues.

This technican was having a conversation with our dispatcher at the end of the day and she mentioned she had felt poorly since the weather turned cold. She had just been tested to see if she was anemic. Her headaches intensified at night.

The tech just had a feeling about what she said and gave her a "loaner" low-level monitor for that night.

The next day in the office the dis-

This failed heat exchanger was also found by our service techncian who tested it using a combustion analyzer.

patcher told him the alarm, which was placed on the nightstand where he had told her to put it, went off the previous night at 114 ppm.

She shut down her furnace.

We went out to her house and found a huge breach in the heat exchanger. The breach allowed the blower fan to fill the exchanger with room air to the point where CO "pegged the analyzer" and spilled over above the burners into the house.

● Our company developed a procedure to identify breached or cracked heat exchangers. The procedure is designed from several sources. Using a combustion analyzer, we determine if the blower fan affects the combustion when 'on' compared to when 'off.' Using this test, we found that new furnace models we sell did not always pass on startup.

THE COMMUNITY IMPACT

Our distributor has three staff members who are NCI CO/Combustion certified. After demonstrating our test to them, they arranged a meeting with the manufacturer to share this finding.

At the meeting, the manufacturer toured us through their production line and showed how they had identified what caused this issue and pointed out the procedure and the change they implemented to remedy it.

This was a major thing for me, as NCI and Jim Davis had provided me with the tools to find and affect change on products used nationally.

As you implement this culture, the quality of everything you do also improves. Your staff becomes focused on knowing that they and the company are who prevent the preventable.

As bold as this statement seems, we believe we improve our community's lives by bettering the health and safety of people in northwest Colorado.

By the way, I no longer use a lighter to determine Pass/Fail for combustion safety. NCI

Vic Updike and his wife Amy own **Masterworks Mechanical LLC** of Craig, CO. Vic has worked in the HVAC Industry as a technician, service manager, as well as other positions for nearly 30 years. If you'd like to learn more about their CO culture, reach out to him at **ncilink.com/ContactMe**.

By Rob Falke

New ANSI/ASHRAE Standard *Creates a New Contractor Product*

Five years ago, a fellow named Bob Baker challenged NCI Leadership to give away its most carefully guarded test method. He said, "Offer to write an ASHRAE standard showing how to score an installed HVAC system, then gift it to the world." Bob coached us through the application process, then quietly passed away.

Let's take a look at how this challenge resulted in a new industry standard. This article will also focus on how it may be used by HVAC professionals to create, build, and field verify one of the highest efficiency products that can be delivered today.

With these goals in mind, an engaged and distinguished American Society of Heating, Air conditioning, Refrigeration Engineers (ASHRAE), committee was formed. Initially, half the committee supported the test method, while the other half either opposed or questioned the concept of scoring an installed system.

The committee consisted of HVAC and mechanical contractors, engineers, PhDs, manufacturers, utilities, energy consultants, compliance personnel, and representatives from a national energy laboratory and NASA.

While maintaining mandatory ASHRAE language, the committee was instructed to write the test method "in the language of the common field technicians." These instructions led to the creation of a new breed of standard that can be used directly by field personnel.

For more than four years the committee worked vigorously to both expand and then simplify three field test methods. It received and responded to every one of nearly 300 comments during three full public reviews. This feedback greatly improved the standard's accuracy and effectiveness.

ANSI/ASHRAE STANDARD 221-2020

This standard legitimizes and details test methods enabling field technicians to publish a score that documents how well a field-installed HVAC system performs. It also reveals previously undetected system interactions and inefficiencies during live operating conditions. The same test may be applied to the system before or after repairs to quantify the impact of improvements made.

You can find the full standard publication at the ASHRAE Bookstore: **ncilink.com/ASHRAE221**.

Keep in mind that 221 is not an installation standard. It is, however, an installed system test method standard that identifies losses and defects in previously built systems. When a system earns a low score, it becomes a call to action often resulting in the decision to make repairs to increase the system's performance and score.

The standard may be used as a bolt-on to an

Equipment and an installed system are two separate products and should be rated or scored separately

existing installation or maintenance standard. It is employed when the technician finds it necessary to make further improvements to increase comfort and efficiency.

SYSTEM OR EQUIPMENT EFFICIENCY?

For many decades, the published equipment efficiency rating number has been mistakenly interpreted to represent the installed system efficiency rating. Equipment and an installed system are two separate products and should be rated or scored separately.

Equipment is built and rated by the OEM (Original Equipment Manufacturer). It is normally packaged for sale and ultimately delivered to an installing contractor. Remember, each piece of equipment is a stand-alone product.

The installing contractor selects and fabricates many parts and pieces to assemble the selected components and build a new and different product, an HVAC system.

New ASHRAE definitions included in Standard 221 clearly separate these two different products. It does this by enabling a new field-measured and documented efficiency score for the installed system. This method honors the standards supporting stand-alone equipment capacity and efficiency ratings. Installed system scoring provides an easily understood test and documentation method that helps consumers compare their installed system to published equipment efficiency ratings.

TEST METHOD DESCRIPTION

This test method is applied to forced-air residential as well as commercial heating and cooling systems of any size. The test requires the use of several airflow, temperature, and electrical test instruments by a technician qualified to use them.

Field technicians report the test and scoring typically takes one hour for systems with 10 tons or less of cooling capacity. Larger systems require an additional hour of testing for each additional 10 tons.

Test times will vary due to an abnormal number of registers and grilles or difficult access.

To score a system's performance, qualified HVAC professionals will follow this abbreviated test procedure.

Abbreviated Test Procedure to Score System Performance

1. Start the system and allow it to stabilize. Leave the system in its present operating condition to reveal the same conditions your customer experiences.
2. Measure airflow from each supply register to find total airflow entering the building.
3. Measure outdoor ambient air and the equipment entering air wet-bulb temperature to help determine equipment-rated capacity under test conditions.
4. Measure the average air conditions (dry bulb temperature in heating mode, enthalpy in cooling mode) from a minimum of three supply registers and into two return grilles. Average the register and grille air conditions to find the system's indoor temperature or enthalpy change.
5. Calculate the system delivered Btuh into the building by multiplying the total system supply air into the building, by the measured temperature or enthalpy change, then by the appropriate Btu multiplier.
6. Divide the system delivered Btuh by the equipment rated Btuh capacity under test conditions to find the heating or cooling system performance score.
7. If the system has an economizer, the economizer Btuh is added or subtracted from the total system Btuh depending on test conditions.
8. You may also divide the system delivered Btuh by the system measured operating watts to find the Installed Cooling System EER (energy efficiency ratio).

SYSTEM SCORING REVEALS THE UNSEEN

An installed system's score expresses the percent of the equipment rated capacity delivered into the building by the installed system delivered capacity. Field testing pinpoints defects that deteriorate system and equipment performance.

Then each flaw can be corrected allowing the equipment to operate within published specifications.

Your ability to increase and document the performance of an installed system defines this new product. It is measurable, quantifiable, and a product most consumers demand once the

score reveals to them the impact on their comfort, efficiency, safety, and health.

More importantly, the custom product is discovered, designed, built, and documented by you, the installing contractor. From the results of your work, your customers are delighted to receive a typical increase in system performance exceeding 50%. Your compensation is, as it should be, equally rewarding.

Meanwhile, HVAC professionals who become skilled in using this test method will hold an extreme advantage over others who are unwilling or unable to quantify system losses or discuss how to increase installed system efficiency.

FAR BEYOND TYPICAL ENERGY UPGRADE PRACTICES

Scoring a system was created for those dedicated to delivering comfort and efficiency to their customers in the field. The magic required to make an installed system operate as it should is not a blanket prescription. It is different for every system. An improvement of a system's score is not manufactured in a plant in a faraway city. It is a unique on-the-job creation.

What you need to increase installed system performance is found by testing and through proper diagnostics — one system at a time. It is custom made in a hands-on manner by those with the skill and ability to do so in the field.

For decades, the path to energy efficiency has been to throw the latest and greatest scientific inventions (and the kitchen sink) at HVAC systems and then deem the outcome as increased energy savings.

Measuring and scoring the operating system enables the contractor to quantify efficiency and comfort losses, pinpoint each systems' specific problems, then make surgical repairs focused on specific outcomes.

Standard 221 calls for field test data to be compared with equipment manufacturers' specifications, industry standards, and practical laws of physics. When conditions measured are outside of reasonable boundaries, hidden system defects become obvious. Now you can create a scope of work to address these unseen deficiencies and correct them.

Home and building owners want so much more than energy efficiency. Testing and diagnostics uncover system issues that may have been accepted and lived with for years.

CUSTOM, OFTEN NON-CONVENTIONAL SYSTEM UPGRADES

HVAC contractor's business models are supported when employees find, repair, and replace HVAC system components. System scoring reveals deficiencies that are repaired by non-conventional as well as every-day repairs.

The HVAC industry is plagued with low value, competing on low price for the same limited number of repairs or replacements that fall within the knowledge and capability of technicians with only basic skills. These repairs are often aimed toward getting the system running again.

When testing, diagnostics, and scoring show that a customer's system is operating at 50% of capacity, the conversation changes. Solutions promising to increase system performance separate the contractor from the competition. This opens the door to many more repairs and upgrades that will deliver higher documented efficiency, quantifiable comfort, and verifiably more healthy and safer environments.

The solutions and score become the product and value sold, which carries far more value than parts and labor alone.

For decades, the National Comfort Institute (NCI) mission has been to enable HVAC professionals to test, diagnose, and resolve undetected system defects. Thanks to a dedicated committee and standards organization, the industry now has a standard that improves and legitimizes the way you test and score HVAC system performance.

The outcome is your increased ability to create, deliver, and verify the results of your unique and profitable custom product: an increased performance score. NCI

Rob "Doc" Falke serves the industry as president of National Comfort Institute, Inc. (NCI), an HVAC-based training company and membership organization. You can contact Doc at **ncilink.com/ContactMe** or call him at 800-633-7058. Go to NCI's website at **nationalcomfortinstitute.com** for free information, articles, and downloads.

High-Performance Town Returns to NCI's 2020 Virtual Summit

National Comfort Institute's (NCI) High-Performance Town Testing and Diagnostic labs return to Summit this year. These virtual sessions consist of three labs, Tuesday, October 6th and Wednesday, October 7th.

Here you will experience the advanced tests and calculations used to diagnose and resolve air system issues that can lead to highly profitable system upgrades. The labs will perform just like your technicians do in the field.

Besides the instruction and virtual hands-on training, you will receive new detailed NCI procedures and quick reports to integrate into your leadership teams coaching after Summit is over.

Instructors for High-Performance Town 2020 are NCI's Rob Falke, Jeff Sturgeon, Scott Fielder, David Richardson, and Justin Bright.

The labs will include the following:

Estimate and Measure A Single Room's Airflow, presented by Rob Falke.

In this session you'll learn about NCI's easy method to estimate and measure room airflow in less than 10 minutes using a new single-page report and procedure.

Duct Temperature Loss Diagnostics. Your instructor, Jeff Sturgeon, will help you learn how to measure, calculate, and repair duct temperature losses and help customers see the immediate impact on their comfort and utility bills.

Where NOT to Measure System Temperatures. This lab is presented by Casey Contreras who will demonstrate the *incorrect* temperature testing locations throughout an HVAC system. He'll also address how to avoid inaccurate duct, equipment, flue, and grille temperature readings.

Package Unit Static Pressure Diagnostics Using the AirMaxx™ App.

NCI's Justin Bright will demonstrate how to use the AirMaxx App in less than 10 minutes to test and diagnose system static pressure and engage customers when you are selling, servicing, or installing HVAC systems.

COVID-19 Ventilation Solutions – Measure Economizer Airflow and Air Changes Per Hour.

Scott Fielder and Jeff Sturgeon will tag-team to teach the principles driving outside air standards and required room air changes stemming from the battle against the COVID pandemic. You will also learn how to accurately measure airflow through an economizer.

Condensing Furnaces – Advanced Diagnostics and Solutions, presented by David Richardson.

Explore how to quickly test and determine the cause of rising CO in condensing furnaces. You'll learn appropriate repairs for each problem.

You can find the entire Virtual Summit 2020 event schedule at **ncilink.com/Summit20Sched.**

October 2020 PowerPack — Get It Now!!!

This month we provide you with some additional content to help you with carbon monoxide testing and more.

Some of the tools included each month **may not be normally accessible** with your membership subscription package. However, you will be able to access these tools through this PowerPack portal during the current month.

Here is what the October 2020 PowerPack includes:

- **How to Perform Draft Interference Testing (Recorded Webinar)**
- **Carbon Monoxide Visual Inspection Form (Download)**
- **SafeMaxx™ CO Test Report (Download)**
- **Heating System Temperature Measurement Procedure (Download)**
- **Cold Feet? Heating Postcard (Download).**

Go to **ncilink.com/PwrPak** to access it today. If you have any questions, or if you are unable to access any of the tools in this program, please contact us at 800-633-7058. We think you'll find these tools and training materials very helpful as you continue to grow your High-Performance HVAC business.

"Repurposed Baking Pan"

— Scott Thompson, The Lee Thompson Company, Houston, TX

American ingenuity really knows no bounds, especially in the HVAC universe. For example, this customer needed a drain pan and decided a Do-It-Yourself approach was called for. The overflow line goes into this pan and shuts off if it ever fills up. Genious!

Scott Thompson from The Lee Thompson Co. is the October 2020 winner of our Photo-of-the-Month contest in the "Bad" category, as voted on by the subscribers to the ***High-Performance HVAC Today*** magazine and visitors to the website (**hvactoday.com**). He will receive a $25 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, go to **ncilink.com/POMSubmit** and fill out the information as requested.

THE NOVEMBER CONTEST OPENS ON OCTOBER 09, 2020.

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

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Go to ncilink.com/ContactMe with your comments and questions.

By Dominick Guarino

NCI's Virtual Training: Lessons Learned

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

It's hard to believe it's only been six months since NCI kicked off its first online, live training. Like many, we were faced with some truly tough choices in response to the complete shutdown of in-person training at distribution locations and other venues across the country.

We were very fortunate to recognize in mid-March that the shutdown was coming, and we scrambled to build a new approach to NCI training that would need to see us through this very different COVID-19 world.

As a result, we learned several valuable lessons that we hope you can benefit from as your business continues to evolve and change, both currently and in a post-pandemic world.

LESSON 1: ADAPT OR DIE

As we saw the handwriting on the wall, we quickly put together a plan to begin producing live, online training. We were faced with several challenges. The first was to reinvent training so it would be more than just a talking head in a webinar.

Because NCI's training is more than just short seminars, we had to figure out a way to keep our students engaged for several hours at a time – not an easy task. We settled on a system of four-hour training sessions with 10-minute breaks every hour.

Each technical class also includes several hands-on testing demonstrations with live equipment. When we first launched the training we surveyed our students about our approach, and asked them their opinions on different options such as two-hour segments with an hour break.

The overwhelming response was to keep the current model, as it worked well and kept them from being pulled too far into something else.

Lesson learned: When you try something new, ask your customers if you are doing it right - and what you could do better.

LESSON 2: BE DECISIVE

Our first step was to invest in a broadcasting studio. We quickly put together a plan to transform our NCI headquarters training center into a versatile TV studio with several cameras, lighting, sound, video control boards, and so forth, so we could create live productions with both classroom-style training and hands-on demos using different stations with working systems.

Because we acted early, in less than 10 days we were able to secure all the equipment we needed to launch. A few days later every vendor was sold out, and showed 30+ days lead time to get more in.

Lesson learned: Act quickly and decisively. When you know the tidal wave is coming, get your supplies before they are all gone. Had we hesitated even a week, we would have missed the window to quickly make virtual training a reality.

LESSON 3: IF YOU BUILD IT THEY WILL COME

Next, we worked day and night to make it happen. We quickly built the studio and met with our curriculum development team led by NCI President Rob Falke to determine which training to launch first.

The team jumped into action and built the initial training modules in record time. The results have been beyond our wildest dreams. We held our first class in early April. Since then, our online training has been a huge success. In a little over six months we have trained roughly 1,500 students in 60 online classes!

Lesson Learned: Once the decision is made, get to work!

We continue this month's "One More Thing" online. To learn about NCI's 4th major lesson, go to ncilink.com/lesson.

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