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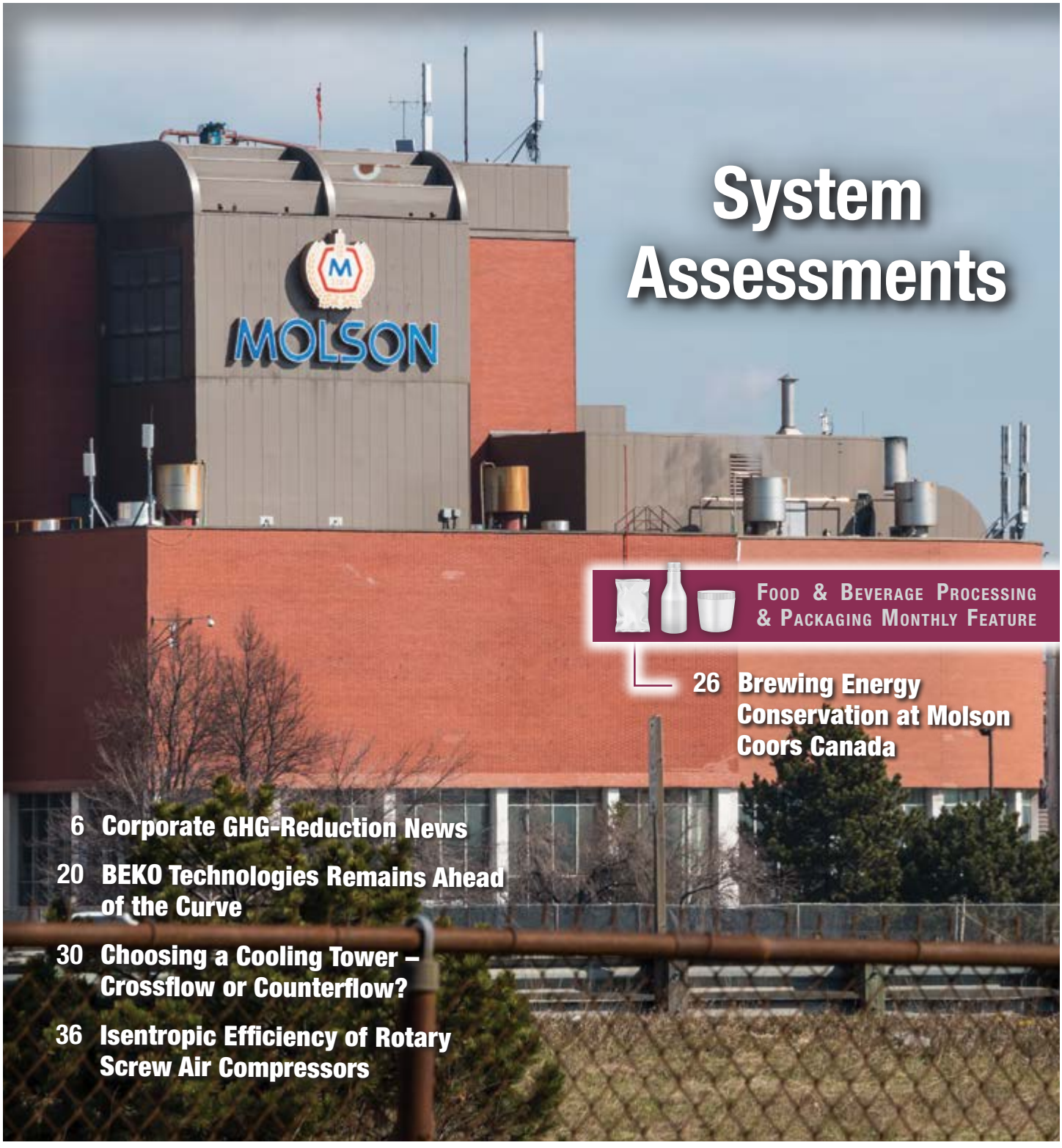

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Compressed Air Best Practices® (USPS# 17130) is published monthly except January-February combined by Smith Onandia Communications LLC, 37 McMurray Rd., Suite 104, Pittsburgh, PA 15241. Periodicals postage paid at Pittsburgh, PA and additional mailing offices. POSTMASTER: Send address changes to: Compressed Air Best Practices®, 37 McMurray Rd, Suite 104, Pittsburgh, PA 15241.

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FROM THE EDITOR

Quality, Safety and Reliability

Since beginning my compressed air career in Spain in 1992, I've had the good fortune to work with BEKO Technologies products and people. Back then, the firm I worked for sold their innovative zero-air-loss condensate drains and we learned to educate plants on the cost of compressed air – sound familiar!? We are very pleased to have had the opportunity to interview their leadership, in the U.S. and Germany, and bring you an article where they express their visions of and investments in the future.

Our subscribers, working for engineering firms and manufacturing plants, have strongly encouraged us to integrate the compressed air and chiller/cooling best practices topics into one larger, higher-impact, technical journal. We are transitioning in this direction and are grateful for the continued support of SPX Cooling Technologies, Inc. – the firm behind the Marley brand of cooling towers. Their contribution this month is titled, "Choosing a Cooling Tower for Your Application - Crossflow or Counterflow?"

Productivity, Sustainability & Energy Conservation

The monthly food & beverage industry feature article is on the efforts underway to optimize compressed air at the Molson Coors brewery in Toronto, Canada. One of the largest in Canada, they brew 3.3 million hectoliters of beer per year – the equivalent of 980 million 12 oz. cans! I hope you enjoy my interview article with their team.

For "serious compressed air people and users" (is that a thing?), we bring you a very useful article titled, "Isentropic Efficiency of Rotary Screw Air Compressors," written by Brian Parks. The Compressed Air & Gas Institute has introduced this important pressure-related factor into their rotary screw air compressor data sheets. This article will help readers understand why and what it means – it definitely helped me!

In closing, we are cautiously thrilled to see the COVID-19 metrics in our country head towards a direction where we hope officials can soon announce the safe and full reopening of the economy. Please keep our Chicago-area November 2-5, 2021 Expo & Conference in mind. We are pushing full steam ahead with our plans to make it happen and hope to see you there!

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

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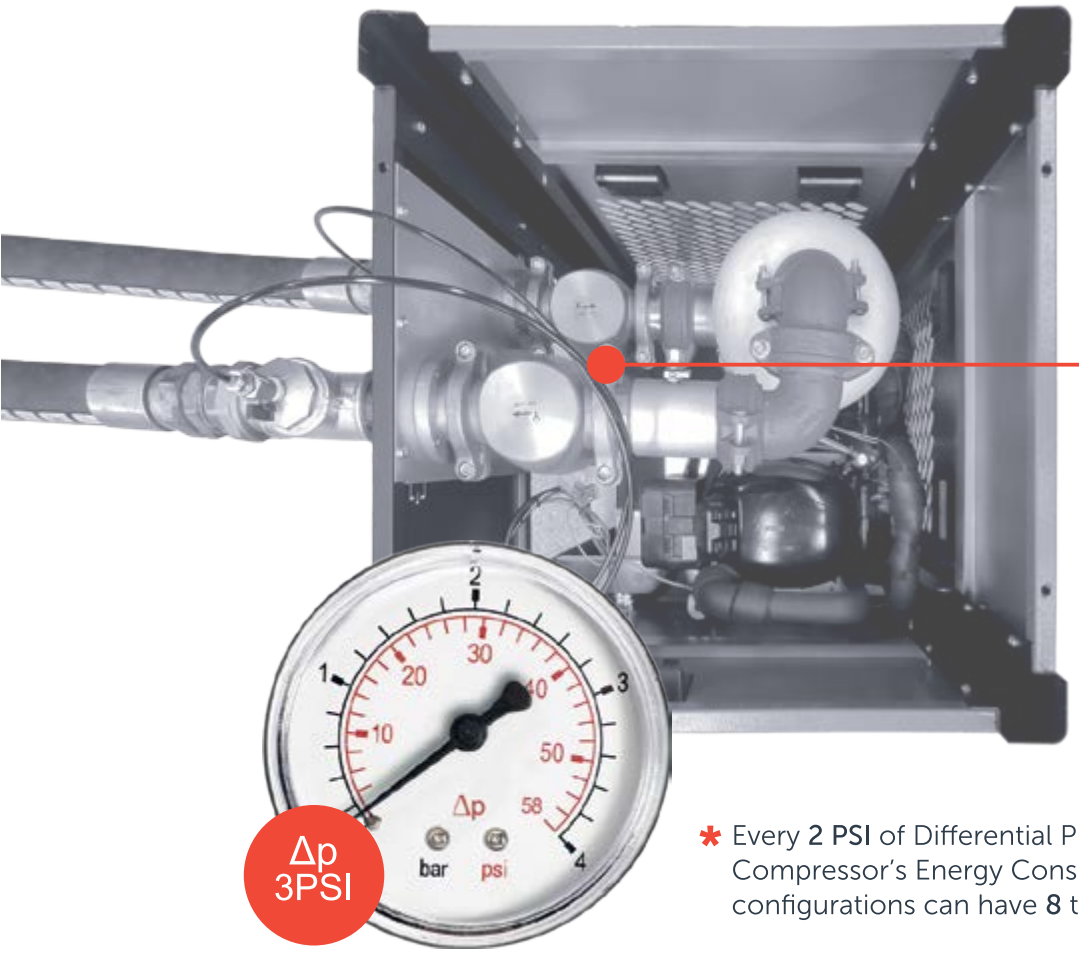

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CORPORATE GHG-REDUCTION NEWS*

* Scope 1 and 2 GHG Emissions from Direct Operations

Tate & Lyle Exceeds 2020 Environmental Targets

Tate & Lyle PLC (Tate & Lyle), a leading global food and beverage ingredient supplier, announced in April 2021, that it has exceeded its 2020 environmental targets, set using a 2008 baseline. Scope 1 and 2 greenhouse gas (GHG) emissions, generated by on-site energy use, were reduced by 25% (target of 19%), and waste to landfill was reduced by 37% (target of 30%). These environmental benefits are equivalent to the carbon captured by nearly 1 million acres of US forestry and 1,700 fewer garbage trucks taken to landfill.

Tate & Lyle's 2020 targets were a 19% intensity reduction in Scope 1 & 2 greenhouse gas emissions and a 30% intensity reduction of landfilled waste, both from a 2008 baseline.

The GHG emissions reduction target was delivered largely by investing in the transition to cleaner energy sources, such as replacing the coal boiler with a natural gas-fired combined heat and power system at the corn wet mill in Loudon, Tennessee (pictured). The waste target was met largely by eliminating certain waste streams from the production process by reclaiming organic solids which would otherwise have been sent to landfill.

In May 2020, Tate & Lyle set new ambitious environmental targets for 2030 for GHG emissions, waste, water and sustainable agriculture. The 2030 GHG emissions reduction targets have been validated as science-based by the Science Based Targets Initiative, meaning they are in line with the goals of the Paris Agreement in Climate Change.

Nick Hampton, Chief Executive at Tate & Lyle, said: "We are proud of the progress we have made against our environmental commitments over the last decade, and are now absolutely focused on delivering our new targets for 2030. Every part of our global team, from production to procurement, supply chain to sales, are playing their part to deliver our purpose of Improving Lives for Generations by caring for our planet and helping to tackle the world's biggest shared challenge of climate change."

Tate & Lyle operates the only two U.S. EPA Energy Star accredited corn wet mills in the U.S. including its facility in Loudon, Tennessee.

Sara Leeman, Global Environmental Leader at Tate & Lyle, said: "In setting our 2030 environmental commitments, we broadened our scope to include water reduction, the beneficial use of all our waste, emissions resulting from our value chain (Scope 3), and support for sustainable agriculture. Our new targets mean we are really challenging ourselves to make real and lasting improvements to the environment around us, while also continuing to grow our business."

Tate & Lyle's 2030 environmental targets, announced in May 2020, are as follows:

- By 2030, we'll have delivered a 30% absolute reduction in our Scope 1 and 2 greenhouse gas emissions with an ambition to reach a 20% reduction by 2025.
- By 2030, we'll have delivered a 15% absolute reduction in our Scope 3 greenhouse gas emissions.
- By 2025, we'll have eliminated coal from all our operations.
- By 2030, 100% of our waste will be beneficially used with an ambition to reach 75% by 2025.
- By 2030, we'll have reduced water use by 15%.
- We'll maintain sustainable acreage equivalent to the volume of corn we buy globally each year, currently 1.5 million acres, and through partnerships we'll accelerate the adoption of conservation practices.

Find out more at https://www.tateandlyle.com/purpose/caring-for-our-planet

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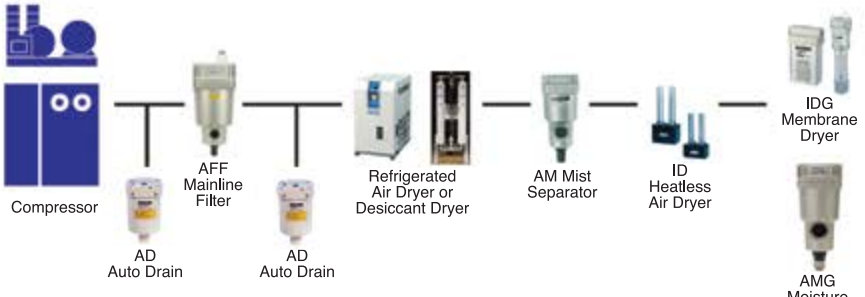

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Corporate GHG-Reduction News

Beiersdorf Group Sets Ambitious Climate Targets for 2025

Beiersdorf Group, in June 2020, publicly committed to new, ambitious climate targets, thus contributing to limiting global warming to 1.5°C. The entire Group plans a significant reduction across the full spectrum of its CO_2 emissions by 2025, which applies equally to both its Consumer and tesa Business Segments. Energy-related emissions (Scopes 1 and 2) are to be reduced by 30 percent in absolute terms by 2025. In addition, a clear cut is also planned in Group-external CO_2 emissions (Scope 3), by suppliers and service providers, for example: The Group has set a value chain GHG emissions-reduction target of 10 percent by 2025.

These ambitious climate targets have now been officially endorsed by the "Science Based Targets initiative" (SBTi), meaning this organization confirms that Beiersdorf's targets are aligned with independent global climate scientists' latest findings. To date, 111 companies worldwide have set themselves targets that received SBTi approval. Currently only eight companies headquartered in Germany are among these, with just a further eight around the world from the "Consumer Products & Durables" sector.

"Climate change confronts us as a society with tremendous challenges. We are taking action based on our sense of duty and our unshakeable belief that we must commit fully and immediately to climate protection, to counteract global warming and its severe consequences," explains Stefan De Loecker, Chairman of the Beiersdorf AG Executive Board. "The official endorsement by the SBTi of our new, ambitious climate targets is welcome confirmation that we are on the right track to actively co-shape a sustainable future for our global society."

In addition to the SBTi's endorsement of climate targets for the entire Beiersdorf Group, the Consumer Business Segment has set itself the target of a 30 percent absolute reduction in its Scope 3 emissions by 2025. On top of this, all Consumer Business Segment production sites are to become climate-neutral by 2030.

Beiersdorf, and in particular its Consumer Business Segment, has made major progress in recent years in reducing its CO_2 emissions: The Group successfully cut its energy-related CO_2 emissions by 60 percent in absolute terms between 2014 and 2019. Various energy-saving measures, the LEED seal-winning sustainable design of production and office locations, and the transformation to green logistics are just a few examples of the Beiersdorf Group's uncompromising climate protection program. Since the end of 2019, 100 percent of the electricity purchased worldwide comes from renewable energy sources.

In its CARE BEYOND SKIN sustainability agenda, launched at the beginning of 2020, Beiersdorf is bundling its climate commitment and action measures in the focus area "For a Carbon Positive Future". Alongside the central issue of climate change, this sustainability agenda defines a further six focus areas in which the Group's Consumer Business Segment, comprising the well-known brands NIVEA and Eucerin, is committed to making a meaningful and measurable contribution to the environment and society.

Also the tesa Business Segment has been implementing numerous measures to increase energy efficiency and reduce CO_2 emissions in the past years. For example, specific CO_2 emissions per ton of end product have been reduced by 34.5 percent since 2015, saving almost 60,000 tons of CO_2 per year. At present, 27 percent of electricity is used from renewable sources and 38 percent is produced by combined heat and power generation (CHP).

On February 16, 2021, Beiersdorf announced it further stepped up its efforts in sustainability in the reporting year with the "Care Beyond Skin" sustainability agenda. In the current ranking of the NGO "Carbon Disclosure Project", Beiersdorf has been listed as a "Climate A List Company" for its environmental transparency and ambitious targets on climate action. Both business segments – Consumer and tesa – now meet 100% of their electricity needs from renewable sources. In 2020, Consumer switched to recycled materials for 90% of all its PET bottles in Europe. It also met the target of using 100% sustainably certified palm oil in all cosmetics manufacturing.

More information on Beiersdorf's Consumer Business Segment sustainability commitment and progress is available at: www.beiersdorf.com/sustainability. For more information about the tesa Business Segment, please visit: https://www.tesa.com/en/about-tesa/responsibility.

Jean-Francois Pascal, Vice President Corporate Sustainability, Beiersdorf

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Corporate GHG-Reduction News

Danone recognized as global environmental leader with triple "A" score given by CDP

Danone announced, in December 2020, that it has been highlighted for the second year in a row as a world environmental leader by the international non-profit organization CDP, whose disclosure and scoring system is recognized as the gold standard of corporate environmental transparency.

Out of the 5,800+ companies scored in 2020, **Danone is one of the only 10 companies that achieved a place on the A List for the three environmental areas** covered by CDP of climate change, forests preservation and water security.

Since its first voluntary environmental disclose to CDP in 2010, Danone has gradually increased its score to reach the Triple "A" list last year for the first time. Being included this year again in these three prestigious lists is a great recognition of Danone's ambitious and longstanding actions to build a low carbon economy, protect natural resources and increase its brands' transparency.

Henri Bruxelles, Chief Operating Officer End-to-End Design-to-Delivery, declared: "For the second year in a row, Danone is recognized as a 'Triple A company' by the CDP. This is an important milestone and achievement that confirms how our 'One Planet. One Health' frame of action and our strategy to focus on grounded and local impact have turned into a deep transformation agenda with major steps taken by our business and brands in 2020: evian and Volvic became carbon neutral from the source to the consumers; the US organic milk leader Horizon Organic set the ambition to become carbon positive in 5 years; Karicare also embarked in a neutrality journey. We launched 'We Act for Water' movement, a set of urgent actions to foster the protection and access to water resources. And we created the first ever segregated Palm-Oil supply chain in the U.S. as part as our commitment to eliminate deforestation. I would like to thank all our teams for their dedication and passion in transforming our value chain, inventing a low carbon economy and protecting natural resources. Transparency is crucial to reinforce consumers' trust in our brands and to provide the financial community with the right tools to assess the resilience and impact of our business models".

The full methodology and criteria for the A List is available on CDP's website at: https://www.cdp.net/en/companies/companies-scores.

Danone's recent natural resources protection and climate achievements and ambitions:

- evian and volvic carbon neutral certification from source to consumer
- Wexford's baby-formula facility carbon neutral certification (which produces leading brands like *Aptamil, Cow & Gate* and *Nutrilon* for consumers in 41 countries around the world).
- Karicare announcement to become the first milk formula brand in Australia and New Zealand to achieve carbon neutrality by 2030.
- Horizon Organic ambition to become Carbon Positive by 2025.
- Reach its full scope carbon emissions peak in 2019, five years ahead of its original plan and commitment and one year prior to the 1.5°C Science-Based Targets commitment. Going forward, its GHG emissions in absolute levels are set to decrease.
- Creation alongside two traders of the first ever Segregated Palm-Oil supply Chain in the U.S. as part of its commitment to eliminating deforestation.
- Publication of its Water Policy in order to act to preserve and restore water resources, today and for future generations
- Launch of "*WeActForWater*" by Danone Water brands, a set of urgent actions, ambitious objectives, and new investments, deployed by Danone's iconic water brands, including evian, Volvic, AQUA and Bonafont, it focuses on responsible packaging, climate neutrality, watershed preservation and access to safe drinking water.

For more information visit Danone at https://www.danone.com

Colgate-Palmolive Earns 11th Consecutive ENERGY STAR®

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Corporate GHG-Reduction News

Partner of the Year Award

In recognition of its commitment to 100% renewable electricity and to reducing its carbon footprint, Colgate-Palmolive Company announced (April 13, 2021) it has received a 2021 ENERGY STAR® Partner of the Year Award for Sustained Excellence for its leadership in energy efficiency across global operations. This marks the 11th consecutive year that Colgate has been recognized by the U.S. Environmental Protection Agency and the U.S. Department of Energy as an authority in energy-saving practices.

This honor recognizes Colgate's commitment to global sustainability, which is further defined in its 2025 Sustainability & Social Impact Strategy. Over the past year, Colgate has achieved measurable progress towards meeting the ambitious sustainability goals outlined in this Strategy, including:

- Developing Colgate's first Renewable Energy Master Plan, which was prompted by two new targets: To source 100% renewable electricity for global operations by 2030 and to become net zero carbon in operations by 2040.
- Implementing 49 new capital energy projects around the world estimated to reduce Colgate's carbon footprint by nearly 9.2 million kilograms – equivalent to 1,000 homes' energy use for one year.
- Working with Colgate's largest suppliers to help increase their climate and energy awareness, with 35% of suppliers responding to our CDP Supply Chain request indicating they now have energy reduction goals.
- Continuing to hold "Energy Treasure Hunts" to encourage employees to uncover causes of energy waste and find opportunities for improvement. Since 2012, this program has identified nearly 2,400 energy savings projects with the potential to reduce Colgate's energy consumption by about 400,000 MWh and CO_2 emissions by more than 140,000 metric tons – equivalent to the carbon sequestered by over 2 million trees grown for 10 years.

The honor from ENERGY STAR® also recognized Colgate's progress towards its long-time goal of reducing Scope 3 emissions by educating consumers about how to save water while using their products. Colgate's Save Water campaign has helped consumers avoid more than an estimated 8.3 million metric tons of CO_2 and 155 billion gallons of water since 2016 (that's the amount of water it takes to fill 234,000 Olympic-sized pools).

"Since the Colgate brand is in more homes than any other, we have the opportunity to help people build sustainable habits into their everyday lives," said Ann Tracy, Colgate's Chief Sustainability Officer. "We are honored to be recognized by ENERGY STAR® for Colgate's achievements in sustainability and ongoing efforts to lead action on climate change – from encouraging suppliers to reduce their energy consumption to making our operations even more energy efficient to helping consumers lead more sustainable lives through the use of our products."

The 2021 ENERGY STAR recognition

demonstrates Colgate's ongoing momentum in its mission to reimagine a healthier, more sustainable future for all people, their pets and our planet. As of 2020, Colgate certified its 20th TRUE Zero Waste plant – more than any other company in the world, was named the top performing Household Products company on the Dow Jones Sustainability Indices, and committed to furthering climate progress through participation in the UN Global Compact's Water Resilience Coalition. Additional details about Colgate's energy management and investment practices can be found in the Sustainability section of Colgate's website. For ongoing updates regarding Colgate's sustainability progress and accomplishments, follow Colgate on LinkedIn.

More background information about ENERGY STAR can be found at: energystar.gov/about and https://www.energystar.gov/about/origins_mission/energy_star_numbers.

For more information about Colgate's global business and how the Company is building a future to smile about, visit www.colgatepalmolive.com.

Firmenich Achieves 4th Consecutive CDP Triple "A" Recognition

Firmenich, the world's largest privately owned fragrance and taste company, announced in February 2021, it has ranked on the CDP Supplier Engagement Leaderboard 2020, setting the pace in environmental leadership. The leaderboard highlights the top 7% of companies that engage with their global supply chains on climate reporting and managing carbon emissions via CDP. This is Firmenich's fourth recognition from the gold standard in corporate environmental reporting this year, adding to the Group's third consecutive CDP Triple "A" score in climate, water, and forests management.

"It is a great honor to be one of only ten companies in the world to be ranked by CDP

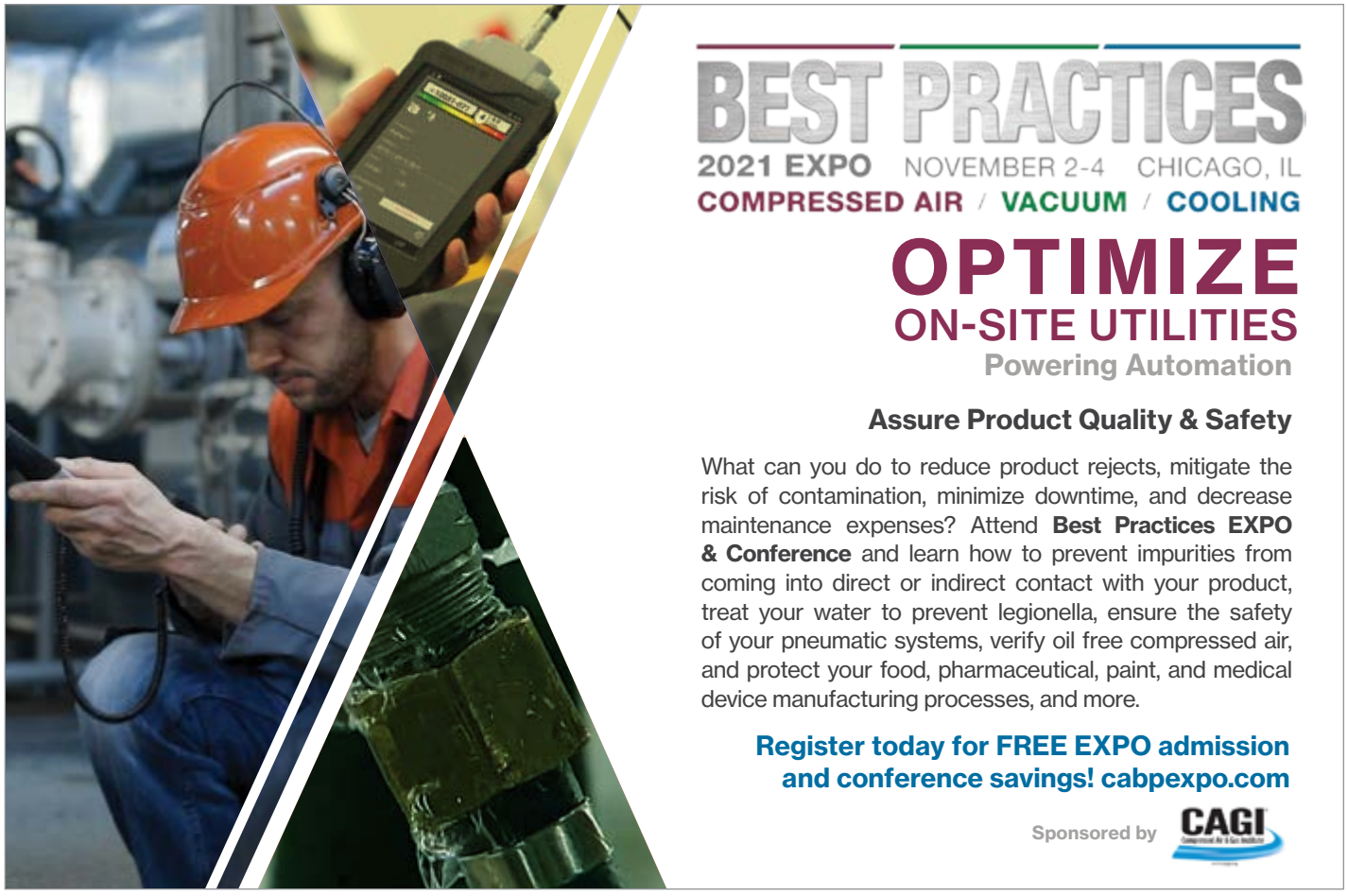
Corporate GHG-Reduction News

Firmenich Recognition (continued from page 13)

on its Supplier Engagement Leaderboard and to achieve triple "A" status for climate change, water security, and forests," said Gilbert Ghostine, CEO Firmenich. "This fourth top score marks world-class recognition of our environmental performance and illustrates how Firmenich's sustainability leadership is well entrenched within our company and beyond, with a positive impact on our supply chain."

"Companies' emissions don't end at the factory door. CDP data shows a company's supply chain emissions are, on average, over 11.4 times greater than its direct emissions. Meaningful corporate climate action means engaging with suppliers to reduce emissions across the value chain," said Sonya Bhonsle, Global Head of Value Chains, CDP. "We congratulate Firmenich for making it on to the CDP Supplier Engagement Leaderboard. This demonstrates that they are setting the pace in environmental management and their commitment to reduce emissions and lower environmental risks across their supply chain."

"We were the first perfume and taste company to engage with our suppliers through CDP when we started disclosing our environmental performance more than 10 years ago," said Neil McFarlane, Senior VP Quality, Health, Safety, Security & Environment, Firmenich. "As we power towards carbon neutrality in our direct operations by 2025, we are very proud of this achievement highlighting the incredible work done by our environmental and procurement teams, and hope it will inspire other companies to develop their own path towards zero impact."



This is the Group's third consecutive listing on CDP's annual Supplier Engagement Leaderboard. CDP assessed more than 5,000 companies on their supply chain engagement strategies, with almost 400 (7%) companies earning a place on the Leaderboard. Discover the business case for supply chain action and how it improves competitiveness and resilience in CDP's *Transparency to Transformation: A Chain Reaction*.

Learn more about Firmenich's ambitious 2025 and 2030 ESG targets at https://www.firmenich.com/company/sustainability/strategy/esg_ambitions_2030.

The Group's 2020 environmental initiatives and performance are detailed in its Performance and Sustainability Report 2020.

Carlsberg Opens Water Recycling Plant Becoming World's Most Water Efficient Brewery

On May 6, 2021, Carlsberg is inaugurating a new, revolutionary water recycling plant that recycles 90% of the process water at the Carlsberg brewery in Fredericia, Denmark. This makes the Fredericia brewery the most water efficient in the world. Learnings from the brewery will enable the group to reach its target to virtually eliminate water waste globally by 2030.

With the new water recycling plant, the Fredericia brewery will save more than 500 million liters of water a year. 90 percent of process water from the production of beer and soft drinks will be recycled in the production facility. Water consumption will be halved from the current 2.9 hl of water per hl of beer to 1.4 hl of water per hl of beer.

Corporate GHG-Reduction News

"We are immensely proud to be able to unveil the world's most water efficient brewing facility. Water is a basic ingredient in all our products, so water resource management is a high priority. Our water to beer ratio has always been low. Now we are taking it a step further. By recycling process water in our production, we are virtually eliminating water waste," says Philip Hodges, EVP Integrated Supply Chain, Carlsberg Group.

Water is not only a basic ingredient in the products from Carlsberg but is also essential to the sustainability of the societies where the brewery operates, and clean water is a priority in the UN Sustainable Development Goals. Therefore, Carlsberg has a goal of eliminating water waste by 2030 as part of the group's sustainability program Together Towards Zero.

"We have a goal of zero water waste globally in 2030. As a global company, we have a responsibility to support the UN Sustainable Development Goals, and as a brewery, we have a special responsibility to reduce water waste in our global production. The new water recycling plant in Fredericia will generate important learnings that can be implemented across our breweries in the rest of the world," says Carlsberg Group CEO, Cees 't Hart.

It is estimated that the water recycling plant will also reduce the brewery's energy consumption by 10% through own biogas production and recirculation of hot water, further contributing to the Together Towards ZERO sustainability program.

The new plant is a result of broad collaboration in the *Danish partnership for Resource and water efficient Industrial food Production (DRIP)*. For the project to succeed both businesses, technical experts and health and food authorities have had to rethink how we use and reuse water and expand the limits of water purification and circularity.

"The plant in Fredericia is built on a new and innovative approach to cleaning and recycling process water where you, among other things, use UV-light to eliminate bacteria. At the same time biogas is produced as a residual product, which can be used to produce energy. It is a whole new form of circularity in food production. In fact, the process water ends up being clean enough to drink, but we are only using the water to clean the production facilities," says Carlsberg Denmark Brewing

Director, Anders Kokholm.

The new facility will be inaugurated at a special event attended by the Danish Prime Minister as well as representatives from Carlsberg and the DRIP-partnership.

About Together Towards Zero

Together Towards ZERO is Carlsberg's vision for a better and more sustainable future in a time with serious challenge such as climate change and water scarcity. The program consists of four goals: ZERO CO_2-emissions, ZERO water waste, ZERO irresponsible drinking culture and ZERO work-related accidents. Each of the four ambitions is supported by individual and measurable goals, which are to be obtained by 2022 or 2030.

Our business depends on the availability of clean water. No water, no beer. But the supplies are becoming more and more scarce in some regions where our beer is brewed, so we must use it sparingly.

With a goal to reduce water consumption in our breweries by half by 2030 and reduce it by 25 percent by 2022, we are obligated to eliminate water waste. Through community partnerships we help preserve common sources of water around our breweries with a focus on areas that are classified as high risk.

Read more about Together Towards Zero at https://www.carlsberggroup.com/sustainability/our-ambitions/

Vanessa Butani Appointed New VP Group Sustainability at Electrolux

Effective May 1, 2021, Vanessa Butani, current Head of Sustainability for Business Area Europe, will take on the role as VP Group Sustainability at Electrolux. She will replace Henrik Sundström, who is retiring from the company.

Vanessa Butani will lead Electrolux forward in the company´s For the Better 2030 framework, which covers the full value chain, from operations and products to helping consumers live more sustainably while using Electrolux products.

"This is an extraordinary opportunity to work across the entire organization to drive our sustainability agenda," says Vanessa Butani. "We have ambitious but achievable objectives and I look forward to the journey ahead to drive positive change both at Electrolux and in the daily lives of our consumers."

In her role, Vanessa Butani will become a member of the Electrolux Consumer Experience Leadership Team and report to Ola Nilsson, Chief Experience Officer at Electrolux.

Vanessa Butani, VP Group Sustainability, Electrolux

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"I'm very pleased to have Vanessa joining the team," says Ola Nilsson. "She will play a key role in taking Electrolux sustainability agenda to the next level, and ensure we have a strong voice as a corporate sustainability leader as well as connect our sustainability conviction with the consumer."

Vanessa Butani has a strong track record in the sustainability field. During an earlier eight-year period at Electrolux, she held several managerial roles in sustainability and connectivity. After three years outside Electrolux she re-joined the company to lead sustainability for Business Area Europe in January this year. She is replacing the current VP Group Sustainability, Henrik Sundström, who will be retiring after 36 years with Electrolux.

"Henrik has been instrumental in establishing Electrolux as a global leader in sustainability. We would not be where we are today without his foundational work in multiple roles across the company. I have no doubt that he will continue to stir impactful discussion with his knowledge and insights going forward," says Ola Nilsson.

The search for Vanessa Butani's successor as Head of Sustainability for Business Area Europe will begin shortly.

Visit https://www.electroluxgroup.com/en/category/sustainability/

Owens Corning Publishes 15th Annual Sustainability Report

Owens Corning (NYSE: OC) published, on April 1st, 2021, its 2020 Sustainability Report. The company's 15th annual report, titled "Beyond Today, Shaping Tomorrow," presents the results of the company's sustainability work in the decade since 2010, as well as progress toward its ambitious slate of 2030 goals.

"Owens Corning faced unprecedented challenges in 2020, but remained committed to our broad sustainability agenda," Chairman and Chief Executive Officer Brian Chambers said. "This report highlights the amazing accomplishments of our 19,000 employees who work hard every day to meet the needs of today while making the world a better place for the future. We've come a long way since we set our second set of long-term goals in 2010, and we have a clear vision of the work that lies ahead."

In the report, the company's sustainability results and commitments are presented through 16 topics that reflect stakeholders' priorities. The topics span every aspect of sustainability, including product innovation, environmental footprint reduction, and the company's impact on people and communities.

Frank O'Brien-Bernini, Senior Vice President and Chief Sustainability Officer said, "The most critical competence of sustainability talent, all across our company, is the ability to lead change. Every individual can shape the future. Our goals for 2030 and beyond, grounded in what the world needs us to get done, compel us to collaborate to accelerate progress."

This year's Sustainability Report includes:

- Results covering the 10-year goal period that concluded in 2020, with commentary from company leaders.
- Disclosures in response to the GRI Comprehensive standard, the Advanced UN Global Compact, the Task Force on Climate-related Financial Disclosures (TCFD) and the Sustainability Accounting Standards Board (SASB) reporting requirements.
- Information about product innovations

for sustainability and the company's work to drive transformation for a circular economy and a decarbonized future.

- Discussion of the impact of COVID-19 on Owens Corning's employees and work around the world, as well as the company's response.
- An overview of the company's inclusion and diversity commitment and initiatives, including details about how the company is working to address racial equity and social justice issues.
- A new feature, "Speaking of Sustainability," in which members of the Owens Corning team discuss their work and their personal interest in sustainability-related topics.

In the past year, the company has earned top rankings and high scores from several external organizations, including ranking #1 on the annual 100 Best Corporate Citizens list from 3BL Media for the second consecutive year. In addition, Owens Corporate was included on the CDP A List for both climate and water, and earned a spot on the Dow Jones Sustainability World Index for the 11th consecutive year (as industry leader for the Building Products Group for the eighth straight year).

Access the 2020 Sustainability Report and learn more about sustainability at Owens Corning at: https://www.owenscorning.com/corporate/sustainability.

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BEKO Technologies Remains Ahead of the Curve

By Mike Grennier, Compressed Air Best Practices® Magazine

DRYPOINT® X desiccant dryers ready for shipment at the BEKO Technologies plant in Atlanta, Georgia.

Norbert Strack and Yannick Koch, Co-Managing Directors, BEKO Technologies (left to right).

When a company serving the compressed air industry bundles a value-based approach with a commitment to developing technologies used to improve safety, save costs and protect the environment it can only mean one thing: Success.

Such is the case with BEKO Technologies GmbH, headquartered in Neuss, Germany. Started decades ago in a backyard garage in Düsseldorf, Germany, the independent, family-owned business has since grown to become a global leader in innovative technologies and complete systems for the treatment and management of compressed air and compressed gas.

Strong growth is also projected for the future, said Yannick Koch, Co-Managing Director, BEKO Technologies, especially given the

company's strategic focus and its history of being ahead of the curve.

"Quality, efficiency and safety are what really counts in the end for users of compressed air. Those are their main goals" said Koch. "Our vision is to help them achieve those goals and do it in way that allows all of us to treat the environment more gently."

Continuity in Leadership

Berthold Koch founded BEKO Technologies (https://www.beko-technologies.com/en/en/) in 1982 and led the company until he unexpectedly passed in 2007. Yet the company's long tradition of a well-run family business continues. Yannick Koch, Berthold's eldest son, was named Co-Managing Director of the company earlier this year. The change in leadership also included the naming of Norbert Strack as Co-Manager. Former Managing Director Manfred Lehner retired at the end of 2020 after 30 years with the company.

Koch assumes responsibility for BEKO Technologies Sales, Service, Product Management, Marketing and Human Resources. Since 2015, he has served as the company's Head of Global Corporate Development. Before joining BEKO Technologies, Koch was involved in various digitalization projects with an international industrial company. He is also an active shareholder in BEKO Holding where he helps shape socially relevant issues.

Strack, who joined BEKO Technologies in 2016 after serving in a variety of leadership roles at various industrial companies, assumes Finance and IT responsibilities, which is in addition to his responsibilities of Research and Development, Production, Supply Chain and Quality.

The newly named leaders plan to continue to foster BEKO Technologies' culture of making long-term investments in compressed air technologies built around customers' needs and industry trends.

"The market continues to gradually shift from being focused only on compressed air as a utility and volume to where it's more about quality and efficiency, as well as sustainability. This is crucial to our value-based approach, as is the need to put the customer first," Koch said. "It will continue to be important to our long-

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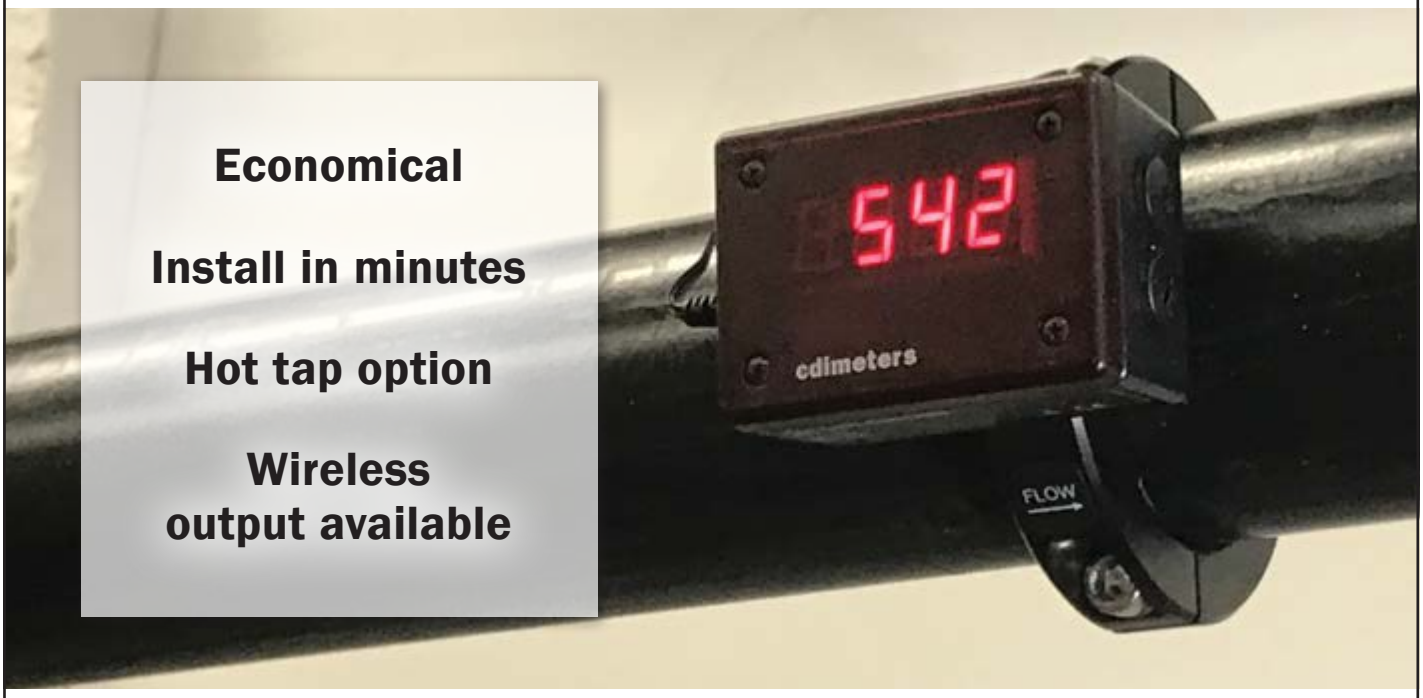

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BEKO Technologies Remains Ahead of the Curve

term success."

Ingenuity Runs Deep

BEKO Technologies' business strategy is rooted in ingenuity, dating to the very beginning when it pioneered the use of zero air loss condensate drains with the introduction of the BEKOMAT® condensate drain. The company, which was far ahead of the curve at the time when it created the BEKOMAT, developed the technology to help users save energy at a time when energy wasn't a priority for most.

Sticking to its belief in sustainability, BEKO Technologies pushed forward with the concept of zero loss drains, which are now prevalent in

A wide range of technologies and systems from BEKO Technologies help users efficiently and effectively treat and manage compressed air and compressed gas.

Many BEKO Technologies' products are manufactured in Neuss, Germany, such as flanges for its line of CLEARPOINT® compressed air filters.

compressed air systems today. The drains open on demand to remove condensate and other liquids without allowing any compressed air to escape from the system. The result is often substantial energy cost savings.

Another prime example of being ahead of the sustainability curve is the company's introduction of oil-water separators. The technology – also widely used today – removes oil from condensate so the treated condensate (or effluent) can be safely discharged into the municipal wastewater system.

Strack said the level of innovation required for the development and introduction of technologies unlike anything that came before doesn't happen by chance. In the case of BEKO Technologies, it's rooted in the company culture.

"Part of our culture means allowing for engineering creativity," he said. "You have to have a certain openness for thinking about what's around the corner and developing new ideas. That's definitely something that happens here. That's our environment."

Proving Compressed Air Quality

While BEKO Technologies has established a rich history of innovation in condensate technology, it hasn't rested on its laurels since it's ahead of the curve in compressed air measurement and management.

"It's very important for compressed air users to have systems in place that provide high quality air, and it's equally important to have systems in place that provide proof of clean air," said Strack, regarding the company's pioneering work in instrumentation.

To that end, BEKO Technologies has invested heavily in the development of flow, pressure, pressure dew point and particulate measurement instruments. Additionally, it continues to push the envelope in technologies used to monitor and measure liquid oil and oil vapor in compressed air systems. The METPOINT® OCV compact, for example, lets users continuously and precisely check for residual oil vapor content in compressed air.

Not surprisingly, information is everything at BEKO Technologies when it comes to managing the quality of compressed air. It's why the company has focused in recent years on monitoring systems and sensor technologies that make it easier for users to visualize, understand, analyze and act on various air quality metrics.

Koch said the company's dedication to monitoring and measurement also means BEKO Technologies will continue to expand its offerings of cloud-based solutions in keeping with the customer demands and the industry's progress toward Industry 4.0.

"It's necessary to know what's going on in a system in order to improve it," Koch said. "We're now laying the foundation for having our products and solutions networked in a way that brings everything together and provides that information through the cloud. That's the next level."

Diverse Air Purification Solutions

A commitment to take things to the next level also describes how BEKO Technologies has evolved into a major, global manufacturer

BEKO Technologies Remains Ahead of the Curve

of diverse air purification solutions.

Today, it offers refrigerant, desiccant, and membrane compressed air dryers engineered to satisfy a wide range of drying temperatures and air quality classes, as well as pressure dew points from 59°F (15°C) to -94°F (-70 °C). Additionally, its compressed air filters and water separators are engineered to help users efficiently achieve various levels of compressed air purity.

To keep pace with demand for its air purification technologies, the company produces highly engineered, high-capacity dryers, such as its Heat of Compression (HOC) and blower purge air dryers, in Germany. It also manufactures high-volume, heatless and blower operated desiccant dryers in the United States, the latter featuring patented, self-adjusting software that adapts to ambient conditions, in addition to its line of unique membrane dryers.

In all, BEKO Technologies operates a total of six manufacturing facilities in Germany, the United States, India and China. Among them is its 30,000-square-foot headquarters operation in Neuss where it manufactures a large portion of its products and systems. The company also operates subsidiaries in Germany, the United States, England, France, Benelux, China, Japan, Scandinavia, India, and Spain. Currently, BEKO Technologies employs more than 500 people and has 14 sales offices located throughout the world.

The value of having manufacturing operations and sales and service representation in strategic regions cannot be understated, said Strack.

"It allows us to best address the needs of the local marketplace, as well as the standards and regulations for each area – and it gives us different opportunities," said Strack. "We also prefer to source materials locally, which is in addition to providing quality service at the local level."

BEKO USA Shines Bright

An area of the world where BEKO Technologies' business strategy and passion for innovation has led to significant growth in particular is the United States. Since it set down roots in Tulsa, Oklahoma, in 1990, BEKO USA has become the largest and fastest growing subsidiary of the company.

Today, the American headquarters is located in Atlanta, Georgia. The facility there also serves as the manufacturing plant for the company's DRYPOINT® M membrane dryers, as well desiccant dryers, oil-water separators, and filtration components. The operation currently employs 87 people working in Engineering, Manufacturing, and Assembly.

BEKO Technologies, Corp. President Tilo Fruth said the formation of BEKO USA more than 30 years ago, positions the company to best meet the needs of customers throughout the United States, Canada, Mexico, and South America. He said the decision also continues to pay dividends in terms of growth, noting BEKO USA's newly opened Mexico subsidiary.

Success in the Americas, said Fruth, has been especially rewarding since it's a unique challenge for any company to put down stakes and grow in a market outside its home base.

"It's difficult in the beginning to step foot in a new country especially when you consider

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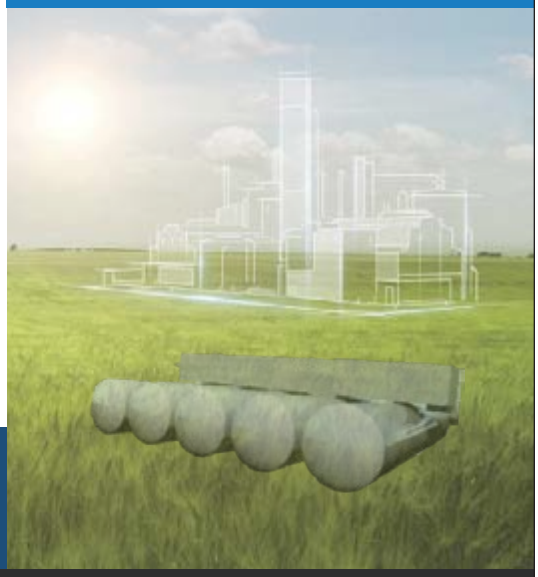

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the importance of understanding the market," Fruth said. "But we've been successful and that's because the customer-focused approach is very strong here and we combined that with long-standing innovations that originated at our headquarters in Germany."

Carving a Path

As with any thriving company, BEKO Technologies continues to adapt to the needs of the marketplace and customers, no matter the region or industry served. Additionally, it continues to pursue technologies and opportunities aligned with its strategic focus.

In short, BEKO Technologies is a company that will go where others aren't willing or able to go in order to best to serve the industry.

"It's about providing the right solution, whether it's focusing on the lifecycle cost of the system versus the low initial cost, or saving energy and improving potential sustainability, or ensuring air quality. It's something we're founded on and we're going to stick to it as the market continues to catch up," said Koch. BP

For more information about BEKO Technologies visit www.bekousa.com

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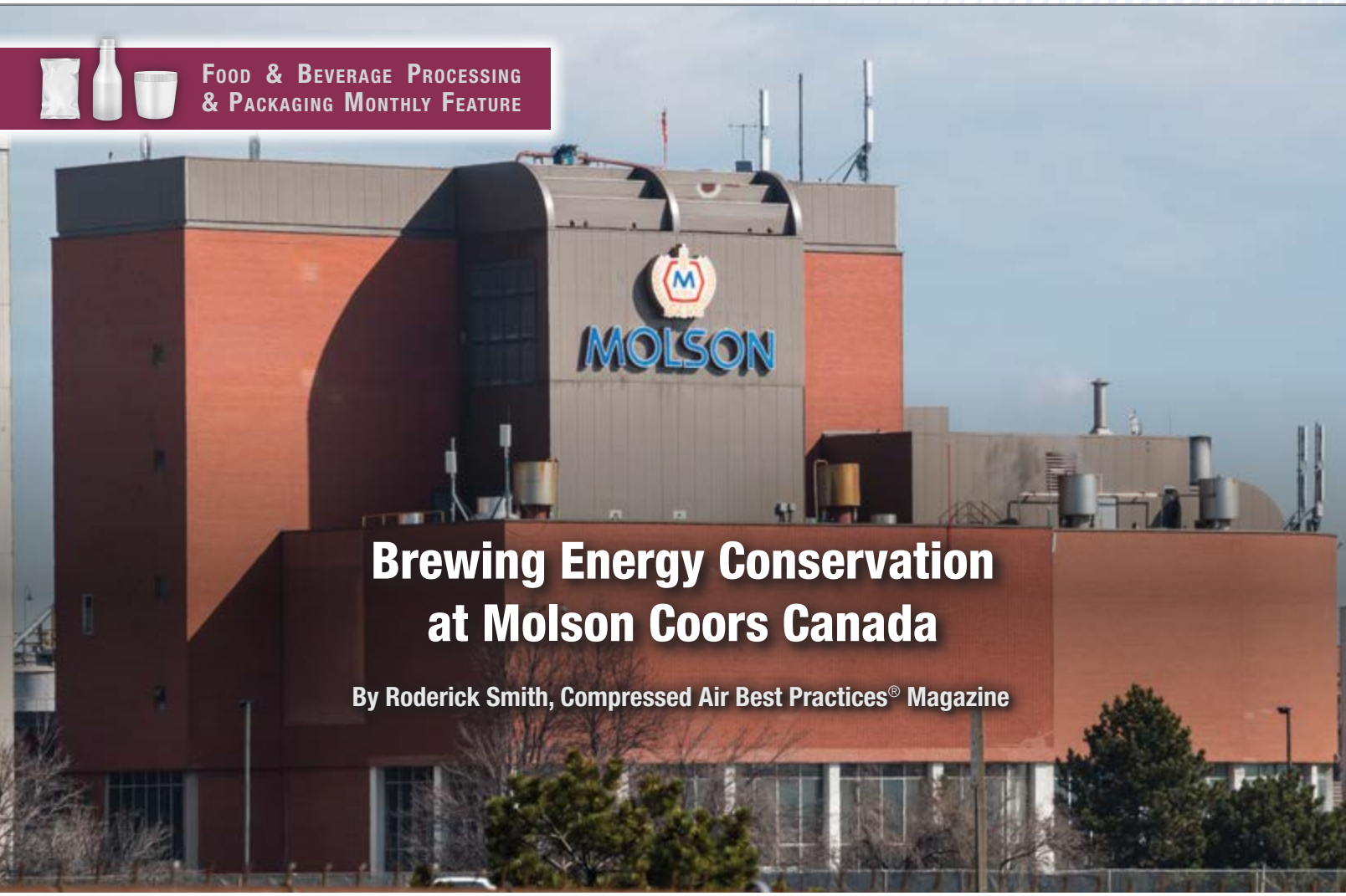

Brewing Energy Conservation at Molson Coors Canada

By Roderick Smith, Compressed Air Best Practices® Magazine

In 2021, Compressed Air Best Practices® Magazine interviewed members of the Molson Coors Canada team, at their Toronto Brewery, to gain an understanding of the work being done to improve energy efficiency. The team members interviewed were Doug Dittburner (Chief Engineer), Antonio Mayne (Utilities Optimization Engineer) and Khalil Daniel (Engineering Intern).

Good morning, can you briefly describe the Molson Coors Toronto Brewery?

Good morning. The Molson Coors Toronto brewery is the largest brewery in our Canada network and it's one of the largest breweries in Canada. We produce 40 brands of beer packaged in a few different sizes of cans, bottles, and kegs. We perform the full brewing process from receiving raw materials, brewing and then packaging finished goods. This facility brews 3.3 million hectoliters of beer per year – the equivalent of 980 million 12 oz. cans.

What energy efficiency goals exists at Molson Coors and what are your roles in achieving them?

Molson Coors launched a project in 2016 to analyze our enterprise carbon and energy footprint. We conducted an audit of our operations to help us identify our key sources of emissions and opportunities to reduce our impacts. By 2025, we aim to reduce absolute carbon emissions from our direct operations by 50%, and achieve an absolute carbon emissions reduction of 20% across our supply chain. To support this goal, we are investing in renewable energy solutions and performance tracking technology to support great accountability and visibility in our operations.

Our energy mix here at our Toronto brewery is electrical at 30% of total energy consumption and fuel making up the 70% balance. Refrigeration chillers for a central ammonia system are the largest electrical energy consumer, followed by compressed air and then motors and drives. Natural gas is by far our largest fuel source. Our team acts as a technical resource on all topics utility-related; electricity, fuel, water and secondary utilities like compressed air, refrigeration and steam. We support the powerhouse, maintenance and production teams.

In Ontario, we have a 97% carbon-free electrical grid as our energy sources are hydro and nuclear. In order for our site to reduce carbon emissions, the focus is on fuel. We have many projects focusing on this. Electricity, however, is rather expensive in the province

Chief Engineer Doug Dittburner "marshalls" a compressed air leak program engaging production and maintenance staff!

at an average price of $0.10 USD per kWh. We believe only California has a higher average cost for electricity in North America.

What key performance indicators are your monitoring to measure energy performance?

Our energy intensity measure in Canada (energy use normalized for production) is kWh per hectoliter (100 liters). In the U.S., they use kWh per barrel (117 liters). I (Antonio) started in this role in 2017 and since then our total (fuel and electricity) energy intensity, at this brewery, has dropped by 20% as of late 2020. We expect it to drop by 30% by the end of 2021 and forecast electrical energy intensity use to drop by 20% during the same time period.

This reflects the corporate decision to prioritize reducing the impact of our operations and to prioritize visibility and accountability. There's been a lot of support within the brewery and from the corporate network.

What kind of compressed air measurement and monitoring is done?

Compressed air was identified years ago as an energy-intensive utility and we have focused resources to optimize it's use. We have four oil-free rotary screw air compressors and run two at a time. Their energy consumption is monitored. The compressed air dryers provide a -40˚F (-40˚C) pressure dew point which is monitored to ensure air quality.

We also monitor compressed air pressure. We monitor it at the main header and at a few other points downstream where we can pull data. Our average pressure at the header is 105 psig.

We also have local pressure gauges to make sure we have enough pressure.

Brewing Energy Conservation at Molson Coors Canada

Compressed air flow is monitored to measure our demand for compressed air. We have divided up the entire plant into four sections to be monitored. The sections are the brewing area and the three major areas of production (cans, bottles, kegs). Most of the compressed air flow meters we use are pitot-tube flow meters. They don't have pinpoint accuracy but what we are looking for is changes in trends to identify problems or validate improvements.

An oil-free rotary screw air compressor at the Molson Coors Toronto Brewery.

Compressed air average pressure, flow and dew point is measured and monitored.

We distribute reports to each major department showing their use of compressed air along with targets for use-reductions for each department. Right now, the targets focus on base load reductions of compressed air use – particularly compressed air leaks.

How do you go about reducing the level of compressed air leaks?

We monitor compressed air use in the four sections of the plant at the department level and monitor some individual pieces of equipment. In the brewing area, for example, we have a pneumatic conveying transport system to remove the remaining husks after we use the malt. This system uses blowers with compressed air as the back-up. We monitor this unit to make sure only the blower air (less than 15 psig) rather than our 105 psig compressed air is being used.

Doug is really good at engaging staff in our compressed air leak program. We have free lunches for both finding and fixing a leak. He made tags available for all production and maintenance personnel. When you find a leak you tag it and submit a copy to a raffle box. If you fix a leak your ballot stays in the raffle box permanently. Sooner or later your name will be drawn and the participation is awesome.

Antonio previously worked in maintenance roles – in both the packaging and brewing areas of the brewery. That experience helped tremendously by providing familiarity with the actual operation of most aspects of the brewery. He's worked closely with most of the staff and management and is not an outsider asking for changes. Having this trust already established makes it clear he is providing support to the maintenance team-not looking for problems.

We are entering all our compressed air leaks into our general maintenance system so they are all tracked. We'll have an identifier in one

of the fields and we can see how we are doing, if parts on order and if they scheduled to be fixed. Leaks are in the backlog of maintenance items just the same as fixing a motor. If leaks are on a separate spreadsheet, it can get lost.

One way we find leaks is by scheduling someone to look for leaks during planned stops on the production line, when we take it down for 10-15 minutes. Operators and maintenance use these planned stops to clean and inspect the productions lines and they are an opportunity to find compressed air leaks. We also perform dedicated leak inspections. We bought an ultrasonic imaging leak detector – you can see the air leak and it's pretty neat. The image is very clear and makes it easier to find in a noisy environment.

We've been doing compressed air leak detection for a few years now. Since we started, we've seen a 20 to 30% reduction in weekend usage of compressed air – which is how we calculate our leak load. We are pretty much idle on weekends and this allows us to make this measurement.

Dino DeFilippis, from Airnergy Management Services, monitors air compressor energy consumption.

How else have you reduced unnecessary use of compressed air?

We have optimized shutdown procedures and shut down equipment which doesn't need to be on. We also use valves to kill compressed air supply to an entire area, over the weekend, when this area is idle. This way there will be no leaks over the weekend.

Some of our case packers have solenoid valves which can be closed. We like that way better because it's easier for maintenance to turn them open them back up. For operators, we give it to them to do in respective areas. Doug's power engineering team will do valving on a header.

Thank you for sharing Best Practices at Molson Coors. BP

For more information about Sustainability at Molson Coors visit https://www.molsoncoors.com/sustainability/sustainability-reporting

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Choosing a Cooling Tower for Your Application – Crossflow or Counterflow?

By Eric Rasmussen, Senior Product Manager, SPX Cooling Technologies, Inc.

Choosing between crossflow (left) and counterflow (right) cooling towers for your application depends on the factors most important to your project specifications.

➤ With efficient heat exchange an important requirement in the design of an HVAC system, the type of cooling tower you specify to support your project's unique cooling goals requires careful consideration. After determining the process parameters required for your application – tonnage, range, and approach – cooling tower capabilities can be analyzed.

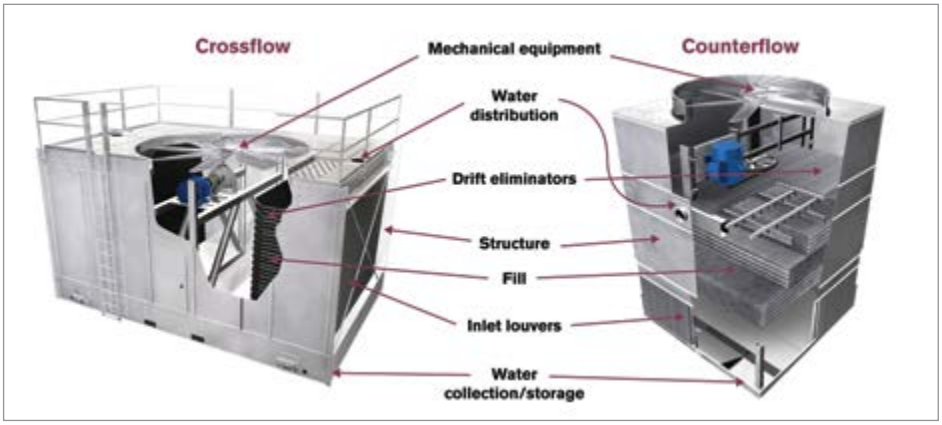
Because induced draft crossflow and counterflow cooling towers both have distinct advantages, the design requirements and conditions specific to your application determine the appropriate cooling tower for your project. The fundamental difference between crossflow and counterflow cooling towers is how the air moving through the tower interacts with the process water being cooled. In a crossflow tower, air travels horizontally across the direction of the falling water. In a counterflow tower, air travels vertically upwards in the opposite direction (counter) to the direction of the falling water.

Physical Size – Footprint

Every cooling tower requires a certain volume of air to effectively exchange the heat in the process water. Thus, a cooling tower's plan area and height must be considered with your specific application in mind.

At cooling capacities up to about 750 tons (3295kW), a counterflow cooling tower with its vertically-stacked components may require less plan area than a crossflow cooling tower. Beyond the 750 ton mark, because crossflow tower modules are stacked vertically at higher tonnages, a counterflow tower offers little to no advantage in footprint versus a crossflow tower and can sometimes take up more plan area.

Depending on the application, a crossflow cooling tower may require less total area than a counterflow tower even at heat loads less



While structural and mechanical components of crossflow and counterflow cooling towers are similar, application-specific design requirements should determine the tower type.

than 750 tons because of the location and number of air inlets – a crossflow tower has two air inlets compared to four air inlets on a counterflow tower.

Maintenance

Routine maintenance is essential to extend the life of a cooling tower so maintenance accessibility is a consideration. The method by which air interacts with the process water in each tower type creates two different styles of plenum areas. This space has a direct effect on maintenance accessibility.

In crossflow cooling towers, the air flow is turned from the horizontal air inlet direction to the vertical discharge direction behind the fill media. This creates a tall, easily accessible plenum inside the tower for inspection and servicing of the cold water basin, drift eliminators, motor, drive system, and fan at the top of the cooling tower.

Counterflow cooling towers turn the air from horizontal to vertical flow beneath the fill media. While this gives good access to the cold water basin, the rest of the tower is more compact with lower overall height. This creates limited access to the spray system, eliminators, motor, drive system, and fan.

Operating Weight

The overall shipping and operating weights of a crossflow cooling tower may be heavier than a counterflow tower due to the crossflow tower's larger footprint, additional structural supports and steel casing for ease of maintenance access and additional piping for water distribution. However, lighter capacity cranes are typically required to hoist individual modules, which are stacked vertically at higher tonnages. Potential crane and logistical savings must be weighed against the need for additional picks per cell.

Gravity-Fed and Pressurized Water Distribution

A significant design difference between a crossflow and counterflow cooling tower is the method by which water is distributed over the fill media.

In a crossflow cooling tower the process water is pumped to the top of the tower into the hot water distribution basin. The distribution basin is out of the way of the airstream and is gravity fed. The only driving force behind the nozzles is the hydrostatic head of water above the nozzle itself. One advantage of gravity-fed crossflow water distribution is that it can be cleaned while in operation since it is easily accessible from the outside top of the cooling tower.

In a counterflow cooling tower, process water is pumped into a sealed header box. The header box then distributes the water into branch arms and nozzles, creating a pressurized water distribution system. Unlike a gravity-fed system, a counterflow tower's water distribution system requires pumps to be shut off to clean the nozzles and the cold water basin. To inspect and clean nozzles, one must enter a crawl space inside the tower.

Variable Flow and Cold-Weather Operation

There are significant energy savings opportunities if a cooling tower can be operated under variable flow conditions. When the conditions allow (reduced heat load or cool ambient conditions), reducing the flow rate over the cooling tower instead of the process

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Choosing a Cooling Tower for Your Application – Crossflow or Counterflow?

keeps the process operating in its most efficient manner. Variable flow, or "turndown," is a way to maximize the effectiveness of the installed cooling tower capacity for any process flow.

Crossflow cooling towers with outboard water inlets and integral inlet louvers handle very high turndown rates (up to 70% or more). Counterflow cooling tower distribution systems are not as easily modified; up to 50% turndown may be achieved but additional pump head may be required.

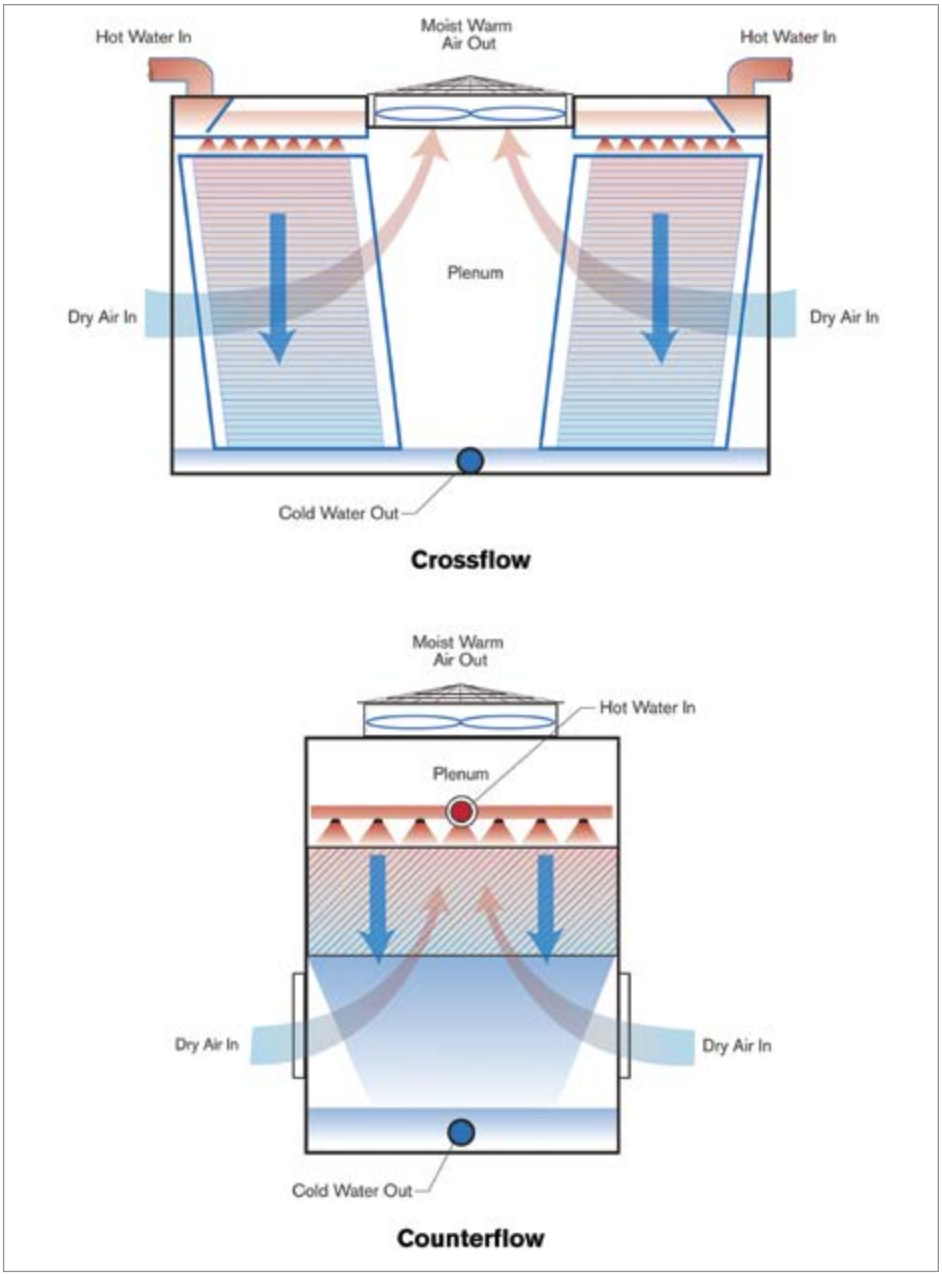
Cold-weather operation is of paramount importance when choosing a cooling tower to operate in sub-freezing conditions. Ice formation is an ever present danger and can damage tower components including the high efficiency heat transfer fill media. The effects of ice damage can result in higher condenser water return temperatures and increased chiller energy consumption during peak cooling season.

A crossflow cooling tower performs especially well in cold weather. With its gravity-fed water distribution system – even with turndown as low as 30% of design flow – water can still be evenly distributed across the fill. Even distribution prevents water channeling, ice development, unpredictable performance, scale buildup, and potential damage to the tower. During cold-weather operation, the use of devices such as cups or dams in the hot water basin can keep the heat load toward the weather exposed face of the fill, alleviating ice buildup.

At low-flow operation, a counterflow cooling tower has less head pressure and fewer nozzles to distribute water across the entire cross-section of the fill allowing for uneven distribution. Uneven distribution leads to water channeling, ice development, unpredictable performance, scale buildup, and potential damage to the tower.

Minimum flow rates are both tower type and model specific. Be sure the cooling tower manufacturer understands the minimum anticipated flow rate and confirm the tower can handle the required hydraulic range.

Louvers are designed to keep water within a cooling tower. They prevent splash out which can turn to ice in sub-freezing ambient conditions. Integral louvers incorporated into the fill of some crossflow towers help keep water contained in the fill. This provides no external surface for ice development to occur. Counterflow tower louvers are separate from



The fundamental difference between crossflow and counterflow cooling towers is how the air moving through the cooling tower interacts with the process water being cooled. Air travels horizontally across the direction of the falling water in a crossflow tower. In a counterflow tower air travels vertically upwards in the opposite direction (counter) to the falling water.

the fill near the cold water basin. The turbulent water splashing in the cold-water basin can lead to ice accumulation on the louver faces during freezing weather.

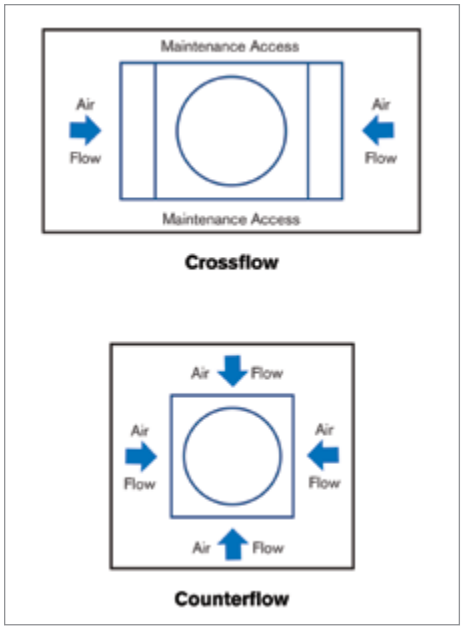
Heat Transfer Fill

Both counterflow and crossflow fills can vary in shape and size. The appropriate fill for your cooling tower should be based primarily on water chemistry. Suspended solids, biological growth potential, and information about constituents in the process water that can lead to scaling must be determined early in the design process.

Balancing the performance required by a specific fill material and the water chemistry of the process water are the significant factors in choosing the right fill and type of cooling tower for your project. The best fill type for your application, either film fill or splash fill, depends on biological growth potential and the level of suspended solids in your source water. Cooling tower manufacturers publish guidelines that can be used to help determine the quality of your process water source.

High-efficiency PVC film fill is typically used in cooling towers with clean water. This fill is manufactured in cross-corrugated sheets that stretch the falling water into a thin film on the surface of the PVC sheet. The water then interacts with the airflow through the tower to facilitate the heat transfer. Because more surface area for air-to-water contact is available, film fill types are more efficient than splash fills.

Film fill is not appropriate for all applications due to its higher propensity for clogging and fouling. Splash fill is more tolerant of dirty water sources but has lower thermal efficiency that requires a larger structure. This often

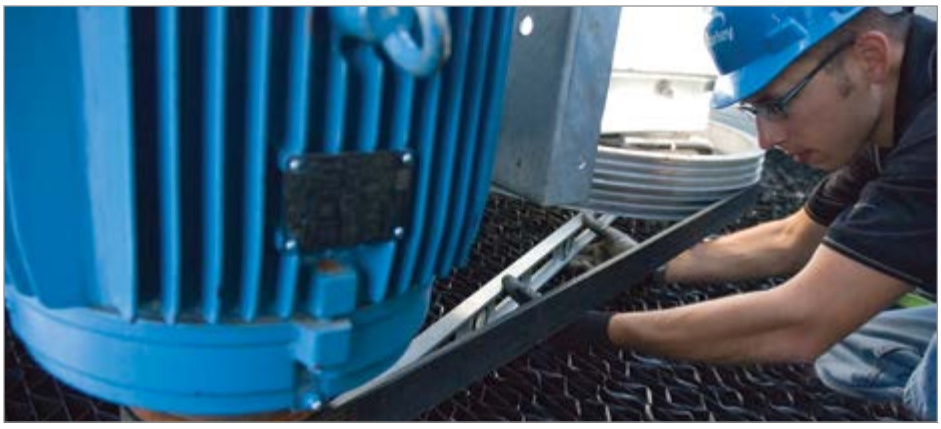


Depending on the application, a crossflow cooling tower may require less total area than a counterflow tower because of the location and number of air inlets; a crossflow tower has two air inlets compared to a counterflow tower's four air inlets.

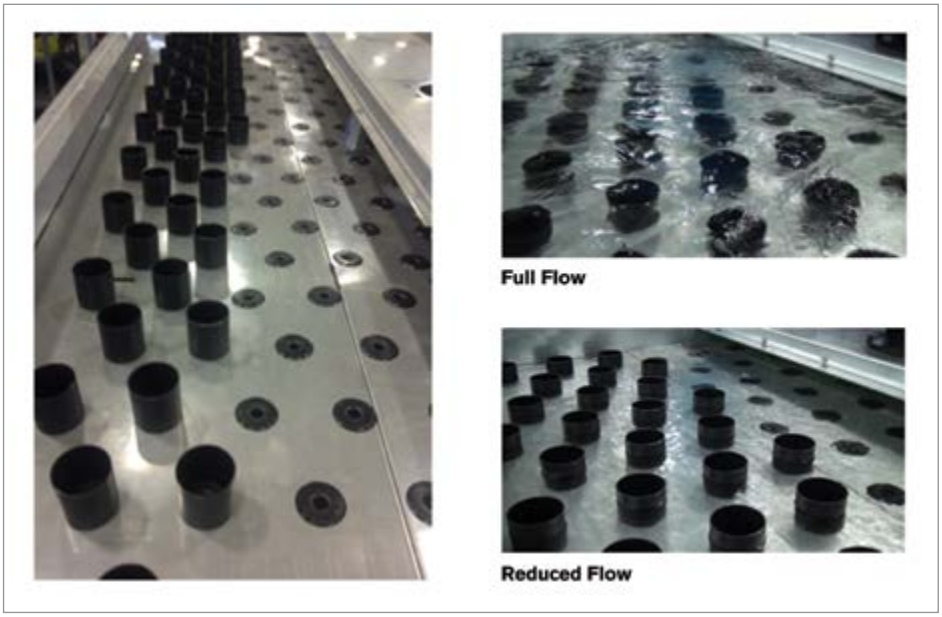
CROSSFLOW AND COUNTERFLOW COOLING TOWER DISTINCTIONS
CROSSFLOW ADVANTAGES
Capable of up to 70% turndown
Performs well in cold-weather applications
Water distribution system can be cleaned while tower is in operation
More access for routine maintenance
Uses high efficiency heat transfer fill
COUNTERFLOW ADVANTAGES
Smaller footprint up to ~750 tonnage (with film fill)
Potentially lower operating weight
May be easier to install
Accommodates wide range of fill types to address source water quality

Choosing a Cooling Tower for Your Application – Crossflow or Counterflow?

A crossflow cooling tower's large plenum area allows easy maintenance.



A counterflow cooling tower's stacked components are less accessible for service.



Variable Flow Cups – when operating a crossflow cooling tower in cold weather, devices such as cups or dams in the hot water basin keep the heat load toward the side of the fill exposed to the elements.

makes it more costly than film fill type towers for a given load.

Clog-resistant film fill provides a happy medium between the efficacy of high-efficiency film fill and splash fill in both thermal performance and clog resistance.

Summary

Choosing between a crossflow and counterflow cooling tower for your application depends on the factors most important to your project specifications. Both types are effective means to support chillers and achieve efficient evaporative cooling with a few distinct design differences. BP

Eric Rasmussen is a senior product manager and licensed engineer at SPX Cooling Technologies, Inc., Overland Park, KS.

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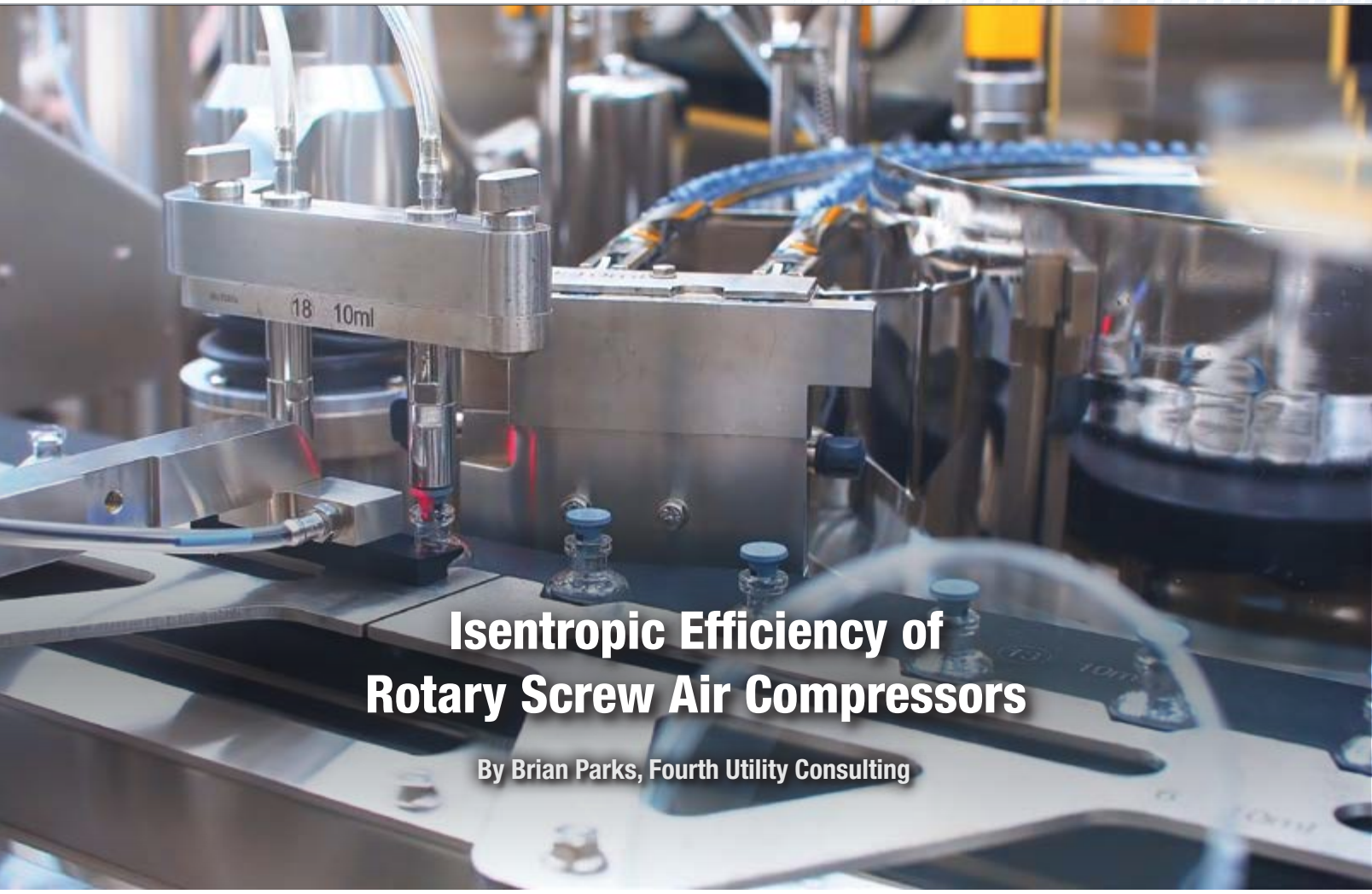

Isentropic Efficiency of Rotary Screw Air Compressors

By Brian Parks, Fourth Utility Consulting

Many astute air compressor users have noticed the Compressed Air and Gas Institute (CAGI) air compressor data sheets, dated after June 2020, have a new term listed; isentropic efficiency. Isentropic Efficiency will be the new standard of reference for a true comparison of the overall efficiency of air compressors at any rated discharge pressure. Now users can see which company produces the most efficient product with an easy reference percentage number. The compressed air industry, in conjunction with CAGI, has been trying to make fair comparisons between air compressors for years. Let us go back in history and review this historical progression before we get into explaining isentropic efficiency (IE) in detail.

Background

In the 1970s, when rotary screw air compressors were new to the marketplace, their competition was primarily double acting reciprocating air compressors. These were very efficient air compressors, at least in the initial years of operation. Clients looked at rotary screw air compressors because the piston machines required lots of expensive maintenance, had vibration related problems and were noisy. Also, most required water-cooling which was becoming more costly over time.

Comprehensive standards for testing the performance of air compressors did not exist in the industry until the early 1990s, when ISO 1217 was the first commonly standard test method implemented. Until that time, air compressor manufacturers tested their machines in slightly different ways. For example, there was no standard for inlet temperature or humidity – which can make a big impact on performance. Some air compressor manufacturers were only measuring the performance of the bare air end, with none of the losses for the inlet valve, coolers, separators, and coolers. This might mean one manufacturer to another could have a package power performance difference of 5% or more.

During this period of history, some air compressor manufacturers did not even publish rated capacity on their brochures. Subsequent audits of the 1970 – 1980 machines have proven they averaged about 425 CFM per 100HP. The double acting reciprocating machines were producing at least 500 CFM per 100HP. With better technology in rotor profiles and tighter machining tolerances, today's rotary screw machines are getting up to 530 CFM for single stages and 600 CFM for two stages – per 100HP motor size.

Until the mid-1970s, end users did not really pay attention to energy costs because electricity was 3 to 5 cents per kilowatt-hour. Most clients had no idea how much an air compressor costs to operate because it was only a small part of a larger bill. Many of the installations employed oversized piston compressors. When they were replaced with less efficient rotary screw machines it did not manifest in any significant change to the power bill. Everyone was simply overjoyed by the lower maintenance cost.

In the 1990s all vendors had their capacities posted on their brochures, but the published capacities varied considerably. For example; one company had a 100 HP compressor rated at 563 CFM at 100PSI, while the rest of the industry was averaging about 490 CFM. Eventually it was found that this particular model was using a 1.40 service factor motor, running at over 125 HP shaft power. It was performing as published but the actual power used was not clear to the customer.

Motor service factors and HP or KW rating has been an evolving subject also. The majority of the industry was using 1.15 service factor motors and using about 10% of the available 15%. Service factor is really the maximum amps, available at a given voltage, that the motor can reliably deliver, given the other design conditions of temperature, altitude (cooling capacity of the air) and Power Factor. Motor manufacturers will nameplate motors any way the customer desires i.e. a 100 HP 1.25 SF motor or a 125HP 1.0 SF are essentially the same motor if in the same frame size. The air compressor manufacturers select and apply the motors for their compressors in many different ways, but the maximum amps available at a rated voltage is the final determining factor.

In the 1980s the industry became more exacting in what was meant by flow. One company started publishing "free air delivery" or FAD, which measures the air at the inlet and published the total power used. They looked less efficient than the others, but they were really about the same.

This article is not casting any dispersions on any of the air compressor manufacturers. They were all publishing good data, they just measured in different ways!

ISO 1217 Annex C

Originally published in 1947, the CAGI Handbook has been the go-to resource for everything compressed air. Now in its seventh edition, and available electronically on the CAGI website, the illustrated handbook contains engineering information from leading manufacturers and valuable reference data about compressed air systems. In the late 1990s, CAGI and their member companies agreed upon a standard where they would measure their machines to the same criteria. CAGI settled on the globally accepted ISO 1217 Annex C, which is the base standard still used today. This test is for the volume flow through an air compressor. CAGI and Pneurop have adopted a definition for Standard Air that is 20 degrees C, 1 bar absolute, and 0% RH. When testing to 1217, you correct back to the inlet conditions of the compressor to calculate the volume that flowed through the compressor. If you want to know the mass that flowed through the compressor, you have to convert the volume flow to standard conditions. That gives you the SCFM (mass) flowing through the compressor at any given ambient conditions.

Isentropic Efficiency of Rotary Screw Air Compressors

CAGI Air Compressor Data Sheets

Once ISO 1217 Annex C was accepted, CAGI and their members agreed to publish a simple standard datasheet for fixed speed compressors that looks like the following. See figures A and B. As part of the CAGI Performance Verification Program, member companies are required to post these datasheets on their website with easy access for customers. An independent testing lab goes to each air compressor manufacturer and randomly selects three compressors to be shipped to the lab. The lab then tests those compressors and verifies that their performance matches the published data sheets. The results of all the tests are available at https://www.cagi.org/pdfs/cagirotarydirectory.pdf

Let's examine the lubricated, fixed-speed rotary screw air compressor data sheet (see Figure A). Variable speed air compressors have data sheets in the same format, but their isentropic efficiency uses a weighted average of full load, 40 percent, and 70 percent of full load.

- Items 1 & 2: manufacturer's name and model, type of cooling (water or air-cooled) and whether it is a single or two stage compressor.
- Item 3: flow capacity at full load. That number is the amount of cubic feet measured at the discharge, adjusted to the inlet conditions at the time of the test per ISO 1217 Annex C.
- Item 4: full load operating pressure. This is the pressure where the capacity and total package power is measured.
- Item 5: maximum full flow pressure. On machines with a load/unload operating system, this is the highest pressure at which the machine will operate before the machine unloads. For this type of machine, this pressure can be 3 to 15 PSI higher than the full load operating pressure. At this pressure, the machine's total package power will be higher.
- Items 6 & 7: nameplate horsepower (HP) of the main drive motor and the efficiency of the motor. The higher number Item 7 is, the more efficient the motor. Some manufacturers have an option for higher efficiency motors.

- Items 8 & 9: fan motor nameplate HP and efficiency. The fans are normally designed to operate at 40°C (104°F). If the air compressor is in a warmer location, a larger fan may be required.
- Item 10: total package operating power when there is no demand on the compressor. This is very important for calculating the efficiency of a load/unload compressor at partial load conditions.
- Item 11: full load operating power in kilowatts, measured at the full load operating pressure. Includes fans, controls and any other device in the package using energy.
- Item 12: package specific power is the amount of kilowatts required to make one hundred (100) CFM. The lower the number-the more efficient the machine.
- Item 13: isentropic efficiency-which will be explained later. The higher the number is, the more efficient the air compressor is. Figure A is the format of the current fixed speed data sheet. The original data sheets, that started in 2002, had less information.

The capacity ratings have a tolerance of up to 7% for capacity and 8% for specific power. The tolerance goes lower for larger air compressors. A tolerance is required because it is impossible to make a compressor that will produce the same flow at the same power

COMPRESSOR DATA SHEET
In Accordance with Federal Uniform Test Method for Certain Lubricated Air Compressors
Rotary Compressor: Fixed Speed

MODEL DATA - FOR COMPRESSED AIR			
1	Manufacturer: **ABC Compressor**		
2	Model Number: **12A 22B 40 - 125 psig / 460V/3ph/60Hz**	Date:	**8/12/19**
	[X] Air-cooled [ ] Water-cooled	Type:	**Screw**
		# of Stages:	**1**
3*	Rated Capacity at Full Load Operating Pressure [a, e]	**175.0**	acfm [a,e]
4*	Full Load Operating Pressure [b]	**125**	psig [b]
5	Maximum Full Flow Operating Pressure [c]	**125**	psig [c]
6	Drive Motor Nominal Rating	**40**	hp
7	Drive Motor Nominal Efficiency	**93.6**	percent
8	Fan Motor Nominal Rating (if applicable)	**1.3**	hp
9	Fan Motor Nominal Efficiency	**80**	percent
10*	Total Package Input Power at Zero Flow [e]	**9.1**	kW [e]
11	Total Package Input Power at Rated Capacity and Full Load Operating Pressure [d]	**36.12**	kW [d]
12*	Package Specific Power at Rated Capacity and Full Load Operating Pressure [e]	**18.69**	kW/100 cfm [e]
13	Isentropic Efficiency	**72.77**	Percent

*For models that are tested in the CAGI Performance Verification Program, these items are verified by the third party administrator.
Consult CAGI website for a list of participants in the third party verification program: www.cagi.org

NOTES:
a. Measured at the discharge terminal point of the compressor package in accordance with ISO 1217, Annex C; ACFM is actual cubic feet per minute at inlet conditions.
b. The operating pressure at which the Capacity (Item 3) and Electrical Consumption (Item 11) were measured for this data sheet.
c. Maximum pressure attainable at full flow, usually the unload pressure setting for load/no load control or the maximum pressure attainable before capacity control begins. May require additional power.
d. Total package input power at other than reported operating points will vary with control strategy.
e. Tolerance is specified in ISO 1217, Annex C, as shown in table below:
NOTE: The terms "power" and "energy" are synonymous for purposes of this document.

CAGI Compressed Air & Gas Institute Member

Volume Flow Rate at specified conditions		Volume Flow Rate	Specific Energy Consumption	No Load / Zero Flow Power
m^3 / min	ft^3 / min	%	%	%
Below 0.5	Below 17.6	+/- 7	+/- 8	+/- 10%
0.5 to 1.5	17.6 to 53	+/- 6	+/- 7	
1.5 to 15	53 to 529.7	+/- 5	+/- 6	
Above 15	Above 529.7	+/- 4	+/- 5	

ROT 030.1

12/19 Rev 3 This form was developed by the Compressed Air and Gas Institute for the use of its members participating in the PVP. CAGI has not independently verified the reported data.

Figure A. Sample CAGI Data Sheet for a lubricated, fixed speed rotary screw air compressor.

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Isentropic Efficiency of Rotary Screw Air Compressors

consistently.

Air Compressor Isentropic Efficiency

The specific power item, in the data sheet, is a calculation intended to show the most efficient compressors. The calculation is (total package KW x 100)/ CFM. The lower the specific power, the more efficient the package. Using specific power for comparison works perfectly if the compressors have the same full load pressure rating. The problem is that many of the compressor manufacturers rate their compressors at different pressures as shown in Figure 1.

The Energy Policy and Conservation Act, as amended, (EPCA) covers certain commercial and industrial equipment, including compressors, for which the Department of Energy (DOE) is authorized to establish energy conservation standards. DOE has determined that EPCA covers commercial and industrial air compressors and has been considering energy conservation standards and test procedures for such equipment. In January 2020, DOE has published a Federal Register notice of final rule

Brand A	100	123 - 125	150	174 - 175	195 - 200	—
Brand B	100	115	125	135	150	190
Brand C	100	125	150	175	200	—
Brand D	115	150	165	—	—	—
Brand E	100	110 - 115	125	150	175	200

Figure 1. Pressures used (psi) for power ratings of lubricated fixed speed rotary screw air compressors.

pertaining to energy efficiency standards for compressors, titled 85FR1504. CAGI and their members fully support the use of isentropic efficiency as the standard of comparison on compressor efficiency. The simplest way to define isentropic efficiency is shown in Figure 2.

Comparing Isentropic Efficiency

This isentropic calculation is based on full load operation only for fixed speed compressors.

$$\eta_{isen} = \frac{16.52 \times \left(\left(\frac{p_2 + 14.5}{14.5} \right)^{0.2857} - 1 \right)}{P_{spec}}$$

η Stands for Efficiency. *"isen"* is an abbreviation for isentropic.

Figure 2.

The highest isentropic efficiency currently published is about 92% and the lowest about 50%. In general, machines above 100 HP have a higher average IE than do those with lower HP. This is because two stage compressors typically start at 100 HP and have higher isentropic efficiencies. With IE, a user can compare a 100PSI compressor to a 150 PSI machine to see which is more efficient. As of July 2020, all CAGI members who participate in the performance verification program have the isentropic efficiency posted on their CAGI datasheets. Above 250 HP, isentropic efficiency is not required on the datasheets, so we used calculated IE for this comparison. Figure 3 shows a comparison of 100 HP compressors

SPECIFIC POWER VS. ISENTROPIC EFFICIENCY SINGLE-STAGE COMPRESSORS

Compressor	Drive Motor Nameplate Rating	Maximum Full Flow Operating Pressure	Full Load Operating Pressure	Rated Capacity at Full Load Operating Pressure	Input kW @ Rated Flow and PSIG	Specific Power kW/100 cfm	Isentropic Efficiency %
A	100 hp	157	150	435	87.2	20.00	82.55
B	100 hp	145	135	465	89.8	19.31	81.10
C	100 hp	115	100	520	91.0	17.50	75.94
D	100 hp	150	150	415	96.3	23.15	71.45
E	100 hp	110	100	466	91.3	19.60	67.82

Figure 3.

SPECIFIC POWER VS. ISENTROPIC EFFICIENCY TWO-STAGE COMPRESSORS

Compressor	Drive Motor Nameplate Rating	Maximum Full Flow Operating Pressure	Full Load Operating Pressure	Rated Capacity at Full Load Operating Pressure	Input kW @ Rated Flow and PSIG	Specific Power kW/100 cfm	Isentropic Efficiency %
A	150 hp	125	125	738	129.9	17.60	85.37
B	150 hp	100	100	890	141.6	15.90	83.53
C	150 hp	200	190	596	135.1	22.70	82.30
D	150 hp	150	150	680	138.0	20.40	81.10
E	150 hp	100	100	826	139.5	16.90	78.70

Figure 4.

Isentropic Efficiency of Rotary Screw Air Compressors

HP	BEST	AVERAGE	WORST
10	72	53	49
15	75	63	54
20	76	68	57
25	80	68	63
30	79	68	63
40	82	72	62
50	82	74	63
60	82	74	63
75	81	75	67
100	86	77	65
125	88	79	62
150	87	79	68
200	92	80	70
250	90	83	70
300	92	82	70
350	90	81	69

Figure 5. Isentropic efficiencies, by horsepower, for lubricated, fixed-speed, rotary screw air compressors. Based on CAGI datasheets dated up to January 2021.

at all different pressures. These are sorted by the isentropic efficiencies. As you see, lower specific power does not necessarily indicate lower isentropic efficiency. Figure 4 shows the same comparison of two-stage compressors and in general they have a higher isentropic efficiency.

Isentropic efficiency comparisons will keep the compressed air industry working to improve efficiencies which in turn will save lots of energy in the future. Someday you may see the DOE or state governments requiring a minimum isentropic efficiency level for a compressor to be sold. BP

About the Author

Brian Parks has worked in the compressed air industry for over 45 years. He has worked in service, sales, machine testing, engineering and regional management in both the US and abroad for two different air compressor manufacturers. After retiring, he started Fourth Utility Consulting, initially doing distributor training, auditing and audit reviewing. Later, the company started doing consultation for compressor companies to help establish the most efficient products by using CAGI datasheet comparisons to increase efficiency. Fourth Utility has a database of over 6,500 archived data sheets, which are used for correct auditing and auditing reviews.

For more information contact Brian Parks, President, Fourth Utility Consulting, email: 4thutilityconsulting@mail.com

For more information on this topic, visit CAGI's website to view the educational video on isentropic efficiency at https://www.cagi.org/education/videos.aspx

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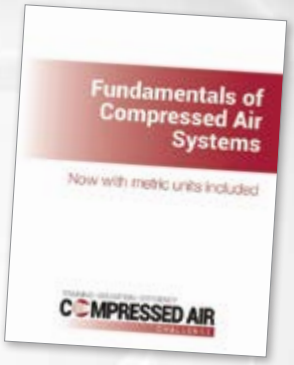

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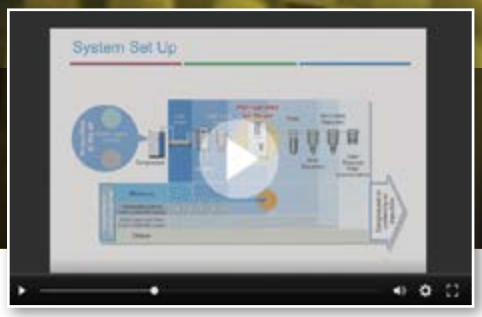

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Kaeser CNC Line of Booster Compressors

Announcing Kaeser's new CNC line of booster compressors, delivering capacities from 28-281 cfm with pressures up to 650 psig. These fully enclosed and integrated units are available in 10-30 hp models. This product line expansion also adds the DNC-XL, bringing Kaeser's advanced booster lineup to nine models with flows ranging from 28-882 cfm. Each package includes a built-in aftercooler for optimized cooling and a sound-dampening enclosure for reduced noise levels and better machine protection. A reduced footprint, easy access design and simple connections make installation and maintenance a breeze. A complete sensor array and the Sigma Control 2 controller offers unsurpassed control and monitoring with enhanced communications capabilities for seamless integration into remote plant control/monitoring systems. All Kaeser booster packages can be ordered for nitrogen compression or as a water-cooled unit and can be customized for specific applications with optional variable speed drives and integral Eco-drains.

Kaeser Compressors, https://us.kaeser.com

Hertz Kompressoren USA Oil-Free Scroll Packages

In honor of their 5-year anniversary, Hertz Kompressoren USA is excited to announce their new HS Series scroll compressors. Hertz prides itself on its flexibility and adaptability in meeting market demand. Eyeing an opening in the market, Hertz decided to manufacture a line of completely oil-free scroll packages to serve industries such as laboratory & life science, medical, food & beverage, and countless others. HS Series package units come in a 2-40 HP range boasting low noise levels, trouble-free maintenance and compact foot prints. With an eye on the future, Hertz believes that this is only the beginning. "I see us growing even more over the next five years, both with Channel Partners and as a company with our employees," said Stephanie Brockman, Chief Operations Officer.

Hertz Kompressoren USA, www.hertz-kompressoren.com

Xebec Acquires Nortec

Xebec, a global provider of clean energy solutions, is pleased to announce on April 30, 2021, it has closed the acquisition of all the outstanding shares of Tennessee based Nortekbelair Corporation. Nortec's principal, Mike Zarif, Ph.D., will remain with Nortec after the acquisition and continue his focus on R&D and product development within the company. With this acquisition, Xebec's manufacturing footprint will expand with an 18,500 sq. foot facility in Maryville, Tennessee, and will provide the company with key personnel to establish a "Center of Excellence" for its dehydration products comprised of compressed air dryers, renewable natural gas dryers, hydrogen dryers and support its Cleantech Service Network. Total consideration payable by Xebec is approximately $8.5 million CAD through a combination of cash on hand, of which $2.6 million CAD was paid in cash on closing, and 735,838 common shares of Xebec at a price of $4.385 per common share were issued to the seller.

Xebec Adsorption, www.xebecinc.com

Total Equipment Instrument Air Compressor Buildings

Total Equipment Company, a distributor and service provider of fluid- and air-handling products, is delivering custom-engineered Instrument Air Compressor Buildings to support many industries in their region. TEC is a trusted name, servicing industries in Pennsylvania, West Virginia, Ohio and beyond, with a broad inventory of pumps, compressors, blowers, mixers and mechanical seals for over 39 years. TEC has custom-engineered Instrument Air Compressor Buildings for customers in their region for more than ten years. With extensive machine and fabrication capabilities in-house, TEC staff mounts complete compressed air systems to steel decks, followed by roof and side paneling assembly. Each building is engineered-to-order, compliant with seismic and wind loads to area classification, delivering instrument air standard-compliant compressed air.

Total Equipment Company, www.totalequipment.com

Donaldson Ultrapac Smart Dryer

Donaldson Company, Inc, a leading worldwide manufacturer of

COMPRESSED AIR INDUSTRY & TECHNOLOGY NEWS

innovative filtration products and solutions, introduced the Ultrapac Smart dryer, a solution that removes condensate and dries compressed air streams in manufacturing facilities using three stages of separation: filtering, drying and purifying. Highly purified compressed air is critical for food and beverage process applications, like beer, bottled water, milk, wine and yogurt. The Ultrapac Smart dryer design accommodates unique location and spatial conditions, enabling configurations that fit among large equipment, conveyor lines and other machines. With three versions – Superplus, Plus and Standard – and a modular design, the dryer can be installed vertically, horizontally or on a wall. As a compact, stand-alone, plug-and-work solution, all of the Ultrapac Smart dryer's components, including the filter elements and the desiccant cartridge, are easy to access and replace.

Donaldson Company, www.Donaldson.com

Festo MS Series Filtration Products

Festo introduces the MS series of filtration products – filters that lower the risk of particle contamination when compressed air comes into direct contact with food or packaging in the food zone. The MS series meets or exceeds the highest industry standards for clean air. Always in stock with guaranteed fast shipping, MS filters arrive assembled with safety and total productive maintenance features typically found as custom add-ons. The units install easily and are priced competitively. The MS series is designed for food and packaging-in-food-zone applications in the dairy, baking, produce, processed foods, pet foods, craft beer, cold food processing, and beverage industries. Furthermore, this versatile series is suitable for a wide range of industries outside of food and beverage where clean compressed air enhances the longevity and efficient operation of pneumatic cylinders and processes.

Festo, www.festo.com

Augwind New Subsidiary in the USA

In great news for industrial manufacturers, Augwind, an innovative Israeli company specializing in advanced compressed air technologies, has opened its first USA subsidiary. Augwind, with global headquarters in Israel, was founded in 2012 by Or Yogev, a graduate of the California Institute of Technology with a focus on thermodynamics. Industrial plants rely heavily on compressed air to run their operations, with such systems accounting for up to 20% of a plant's energy use. Most of the time, that use is inefficient and costly. Augwind's unique energy-saving technology has already saved current customers over 10 million kWh and is now available for the first time in the USA. Leading Augwind's foray into the US market is Larry Wilson, an expert with over 35 years in the compressed air industry.

Augwind, www.aug-wind.com

Ingersoll Rand Sells High Pressure Solutions Segment

Ingersoll Rand Inc., a global provider of mission-critical flow creation and industrial solutions, has entered into an agreement to sell a majority interest in its High Pressure Solutions Segment to the private equity firm American Industrial Partners. Ingersoll Rand will receive cash proceeds of approximately $300 million at closing for its majority interest and will retain a 45% common equity interest in the business. The transaction, subject to standard closing conditions, is expected to be completed in the first half of 2021. "Today's transaction is a meaningful step forward in our transformation and achieves many of the goals we have previously communicated," said Vicente Reynal, chief executive officer of Ingersoll Rand. "It significantly reduces our direct exposure to the upstream oil and gas market to non-material revenue exposure of <2%, and accelerates our ESG commitments."

Ingersoll Rand, www.IRCO.com

CHILLER & COOLING INDUSTRY & TECHNOLOGY NEWS

Portable Air-Cooled Chillers

Frigel is introducing air-cooled portable chillers into its product line. With chilling capacities from 3.5 to 15.5 tons, the eight-model product line has the broadest operating temperature range available today, from 23°F to 77°F. In addition, the MRS chillers are uniquely designed for both indoor and outdoor applications. Designed for maximum ambient temperatures from 113°F to 122°F, the chillers offer high performance at high ambient conditions. The MRS unique condenser design also offers customers several measurable operational advantages. With dB(A) ratings of 48 to 58, the MRS is the quietest chiller on the market with fans that eliminate problems associated with dB(A) ratings greater than 85. Standard with the product line is its unique non-ferrous water contact surfaces design which features stainless steel brazed plate evaporators and pumps with stainless steel coolant contact surfaces.

Frigel, www.frigel.com

BluEdge Digital Service Platform

Carrier is launching a new tiered service offering to complement its existing BluEdge service platform: BluEdge Digital. The new digital offering, which can stand alone or be added to existing BluEdge service agreements, connects customers' equipment to Carrier's cloud-based IoT platform, providing them with advanced analytics and actionable insights to visualize, advise and optimize machine health and life cycle outcomes. That includes OnDemand service request capability, web / mobile real-time chiller dashboards, prioritized alarm and alert notifications, and performance and vibration reports. More advanced digital solutions including remote monitoring, performance optimization and predictive services are provided in the Enhance and Elite tiers, while BluEdge Digital Elite tier customers with connected chillers will receive continuous support from BluEdge Command Centers, remote teams of data scientists and engineers that provide real-time monitoring of building and equipment operations.

Carrier, www.carrier.com

High-SST Turbocor Compressors

Danfoss has expanded the capabilities of Turbocor compressors TTS and TGS with a higher saturated suction temperature (SST) operating range – helping OEMs bring the benefits of oil-free technology to data centers operating at higher temperatures. Available on TTS and TGS compressors designed for both air-cooled and water-cooled chillers, the new high-SST option enables select Turbocor models to generate leaving water temperatures as high as 82°F, substantially reducing compressor load and power consumption. This change enables OEMs to offer next-generation operators all the benefits that have made Turbocor oil-free compressors a proven, successful choice for data center chillers – such as efficiency, accuracy, and long-lasting reliability with no performance degradation over time. The newly equipped Danfoss Turbocor models are designed for use with A1 and A2L low-GWP refrigerants R134a, R515B, R513A, and R1234ze.

Danfoss, www.danfoss.com

Outdoor Pumps with Permanent Magnet Motors

Armstrong Fluid Technology has announced that Design Envelope pumps with Permanent Magnet motors up to 10hp are now available NEMA 4X/IP66 rated, for outdoor installation. Featuring advanced performance mapping technology and load-limiting logic, the new pumps reduce energy consumption by as much as 30% compared to pumps supplied with a loose variable speed drive. Together with new more efficient pump hydraulics, the new 1 to 10hp pumps can save an additional 20% compared to competing integrated products with induction motors. Features of the new Design Envelope outdoor pumps include overhead weather shield to protect motor fans, a cover to protect touchscreen user interface, TL approved factory tested NEMA 4X rated controls, parallel sensorless control providing additional energy savings, available Pump Manager service and more.

Armstrong Fluid Technology, www.armstrongfluidtechnology.com

CHILLER & COOLING INDUSTRY & TECHNOLOGY NEWS

Biodegradable Scale Remover

EcoClean Scale Remover is one of the fastest acting products on the market for dissolving heavy scale, corrosion, and naturally occurring oxides off metals. It is effective and safe to use on iron, carbon steel, stainless steel, copper, aluminum, magnesium, and their alloys. It improves heat-transfer efficiency by creating clean surfaces on all heat-exchanger equipment and improving water flow in obstructed pipes. Powerful corrosion inhibitors contained in the scale remover protect treated metals from flash rust. As an added bonus, EcoClean Biodegradable Scale and Rust Remover Powered by Nano-VpCI is a USDA Certified Biobased Product that contains 100% USDA certified biobased content. It meets minimum biobased content requirements under the mandatory federal purchasing initiative of the USDA BioPreferred Program, making it ideal for use by federal agencies and their contractors.

Cortec Corporation, www.cortecwatertreatment.com

Rogers Mechanical Contractors Acquires R&D Mechanical Services

Rogers Mechanical Contractors (Rogers) announced its acquisition of R&D Mechanical Services, a Ball Ground, GA based provider of commercial HVAC preventive maintenance, repair, and retrofit/replacement services in the Greater Atlanta area, with a particular focus on the distribution center market. Rogers is a leading HVAC/mechanical and plumbing contractor headquartered in Villa Rica, Georgia and serves customers across the country, for which this acquisition further enhances its product offerings. Effective immediately, R&D Mechanical Services will begin operating as Rogers Mechanical Contractors. As part of the transaction, all employees of R&D Mechanical Services will be retained and new additional employment opportunities will be posted online.

Rogers Mechanical Contractors, www.rmciga.com

Emerson Joins the Carrier Alliance Supplier Program

Emerson has joined the Carrier Alliance program. As part of the program, Emerson will continue to provide leading-edge software and technologies from its air conditioning and cold chain businesses, such as compressors, valves, and sensors, to a range of products throughout the Carrier portfolio. Emerson and Carrier will continue collaborating to develop and deploy a robust set of leading technologies and solutions throughout Carrier's HVAC and Refrigeration segments serving residential, commercial and transportation markets. Carrier has long leveraged Emerson's Copeland compressors, White-Rodgers valves, controls and thermostats, and Thermo-O-Disc sensors it its products. Emerson's Copeland Compressors have been integral to Carrier's product portfolio and will be a critical component of Carrier's offering to meet or exceed higher Season Energy Efficiency Ratio (SEER) rating requirements beginning in 2023.

Emerson, www.emerson.com

Embraco Celebrates 50-Year Anniversary

In March, Nidec Global Appliance celebrated the anniversary of one of its brands: Embraco, a name globally known as a reference in refrigeration technology for the home appliances and commercial cold chain since 1971. The product brand completes half a century of its innovative approach and is ready to refresh the future. After being acquired by Nidec Corporation, in July 2019, Embraco was integrated into the Nidec Global Appliance division, gaining a structure to accelerate growth. Nidec Global Appliance is organized into three business units (BU): Home Appliances, Commercial Appliances and HVAC. This segmentation gives Embraco the opportunity to operate with a more dedicated focus on specific market segments, strengthening its customer centric approach and improving its portfolio of compressors and condensing units.

Embraco, www.embraco.com

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Advertising/Editorial Rod Smith • rod@airbestpractices.com • Tel: 412-980-9901
Subscriptions Administration Patricia Smith • patricia@airbestpractices.com • Tel: 412-980-9902
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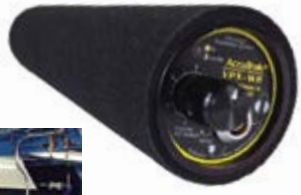

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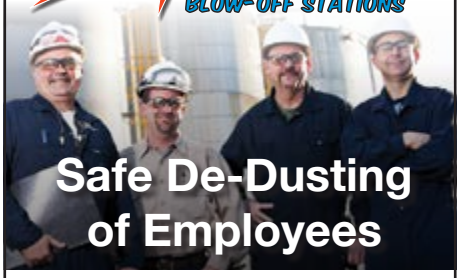

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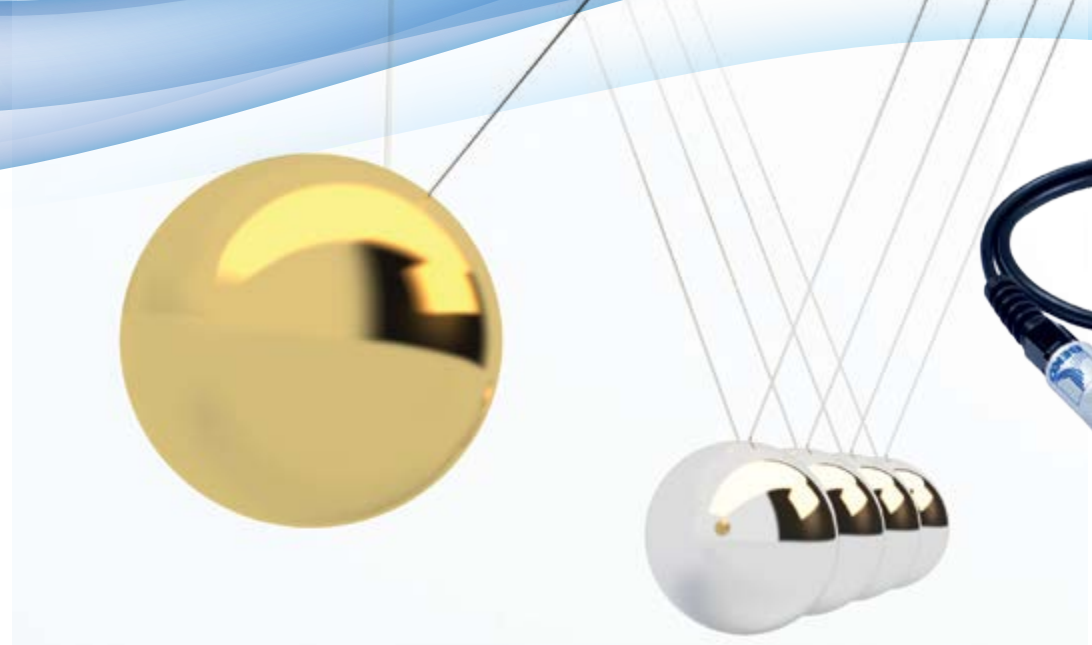

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