National Comfort Institute, Inc.

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HIGH-PERFORMANCE HVAC TODAY™

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

Differentiating Your Business

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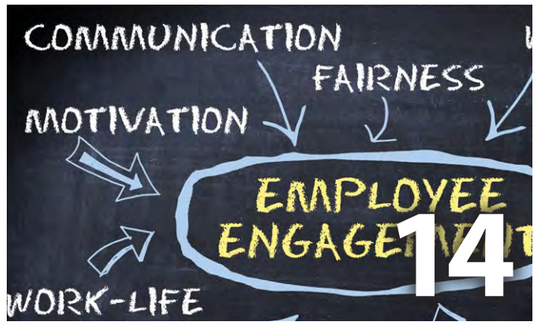
Why SBA Borrowing Differentiates Your Performance-Based Business

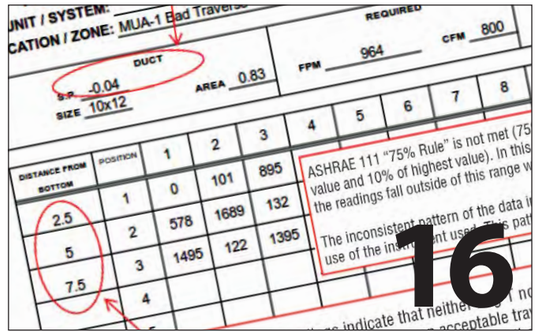
Unlike a conventional bank loan, an SBA loan has more advantages to you as a small business owner.



MANAGEMENT:

Build Success Through Fully Engaged Employees

Are your employees engaged in your High-Performance HVAC business? Here is why they should be.



TECHNICAL:

Five Ways to Spot a Bad Duct Traverse

Can you spot errors in a TAB Report due to bad data? Scott Fielder shares how to do that and why it's important.

DEPARTMENTS

By Mike Weil

Taking One Small Step ...
Celebrating 50 Years of Excellence

Several weeks ago, the world celebrated the 50th anniversary of the Apollo 11 moon landing. Yes, on July 20, 1969 Neil Armstrong uttered the most famous words of the 20th Century as he became the first human to set foot on the moon.

"That's one small step for (a) man, one giant leap for mankind."

And it was a giant leap in so many ways. Besides creating a national pride the like of which hasn't been felt since, the advancements made as a direct result of the science, engineering, and research that went into the space program are nearly incalculable.

From the creation of lightweight breathing masks to cordless tools, modern computer microchips, smoke detectors, and even the transparent brackets commonly used for straightening teeth – all can be traced back to the moon missions.

It all started with one small step.

The need to miniaturize computers for space exploration in the 1960s motivated the entire industry to design smaller, faster, and more energy-efficient computers. This also affected practically every facet of life today, from communications to health and manufacturing to transportation.

Even the tech behind mobile phones and tablets that we take for granted are descendant from the Apollo and Gemini space programs.

Oh, and they are so MUCH MORE POWERFUL!

Hand-held devices today routinely perform instructions 120 million times faster than the guidance system that enabled the liftoff of Apollo 11!

Think about it. In the HVAC arena, many of the digital instruments you use to measure and test the systems that keep consumers comfortable and productive and protect our foods and medicines, are born from Apollo technological advances.

One thing is clear – that tech and its resulting data became the absolute key to keeping Astronauts Neil Armstrong, Michael Collins, and Buzz Aldrin alive and safe on their incredible journey.

Data – it's gathering, analysis, and use is the difference between good HVAC contracting firms, and Performance-Based Contracting™ firms. The fact is, whether it's a space mission or an HVAC service call, data is vital. It enables High-Performance HVAC contractors to deliver what they promise and then prove that to customers.

Which is why David Holt's article on *Differentiating Your Business by Turning Data into Dollars* (page 11 or **ncilink.com/Data$$**) is an important read. He discusses the need for taking measurements and conducting tests, then capturing the results to help show customers what is actually going on with their systems. That same data is also used for providing them options for making their systems perform as designed and selling customers repairs and upgrades.

Performing duct traverses is one key way to gather data about airflow.

In his article, *Five Ways to Spot A Bad Duct Traverse* (page 16 or **ncilink.com/BadData**), Scott Fielder highlights the impact of ***bad*** data based on improper traverse methods or inadequate documentation. He provides some clear examples and ways to avoid the issues in the first place.

These two editorials really demonstrate the importance of properly obtained and properly used data in creating excellence in comfort systems.

With that in mind, 50 years after Neil Armstrong's small step, we celebrate our accomplishments in space. Isn't it time to start celebrating your accomplishments along the path to High Performance as you take steps toward using data to differentiate your contracting business?

Just take just one small step today.

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

Written By HVAC Professionals for HVAC Professionals

ENSORCON INDUSTRIAL PRO PERSONAL CO SAFETY MONITOR

Nothing is more important than keeping yourself safe on the job and everywhere you go. That is why I recommend you carry the **Ensorcon Industrial Pro Personal CO Safety Monitor**. It only has to save your life once to demonstrate its value.

I have used many personal monitors and have investigated others. So far, I have found nothing that compares to the features, simplicity, dependability, or the longevity of the Industrial Pro device.

It has audio, visual, and vibrating indications of elevated CO levels. Its response time is just seconds. You can custom-set CO level alerts for both low and high-level readings. This safety monitor also has a mute button and a maximum level lock feature.

The Industrial Pro has a CO range of 1 to 2000 ppm. Hopefully, you will never see the high range in an area where you are working.

Its replaceable camera-type battery is easy to change. Many other personal monitors need to be thrown away if the battery dies. The Industrial Pro also has an EOL (end of life) warning. This will usually show up every six months. This doesn't mean the instrument is bad, it just needs to be calibrated.

There is an easy way to determine if the Industrial Pro is operating properly. Take a plastic food bag and place the Industrial Pro inside. Then take a couple of matches, light them, then blow them out and allow the smoke to enter the bag. Close the bag and watch the readings. If they rapidly climb to 15 ppm or higher it is good to go. This is the same test used to check Low-Level CO monitors.

Save your life, your family's lives, and of course, your customers' lives!

If you are interested in learning more visit the NCI store at **ncilink.com/EnersconCO.**

By Jim Davis, National Comfort Institute

FIELDPIECE SC660 WIRELESS CLAMP METER

If you are looking for your next voltmeter, consider some features built into this compact multimeter. It can help you collect additional data to diagnose and communicate performance issues. The SC660 can transmit its readings remotely to Bluetooth devices eliminating wires pinched in blower compartment doors.

It can also can calculate the operating wattage for indoor and outdoor units on the meter or through the app. When paired with the Job Link app, the system wattage is used to estimate the unit's current operational SEER and EER to compare to the manufacturer's ratings.

Because the app allows remote viewing, it becomes a powerful tool to help

customers see in real time the impact of poor performance and fan wattage. It shows them why more comprehensive system testing is necessary.

If you are starting up new commercial equipment or working on a balancing project, this instrument has built-in phase rotation verification, which can be used to prevent damage from operating equipment in the wrong direction.

The SC660 has plenty of familiar functions such as K-type thermocouple temperature measurement, capacitance testing, and non-contact voltage sensing, displaying both a visible LED and an audible tone when sensing high voltage.

The SC660 accuracy and range meets the test instrument requirement for all NCI certifications as well as being NIST traceable.

If interested in learning more about the Fieldpiece SC660 Wireless Clamp Meter go to **ncilink.com/SC660**.

By Justin Bright,
NCI Field Coach and Instructor

By Brandon Jacob, CPA

Why SBA Borrowing is Important *to Your Performance-Based Business*

Any service and replacement HVAC company is a great business to own and operate, but a High-Performance contracting firm has so many differentiating aspects that it can truly be a dominant force in any marketplace.

Managed correctly, there are great profits to be realized and due to air upgrades, duct renovations, and equipment replacements, there always is the opportunity for larger dollar (and high gross profit margin) invoices. Perhaps equally as important, with comfort expectations today, there is no chance the need for your services will end anytime soon.

> **"UNLIKE A CONVENTIONAL BANK LOAN,** AN SBA LOAN HAS MORE LENIENT TERMS, ALIGNING WITH THEIR MISSION TO EXPAND BUSINESS OWNERSHIP AND CREATE JOBS."

Like any small business, it is just a good practice to maintain a line of credit or access to money loans to capitalize acquisitions – whether those are for buying another company or to invest in growing your business. Such capital infusions can help when you need more trucks for your duct renovation crews as you expand into Performance-Based Contracting™, or for equipping field techs with the best instruments for doing the measurements necessary to do their jobs.

The fact that traditional banks are not clamoring to lend to HVAC companies is surprising. Or is it? Traditional banks lend money and secure their loan in the form of collateral. If your business is unable to pay back the loan, the bank gets the collateral. This is where the challenges start.

Having been inside hundreds of HVAC businesses, I've found one consistent characteristic: most contracting firms do not have much in the form of collateral. For this reason, traditional bankers tend to shy away from loaning to HVAC contractors.

But what if there was a bank that did not rely on collateral to secure a loan. Let's say the bank was able to have some type of guarantee that they would be reimbursed if your loan went bad. If this was the case, banks would be able to lend based on cashflow and not collateral. But who will step up and guarantee loans like this?

The answer is the U.S. Small Business Administration (SBA). Go to **www.sba.gov**.

THE SBA AND SBA LOANS:

An SBA loan is guaranteed by the Small Business Administration and enables banks to lend to small privately held businesses up to five million dollars. An HVAC contractor who applies for an SBA loan is NOT borrowing directly from the government. The SBA only guarantees (insures) bank loans to small businesses that meet the SBA's size criteria for that industry. It is this guarantee that makes the HVAC industry bankable. This applies to all contractors – both High-Performance and non-High-Performance.

As a borrower, you work with a bank that is enabled by the SBA to make this type of loan. Does your business qualify for such a loan? The size criteria for a business is that it produces $15 million or less in sales.

Even if your company is doing more than that, there is an alternative size standard under which you can qualify for an SBA loan.

Unlike a conventional bank loan, an SBA loan has more lenient terms, aligning with the SBA's mission to expand business ownership and create jobs. Terms are generous, up to 10 years on a business loan for a business acquisition or working capital and up to 25 years for a transaction involving real estate.

There are no bank covenants that will restrict your business's growth as long as the loan is paid back as agreed.

SBA loans can be used to acquire a business, whether you are an existing HVAC company looking to buy a competitor or a general manager who has been the identified successor to the current owner. The loans can also be used to refinance existing business debt, to purchase equipment, or for working capital.

SBA loans can be used to acquire real estate for your new headquarters if you want to buy or build your satellite location. Or you can use them to add on to your existing property. Applicants must be able to demonstrate that the loan will be used for a sound business purpose.

KEY DIFFERENCES BETWEEN SBA AND CONVENTIONAL LOANS

The key difference is that an SBA loan does not require business assets or the owner's personal assets to be enough to fully secure the loan. The reliance is on the character and resume of the owner/guarantor, as well as the ability of the business to operate successfully.

It also looks for historic financial statements to demonstrate the strength of business cash flow to meet all proposed and existing debt payments while continuing to pay the owner a comfortable salary.

This is important for an HVAC business where there will not be enough assets, like real estate or equipment, to fully secure the loan with a traditional bank.

An SBA loan provides the opportunity for businesses with the cash flow, but not necessarily the collateral, to secure funding to grow. This also means that your son or daughter, for example, who worked his or her way up through the business from technician to general manager, can now possibly purchase the company from you without necessarily having the personal assets to fully secure the loan.

This is a major plus as up until now many owners of HVAC companies had to carry a seller's note to complete the sale. Sellers now have the option to sell and receive all or most of the proceeds from the sale upfront rather than having to wait 10 years and cross their fingers that the buyer pays them back.

Many banks may offer SBA loans but

are not efficient at handling the paperwork. They often do not truly understand the variables involved in SBA financing and loan purposes. Banks that specialize in SBA lending can reduce the time it takes to secure an SBA loan. This expertise is comparable to the Performance-Based expertise your business may have.

One such bank that recently selected our industry as a prime industry to lend to is Live Oak Bank headquartered in Wilmington, NC. Live Oak Bank specializes in SBA loans and has developed expertise in facilitating the process. So much so that the bank was the top SBA 7(a) lender by volume for Fiscal Year 2018.

For HVAC contractors looking to acquire a local competitor, expand to a new business line, or redefine their service area, an SBA loan is a great tool to use to purchase a business and an "arrow in your quiver."

Brandon Bolen, who leads the Service Contracting Group within Live Oak Bank stated, "Live Oak is very excited to be lending to HVAC service contractors. We travel all over the country to visit with our customers prior to their loans closing and it has been great as each contractor talked about expansion ideas they had and, for one reason or another, was just out of their reach. Now, these opportunities are absolutely within their reach."

Having personally been active in valuing, buying, and selling HVAC businesses for more than 20 years, the availability of an SBA loan from a bank that understands HVAC industry, but also has the ability to process loans on a timely basis is a game-changer.

If you are contemplating expanding your business to move into Performance-Based Contracting and need a loan to do so, or need a working capital loan to purchase a building, and so on, strongly consider an SBA loan. NCI

Brandon Jacob is recognized industry-wide for his experience and knowledge in business valuations, mergers, acquisitions and the ability to help contractors with successful exit strategies. He speaks on this topic throughout the HVAC industry and has published many articles on the valuation of air conditioning and plumbing businesses. He is the principal at Contractors Financial Opportunity, LLC in Houston, TX. He can be reached by phone at 713-443-8311 or email at brandon@contractorscfo.com.

By David Holt

Differentiate Your Business By Turning Data Into Dollars

We can all agree that gold is a very precious metal of significant value. Therefore, gold should not be wasted or treated carelessly. It is highly esteemed, greatly loved, treasured, collected, and cherished by many.

Gold is valuable to mankind because...

- It's considered a "noble" metal that stands apart from all others
- It's pretty rare, so increased demand increases its worth
- It's very malleable, has excellent ductile strength, and conducts electricity well
- It barely reacts with other elements, so it retains its properties and does not tarnish.

While it's a naturally occurring element, gold isn't easy to locate, collect, or refine. It takes a lot of hard work to transform it into the raw material used to produce bullion, coins, jewelry, art forms, industrial processes, product manufacturing, infrared shielding, colored-glass production, gold leafing, tooth restoration, and medicines, just to name a few of gold's many applications.

Even though it takes a lot of work, people continue to search worldwide for a "mother lode" of gold every day. While many fail, successful prospectors earn huge fortunes. But the real value is earned by those who turn the "located, mined, and refined" gold into useful products desired by lots of paying customers.

DATA IS "BUSINESS GOLD"

Following along the same lines as the gold discussion, let's change a few words to see how "data" is so important to your business.

We can all agree that data is very precious and of great value. Therefore, data should not be wasted or treated carelessly. It must be highly esteemed, greatly loved, treasured, collected, and cherished if you're to enjoy a successful, High-Performance HVAC Contracting business.

Extremely valuable business data includes but is not limited to...

- Contact names, mailing and shipping addresses, phone numbers, email addresses
- Equipment types, model numbers, serial numbers, installation, and warranty expiration dates
- Invoice numbers, dollar amounts, transaction dates, due dates
- Receipt numbers, receipt types, dates, dollar amounts, apply-to-invoice numbers
- Payment numbers, payment types, dates, dollar amounts
- Building dimensions, orientation to the sun, construction types, heat loss/heat gain
- Static pressures, temperatures, amperages, voltages, air volume
- Agreement types, dates, dollar amounts
- Call type, schedule date, rep assigned, reason for call, recommendations, resolution
- and many more data elements.

While data is all around you, it isn't always easy to locate, collect, and refine. It takes a lot of hard work to transform it into the raw material used in customer relationship management, sales lead generation, scheduling, scope of work development, product pricing, invoicing, payroll, purchasing, and financial reporting, just to name a few of data's many important applications.

Even though it takes a lot of work, business owners and managers continue to search all over their company for the "mother lode" of data every day. While many fail, those successful high-performance data prospectors earn fab-

GOLD IS TO THE PROSPECTOR AS DATA IS TO THE BUSINESS OWNER.

ulous fortunes. But the real value is earned by those who turn the "located, mined, and refined" data into useful products desired by lots of paying customers.

LOCATING THE GOLD

Gold ore is found in rock formations while native gold is in lode deposits. Gold is also discovered as free flakes, grains, or larger nuggets in and around streams. It takes skill to locate it, although luck has played a role in many of the significant discoveries of the past.

"Business gold" (sometimes called data) is a part of every transaction you have with employees, vendors, and customers. It's not terribly difficult to identify, but much of it simply passes through your fingers every day and cannot be mined for its greater value in the future.

I believe this is true because most people don't understand the long-term value of data. They don't look ahead and ask, "why is this data important to my future ability to take great care of my employees, my vendors, and my customers?"

Understanding the "why" in your business is like honing a laser to a razor point that's sharp enough to cut through steel. The "why" isn't just the reason you do what you do, it's a consistent reminder that keeps you and your team grounded, energized, and focused on goals. It's your cause, purpose, motive, proof, and your values. The "why" is the core belief that drives what you do every day.

While there are way too many reasons to identify in this article, **Table 1** will get you thinking about why data is so important to your future success:

But it's not enough to just know "why" this data is important. Your entire team must take consistent action to accurately collect the data and store it somewhere so you can easily access it in the future.

COLLECTING THE GOLD

Once gold is located, mine development begins. This involves the planning and construction of the mine and associated infrastructure. Mining companies must obtain appropriate permits and licenses before they can begin construction.

This will generally take several years, although timeframes vary greatly depending on location.

You have it a little easier in the service business. There are many "data mines" you can employ to collect and protect your valuable information. From manual forms and filing systems to the latest in cloud-based technology, there's no reason to avoid collecting the important data that impacts your business.

If you've been part of the NCI family for more than five minutes, you know that our motto of ***"If You Don't Measure, You're Just Guessing™"*** is based on Lord Kelvin's famous quote.

What we choose to measure is a window into our values. It proves to the world (including our team) what we really value and how important the related information is to us.

If the data is important, it's worth collecting, storing, and protecting.

REFINING THE GOLD

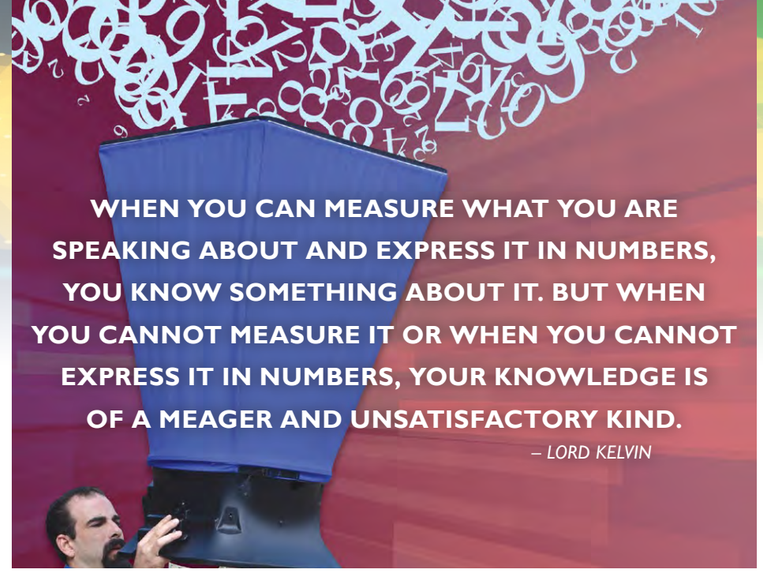
The refining stage represents the productive life of a mine, during which ore is extracted and processed into a metallic alloy – known as ***doré.*** This typically contains between 60-90% gold. During its life, a number of business factors dictate how much mining work is performed. Gold mining operations are regularly re-assessed as market conditions change and new technical information comes to light.

Business data mining and refining work much the same way. Here's an example. When business factors suggest that you need more sales to keep your crews busy, you begin digging in your mine to find people in need of safety, health, comfort, or energy efficiency upgrades. This is where computerized databases can really strut their stuff.

Let's say you're fast approaching the end of winter and expect milder weather just around the corner. The "raw material" we are looking for is contact information for all those customers who have aging air conditioning equipment with a high lifetime repair cost.

Here's another reason why collecting data is critically important to your success: your software can't provide you what it doesn't have in the database. If you don't record the customer contact information, equipment type, age, and repair history, there's no way to identify customers who have the highest probability of upgrading their system before it breaks down on the hottest day of the summer.

To provide the high-performance customer service levels your customer deserves, you must be able to consistently do the things that keep them safe, healthy, comfortable, and energy efficient all year round. It's your job to alert and educate them of pending trouble before it becomes an emergency. This is the professional way to WOW your customers and earn premium profits for the premium products your team delivers.



PRODUCING GREAT VALUE

Artists, jewelry makers, pharmaceutical companies, electronics manufacturers, dentists, and many others rely on refined gold to produce their products and services.

While the folks involved in locating, mining, and refining the gold earn good money each step of the way, the biggest money is earned in the retail transaction between the manufacturer of products that use the refined gold and the consumer.

As High-Performance HVAC professionals, **YOU** are the "manufacturer" of the indoor comfort system that your customer enjoys. Sure, the manufacturers that supply system components to your business are important, but the most important person as far as the customer is concerned is you and your team.

They rely on you to design, select, and install the proper components in such a way that their completed system consistently delivers the safest, healthiest, most comfortable, and energy efficient results possible.

Zig Ziglar is famous for saying *"if you help enough people get what they want, they'll help you get what you want."*

When your team can locate, mine, and refine data that is relevant to your business, you will have no problem helping enough people get what they want. Your biggest challenge will be keeping up with demand!

TURNING DATA INTO DOLLARS

Data is precious to your business success. I can't think of a single reason why any High-Performance HVAC Contractor would want to operate without a great data management system in place.

Think about static pressure measurements. The numbers you measure are just data. It's up to you to evaluate the data, act on it, share its meaning with the customer, recommend solutions, and turn that raw data into new dollars.

My dear friend and former NCI Coach, John Garofalo, used to ask a simple yet profound question: "Is the juice worth the squeeze?"

Yes, friends, the "juice" of premium profits is well worth the "squeeze" of locating, mining, and refining data.

Now get out there and turn some data into dollars!

DATA THAT IS GOLDEN

EMPLOYEES	VENDORS	CUSTOMERS
Anniversary recognition (hiring, birth, marriage, review, pay adjustment, certifications, licenses)	**Anniversary recognition** (years of service)	**Anniversary recognition** (years of business)
Goal achievement (education, calls, leads, presentations, sales, installs, quality)	**Prompt payment** (discounts earned, discounts taken, discounts lost)	**Equipment** (recalls, warranties, repair part orders, repair costs, service life)
Performance reviews (attendance, production, testimonials, complaints)	**Volume discounts** (item quantity purchases)	**History** (communications, repairs, maintenance, recommendations, upgrades)
	Warranty claims (claims filed, claims paid, claims unpaid)	

Table 1 - Useful data that can be mined and converted into dollars.

David Holt is the director of business training and coaching for National Comfort Institute. He helps HVAC contractors implement Performance-Based Contracting into their companies and is responsible for NCI class development and teaching. He can be reached at DavidH@NCIHVAC.com.

By Steve Vannoy

Building Success
Through Fully Engaged Employees

The HVAC industry has struggled to keep up with a shortage of qualified employees for many years. With projected continued growth, the gap between supply and demand will only increase. So now is the time to be proactive and develop a strategy to retain good employees once you find them. Improving employee engagement can help make your company a place where people want to work.

So, what's the big deal about employee engagement? Well, to get technical about it, employee engagement is a concept that attempts to both quantitatively and qualitatively understand the relationship between a company and its employees. But what does that mean to you and your business on a practical level?

Although the idea of employee engagement has been around for a while under various guises such as employee morale, or job satisfaction, it has more recently come into sharper focus in relation to the new generation of worker. With millennials now making up a larger portion of the workforce, perhaps it's time to update our idea of what contributes to developing fully engaged employees, and why it matters.

> "MORE THAN A QUARTER OF YOUR WORKFORCE **MAY HAVE ESSENTIALLY "CHECKED OUT"** AND THAT CAN HAVE A PRETTY DESTRUCTIVE IMPACT ON YOUR BUSINESS."

THE PROBLEM ...

According to a recent survey by Dale Carnegie Training (**ncilink.com/DCStudy**) and MSW Research (**ncilink.com/MSWResearch**), only about 29% of employees are fully engaged in their jobs. About 45% are partially engaged, and 26% are actively disengaged.

That's right... more than a quarter of your workforce may have essentially "checked out!" And with almost another half only partially engaged, that can have a pretty destructive impact on your business. Plunging productivity, falling profits, poor customer satisfaction, and sinking employee morale are just a few of the damaging effects that come to mind.

A 2017 Gallup report estimated the cost of actively disengaged employees to businesses nationwide was well over $483 billion in lost productivity. The term they coined was that disengaged employees generate a cost of "presenteeism." (See what they did there?) That is more than a little disturbing.

The flip side of the coin is that businesses with engaged employees enjoy some substantial benefits. According to the same Gallup report, reduced absenteeism, less employee turnover, fewer quality defects, and increased customer satisfaction were just a few. All of this resulted in 17% better productivity, 20% higher sales, and 21% greater profits. So, I think it would be fair to say that an organization with high employee engagement could be expected to outperform those with low employee engagement.

THE ENGAGED EMPLOYEE...

What is an engaged employee? One way to define it would be that an engaged employee is one who is fully involved in, and enthusiastic about their job, and who actively seeks to advance company goals and interests. An engaged employee has an optimistic attitude towards the company and, equally important, their future with it. The next obvious question is how do you get and keep them engaged? Research shows that there are some key factors that drive employee engagement:

- 60% of respondents in the Gallup report said that being able to do what they do best has the greatest impact
- Career advancement and learning opportunities rank highly
- Perception of the importance of their job within the company is another major factor
- Their opinion of the company values and leadership also plays a role.

Engaged employees have an emotional commitment to the company when they feel an *intrinsic desire* to work for a company rather than feeling *compelled* to work there.

So how do you create an environment to do this and how do you measure the level of engagement in your company?

To find out read the entire article online at **ncilink.com/employees**.

Steve Vannoy has been involved in the development and maintenance of technical curriculum at NCI since 2006 He has +40 years of experience in the HVAC industry, including more than 25 years in the training and development area. He has overseen and participated in the development of comprehensive training for all phases of an HVAC contracting business.

By Scott Fielder

5 Ways to Spot a Bad Duct Traverse

In the world of Testing, Adjusting, and Balancing (TAB) airflow in commercial rooftop units (RTU), fans, and so on, there is a wide debate on which testing method to use. There are, in fact, two methods – **Log Tchebycheff** (Log-T) and **Equal Area** traverse – and the debate centers around which is the most accurate. Most TAB professionals will say that either method is acceptable, but only one of them should be used on any particular job.

My purpose here isn't to continue this debate. Instead, I want to highlight the impact of improper methods and/or inadequate documentation that can complicate results, no matter which method is used. There are a few clear indicators of this that I've encountered hundreds of times over the years.

First, some definitions: The **Log-Tchebycheff, or Log-T** was developed by a Russian mathematician, and is based upon a **logarithm** (ncilink.com/LogDefinition) that calculates where to drill holes or "install test ports," and where to mark the test probe to obtain accurate readings in the duct. For rectangular ductwork, this method requires a minimum of 25 readings, and a maximum of 47 readings. It also requires all measurements be taken to three decimal places.

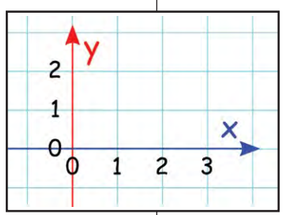


Figure 1: This is a generic graph depicting the X and Y-axis.

The **Equal Area Method**, on the other hand, simply divides the rectangle into equal areas. For the Y-Axis (the vertical line on a graph – see **Figure 1**), you divide the exterior dimension by eight for the first hole or marking, and then you divide the exterior dimension by four for the second hole or marking.

You repeat the process with the X-Axis or the horizontal line on the graph.

I saw a simple illustration in a SMACNA (www.smacna.org/) manual 20 years ago, and I never forgot it. Again, avoiding the debate over which method is more accurate, I'd like to point out that using **Imperial, P/I units**, a standard tape measure in the United States, doesn't account for three decimal places. It does, however, include halves, quarters, and eighths which you can use for the Equal Area Method. This results in greater accuracy and field technician repeatability.

With this in mind, here are five ways to spot bad traverses:

1 YOU NEED ADEQUATE INFORMATION TO EVALUATE THE DATA

Aside from the requisite number of velocity readings, are TAB professionals measuring and providing external duct dimensions, insulation size (if any), internal duct-free area, instrument(s) used, static pressure, type of unit and unit designation in their TAB reports?

Is there complete unit information to include all motor tag information, measured volts, amps, static pressure, motor, and fan rpm/fan speed settings?

Did the technician provide all the data? I mean, EVERYTHING?

When there are issues with a unit, ALL data, down to the motor bore size and sheaves are relevant. There is an annoying trend among TAB technicians to only collect partial data when encountering airflow issues. Step one in the troubleshooting process is to collect ALL data as if the report will be turned in as final.

2 DOES THE AIRFLOW/TRAVERSE MAKE SENSE?

The professional approach is to question everything. Is the equipment a Make-Up Air Unit (MUA) showing a negative discharge static pressure? Was it in heating mode when the reading was taken with a thermal anemometer? Was it a 12" x 12" duct, with one-inch duct lining, and a recorded internal free area of 1.0. That's a difference in the free area of .694 square feet that will greatly impact the final numbers. It's also a very common mistake?

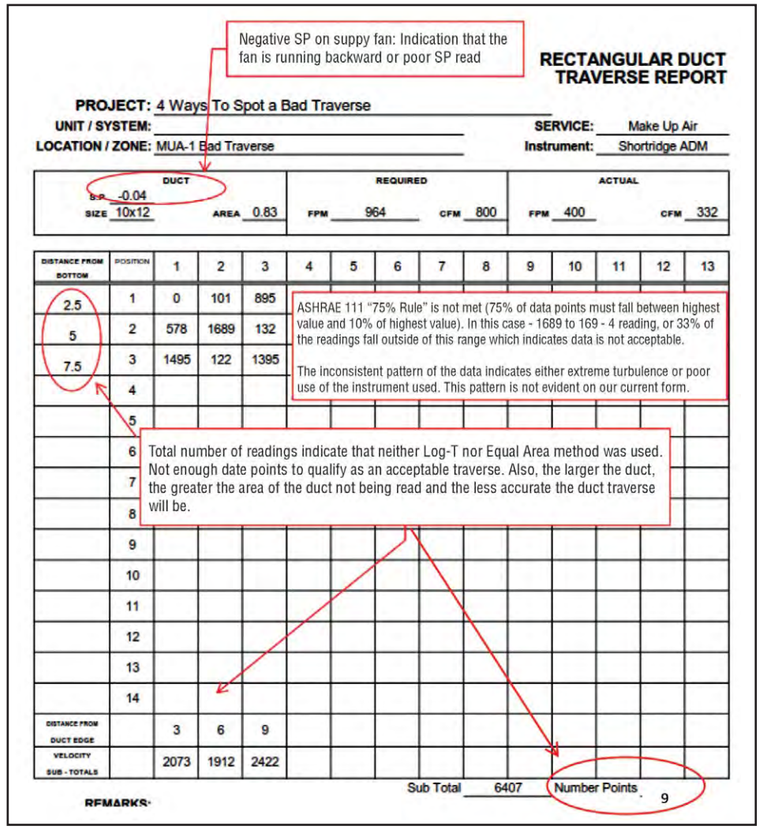


Figure 2: How to spot a bad duct traverse in a TAB report.

It is very common to see irregular airflow or velocity readings in a supply fan duct traverse, with a negative static pressure reading on the fan discharge.

Although the laws of physics tell us this is not possible, it's a common occurrence for multiple reasons. A negative static pressure reading on the fan discharge is accompanied by other poor readings. This can happen due to turbulence or excessive velocity.

Starting with the latter, it is possible that velocity at the fan discharge is so high, that it is sucking in air through the static pressure port. Another possibility is that AMCA (Air Movement and Control Association) standards (www.amca.org/) are not being met and system effect (ncilink.com/SystemEffect-ACHRNews) is occurring. When present, it will produce random negative static pressure readings and erratic airflow.

The final possibility has to do with forward curve centrifugal fans (ncilink.com/CentrifugalFan) that run backwards. They will still supply airflow, and not move air in the opposite direction, but only move 20% to 50% of the flow. This produces "choppy airflow" patterns and negative discharge static pressure, where it is normally not possible.

3 ARE THERE ENOUGH READINGS FOR A GOOD DUCT TRAVERSE?

On a rectangular duct, The Equal Area method requires a minimum of 16 readings on a rectangular duct traverse and the Log – Tchebycheff (or Log-T method) requires a minimum of 25 readings on a rectangular duct traverse. Yes, it is possible to obtain a "good" traverse with only nine or 12 readings, but that not only shows a lack of professionalism, it opens the door to a greater possibility that the duct traverse data is unreliable.

4 DOES AIRFLOW DATA MAKE SENSE IN RELATION TO UNIT DATA?

For example: Let's say the unit is at full load amps, its static pressure is 120% of design, and fan rpms are 110% of design. But the duct traverse shows 50% airflow.

Next, you measure and read a 20° temperature drop on a DX (Direct Expansion) Air Handling Unit (AHU) or Roof Top Unit (RTU). What? This is physically impossible, and on DX units the coils ice-up around 70% airflow and below.

Keep in mind that the industry standard is 400 CFM per ton of air conditioning, or 12,000 Btus (British Thermal Units). Also, as airflow decreases, the temperature difference increases.

Two other examples come to mind:

- Last year, I received a TAB Report that showed the unit at 50% airflow but had a 19.5° temperature split when the design temperature change

(ΔT) was 20.1°. The traverse sheet was not included, so I could not evaluate the actual traverse. The indoor motor amp draw, fan rpm, and Total External Static Pressure (TESP), once plotted on the fan curve, indicated the unit was performing within 10% to 20% of design airflow.

Fan curves are not always accurate, as they are created under very strict laboratory conditions and can vary greatly from design given installation conditions. The above-mentioned report was sent to me by a facility manager who was about to call the manufacturer and complain, but wanted a second opinion. I asked him if the coils were freezing up and if there were any comfort complaints in the area served by this unit?

Other questions included, how long the new unit had been in place (around six weeks by this point), and whether he could confirm the equipment entering and leaving dry bulb temperatures?

He responded that the coils weren't frozen, the occupants were comfortable, and he had a 20° ΔT at the unit. Even without seeing the actual duct traverse data, I had a clear picture. All other data indicated the duct traverse data was wrong.

- In another situation that occurred very recently, a TAB contractor traversed a 7.5-ton unit, designed for 3,000 cfm. His traverse showed the unit moving 1284 cfm of airflow. The traverse was consistent with his balancing hood readings.

However, the ductwork on the mechanical drawings did not match the prints. The prints were "Straight Line Drawings" and the ductwork had multiple transitions to overcome existing structural conditions.

He plotted airflow from the manufacturer-provided fan table, which indicated the unit was delivering between 2000 to 2400 cfm. His actual duct traverse sheet showed very good laminar (ncilink.com/laminarDef) airflow, which is a good indication that the traverse was done properly, at a good location, and acceptable.

The key element in confirming the duct traverse was the temperature drops. The fan curve proved to be unreliable due to installation conditions.

The RTU was designed for a 19.2° dry bulb ΔT, and a 6.7° wet bulb ΔT. Actual temperature readings were 27.1° dry bulb, and 15.5° wet bulb temperature.

Of further note, after an hour of operation, the coil froze up. All of these factors – laminar flow with a 16-point duct traverse, temperature drops beyond design parameters, and a frozen coil indicated that the duct traverse was most likely accurate, in spite of the discrepancy with the fan curve.

If you encounter this situation, there needs to be A LOT of supporting data. It could be leakage at the curb, or it could be the wrong unit on the wrong curb. However, most of the time, it's a bad duct traverse.

5 DOES THE DATA MEET THE ASHRAE 111 75% RULE?

The ASHRAE 111-2008 (RA 2017) "Testing, Adjusting, and Balancing of Building HVAC Systems rule (ncilink.com/ASHRAE111) states that for a duct traverse to be acceptable, 75% of the readings MUST be between the highest reading and 10% of the highest readings.

This is to say that if you have a duct traverse with 16 readings, and the highest reading is 1000 fpm, then 75% or 12 of those readings must be greater than or equal to 100 fpm.

For example, if the highest reading is 1000 fpm and six of 16 readings are "78, 34, 89, 54, 69, 91" – THAT is NOT an acceptable duct traverse, per ASHRAE standards.

There is much more that can be written on this subject. However, the purpose of this article is to provide a broad overview so that a poorly performed, or improperly recorded duct traverse jumps off the page when reviewed by a TAB professional.

These are simple rules that are often not followed. They apply to professional TAB Supervisors reviewing information from their own TAB technicians, the design team reviewing the TAB report, and even the end user.

NOTE: TAB professionals can find themselves being accused of fabricating or "pencil whipping" data in TAB reports. In most cases this is untrue. They aren't pencil whipping. Bad data usually is due to poor practices, lack of knowledge on how to interpret the data in the field, and a general lack of proper supervision.

EVERY Certified TAB Professional, at the technician or supervisor level, must understand how to properly take the data in the field, and how to interpret it prior to publishing the report and certification. NCI

Scott Fielder is the director of National Balancing Council (NBC), an operating unit of National Comfort Institute (NCI). He is an instructor and course developer who works closely with applicants for NBC certification and provides both technical and administrative support to NBC Certified Professionals. He can be reached at *scottf@ncihvac.com*.

"Condenser Bling"

—Vic Updike, Masterworks Mechanical, Inc., Craig, CO

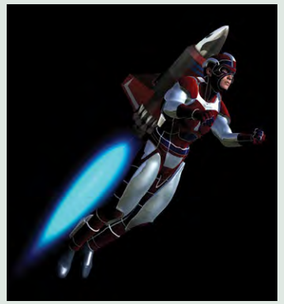
This condenser is most certainly calibrated for altitude!!!

Vic Updike from Masterworks Mechanical is the August 2019 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. 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, go to ncilink.com/POMSubmit and fill out the information as requested.

THE SEPTEMBER 2019 CONTEST OPENS ON AUGUST 12, 2019.

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



The August PowerPack is Now Available

Last month's PowerPack focused on helping you integrate testing and diagnostics into your company's culture.

This month we focus on:

- **System Temperature Measurement Basics** (Online Training)
- **Enthalpy Chart** (Download)
- **CoolMaxx Report and Procedure** (Download)
- **Tech Tip: Measuring Wet Bulb Temperature** (Download).

Plus you can still access the video of the first Trailblazer Coaching session and sign up for the monthly sessions.

We think you'll find these tools and training materials very helpful as you continue to grow your High-Performance HVAC business.

Be sure to share your PowerPack with your entire team! Go to **ncilink.com/PwrPak**.

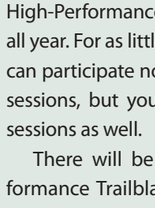
If you have any questions, or if you are unable to access any of the tools in this program, please contact our Customer Care team at 800-633-7058.

Trailblazer Coaching Is A-Rockin!

Now in its third month, the **High-Performance Trailblazer Coaching 2019-2020** program is in full swing and is rocking the world with those who are already participating.

Don't take our word for it. Here are what several members say about their experience so far:

"I consider the Trailblazer Coaching program, as well as the entire NCI team, as my champions. They stay in touch with me between Trailblazer sessions to make sure I am successful and staying on the Performance Path. I love how these sessions re-



inforce what I learned at Summit as well as what I learn in NCI training." ***– Mike Greany, Service Manager, All Pro Plumbing Heating, Air & Electrical, Ontario, CA.***

"Attending Summit and this Trailblazer Coaching has really shown me the importance of consistency and has been very helpful in keeping me and my company on the path.

"Over a five-year period, Control Point's atmosphere and attitude is so different than when we started. What I've learned

and continue to learn is that by staying consistent and by explaining the 'why' to our team and our customers, we were able to change our culture and have become unstoppable." ***– John Fullen, Operations Manager, Control Point Mechanical, Shrewsbury, MA.***

Trailblazer Coaching was designed to bring the concepts taught during NCI's High-Performance HVAC Summit to you all year. For as little as $35 per month, you can participate not only in the upcoming sessions, but you can listen to the past sessions as well.

There will be 12 monthly High-Performance Trailblazer Coaching sessions. You can participate with fellow HVAC contractors from across the country and either learn or refresh all the concepts taught during the 2019 Summit event.

NCI's David Holt and David Richardson are the coaches.

To register and participate, just go to **ncilink.com/TrailBlazeReg** today.

Seriously, don't miss this tremendous opportunity.

New Online Training

In our continuing mission to add to and improve the training content available to members, NCI is pleased to announce two new courses:

- **Fundamentals of Fan Airflow** – Learn the three rules of airflow and the six steps of fan operation in a system, and more!
- **Balancing Hood Basics** – Learn the basic functions of balancing hoods as well as proper positioning and how to accurately measure grille and register airflow.

These two courses join our other inexpensive Online University training for your employees and target NCI-specific training. The University includes modules covering testing and measuring HVAC systems as well as best High-Performance business practices.

Now NCI's Online University is more affordable than ever! Take advantage of our new more-competitive pricing on all online training - and as a member, you save even more!

Plus, Learning Excellence Online, Learning Excellence Premium, and High-Performance HVAC Alliance members have unlimited access to all online university courses for all their employees!

Check out all our online courses by going to **ncilink.com/OnlineU**.

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Mike Weil

Art Director
Connie Conklin

Online Development Director
Brian Roseman

Circulation Manager
Andrea Begany- Garsed

Editorial Assistant
Marge Smith

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

By Dom Guarino

Baby Steps!

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

At least once a week I talk to an HVAC contractor who has taken NCI training and is trying to figure out how to integrate measured performance into his or her business. NCI's dozens of instructors and customer support staff get similar questions every day.

As we examine how companies we've trained over the years have made the transition, we found a common thread in three key areas:

1. Technical knowledge and skills

2. Investment in tools and instruments

3. Consistent systems and processes.

Many of the contractors we talk to have made significant strides in the first two areas. They have a pretty good grasp of the technical knowledge to test, diagnose, and improve systems. Many have the tools and instruments to get the job done. However, most share that their biggest weaknesses are lack of systems and processes.

Roughly 20% of those we talk to have made the leap from the "potential" to deliver measured performance, to actually doing it. The common denominator is they already have good systems and processes in place. They have a good grasp of how their companies run, and good documentation of how they do what they do.

While they focus on great customer service, and installing high-quality systems, most companies are still working on creating consistent, documented processes. As a result, they find it a lot tougher to implement new offerings like measured performance improvements.

SO WHERE DO YOU BEGIN? BABY STEPS!

The secret to implementing something as new and revolutionary like delivered performance is to take small steps and build momentum. The old adage, "How do you eat an elephant? One bite at a time," truly applies here.

Here are some *Baby Steps* you can take as you begin to integrate measured performance into your company culture. These steps assume some of your people already have the needed knowledge, skills, and tools:

1. Build a "Pilot" team. Choose one technician, one salesperson, and one installation crew. Your service and sales team should test performance on every service and sales call they can. Task your install crew with performing and "testing out" system enhancements, both as part of equipment installation and stand-alone.

2. Use the experience you gain from these initial projects to hone your process. It's very important to document what was done, what worked, and what didn't. What might work in one company may not work in another. Your successes and failures will help your team determine what works best in your market - and for your company. This experience will help you make good course corrections as you move forward.

3. Learn from others. There are hundreds of NCI members in various stages of implementation. If you are a member, reach out and ask questions on our online forum, *High-Performance Talk*. If you're not a member, start with a 30-day free trial. In addition to the support available with your membership, during these 30 days you can reach out to other members and learn how they overcame the inevitable challenges of implementing this new process in their companies.

Go to NCILink.com/trial to learn how to get a trial membership.

4. Keep going. As your pilot team improves their processes, you will generate new opportunities for performance improvements and take on bigger and more profitable projects. Most importantly, the team will start to "rub off" on their peers within your company.

This baby-steps approach allows you to grow a High-Performance culture organically within your organization. The good news is you don't have to do it all at once.

Remember, you don't need to go it alone. You can access the wisdom of hundreds of High-Performance contractors plus NCI instructors and support staff as you embark on this exciting and worthwhile journey.

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SAVE $$$ Hundreds on Early-Bird Registration when you register by September 1, 2019!

HIGH-PERFORMANCE HVAC SUMMIT 2020

April 6-9, 2020
Scottsdale, AZ

REGISTER NOW for NCI's High-Performance HVAC Summit 2020 that will be held at We-Ko-Pa Resort & Conference Center near Scottsdale, AZ. Don't miss out, get the Early-bird special pricing!

Registration is Now Open!

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