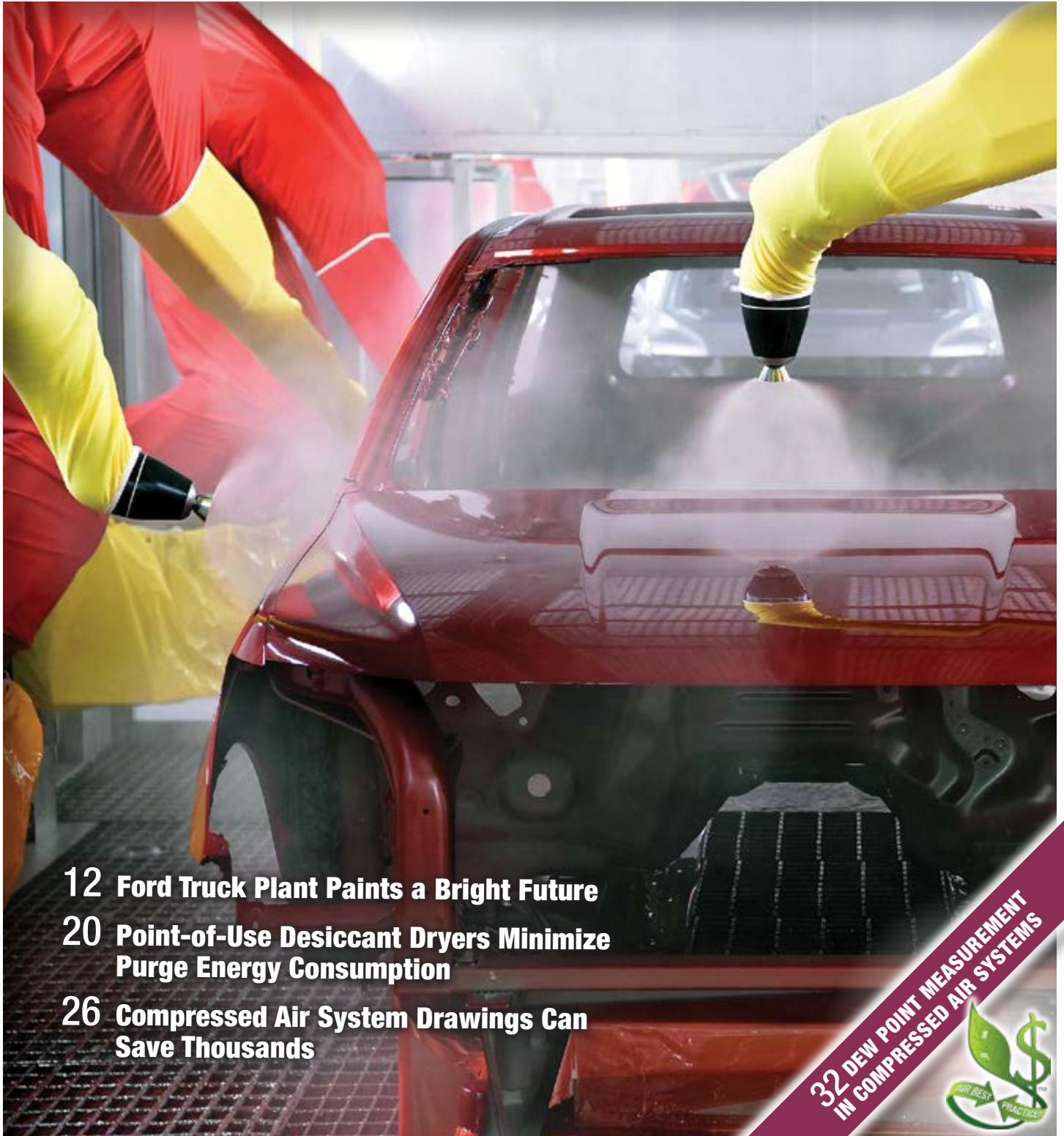


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October 2020



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FROM THE EDITOR



Quality, Safety and Reliability

We were very pleased to receive the article, from veteran compressed air system auditor Paul Edwards, titled, “Compressed Air System Drawings: A Picture Can Save Tens of Thousands of Dollars.” In it he provides real-world examples of how this under-used practice helped in three different compressed air systems.

“Measurement” is the one-word answer I provide, when asked about the next big trend in compressed air. I believe Dew Point will be one of the key performance indicators measured, in every air compressor room, and also in front of every critical-use piece of production equipment where compressed air comes into direct or indirect contact with products. For this reason, we are thankful Martin Raab, from E+E Elektronik, sent us an article titled, “Dew Point Measurement in Compressed Air Systems.”

Solid particles are also a significant contaminant to be measured. Compressed air particle measurement is not wide-spread or understood, yet there are quality management specialists already doing this. Two such firms are Trace Analytics and Quality Assurance Management, who have sent us an interesting article titled, “Troubleshoot Particle Contamination in Compressed Air with Laser Particle Counters.”

Productivity, Sustainability & Energy Conservation

Did you know Ford Motor Company has committed to reducing energy demand by a minimum 25%, from 2011 to 2021 in its 25 U.S. manufacturing plants? This blows me away. A U.S. DOE Better Buildings Better Plants Challenge Partner, Ford allowed our own Mike Grennier to write a feature article on the upgrade done to the entire compressed air system at their six million square-foot Kentucky Truck Plant.

An energy conservation opportunity, for many plants, is to reduce the volume of purge air (typically 15%) consumed by heatless desiccant compressed air dryers. Heatless dryers have the highest unit sales, in the desiccant dryer category, making this a worthwhile topic. One approach to solving this issue is presented by Jim DiMaiolo, from Altec AIR, in his article, “Utilizing Smaller Point-of-Use Desiccant Dryers to Minimize Purge Energy Consumption.”

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ROD SMITH, Editor

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COMPRESSED AIR SYSTEM INDUSTRY NEWS

Relevant Rental Completes Acquisition and Rebrands as Critical Rental Solutions

Relevant Rental announced the strategic acquisition of Surplus Group, a leading supplier of temperature control equipment, and the concurrent rebranding of Relevant Rental to Critical Rental Solutions.

Surplus Group serves a global customer base from its 80,000 ft² facility in Dallas, TX, where it has one of the largest and highest quality fleets of surplus temperature control equipment, including air and water-cooled chillers, cooling towers, and related accessories, in North America. Surplus Group will continue to grow its share of the temperature control equipment sales market while adding temperature control expertise to Critical Rental Solutions' rental platform.

This acquisition adds a full suite of temperature control equipment and capabilities to Critical Rental Solutions' existing capabilities as the leading independent North American provider of oil-free air rental services. "With the addition of Surplus Group, we are expanding our product and service offering to become a more valuable partner to our customers while maintaining our niche position within the equipment rental industry," said CEO and President, Mark Shedd.

About Critical Rental Solutions

With Channel Partner relationships across North America, Critical Rental Solutions is expanding its services to ultimately provide end users with a broader offering of cost-effective, nimble, critical solutions with continued safe work environments and

maximized environmental efficiencies. Critical Rental Solutions provides niche rental services globally through its primary facility in Houston, Texas, which houses a high-quality fleet of oil-free compressors, dryers, and low-pressure blowers and fans. To learn more about Critical Rental Solutions, visit <https://criticalrentalsolutions.com>.

Motion Industries Announces Two Acquisitions

Motion Industries, Inc., a leading distributor of maintenance, repair, and operation replacement parts and a wholly owned subsidiary of Genuine Parts Company (GPC), announced two acquisitions. Motion has entered into agreements to acquire TRC Hydraulics, a Canadian-based supplier of hydraulic products and services, and F&L Industrial Solutions, Inc., a distributor of T-slotted aluminum extrusion components.



Motion has entered into agreements to acquire TRC Hydraulics and F&L Industrial Solutions, Inc.

In business since 1986, TRC Hydraulics has served the Atlantic Canada region with several full-service sales and repair facilities in Canada. In 2019, TRC Hydraulics expanded

by opening a facility near Spartanburg, South Carolina. Along with distributing many lines of hydraulic product, TRC designs, manufactures, and maintains hydraulic components and systems. TRC also engineers customized hydraulic and mechanical solutions, and offers the additional services of experienced fabricators, welders, machinists, and hydraulic technicians.

"This is a fantastic opportunity to grow our business with a leading company that shares the same core values as we do," said TRC President and CEO Terry Coyle. "We look forward to leveraging the many resources that Motion Industries offers and enhancing our services to provide greater value to our customers."

Based near San Diego, California, F&L Industrial Solutions has served the southwest U.S. with full-service aluminum extrusion components since 2002. F&L offers local inventory including the 80/20 brand of aluminum, an experienced staff of CAD designers, in-house machining, digital panel cutting, full assembly/manufacturing, on-site delivery, and installation. Custom-designed products include a wide array of enclosures, clean rooms, walls, platforms, cabinets, racks, sneeze guards, tool holders, electrical connections, robotics, specialized carts, and more.

"It's a perfect fit of our analogous visions and business cultures," said F&L Industrial Owner, Mike Fanolla, who co-founded F&L. "We look forward to the growth opportunities, and with us joining Motion Industries, our customers can anticipate even greater high-quality service they've come to know from our company."

“We are pleased to welcome these outstanding organizations, TRC Hydraulics and F&L Industrial, to the Motion family,” said Motion Industries President, Randy Breaux. “TRC gives us the opportunity to expand our hydraulics business in the Atlantic Canada markets. And with its aluminum extrusion niche, F&L will nicely supplement our Mi Automation Solutions Group. We look forward to working with the talented people of both companies to grow our market footprint and build on our industry-leading position, creating even more value for our customers in the coming years.”

Mi Automation Solutions Group offerings to customers include control panels, conveyors, machine vision, motion control, network connectivity, pneumatics, robotics, sensing I/O and other automation-related solutions

About Motion Industries

With annual sales of \$6.0 billion, Motion Industries is a leading industrial distributor of bearings, mechanical power transmission products, electrical and industrial automation components, hydraulic and industrial hose, hydraulic and pneumatic components, industrial and safety products, as well as material handling products and solutions. Motion Industries has over 550 locations, including 15 distribution centers throughout North America, and serves more than 200,000 customers from the food and beverage, pulp and paper, iron and steel, chemical, mining and aggregate, petrochemical, automotive, semiconductor, wood and lumber, medical, and pharmaceutical industries. Motion Industries is a wholly owned subsidiary of Genuine Parts Company. Visit our website at www.MotionIndustries.com.



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COMPRESSED AIR SYSTEM INDUSTRY NEWS

ASHRAE Releases Updated Building Readiness Guide

As many buildings are preparing to reopen during this pandemic, the ASHRAE Epidemic Task Force has updated its reopening “Building Readiness” guidance for HVAC systems to help mitigate the transmission of SARS-CoV-2.

“The Building Readiness Guide includes additional information and clarifications so that owners can avoid operating their HVAC systems 24/7,” said Wade Conlan, ASHRAE Epidemic Task Force Building Readiness Team lead. “By rolling out this updated guidance, we are providing a more robust structure for building owners to complete the objectives of their Building Readiness Plan and anticipate the needs of building occupants.”

Specific updated recommendations to the building readiness guidance include the following:

- Pre- and Post- Occupancy with Outdoor Air: The intent of this strategy is to ensure that infectious aerosol in the building at the end of occupancy is removed prior to the next occupied period. The building is flushed for a duration sufficient to reduce concentration of airborne infectious particles by 95%. For a well-mixed space, this would require three air changes (three times the building volume) of outdoor air (or three equivalent air changes including the effect of filtration and air cleaners) as detailed in the calculation methodology.

There is also guidance on methods to increase the quantity of outdoor air introduced by systems.

- Energy Recovery Ventilation (ERV) Systems Operation: Guidance is provided to assist in determining if an energy recovery system using an energy wheel is well designed and maintained and whether it should remain in operation. Based on the assessment of ERV conditions, it may be possible to fix problems and return it to service.
- Building Readiness Modes of Operation for the Building: These should include the following:
 - Epidemic Operating Conditions in Place (ECiP)
 - Occupied- at pre-epidemic capacity
 - Occupied- at reduced capacity or Unoccupied temporarily
 - Operation during building closure for indefinite periods
 - Post-Epidemic Conditions in Place (P-ECiP)
 - Prior to Occupying
 - Operational Considerations once Occupied

The guidance still addresses the tactical commissioning and systems analysis to develop a Building Readiness Plan, increased filtration, air cleaning strategies, domestic and plumbing water systems, and overall improvements to a systems ability to mitigate virus transmission.

About ASHRAE

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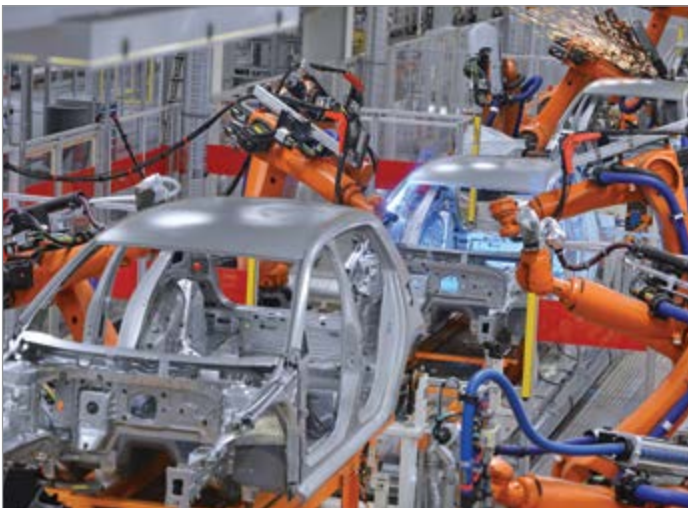

of heating, ventilation, air conditioning, refrigeration and their allied fields. As an industry leader in research, standards writing, publishing, certification and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries. ASHRAE is celebrating 125 years of shaping the built environment. For more information and to stay up to date on ASHRAE, visit www.ashrae.org.

Festo Predictive Analytics Software Named an AI Champion

Festo has been named an artificial intelligence (AI) Champion for the company's project Intelligent Pneumatic Runtime Monitoring. The award was given during the inaugural Baden-Württemberg awards ceremony on August 11. Baden-Württemberg, Germany's third largest state, is one of that country's leading regions for AI development.

Thousands of pneumatic clamping systems are used daily in the automotive industry for tasks such as holding individual parts in place during body-shop welding. The Intelligent Pneumatic Runtime Monitoring software from Festo with AI from Resolto, a member of the Festo Group that specializes in AI development, alerts the auto manufacturer to replace clamps during routine maintenance periods to avoid costly unplanned shutdowns due to unforeseen failures. This AI-based algorithm relies on signals from the valves and the end positions of the actuators for its diagnostics – information that is readily available.

A total of nine awards for AI projects were given during the AI



The AI solution for clamping systems in the automotive industry prevents expensive production line shutdowns due to clamp failure.

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Champions' virtual ceremony. The honorees included a research organization, Festo, and two other companies with more than 500 employees, and five companies with less than 500 employees.

“Artificial Intelligence is the key technology of the future – just as important for the economy as it is for solving global social challenges,” said Dr. Nicole Hoffmeister-Kraut, the Baden-Württemberg’s Minister of Economic Affairs, Employment, and Housing, as she introduced the winners. Dr. Thilo Streichert, Head of Development Embedded Software, and Dr. Dominic Kraus, Product Management and Business Development, accepted the award on behalf of Festo via live transmission.

Commenting on the award, Festo Management Board Member for Product and Technology Management Dr. Frank Melzer said, “As artificial intelligence is the key technology of the future, Festo’s focus is on the further development of decentralized, autonomous systems and artificial intelligence. In 2018, we acquired the AI specialist Resolto

and have been steadily advancing the fields of analytics and artificial intelligence since that acquisition. AI will have an enormous impact on our product portfolio by enabling AI algorithms to be integrated into the cloud as well as directly into Festo components. I am particularly proud of this award in the inaugural Baden-Württemberg AI Champions.”

About Festo

Festo is a leading manufacturer of pneumatic and electromechanical systems, components, and controls for process and industrial automation. For more than 40 years, Festo Corporation has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performing, more profitable automated manufacturing and processing equipment. For more information, visit www.festo.com.

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PRODUCTIVITY, SUSTAINABILITY AND ENERGY CONSERVATION



Ford Motor Company's Kentucky Truck Plant HELPS PAINT A BRIGHT ENERGY FUTURE

By Mike Grennier, Compressed Air Best Practices® Magazine.

The use of advanced manufacturing technologies and tools at the Kentucky Truck Plant in Louisville, Kentucky, are helping Ford upskill its workforce and deliver better quality F Series Super Duty Pickup Trucks, Lincoln Navigators and Ford Expeditions to customers more quickly. (Photo courtesy of Ford Motor Company.)

► The Ford Motor Company Kentucky Truck Plant (KTP) not only manufactures upscale SUVs and pickup trucks painted in wide variety of stellar, high-quality colors and finishes – it does so cost-effectively by conserving annual compressed air energy of approximately 9.2

GWh thanks to a major overhaul of the plant's compressed air system.

Ford, headquartered in Dearborn, Michigan, and a U.S. Department of Energy's Better Buildings Better Plants Challenge Partner, has committed to reducing energy demand by a

minimum of 25% from 2011 to 2021 in its 25 U.S. manufacturing plants. The compressed air project at KTP is just one of many initiatives to achieve its goals.

Initially planned to support the need for quality air and energy savings associated



“Ford is very mindful of its impact on our climate and specifically the local environment at our various locations and have established sustainability goals that must be achieved.”

— Jeff White, Energy Manager, Ford Motor Company

with a new paint shop, the compressed air system upgrade at KTP in Louisville, Kentucky, broadened to ensure reliable and efficient delivery of clean and dry compressed air to the entire six million-square-foot plant, said Ford Motor Company Energy Manager Jeff White.

“We started out focused on putting in a new system to feed dry air to the new paint shop, but as time went on, we decided to upgrade the whole plant. It was a good decision,” White said.

Efficiency Means 88 Vehicles Per Hour

The KTP operation manufactures F-series Ford Super Duty Trucks and Ford Expedition and Lincoln Navigators SUVs. Originally built in 1969, the plant has evolved and grown tremendously with a floor area that has nearly doubled since it opened. At the sprawling plant, 8,920 employees produce as many as 88 vehicles per hour between two assembly lines.

At KTP, production begins when aluminum coils arrive at the plant where they’re stamped into parts and shipped to subassembly. The subassemblies are then conveyed to the body shop for assembly of various parts. From there, vehicle bodies are conveyed to the paint operation. The white bodies are painted and processed through an oven before being sent to final assembly.

The plant regularly upgrades its operation to efficiently manufacture its popular brands of trucks and SUVs. Among the most significant projects in recent history is a new body shop for building vehicles with aluminum body. Another facility built at the same time in 2016 is the new paint plant, which incorporates the use of highly advanced and unique painting

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FORD MOTOR COMPANY'S KENTUCKY TRUCK PLANT HELPS PAINT A BRIGHT ENERGY FUTURE

technologies.

Less Energy and Even Higher Quality Paint Jobs

Decision-makers at KTP combined streamlined production techniques with advanced technology to achieve the operation's energy reduction and production efficiency goals when planning the new paint facility.

The strategy involved the dedication of the new paint facility to painting only SUVs, which in turn, freed up the existing paint facility

for painting Super Duty trucks. The strategy allowed the plant to boost vehicle production by approximately 15% by total volume. It also addressed ongoing plant-wide goals of continuous improvement and energy reduction.

"With the new paint shop, we're able to ensure a premium paint job while also increasing overall production efficiencies throughout the plant," said Mark Melvin, Facilities Engineer for Global Paint Engineering.

Just some of the highlights of the energy-

efficient paint facility include:

- A single dry booth/single oven and three-wet painting and curing process, which eliminates the need for an additional paint booth and oven for curing, resulting in energy and cost savings.
- A dry booth process (versus a wet-booth process), reduces the amount of air supply and fans needed compared with a

Ford Motor Company is creating high-quality vehicles in an environmentally and socially responsible way and reducing the impacts of its operations and supply chains through world-class facilities, innovative manufacturing processes and the most sustainable materials. What follows are highlights from its 2020 Sustainability Report.

| Goals | 2019/2020 Progress Examples |
|---|---|
| Reduce global facility CO ₂ emissions by 18% (2019 – 2023). | We aspire to achieve carbon neutrality by 2050. We have set a goal that exceeds the requirement of the IEA ETP 2017 Beyond 2°C (35.6°F) Scenario pathway for Ford's manufacturing operations. |
| Achieve 32% renewable energy by 2023 and 100% locally sourced renewable energy by 2035. | Our Dearborn Truck Plant, Michigan Assembly Plant and several new buildings on our Research and Engineering and Corktown campuses will be powered by 100% locally sourced renewable energy by January 2021 |
| Air emissions reductions other than CO ₂ . | We are working to reduce emissions of non-CO ₂ pollutants, in accordance with increasingly stringent standards around the world. In February 2019, we announced the largest renewable energy procurement in our history through a collaboration with DTE Energy. |
| Save an additional 30% of the water from our manufacturing (2015–2020). | We have reduced our absolute operational water use by 13% since 2018 and by 70% since 2000 (saving more than 11 billion gallons). |
| Use freshwater sources for human consumption only. | We have installed more non-water-based technologies and used alternative sources such as other companies' treated wastewater. |
| Make zero water withdrawals for manufacturing processes. | We are incorporating more water processes and technologies in our assembly plants, including water reuse and recycling systems. |

conventional system. Additionally, less air needs to be brought in from the outside and 80% of the air can be easily recirculated.

- Ovens optimized for minimal airflow, eliminating radiant zones and using direct-drive blowers.
- A RO Dip® pretreatment and E-Coat process, allowing for higher quality paint finishes and a significantly smaller physical footprint to allow more space for production.
- An updated abatement system using VOC concentrators and

highly efficiently regenerative thermal oxidizers, allowing for significant energy savings.

- Booth air cascading and re-circulation strategies, as well as advanced building management controls to cascade ventilation air through different paint zones.
- LED lighting throughout the facility.

A major consideration when planning the new paint facility was the need for high quality compressed air given its importance to the painting process. Yet, decision-makers wanted the same for the remainder of the plant, which

led to a compressed air system makeover.

Clean, Dry Air Goal No. 1

To tackle the compressed air project, KTP partnered with Universal Compressed Air (UCA), Bethlehem, Pennsylvania. UCA (www.UniversalCompressedAir.com) is an industrial gas company specializing in producing and distributing compressed air with a focus on supplying compressed air to sites that require air for around-the-clock operations. Additionally, UCA maintains complete compressed air supply and distribution systems for a range of companies.

White said extensive planning led to the decision to upgrade the compressed air system used for the entire plant because other areas of

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FORD MOTOR COMPANY'S KENTUCKY TRUCK PLANT HELPS PAINT A BRIGHT ENERGY FUTURE



Quality and efficiency best describe the high-tech paint facility at the high-tech Ford Kentucky Truck Plant. (Photo courtesy of Ford Motor Company.)



The upgraded compressed air system at KTP has reduced energy consumption by approximately 9.2 GWh. (Photo courtesy of Universal Compressed Air.)

the plant besides the paint operations require clean dry air without fail – and the potential for energy savings were clear to all.

“The new aluminum body shop tooling that was coming in, as an example, needed dry air so rather than installing things in piecemeal fashion we decided to upgrade the entire compressed air system, including the use of desiccant air dryers where we could,” White said.

Melvin could not overemphasize the importance of dry compressed air for the paint plant given the impact on the quality of the paint job and overall productivity.

“Probably 60% of the air is used for the spray booth, which includes the use of a high-speed rotating bell for atomizing the paint,” Melvin said. “Compressed air actually shapes the cone of paint coming out of the rotating bell as it is applied. In addition to the proper pressure the air needs to be really dry to ensure the paint quality. You also don’t want lubricant anywhere near that area.”

With clearly established goals and firm plans in place, KTP and UCA entered into a performance contract that called for UCA to upgrade the compressed air system, maintain it and guarantee the power consumption for the duration of the eight-year contract.

Total Compressed Air System Makeover

KTP’s original compressed air system included nine aging centrifugal air compressors paired with nine refrigerated dryers to supply air to all areas of the plant. It also included the use of heatless desiccant dryers dedicated to the old paint shop for delivering compressed air at minus 40°F (-40°C) pressure dew point. The dryers used for the paint shop included one

dryer rated at 5,000 cfm for the prime painting booth and two dryers, rated at 6,500 cfm each, for two enamel painting booths. Additionally, one dryer rated at 1,000 cfm was dedicated to the paint mix area.

The KTP-UCA team decided to replace the aging centrifugal air compressors with new centrifugal machines, refurbish an existing centrifugal air compressor, and remove the refrigerated dryers, as well as the point-of-use desiccant dryers dedicated to the old paint shop. It also decided to install new Heat of Compression (HOC) desiccant dryers to supply air at minus 40°F to the entire plant with minimal energy consumption. Additionally, the team addressed the cooling system and controls for the compressed air system.

The new compressed air system, which was implemented in a series of carefully planned stages to allow for uninterrupted production, includes:

- Six, multi-stage centrifugal air compressors, each of which is 1,750 horsepower (hp) and rated to deliver up to 7,500 scfm at 115 psig. Combined, all six machines deliver up to 45,000 scfm of air.
- One refurbished, multi-stage, 1,250 hp centrifugal air compressor rated to deliver 5,000 scfm at 125 psig. The refurbished unit serves as a trim air compressor.
- Six HOC dryers, with three rated at 7,500 scfm and three rated at 10,000 scfm.
- A master controller to ensure optimum efficiency of the compressed air system.

- Four new, rooftop evaporative cooling towers and upgraded pumping and filtration equipment to supply 4,000 gallons per minute (GPM) of clean water to the compressed air system.

The system is configured so three of the air compressors and dryers supply air to the paint shop at 110 psi and three air compressors and dryers supply the manufacturing facility at 98 psi. The project also included the installation of a 10-inch stainless steel pipe to supply the air at 110 psi to the new paint shop, which is in addition to existing piping used to supply air to the old paint shop and the old and new body shop and remaining plant production areas.

The upgraded system’s master controller maintains constant pressure control at plus or minus two psi and works with a new spillover valve to allow air from the high-pressure side of the system to be routed to the low-pressure side of the system whenever the new paint shop’s demand for air declines. Doing so eliminates the need for the centrifugal units to blow-off air and ensures the optimal number of air compressors operate when needed to meet the demand for air.

With 100% uptime of the utmost importance, the system was designed with N+1 redundancy. As such, one air compressor and dryer on each system serves as a backup machine. Additionally, the piping is designed so the

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FORD MOTOR COMPANY’S KENTUCKY TRUCK PLANT HELPS PAINT A BRIGHT ENERGY FUTURE

high-pressure system can supply air to the low-pressure system should one of the air compressors or dryers on the low pressure system fail and vice versa.

Project Supports Mindful Sustainability Approach

With the new compressed air system in place – and guarantees in savings from UCA under the service agreement – KTP’s upgraded compressed air system has allowed the plant to reduce the amount of electrical power required for compressed air by approximately 9.2 GWh per year.

White said the compressed air project represents a significant achievement, especially given the need to upgrade the system while ensuring plant uptime.

“This really required a partnership between the KTP plant and UCA and a commitment to a win-win scenario,” White said. “We’ve since standardized on the approach and the technology. Now, if you walk into one Ford plant or the next, you’ll see pretty much the same thing.”

While proud of the project, White said he’s equally proud of Ford’s relationship with the DOE’s Better Buildings Better Plants program (<https://betterbuildingssolutioncenter.energy.gov/better-plants>).

“We entered Better Buildings Better Plants Challenge Partner program knowing it would help us achieve our goals,” White said. “Those types of challenges and programs are important because it’s recognition and a third-party coming in and saying, ‘Yeah, Ford has a good program.’”

Ultimately, it comes down to Ford’s goal of protecting the planet by investing in world-class

facilities and successful projects like the KTP compressed air system upgrade, White said.

“Ford is very mindful of its impact on our climate and specifically the local environment at our various locations and have established sustainability goals that must be achieved. Given this background, energy efficiency improvements such as were achieved with this project contribute in a big way to those objective,” he said. “We’re very happy with the success of this particular project, and in fact, have replicated the concept at several other Ford locations.” **BP**

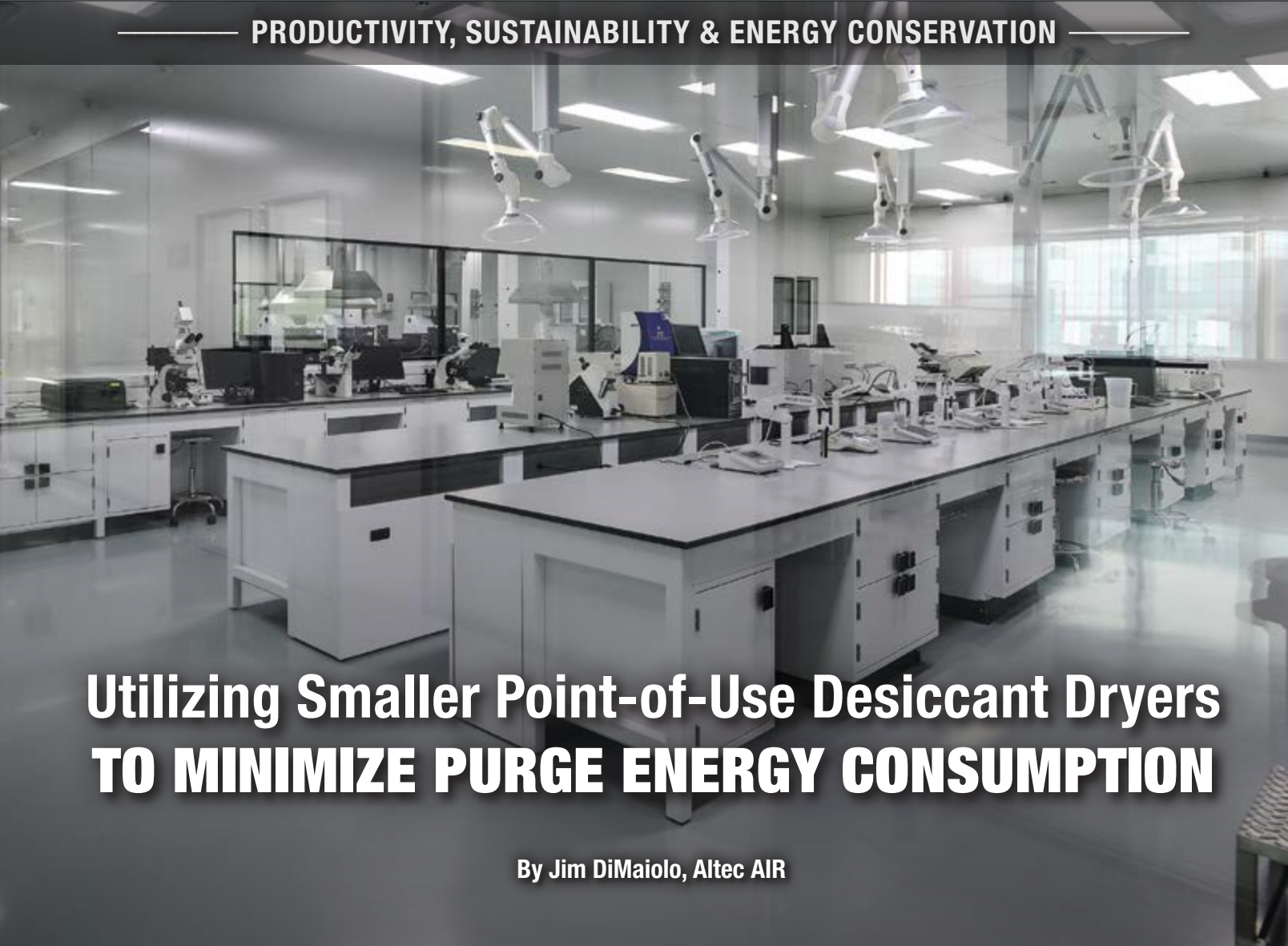
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Utilizing Smaller Point-of-Use Desiccant Dryers TO MINIMIZE PURGE ENERGY CONSUMPTION

By Jim DiMaiolo, Altec AIR

► For many installations of industrial air dryers, a dilemma can occur when trying to achieve the correct balance between desired specifications and efficiency in the applications. Sometimes there is no way around a requirement to achieve ultra-dry dew points, but are we always considering the point-of-use needs when implementing

a dry air solution? Often the dry air system is configured with one end goal in mind which is dry air but doing so without accounting for the point-of-use factors that can lead to added expenses and wasted energy.

Two of the most common applications or requirements for ultra-dry dew points are

environmental conditions (compressed air lines operating at or below freezing temperatures) or moisture-sensitive applications (electrical testing, laboratory processes, etc.). In these scenarios utilizing desiccant air dryers are necessary to provide these extreme requirements consistently, but are they always sized, specified, and installed efficiently? To get



“To provide the best solution for any facility, we need to understand the specific dew point requirements for the facility’s environment, as well as each application.”

— Jim DiMaiolo, Altec AIR

to our destination we must first know where to start and that all begins with understanding the facility and application requirements.

We know from experience that the more effort we put into the front end of a process the better the result will be. Therefore, we must ask the right questions to provide an efficient and viable solution. Here we discuss how point-of-use dryers can often save energy in applications that involve ultra-dry dew points.

Understanding the Requirement for Ultra Dry Dew Points

Before we can begin, we need to understand what is dew point? The dewpoint temperature is a measurement of the amount of moisture or water vapor in the air. The specific temperature is the temperature at which water will condense from the compressed air to a liquid. Any moisture in a compressed air system can be detrimental to the performance and life of the equipment utilizing the air.

To eliminate or minimize the amount of moisture in the system, compressed air dryers help to reduce the dew point of the air lines. The international standard ISO 8573-1 can guide these requirements. This standard identifies three primary contaminant types that are present in a compressed air system: particulates, water, and oil. Each is categorized and assigned a quality class where the end user can identify their requirements for their application or process.

There are several types of air dryers that produce different dew points to help meet the quality class of the water contaminant component outlined in ISO 8573-1. Refrigerated air dryers are the most common and can produce dew points of 38°F (3°C) Class



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UTILIZING SMALLER POINT-OF-USE DESICCANT DRYERS TO MINIMIZE PURGE ENERGY CONSUMPTION

4 moisture content. The next most common are desiccant air dryers, which can achieve very low dew points from -40°F (-40°C) to -100°F (-73°C) Class 2 and 1 moisture content, respectively. These are the air dryers needed for operating at or below freezing ambient temperatures, as well as when using compressed air for moisture sensitive testing and processes.

To begin to determine the requirement for moisture content, the main two questions that need to be asked are, “What is the dewpoint required for each application in my system and what is the lowest operating temperature inside my compressed air system?”

Based on these questions, we can determine what type of dryer(s) need to be installed and if there is a solution to minimize the amount of airflow for Class 1 or 2 moisture content.

Heatless Regenerative Desiccant Air Dryer

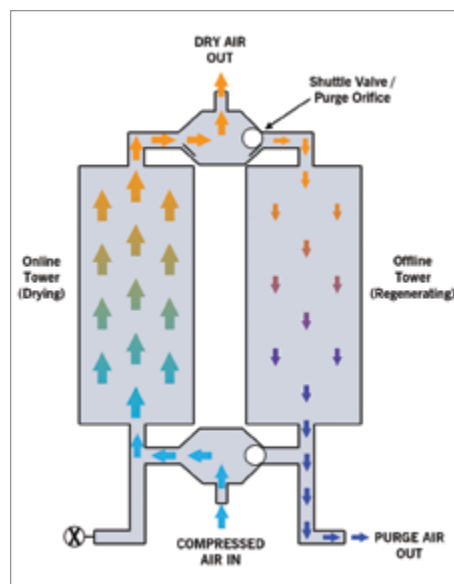
There are several types of regenerative desiccant air dryers: heatless, heated (internally or externally), blower purge, and heat of compression. We are going to focus on the most popular and common type: Heatless regenerative desiccant air dryers. These air dryers use a process called Pressure Swing Adsorption to consistently provide clean dry air. These are one of the simplest forms of regenerative desiccant air dryers and are an economical option but do have a hidden cost.

Heatless desiccant air dryers come in a variety of sizes. From the larger units that can handle flow rates greater than 3,000 scfm and all the way down to the ultra-compact flow rates of 0.4 scfm. No matter the size, they all operate on the same principles.

These air dryers typically consist of a twin-

tower construction. The towers are filled with desiccant which comes in a variety of sizes, shapes, and compositions. Desiccants are adsorbent materials that remove moisture from the compressed air stream down to extremely low-pressure dew points.

While one tower actively dries the compressed air stream, the other off-line tower is being regenerated. The regeneration process is initiated through a timed purge cycle that depressurizes the off-line tower and then



Basic operation of a typical heatless desiccant dryer.

bleeds a small portion of the ultra-dry outlet air from the on-line tower to the off-line tower through a flow control device.

This air flow is the regeneration process is called the “purge air” and is typically 15 to 25 percent of the inlet air flow into the heatless air dryer.

The purge air used to regenerate the off-line desiccant tower is energy consumed to achieve the ultra-dry dew points. This energy loss can add up over time. There are however a few ways

to help minimize the energy impact. Purge air economizers or dew point controllers are some of the more popular options and accessories that are available on these systems. These accessories monitor the outlet dew point and turn on or off the purge flow to be able to reduce the energy lost.

The larger systems are installed to match the inlet flow rate and conditions of the plant compressed air system. When selecting a desiccant air dryer it is imperative to understand the impact on both the air compressor and the plant air systems. Manufacturers create heatless desiccant dryer flow capacities to achieve -40°F (-40°C) pressure dew points based on Compressed Air and Gas Institute (CAGI) Standard ADF200 where dryer operating conditions are 100 psig, 100°F inlet air temperature, and 100% inlet air relative humidity.

Point-Of-Use Dryers

What is a point-of-use desiccant air dryer? These are smaller, more compact air dryers that are installed at an application that might require a lower dew point than the rest of the compressed air system.

These compact regenerative point-of-use desiccant air dryers have similar features to the larger (more traditional) models but are sized for smaller flow rates, which will use less purge to regenerate and will help reduce energy loss when looking at the entire compressed air system. Some other features include spring-loaded desiccant chambers which help immobilize the desiccant bed to extend the life of the desiccant and allow for multiple mounting configurations. Another difference is the purge functionality. The timing cycle on these smaller dryers ranges from one to three minutes whereas the larger dryers have a

10-minute cycle. Another distinguishing feature is the fixed-purge orifice integrated into the outlet shuttle valve assembly. The fixed orifice allows for out-of-the-box performance with minimal setup time at the installation.

A point-of-use dryer will be installed at the site of the application and will be sized for the outlet flow rate (or the demand of the application). Three key pieces of information required for sizing a point-of-use dryer are: required dew point, inlet pressure, and either inlet or outlet flow rate. With these smaller dryers, there is also the option to customize and dial-in the purge rate to minimize the wasted energy.

What follows are two different cases where a facility had the choice to install a larger

desiccant air dryer, or a smaller point-of-use air dryer to meet their ultra-dry dew point requirements.

Cyclic Corrosion Test Chamber Application

A manufacturer in St. Joseph, Missouri, is adding a cyclic corrosion test chamber to their design assurance facility, which has an existing compressed air system. The air compressor is a 30 horsepower (hp) rotary screw machine with a refrigerated air dryer producing 38°F (3.333°C) pressure dew point at 125 psig. In accordance with the manual, the chamber requires 10 scfm of clean dry air at -40°F (-40°C) dew point and 100 to 110 psig.

The new chamber will run sporadically as required testing at the facility. Tests could

run 24 hours/day, seven days a week for an extended period of time depending on the test procedure. There could also be periods of time when no test will be running. The facility had plenty of capacity to add 10 scfm to their demand for the new equipment.

The plant had a couple of options. One was to replace the refrigerated air dryer with a large desiccant air dryer to match the flow of the air compressor (160 scfm). Another option was to add a point-of-use heatless air dryer and install it at the application.

Option 1 – refrigerated dryer: Inlet flow rate of 160 scfm, purge rate at 120 psi = 25.4 scfm when regenerating.

Option 2 – point of use dryer with custom-



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sized purge orifice: Outlet flow rate 10 scfm, purge at 120 psi = 3.5 scfm when regenerating.

By utilizing a smaller point-of-use desiccant air dryer in Option 2 we can reduce the purge rate by 86% during regeneration, which can add up to a real energy savings as well as reduced capital expenses on the initial installation.

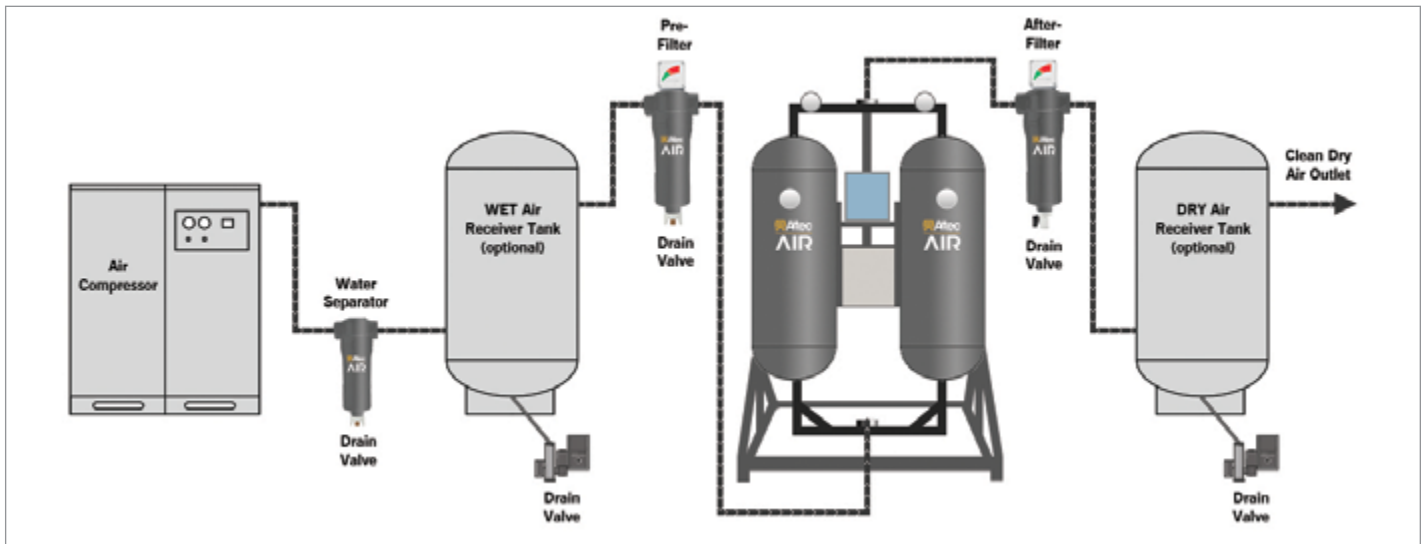
Variable Production Loads Application

A biotechnology manufacturing company located in Raleigh, North Carolina, developed a new product and process that requires large amounts of clean dry air in batches.

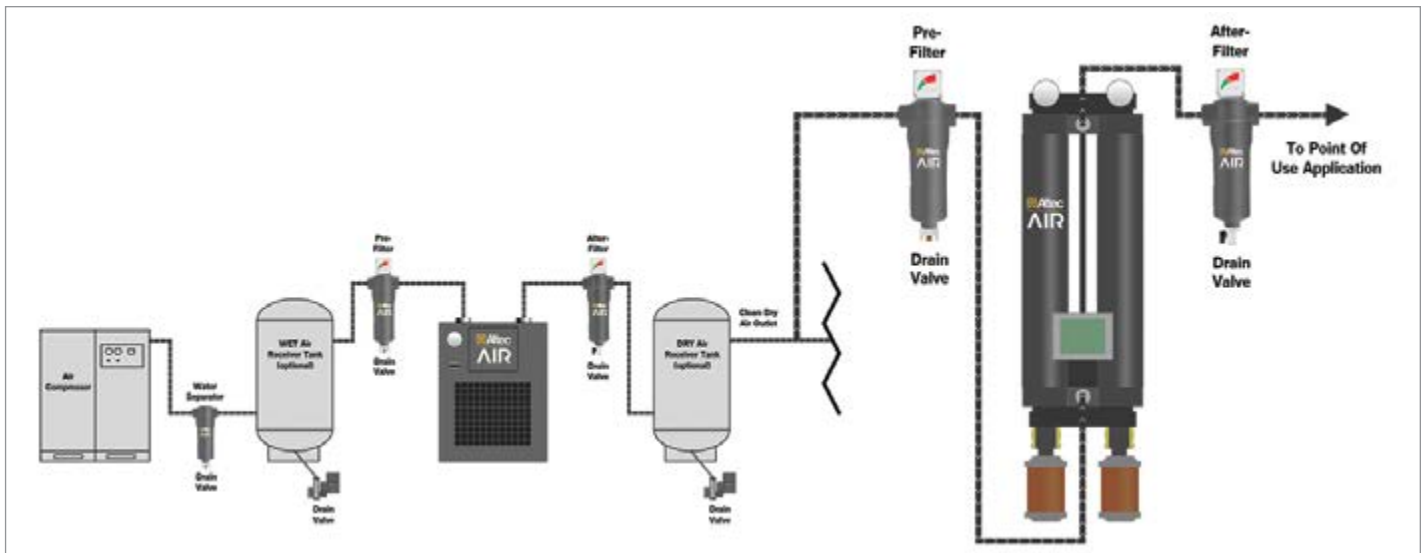
The process requires 18 scfm at -40°F (-40°C) pressure dew point per batch. They manufacture this product in many different

locations around the world and have different schedules and production levels of this product up to 20 batches at a single time.

Each facility already has a compressed air system with a refrigerated air dryer and enough capacity to cover the demand of the new process. They considered options to size a desiccant air dryer to match the largest capacity of each facility or to purchase smaller



Shown is a typical installation of a large heatless desiccant air dryer, including a 0.1 micron coalescing pre-filter and one micron particulate after-filter.



Shown is a typical installation of point-of-use heatless desiccant dryers with a 0.1 micron coalescing pre-filter and one micron particulate after-filter.

desiccant air dryers sized per batch of product. These batches run 24 hours for five days at a time and start at different times.

In their Brazil facility, they had a maximum capacity for 20 batches running at a single time but averaged eight batches running at a single time during more than eight months of the year. If all 20 batches were running simultaneously, the facility would require a maximum outlet flow of 360 scfm.

Option 1 – large desiccant dryer at 100 psi: inlet flow rate of 436 scfm, purge rate at 100 psi = 76 scfm when regenerating.

Option 2 – point-of-use dryer with a standard purge orifice for each batch at 100 psi: inlet flow rate of 23.4 scfm, purge rate at 100 psi = 5.4 scfm when regenerating.

The plant could decrease the purge from 76 scfm to 43.2 scfm for a 43% reduction in purge consumption by using point-of-use dryer with Option 2 when the need is to only process eight batches. The larger desiccant dryer in Option 1 would, however, be more energy efficient when running at full capacity.

Selecting the Right Dryer Equals Energy Savings

There is no one-size-fits-all solution with compressed air treatment applications. To provide the best solution for any facility, we need to understand the specific dew point requirements for the facility's environment, as well as each application. This can help us be more efficient and minimize the energy impact of ultra-dry dew point requirements to by selecting the right air dryer for the right application. **BP**

About the Author

Jim DiMaiolo is the Market Manager at Altec AIR. He has held various engineering and market development roles with Altec for nine years. Jim has a Bachelor of Science Degree in Mechanical Engineering from Duke University and is a licensed professional engineer in the State of Colorado. Contact Jim at tel: 908-902-1576, email: jim.dimaiolo@AltecAIR.com.

About Altec AIR

Since 1954, Altec AIR has been designing and manufacturing air-drying solutions in the United States for a variety of markets and applications. Whether your requirements are for desiccant or refrigerated air

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QUALITY, SAFETY & RELIABILITY

COMPRESSED AIR SYSTEM DRAWINGS A Picture Can Save Tens of Thousands of Dollars

By Paul Edwards, Compressed Air Consultants, Inc.

► There are some fundamentals when it comes to compressed air system improvements. One strategy that is overlooked is just drawing the details of whatever aspect of a system you are looking at. It is fairly common to see a misdiagnosis of some particular technical issue that would have been obvious should someone have created the drawing to describe the problem.

Sometimes data is required to be overlaid on the drawing but the combination often can combine to make something obvious. This happens whether the problem is in supply, distribution, or demand. Too often, the plant engineer, service technician, sales engineer, or auditor are in such a hurry they miss fundamental information that would have allowed the solution to be properly assessed.

Demand Side Example

One plant in Europe had two dilute phase conveying pumps which required seal air to protect both the pump's motor and outboard bearings. In this particular pump design, they are able to use an air source from the pump conveying system or compressed air. In both systems, piping was set up so the blower air would always serve the discharge bearings and



“Understanding the real root cause would have allowed the plant to fix the problem for \$1,000 to \$2,000 and decreased the operating cost by more than \$10,000 per year.”

— Paul Edwards, Compressed Air Consultants, Inc.

For those interested in communicating technical information graphically, Edward R. Tufte's book, "The Visual Display of Quantitative Information" is a classic. One particularly useful concept is "data ink" versus "non-data ink." The idea behind that is the first should be maximized while the second should be minimized as a matter of principle.

the plant had an option to use compressed air or the blower air on the motor bearings. This set up is shown in Figure 1.

When the drawing (Figure 2) was created for the pumps, it was obvious the plant was wasting money while there was significant risk for a catastrophic failure.

- The "off" pump was consuming compressed air through a valve that was left partially open. Not only was compressed air feeding the idle motor seals, the bypass line was open allowing it to feed both the discharge seals as well as the low-pressure blower system. Energy consumption was 5,000 euros per year.
- The "on" pump had all of its air off, putting the machine at risk for the dust to work its way into the pump's

outboard bearings or motor bearings. This could turn into a 5,000 euros-plus repair.

The drawing also allowed that the solution would communicate the required changes, which included automating the feed air, regulating the compressed air while adding a check valve to ensure compressed air could feed the outboard bearings but not the blower system.

Distribution Example

This particular plant was suffering from low pressure and was convinced the problem was the piping system. The auditor agreed to do a pressure drop map to help pinpoint the problem as he was suspicious the issue was something else. The best guess was the plant was consuming 800 scfm to 1,400 scfm and the piping system consisted of a three-inch loop system.

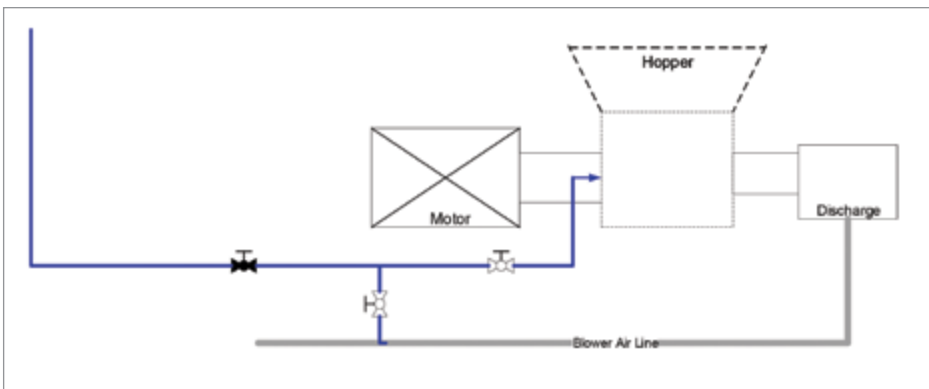


Figure 1.

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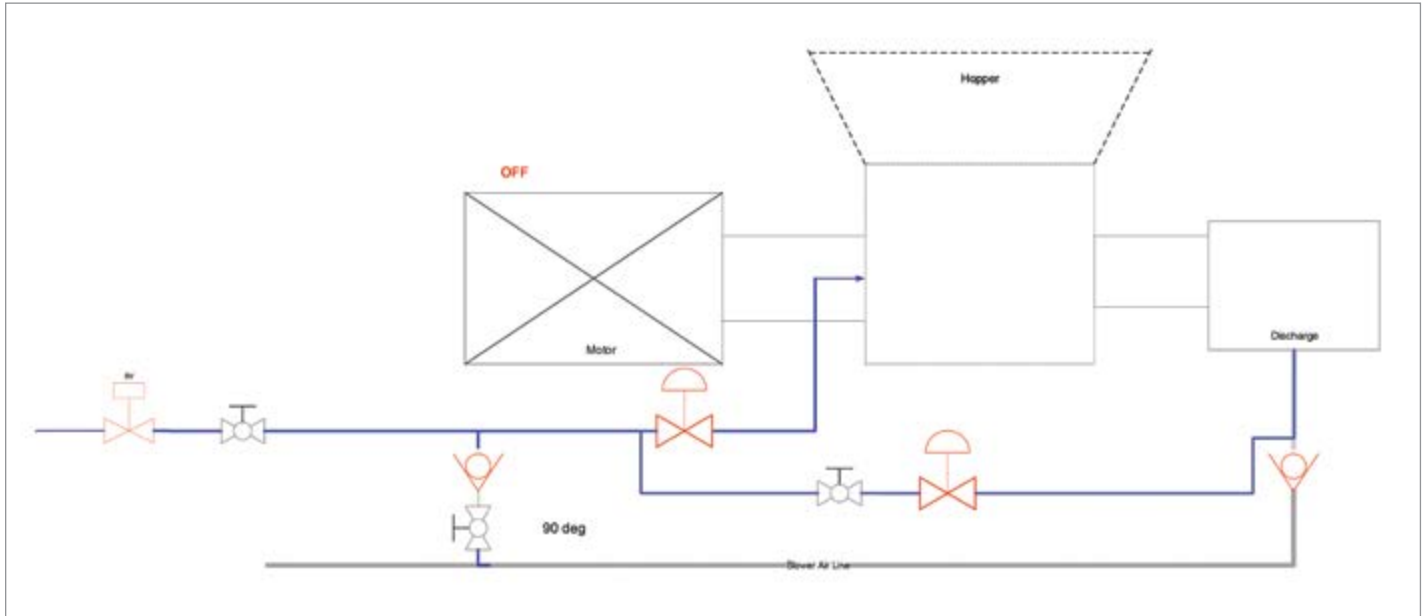


Figure 2.

The pressure map (Figure 3) showed there were pressure issues in the air compressor room (not shown) but the bigger problem was in the distribution system as the plant suspected. However, the problem wasn't in the main loop but in the individual branch lines. This drawing made it clear to the plant where the issues lay and that no modifications would be required to the main piping system.

Supply Side Example

In the next example (Figure 4), there were numerous problems for this particular facility including wet air throughout the plant. The plant had called the local air compressor company to evaluate low air pressure and wet air throughout the facility. The plant originally had two systems serving different processes within the facility. The first was the area serving the trucks loading cement. The second was a bagging operation that included dense phase conveying.

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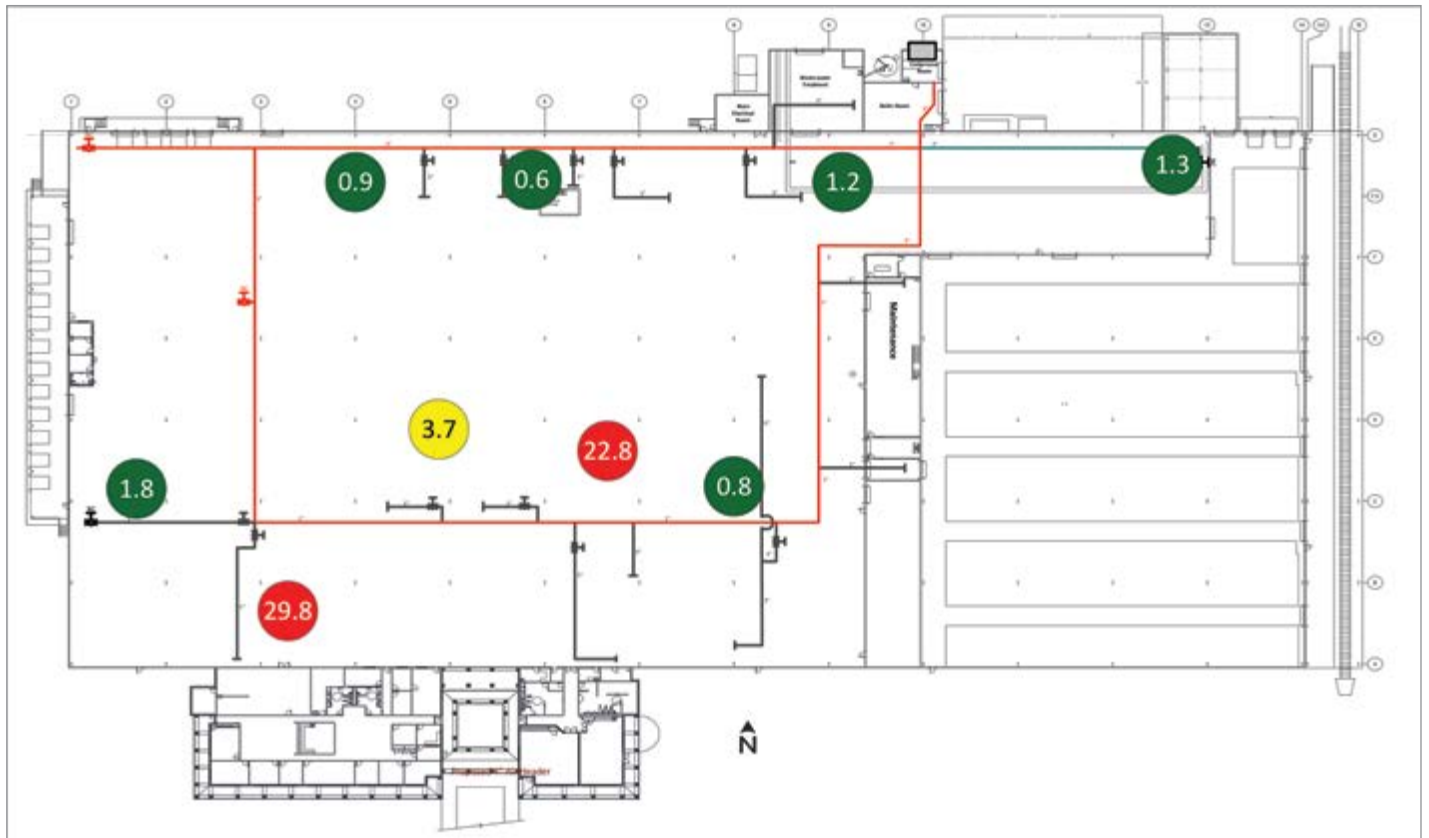


Figure 3: In this diagram, the existing three-inch header is in red and the existing two-inch header is in green. The black line represents the existing three quarter to one-inch existing air header. Pressure drop in each location is shown by the number within each circle.

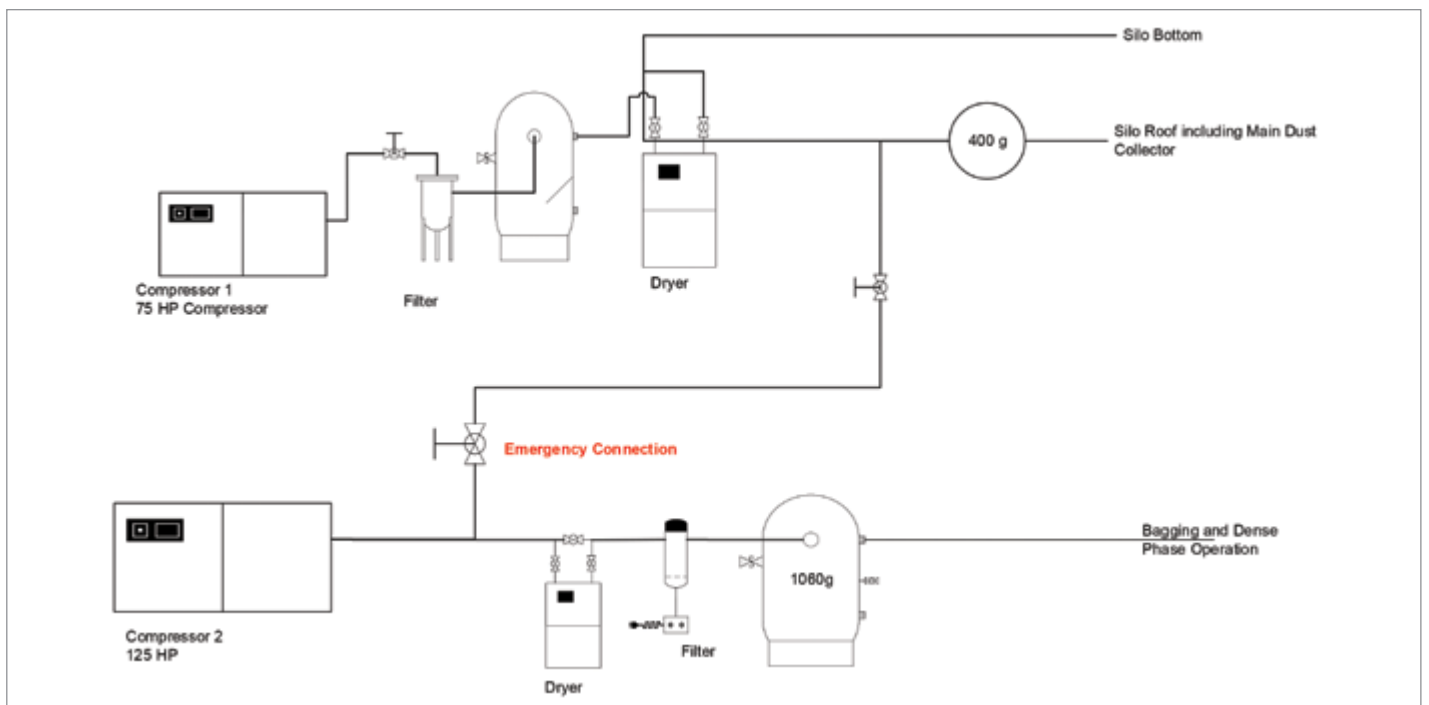


Figure 4.

At some point in the past, the truck-loading air compressor failed and an emergency connection was made between the two systems. The individual responsible for making the connection was unaware of the importance of tying into a spot where the air had been dried, and as a consequence, made the connection upstream of the dryer. When analyzing the wet air in the system, the air compressor company assumed the problem lay with the dryer technology, and as a consequence, their solution was to add a desiccant dryer when a refrigerated air dryer would have been perfectly sufficient.

This root cause was missed and, as a consequence, other parts of the system were not sufficiently examined. This led to a

recommendation for a \$50,000 project that would increase operating costs by \$20,000 to \$30,000 per year. Understanding the real root cause would have allowed the plant to fix the problem for \$1,000 to \$2,000 and decreased the operating cost by more than \$10,000 per year.

Drawings Save Money

Sometimes, troubleshooters neglect to create a drawing regarding a technical matter. Whether it is to save time or that the individual doesn't think the information is important to understand precisely, the consequences can cost tens of thousands of dollars in capital and

tens of thousands of dollars in operating costs annually if missed. Any technical problem that has a substantial economic consequence to a plant is one worth putting onto paper. **BP**

About the Author

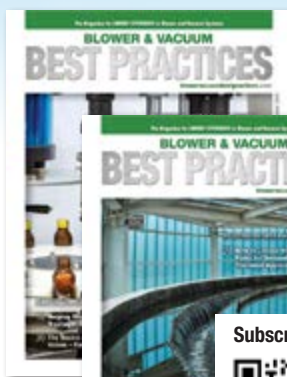
Paul Edwards, with 39 years of experience in the compressed air industry, is the principal at Compressed Air Consultants, email: paul.edwards@loweraircost.com, tel: 704-376-2600, or visit www.loweraircost.com.

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QUALITY, SAFETY & RELIABILITY

DEW POINT MEASUREMENT in Compressed Air Systems

By Martin Raab, E+E Elektronik Ges.m.b.H.

► Wherever compressed air is used, accurate and continuous monitoring of the dew point temperature is advisable. The dew point provides information about the absolute humidity content of the compressed air. A too high humidity content can have negative effects

on the quality of the final product, lead to problems during the manufacturing process, or even result in complete system shutdown. Therefore, operators of compressed air systems should address this issue before it causes serious and costly issues. The following explains

the basics of dew point measurement and what is important in practice.

Dew Point and Dalton's Law

The dew point, or dew point temperature (T_d), is the temperature to which the air must be



“Those who cut corners when it comes to compressed air drying risk poor product quality, malfunctions in the process, and even system downtime and loss of production.”

— Martin Raab, E+E Elektronik Ges.m.b.H.

cooled for the water contained in the air to start condensing. The dew point measurement relates to the absolute amount of water vapor contained in the air. In contrast, the measurement of relative humidity (RH) indicates how close the air is to the saturation point.

Dalton's Law states the total pressure of an (ideal) gas mixture is the sum of the partial pressures of the individual gases. The main constituents of air are nitrogen (N₂), oxygen (O₂), argon (Ar) and carbon dioxide (CO₂). Other components of air can be ignored as their share is negligible. Therefore, for fully dry air at sea level (1013.25 hPa) the following applies:

$$P_{\text{Total}} = p_{\text{N}_2} + p_{\text{O}_2} + p_{\text{Ar}} + p_{\text{CO}_2}$$

Another common component of air is water vapor (= water in its gaseous phase). For the total pressure of humid air, the following applies:

$$P_{\text{Total}} = p_{\text{N}_2} + p_{\text{O}_2} + p_{\text{Ar}} + p_{\text{CO}_2} + e'$$

$$\text{or } p_{\text{Total}} = p_a + e'$$

- e' = Water vapor partial pressure
- p_a = Partial pressure of dry air
- p = Total pressure of the air

The maximum possible water vapor partial pressure in the air is called saturation vapor pressure and is determined by the temperature. As of this point, the air cannot hold any more water vapor, resulting in condensation.



Reliable measurement and continuous monitoring of the dew point in compressed air systems using dew point transmitters, such as the E+E Elektronik EE371, can help ensure smooth production processes and product quality.

The Effect of Temperature on Dew Point

As the dew point temperature relates to the absolute amount of water vapor in the air, it is not affected by changes of the air temperature. When the air temperature approaches the dew point temperature, the relative humidity increases and, with it, the risk of condensation. These relationships, including the calculation of measurement uncertainties, can be calculated very easily with an online calculator, such as the E+E Elektronik's humidity calculator.

Here's a practical example of this relationship in a compressed air network:

The air at the compressor outlet is at 50°C (122°F) and is fully saturated. Thus, the air has a dew point temperature T_d = 50°C (122°F) and the relative humidity RH = 100%. The air is then dried to a dew point of T_d = 10°C (50°F) and thereby cooled to 30°C (86°F). The RH is now = 28.9%, and consequently there no risk of condensation.

CAGI: The Voice of the Compressed Air Industry

CAGI (The Compressed Air and Gas Institute) has been running performance verification on products for years, but did you know they now also have a testing program for the people who serve you?



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DEW POINT MEASUREMENT IN COMPRESSED AIR SYSTEMS

In a secondary pipeline, the same air is cooled to $T = 5^{\circ}\text{C}$ (41°F) by cold weather. By this, the air temperature T drops under the dew point temperature of $T_d = 10^{\circ}\text{C}$ (50°F), which causes condensation in the pipe.

In order to prevent condensation in the secondary pipe, the air must be dried in advance so its dew point temperature is lower than the minimum possible air temperature, so $T_d < 5^{\circ}\text{C}$ ($< 41^{\circ}\text{F}$).

The Effect of Pressure on Dew Point

If the dew point temperature of compressed air is measured, this is called the pressure dew point. A change in the pressure, e.g. through compression in a compressed air line, has a great effect on the dew point. If air is compressed, the dew point temperature rises. Here's an example:

In the case of air with a dew point temperature $T_d = 10^{\circ}\text{C}$ (50°F) and pressure $p = 1$ bar (1.5 psi), the water vapor partial pressure is 12.33 mbar (1233 Pa). If this air is now compressed sevenfold to 7 bar (101.5 psi), then the water vapor partial pressure (see Dalton's Law) also increases sevenfold to 86.31 mbar (8631 Pa). This water vapor partial pressure corresponds to $T_d = 42.9^{\circ}\text{C}$ (109.22°F). In this case, this means that at $T < 42.9^{\circ}\text{C}$ ($< 109.22^{\circ}\text{F}$), water from the air will condense. In practice, this effect can be observed with an air compressor. If the compressed air is fully saturated and the ambient temperature falls below the dew point, then condensed water will be present in the compressed air line.

Measurement Using a Dew Point Hygrometer

The dew point can be measured very accurately and directly with a dew point hygrometer (dew point mirror). This involves cooling down a temperature-controlled mirror until condensation arises on the surface. The condensation changes the reflectivity of the mirror's surface, which is detected by the integrated measurement optics. The corresponding mirror temperature is the dew point temperature of the air or gas. Modern dew point mirrors can measure in the range -100°C Td (-14°F Td) to 100°C Td (212°F Td) with an accuracy of $\pm 0.1^{\circ}\text{C}$ Td ($\pm 0.18^{\circ}\text{F}$ Td).

Dew point mirrors are high-precision, expensive measuring devices primarily employed as reference devices in calibration laboratories. Due to their design, dew point mirrors are unsuitable for installation in compressed air lines.

Measurement Using a Hygrometric Dew Point Transmitter

In practice, compact dew point transmitters with hygrometric measuring principle are used for dew point measurement in compressed air lines. Such a dew point meter features a capacitive humidity sensor and a temperature sensor. From the measured relative humidity and temperature the device calculates the

dew point temperature with an accuracy of $\pm 2^{\circ}\text{C}$ Td ($\pm 3.6^{\circ}\text{F}$ Td) across the measuring range relevant for compressed air applications, -60°C Td (-76°F Td) to 60°C Td (140°F Td).

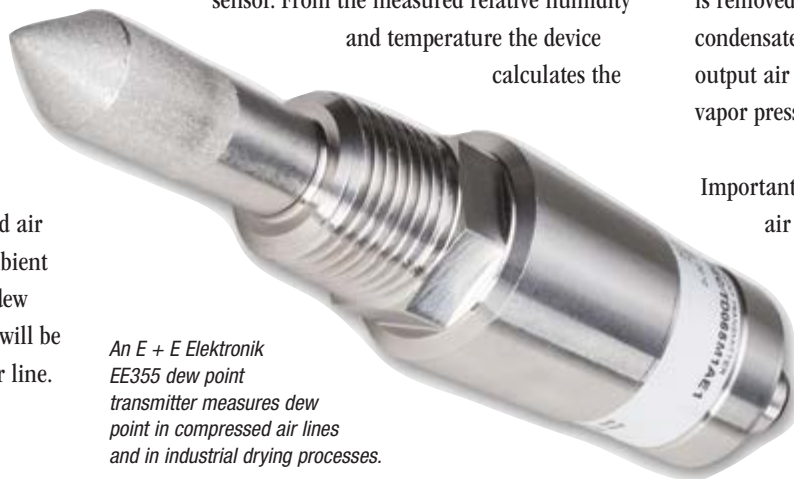
The prerequisite for this is a high quality capacitive sensor together with an auto-calibration procedure, such as the E+E Elektronik's HMC monolithic dew point sensor. The humidity and the temperature sensor of the dew point transmitter are built on the same substrate. The reproducible auto-calibration procedure is only made possible by the thermal coupling between the two sensors.

During the periodical auto-calibration the sensor is heated up, which reduces the relative humidity at the sensor to virtually 0% RH. This automatic zero point adjustment enables measuring accuracy of very low relative humidity and of the calculated low dew point temperature.

Why Does Compressed Air Need to be Dried?

As the temperature rises when air is compressed, the condensation does not arise directly in the air compressor, but in the pipeline after the air compressor, when the air temperature decreases. Although the water is removed from the compressed air by a condensate drain and filter, the air compressor output air is still very close to the saturation vapor pressure, its RH is near to 100%.

Importantly, the problems caused by humid air in compressed air lines have been ignored for many years. All the while the development of increasingly demanding manufacturing processes and products has significantly



An E + E Elektronik EE355 dew point transmitter measures dew point in compressed air lines and in industrial drying processes.

increased the need for clean, dry compressed air. Compressed air dryers and reliable measuring technology are indispensable for high quality compressed air supply.

Modern compressed air dryers are becoming standard, and are used for the following reasons:

- In production operations and in the process industry, where many processes depend on the smooth functioning of the systems, moisture in the compressed air causes problems and breakdowns in the operation of pneumatics, solenoid valves and nozzles. Air compressor motors are damaged by rust and the increased wear of moving parts, since the lubrication is washed off.
- Moisture has a negative effect on the color, adhesion and the finishing of paint applied with compressed air.
- In cold weather, freezing moisture can lead to malfunctions in pneumatic control lines.
- Corrosion caused by moisture on pneumatic components can result in malfunction, interruption or breakdown of process and machinery.
- In the food and pharmaceutical industry, moisture can have a strong negative impact on the required sterile manufacturing conditions.

Accurate Dew Point Monitoring Invaluable

Those who cut corners when it comes to compressed air drying risk poor product quality, malfunctions in the process, and even

system downtime and loss of production. Accurate dew point monitoring leads to a high, stable quality of the compressed air supply and to relevant savings. It is worth investing in tailor-made solutions for dew point measurement. **BP**

About the Author

Martin Raab is a Product Manager with E+E Elektronik Ges.m.b.H.

About E+E Elektronik

E+E Elektronik develops and manufactures sensors and transmitters for humidity, dew point, moisture in oil, CO₂, air velocity, mass flow, temperature and pressure. Hand-held meters, humidity calibration systems and calibration services complete the comprehensive product portfolio of the Austrian sensor specialist with headquarters in Engerwitzdorf, Austria. For more information, visit <https://www.epluse.com/en/>.

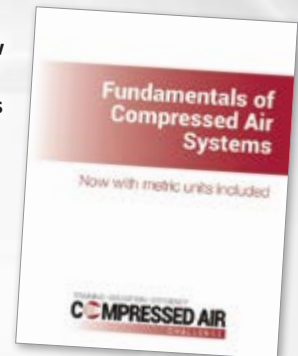
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Like the popular in-person class, the web-based workshop is designed to teach facility engineers, operators, and maintenance staff how they can achieve 15-25 percent cost savings through proper operation and controls, system maintenance, and appropriate uses of compressed air. Both the in-person and web-based classes utilize the same basic content and adhere to the CAC's principles of product-neutrality and a focus on the systems approach to managing compressed air.



For more information, please contact CAC Executive Director, Tracey Kohler at tkohler@compressedairchallenge.org.



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QUALITY, SAFETY & RELIABILITY

TROUBLESHOOT PARTICLE CONTAMINATION in Compressed Air with Laser Particle Counters

By Jenny Palkowitsh, Trace Analytics, LLC, and
Gary Ault, Quality Assurance Management, Inc.

ISO 8573-4 specifies non-viable particle contamination be monitored in compressed air.

► Compressed air contamination can come in various forms, including particles, water, oil, and microorganisms. Non-viable particle contamination is specified in ISO 8573-4:2019 as one of the major contaminants in compressed air to be monitored. Troubleshooting particle contamination

with Laser Particle Counters (LPCs) is the focus of this article.

A Valuable Troubleshooting Tool

Because compressed air systems are complicated and dynamic, the sources of particle contamination can be difficult

to pinpoint. LPCs, which are an efficient and effective way to troubleshoot particle contamination, can quickly process multiple samples and provide real-time data. Doing so can greatly improve troubleshooting efforts and help to highlight problem areas. The results are only a snapshot of the system



“Working with a third-party accredited laboratory allows manufacturers to rent the LPC, train their technicians effectively, and receive real-time results with a validated set-up.”

— Jenny Palkowitsh, Trace Analytics, LLC, and Gary Ault, Quality Assurance Management, Inc.

at that moment in time, but immediate results mean manufacturers do not have to wait for laboratory analysis which can take several days.

ISO 8573-4:2019 requires particles be sized into four ranges as listed in Table 1.

LPCs are a validated tool for sizing and counting particles instantly. Their ability to size and count particles into ranges can help determine if filters are functioning properly. Third-party companies can then extrapolate the LPC data and report it per the ISO 8573 standard.

These instruments must be calibrated on an

Table 1 - Compressed air purity classes for particles

| Class ^a | Maximum number of particles per cubic metre as a function of particle size, d^b | | |
|--------------------|---|--|--|
| | $0,1 \mu\text{m} < d \leq 0,5 \mu\text{m}$ | $0,5 \mu\text{m} < d \leq 1,0 \mu\text{m}$ | $1,0 \mu\text{m} < d \leq 5,0 \mu\text{m}$ |
| 0 | As specified by the equipment user or supplier and more stringent than class 1 | | |
| 1 | $\leq 20\,000$ | ≤ 400 | ≤ 10 |
| 2 | $\leq 400\,000$ | $\leq 6\,000$ | ≤ 100 |
| 3 | Not specified | $\leq 90\,000$ | $\leq 1\,000$ |
| 4 | Not specified | Not specified | $\leq 10\,000$ |
| 5 | Not specified | Not specified | $\leq 100\,000$ |
| Class | Mass concentration ^b C_p mg/m^3 | | |
| 6 ^c | $0 < C_p \leq 5$ | | |
| 7 ^c | $5 < C_p \leq 10$ | | |
| X | $C_p > 10$ | | |

^a To qualify for a class designation, each size range and particle number within a class shall be met.
^b At reference conditions; see Clause 4.
^c See A.3.2.2.

ISO 8573-4:2019 purity classes for particle contamination.



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TROUBLESHOOT PARTICLE CONTAMINATION IN COMPRESSED AIR WITH LASER PARTICLE COUNTERS

annual schedule in accordance with ISO 21501-4 (ISO 8573-4:2019). There are a variety of options available to meet both facility needs and specification requirements.

Isolate and Address Problem Areas

LPCs are especially helpful when a problem exists with particles because they help to isolate the problem area. Recent maintenance, leftover construction materials, particle-shedding tubing, and O-ring breakdown can all introduce particle contamination into a compressed air system. Damaged or inappropriate filters can allow particles to pass through systems. No consumer wants metal shavings in their coffee grounds or rust in their canned tomatoes. LPC tests can help ensure preventive measures are working properly



A handheld LPC is a validated method of particle analysis.

at critical control points.

The data provided by an LPC can provide useful information on where contamination is coming from. Collecting multiple sample locations across a system will allow manufacturers to see where the contamination originates. It can help users understand if something in the system is causing particle contamination or allowing it to pass through.

Technicians can compare a passing sampling point to the failing one. A sample can be taken at the source, immediately after the filter, to gain an understanding of the quality of the air at the beginning of the line. Another sample can then be taken at the end of the line to determine if there are any sources of contamination between the two points that might affect end products. Small adjustments can be made and new tests can be immediately taken to determine if that solution fixed the contamination issue.

LPCs take multiple samples quickly and provide instant results, therefore allowing manufacturers to move rapidly through multiple sampling points and compare the results. Trial and error testing allows users to see immediately if they have solved the problem.

Common LPC Applications

There are a variety of situations where LPCs can be effectively used to troubleshoot particle contamination in compressed air systems.

Manufacturers sometimes mistakenly choose a filter made for the wrong industry. For example, a company found they were consistently failing for particles and could not meet their required purity classes. Their LPC results showed an excess of particles in a certain size range. The filter they had

purchased was supposed to prevent particles in that size range from passing through. It was eventually discovered they had chosen an automotive industry filter with an inappropriate efficiency rating which was allowing these particulates to move through the filter. Once that filter was replaced with one appropriate for the food industry their results showed the new filter caught particles in the required size ranges.

Sometimes particle contamination comes from an inappropriate hose or old O-ring installed after the filter. In one such case another company used the LPC to identify a problem with their process. They had installed a hose after the filter. They tested the line both before and after the hose placement. The air was of an appropriate quality before the hose but showed particles afterward. They determined the rubber hose was shedding particles. Because it was placed after the filter, the hose was contaminating the air. By changing out the material they corrected the problem.

LPCs can also be useful for troubleshooting during compressed air system validations or qualifications. Some qualification protocols require sampling all points-of-use for three consecutive days. The ability to take samples and get instant results is invaluable during this time. Immediate feedback prevents the validation from stalling or having to be repeated. It is also helpful to test a point immediately after system filtration to determine if the quality of air being produced meets the requirements. This helps to gain an understanding of how the system itself might be affecting results downstream.

When an LPC reveals contamination in a system, cycle purging can be used to “wash the walls” of the distribution system. Cycle purging involves filling the system with filtered dry gas

to working pressure, isolating the source and releasing the pressure at the sample point you are trying to remove the particles. The process requires technicians to drop the pressure down to a level that will allow the backfill at the gas source to create a turbulent flow and “wash the walls” as the system is re-pressurized. Depending on the amount of contamination, this process may be repeated as many times as necessary to meet specification. Once these purges have been completed, the LPC can be used to test each branch to ensure that the contamination has been removed.

When testing with an LPC and troubleshooting particle contamination, it is important to remember actions must be taken to remedy the issue. The goal is not to just pass a test, but to

make sure the end-product is safe. LPCs can help isolate problem areas and allow for trial and error testing until the contamination is remedied.

The best way to ensure compressed air filters are appropriate and working properly is to perform routine compressed air testing.

Laser Particle Counter Considerations

Though there are other forms of particle analysis, LPCs do not require extensive labor and are not only designed to be used by highly trained technicians. Other forms of particle analysis, such as microscopy or gravimetry, require a user to sample the compressed air and ship the media to a third-party laboratory where trained technicians and specific

laboratory equipment perform the analyses. LPCs, on the other hand, provide a real-time, onsite solution.

LPCs are expensive instruments that require yearly calibration. These ISO 8573-4:2019 requirements allow for more precise and accurate particle results from optical particle sizing and counting instruments. Because of this, renting the equipment from an accredited third-party laboratory can ease the burden for manufacturers. Manufacturers can schedule testing, utilize the LPC for analysis, and receive their results for a fraction of the cost of purchasing a new LPC for themselves. Facilities that choose to purchase LPCs for their own use need to create protocols and procedures to validate the instrument and find ways to



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connect the instruments to their compressed air systems.

It's also important to note LPCs do not test for total oil or water, which are both major contaminants specified in ISO 8573. LPCs do not recognize water or oil and are not designed to report these contaminants. Water and total oil testing can be completed with a separate kit that is available for rent or purchase. Particle results from the LPC, and water and oil results from the rented or purchased kit, can be combined into one report if an ISO 8573 report is required.

Another challenge with LPCs is that they do not differentiate between liquids and solid particles. If there is excess liquid in the system this could register as a "particle" to the LPC and provide inaccurate data. Some companies, like Trace Analytics, require a pre-test before renting an LPC to ensure the air meets oil and water requirements and that other contaminants will not damage the instrument

or cause false readings. It's also important for companies renting LPCs to have their technicians who perform tests receive training before sampling because an LPC is an accredited method of analysis.

Types of Laser Particle Counters

The 2019 version of ISO 8573-4 specifies two types of LPCs: the Optical Particle Counter (OPC) and the Optical Aerosol Spectrometer (OAS).

A handheld LPC, is an OPC, and is a validated method of particle analysis. Some can size particles down to 0.3 microns and provides an analysis of the particle contamination in the system at a particular point in time. They do it by counting the pulses of scattered light from a particle that is illuminated with a light beam. The size of the particles can be determined by the magnitude of these pulses. Lightweight and user-friendly, the handheld LPC can accommodate multiple sampling points and assist manufacturers in particle troubleshooting

efforts.

Another type of validated LPC available for rent is a bench LPC, which is also considered an OPC. This instrument is larger and heavier than a handheld instrument, but can size particles down to 0.1 microns, which is sometimes required for sampling particle contamination in high-risk systems. Some devices use an enhanced signal-to-noise ratio to count these small particles. ISO 8573 purity classes 1 and 2 require particle sizing down to the 0.1 to 0.5 micron range.

Manufacturers can use a risk assessment to determine the levels of quality required for their particular use and end-product. A risk assessment looks at the type of piping, the filtration that is installed, dryer types, and the compressed air system as a whole. For high-risk uses, the bench LPC is available.

A Good Choice for Troubleshooting Particle Contamination

With the help of LPCs, manufacturers can more easily troubleshoot particle contamination in their compressed air systems. Depending on the facilities' unique needs, either a handheld or a bench LPC may be the appropriate choice.

Working with a third-party accredited laboratory allows manufacturers to rent the LPC, train their technicians effectively, and receive real-time results with a validated set-up. This cost-effective method provides them with immediate results ideal for taking multiple samples. **BP**

About the Authors

Jenny Palkowitsh is the Business Development Director at Trace Analytics. With a background in marketing and sales, Jenny works diligently with her teams to provide the educational materials and



A bench LPC is sometimes required for sampling particle contamination in high-risk systems.

exceptional service that Trace Analytics is known for. Contact Jenny at tel: 512-263-0000 Ext. 5, email: sales@airchecklab.com.

Gary Ault is a QAR Manager at Quality Assurance Management. Gary has 30-plus years in the analytical and testing industry for the semiconductor, food and life science industries. Contact Gary at tel: 972 331-5805, email: gault@qam.com.

About Trace Analytics

Trace Analytics, LLC, is an ISO 17025-accredited laboratory specializing in the analysis of compressed air. Testing at Trace includes the analysis of particles, water, oil, and microbial contamination according to ISO 8573 standards through the use of gravimetry, GCMS, microscopy,

and Laser Particle Counter (LPC) techniques. To learn more, visit www.AirCheckLab.com.

About Quality Assurance Management

Quality Assurance Management, Inc. headquartered in Carrollton, Texas, is a Trace Analytics, LLC, distributor and leader in providing quality assurance, analytical testing and inspection services for process piping systems in the semiconductor, life science, food and advanced manufacturing industries. With over 25 years of experience, QAM is committed to providing the highest level of quality and integrity while delivering true third-party inspection and testing services. For more information, visit www.QAM.com.

All photos courtesy of Trace Analytics, LLC.

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“We used to think of energy efficiency primarily as a means to save money, but that’s changed. We believe there are a lot of benefits beyond that and it’s become part of our identity.”

— Sharon Nolen, Manager of Global Natural Resource Management, Eastman

“As an example, we were using higher pressure air compressors for an application that didn’t need that amount of pressure so we installed a blower rated to deliver air at 15 psi, which saved \$30,000 a year.”

— Nick Waibel, Global Energy Lead, Tate & Lyle

“Demand Side” and “Supply Side” information on compressed air technologies and system assessments is delivered to readers to help them save energy. For this reason, we feature Best Practice articles on when/how to correctly apply **air compressor, air treatment, piping, storage, measurement and pneumatic control technology**.

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— Lora Gans, Environmental Health & Safety Manager,
Stanley Black & Decker

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COMPRESSED AIR SYSTEM TECHNOLOGY NEWS

Atlas Copco Launches Remodeled Oil-Injected G90-250 Range

Atlas Copco has launched the newly remodeled, oil-injected G90-250 range (125 to 335 horsepower). The new G range is the sister product of the advanced GA and GA+ ranges, completing the lineup in the company's mid-large oil-injected horsepower category.



Atlas Copco's newly remodeled, oil-injected G90-250 range.

The remodeled range features a new, more compact design and is built on the principles of simplicity, reliability and efficiency. It boasts a new element specifically designed for the range and offers increase in flow rates of up to 5% over the previous generation. The new design not only looks cool on the outside, but it also keeps cool on the inside – featuring a cool air zone that lowers the energy needed to efficiently compress air.

The updated G range is a strong, new contributor to Atlas Copco's strategy of offering choice in all product ranges and ensuring customers are precisely matched with the perfect product for their needs. The new G range provides customers the option of either a fixed-speed design or the advanced, variable

speed drive design. Air-cooled and water-cooled options are available, along with a range of auxiliary options designed to ensure the compressor performs well within each customer's environment and aligns with their air demands.

"This is a tremendous new product for customers, especially those who need to balance their capital expenditure while still focusing on efficiency," said Neal Mukherjee, vice president of Atlas Copco's OFA division in the U.S. "This is part of a complete range we offer, and we have developed an array of tools to help customers understand which product fits their needs, both short and long-term, perfectly."

Connectivity is ensured through the Elektronikon® controller, which was specially designed to maximize the performance of the customer's compressor under a variety of conditions. The clear, intuitive display allows for easy interpretation of all key data. Customers can also connect to and monitor the compressor 24x7 via its built-in SMARTLINK capability. The new G90-250 range is available on Atlas Copco's current zero-down financing programs.

About Atlas Copco Compressors

Atlas Copco Compressors LLC is part of the Compressor Technique Business Area, headquartered in Rock Hill, South Carolina. Atlas Copco Compressors provides innovative solutions including world-class compressors, vacuum pumps, air blowers, quality air products and gas generation systems, all backed with full service, remote monitoring and auditing services. With a nationwide service and distribution network, Atlas Copco Compressors is your local, national and global partner for all your compressed air needs. Learn more at www.atlascopco.com/air-usa.

SA Performance Introduces the 2.5 Gallon Performance Pail

The new 2.5-gallon Performance Pail exclusively from SA Performance, provides a safer, more efficient alternative to the traditional 5-gallon lubricant pail. Designed with service techs in mind, the Performance Pail creates less risk of injury, and meets OSHA recommendations for RWL (recommended weight limit). Safety features include case packaging with hand-holds, allowing Service Techs to carry a balanced weight load close to the body, per OSHA recommendation. At half the weight of a 5-gallon pail, the 2.5-gallon Performance Pail is easier to lift and pour into an air compressor sump.

In addition to safety, the Performance Pail boasts smart design features including an oil-level indicator and smooth-pour design, made possible by the built-in handle vent and large spout. As with all SA Performance lubricants, the Performance Pail is available for private labeling. To learn more about the



Performance Pails are packaged two per case. One case replaces the traditional 5-gallon pail. The 2.5-gallon size is a versatile solution for filling and maintaining today's sumps.

COMPRESSED AIR SYSTEM TECHNOLOGY NEWS

new 2.5-gallon Performance Pail, contact a SA Performance representative at 904-723-4946, email info@saperformance.net or visit www.saperformance.net.

About SA Performance

SA Performance offers a complete line of high-performance compressor lubricants, all manufactured in facilities with ISO9001 and ISO21469 certifications, with multiple distribution points across the United States, to best serve their customers. SA Performance also offers complete air end remanufacturing services including rotor balancing and machine work, performed in-house at their own specialized facility. Pairing compressor expertise with lubricant knowledge has helped SA Performance become a leading partner across the compressed air industry. For more information, visit www.saperformance.net.

New Kaeser Mobilair M118 Portable Compressor

Kaeser Compressors' new M118 comes standard with the power-saving Sigma Profile™ rotary screw airend and heavy-duty Tier 4 Final 4-cylinder Deutz diesel engine. The onboard Sigma Control Mobil™ controller enables variable pressure ranges between 87 and 145 psig to tackle the different pressures needed for powering breakers, cable blowing, and even

high pressure applications like drilling. The Selective Catalytic Reduction system along with the Diesel Particulate Filter protects air quality and meets even the most stringent emission requirements. Plus, the optional clean air treatment packages make the M118 an excellent choice for sandblasting and back-up plant air.

The fully weatherproofed polyethylene canopy protects internal components and wide-opening gull wing doors allow quick access to all components for easy servicing and also reduce noise levels. The steel chassis, torsion bar suspension, oversized tires, and instrument and light package ensure easy portability and excellent road handling, while the high capacity, cold start battery assures year round reliability in temperatures from 14 to 113°F.

About Kaeser Compressors, Inc.

Kaeser Compressors is a leader in reliable, energy efficient compressed air equipment and system design. We offer a complete line of superior quality industrial air compressors as well as dryers, filters, SmartPipe™, master controls, and other system accessories. Kaeser also offers blowers, vacuum pumps, and portable gasoline and diesel screw compressors. Our national service network provides installation, rentals, maintenance, repair,

and system audits. Kaeser is an ENERGY STAR Partner. For more information, visit www.us.kaeser.com.

Tsunami Releases New Dust Collector Regenerative Dryer

Tsunami Compressed Air Solutions has released the new Dust Collector Regenerative Dryer. The robust drying system provides an all-in-one solution for dust collector systems designed to eliminate supercooling and supply ultra clean air to pulse valves.

“We set out to design a complete system driven towards ease of use for the end user” said Product Manager, Troy Robins. “We’re excited that the industry has quickly recognized our new approach to dramatically reducing the operational costs associated with dust collectors. Our solution takes a unique angle unlike any other seen before, by designing a total best practice air system that dries, stores, and sends air downstream in the most effective way possible for dust collectors.”

Tsunami’s Dust Collector Regenerative Dryers are tested and proven to save plants up to 50% in air consumption and can increase bag (sock) life by up to 3X. By eliminating the moisture created during the supercooling process, bags remain moisture free, allowing for proper vacuum and preventing premature reduction in differential pressure drop.

About Supercooling: Supercooling explains the rapid expansion of air that loses heat due to the immediate separation of molecules. Simply put, for every 20°F that air cools, it loses approximately 50% of its ability to hold moisture in the form of vapor, or humidity. In collector applications, this cooling effect converts water vapor to liquid as air quickly expands out of each pulse valve. Damp air hits the bags or elements creating a wet cake substance that prematurely clogs the filter and



Kaeser M118 delivers 405 cfm at 100 psig.



The Dust Collector Regenerative Dryer from Tsunami Compressed Air Solutions.

inhibits air from passing through. Not only does this wet air reduce the life of each filter, it also wreaks havoc on collector systems in climates where freezing may occur.

About Suburban Manufacturing Group

Suburban Manufacturing Group is an engineer-driven organization that partners with customers to design and develop high-performance fluid power solutions. Today, they distribute thousands of products worldwide across several markets including Agriculture, Construction, Oil & Gas, Defense, Transportation and many more; right from the U.S. manufacturing headquarters located in Monticello, Minnesota. In addition to Tsunami Compressed Air Solutions, Suburban offers a complete line of industry-leading products sold under the Python Protective Sleeve + Covers, LubeMinder® Oil & Grease Systems brands. For more information, visit www.tsunami.us.com.

Hycomp Introduces the New DSi Easy-Install

The Odyssey DSi Easy-Install greatly reduces the potential for installation errors and incorrect component selection by providing the user with everything needed to ensure a turnkey booster installation. Included is the plumbing and wiring to connect the suction and discharge to an existing Hycomp booster. Inclusion of Hycomp recommended components, pre-assembled and tested at our manufacturing facility, ensures a bulletproof installation solution at a lower cost.

The innovative recycle line featured in the DSi Easy-Install is used to recirculate excess compressed gas back through the booster. This results in fewer load/unload cycles, which extends the life of the booster. Recirculation of excess gas also eliminates the need for large and expensive storage vessels, giving the user a better value on cost and on the space used in their facility.

The DSi Easy-Install provides protection of equipment with Hycomp specified filters. Inclusion of a pulsation rated inlet filter provides an extra barrier between supplied air or gas and the Hycomp booster. Limiting the amount of debris entering the booster reduces wear and tear on internal components and results in lowered maintenance costs. The included discharge filter provides added protection to the user's downstream equipment.

The addition of the DSi is just a small portion of the add-ons offered within the Odyssey product line. Other add-ons offered include moisture separators, panel upgrades, cold weather packages, voltage conversions, and more. This add-on may also be customized to fit non-Odyssey Hycomp products. Please contact Hycomp for more information about the Odyssey DSi Easy-Install.

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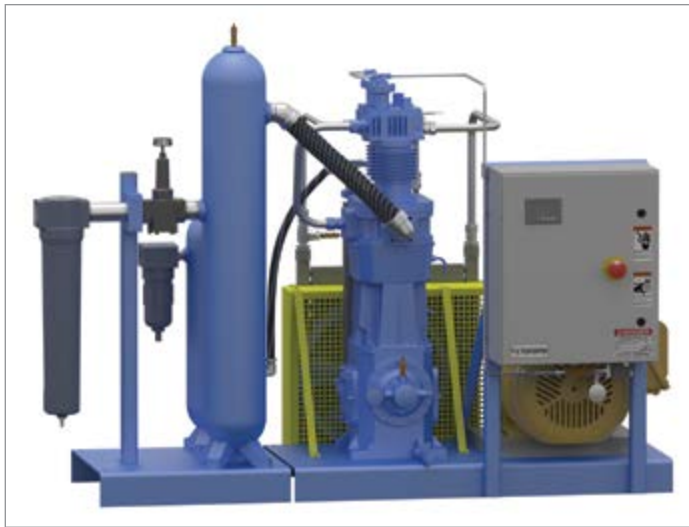
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Hycomp's DSI Easy-Install with Odyssey DS060.

Aggreko Launches Remote Dryer Dew Point Monitoring System

Aggreko, a world-leading provider of mobile, modular power, temperature control and energy services, announced the development of its new Dryer Dew Point Monitoring System for its Oil-Free Air Compressor product line. The system can remotely monitor a customer's dryer dew point and operating status, cutting out the cost and time involved with sending site personnel to inspect the dryer and its performance.

The dew point: the temperature where water vapor condenses into liquid water, can be an issue for companies using oil-free air to operate their equipment or process. If the drying system is not monitored correctly, it can lead to moisture entering the machinery or product, causing damage and disruption to operations. Aggreko's new development is a significant step forward for the industry, as it can offer real-time dryer performance, operation, and alarm notifications – without needing an engineer on the ground.

The 24/7 monitoring system enables customers to receive alerts and check that their dryer is running optimally and make any necessary adjustments that are required. On average the system can identify issues every five minutes, ensuring that any troubleshooting can be made as

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quickly as possible. Catching these issues early allows customers to save operating costs as well as preventing an impact on their bottom line.

Kenny Delahoussaye, Head of Technical Services and Engineering said, “The Dryer Dew Point Monitoring System is a unique offering from Aggreko and will significantly help customers monitor and operate their dryer’s dew-point levels, saving them time and money by making their operation more efficient.” Fernando Arce-Larreta, Head of Oil-Free Air said, “We’re already seeing the benefits of the system with it being in operation for several weeks and look forward to providing this service to more customers in the coming weeks and months.”

The remote monitoring element of this system builds on Aggreko’s existing remote operations, which are becoming increasingly important considering COVID-19, when limited feet on ground is essential for the safety of customers and colleagues.

About Aggreko

We provide power, heating, cooling, oil free air and energy services to make a difference for people, industries and communities, globally. We know that as the world demands cleaner energy, we can fulfill that with our expert people, our dedication and investment in new technology and keeping our customers at the forefront of everything we do. Together we make a difference. For more information, visit www.aggreko.com.



Aggreko Dryer Dew Point Monitoring System.

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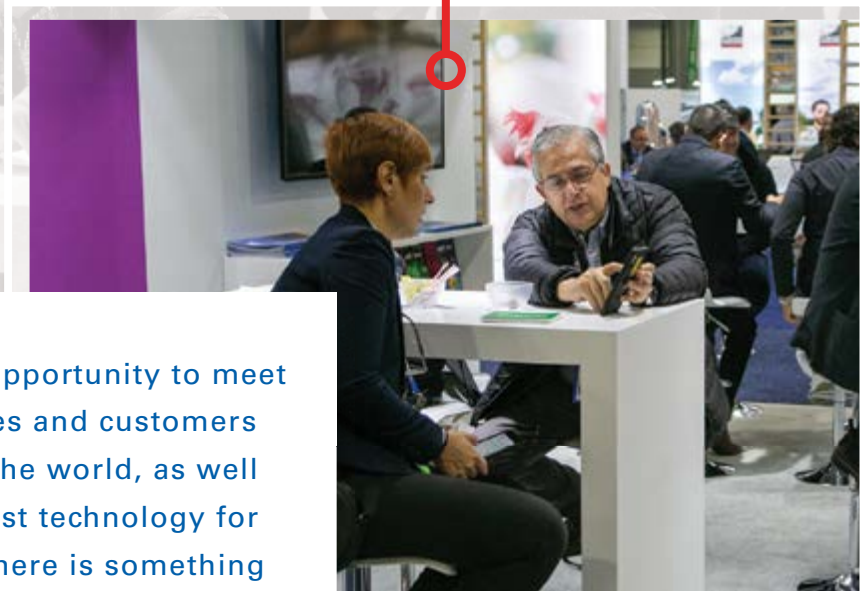
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