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SUSTAINABILITY & ENERGY/WATER EFFICIENCY FEATURES

SUSTAINABILITY & EFFICIENT TECHNOLOGY NEWS

EVERY ISSUE

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FROM THE EDITOR

Quality, Safety and Reliability

Winter is coming and the Compressed Air & Gas Institute's Reciprocating Air Compressor Section has sent us a useful article on how to prepare reciprocating air compressors for reliable winter performance.

Robert Marsiglia, from Asahi America, has sent an interesting article about the use of engineered polyethylene (PE) plastic piping material for compressed air. The differences, under pressure, between PE and unsuitable plastic materials such as polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) are clearly pointed out.

Sticking with the safety topic, during my travels I'm pleased to observe the growing demand for compressed air purity verification, via measurement and testing. We thank Jenny Palkowitsh, from the laboratory folks at Trace Analytics, for an article titled, "Pure Gas Testing-the Benefits of Point of Use Sampling."

Sustainability & Energy/Water Conservation

Production equipment will consume significant portions of a company's over-all energy and water-consumption footprint. Our own Mike Grennier was pleased to receive the opportunity to interview Tetra Pak's Vice President of Liquid Food, Frederik Wellendorph, and write about their new portfolio of solutions designed to allow Ultra-Heat Treatment (UHT) milk processors save energy and water – and reduce their overall carbon footprint by as much as 56%.

Jasween Jagjit-Webb, from Klüber Lubrication, has sent us an enlightening article about how the appropriate selection of high-quality air compressor lubricants can indeed contribute to sustainability efforts.

Thank you for investing your time and efforts into ***Compressed Air Best Practices.***

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CORPORATE GHG-REDUCTION NEWS*

Featuring: Signify, Merck and PepsiCo

* Scope 1 and 2 GHG Emissions from Direct Operations

Signify Achieves Carbon Neutrality and Sets Course to Double Its Positive Impact on the Environment and Society

Eindhoven, the Netherlands, September 8, 2020 – Signify (Euronext: LIGHT), the world leader in lighting, is proud to announce that it has achieved carbon neutrality for all its operations across the world as well as using 100% renewable electricity[1]. While the company progresses towards its remaining commitments for 2020, it will already embark on a new five-year journey in which it will focus on doubling its positive impact on the environment and society.

Signify achieves Carbon Neutrality in September 2020

Signify has reduced its operational emissions by more than 70% since 2010, having shifted to more energy-efficient technologies at its sites, to more sustainable modes of transport and optimized logistics planning, and to less travel in a more sustainable way. It also uses 100% renewable electricity, supported through two power purchase agreements, one in Texas and a second in Poland. The balance of emission reductions is achieved through a carbon offsetting program with projects aimed at benefiting the wellbeing of local communities.

"We would like to congratulate Signify on their fantastic achievement of carbon neutrality across all operations in 2020. We have been working in partnership with Signify for over 10 years to accelerate the global adoption of energy efficient LED lighting and through Signify's support of RE100 and EV100," said Helen Clarkson, CEO of The Climate Group. "The 2020s are the Climate Decade as we need to halve global emissions by 2030 to get us on track to meet the goals of the Paris agreement, so we need more companies to follow Signify's lead in setting their own net zero targets."

"I'm extremely proud of all the Signify employees and thank them for supporting our carbon neutrality objective. It is a truly significant achievement for us and we call on many others to join us," said Eric Rondolat, CEO of Signify. "However, the world is still facing demographic change, urbanization, climate change and resource scarcity. This is not a time to pause and celebrate, but a time to become even more ambitious and accelerate our efforts to address these challenges. Growth for sustainability and providing a great place to work are firmly anchored as central parts of our company strategy. This means that when it comes to sustainability, we will go beyond carbon neutrality and double our positive impact on the environment and on society in 2025."

Brighter Lives, Better World 2025: Our new sustainability program beyond carbon neutrality

Today, Signify starts implementing its new sustainability program and sets course to double its positive impact on the environment and society. The UN Sustainable Development Goals will be used as its strategic compass to work towards the following four goals:

Double the pace of the Paris Agreement – As part of our commitment to climate action (SDG13), we will go beyond carbon neutrality and reduce carbon emissions over our entire value chain. Already in 2025, we will achieve the 2031 target set out for companies in the Paris agreement to limit temperature rises to 1.5˚C over pre-industrial times. We will do so by increasing the energy efficiency of our portfolio, which will reduce emissions of our customers, and by driving carbon reductions at our suppliers.

We also call upon the world to accelerate the adoption of affordable and clean energy (SDG7). Our highly energy-efficient LED lighting saves an average of 50% of the electricity consumed by conventional lighting. An additional saving of around 30% is achieved by using connectivity and lighting control systems. Moreover, we believe that the expansion of solar-powered lighting systems will provide another very effective opportunity to reduce carbon emissions.

Double our circular revenues to 32% – Making our economy more circular has become more important than ever. Today we use 1.6 times the resources our planet can sustain and resource scarcity and waste have reached worrying proportions. We are committed to responsible consumption and production (SDG12) with products that can be reprinted, refurbished, reused or recycled. This will help us to achieve our goal of doubling our revenues from circular products, systems and services to 32% in 2025. This includes revenues from 3D printed luminaires, which we were the first lighting company to develop at scale, and from streetlights with reusable components and recyclable parts that we introduced earlier this year.

As part of our commitment to a circular economy, we have also committed to sustainable packaging, removing plastics from all our consumer packaging before the end of 2021, and to sending zero waste to landfill.

1. Cooper Lighting and Klite are not part of Signify's EHS reporting yet. These two companies are currently being integrated and will be included in Signify's annual reporting starting in 2021. The company aims to include them in its commitments in 2022.

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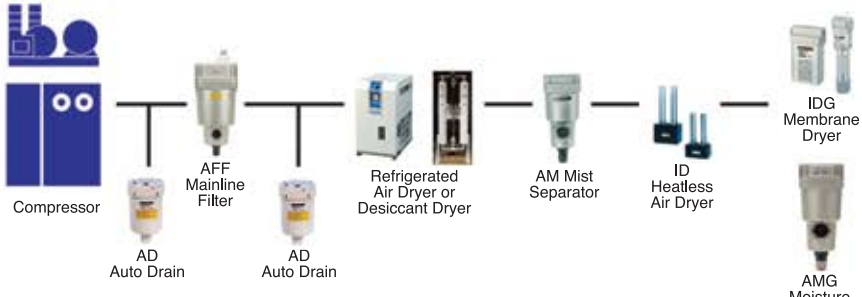

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Corporate GHG-Reduction News

Double our revenues for brighter lives, through innovations that benefit society, to 32% – We are committed to supporting good health and wellbeing (SDG3) and sustainable cities and communities (SDG11). We will double the percentage of our revenues for brighter lives, which benefit society, to 32%. This includes revenues from lighting innovations which increase food availability, safety & security or health & wellbeing.

About Signify

Signify (Euronext: LIGHT) is the world leader in lighting for professionals and consumers and lighting for the Internet of Things. Our Philips products, Interact connected lighting systems and data-enabled services, deliver business value and transform life in homes, buildings and public spaces. With 2019 sales of EUR 6.2 billion, we have approximately 36,000 employees and are present in over 70 countries. We unlock the extraordinary potential of light for brighter lives and a better world. We have been named Industry Leader in the Dow Jones Sustainability Index for three years in a row. More information can be found at https://www.signify.com/global/our-company/investors/news

Creating Sustainable Value: Merck Publishes Sustainability Report for 2020

Darmstadt, Germany, April 13, 2021 – Merck KGaA, Darmstadt, Germany, a leading science and technology company, today published its Sustainability Report for 2020. The interactive online report comprehensively and transparently illustrates how the company is living up to its corporate responsibility and the progress the company has made towards achieving its goals.

"The pandemic is showing us in no uncertain terms that technological progress and the positive force of science create sustainable added value for society. At Merck KGaA, Darmstadt, Germany, we are also contributing to the efforts to fight the virus," said Stefan Oschmann, Chairman of the Executive Board and CEO. "As a science and technology company, we take on responsibility to find answers to the most pressing challenges of our time. It is clear to us that sustainable entrepreneurship and profitable growth are not mutually exclusive, but rather mutually dependent."

Merck KGaA, Darmstadt, Germany, presented its new sustainability strategy in late 2020. The company has consequently embedded the topic as an essential element of its corporate strategy. With the new strategy, it is pursuing specific goals in the areas of science and technology, value chain as well as climate and the environment. In doing so, Merck KGaA, Darmstadt, Germany, also intends to make a clearly recognizable contribution to the Sustainable Development Goals of the United Nations.

In addition, the company has formulated interim targets to support the achievement of its environmental goals. By 2040, Merck KGaA, Darmstadt, Germany, aims to achieve climate neutrality. The company is thus planning to reduce direct greenhouse gas emissions and emissions from energy purchases (Scope 1 and 2) by 50% by 2030 compared with 2020. By then, company also intends to reduce indirect greenhouse gas emissions from the upstream and downstream value chain (Scope 3) by a total of 1,500 metric kilotons of CO_2 equivalents.

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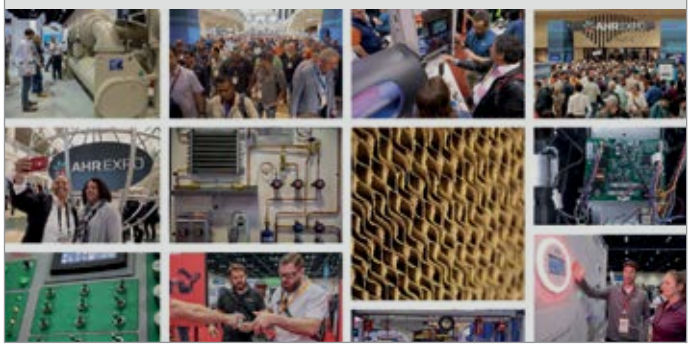

Corporate GHG-Reduction News

Moreover, Merck KGaA, Darmstadt, Germany, intends to improve its water efficiency and reduce its "Water Intensity Score" by 10% by 2025 compared with 2019.

Science & technology: Pioneer in the fight against schistosomiasis

The 2020 Sustainability Report shows how Merck KGaA, Darmstadt, Germany, is developing products and technologies aimed at improving people's lives. To improve the health of underserved populations in low- and middle-income countries, it is collaborating closely with numerous partner organizations. The company is developing integrated solutions, such as medicines, diagnostic procedures, technologies, and methods of infectious disease control, both against the tropical parasitic disease schistosomiasis and against malaria. In 2020, Merck KGaA, Darmstadt, Germany, donated approximately 226 million tablets to treat schistosomiasis in 30 countries. Moreover, its "Open Innovation" initiative enables the exchange of intellectual property. This means medicines can be discovered more quickly for diseases that require a high degree of medical intervention. In this context, the company is initially focusing on neglected tropical diseases.

To enable sustainable innovations, Merck KGaA, Darmstadt, Germany, has developed the Design for Sustainability (DfS) program, for example. This is a comprehensive method to improve the sustainability of Life Science products by analyzing various sustainability criteria.

Value chain: Securing social, ethical and ecological standards

In 2020, Merck KGaA, Darmstadt, Germany, worked with approximately 60,000 suppliers in nearly 160 countries. As part of the Together for Sustainability (TfS) initiative launched by the chemical industry, the company is calling on its suppliers to be evaluated using self-reported information or audits. Evaluation criteria include environmental aspects, labor and human rights, ethics, and sustainable procurement.

The online tool DOZN™ makes it possible for the company to evaluate sustainable alternatives to various chemicals. The tool is also available to customers and creates new possibilities for sustainable product design. Users can evaluate their own products and processes and make more environmentally sustainable decisions regarding their development processes.

Climate & environment: Environmental targets exceeded

Merck KGaA, Darmstadt, Germany, exceeded its environmental targets for 2020. Excluding the legacy Versum business, the company lowered its

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greenhouse gas emissions (Scope 1 and 2) by 25% relative to the 2006 baseline. A reduction of 20% was planned. Merck KGaA, Darmstadt, Germany, cut its water consumption at sites in water-stressed areas by 27% relative to the 2014 baseline; a reduction of 10% was planned. With respect to waste disposal, the company believes that it is well on track to lowering its key waste management indicator, the "Waste Score", by 5% by 2025. At the end of 2020, Merck KGaA, Darmstadt, Germany, had already achieved a reduction of 4.6%.

Community outreach: 274 projects in 96 countries

Merck KGaA, Darmstadt, Germany, clusters its community outreach activities under the heading "Our Good Deeds". In 2020, 274 projects were carried out in 96 countries around the world. As part of this, Merck KGaA, Darmstadt, Germany, supports people in need in the vicinity of its sites and provides disaster relief. Last year, community outreach activities by Merck KGaA, Darmstadt, Germany, encompassed projects worth approximately € 54 million in total. In the fight against Covid-19, the company donated 2 million protective face masks to healthcare providers. In more than 30 countries, Merck KGaA, Darmstadt, Germany, teams initiated numerous donation campaigns, which collected several million euros in cash and goods.

The Sustainability Report 2020 can be viewed at https://www.emdgroup.com/en/news/sustainability-report-2020-04-13.html

PepsiCo Announces Strategic End-To-End Transformation: pep+ (PepsiCo Positive)

PURCHASE, N.Y., Sept. 15, 2021: PepsiCo, Inc. (NASDAQ:PEP) today introduced pep+ (pep Positive), a strategic end-to-end transformation with sustainability at the center of how the company will create growth and value by operating within planetary boundaries and inspiring positive change for the planet and people. pep+ will guide how PepsiCo will transform its business operations: from sourcing ingredients and making and selling its products in a more sustainable way, to leveraging its more than one billion connections with consumers each day to take sustainability mainstream and engage people to make choices that are better for themselves and the planet.

"**pep+** is the future of our company – a fundamental transformation of what we do and how we do it to create growth and shared value with sustainability and human capital at the center. It reflects a new business reality, where consumers are becoming more interested in the future of the planet and society," said Ramon Laguarta, PepsiCo's Chairman and CEO. "pep+ will change our brands and how they win in the market. For example, imagine Lay's will start with a potato grown sustainably on a regenerative field, and then be cooked and delivered from a Net-Zero and Net Water Positive supply chain, sold in a bio-compostable bag, with the lowest sodium levels in the market. That's a positive choice. That's the best tasting, #1 potato chip of the future. That's how pep+ will be better for people, for the planet, and for our business. Now, imagine the scale and impact when applied to all 23 of our billion-dollar brands."

Ramon Laguarta, Chairman & CEO, PepsiCo

pep+ drives action and progress across three key pillars, bringing together a number of industry-leading 2030 goals under a comprehensive framework:

- **Positive Agriculture:** PepsiCo is working to spread regenerative practices to restore the Earth across land equal to the company's entire agricultural footprint (approximately 7 million acres), sustainably source key crops and ingredients, and improve the livelihoods of more than 250,000 people in its agricultural supply chain.

- **Positive Value Chain:** PepsiCo will help build a circular and inclusive value chain through actions to:

  - Achieve Net-Zero emissions by 2040;

  - Become Net Water Positive by 2030; and

  - Introduce more sustainable packaging into the value chain.

    - PepsiCo announced today new goals to **cut virgin plastic per serving by 50% across its global food & beverage portfolio** by 2030[1], **using 50% recycled content in its plastic packaging** and **scaling the SodaStream business globally,** an innovative platform that almost entirely eliminates the need for beverage packaging, among other levers.

Corporate GHG-Reduction News

- The company will also progress its more than $570 million diversity, equity and inclusion journey; and
- Today introduced a **new global workforce volunteering program,** *One Smile at a Time,* to encourage, support and empower each one of its 291,000 employees to make positive impacts in their local communities.

- **Positive Choices:** PepsiCo continues to evolve its portfolio of food & beverage products so that they are better for the planet and people, including by:
  - **Incorporating more diverse ingredients** in both new and existing food products that are better for the planet and/or deliver nutritional benefits, prioritizing chickpeas, plant-based proteins and whole grains;
  - **Expanding its position in the nuts & seeds category,** where PepsiCo is already the global branded leader, including leadership positions in Mexico, China and several Western European markets;
  - **Accelerating its reduction of added sugars and sodium through the use of science-based targets across its portfolio and cooking its food offerings with healthier oils;** and
  - Continuing to **scale new business models that require little or no single-use packaging,** including its global SodaStream business – an icon of a Positive Choice and the largest sparkling water brand in the world by volume. **SodaStream, already sold in more than 40 countries,** is bringing PepsiCo flavor options like Pepsi Zero Sugar, Lipton and bubly to 23 markets, and its new **SodaStream Professional platform will expand into functional beverages and reach more than 10 additional markets** by the end of 2022, part of the brand's effort to help consumers **avoid more than 200 billion plastic bottles by 2030.**

"pep+ directly links the future of our business with the future of our planet, for the benefit of both – from how we source ingredients and make and sell our products; to how we inspire consumers through our iconic brands to make better choices for themselves and the planet; to how we support communities and improve livelihoods throughout our supply chain," said Jim Andrew, Chief Sustainability Officer, PepsiCo. "Take SodaStream, for example. By rapidly expanding the SodaStream ecosystem, we are meeting the needs of consumers at home, away from home, and on-the-go. At the same time, we are also offering consumers positive choices that use less plastic, create fewer emissions, and are better for people. pep+ is our roadmap to create the food and drinks people love in a way that helps build the sustainable future we all must have."

The company's brands across its food & beverage portfolio are accelerating their efforts to realize PepsiCo's sustainable packaging vision and leveraging their influence to educate consumers on recycling and the planetary impacts of their choices.

- **11 European markets are moving key Pepsi-branded[2] products to 100% rPET** bottles by 2022. PepsiCo estimates that shifting to a 100% rPET bottle will lower GHG emissions by approximately 30% per bottle.
- **In the U.S., all Pepsi-branded products will be converted to 100% rPET bottles by 2030,** with Pepsi Zero Sugar beginning to be sold in 100% rPET bottles by 2022. The brand is celebrating this important move to sustainable packaging with a new consumer-centric platform leveraging fall football and driving recycling awareness, education and

advocacy, which are critical because rPET availability depends on consumers' commitment to recycling.

- PepsiCo has been **investing in breakthrough food packaging technology and** is now introducing **a fully compostable bag** made with plant-based materials. Starting with Off The Eaten Path, one of Frito-Lay's plant-based brands, this industrially compostable packaging will be available to consumers in the U.S. at Whole Foods stores beginning this month. Notably, the company also announced today that it is willing to work with other companies **to license the same technology at no cost given the importance of creating a circular food packaging system.**

To learn more about the pep+ agenda, please visit www.pepsico.com/pepsicopositive.

About PepsiCo

PepsiCo products are enjoyed by consumers more than one billion times a day in more than 200 countries and territories around the world. PepsiCo generated more than $70 billion in net revenue in 2020, driven by a complementary food and beverage portfolio that includes Frito-Lay, Gatorade, Pepsi-Cola, Quaker, Tropicana and SodaStream. PepsiCo's product portfolio includes a wide range of enjoyable foods and beverages, including 23 brands that generate more than $1 billion each in estimated annual retail sales. Guiding PepsiCo is our vision to Be the Global Leader in Convenient Foods and Beverages by Winning with Purpose. "Winning with Purpose" reflects our ambition to win sustainably in the marketplace and embed purpose into all aspects of our business strategy and brands. For more information, visit www.pepsico.com.

1. Against 2020 baseline.
2. Includes Pepsi, Pepsi MAX, Pepsi MAX Lime, Pepsi MAX without caffeine, Pepsi Light, Pepsi Light without caffeine.

FOOD & BEVERAGE PROCESSING & PACKAGING MONTHLY FEATURE

Tetra Pak Solutions Conserve Water & Energy for Food & Beverage Sector

By Mike Grennier, Compressed Air Best Practices® Magazine

For Tetra Pak, looking inward is a given when it comes to protecting the planet – yet the global processing and packaging company also appreciates the need to look outward to enhance its sustainability efforts across its entire value chain.

Tetra Pak believes the best way to make a positive environmental impact is a holistic approach, whether that means maintaining its own energy-and water efficient operations, working with partners and suppliers to promote renewable materials, or helping customers achieve their own sustainability ambitions, said Frederik Wellendorph, Vice President Liquid Food, Tetra Pak.

The Tetra Pak® UHT 2.0 heating portfolio helps UHT milk processors conserve water and energy.

"Our view is always from the perspective of the value chain from the raw materials to the end product," Wellendorph said. "How do we work with our suppliers who supply us? How do we look at our own manufacturing to avoid waste? Then, how can our equipment minimize the amount of energy or water it uses when processing and packaging customers products? It's more than just focusing on ourselves."

Doing the Right Thing

With its headquarters in Lausanne, Switzerland, Tetra Pak (www.tetrapak.com) employs over 25,000 people in 160 countries. Its processing and packaging solutions are used in the production and delivery of numerous products, including beverages, milk, ice cream, cheese, powder products, prepared food, and many others.

Sustainability has always been at the core of how Tetra Pak operates its business. The company began collecting data on energy use and Greenhouse Gas (GHG) emissions annually since 1999. At its own facilities, the company invested $22 million into energy efficiency since 2011, which prevented energy use increasing by 23% to date. In 2020, its use of renewable electricity sources stood at 83%, up from 69% in 2019, and is expected to reach 100% before 2030. Its goal is to reach net zero GHG emissions at its operations by 2030, with the ambition to achieve net zero GHG emissions for the entire value chain by 2050.

"Using renewable resources and making sure we run our operations in a sustainable way is the right thing to do," said Wellendorph.

Frederik Wellendorph, Vice President Liquid Food, Tetra Pak.

Tetra Pak Solutions Conserve Water & Energy for Food & Beverage Sector

Tetra Pak's E3/Speed Hyper packaging machine uses eBeam technology to sterilize packaging material with electronic beams versus the traditional hydrogen peroxide sterilization process. The result is significant energy savings.

In addition to operating resource-efficient facilities, a second component of Tetra Pak's sustainability strategy is a commitment to a low-carbon circular economy that considers not just recycling and reuse of materials, but also the climate impact of raw materials and manufacturing.

The strategy is particularly crucial to sustainability goals concerning its carton packages. As an example, Tetra Pak began to restructure its packaging innovation strategy in 2018 around the ideal beverage carton: a fully renewable and recyclable package. Since then, it has significantly accelerated development efforts and increased investments to achieve its vision. Its goal is to field-test an aseptic package made entirely from renewable sources by 2022.

Saving Energy and Water in UHT Milk Processing

Aside from efficient operations and better carton packages, a critical aspect of Tetra Pak sustainability strategy involves ongoing development of solutions to help milk and beverage processors, as well as other customers, achieve their own sustainability ambitions.

Recently, the company introduced its UHT 2.0 portfolio, which in combination with E3/Speed Hyper packaging equipment, helps Ultra-Heat Treatment (UHT) milk processors reduce electrical consumption by as much as 31%, steam by up to 78% and freshwater consumption up to 40% when compared with the traditional UHT production process. By using the new technology versus the traditional approach to UHT milk production, producers stand to reduce their carbon footprint by as much as 56%.

Commonly found throughout Europe, UHT milk is produced using a process that allows milk to be packaged in sterile containers and stored

Companies that produce Juice, Nectar and Still Drink (JNSD) beverages can save water and energy with Tetra Pak's new JNSD processing solution.

unrefrigerated without spoilage for as long as nine months. By contrast, pasteurized milk common to North America and other areas of the world requires refrigeration and offers a limited shelf life of approximately two weeks after processing.

Given its experience with traditional UHT milk processing – and its goals in helping producers – Tetra Pak determined production efficiencies were to be gained, Wellendorph said.

"Energy and water savings are extremely important to dairy operators," he said. "They are always targeting OPEX costs. How can we minimize the use of water, steam, chemicals, detergents? How can we improve the ratios?"

UHT Milk Production 2.0

Tetra Pak's approach to conserving energy and water in UHT milk processing reduces the number of steps involved in production, which in turn, reduces the resources and costs involved.

UHT milk processing involves heating raw milk to higher than 275˚F (135˚C) for approximately one second, cooling it rapidly,

Tetra Pak Solutions Conserve Water & Energy for Food & Beverage Sector

and then aseptically packaging the milk into sterile containers. The continuous process is also used commonly used in processing fruit juices and other liquids.

With traditional UHT milk processing, raw milk is typically preheated from 42˚F (5˚C) to 190˚F (90˚C) using tubular or plate heat exchangers. The next step involves homogenization (also called separation) in order to separate the fat in milk and increase the product's storage stability. Depending on the system used, homogenization occurs before or after the pasteurization. In the pasteurization stage, the milk is heated using either direct or indirect heating systems to reach the targeted temperature of 275˚F (135˚C). With direct heating, the product is put into direct contact with hot steam. Indirect heating is performed with tubular or plate heat exchangers.

After pasteurization, the milk is cooled to the original temperature of the raw milk. From there it enters the standardization process, which adjusts the constituents of milk to reduce butterfat content. It is then regeneratively cooled and held in storage in aseptic tanks until it is sent to an aseptic packer.

Unlike the traditional process, Tetra Pak's UHT 2.0 with its "OneStep" technology eliminates the need for pasteurization, as well as storage. In a single, unbroken step, the raw milk is pre-heated, separated, standardized, and homogenized, before being sent to a UHT treatment unit where the milk is heated to 275˚F (135˚C) and then cooled. The milk is then transferred to aseptic tanks as with the traditional UHT milk process. Additionally, the solution includes a Tetra Pak® E3/Speed Hyper packaging equipment, which uses eBeam technology. Developed by Tetra Pak in combination with partner company COMET, eBeam technology sterilizes packaging material using electronic beams, replacing the traditional hydrogen peroxide sterilization process.

If a processor starts production of UHT milk with powder versus raw milk, UHT 2.0 with OneStep technology can be used to combine concentrate mixing with in-line blending, also without the need for pasteurization or storage tanks. By adding different streams in the blending steps, such as a chocolate slurry or protein concentrate, processors can also produce a range of value-added products.

Fewer Steps Saves Resources

Although the potential energy and water savings – as well as operational costs – vary based on the uniqueness of each UHT processing plant and its geographic location, the Tetra Pak solution offers the opportunity for most to come out ahead given the reduction in processing steps, said Wellendorph.

"We found we can cut out the middle step, which is from the point when raw milk is received until it gets ultra-high treated. We've eliminated the pasteurization step and eliminated storage," he said.

Wellendorph said a processor's decision to install UHT 2.0 solution is typically driven by the addition of an entirely new production line, or replacement an old production line due to the economies of scale. Regardless the reasons for installing the technology, he said less processing and storage equates to more in terms of energy and water savings.

"Every time you have a vessel, and you have a pipe, and a pasteurizer, it needs to be cleaned quite frequently. Cleaning also requires heating up and cooling down. That costs energy, that costs water, that is a waste of raw materials. It's unavoidable," he said. "With this technology, energy consumption can be reduced by as much as a third and we can more than halve the water usage when it comes to cleaning. That translates into a near 60% reduction in a plant's carbon footprint."

Saving Energy and Water in JNSD Beverage Processing

While the UHT 2.0 portfolio gives UHT milk producers another method to minimize their environmental impact and reduce operational costs, Tetra Pak has also introduced a similar solution for companies that produce Juice, Nectar and Still Drink (JNSD) beverages.

The solution meets the growing demand for sustainable methods of producing this category of beverages, which are made from concentrates. The beverage category consists of juice, which is extracted from the pulp of fruits; nectar, which is a non-carbonated drink that contains some fruit juice and other ingredients such as water and sweeteners; and still drinks, which are non-alcoholic beverages without carbonation.

In traditional methods used to process JNSD beverages the full volume of juice concentrate and water is pasteurized. The new Tetra Pak solution, however, pasteurizes only the juice concentrate and not the entire volume of concentrate and water. The water is also treated with an optimized UV light and filtration. The process then blends the concentrate and water aseptically in line after the treatments.

Wellendorph said the first-of-its-kind process drastically reduces energy and water consumption, which in turn, can reduce a processing plant's production costs and its environmental impact.

"This technology will have a massive impact on a plant's energy consumption," he said. "With standard orange juice made from concentrate, we have tested the process and seen nearly a 70% reduction in energy use. Plus, water consumption has been reduced by more than half."

Wellendorph points out the need for JNSD beverage plants to factor in safety when deciding whether to use the Tetra Pak solution given the different processes and conditions involved.

"It can work on juice in general. As long as it's from concentrate, it's possible, but you really need to understand how to design a safe, hygienic plant, as well."

Whether it's Tetra Pak's new solution for JNSD beverage processing, or a new option for processing UHT milk, Wellendorph said the trend in the beverage processing industry is pointing strongly toward a future focused on continued sustainability.

"It's about taking steps to find solutions. It's a big decision to invest in technologies like these, but it will be the future. It will come." BP

All photos courtesy of Tetra Pak.

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Preparing Reciprocating Air Compressors for Winter

By the Compressed Air & Gas Institute

➤ Are you preparing for winter? Your reciprocating air compressor needs to as well.

The colder months are upon us, and your compressed air system maintenance routine can be more complex in colder climates. Freezing temperatures can have negative effects on your reciprocating air compressor, dryer, and many accessories. One of the best practices to adopt is keeping a detailed maintenance log. At the end of each season, take note of the condition your equipment is in, and address it promptly using the manufacturer's instructions to keep it operating smoothly and efficiently.

Most reciprocating compressors are designed to operate in temperatures above 40°F (4°C). If your system is not in a temperature-controlled indoor environment, your machine could sustain short-term and long-lasting damage.

Here is a list of best practices for preventative maintenance in cold weather in order to maintain efficiency and ensure consistent operations:

1. Change Filters and Oil

Clear air filters are essential to your system's operation. A clog can lead to contamination and cause pressure drops. Ensure your oil is rated for ambient temperatures and consistently remains fluid throughout

Most reciprocating compressors are designed to operate in temperatures above 40°F (4°C).

the season. Lubricant can thicken during colder weather, causing your reciprocating compressor to be less effective and overload the motor, putting undue wear on the compressor.

2. Clean the Exterior

Keeping the outside of your reciprocating compressor clean can prevent corrosion and make it easier to spot oil leaks. It also allows you to examine all the air compressor's components for safety concerns, as well as wear and tear. Along with the exterior, check the feet and mounting of the reciprocating compressor. Worn or damaged feet can cause unnecessary vibration, which could lead to operational issues.

3. Check Compressed Air Dryers, System Drains, and Tanks for Moisture

In cold weather conditions, dryers and drains must be closely monitored, as they cannot properly operate below 32˚F (0˚C) without proper freeze protection. The heat exchanger in a dryer can become damaged and blocked when moisture is allowed to freeze. Freezing in a refrigeration dryer can also cause cracking and damage to components. In extremely cold weather, drain valves can also freeze open or closed, preventing proper operation. Freezing in drain valves can also cause cracking in the housing, requiring repair resulting in downtime. Tanks can also collect condensation that is susceptible to freezing, and therefore, it must be checked regularly during the colder months.

4. Weatherproof the Air Compressor Room

Consider providing ambient temperatures around your compressed air system by installing heaters or proper ventilation methods. This space does not need to be heated to the same levels required for human comfort. However, maintaining the room temperature around 45˚F (7˚C) will significantly assist in keeping your system up and running. Freezing weather can cause frozen moisture to accumulate on or in your reciprocating air compressor. This freezing and thawing of the moisture will cause stress on the components of the equipment. The stress from freezing and thawing can compromise the equipment's structure and weaken it prematurely.

When you properly prepare and maintain your compressed

Maintaining air compressor room temperature around 45˚F (7˚C) will significantly assist in keeping your system up and running.

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Preparing Reciprocating Air Compressors for Winter

air system during the colder months, you and your company will benefit from the following:

- Consistent production and limited downtime
- Reduced operational or repair costs
- Reduced moisture damage on products
- Energy savings
- Environmentally sound operation

Every manufacturer has a specific maintenance schedule and safety requirements to do proper service. Always refer to the original manufacturer's operator manual before performing service or repairs.

Remember, when performing maintenance on equipment, always ensure your unit is off and disconnected from the power source. BP

For more information, visit the CAGI website at www.cagi.org.

All photos are courtesy of the Compressed Air and Gas Institute..

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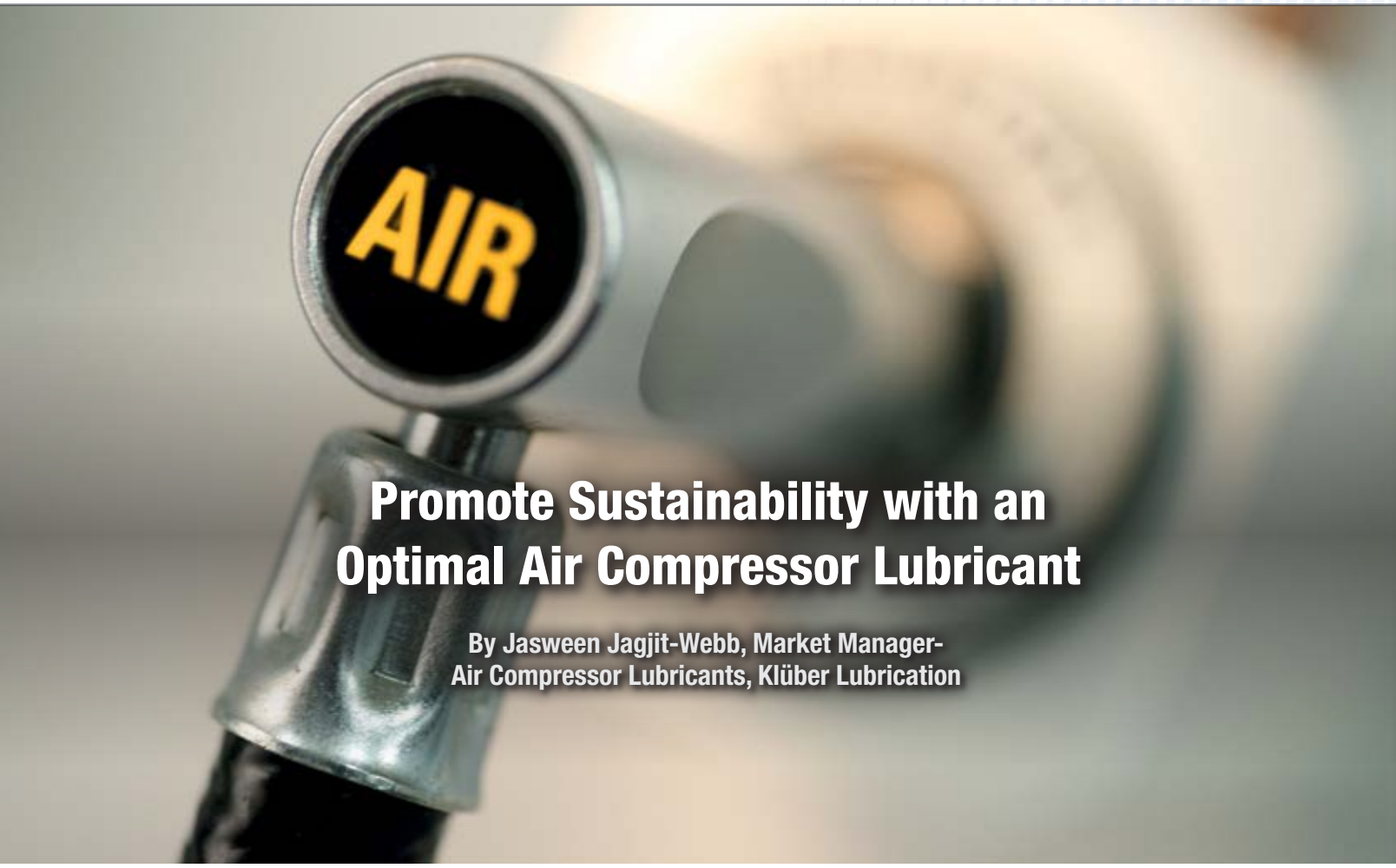

Promote Sustainability with an Optimal Air Compressor Lubricant

By Jasween Jagjit-Webb, Market Manager-
Air Compressor Lubricants, Klüber Lubrication

When facilities look to improving sustainability, they tend to focus first on traditional energy utilities – natural gas, heating oil, electricity and water. As facilities achieve greater sustainability through efficiencies that reduce utility energy waste and minimize the plant's carbon footprint, they begin to focus on other energy sources, including compressed air, to enhance sustainability efforts.

Facility engineers recognize that they can lower energy costs by recovering the heat generated by the air compressor, the heart of many critical commercial and industrial processes. They understand that the efficient operation of this vital power source can play a role in meeting sustainability goals. However, they may not recognize the importance of the lubricant – the lifeblood of the air compressor – in promoting efficient operation.

In an effort to reduce costs, users often buy standard, all-purpose mineral oils for lubricants regardless of the air compressor application. While this practice initially lowers operational costs, an overlooked root cause of air compressor downtime or failure can be the choice of lubricants. Purchasing a high-quality synthetic lubricant formulated specifically for

Air compressor lubricants can promote sustainability.

the air compressor application can ultimately reduce Total Cost of Ownership (TCO).

The Role of Air Compressor Lubricants

Air compressor lubricants have four key roles:

1. **Coating** to inhibit corrosion
2. **Coolant** to remove heat
3. **Lubrication** to minimize friction
4. **Sealant** to prevent air leakage

Standard mineral compressor oils are suitable for applications that don't require continuous use. However, their composition makes them an inherently poor choice for industrial applications. Mineral oils have low transfer properties, which cause them to overheat. They are volatile with low flash temperatures and are more likely to evaporate and be used up quickly. Standard mineral oils contain sulfur, nitrogen, and oxygen, which collectively increase acid development, oxidation, and buildup (sludge). The molecular composition of standard oils tends to cause inconsistencies in surface lubrication that increases friction between air compressor parts.

The Benefits of Synthetic Lubricants Optimized for Applications

The benefits of synthetic lubricants chosen for specific commercial manufacturing and industrial applications include the following.

1. **Oxidation Resistance**
   Sludge is a common problem in air compressor use. It is caused not only by poor compressor maintenance, but also by using mineral oils and synthetic products that are prone to oxidation. When inferior products are used in high heat applications, the oil and varnish break down more quickly and require more frequent changeouts that increase equipment downtime.

The oxidative stability of many synthetic lubricants contributes to their high usage per hour, extending parts life and lowering the costs of parts over the life of the compressor. Selecting a high-performance synthetic lubricant with additives that minimize oxidation can increase uptime, save on parts cost and thereby contribute to sustainability goals.

Promote Sustainability with an Optimal Air Compressor Lubricant

2. **High Energy Efficiency and Extended Drain Intervals**
   Selecting a lubricant based on the air compressor's operating conditions is key to achieving optimum energy efficiency and extended drain intervals. In commercial and industrial applications where an uninterrupted power source is vital, the primary role of the lubricant is to serve as a coolant so the compressor doesn't overheat. Synthetic lubricants offer outstanding thermal stability versus mineral oils. The additives in synthetic lubricants enable air compressors to run at lower temperatures which results in increased energy efficiencies that lower energy costs.

   Synthetic lubricants also last longer in many air compressor applications. For example, while the life of a mineral oil used in a rotary screw compressor typically is about 2,000 hours, the life of a synthetic lubricant can range anywhere from 8,000 to 12,000 hours depending on operating conditions (e.g., discharge temperature, humidity, cleanliness, and contaminants generated from air intake).

   Because so there are so many variables to consider when choosing a synthetic lubricant, it's advisable to consult with highly experienced lubricant manufacturers that offer a broad product portfolio. One size does not fit all, and the ability to consult with technical experts who can discuss your sustainability goals may be crucial to meeting them.

3. **Friction Reduction**
   Unlike mineral oils, synthetic lubricants are formulated to minimize friction. Reducing friction in air compressor operation results in longer parts life, which lowers the cost of parts over the life of the compressor, and reduces downtime for changeouts. This can result in significant cost savings for continuous use applications.

4. **Optimal Viscosity**
   Lubricants must be thick enough to reduce friction but not so thick that they slow air compressor operation. Choosing the right lubricant viscosity is dependent on the design of the compressor, the type of lubricant required, and the discharge temperature and pressure. Consulting with the lubricant manufacturer can help ensure optimal viscosity for a given operation.

5. **Higher Flash and Fire Points**
   Synthetic lubricants have higher flash and fire points than mineral oils, and some synthetics are designed specifically for use in fire hazard areas and in environments with extreme temperature ranges.

Potential Sustainability Gains

Sustainability gains through proper air compressor lubricant selection can include the following.

1. **Reduced Expenditures for Parts**
   Synthetic lubricants that minimize oxidation reduce parts wear. Parts last longer when synthetics are used, resulting in less frequent changeouts that lead to cost savings. Additional savings are often achieved because in many applications different parts are

changed out simultaneously regardless of wear (e.g., lubricant, filters, bearings and separators). While cost savings will vary depending on the application, contributions to sustainability goals can be significant.

2. **Lower Maintenance Costs**
Since changeouts are less frequent with synthetic lubricants, labor costs are reduced and equipment uptime is maximized.

3. **Less Waste**
Using a long-life, 12,000-hour synthetic lubricant reduces waste, which promotes greater sustainability. Oil carryover is reduced, which leads to fewer compressor top offs.

Lubricant selection can impact sustainability goals.

Promote Sustainability with an Optimal Air Compressor Lubricant

4. **Decreased Energy Costs**
   Synthetic lubricants have very low coefficients of friction and superior heat transfer characteristics that lower operating air compressor temperatures for greater energy savings. Switching from a higher viscosity mineral oil to a lower viscosity synthetic can result in improved energy efficiency.

5. **Reduced CO_2 Emissions**
   Increasing energy efficiency by using a lubricant with low friction coefficients and superior heat transfer properties also results in reduced CO_2 emissions. Synthetics, especially low viscosity oils (LVOs), can help meet sustainability goals.

6. **Improved Health & Safety**
   Synthetics have higher flash/fire/autoignition temperatures than mineral oils and therefore are inherently safer to both use and store.

   Because synthetics lubricants reduce maintenance requirements and minimize downtime, they help reduce stress and workload demands placed on busy service and repair teams. Reduced changeouts are especially important for applications that require intense physical effort in uncomfortable working environments.

7. **Able to Meet Environmentally Considerate/Biodegradable Criteria**
   Lubricants can be comprised of high-performance biobased materials and also be environmentally considerate. Biodegradability has many definitions. Technically, all lubricants are biodegradable, but only "readily biodegradable" lubricants will meet sustainability goals. The key is to select a lubricant with low toxicity and non-bioaccumulative properties.[1]

The Importance of the Supplier in Selecting Lubricants

Choosing a lubricant to achieve optimal air compressor performance can be challenging because operating conditions and regulatory requirements vary widely by industry and application. Significant sustainability gains can be made by working with a lubricant supplier who meets these criteria.

Understands the Importance of Total Cost of Ownership

Many suppliers solely focus on air compressor selection without considering TCO. This short-sighted approach is a barrier to achieving long-term sustainability goals. A supplier with an understanding of both air compressor equipment and a wide variety of lubricants can consider the entire range of factors that affect operation and that ultimately can help lower TCO. A superior lubricant supplier will have performance data and test results to back performance claims.

Possesses a Problem-solving Mindset

A supplier with a problem-solving mindset will work with management and facilities and service teams to understand specific application needs and sustainability goals. Every application is different. Partnering with a supplier with an abundance of high-performance lubricants formulated for diverse uses can be key to optimizing equipment operation and improving sustainability.

Has Industry Knowledge and Experience
Suppliers who are familiar with environmental operation conditions in your industry as well as regulations can be an invaluable in selecting lubricants. Here are two examples of successes in the industry:

Cement Processing – Cement plants are notoriously dusty, dirty environments with unique operational challenges. Dust is sucked into the compressor system along with the intake air, which in combination with elevated humidity levels and high ambient temperatures, can lead to machinery failure and unexpected compressor downtime. One recent study demonstrates how selecting specific high-performance lubricants for cement processing can improve the energy efficiency of screw-type air compressors.[2]

Food & Beverage Processing – Technology is now available to formulate food-grade lubricants that eliminate varnish and that can achieve significant cost savings, typically 80% in total cost of parts, maintenance and lube. One multi-synthetic lubricant, Klüber FG Elite Series, lasts 8,000 hours before changeouts are required. Innovative chemistry was used to create an NSF Food Grade approved base stock component for use with traditional rotary screw air compressors.

Conclusion

Selecting a synthetic lubricant formulated for a specific air compressor application can promote sustainability. Significant gains can be garnered by increasing energy efficiency and improving equipment reliability. Key benefits can include greater equipment downtime, lower parts and maintenance costs, and reduced waste. BP

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About the Author

Jasween Jagjit-Webb is Market Manager for Air Compressor Lubricants at Klüber Lubrication. In her role, she is responsible for developing new business in the air compressor lubricant industry. Jasween joined Klüber Lubrication in 2013 and has held a number of positions within the Klüber group. She is an accomplished sales manager with more than 12 years of technical product sales experience in the air & gas compressor industry. Jasween received an M.B.A. from Northwood University and a B.S. in Chemical Engineering from Michigan Technological University.

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Both Metal and Plastic Pipe Necessary for Compressed Air Applications

By Rob Marsiglia, Business Development Manager – Commercial Products, Asahi/America

➤ Introduction

Metal pipes have been used and installed in fluid and gas applications since the mid-19th century. Metal pipes are strong, safe, and provide excellent performance for many demanding services. Plastic pipes are an alternative to metal pipes for many fluid applications. They do not have the same high-pressure ratings, but they are highly corrosion resistant. They do not rust, scale, pit or corrode. They are lightweight and easy-to-install, which make them an excellent choice for many liquid applications. Over the decades, users have learned that a plastic piping system, when properly selected and installed, will require very little maintenance and will offer many years of uniform service. Since thermoplastic piping is an ideal choice to transport fluids, how would plastic piping perform with compressed air? This article will focus on the suitability of plastic pipe systems as well as joining methodology in compressed air applications.

Thermoplastic Pipe Materials

There are two basic types of plastic materials – thermoplastic and thermoset. We'll focus on the thermoplastics, and discuss some of the materials therein. Thermoplastic materials are melt-processible. Thermoplastic resins can be heat processed and either extruded into shapes, such as pipe, or molded into components, such as fittings. Thermoplastic implies that the material is processed and can be re-processed by melting and forming, using heat. There are

three main groups of thermoplastic materials used for piping applications: vinyls, olefins, and fluoropolymers. Vinyl materials include polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC). Olefin materials include polyethylene (PE) and polypropylene (PP). There are several fluoropolymer materials such as Halar (ECTFE) and PVDF. Additionally, there is acrylonitrile butadiene styrene (ABS), which is in its own class.

Plastic Pipes for Compressed Air & OSHA Standards (weeding out the options)

Thermoplastic pipe options are limited for compressed air. Primarily, this is due to the catastrophic failure mode of many plastics. This is the primary reason PVC and CPVC should not be used for compressed air systems. PVC and CPVC pipes fail in an unsafe, catastrophic manner. OSHA's standards state that if thermoplastic piping materials are to be used for compressed air or gas applications "the pipes must either be constructed of or encased in shatter resistant material." (OSHA standard interpretation dated February 28, 1991)

PVC Schedule 40 catastrophic failure mode.

Polypropylene (PP) pipes can be unsafe in cold conditions without an encasement, as they become more brittle as temperatures decrease. ABS pipes, designed for compressed air, are available, but they are not compatible with all compressor lubricants, and they may fail due to use with a non-compatible lubricant. Fluoropolymer materials, such as PVDF and Halar, are cost prohibitive.

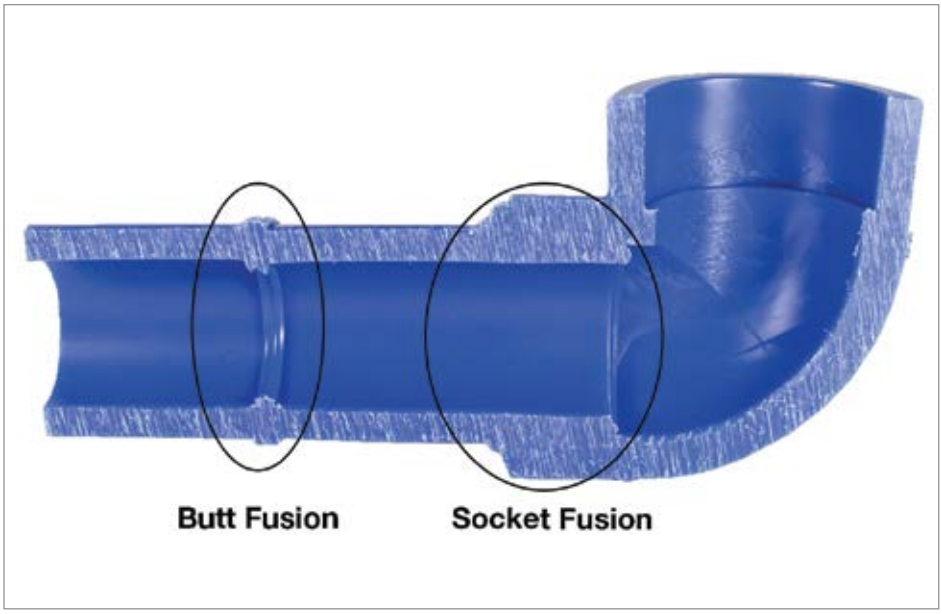
Polyethylene (PE) Material

Polyethylene can be engineered to handle compressed air applications. It has excellent physical and mechanical properties, with broad chemical resistance. The material retains its ductile properties well below 0˚F (< -40˚F). If it were to fail, it would fail in a safe mode. This shatter resistant material would simply balloon and tear, keeping the pipe material intact.

Asahi/America's Air-Pro® over-pressurized ductile failure in safe mode during burst test (pressure ≥ 800psi).

PE resin for compressed air applications must be specially formulated to handle the

Both Metal and Plastic Pipe Necessary for Compressed Air Applications



Asahi/America's Air-Pro® pipe and fittings joined with non-mechanical butt and socket fusion methods, as indicated in the figure.

oxidative effect of compressed air for long-term performance. Standard US domestic HDPE pipes, like PE4710, are designed for fluids, but not for compressed air. PE resin manufacturers in Europe formulate a resin class, known as PE100, to handle both liquid and air/gas applications. A piping system made of PE100 designed specifically for compressed air applications has been marketed in North America since 1992. In 1993, California OSHA issued a letter certifying that this specially formulated PE100 piping system meets California testing requirements and can be installed in compressed air applications. This certification was updated and re-issued in March 2021. Since 1993, there have been thousands of PE100 compressed air piping systems installed in North America, in numerous types of applications, with no incidences of hazardous failure.

PE100 Pipe Joining Methods

PE100 pipe and fittings can be joined through heat fusion, which is a type of melt-processing. Heat fusion joining brings two melted surfaces together and allows them to cool under pressure. This process produces one continuous piece, free of any foreign material or seams. The weld joint is as strong as the pipe itself. PE100 pipes and fittings are joined by socket or butt fusion. With socket fusion, pipe is inserted in socket fittings that have a slight taper; the tapered fitting increases the pressure of the pipe up to a stop in the fitting. The entire insertion depth is the weld area. Butt fusion fittings are the same inside diameter (ID) and outside diameter (OD) as the pipe for end-to-end fusing. Two pipes can be butt-fused together without a coupling. Butt fusion always produces an external and internal bead. The reliability and integrity of PE butt fusion welds is universally accepted. The natural gas industry has been using butt-fused PE pipes for underground gas utility for decades in the US.

Asahi/America's Air-Pro®, covered in chemical dust, safely operating at a fertilizer manufacturer.

Asahi/America's Air-Pro® specially formulated PE piping system installed at a manufacturing facility.

Two Joining Philosophies for Compressed Air Pipe

Understanding the way pipes are joined is important. Leaks are costly and wasteful. A ¼" orifice @ 100psi wastes about 104 cubic-feet-per-minute (cfm) and can cost as much as $10,000 per year. Joint leaks are a common cause of wasted compressed air energy. There are two joining philosophies to consider:

1. Mechanical Joining: System connections that use a gasket, O-ring, pipe compound, or the like to affect a seal in a system connection. Examples would include flange-to-flange connections, threaded joints, compression, push-fit, and "pro-press" type connections.

2. Non-mechanical Joining: System connections that provide what is considered to be a permanent joint. Typically referred to as welded connections, they include soldered and brazed copper, and welded steel

Both Metal and Plastic Pipe Necessary for Compressed Air Applications

and stainless steel materials. Welded joints also include the homogenous joints produced by socket and butt fusion of polyolefins, and the "solvent cemented" joints of vinyls and ABS.

Why does the compressed air industry need both joining method options?

There are many facilities that require routine adjustment and re-configuration of their operations. Micro-breweries, custom machine shops and assemblers, as well as job-specific printing houses all need to break down and re-assemble portions of their compressed air system. In these instances, a system that incorporates mechanical joints is necessary. There are many high-quality aluminum piping systems on the market that provide the ability to assemble, disassemble and reassemble the system and maintain the system's operating integrity while doing so.

Of course, there are many installations that are more permanent, and once installed, are designed to stay in place for a significant amount of time. Manufacturing facilities often have central utility areas, where various services are fed throughout the plant. Compressed air is one of those. Here, a main trunk line (or lines) is permanently installed

TABLE 1

APPLICATION	SUITABILITY	
	METAL	PE100
Pressure above 230psi	YES	NO
Temperature above 120°F	YES	Limited Life
Marine or Corrosive	Limited Life	YES
Below Ground	Mechanical Joints - NO	YES
Above Ground	YES	YES
Portability	Mechanical Joints - YES	Fusion Joining - NO
Typical Shop	YES	YES
Typical Industrial Plant	YES	YES
Clean - Contaminant Free	YES – (Aluminum/Copper)	YES
> 50 year life	?	YES

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Rod Smith, Publisher, Best Practices Magazines & EXPO

Collaborative Artificial Intelligence Drives Energy Conservation to Save California Dairies
Elhay Farkash, CEO, Zira Group

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Both Metal and Plastic Pipe Necessary for Compressed Air Applications

throughout the plant. This line is welded to serve as a fixed line.

In many instances, there are buried compressed air lines. Manufacturing campuses, military installations, heavy equipment manufacturers, rail and lumberyards, and theme parks are all examples of facilities with extensive underground installations, where leaks are an anathema. Here, a permanently joined, corrosion resistant system, like a PE100 homogenous fused system, would be ideal.

Why does the compressed air industry need both metal and plastic pipe options?

Most applications have varied system requirements and one size can't fit all. Even in the applications mentioned above, a system with a permanent trunk line may have numerous drops and require those drops to be adaptable to tool changes. Therefore, it could be said that mechanical and non-mechanical joining and metal and PE100 pipes are necessary to handle the varied requirements of compressed air applications.

Asahi/America's Air-Pro® in a buried application at a railroad station.

Table 1 illustrates that both metal and PE100 piping systems have some limitations, which are marked as "NO" or "limited life". Yet both options would probably handle the majority of real-world applications. For those applications, cost of ownership, ease-of-use and system flexibility, elimination of leak points, and service life must be taken into consideration.

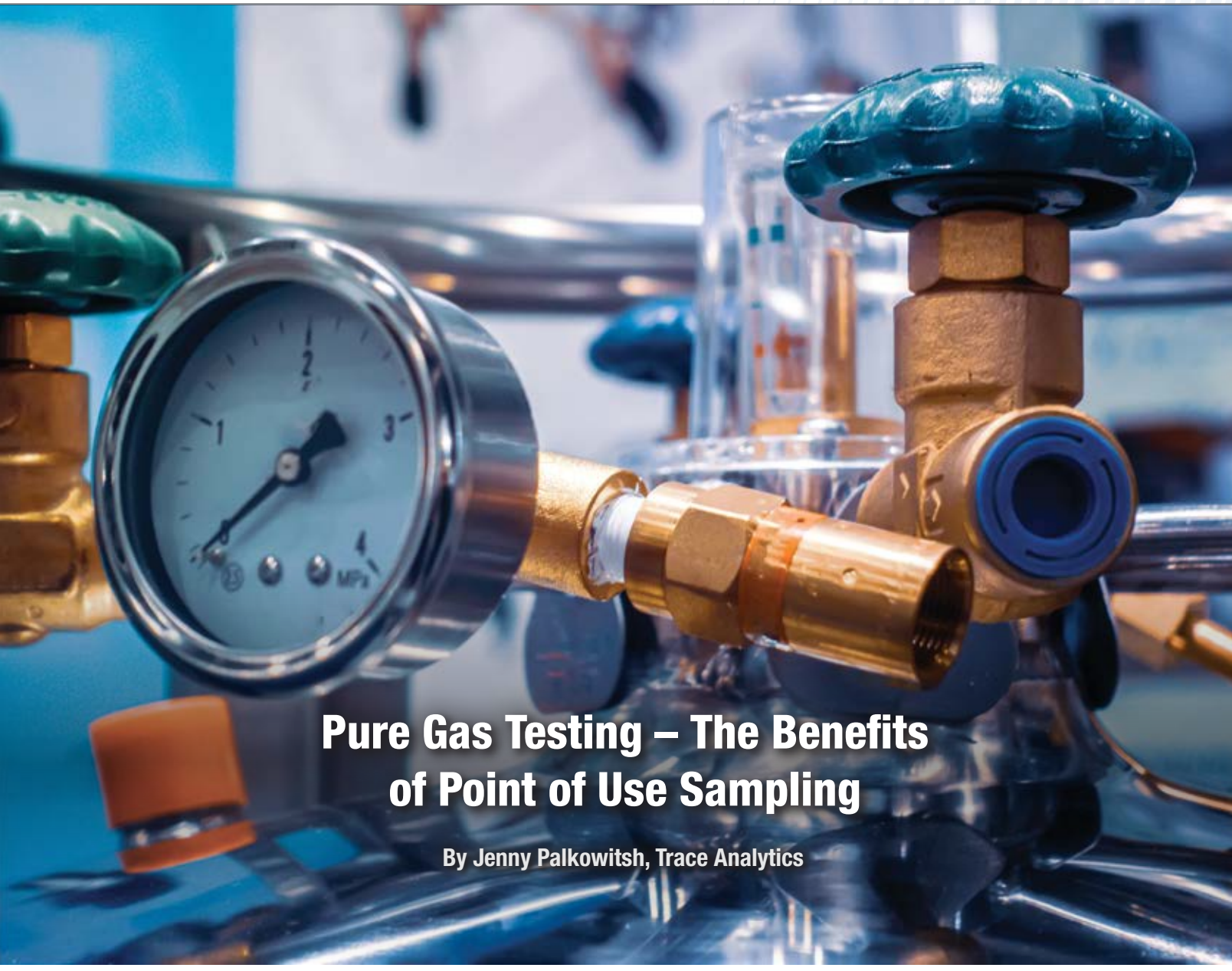
Conclusion

Compressed air consultants need to have both mechanical and non-mechanical piping options as well as metal and PE100 options to meet the needs of their clients. Since PE100 can be joined to metal systems by mechanical means, a hybrid system with both metal piping and PE100 piping would be possible; indeed, some might call it, "the best of both worlds." BP

For more information visit https://www.asahi-america.com

To read articles on ***Compressed Air Piping System Assessments***, visit https://www.airbestpractices.com/system-assessments/piping-storage

For expert presentations, visit our Webinar Archive Section dedicated to ***Air Purification & Piping*** at https://www.airbestpractices.com/magazine/webinars



Pure Gas Testing – The Benefits of Point of Use Sampling

By Jenny Palkowitsh, Trace Analytics

Pure gases are used frequently across a range of industries: from food and beverage to hospitals, pharmaceutical, and medical device manufacturing. Depending on the usage of the pure gas, different quality standards and acceptable purity limits may apply. Whether the gas is used for purification, extraction, fermentation, or is administered to patients, it is critical that the levels of purity and contamination are acceptable for that particular use. Quality evaluations should be performed at the point of use to understand whether the system is impacting the gas in any way and to ensure the gas is of appropriate purity for its use. Point of use testing for both purity and contamination can be performed by a third-party, accredited laboratory.

Pure Gas Usage in Industry

Pure gases like nitrogen, oxygen, carbon dioxide are versatile and becoming even more frequently used as technology advances.

- Nitrogen helps protect and preserve supplies from oxidation and helps to keep products dry and sterile. "Blanketing with nitrogen" preserves the quality of many food and pharmaceutical products. Oxygen sensitive products require appropriate Nitrogen purity. Nitrogen is also used extensively in hospitals for cancer and lesion removal, the storage of cells and blood, and for the manufacturing of medicines (CHT, 2020).

- Oxygen can be used for fermenting, extending the shelf life of various foods, and as a shield for beef products. It can also prevent the growth of anaerobic bacteria (Inmatec, 2021). In hospital settings, oxygen is used for treating medical conditions such as respiratory arrest, resuscitation, and life support (CHT, 2020).

- Carbon Dioxide plays an important role in many food packaging and manufacturing processes. Particularly in beverages, CO_2 is responsible for the flavor and freshness of soda, mineral water, and alcoholic drinks. This gas prevents oxidation and slows down fermentation (Rocky Mountain Air Solutions, 2018).

- Pure gas mixtures allow users to create modified atmospheric packaging which help ensure the longevity of the products' lifespan. It can be essential that the right amounts of each gas are in the mixture and free from contamination.

Because the success of the product and/or treatment depends on the quality of the pure gases, regular monitoring for both purity and contamination is something that should be included in every users' protocol. Point of use testing helps ensure that maintenance procedures, system dryers, and filtration devices are adequate and appropriate. Pure gases are generally used in high-risk / essential functions and regular point of use monitoring provides confidence that the pure gas is not negatively impacting the product or consumer.

Gaseous Contamination and Purity

It's important to understand the difference between gas purity and gaseous contamination. Purity is the percentage of a gas in the mixture. Gas purity refers to the proportion of gas present in a sample (Nigen, 2021). For example, the usage may require 99% nitrogen, or 99% oxygen. Specifications like USP dictate acceptable amounts of other gases present. Gas purity can be influenced or disrupted by leaks in the system, which can add ambient air to the mixture. It is also possible that the system could become incapable of producing an appropriate level of purity. Proper tubing (to reduce permeation), the appropriate regulator, and correctly fitted joints can help prevent other gases from affecting the process (Kandl, 2005). An inappropriate level of purity can have disastrous effects on the products or harmful effects on the consumer.

Imagine trying to drink clean water through a dirty, contaminated straw. The purity of the water at the beginning will be diminished due to the distribution (the straw). The same is true for pure gases, which is why point of use testing for purity and contamination is critical.

Pure gases are susceptible to contamination and a reduction of quality just like any other process air, compressed air, or instrument air. Contamination from particles, water, oil, microorganisms, or gases could be detrimental to the end product, resulting in recalls, illness, or a shortened system life span. Gaseous contamination refers to particles, water, oil, microorganisms and gases that may be impacting the gas. Most commonly, water, oxygen and hydrocarbons contaminate pure gases (Kandl and Bartram, 2015). Since they are abundant in the atmosphere, it is quite common for these contaminants to enter a pure gas system.

Contamination can also come from the distribution system itself. Ideally, all systems would be made of only stainless steel - the best material to use to avoid contamination. Piping like black iron or mixed metals produce large amounts of rust that often cause failing particle tests. Additionally, metal shavings from maintenance or degradation of o-rings or hoses can all contaminate the pure gas. Condensation or humid ambient air from an intake or leak can add undesirable amounts of moisture to the gas which can cause microorganism growth. Depending on the type of system you have, further contamination can be introduced

Pure Gas Testing – The Benefits of Point of Use Sampling

from nearby vehicles, cleaning supplies, or systemic oils themselves. Testing for particles, water, oil, microbes, and gases in these systems is an essential part of ensuring the quality of your pure gas.

Point of Use Testing

Contamination can come from many locations and sources. In industries where quality and consistency are key, regular testing is the best way to monitor the purity of your gas over time. Pure gases used for critical end-products and that are administered to patients must be of appropriate quality. Point of use testing reliably demonstrates these quality levels where it is most important. Since gases are regulated as "finished pharmaceuticals" by the FDA, they are expected to meet GMP requirements. The Joint Expert Committee on Food Additives (JECFA) sets purity limits for nitrogen gas used in food manufacturing, as does the FCC. CGA, EU 231, NFPA 99, and USP all also have requirements for pure gases.

Facilities employ filtration to further ensure the quality of their pure gases. Filtration must be monitored, as an inadequate filter will allow contamination to pass through, leaving the end product or patient vulnerable to contamination. Testing before and after filter changes provides data to understand whether their filtration is working as expected. It is recommended to change all filters based on the OEM's requirements, but some facilities have high levels of particulate matter which may require more frequent filtration changes. Point of use testing provides data on the efficacy of the filters and maintenance schedules.

Point of use testing can be used as a comparison tool as well. Taking samples at the beginning of the distribution system, the middle of the system, and the point of use can help users understand if any part of the distribution piping is contributing to contamination. This could point to any issues with leaks, particulates, or residue. Knowing purity at the beginning of the line is helpful for troubleshooting, but at the bare minimum, manufacturers and suppliers must demonstrate that the gas at the point of use meets the users' requirement.

The best way to know that the distribution system and pure gases are maintaining quality levels as expected and that maintenance schedules are appropriate is to employ quarterly point of use testing to aid in trend analysis. However, for many standards and certifications, annual testing alone will meet the minimum requirements.

How to Test

One challenge that users sometimes face is how to complete a pure gas test cost-effectively and efficiently. At Trace Analytics, we provide AirCheck Kits designed to quickly take pure gas samples at the point of use, or other points in your line. The AirCheck kits can test for purity and contaminants based on your needs and specifications. Made mostly of stainless steel parts, the AirCheck kits take pure gas samples quickly and easily. The sampling media (usually a filter, source bottle, and detector tube) are then shipped back to the laboratory for analysis. For microbial sampling, agar plates and an impaction sampler are shipped to the facility for testing and immediately returned for incubation and analysis. Calibration and validation documentation are available for some kits. Pure gas testing can help users meet standards like JECFA, FCC, CGA, EU 231, NFPA 99, USP, ISO 8573 and more.

Whether you're testing nitrogen, oxygen, argon, or mixed gases, Trace Analytics has the expertise and experience to make the whole process simple and straightforward. Connect the AirCheck Kit up to your sampling point, take a short sample following our detailed instructions and receive results within 5 business days of receipt of the sample at the laboratory. Analyses are performed using GC-MS, optical light microscopy, laser particle counters, gravimetry, detector tubes, or Gram staining and phenotypic ID. Most specifications and certifications require a non-biased, third-party, accredited laboratory to perform analyses and provide results. Though in-house and in-line testing can be helpful at times, the best way to ensure your system is meeting requirements and your results are accurate and adequate is to use an accredited laboratory. With so much on the line, testing with a reputable and accredited laboratory can give users peace of mind.

Conclusion

Regular testing of pure gases helps to ensure the safety of consumers and of end products. Whether the pure gas is used directly for medical patients, or in the manufacturing of food, beverages, or pharmaceutical products, quality is of the highest importance. Inadequate levels of purity or unsafe contamination can be detrimental to the products or consumers. Trace Analytics helps make point of use pure gas testing easy for users in all industries. For more information on pure gas testing, please contact our team of experts. BP

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 the Author

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

To read articles on ***Compressed Air and Nitrogen Purity System Assessments***, visit https://www.airbestpractices.com/system-assessments/air-treatment-n2

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COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

FS-Curtis Eco-Turbo Centrifugal Air Compressor

FS-Curtis, a leading manufacturer of reciprocating, rotary screw, and oil-less air compressors is pleased to announce the launch of the new ECO-Turbo Series. FS-Curtis, headquartered in St. Louis, MO., launched this innovative compressor on the market nationally. This state-of-the-art, Oil-Free, Class 0 compressor uses a trusted FS-Elliott engineered airend which allows the unit to be one of the most powerful compressors on the market. The ECO-Turbo series is suitable for use in a wide range of industries and applications where 100% oil-free compressed air is required with higher demand, ranging from 185 kW to 250 kW drive power at a final compression pressure of up to 125 psi. This enhanced technology exhibits above-average service life since the design has been optimized with a wear-free compression principle which results in lower maintenance and fewer downtimes.

FS-Curtis, www.fscurtis.com

BOGE DAV-2 Adsorption Dryers

The electronic and automotive industries with their huge manufacturing plants and pharmaceutical manufacturers with their strict requirements share one common feature: the need for the total exclusion of contamination and water from their industrial processes. And the same goes for the entire production chain and, therefore, also the generation of compressed air. Compressed air specialist BOGE is on hand to help with its external heated regeneration adsorption dryers. The new DAV-2 series has been producing dry compressed air since April 2021, thanks to its thermal insulation, these dryers are more energy-efficient, safer and more readily accessible for servicing and maintenance than previous models. In addition, they also boast high-quality PLC control, a range of different interfaces and even IoT connectivity.

BOGE, www.boge.com

Atlas Copco OGP+ On-site Oxygen Generator

With the introduction of the new 8-model OGP+ Pressure Swing Adsorption oxygen generator series, Atlas Copco sets the bar even higher with a host of new user benefits and significant operational savings, by optimizing PSA technology, the OGP+ range consumes 30% less feed air at full load to produce the same amount of oxygen as a traditional generator. As a result, customers are able to enjoy double-digit reductions in the total cost per unit of oxygen. The OGP+ also introduces additional energy savings at low load with its in-house developed Variable Cycle Saver technology. VCS optimizes the PSA cycle to reduce the air requirement to what is needed to generate a lower volume of oxygen. By eliminating energy waste during lower demand, VCS generates up to 70% extra energy savings.

Atlas Copco Compressors, www.atlascopco.com/air-usa

CAGI Conference Session at Best Practices EXPO

The Best Practices 2021 EXPO & Conference, the event devoted exclusively to optimizing on-site utilities powering automation, announced the Compressed Air & Gas Institute will again conduct a two-hour conference session. CAGI is the Event Sponsor of the Best Practices 2021 EXPO & Conference hosted at the Renaissance Schaumburg Convention Center & Hotel in Chicago from November 2-4, 2021. "We are pleased to have the Compressed Air & Gas Institute as the Event Sponsor of the Best Practices EXPO & Conference, as well as a very active participant. CAGI serves as the unbiased authority on technical and educational matters affecting the compressed air industry," said Rod Smith, Publisher, Best Practices Magazines & EXPO.

Best Practices EXPO, https://cabpexpo.com

COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

Dollinger GP-198 Coalescing Filters

Remove liquid and solid contaminants from your gas stream with the Dollinger GP-198 coalescing filter from Celeros Flow Technology. The Dollinger GP-198 is engineered for the efficient removal of entrained oil, water mist, hydrocarbon condensates and other liquids /solid particles from compressed air, natural gas and other streams. Used within its rated design conditions, the GP-198 filter can achieve an efficiency of 99.97% on 0.3 micron aerosols. Applications that would benefit from its deployment include the removal of water and oil mist from compressed air systems, the recovery of oil downstream of rotating machinery, final stage protection of high performance equipment including gas turbines or Upstream/Midstream gas refinery applications. The Dollinger GP-198 is also suited for use as a pre-filter/separator – for absorptive air applications, or as part of a gas dehydration system.

Celeros Flow Technology, www.celerosft.com

ELGi Extends Warranty to Five Years

ELGi North America announced an enhanced warranty program for its lubricated screw compressor product line. By extending its warranty from one year to five years, ELGi now provides the longest package warranty period in the industry. The new five-year package warranty is in addition to the lifetime air end coverage on the EG Series and the six-year air end coverage on the EN Series. With this, ELGi's industry-leading warranty program will ensure unparalleled value and service for ELGi customers. ELGi's expanded warranty program reinforces the company's "Always Better" brand promise and commitment to providing reliable compressed air. Compressed air is a critical component for several industries and essential for operating machinery for specialized functions such as molding, cutting, and driving pneumatic tools.

ELGi, www.elgi.com

Pattons Appoints Scott Sutton as VP and GM

Pattons announced the appointment of its new Vice President and General Manager Scott Sutton. In this role, Scott will lead Pattons' continued growth as a trusted name supporting thousands of satisfied customers for the supply and service of air compressors across Virginia, North Carolina, South Carolina, Georgia, and Alabama. Scott joins Pattons with comprehensive management and leadership experience in sales, service, and operations in various industrial businesses, including compressed air, commercial HVAC, elevators, and life safety technology and services. Most recently, he was the North America Sales Operations Leader with Carrier Corporation, where he was responsible for commercial service and aftermarket sales across the US and Canada. Scott holds a Bachelor of Science degree from East Carolina University and a Master of Science degree from the University of Notre Dame.

Pattons, www.pattonsinc.com

Walker Filtration 20 Years of Operation

Walker Filtration Inc., the American division of Walker Filtration Ltd. located in Erie, Pennsylvania, is celebrating its 20th anniversary and its success as a leader in the filtration, vacuum, and drying industries. In 2001, Walker Filtration Ltd., a UK based company, decided to expand operations into the USA. Starting in Erie, Pennsylvania with only two employees and a 4,600 square foot facility, the US location has grown substantially and is now the largest division within the Walker Filtration group. Since its humble beginnings, Walker Filtration Inc. has been dedicated to serving the local and global filtration markets within the United States, Mexico, Central and South America. The company plans to mark this important milestone with a week-long celebration for employees. Events will include a presentation by the senior management team and global colleagues, food trucks, staff recognition and service awards.

Walker Filtration, www.walkerfiltration.com

COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

Festo DSNU-S Pneumatic Cylinder

The new DSNU-S round cylinder is the latest response from Festo to the need of machine designers for smaller versions of standard components so they can shrink the footprint of their machines or production lines accordingly. The DSNU-S, part of Festo's core product range of always-in-stock components, is up to 40% slimmer, 35 mm shorter, and 50% lighter than its ISO counterpart DSNU of the same bore and stroke length. The DSNU-S is designed for direct mount installation and built for reliability and a long service life thanks to its low-wear polyurethane seals and corrosion resistant piston rod and housing. Depending on the size, the DSNU-S is available with fixed end cushioning or the Festo proprietary self-adjusting cushioning. The latter makes commissioning easier and eliminates the need for further adjustments for load changes over the lifespan of the cylinder.

Festo, www.festo.us

UCA Welcomes Glenn Burchett as Ops and Safety Manager

Universal Compressed Air, a Pennsylvania-based provider of innovative compressed air systems, has appointed Glenn Burchett as Operations and Safety Manager. Reporting to Rick Kowey, Senior VP and COO, Glenn will lead UCA's operations and HSE functions. Burchett offers more than 40 years of experience in industry, serving the Chemicals, Coatings, Plastics, Pharmaceuticals, Explosives, and Automotive industries. Within these industries, Burchett served in multiple plant management and director level positions for organizations such as BASF, Occidental, Ashland, Honeywell, and Elementis. Throughout his years in business, Burchett has gained experience in operations, engineering and construction, M & A, utilities, facilities management, lean 6 Sigma, TQM, and HSE. Burchett holds a degree in Chemical Engineering Technology from Penn State, a BS in Chemical Engineering from Ohio University and graduate work with Ohio University and WV Institute of Technology with focus in Chemical Engineering and Engineering Management.

Universal Compressed Air, https://UniversalCompressedAir.com

SONOTEC Software for Preventive Maintenance

With the software release of the SONAPHONE DataSuite S for the SONAPHONE digital ultrasonic testing device, SONOTEC introduces a workgroup license of the established maintenance PC software. SONAPHONE DataSuite S is installed via a central server on the respective company network. This allows all users to access the central data hub – regardless of location, inspection task and SONAPHONE used. With the new version, the following user roles can now be assigned with different rights: Maintenance manager: preparation and monitoring of maintenance tasks, Operator: monitoring and processing of work orders and Admin: editing rights in all projects. In addition to the new DataSuite S, three software versions are available to the user: The entry-level version SONAPHONE DataSuite V, the full version SONAPHONE DataSuite D and the SONAPHONE DataSuite S for company networks.

SONOTEC, www.sonotec.eu/en

Arcline Acquires Dwyer Instruments

Arcline Investment Management, a growth-oriented private equity firm, announced that it has acquired a controlling stake in Dwyer Instruments from the Clark family and management. Dwyer Instruments is a leading designer and manufacturer of sensor and instrumentation solutions for the worldwide process automation, HVAC, and building automation markets. The company holds 93 active and pending patents and offers a broad suite of over 40,000 configurable SKUs, enabling it to service nearly all customer-required applications. Dwyer serves over 20,000 active OEM, distribution and end-user customers through its offices in the U.S., U.K., Hong Kong, Australia and Singapore. Arcline said, "The Clark family and the Dwyer team have built a strong brand with market-leading sensor and instrumentation solutions for process automation markets. We believe the Company's differentiated products position it well to serve the growing trend toward greater process automation, connected devices and improved indoor air quality and energy efficiency."

Dwyer Instruments, www.dwyer-inst.com

COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

VPInstruments Establishes Office in China

VPInstruments announced the establishment of a new office in Shanghai, China. China has been ranking at the world's largest manufacturing country for 11 consecutive years. With the development of digitalization and smart manufacturing, more and more companies put attention on monitoring of compressed air and other industrial gases. Also, the growing awareness for energy savings brings customers to seek value from measured data. VPInstruments gives customer a perfect solution for gas monitoring and energy savings. The VPInstruments China office's main goal is contributing to sales growth and strengthen customer service in China. We will also help customers to gain awareness on energy-savings and make efforts to build a greener manufacturing industry. We would like to introduce Mr. Rex Zhu – the Managing Director of VPInstruments China. Mr. Zhu will be VPInstruments representative in China market.

VPInstruments, www.vpinstruments.com

Atlas Copco Acquires Airflow Compressors & Pneumatics

Atlas Copco has acquired Airflow Compressors & Pneumatics Ltd, a UK company. The company's customers are mainly industrial and service companies active in the North West of England. Airflow is a privately owned company and has 16 employees. The company is located in the city of Leigh and has a strong market presence in the North West region of England. "Thanks to Airflow's strong reputation in the market, this acquisition will enable us to increase the footprint of our brand portfolio products and to develop the business further in the industrial hubs of Liverpool and Manchester," said Vagner Rego, Business Area President Compressor Technique. The purchase price is not material relative to Atlas Copco's market capitalization and is not disclosed. The company will become part of the service division within the Compressor Technique Business Area.

Atlas Copco, www.atlascopcogroup.com

FLIR T865 Thermal Camera

FLIR Systems announced the latest T-Series high-performance thermal camera, the FLIR T865. Built for electrical condition and mechanical equipment inspection, and for use in research and development applications, the T865 provides ±1°C (±1.6°F) or ±1% temperature measurement accuracy, a wider temperature range between –40°C to 120°C (-40°F to 248°F), and more on-camera tools for improved analysis. A free 3-month subscription to FLIR Thermal Studio Pro and FLIR Route Creator, and a 1-month subscription to FLIR Research Studio is included with purchase. With ±1°C (±1.6°F) or ±1% temperature measurement accuracy, professionals can more confidently inspect and assess equipment health regardless of the time between inspections or changes in environment conditions.

Teledyne FLIR, www.flir.com

Total Equipment Company Acquired by DXP

Total Equipment Company, based in Coraopolis, PA, announced it has been acquired by DXP Enterprises, Inc., a publicly traded professional distribution management company providing products and services through its pumping solutions, supply chain services, and MROP products and services. Financial terms of the transaction were not disclosed. TEC will continue distributing and servicing fluid- and air-handling products in Pennsylvania, West Virginia, Ohio and beyond as an authorized Ingersoll Rand distributor. TEC will maintain their company name with established brand recognition in the Ohio River Valley region, employing a workforce of 125, operating out of five facilities. TEC's senior management team will continue with Chuck Gerbe as senior account manager, Pat Manning as operations manager and Eric Solverson as sales manager.

Total Equipment Company, www.totalequipment.com

THE MARKETPLACE

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