

Compressed air, nitrogen and vacuum in food processing



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From the editor ...



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Air breathes life into so many industries - not least the food industry where compressed air is regularly used for mixing, cutting, sparging, drying, transporting and packaging. But something so essential is easy to overlook. Power bills don't itemise the cost of air so it is easy to overlook the benefits that can be generated by optimising your air supply. Equally, it is easy to overlook the potential for disaster if your compressed air is contaminated.

This eBook is full of tips and tricks to make sure that your compressed air, nitrogen and vacuum systems are being kind to your bottom line and to your products.

Sometimes the easiest way to discover what you can do in your plant is to find out about how other companies have handled similar problems. The case studies in this eBook give you some insight into how other food companies have solved their compressed air, nitrogen and vacuum problems; and because the case studies are all from food industry players, you can be sure that they have had to meet the strict hygiene demands of the food industry. This means their solutions are so much more relevant to you and your situation.


I hope you find this eBook worthwhile.

Regards

Janette Woodhouse

Editor - *What's New in Food Technology and Manufacturing*

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Have you got the right technology?

Sonik Barot

Food: we might not know where it comes from, which processes it passes through, but we expect it to be available, safe and of very good quality! Food has travelled around the globe since ancient times, but as production technology and transport methods have evolved the volume of its production and trade has increased significantly.

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It costs up to five times as much to recall a product as it does to distribute it, even before other costs such as legal claims, product disposal, loss of reputation and loss of market share are considered. To avoid recalls and protect your brand's reputation, you need to put the right technology in place right at the beginning.

Consumers have a right to expect safe, high-quality food. The food industry is working hard to ensure safety, putting in place fundamental programs of pest control, basic hygiene, employee training, good laboratory practices, hazard analysis and critical control points (HACCP) programs, foreign matter control - and the list goes on. The thing to remember about food safety is that it is not a competitive advantage, it's a point of entry and is key to your brand image. Having the right technology in food processing or manufacturing plants is crucial to avoiding contaminants.

Compressed air

Industrial gases like compressed air are used in a broad range of applications in the food processing industry, such as mixing ingre-

dients, cutting, spraying, drying of product, transporting/propelling product through processing systems and packaging of final product.

In many of these applications, compressed air is in direct or indirect contact with food product and any impurities in the compressed air may contaminate the food product, which can result in change of colour and taste and reduced shelf life. In addition, exposure to bacteria and other microorganisms can result in product recalls.

Other industrial gases like nitrogen and carbon dioxide can be generated on-site. They are widely used for food safety or preservation and in carbonated products respectively. Vacuum is often used during the packing process in the food industry and is often integrated by the OEM (original equipment manufacturer), resulting in multiple point-of-use vacuum pumps spread through the process.

When selecting compressed air, product gases or vacuum equipment for food processing facilities, considering the potential for product and process contaminants is vital.

So how do you know you're choosing the right technology company to partner with? The first step is to be very clear about



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the strategic competencies you need and your requirements for the project or process. Going with the lowest price is often not the best decision. Leaving the entire responsibility to multiple equipment OEMs is often not the most energy-effective solution. Before you solicit a technology partner, make sure your vision, budget and timeline are realistic and - most importantly - that the company's equipment meets your process requirements.

Here are some crucial questions to help you choose the right technology partner for your compressed air, vacuum or industrial gas requirements needs:

How do you find potential technology partners?

- Ask for referrals from trusted contacts and be sure you understand why they recommend the vendor.
- As you consider candidates, examine their areas of strength, depth of experience, client portfolio and technologies.
- Ask for customer references and past performance summaries for projects similar to yours.
- Consider how established, experienced and stable the vendor is (ie, years in business, financial stability, recognition and awards).
- Make sure a vendor provides the full gamut of services you will need, such as specialised subject matter expertise, support and training.

The most important question to ask is this: Is this technology aligned to my company's business objectives?

How good is the presale process?

If you are not impressed with the company's expertise, responsiveness, thoroughness, communication and enthusiasm, it's unlikely things will get better. Consider the quality of the people you're partnering with, rather than just the costs that can be saved.

Will you be able to be face to face when it really counts?

Project kickoff, gathering requirements, design stage, equipment selections and milestone releases are key phases where communication and collaboration needs to be effective. Communication is key to any successful client-supplier relationship, but food industry technology projects demand a greater degree of skill to ensure the numerous details and different stakeholder requirements are understood and integrated correctly into the process.

Will the vendor transfer knowledge to your team?

Vendors often have you rely on them for basic system/process maintenance, which can be an unexpectedly high post-deployment cost. Think about lowering these costs by training your internal staff to handle this and discuss the option with vendors. Make sure this is addressed fully in the proposal.

Choosing wisely

Choosing a technology partner always entails some degree of risk. You can dramatically increase your chances of success by asking the right questions and be much more confident in your decision by thoroughly understanding the processes and technology used by your prospective partner.

Take advantage of what great partners can really offer - new strategic competencies. Whether you need strategic direction to help you innovate and compete, with the right partner, you can leverage the best technology available and instantly gain capabilities for success, which can be capitalised on and marketed.



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What gets your product in the shopping trolley?

Pierre Matschke

The food manufacturing and packaging market has proved to be one of the most competitive. Companies are on a constant lookout for new innovation and that little something that improves the bottom line. Your utilities could give you the edge.

Your clients buy your product because they want it. They want it because it looks good, will stay fresh and is priced right. Unfortunately, this is no secret and all your competitors are concentrating on getting the product to point of sale with this in mind. There is also no secret in how to get it there. The use of 'special' production and packaging methods appears to be the key. These methods ultimately require utilities such as compressed air, vacuum, nitrogen and others that directly affect your product-quality presentation and manufacturing cost - and, dare we state, your sell price.

So how do these utilities affect your product quality?

Compressed air is one of the most widely used utilities in the food industry. Whether it's used to drive pneumatics, conveying or blowing of packaging or product, the quality of this air will affect your product if used in the production area. Air quality is key and can be assessed by considering three contaminants: moisture, particles and oil content. Moisture, commonly measured as pressure dewpoint in degrees celsius, will have a direct influence on bacterial growth.

A pressure dewpoint (PDP) of greater than -26°C will inhibit the growth of microorganisms. In most cases refrigerant air dryers are used to control moisture, but as they have an absolute best PDP of just $+3^{\circ}\text{C}$, microorganisms are not controlled.

Oil carry-over from traditional oil-injected compressors can be considered at 3 mg/m^3 of air. Common use of activated carbon filters can reduce this to 0.003mg/m^3 at best but only when the filters are new. Due to Australia's relatively high ambient temperatures, these filters require very regular ($\pm 500\text{ h}$) replacement to ensure low oil contamination. The use of expensive food-grade oil is often an alternative. However, the achievable oil life of these will also require frequent changes and will never be a suitable ingredient for your top-quality product.

Vacuum is widely used for evacuation and process in food production. Common practice is to have multiple pumps in the production area, usually supplied with packaging or process machinery. Oil-flooded rotary vane pumps will exhaust oil fumes into the immediate atmosphere at $\pm 5\text{ mg/m}^3$ - another ingredient that will never be suitable for your product or health of your production

staff. Additional filtration or exhaust piping can be used but these will affect the efficiency and cost to operate the vacuum pumps.

Nitrogen, predominantly used to preserve your product through modified atmosphere packaging (MAP), has very little contaminant influence on your product. However, the final purity in the packaging makes the difference. This is often related to the supply purity or the volume introduced. Due to the relatively high expense of this utility, the bare minimum is used when greater volume or purity could be better.

How do you improve product quality (and thereby possibly the product sell price) and reduce the overall utility cost (and thus product cost)?

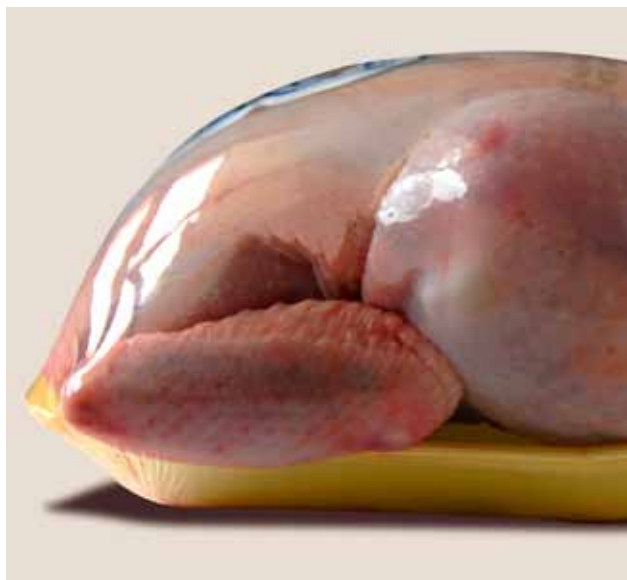
Let's start with product quality. Eliminate oil with available oil-free compressor technologies that provide oil-free air (class zero). These systems ensure there is no oil in the compression stage or air system. Use suitable air-drying technologies that can provide air with a pressure dew point as low as -70°C , and ensure there is no bacteria. Although 'oil-free' vacuum pumps are available, the limitations in ultimate vacuum level and efficiencies rarely offer an advantage in the food industry. Centralising the vacuum utility outside of the production area can drastically reduce oil and noise pollution in the production area. If you have a relatively inexpensive and flexible supply of nitrogen, will you use more to improve your end purity and thereby product quality?

All this sounds expensive. How will this reduce the product cost? All too often we are "penny wise and pound foolish", and it will seem expensive when you only consider the initial investment. There is a multitude of compressor, vacuum pump and gas companies that will take advantage of a narrow-minded initial investment review of product offerings.

Take air compressors as an example. The initial purchase cost is generally only 11% of the total life-cycle cost over five years. If you save 20% on the initial investment, you potentially only save 2.2% on the life-cycle cost. If you spent 30% more on the initial investment, whether it be oil-free technology or variable speed drive, you could save 35% to 50% on the life-cycle cost. Major contributors to life-cycle cost are energy at more than 70% and maintenance at $\pm 17\%$.




In today's economic environment, sustainability is key. How long can you pay more for the life cycle of a utility?



Similar savings in centralised vacuum systems can be achieved. The initial expense will be a vacuum reticulation system. However this is a once-off expense and the added reliability, energy and maintenance savings that can be achieved will offer an excellent return on investment. Why not produce your own nitrogen? It's easier than you may think and could cost you much less when compared to gas-supply contracts. If you are paying more than a dollar for a cubic metre of nitrogen, you can save!

In today's economic environment, sustainability is key. How long can you pay more for the life cycle of a utility? How long can you continue to risk product quality and possible contamination? In business, much like a game of chess, it may only take one clever move to win. That move could be the call you make to a reputable supplier that has the knowledge, experience and willingness to assist you with your compressed air, vacuum and nitrogen requirements. A comprehensive survey into your requirements will uncover potential savings and provide you with the necessary information to make an informed decision, at the cost of a local phone call.



Out-of-the-box compressed air solution for snack manufacturer

When London crisps and snacks manufacturer Kolak Snack Foods experienced an upturn in business and needed to increase its output capacity, the company decided to upgrade its production equipment, including its compressors.

In selecting new compressors, Kolak had several must-haves: reliability, continuity of output and no risk of contamination during process operations. To achieve this, Kolak chose to replace its existing units with Atlas Copco oil-free, rotary screw, full-feature machines.

The company installed two ZT 90 FF compressors and a ZT 90 VSD FF, which provide a guaranteed supply of high-quality air. As a result of the installation, the process air at Kolak's London plant complies with the ISO 8573-1 (2010) CLASS 0 standard of air purity, which embraces the Class 0 industry standard. Class 0 measures all three forms of oil contamination: aerosol, vapour and liquid, and Atlas Copco was the first compressor manufacturer in the world to achieve the TÜV-certified standard for its zero-oil, zero-risk Z-series of stationary compressors.

In order to meet production demand, the plant operates 24 hours a day, seven days a week, meaning that energy efficiency was also an essential consideration in the selection of new compressors.

“The Atlas Copco VSD compressor works in tandem with the base load compressors to cover all the main 7 bar plant air application duties, including heat exchanger, steam boiler and packing operations. This ensures that output is matched to demand in the most energy-efficient way, with the VSD compressor taking over any additional site load,” said Rikin Lakhani, Kolak's director.

Each of the Atlas Copco compressors is a full-feature, total installation concept: a pre-wired and pre-piped solution, ready for use out

Each of the Atlas Copco compressors is a full-feature, total installation concept: a pre-wired and pre-piped solution, ready for use out of the box.

of the box. According to Atlas Copco, integrating the compressor's IMD dryer and its variable speed drive enables the compact package to supply high-quality dry compressed air at the lowest cost.

The IMD adsorption dryer eliminates moisture before it enters the air net to ensure a reliable process and contamination-free end product. No external energy is required to dry the air and, as the dryer needs no purge air, no compressed air is wasted. The pressure drop through the dryer is minimal, which also reduces the operating cost.

Kolak also entered into a 10-year Total Care agreement with Atlas Copco for compressor system maintenance and servicing. Atlas Copco undertakes responsibility for monitoring and maintaining the installation's performance.

“We invested in the best possible service package in order to make us futureproof,” Rikin said.



Compressors supply pure, oil-free air to nutritional supplement manufacturer

Kingdomway Group, a provider of nutritional supplements, operates four production facilities in Xiamen and Hohhot, Mongolia.

“**F**ermentation is one of the most important steps in producing our key additives, including coenzyme Q10, DHA, and ARA for milk and nutritious health products. As the compressed air comes into direct contact with the fermentation process, air purity is vital. The presence of even small oil traces will kill the bacteria, contaminate the end product and put consumers’ health at risk. Therefore, absolute oil-free compressed air is our focus,” said Mr Jiang, Site Manager at Hohhot.

To meet their compressed air requirements during the fermentation process, Atlas Copco recommended ZA 6G-300 low-pressure, oil-free screw compressors to keep the Hohhot production line running smoothly.

“As there are 16 fermentation tanks connected to the production line, the pre-filter, moisture separators and other equipment may cause drops in pressure and air loss,” said Leo Yang, Senior Sales Engineer with Atlas Copco. “To maintain the incoming air pressure in the

Atlas Copco ZA compressors have received ISO 8573-1 Class 0 (2010) certification for 100% air purity.

fermentation tank at 2-2.5 bar - and taking into consideration other production processes and conditions - we set the front-end input pressure at 3 bar to keep the fermentation production line running stably.”

Atlas Copco ZA compressors have received ISO 8573-1 Class 0 (2010) certification for 100% air purity. The compressors incorporate stainless steel coolers, AGMA A4/DIN 5 gears, and an integrated variable-speed electrical drive system, which the company says offers energy savings of up to 35%.

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About Atlas Copco

Atlas Copco is a world-leading provider of sustainable productivity solutions. In particular, the company serves food industries with energy-efficient compressed air, industrial gas and vacuum generating systems as well as compressed air and gas treatment systems to suit. Creating sustainable values for our customers is at the core of our products and service.

Atlas Copco is over 140 years old and has operated in Australia for more than 60 years. With highly qualified specialists in all aspects of our business, we are in perfect position to support the food processing industry and their demands for increasingly advanced compressed air, vacuum and industrial gas generation solutions. Atlas Copco Australia maintains a service presence in the 25 largest cities across the country to ensure customer reach and rapid service. We have a comprehensive range of products and services to support nationwide industries and ensure your industrial process is in safe hands.

Atlas Copco Compressors Australia

website: www.atlascopco.com.au

How Nitrogen plays an important role in wine preservation

<http://www.atlascopco.com/nitrogenus/applicationstories/houseofgilliard>

Vacuum pumps use one-third less energy at meat processing facility

<http://goo.gl/LdaTV2>

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