Refrigeration and Air Conditioning Africa

RACA JOURNAL®

ISSN1812-772X | R92.00 January 2024 | Vol 39 No. 11

Heating | Energy | Ventilation | Air Conditioning | Refrigeration

NEWS
IQ Air Conditioners' sixfold increase in warehouse space underscores growth

ASSOCIATIONS
SAIRAC October Tech Talk Topic: AxiEco fans

FEATURE
Pipe and valve selection for a cooling system

PROJECT
Maninga Engineering assists Wits in its strategic vision

Amazingly simple installation – sustainable outdoor performance

GEA BluAir Chiller – your chiller or HVAC solution

GEA BluAir models offer customers a greater flexibility in choosing an installation location. The outdoor series can be erected in any desired place. A specifically GEA-designed weather-proof enclosure includes a heating system, a refrigerant detection device, and a ventilation which stays in operation in case of an emergency stop of the chiller. The enclosure reduces sound emissions by 20 dB(A) making the GEA BluAir a perfect fit in residential areas, too. Flexibility is your benefit, too, when it comes to the condenser execution. Choose an air-cooled condenser system either included in our scope of supply or provided by you, or a water-/glycol-cooled condenser.

The GEA BluAir series runs with the highly efficient, zero-GWP ammonia and is equipped with proven GEA screw compressor technology, the industry-leading GEA Omni control panel and high-end components – all of which are based on many decades of experience in the refrigeration business.

Features and benefits at a glance

- Exclusive use of ammonia (R717) as refrigerant
- Low ammonia content of appr. 120 g/kW (lowest in class)
- Designed water chiller and HVAC applications
- Cooling capacity of 300-1,200 kW (R717, +12/+6 °C)
- Secondary refrigerant outlet temperature -15/+18 °C
- High-quality enclosure fully equipped according EN 378 (ambient -15/40 °C max.) with ammonia detection
- High-quality heat exchanger for best ESEER; condenser temp. approach (default) 12 K (air-cooled condenser system)

For more information, contact: Ryno Rüster at +27 (0)21 555 9000 or Ryno.Ruster@gea.com
Ralph Ruiters at +21 (0)21 555 9000 or Ralph.Ruiters@gea.com

engineering for a better world

gea.com

RACA Journal: ISSN 1812-772X

+27 (0) 82 560 8718
RACA Journal Publication
www.refrigerationandaircon.co.za
eamonn@interactmedia.co.za

SA'S ENERGY FUTURE GIVES CAUSE FOR OPTIMISM

The heating, energy, ventilation, air conditioning and refrigeration (HEVACR) industry is rapidly developing technology with eco-friendly efficiency, as the necessity of energy-efficiency designs gain urgency amid the looming energy crisis. The latest and best technology the market has to offer is showcased at Africa's only dedicated HEVAC&R expo, Frigair, which takes place next year in Gauteng.

The E of HEVAC&R is likely to make up an outsized component of the expo as renewable energy is gaining momentum around the world – and South Africa is no exception. As the country seeks to reduce its dependence on fossil fuels and transition to cleaner, more sustainable energy sources, investment and financing into the renewable energy space have become increasingly important.

Last year's Energy Indaba attracted a great deal of foreign interest. Indeed, foreign interest in Africa lies at the bottom of the many initiatives under way in South Africa. There is a palpable desire by foreign investors to make a success of the energy sector in South Africa, so as to develop a platform that can be replicated in the rest of Africa for investors. There is a pool of international investors active in South Africa who already have a deep knowledge of Africa and its challenges. These are impressive people with impressive intellectual property and business gravitas.

However, such investors wish to shy away from handing money to government bodies so as to demonstrate an intent to fix the country's energy problem – irrespective of what government does. That too may be changing: there appears to be a trend for government to loosen up on allowing IPPs to start integrating and for the private sector to focus on transmission. While the Eskom grid has always been – and currently still is – untouchable, the transmission grid is becoming a bit more collaborative in terms of finding solutions.

This shift towards renewables has created a growing demand for capital to fund projects and infrastructure, while also presenting opportunities for investors looking to capitalise on the rapidly expanding market. Discussions are tending to revolve around the challenges involving the future of the coal-fired power stations and how to get traction on new renewable energy projects quickly, while the biggest frustration one hears relates to the transmission grid and government obduracy in freeing up the market.

For years, some companies have been offering to build their own grid to integrate into Eskom's national grid – an offer continually rebuffed by government's excessive red tape.

Underlying this reluctance is perhaps an important behavioural issue: while Europeans have long been accustomed to expensive energy – a factor which sparked innovation in renewables from an early point – South Africans have historically been used to cheaper electricity. Consequently, at a consumer and business level we are only now taking a belated interest in energy efficiency, or even taking elementary measures such as installing solar geysers. Done timeously, a more ubiquitous roll-out of solar geysers alone could have given South Africa an average 30% saving in electricity consumption.

A positive one takes from discussions with the renewable energy sector – whether investors or financiers – is that there is a powerful amount of IP and 'dry powder' in this country that is imminently going to be investing in the sector. The single biggest obstacle is crime and corruption. Investors have made it plain they won't have their capital go via government but rather directly to IPPs. To achieve this, they've set up conduits to manage the flow of funds to make this work.

Notwithstanding widespread scepticism, there is more happening in the energy sector than most people are commonly aware of, which in aggregate is the output of a Medupi power station.

Unfortunately, African countries are acting alone in the absence of a co-ordinated power grid. It was this factor which had greatly assisted Europe in the wake of the Ukraine-Russia war, to redeploy power from other regions to replace Russian power. There is no equivalent in Africa.

In some ways this could assist Africa in adopting a decentralised power grid which could enable the skipping of a generation or two of technology advancement – much as has occurred with mobile telephony. This has spread throughout Africa without a ubiquitous national phone service ever having been established in most countries.

In the power sector, decentralised hydrogen cells represent the potential to replace a centralised grid with a vast number of standalone units throughout rural parts of Africa, as these hydrogen cells are batteries 'on steroids'. RACA

Eamonn

REFERENCE

1. *Interview with Andrew Bahlmann, chief executive: DLI*

RACA JOURNAL
Refrigeration + Airconditioning Africa
ISSN 1812-772X

Africa's only monthly publication serving the HEVAC&R sectors

ISSN 1812-772X

JANUARY 2024 | VOL 39 NO 11

Contents

REGULARS
1 Hot and chilled
29 Mareli Botha: 2023 CESA Young Engineer of the Year
42 Products
44 Brandlistings
48 Final fix

NEWS
3 IQ Air Conditioners' sixfold increase in warehouse space underscores growth
5 Tru-Temp's 50th anniversary
7 FabricAir secures African market

ASSOCIATIONS
9 SAIRAC October Tech Talk Topic: AxiEco fans
12 Back to the future: Our industry in 2030 (Part 2)
14 SAIRAC Joburg honours Fellows
16 Doctoral student awarded national prize for exceptional research work
17 Introducing SARACCA's new executive director

EVENTS AND EXHIBITIONS
19 Frigair 2025 will feature the latest in design, technology and trends

BUSINESS AND TRAINING
21 Why clients are moving from a wet cooler to adiabatic dry system

FEATURE
24 Pipe and valve selection for a cooling system

PROJECT
30 Maninga Engineering assists Wits in its strategic vision

CONTRIBUTORS
36 Welcome to the solutions page
39 How to cool the data centre in the 21st century

TECHNICAL
40 The crucial role of project management in addressing key cleanroom project challenges

Cover Credit: Maninga Engineering

30
Maninga Engineering assists Wits in its strategic vision

ERROR IN RACA JOURNAL NOVEMBER PAGE 34

We wish to apologise for an error in the project article written by Dusan Stefanov and Levi Brands of Service First GP. Through an administrative error, the introduction from the previous issue's project was included in this article, and was never part of the contributed article. RACA

PUBLISHER DETAILS

PUBLISHED BY INTERACT MEDIA DEFINED (PTY) LTD
13A Riley Rd, Bedfordview 2007, South Africa
PO Box 695, Edenvale, 1610
Tel: +27 (0) 11 579 4940 | Web: www.interactmedia.co.za

PUBLISHING UNIT LEAD: Dale Macnamara | dale@interactmedia.co.za
EDITOR: Eamonn Ryan | eamonn@interactmedia.co.za

ADVERTISING EXTERNAL SALES
Dale Macnamara | sales@interactmedia.co.za

SUBSCRIPTIONS:
Ralph Shongwe | ralph@interactmedia.co.za

SUB-EDITOR: Megan O'Connor | megan@interactmedia.co.za

DESIGN AND LAYOUT: Glyniss Bone | glyniss@interactmedia.co.za
PROCESS CO-ORDINATOR: Lebo Bucibo | lebo@interactmedia.co.za

REGULAR CONTRIBUTORS
Grant Laidlaw, Barney Richardson and Michael Young

ADVISORY COMMITTEE
Grant Laidlaw, John Parry, Pat Burke, Graeme Page and Willem van der Westhuizen

MANAGEMENT
Operations/Finance: Sean Macnamara | sean@interactmedia.co.za
Finance: Laetitia Arnott | laetitia@interactmedia.co.za

PRINTER: Typo Colour Printing Specialists

DISTRIBUTION/MAILING: distribution@interactmedia.co.za

ENVIRONMENT-FRIENDLY PRINTING: All paper is sourced from the Forest Stewardship Council and Chain of Custody-certified suppliers. All wastepaper from the plant is recycled. All used plates are recycled. All new printing equipment is purchased for low energy-consumption levels and low volatile organic-compound emissions.

PRESS OMBUDSMAN:
This publication has committed itself to maintain the highest standards of journalism as embodied in the Press Code of Professional Practice. If you believe we have failed to report news and comment accurately, honestly and fairly, you may lodge a complaint with the Press Ombudsman either by email, letter, or by telephoning the office for the procedure to be followed.
Tel: +27 (0) 11 484 3612/8 | Email: enquiries@ombudsman.org.za
Website: www.presscouncil.org.za for the press code and/or the complaints form.

INTERACT Media Defined
When measurement matters

Audit Bureau of Circulations of South Africa
Jul - Sep 2023
Print: 3 023
Online: 5 069

IQ AIR CONDITIONERS' SIXFOLD INCREASE IN WAREHOUSE SPACE UNDERSCORES GROWTH

By Eamonn Ryan

Having started out more than a decade ago at a small 300m² facility, South Africa's IQ Air Conditioners has recently upgraded to a much larger, 2 000m² premises in Midrand.

This is to accommodate its current growth, with added space for skills training and greater stockholding capabilities.

Over that time, IQ has been providing a wide range of high-quality HVAC products and services across the entire HVAC and climate control spectrum for industrial, commercial and home use.

The IQ difference is superior technology and outstanding customer service. Operating throughout Africa, their strategic partnerships with leading global manufacturers ensures next-gen air conditioning technology created by world leaders in reliability, energy efficiency and quality. These state-of-the-art systems make for easy and flexible installation of both inverter and non-inverter ranges with proven performance in harsh African environments. Each product in their range is selected after extensive searches for a combination of factors: energy saving, durability, elegant design and comfort features.

One of SA's leading suppliers, IQ has earned their reputation through competitive pricing, industry leading back-up services and client confidence in product availability. Whether it is units, bulk orders, components or specialised back-up services, speedy turn-around times on quotations means that projects and repairs are taken care of swiftly.

IQ has expanded its product range into ice machines, pool and geyser heat pumps, refrigeration and cold rooms, generators and inverters.

Air-conditioning product categories include:

- Domestic air coolers
- Mid-wall splits
- Window walls
- Ducted evaporative air coolers
- Rooftop packaged unit
- Ceiling and floor-type
- VRF slim duct unit

IQ's business motto 'IQ, on cue, for you' represents their ideals to be a customer-focused solutions supplier.

IQ, constantly at the forefront of HVAC technology, provides an additional service relating to the energy performance of chillers with water mist assisted air-cooled condensers. This system improves the coefficient of performance of air-cooled chillers by adopting condensing set point temperature control and using mist evaporation to pre-cool ambient air entering the condensers to trigger a lower condensing temperature.

RACA Journal

The showroom at the new IQ offices.

The next phase of the company's growth involves the establishment of an inhouse training facility for installer clients. Its own technicians undertake regular generic HVAC training supplemented with product specific training delivered by OEMs. IQ is currently piloting the first of what will ultimately be a multi-course programme – which can now be comfortably accommodated in its expanded new premises – along with an increase in stockholding. The courses will ultimately lead to certification for participants.

With its strategy and new premises, IQ believes its exponential growth rate will not flag, and anticipates 20-50% growth over the coming two years as the economy emerges from the current downswing and the IQ brand awareness continues to grow.

IQ has a branch in Boksburg to service the East Rand and will open further branches as the demand and need increases. A new exciting partnership lies in the coming months as IQ partners with one of China's top renewable energy manufacturers. Set to hit stores in January of 2024, the new inverter range will be compact and efficient. Priced affordably, the range would ensure quality back-up power solutions to those who need it most. Backorders have indicated a projection of nearly 500 homes making use of these state-of-the-art units by the end of the first quarter alone.

In an effort to keep quality affordable, as well as provide convenience and comfort, in 2024 the IQ brand will be motivated by the needs of everyday South Africans. RACA

South African Institute for Refrigeration and Air-Conditioning

www.sairac.co.za

SAIRAC

MISSION

The mission of SAIRAC is to offer our membership the following:

- Regular monthly Technical Meetings on trending & current subject matters, in each of the Centres.
- Site visits and plant tours.
- Enrichment courses.
- Feedback related to the revision of SANS/NCRS codes of practice.
- Feedback on the HCFC phase-out program and green alternatives to HFC.
- The SAIRAC Technical Data Manual in CD format.
- The Dreosti Memorial Lecture on globally trending research and applications.
- FRIGAIR exhibitions, conferences and workshops every three years.
- The creation of a culture of learning and improvement by means of:
  - The recognition of the achievements of SAIRAC members, in their working environments and professional capacities, in the Environmental Control Industry.
  - The recognition of the achievements of students at tertiary educational institutions.
  - The recognition of the achievements of learners in the Industry.

MEMBERSHIP

Membership of SAIRAC is categorized in the following grades:

• Student • Associate • Member • Fellow

STRUCTURES

SAIRAC is active in the following geographic Centres: Cape Town - Durban - Johannesburg - Port Elizabeth
The affairs of SAIRAC in each Centre are managed by an elected committee, consisting of the Chairman, Vice Chairman, Secretary, Treasurer and representatives of each grade of membership. National control and management of SAIRAC is vested in a Council, headed by the President, who is elected by the Corporate Members. Council members include the Chairman of each Centre, a Vice-President, immediate Past President and Treasurer.

AFFILIATION

SAIRAC is affiliated as an international associate of:

- The American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
- Institute of Refrigeration (IOR)

ECSA REGISTRATION

SAIRAC is registered with the Engineering Council of South Africa as a Category A Voluntary Association. SAIRAC members in good standing receive a reduction in their ECSA annual membership fees.

TECHNICAL DATA MANUAL IN CD FORMAT

The data manual is written in the form of a disc-based website that starts with a dynamic index. This makes it very easy to find information on any topic just by clicking on the hot links. We have developed the content from the basics much like a text book. The object is not to teach refrigeration and air conditioning, rather it is to provide a rich source of reference material. Some of the information is better handled by software and where appropriate, we have included a number of software programs. Some of these are: a psychrometric chart generator, refrigerant properties, heat transfer coefficient calculator and a world locations database. The contents cover a broad range of subjects highly relevant to HVAC & R.

CONTACT DETAILS

National Secretary nationalsecretary@sairac.co.za
Cape Town Secretary capetownsecretary@sairac.co.za
Durban Secretary durbanlsecretary@sairac.co.za
Johannesburg Secretary johannesburgsecretary@sairac.co.za
Port Elizabeth Secretary portelizabethsecretary@sairac.co.za
www.sairac.co.za

TRU-TEMP'S 50TH ANNIVERSARY

Contributed by Fanus Blom, MD of Tru-Temp Airconditioning

Freepik

Tru-Temp Airconditioning has been providing quality HVAC services in the Western Cape for the past 50 years.

Tru-Temp Airconditioning was founded by Ivan Foat and started trading in 1973 from his garage. It soon grew into a business that needed bigger premises. The business then moved to 4th Avenue in Maitland and later to 16th Avenue. Around 1988 Tru-Temp acquired its own premises in Dapper Road, from where the company is still trading today. This 1 800m² building went through several changes during the years as the requirements changed, and now consists of an office block with a showroom, boardrooms, open plan planning and drafts area and various offices. The mechanical services building houses a well-equipped workshop and repair area, service bays, welding bay, sheet metal and manufacturing area and a number of storerooms.

I joined Tru-Temp Airconditioning as a director in 1998 and was in the fortunate position to buy the remainder of the shares from Ivan Foat's estate in 2011. With constant growth since then, it soon become necessary to introduce a succession plan. During 2021 the company appointed two more directors, Lance Killien and Lyne Kotze.

With the support of our excellent team, it makes me proud to be the managing director of this company. Everyone in this team plays a vital role in the development of our company and ensures that we live up to our motto 'Success Through Service'. It is their enthusiasm, support and dedication that have brought us to this height of celebrating our 50th anniversary. Tru-Temp Airconditioning shall forever remain indebted to its employees for their contributions.

During the past 50 years we have sold a variety of brands of air conditioning units, some of which do not exist anymore, while others are no longer available in South Africa. The old stalwarts might remember some of these brands: Fedders,

Supplied by Tru-Temp Air Conditioning

The three directors from left to right: Fanus Blom (managing director), Lance Killien and Lyne Kotze.

Supplied by Tru-Temp Air Conditioning

Tru-Temp's administrative and technical staff.

Airtemp, Westinghouse, McQuay, Airco, National, Panasonic, Akia, Platonic, York, Carrier, Rheem, Trane, Goodman, Mitsubishi, Lennox, Amana, Haier, Gree, Toshiba, Hitachi, Frigidaire, Goldstar, LG, Samsung, Sinclair, Alliance, Midea, Dunham Bush, Daikin, Hisense, Luxaire, Sanyo, Westpoint, Fujitsu, Dawoo, General Electric, Emerson and Hiross, etc.

During the last 10 years the industry has changed substantially, and we are trying our best to stay ahead of the changes in technology. Where possible, we attend all training courses presented by the various suppliers, as the electromechanical era is something of the past and the technicians must stay abreast of the latest electronic and inverter technology. A trade test alone is also no longer acceptable and sufficient. The staff need to comply with the safe handling of gas and therefore must obtain the relevant gas licence.

We believe in our staff, and we try to develop them to become the best person possible, not only technically but also improving their social skills, reading, writing and to obtain a driver's license. We regard training as an investment in the future of our country as well. There seems to be a resistance from industry to train technicians as the learners tend to leave their current employment as soon as they qualify. Our biggest concern is, what if you do not train and the employee stays?

Other challenges we have faced during the last few years include: the ever-changing criteria for BBBEE; health and safety requirements; different policies and returns; the implementation of the POPI Act; Covid-19; continuous loadshedding; and other requirements that SMEs must comply with. About 20% of our market is domestic installation where we must compete with one-man businesses. There has also been a change in the type of gas that the manufactures use in the equipment to limit the CFCs. Therefore, we had to change our way of thinking and working and carry the correct tools that are required for the different gases. Our waste management policy includes the recovery of gas, disposal of polystyrene, cardboard, metal, glass, plastic, electronic equipment and water-saving procedures.

Our focus for the next 10 years is to continue to provide the best possible service and advice to our customer base, which has been supporting us for almost 50 years. We also need to make sure that we propose the correct brands currently available to our clients to be able to support them with spare parts during the next couple of years. We will also strive to live up to our moto 'Success Through Service' and as our founder, Ivan Foat used to say, "Polish the marble" or in other words, "Take care of your customer or someone else will."

At Tru-Temp Air Conditioning we look back with gratitude and forward with positivity and expectation. RACA

FABRICAIR SECURES AFRICAN MARKET

By Eamonn Ryan

FabricAir, a global fabric ducting solutions company, commemorates increased geographic access with the acquisition of a new subsidiary in South Africa.

The local subsidiary, EDS t/a FabricAir South Africa, already demonstrates its value with robust annual growth figures.

This crucial milestone marks a solidified position in South Africa, a prime location for further growth across the African continent. With a head office in Copenhagen, manufacturing in Lithuania, and a regional Middle Eastern and African office based in Turkey, the establishment of a flagship office for Africa, expands their global reach.

Now appointed as general manager Africa, David Mitchell had already secured several projects driving African expansion and emerged as an ideal partner for continental growth during his visit to the Copenhagen headquarters. This pivotal moment initiated Mitchell's buyout of his national partner, and the subsequent establishment of a formalised African sector. He reflects, "Having worked as the territory's sole distributor for FabricAir since 2014, I am delighted to be a part of a company that is constantly widening its global growth. Our market has vast potential for fabric-based air dispersion solutions, and I look forward to scaling our presence across new territories."

Mitchell will facilitate the expected significant surge in opportunity in the African market. He will report directly to Brian Refsgaard, CEO at FabricAir, who defines the value of this upscaling saying, "FabricAir prides itself on being convenient to our customers and meeting their needs. Opening the new subsidiary will further ensure that we can deliver on our objectives and stated values," he adds.

FabricAir is now better positioned to meet the growing worldwide demand for its innovative and sustainable air dispersion systems. This development is a sound investment in their African expansion bringing expertise and a commitment to deliver high quality products.

"With streamlined ownership in 2021, growth efficiency improved – and the South African market position was strengthened, as was happening globally when FabricAir became the global market leader," says Mitchell. "The priorities for the future of my business are appropriate resourcing for expansion into Africa, and the implementation of governance structures. These will serve as a foundation for a suitable succession plan as I approach retirement," he adds.

RACA Journal

FabricAir Africa managing director, Dave Mitchell.

> *"This development is a sound investment in their African expansion bringing expertise and a commitment to deliver high quality products."*

The agreement forecasts Mitchell overseeing African expansion for a minimum of five years, while mentoring a suitable successor. He notes that, "The intricacies of South African operations require first-hand experience in the market."

Since the acquisition, FabricAir has been focused on formalising the business and strengthening its operations within the South African market. The opening of FabricAir South Africa's Cape Town office on 1 October 2023, adds to FabricAir's network of 16 intercontinental subsidiaries and vast network of worldwide distributors. One of FabricAir's core values, being close to its clients, is exemplified in this vital expansion. RACA

gmc airconditioning (PTY) Ltd

Inverter

Airconditioning

gmc thermal solutions

Water Heat Pump

GMC AIRCONDITIONING (PTY) Ltd

Centurion 0046, Republic of South Africa

Tel: +27 12 661 1173 Email: sales@gmcaircon.com

www.gmcaircon.co.za

SAIRAC OCTOBER TECH TALK TOPIC: AXIECO FANS

The following is a presentation delivered at the SAIRAC Johannesburg centre by Francois Schoombie (N.Dipl. Mech Eng. TUT), technical manager and EC product specialist for ebm-papst, during August.

Tough ambient conditions prevail in the ventilation, air conditioning and refrigeration sectors, as well as in mechanical engineering. To cope with these applications effectively, you need electrically and mechanically robust solutions that also work at a high level of efficiency.

AC axial fans that have been widely used up until now will reach their limits in this contentious area by the time the next stage of the ErP comes into force. The EC range of AxiEco Protect and AxiEco Perform duos, are a series that perfectly adapts to these requirements.

ErP stands for Energy-related Products. It is a European Union directive that sets minimum energy performance standards for heating and cooling products, including air conditioners, heat pumps and boilers. The ErP directive aims to reduce energy consumption, improve energy efficiency and reduce carbon emissions.

Some examples of affected products are fans, electric motors, pumps and compressors. There are other standards and regulations, such as ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and FER (Fan Energy Rating).

The ErP Directive was implemented in phases over five-year intervals. The first phase started in 2011, when the minimum efficiency standards were set. In 2015, ±30% of fans did not meet these standards and were no longer allowed to be sold within the EU market.

The ErP Directive initially applied to individual components, such as fans, pumps or compressors. Later, it expanded to cover the whole unit and systems that use these components and introduced new efficiency metrics and requirements.

Supplied by ebm-papst

In South Africa, there is a growing interest in energy efficiency and green building awareness, especially in the context of rising electricity costs and environmental concerns. However, there is still a lack of standards and regulations in South Africa to enforce these practices. Some experts and stakeholders have been advocating for energy efficiency since 2007 and have shown the potential savings and benefits of adopting more efficient products and systems. Therefore, there is a growing demand for more education and implementation of similar initiatives in South Africa.

RACA Journal

Francois Schoombie, technical manager and EC product specialist for ebm-papst.

RACA Journal

Chairman of the SAIRAC Johannesburg committee Gregory Grobbelaar introducing the speaker.

This ErP implementation in EU countries has had a huge impact on the whole industry, not just the suppliers. These standards also meant that any product that needed to be replaced had to comply with the current efficiency requirements. For example, if you had an air-conditioning unit with a fan or a

RACA Journal

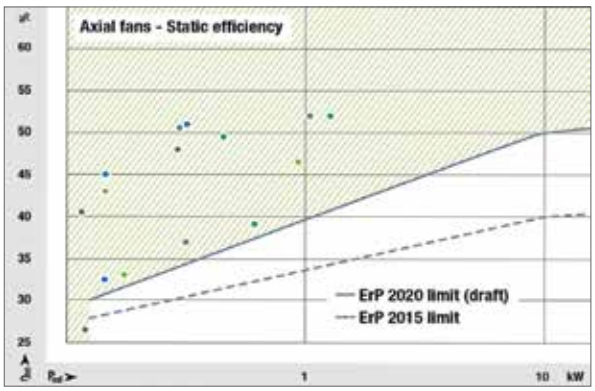
Question time.

compressor that failed, you could not replace it with the same model if it did not meet the standards. You would have to find a more efficient product instead. This increased the demand for more energy-efficient products, which in turn reduced energy consumption and carbon emissions in the long run. According to some estimates, the ErP Directive saved some ± 20 million tons of CO_2 emissions since 2012.

Supplied by ebm-papst

These figures are based on the EU market, but similar standards and regulations are also followed by other countries and regions, such as the US and ASHRAE. Therefore, the ErP Directive has a global influence on the eco-design of ALL energy-related products.

The ErP Directive is a mandatory requirement for the European market, and it influences the product selection and replacement decisions of the customers and suppliers. In South Africa, however, there is less incentive and awareness to choose more efficient products, even though they can save energy and money in the long run. The suppliers and contractors often prefer to sell cheaper and readily available products, rather than premium and compliant ones. This is a short-sighted approach that ignores the long-term implications of energy efficiency and environmental impact. Determining whether a fan conforms to the ErP regulation – this involves assessing the efficiency of the fan as a whole, i.e., the entire unit comprising control electronics (if fitted), motor and fan impeller. It is based on the ratio of air flow to power consumption. The higher the overall efficiency, the more efficient the fan. The ErP Directive sets minimum Efficiency values for different types of fans. Refer to graph:



Supplied by ebm-papst

There are different kinds of fans, such as axial fans and centrifugal fans. Axial fans have a hub and blades that rotate around an axis. The air enters and exits in the axial direction. Centrifugal fans have blades that curve outwards from the hub. The air enters in the axial direction and exits at a 90-degree angle (centrifugal forces). Depending on the application, you need different fans for different purposes. Axial fans are usually used for low-pressure applications, such as in the HVAC&R industry.

Centrifugal fans are used for higher-pressure applications as also found in the HVAC industry, namely for Air Handling Units (AHUs). The power absorbed by a fan is measured by its pressure and volume flow rate.

Axial fans have a region where the pressure drops and then rises again. This is called the stall or saddle region, which is dependent on the fan geometry, blade angle and speed. In this condition, the fan is rotating but not delivering the full potential of air flow. The pressure is mainly determined by the velocity component, which is why we design the ducts with specific velocities.

If there is turbulence within the (suction) airflow path, this disrupts the pressure balance and causes noise. This is typically in the range of 250 to 500Hz. Higher frequencies are always easier to attenuate. A conventional axial fan without a rotating diffuser, has high velocity regions near the blades and a large recirculation zone behind the fan. This reduces efficiency and increases noise. A fan with a rotating diffuser has lower velocity regions and a smaller recirculation zone. An optimised design with a rotating diffuser has more uniform velocity distribution and minimal recirculation. This improves performance and reduces noise. Depending on the application, you may want the best possible Air-Throw within your typical application.

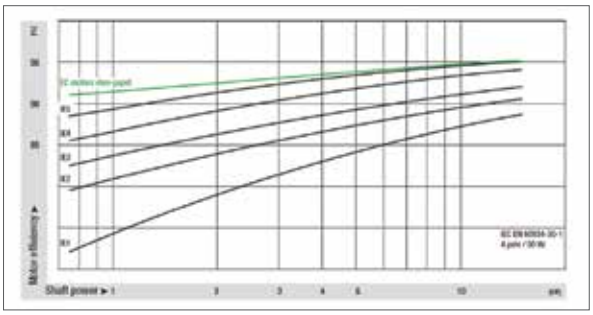
"According to some estimates, the ErP Directive saved some ± 20 million tons of CO_2 emissions since 2012."

Another benefit of the rotating diffuser design is the increased rigidity thereby allowing the impeller to rotate at a higher rpm without deformation. This gives us more power density, which means we can use a smaller fan with higher RPM and get better performance and efficiency.

This is useful for applications where optimal air-flow designs are necessary. In the past, you could not use axial fans for these applications, but now we have a solution that can meet all your requirements.

HOW EC MOTORS DIFFER FROM AC MOTORS

EC is an abbreviation for electronically commutated, which means that these motors deliver higher efficiencies than the conventional AC type. Refer to Graph:



Supplied by ebm-papst

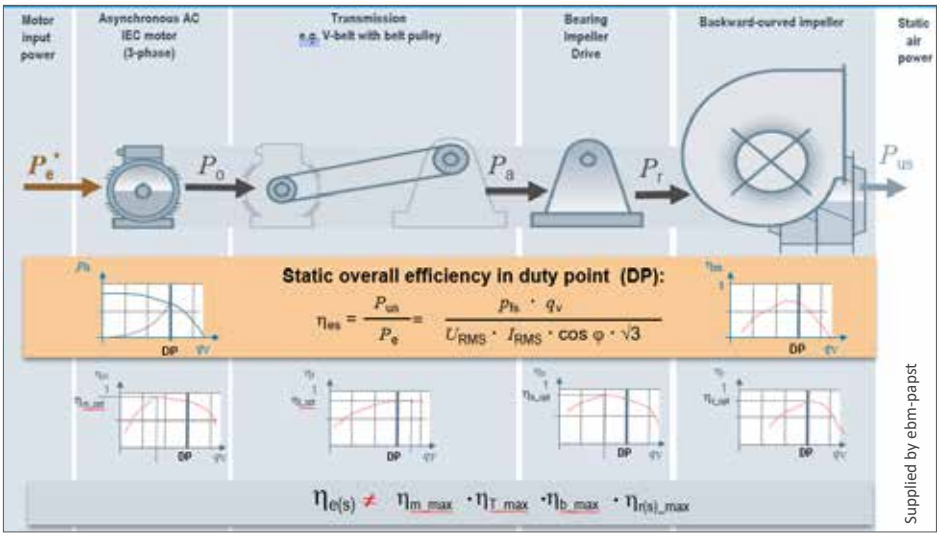
DC motors are easier to speed control by fluctuating the voltage, and they are more efficient than AC motors in terms of electrical input power versus shaft output power. AC motors were the most common type of motors that we used, and they work by supplying alternating current to the windings that create an electromagnetic field. This field induces a secondary magnetic field within the rotor, and the relative movement of these fields causes the rotor to spin. The frequency of the AC power determines the speed of rotation. To use a DC motor, one needs to convert the AC power into DC power, which is all integrated within our EC motors. There are also other advantages of EC motors, such as Modbus communications and built-in protection devices.

FAN AERODYNAMICS

Each one of the individual components has a role to play in the overall performance of the fan. If we look at only the motors, we would have heard about IE ratings. The conventional AC motors used in the past were IE1 or IE2. Nowadays, we can go up to IE4 and higher.

The efficiency of a fan is the ratio of what we get out vs what we put in. We put in electrical power and we get out air movement. The air movement can be measured in kilowatts if we use the formula: volume (in cubic meters per second) x pressure (in Pascals). This is the ideal power required to move air, without considering any losses. But in reality, the fan has many individual components that contribute to such losses, such as the motor windings, belt drives, bearings and overall aerodynamics of the impeller itself. For example, if we put one kilowatt of electrical power into the motor, we don't get one kilowatt of shaft power out of it. The motor has an efficiency rating that tells us how much power it can deliver to the shaft. As an example, if we buy a standard 3kW IE2 motor, it has an efficiency of ±86%. If we buy a premium IE4 motor, it has an efficiency of ±88%. This means that for every kilowatt of electrical power we put in, we get 0.86 or 0.88kW of shaft power out. The same principle applies to the other components of the fan. So, to calculate the overall efficiency of the fan, we need to consider all such factors and losses.

To accurately calculate the overall efficiency of a fan, we cannot simply use the catalogue data of maximum efficiency for individual components. We need to adjust the efficiency of the various components according to the actual performance of such, within the duty point.



This is done by applying the correction factors from ISO 12759. For example, if we assume that the fan and the motor are both 86% efficient based on the catalogue data, we are totally wrong. The actual overall efficiency of the fan is only 58%. So, if I want to sell you a fan that is 2% more efficient, but you have to pay 10% more, how can I ever convince you? The best and most accurate way to determine the fan efficiency is to measure it physically. We need to measure the electrical input power and the air output power and divide them by each other. However, this is not always easy in the installations or design phase. That's why we use these calculations to obtain accurate results.

Globally and locally, ebmpapst can assist with selecting the most efficient fans, as well as providing detailed Life Cycle Cost calculations.

Please contact your nearest office for any further assistance. RACA

"If we assume that the fan and the motor are both 86% efficient based on the catalogue data, we are totally wrong."

ASHRAE South Africa Chapter

BACK TO THE FUTURE: OUR INDUSTRY IN 2030 (PART 2)

On 13 June, Timothy G. Wentz, PE, HBDP | Fellow / Presidential Member ASHRAE, gave the third of a series of three presentations over three weeks to the South African Chapter of ASHRAE. The third was on the topic of *Back to the future: Our industry in 2030* hosted by the ASHRAE Society Chapter Technology Transfer Committee (CTTC). The following is a relatively complete review of the second part of that presentation, edited by **Eamonn Ryan**.

...continued from part one.

Recent events, such as the 27th UN Climate Change Conference of the Parties (COP 27) in Sharm El Sheikh, Egypt, have highlighted the stark reality that we are not on track to meet our climate goals. The global average temperature has already risen by approximately 1.1°C, and the target of limiting warming to 1.5°C is slipping further away. This widening gap between where we need to be, and our current trajectory poses a significant challenge for our future.

Data provided by Swiss Re, an insurance company, emphasises the global nature of this problem. The graph of insurance losses showcases a substantial increase in frequency, signifying the inevitability of more severe and frequent disasters. This paints a vivid picture of our future, highlighting the urgent need for action.

Acknowledging the reality of the climate crisis does not mean surrendering to its consequences. On the contrary, it serves as a call to redouble our efforts towards decarbonisation, energy efficiency and sustainable practices. The HVAC&R sector has a pivotal role to play in mitigating climate change and ensuring a resilient future for all.

To navigate the challenges ahead, the HVAC&R industry must embrace innovation and collaboration. This entails integrating advanced technologies, such as AI and machine learning, to optimise energy usage, enhance building performance and minimise environmental impact. By adopting integrated design approaches and leveraging tools like BIM, we can create more efficient and sustainable buildings.

Given the challenges we face and the likelihood of not meeting our climate goals, it is imperative to prioritise resilience. Resilience encompasses our ability to withstand and recover from adverse events, ensuring the continuity of operations in the face of disruptions. Furthermore, cybersecurity has emerged as a critical concern. A study conducted by the Mechanical Contractors Association reveals that approximately 60% of small to mid-sized corporations are ill-prepared to withstand a massive cyber-attack. As our industry predominantly comprises such enterprises, it becomes evident that cybersecurity is an issue that cannot be ignored.

Timothy G. Wentz, PE, HBDP | Fellow / Presidential Member ASHRAE.

Looking ahead, the future of the HVAC&R sector lies in a merging of sustainability, resilience, security, design and construction. Integrated design, which considers all these elements, is key to navigating the complex environmental landscape. By embracing this holistic approach, we can create buildings and systems that are efficient, sustainable, secure and adaptable to evolving challenges. The need for integrated solutions arises from the unique environmental circumstances we are likely to face in the future.

The HVAC Global Summit held by ASHRAE identified six common problems faced by the industry globally. These issues, which include energy efficiency, indoor air quality and climate change mitigation, present opportunities for HVAC&R professionals to make a meaningful impact. As the HVAC&R industry plays a vital role in each of these areas, it offers an avenue for individuals to contribute towards a sustainable future.

For those considering a career in the HVAC&R sector, joining ASHRAE provides valuable opportunities for preparation and growth. ASHRAE has established the Task Force on Decarbonisation to align its efforts with global initiatives and enhance operational expertise to reduce greenhouse gas (GHG)

emissions. Energy efficiency remains a crucial focus, as it is an integral component of decarbonisation. By leveraging cleaner energy sources and promoting electricity produced from low-carbon sources, ASHRAE aims to support the decarbonisation of buildings.

To meet the urgent challenges we face, ASHRAE has set ambitious goals to cut carbon emissions in half by 2030. This target reflects the pressing need for immediate action. The data available today demonstrates that we are not on track to mitigate the impacts of climate change effectively. By prioritising net-zero energy buildings, we can significantly reduce environmental impacts while reaping benefits such as cost savings, enhanced resilience and improved energy security.

While decarbonisation presents a broader perspective, energy efficiency remains a vital component. ASHRAE members need not fear that the focus on energy efficiency will be abandoned in favour of decarbonisation. Both aspects are interdependent and essential to achieve sustainability goals. Buildings consume 35% of the world's energy and emit 38% of carbon emissions. By prioritising energy efficiency, our industry can make a significant impact on climate change mitigation.

RACA Journal

Buildings consume 35% of the world's energy and emit 38% of carbon emissions.

ASHRAE'S THREE PILLARS FOR DECARBONISATION

ASHRAE is dedicated to leveraging its operational expertise to reduce or eliminate greenhouse gas (GHG) emissions. The organisation's three pillars for achieving decarbonisation are energy efficiency, switching to cleaner energy sources and utilising low-carbon electricity.

- **Behavioural change and design guides:** Recognising the significance of human behaviour, ASHRAE invests considerable effort in understanding and harnessing its potential for energy savings. Research has revealed that focusing on human behaviour can lead to 10-20% energy savings. ASHRAE's Advanced Energy Design Guides and Zero Energy Design Guides offer valuable design ideas, now freely available for download. Additionally, ASHRAE has reformed its materials to align with social modelling, understanding that humans are inherently inclined to adapt to group behaviour. The Building Energy Quotient (Building EQ) measures the energy gap between design and operation, emphasising the role of human behaviour in energy efficiency.
- **Adaptability and agility:** ASHRAE recognises the need for speed and adaptability in addressing emerging challenges. Just as a vintage car might evoke nostalgia, it is essential to acknowledge that it may not meet the demands of the future. ASHRAE is committed to becoming faster and more nimble, continuously evolving to keep pace.
- **Embracing growth and adaptability:** In the words of wisdom from my grandfather, growth and decay are the only two states of being for individuals and organisations. ASHRAE recognises the importance of growth to benefit its members and the communities they serve. This includes eliminating silos, empowering decision-making at lower levels and fostering a collaborative approach through councils, regions and chapters.

ENERGY AND FOOD SECURITY

The HVAC&R sector has a significant role to play in ensuring both energy and food security. Energy security is closely linked to energy efficiency, reducing reliance on the grid and mitigating risks associated with extraordinary events. ASHRAE is actively involved in promoting renewable energy sources such as wind, solar and nuclear power, as well as supporting efforts to scale up investments in renewables. By embracing a people-cantered and inclusive approach to energy access, ASHRAE aims to combat energy poverty and its adverse effects.

Similarly, food security is an area where the HVAC&R industry can make a substantial impact. Proper refrigeration has the potential to preserve vast quantities of food, ensuring its availability to those in need. Estimates suggest that refrigeration could save 475 million tons of food, which could feed approximately 950 million people. ASHRAE recognises the importance of refrigeration in addressing food security and continues to work toward innovative solutions in this realm. RACA

SAIRAC JOBURG HONOURS FELLOWS

All images by RACA Journal

Johannesburg Country Club.

By Eamonn Ryan

In October 2023, SAIRAC Johannesburg Centre hosted its annual Fellows luncheon.

The Fellows lunch provides an opportunity for those within the refrigeration and air conditioning industry to give thanks, and to honour the Fellows of the institute who have shaped and nurtured our industry into what it is today.

The title 'Fellow' requires a minimum membership to SAIRAC of 10 years and is awarded to those who have shown significant performance, with recognised contributions to the industry, among other criteria.

Left to right – The Fellows: AG Curry, PW Burke, RFW Hannah and GK Laidlaw.

Johannesburg centre chairman Gregory Grobbelaar opened with a message of thanks to all the Fellows, most of whom have had an integral part in the setting of standards and dissemination of knowledge within the HERVAC industry.

Present were Robert Fox, SAIRAC president; Grant Laidlaw, SAIRAC national treasurer; all the Johannesburg Centre committee members; as well those Fellows able to make the event:

- Mr PW Burke
- Mr AP Curry
- Mr RFW Hannim
- Mr GK Laidlaw

"Their efforts have directly contributed to the growth and stability of the SAIRAC institution," Grobbelaar commented.

Lunch was then served, and the Johannesburg Country Club was as impressive as ever, providing a beautiful backdrop to accompany the excellent food and service that we have come to expect.

"Your continued support is greatly appreciated, and instrumental to the sustainability and continuous growth of our institution" Grobbelaar concluded. RACA

The Fellows table.

SAIRAC Johannesburg Centre chairman Gregory Grobbelaar.

Left to right: Charles Freedman, CEO of ServCraft; Robert Fox, president of SAIRAC; Grant Laidlaw, founder of ACRA and national treasurer of SAIRAC; and James Laidlaw.

DOCTORAL STUDENT AWARDED NATIONAL PRIZE FOR EXCEPTIONAL RESEARCH WORK

Edited by Eamonn Ryan

At the SAIRAC 60th anniversary celebration late last year, Bongani Radebe, a doctoral student from the Tshwane University of Technology's Faculty of Engineering and the Built Environment (FEBE) was awarded SAIRAC's national prize for best outstanding research work.

SAIRAC President, Robert Fox, said the SAIRAC National Prize is given to the author of the best thesis on refrigeration and air conditioning by a final-year student at any higher institution in South Africa. SAIRAC annually honours individuals making outstanding contributions towards research and development in the refrigeration and air conditioning industry, with both a national and international impact.

Radebe is a full-time doctoral student in mechanical engineering, specialising in thermodynamics, refrigeration and air conditioning energy storage. He was recognised for presenting the best thesis among final-year students at various universities in South Africa. In his research project, Radebe invented a new phase change thermal storage unit, enhancing cold chain applications through nanoparticles.

The evening of SAIRAC's 60th anniversary.

All images by RACA Journal

SAIRAC President Robert Fox is pictured alongside Bongani Radebe, who won the national prize for outstanding research as a doctoral student of FEBE.

Professor Zhongjie Huan has been supervising Radebe since his master's programme and describes Radebe as a highly refined and skilled doctoral candidate with a positive attitude and extensive knowledge of refrigeration and its applications. "He has the necessary qualifications to solve real-world problems, generate new knowledge, and innovate new technologies and products," said Huan. He furthermore expressed his appreciation to SAIRAC "for stimulating the young generation to study and contribute to refrigeration and air conditioning."

Radebe expressed his delight at the anniversary celebration: "I am more than pleased to receive the award from SAIRAC in recognition for my work. I thank Professor Huan for his mentorship and supervision throughout the years – this keeps me motivated to work harder. Through his leadership, I managed to publish ten original research papers in accredited journals and conferences."

Fox said: "It gave me great pleasure to hand out the award to Mr Radebe in recognition of his research. It is encouraging to see a student doing research in the HVAC&R industry. I can only hope that we see more students doing research in the industry in the future." RACA

"Radebe is a full-time doctoral student in mechanical engineering, specialising in thermodynamics, refrigeration and air conditioning energy storage."

INTRODUCING SARACCA'S NEW EXECUTIVE DIRECTOR

By Eamonn Ryan

David Botha has been appointed as the new executive director of SARACCA, effective October 2023, replacing retiring (for the second time) Barney Richardson.

Botha was previously serving as the vice-president for SARACCA and branch chairman for the Gauteng area and has been serving on the association's executive committee for many years. Botha was appointed after the untimely death of John Parry earlier in the 2023 year.

"We had a succession plan to ensure a smooth transition from Barney to John, and only thereafter once John retired, I would step up. But circumstances altered that."

When asked if he would like to be in the position for a long time, Botha replied "yes, I'm not going anywhere – the industry is my passion." Botha started in air conditioning in 1991 as an apprentice. In 1997 he joined AMPROS, and from there started his own business ABMS maintenance service.

The primary focuses of Botha's job – and indeed SARACCA as a whole – are the following:

- Managing the registration of HVAC&R practitioners with SAQCC Gas – ensuring the paperwork of their qualifications is correct – and getting more practitioners registered on the platform.
- Growing the SARACCA membership base amongst contractors.
- Assisting its existing 125 member companies with any technical queries they may have.
- Facilitating training: SARACCA has 18 approved training service providers recognised for HVAC&R training.

"One of the things that we need to do for the future is to get more training providers recognised by SARACCA to make it easier for practitioners to attend training in the HVAC&R industry wherever they are located."

He notes that members receive a highly attractive 75% rebate on registered training courses at SARACCA's approved training centres. This scheme helps member companies train more people and improve their skill levels. "We have seen a much high number of training claims in the last few months, ranging from intermediate to higher levels, including the SAQCC Gas courses relating to safe handling of refrigerants.

RACA Journal

David Botha has been appointed as the new executive director of SARACCA, effective October 2023.

This latter training alone has seen 274 new applicants register in the last 6 months."

SARACCA recognises three different categories of practitioners:

- Category A covers people who can do the work with recognised skills, but do not yet have the any trade qualification – this is where much of the SARACCA training is focused.
- Category B covers practitioners that are qualified with a trade to their name, and typically enroll in training programmes to add new disciplines to their skills set, and renewal of refrigerant safety requirements.
- Category C covers inspectors and designers.

Botha lists one of the struggles in HVAC&R as being that consumers and businesses rarely consider requesting a COC for a job performed, whereas they would automatically do so in relation to LP gas jobs. SARACCA has consequently developed a media communication campaign to educate people on the legal

requirements for a COC with regards to air conditioning, but Botha admits "there's still a long way to go before the message gains traction."

Even among HVAC&R firms, he cautions that it sometimes may take an audit from the Department of Labour and a report stating that they have no SAQCC Gas registered practitioners, before the message sinks in. "We'd like to help them avoid that shock by educating them on the relevant SANS regulations, OHS laws, design or installation challenges.

"Above all, we need to grow the membership base, as this is how we ultimately prove our relevance as a contractors' association. We need to grow the association to a critical mass whereby it releases resources to then assist start-up and smaller companies coming into the association to survive. Most businesses in South Africa fail between the first two to five years. In the case of HVAC&R we need to assist these smaller start-ups to stay in business by assisting them to follow regulations, and thereby grow their businesses to be sustainable," explains Botha.

Currently, there are only about 4 000 registered practitioners in South Africa – a small figure that implies the bulk of practitioners are not registered and are therefore non-compliant. To judge the scale of the informal sector, Botha points out that a country like Australia – with a far smaller population – has 33 000 registered practitioners. "This highlights the importance of getting more practitioners to register, to recover refrigerants and to write out certificates of conformity. With such COC clients, contractors and engineers can then have confidence that they have well trained practitioners working on their equipment.

South Africa is going through tough times, but energy and water security are two of the most pressing concerns for the years ahead. As an association and industry, Botha asserts SARACCA must do its part to protect the environment. "One of the main issues we face is getting HVAC&R companies to recycle refrigerants instead of venting them. With the phase out of refrigerants increasing over the coming years, refrigerants such as R22 will not be available much longer, or only in small quantities. It's important that we ensure companies and individual contractors are aware of the need to recycle refrigerants.

"The training courses available educate practitioners on how to recover refrigerants and return them to main suppliers for reclamation or destruction. This way, we can prevent damage to the environment and the ozone layer. We also work closely with environmental services in the government to this end," says Botha. RACA

> *"Above all, we need to grow the membership base, as this is how we ultimately prove our relevance as a contractors' association."*

FRIGAIR 2025 WILL FEATURE THE LATEST IN DESIGN, TECHNOLOGY AND TRENDS

Compiled by Eamonn Ryan

With just over a year to go, the best stands in the 2025 offering of Frigair are rapidly being booked. As the HERVAC sector's only dedicated event in Africa, it represents a not-to-be-missed opportunity to be seen amongst the elite of the industry. The HERVAC industry is known to produce the best outcomes when done through physical interaction and such opportunities abound at FRIGAIR.

Since 1980, FRIGAIR has been providing an industry-preferred platform for engagement on doing business, knowledge transfer and networking opportunities. The 2025 event will no doubt create excitement and stimulus for the entire heating, energy, refrigeration, ventilation and air conditioning (HERVAC) industries.

It is one of the South African Institute for Refrigeration and Air Conditioning's (SAIRAC) premier events, as well as the largest dedicated HERVAC trade exhibition in Africa. FRIGAIR 2025 will feature an exhibition, workshops and courses which are eagerly anticipated by the industry, if 2022's event is anything to go by. The exhibition and its line-up of several free-to-attend workshops and courses will once again take place at the Gallagher Convention Centre in Midrand, at a date to be announced closer to the time.

A lot of progress in techniques and technology has occurred over recent years, driven primarily by solutions to aspects related to indoor air quality, as well as efficiency and the heightened drive to mitigate global warming and its effects — where the HERVAC sector plays a significant role in terms of energy and refrigerants.

SO MUCH ON OFFER FOR VISITORS, YOU CAN'T MISS OUT!

Some key reasons to visit will include:

- Sourcing cutting edge products and technologies.
- Learning opportunities from daily workshops and courses.
- Network with suppliers and service providers.
- Engage with 100+ knowledgeable exhibitors.
- Experience live demos.
- Discover new products and solutions.

FRIGAIR 2025 AIMS TO TOP 2022

FRIGAIR 2022 delivered a truly world-class showcase of the latest and greatest the HERVAC industry has to offer, from both top local and international suppliers. Praised as the ideal platform to not only present cutting-edge industry trends and technology, it is also the platform that ticks all the boxes of true and complete industry engagement.

Held at Gallagher Convention Centre in Midrand, Johannesburg from 1-3 June 2022, the three-day event boasted 102 local and international exhibitors and drew thousands of high-profile industry professionals from all levels and industry sectors. FRIGAIR, now recognised as the show that delivers results, had both exhibitors and visitors alike reporting successful delivery of leads and knowledge transfer, in addition to unrivalled networking opportunities greatly missed over the period since the prior event.

Being delayed by a year owing to the global pandemic, FRIGAIR 2022 indeed held the key to renewed industry stimulus and will continue every three years going forward. The general consensus for last year was that this prestigious industry gathering went well beyond expectations, with:

RACA Journal

Frigair 2022.

- Three days of free-to-attend workshops arranged and hosted by SAIRAC as part of their commitment to further the education of the HERVAC industry
- Several product launches
- Demonstrations
- Celebrations
- Long-awaited face-to-face interactions

"With such a great and diverse line-up of technology and trends that exhibitors showcased, as well as the educational opportunities on offer, FRIGAIR once again proved its status as a premier event and has built onto its status as the largest dedicated event for these sectors on the continent. In fact, the quality of the FRIGAIR exhibition is comparable to the best the world has to offer and we are proud to be a partner in that." – SAIRAC

If you are interested in exhibiting at FRIGAIR 2025, get in touch with the team that will be available to discuss a solution that suits your business. By 2025, during the four years since FRIGAIR 2022, many of your target clients – namely engineers, contractors and technicians have entered the industry. So if you think everyone already knows your brand, think again!

This is the perfect opportunity to establish and build new relationships as the industry comes together in the same place at the same time to partake in the proven experience of face-to-face interactions.

Some top reasons to exhibit include:

- Branding
- Generate on-site sales and extend your pipeline with quality sales leads
- Showcase your latest energy efficient and environmentally friendly solutions
- Launch new products and services
- Engage on a proven face-to-face platform preferred by industry role players
- Thousands of relevant buyers coming to you

SPEAK TO THE TEAM

- Sales manager: sales@interactmedia.co.za
- Editorial: eamonn@interactmedia.co.za
- Marketing: marketing@specialised.com
- Websites: www.frigairexpo.co.za | www.sairac.co.za

The FRIGAIR exhibition is owned by the South African Institute for Refrigeration and Airconditioning (SAIRAC) and managed through organisers Interact Media Defined and Specialised Exhibitions – a division of the Montgomery Group. RACA

WHY CLIENTS ARE MOVING FROM A WET COOLER TO ADIABATIC DRY SYSTEM

Edited by Eamonn Ryan

SAIRAC organised one of its regular factory tours late last year, this time to Evapco's premises in Isando, Johannesburg. The following presentation was delivered by MD Andre van der Merwe.

In 1982, Evapco took its first step towards global expansion by establishing its presence in South Africa. Last year marked a significant milestone for the company as it celebrated its 40th anniversary in South Africa, highlighting its enduring success in the region. Evapco first expanded into Italy in 1979 and then South Africa.

Over the years, Evapco has strategically diversified its product portfolio, evolving from a company solely focused on evaporative cooling products such as cooling towers, evaporative condensers, and fluid coolers, to offering a complete range of wet, dry and hybrid adiabatic coolers. Moreover, the company has ventured into various other product segments. Today, Evapco boasts nearly a dozen facilities across the US, four facilities in Europe, four facilities in China, and one in each of South America, Australia and South Africa.

The global firm does prolific research and development (R&D), while the South Africa operation is a full licensee of Evapco that contributes financially to that R&D. The company boasts cutting-edge facilities, including thermal laboratories equipped with advanced testing capabilities.

While modern technology has introduced tools like computerised fluid dynamics (CFD) for testing and rating purposes, Evapco firmly believes that full-scale testing remains the most accurate measure of product performance for the creation of top-quality products.

Evapco's products not only meet high standards but also cater to specific market requirements. For instance, the US, particularly California, imposes stringent seismic testing regulations, ensuring safety and reliability during seismic events. Evapco readily complies with these demanding specifications, demonstrating its commitment to providing exceptional products.

Furthermore, Evapco recognises the importance of meeting environmental standards. Green initiatives have gained significant traction across the globe, with California being a pioneer in this regard. The state's susceptibility to earthquakes and water shortage issues has led to the implementation of strict regulations and significant rebates for green building designs. While South Africa has embraced the concept of green buildings, the lack of financial incentives has limited widespread adoption. In contrast, cities like Melbourne in Australia have seen a surge in green buildings due to attractive tax benefits and rebates.

With climate change becoming increasingly evident, Evapco acknowledges the need to address environmental concerns. As extreme weather events continue to occur worldwide, it is

All images by RACA Journal

Gregory Grobelaar, SAIRAC Johannesburg Centre chairman and by Evapco MD Andre van der Merwe.

Various completed units ready for shipment.

crucial for manufacturers to evaluate their impact and contribute towards sustainable solutions. The company urges organisations to prioritise the development of eco-friendly products and technologies to mitigate the effects of climate change.

The various types of Evapco cooling systems – known as the full Spectrum of Cooling Products – available include:

- **Evaporative fluid cooler or evaporative condenser:** This product range represents the standard for Evapco cooling systems. It operates as a closed-circuit fluid cooler, ensuring optimal efficiency for your cooling needs.
- **Hybrid fluid cooler or Hybrid Condenser:** Evapco also offers a hybrid fluid cooler, which combines a dry coil and a wet well. This configuration optimises the system's operation and provides improved performance for your cooling requirements. It offers the best combination of both water and energy savings.
- **Full air cooled units:** The next step in the evolution of Evapco cooling systems is the full air cooled unit. These units operate without the need for water, making them straightforward and easy to understand.
- **Air cooled units with adiabatic pads:** One of the most interesting options offered by Evapco is the air cooled unit with adiabatic pads. These units provide enhanced cooling performance by utilising adiabatic pads. Essentially this is a dry cooler with wet trim.

Understanding the principle of operation of evaporative condensers is crucial in comparing different Evapco cooling systems. The coil in these systems allows for the efficient introduction of refrigerant, resulting in 100% wet conditions throughout the year.

Comparing the water consumption of various Evapco cooling systems is essential. The suggested rule of thumb for evaporative systems is that 85% of the process involves latent heat rejection, while 15% is related to sensible heat rejection.

Each Evapco cooling system requires consideration of factors such as evaporation rate, drift loss and bleed. Drift loss depends on the efficiency of drift eliminators, and Evapco systems are designed to achieve high efficiency in this regard. Additionally, working with a qualified water treatment professional can help ensure the appropriate cycles of concentration are maintained.

The hybrid cooler, featuring a combination of dry and wet modes of operation, offers significant water and energy savings as it fluctuates between different modes based on ambient conditions. This allows for a more efficient and sustainable cooling solution.

Dry coolers operate solely based on the ambient dry bulb temperature. While they offer zero water consumption, they are restricted to higher operating fluid temperatures. Their physical size and weight may also pose challenges during retrofitting and installation. To offer some needed temperature efficiency to the Dry Coolers the coolers can be supplemented with Adiabatic Pads. Evapco's adiabatic dry cooler offers substantial water savings compared to the wet cooler, making it a desirable solution in a world facing climate change, high water costs and stricter regulations. It is a popular option for companies unable to get water quota in some municipalities.

Regarding the advantages of Evapco's adiabatic condensers compared to air-cooled ones, the adiabatic condensers have lower installed power, a smaller footprint and higher capacity. This means they can provide more efficient cooling in a compact design. The adiabatic pads are installed on the outside of the condenser unit. Additionally, Evapco offers a free cooling system with solenoid valves that activate the pads and introduce water when needed.

There are two approaches to water management in the cooling system: pumped pad and once through system. Previously, most designs used the pumped pad system, where water recirculates through a pump. However, this can lead to an increase in dissolved solids concentration if water quality is not closely monitored. As a more practical solution, the once through system directs water through the pad and straight to drain. With the pumped pad some manufacturers have even recommend using de-mineralised water, but this can be expensive. Evapco's eco Air Series units utilise the once through pad system, which eliminates the need for expensive water treatment.

"Evapco's adiabatic dry cooler offers substantial water savings compared to the wet cooler, making it a desirable solution in a world facing climate change, high water costs and stricter regulations."

In conclusion, Evapco constructs coolers with a focus on coil construction, fan section options, control systems and incorporating efficient adiabatic coolers and condensers. Their goal is to provide reliable and energy-efficient cooling solutions for various applications that offer tested and certified capacity. RACA

A group shot of the attendees at the Evapco site visit.

Eco Aire series dry coolers in final assembly.

Eco Aire Series Dry Cooler c/w Adiabatic spray control system.

PIPE AND VALVE SELECTION FOR A COOLING SYSTEM

Complied by Eamonn Ryan

Each component of valves, pipes and controls throughout a cooling system is critical to the overall efficiency and effectiveness.

When designing a cooling system, it is crucial to choose the right pipes and valves. It's important to understand the options available and the possible outcomes associated with each selection. Many factors can impact the effectiveness, longevity and quality of the overall cooling system, and each of these factors should be examined when choosing the best pipes and valves for the application. In most cases, valves, piping and sensors are all key factors to a cooling system's effectiveness and overall quality.

PRESSURE INDEPENDENT CONTROL VALVES

Automated Control Solutions (ACS) supplies several brands of control and balancing valves. Today, ACS primarily distributes Danfoss, iSMA Controlli, Genebre and Honeywell valves and Actuators, particularly for chilled water application. ACS services HVAC system integrators and mechanical contractors with high end quality international products.

Adrian Hofmann, technical sales and support at ACS, says: "when it comes to the big tenders for large buildings and shopping malls, engineers like good quality valves and Danfoss and iSMA Controlli valves fit the bill nicely. There are two different sets of valves we do from Danfoss and iSMA Controlli: conventional two- and three-way control valves with manual balancing. This is the traditional way that people still use valves – up to about 150mm in two-way, and in three-way up to 300mm for chiller plant managing. We also do Danfoss' AB-QM 4.0 range, which is their Pressure Independent Control Valve (PICV) solution from 10mm up to 250mm, which are massive pressure independent control valves combined with automatic balancing valves. In particular, data centres like those valves because they require less commissioning and have far better control with up to 100% valve authority. PICV are combo two-way control valves with built-in automatic balancing valves which also save space on the valve arrangement, as there is now only one valve installed instead of two – this makes for a very neat installation."

iSMA Controlli valves and actuators are an alternative to Danfoss, they have some highly specialised stainless-steel options with actuators suitable for outdoor installations with IP65 enclosures – unique products with competitive pricing.

Conventional valves have been around a long time and Hofmann explains that one can either have on-off control or modulating control. "Modulating control is not new and gives superior control of the water flow. You'd have a controller like an 'iSMA AAC20' on an AHU unit giving a 0-to-10-volt signal to the actuator, which would be open or closed or anywhere in between the whole time, depending on the demand through the building," says Hofman.

In the past, there were constant flow systems with three-way valves. There could be a set of pumps running full blast all day long regardless of the load, with the only thing changing being that the valve opens and closes, and water either goes through the coil or bypasses back to the chiller – a highly energy-inefficient system. "Now, with the design of the PICV, it's a control valve and an automatic balancing valve all in one piece. There is no running up and down for weeks balancing the system – the valves are pre-set on installation, and they will take care of the rest. There's no bypass at the coils, which means variable speed drives (VSD) can now control the pumps to maximum efficiency, in the morning and evening, when the load is low, the VSDs run slowly, and entire plant runs more energy efficiently. As a result, those PICVs have grown in popularity – even though they're more expensive than conventional valves, they provide a good return on investment on energy saving alone, never mind the savings on installation and commissioning," says Hofmann.

BALANCING THE SYSTEM

He says the PICV is pre-set according to the flow requirement during installation, the valve taking care of the rest. The manual balancing valve can only be set once the water is pumping through the whole system at full load. Only at that point can the commissioning engineers start adjusting each valve, whether it be for fan coil units, AHUs, the branches or the risers – on big systems there are typically hundreds of these valves. What happens is, as one starts throttling these manual balancing valves to let the required amount of flow through, pressure starts increasing in the rest of the system, with the result the commissioning engineers must return to the previous valves to balance them again, this could take approximately two to three attempts 'per valve' to balance the system.

"PICVs always let just the required amount through the coil, regardless of changing system pressures, so the pump is running at the right speed, and the whole system is more efficient – for a

power saving for the end user. They'll pay more from the start but get their money back from power savings, normally well within two to three years. Unfortunately, it is often about the capex rather than opex. The mechanical engineer designs the system according to the client's budget and it is the price of the system that ultimately determines which solution they go for.

"However, when a building is aiming for green star rating certification from the Green Building Council SA (GBCSA) they will certainly budget for PICVs in order to get the energy savings and the points. As green buildings are being pushed quite extensively, we have been seeing an increasing adoption rate over the past 10 years. However, there are still plenty developers who are not worried about their client's energy usage because of the upfront cost," adds Hofmann.

He notes that Danfoss PICVs can be retrofitted to existing two-way systems. "It is messy work – but there is no question that it will pay for itself in a very short time."

Automated Control Solutions

Danfoss ABQM FCU Valve and actuator installed in very tight space.

Automated Control Solutions

Danfoss ABQM DN150 installed at a local data centre.

FEATURES AND BENEFITS

- Easy setting and sizing: Selecting the right AB-QM is much less complicated than sizing and selecting conventional control valves. Once the design flow is determined the matching AB-QM can be selected, no additional Kv and authority calculations are required.
- 100% authority: Having a 100% valve authority increases the control quality and precision, also at low flow requirements. This creates a better comfort in the building, as well as increasing the energy savings.
- Perfect control: By providing the right flow at the right time, the AB-QM optimises chiller and boiler efficiency and reduces pumping costs. In addition, the actuators need to make much less movements, increasing the lifetime value and lowering the Total Cost of Ownership.

WHEN COOLING SYSTEMS ARE EXPOSED TO THE ATMOSPHERE

Cooling towers are often open to the atmosphere, which exposes them to outside elements. To combat this issue, it's typically required to treat the water with a series of decontaminants that will aid in the slowing of corrosion and erosion caused by the chemicals and foreign particles in the water that is used to cool the system. Closed systems may be used for smaller cooling applications.

Choosing the best piping for a cooling system is a crucial part of the assembly process. There are five types of piping that can be used for a cooling system: tubing, iron, steel, stainless steel or exotic alloys, and plastic. The size and type of piping that should be used in the system is determined by factors such as the desired velocity through the system and compatibility with the fluid and chemicals that need to be introduced into the system to ensure efficiency.

The size of the piping is important but can easily be determined by how much water needs to flow through the system. Higher grades of piping material come with a higher cost but will help with longevity and reliability. The compatibility of the piping system is important because water will be running through it at a near-constant flow rate. As the flow rate of water increases, a more chemically resistant pipe material is required to better hold up to corrosion.

If there is corrosion within the piping system, there can be a number of issues, including leaks within the piping system where

"It could be a needless expense to buy an extremely precise and more expensive control valve when a less precise one could have done the job just as well."

RACA Journal

Adriaan Hofmann, technical sales manager at ACS at Frigair.

Automated Control Solutions

A DN250 Danfoss AB-QM PICV valve and actuator – one of six installed at a local data centre.

water can seep through, and corrosion builds up in the pipe. Corrosion will inevitably reduce the flow area of the water. This corrosion issue is more predominant in small systems.

The diameter of the pipe is a crucial factor to consider in the design of a cooling system. The size of the pipe must be calculated correctly to ensure that it fits with the overall system, with the calculations of the pipe diameter accurate so that the velocity of the system is optimised and efficient. If the velocity is minimised throughout the system, then the water will be able to freely run and cool areas. Additionally, there will be less corrosion if the velocity is kept to a minimum.

The introduction of chemicals in the water is the last element to consider when looking at piping. In an open-atmosphere system, chemicals are typically introduced to control the pH level of the water. If chemicals are not introduced and the pH levels are not monitored, corrosion is likely in the piping system, causing a slow flow of water. In closed systems, there tend to be fewer minerals in the water. Consequently, closed systems can use aggressive fluids such as de-ionised water, requiring the use of plastic piping or stainless steels rather than iron or steel.

CHOOSING THE RIGHT VALVE TYPE FOR A COOLING SYSTEM

When it comes to cooling systems, the valves that are selected are typically going to be flow control valves and shutoff or bypass isolation valves. There are a number of points to consider before picking the valve for the cooling system:

- The flow capacity, for which it is important to remember in valve selection the pipe size.
- What flow capacity is needed for the cooling system?
- What size piping will be used?

The valve pressure/temperature rating must be within the system design parameters. The initial factor to be considered is the maximum pressure that the cooling system will have to hold, to determine the valve rating. Regarding the capacity of the system, consideration should be given to choosing whether a small-diameter pipe (globe control valve); mid-diameter pipe (segmented ball valve); or large-diameter pipe (high performance butterfly valve).

Different types of isolation valves also are considered based on pressure and related capacity:

- Small-diameter pipe: two- or three-piece ball valve
- Mid-diameter pipe: three-piece or flanged ball valve
- Large-diameter pipe: butterfly valve

The capacity of the overall cooling system is something that should be considered – the smaller the system size, the more accurate it will likely need to be. The cooling system in a CPU liquid cooler is one that should be accurate as there is a finite amount of space the water works with to cool the variables along the piping system.

> *"There could be a set of pumps running full blast all day long regardless of the load, with the only thing changing being that the valve opens and closes and water either goes through the coil, or bypasses back to the chiller – a highly energy-inefficient system."*

This is not to say that the accuracy of the valve is not important in large systems. Rather, it is simply to understand when selecting a valve the factors that make up the valve's accuracy. The factors that make one valve more accurate than another include construction of the valve, complexity of internal components and higher engineered designs.

The preciseness of the valve is therefore key: it could be a needless expense to buy an extremely precise and more expensive control valve when a less precise one could have done the job just as well. Consequently, it is important to determine the margin of error that a system can endure while still being efficient.

Finally, it is important to narrow down valve selection by taking a look at the heat transfer fluids – such as water – that will be involved in the cooling process system:

- What is the source of the fluid?
- What is the target water temperature?
- To what degree does the system need to be cooled down?
- What is the temperature of the water when it is introduced into the system?
- Is the water clean?
- Is the water going to be treated before it reaches the valve?

These questions will also determine the material of construction selected for the cooling system and valves, based on the strength needed in the system (pressure and temperature rating); the internal and external environment of the system (open or closed); and the resistance to corrosion or erosion of the fluid being used to cool the system.

THE CRUCIAL ROLE OF PIPES AND VALVES

Pipes are used to transport refrigerant, water and air between the various components of the system, while valves are used to regulate the flow of these fluids. Their proper functioning is critical to the efficient operation of an HVAC system.

Valves play a crucial role in regulating the pressure range in HVAC systems and protecting the actuators from letting the pressure reach its maximum level. There are different types of valves used in HVAC, including butterfly valve, gate valve, check valve, air-vent valve, motorised on/off valve and pressure independent balancing control valve.

There are several common problems that can occur with pipes and valves in HVAC systems. Here are some of them:

- **Leaking:** Leaks in pipes can cause significant damage to an HVAC system.
- **Corrosion:** Mineralisation, tarnish and wearing will corrode the parts inside your valves over time.
- **Clogging:** Clogging is a common problem with valves in HVAC systems. It can be caused by dirt, debris or mineral buildup.
- **Freezing:** Pipes and valves can freeze in cold weather conditions, which can cause significant damage to an HVAC system.
- **Pressure problems:** Pressure problems can occur when the pressure range in an HVAC system is not regulated properly.

Consequently, maintenance of valves and pipes in an HVAC system is crucial to ensure the efficient operation of the system. Here are some general tips on how to maintain your valves and pipes:

- **Clean all valves:** Cleaning valves is one of the simplest methods to extend their life. One can use a soft brush or cloth to remove any dirt or debris that may have accumulated on the valve.
- **Clean dirt and debris from pipes:** In addition, vent pipes should be protected to prevent the entrance of rainwater, which would inhibit valve operation.
- **Check for leaks:** Leaks in pipes can cause significant damage to an HVAC system. One should check for leaks regularly and repair them as soon as possible.
- **Replace damaged parts:** When noticing any damaged parts, such as a damaged pipe or cracked valve body, one should replace them immediately.
- **Assess valves regularly:** Valves should be examined and checked on a regular basis. This will help with identifying any potential issues before they become major problems.
- **Perform routine shutdown maintenance:** Mineralisation, tarnish and wearing will corrode the parts inside your valves over time. To prevent this, you should perform routine shutdown maintenance on your valves.
- **Lubricate valves:** Valves need lubrication to reduce friction and wear on the valve components, thereby extending their lifespan.

CONTROL VALVES IN AN HVAC SYSTEM

Valves are part of the most essential components in an HVAC system, whether cooling water pumps, fan coil units, air handling units or water chillers, in order to control the flow of air, gas and water.

Automated Control Solutions

Danfoss ABQM DN250 at a local data centre.

The most common control valves in an HVAC system are the following:

- Butterfly valves, ball valves and plug valves assist in controlling the ventilation and heating of an air conditioner. Others are diaphragm valves, gate valves and knife gate valves.
- Triple-duty valves for cooling and heating hydronics, are a part of many HVAC systems. They simultaneously act as balancing valves, check valves and shut-off valves. There are also automatic flow, limiting valves that control the speed pumping system to regulate water flow in an HVAC unit.
- Some contain pressure reducing valves that control the water pressure in this loop, and/or circuit setter valves that maintain a specific amount of water flow through the piping loop in an HVAC.

Control valves are critical for HVAC systems. They play an essential role in ensuring that they operate efficiently and last for an extended period.

HVAC systems contain varying fluids which depend on the pressure range operated by actuators. Control valves assist in controlling the forces regulating the pressure range in HVAC systems. They prevent the actuators from letting the pressure reach its maximum level – once pressure starts touching the upper limit, the valves divert excess oil to bring the pressure down. In addition to this, valves also help release cracking pressure in HVAC fluids.

The control valve plays a crucial role when it comes to pressure overriding in an HVAC unit. On the one hand, it regulates cracking pressure that allows HVAC fluids to pass quickly. But on the other hand, it also allows full-flow pressure into the HVAC unit. Together, they help improve the efficiency of your HVAC system significantly.

Automated Control Solutions

The New Danfoss ABQM4 FCU Valve.

SAFETY RELIEF VALVE REPLACEMENT, MAINTENANCE AND INSTALLATION

Safety relief valves are relatively maintenance-free devices, though periodic visual inspection should be made to verify the condition of the valves. While performing this inspection, some of the conditions to watch for are:

Signs of corrosion that could make a valve malfunction

- Broken or missing seal wires
- Valve leakage
- Missing nameplate
- 'Stacked' relief valves

A major question concerning relief valves is, when and how often should the system relief valves be changed? They should be changed out after discharge to ensure safeguarding a system with a properly set relief valve. Most systems are subject to accumulations of piping debris such as metal shavings and solder impurities, as the system is fitted for installation.

These impurities are generally blown into the relief valve seats at the time the valve is discharged. The impinged debris then inhibits the relief valve from reseating at its original set pressure. Valves are then found to relieve at considerably lower pressure settings than the stamped valve setting, due to the force of the reclosing action.

The International Institute of Ammonia Refrigeration (IIAR), in its Bulletin 109, IIAR Minimum Safety Criteria for a Safe Ammonia Refrigeration System, recommends that the relief valve be replaced or inspected, cleaned and tested every five years.

ANSI STD K61.1-1989, Safety Requirements for the Storage and Handling of Anhydrous Ammonia, is very specific in its requirements. Paragraph 6.8.15 states:

"No container pressure relief devices shall be used after the replacement date as specified by the manufacturer of the device. If no date is specified, a pressure relief valve shall be replaced no later than five years following the date of its manufacture." RACA

REFERENCES

1. IIAR
2. https://www.achrnews.com/articles/94640-safety-relief-valve-replacement-maintenance-and-installation
3. https://www.scienceworldreport.com/articles/61696/20200730/what-is-the-function-of-control-valves-in-an-hvac-system.htm
4. https://www.valin.com/resources/articles/best-practices-pipe-and-valve-selection-for-cooling-system

MARELI BOTHA: 2023 CESA YOUNG ENGINEER OF THE YEAR

Edited by Eamonn Ryan

Mareli Botha of Zutari was named the 2023 CESA Young Engineer of the Year, and *RACA Journal* caught up with her to get her story.

This is a woman for whom gender was no obstacle. She lists her areas of engineering competence and experience as: process engineering (chemical engineering), sustainability, green process engineering design and project management. The following is in her own words:

I decided to study chemical engineering because of the connection to systems thinking – and to be honest, that is about all I knew about this field when I started my studies. Thank goodness it turned out to be something I really love.

Then, while studying, I got the amazing opportunity to do vacation work for NECSA (the South African Nuclear Energy Corporation), in the plasma engineering department. I completed a couple of designs for a plasma waste-to-energy project and found my passion. The combination of engineering, creative design, and the concept of making a difference to one of the largest problems internationally – namely the waste crisis and environmental impact – became my inspiration.

I wanted to continue working in this field. So, when I finished my studies, I basically cold called one of the leading specialists in the world on plasma engineering in the world and begged him to allow me to do an internship under him. Prof Laux agreed, and off I went to Paris, France. I worked for Prof Laux for a couple of months and later got accepted to do an international masters in France in project management, energy and environmental engineering. This course opened my eyes to all of the other options in environmental engineering and sustainable design. So here I am, a couple of years later, working in green process engineering and project management at Zutari. At this company I have access to excellent colleagues and mentors and am able to work in my field of passion every day.

In process engineering, there are so many different career opportunities that every person can find their fit – from working in design engineering, to working on site as part of the operations teams, to construction and commissioning, to research and development, to management, to systems design and business processes. There are also a number of specialist fields within process engineering, such as bio-engineering, minerals processing, petrochemical, water, green engineering, etc. It's a fascinating field that allows many different personalities to find their match.

RACA Journal

Mareli Botha of Zutari was named the 2023 CESA Young Engineer of the Year.

What makes us (women) strong is having variety in the field – different genders and cultures bring different ways of thinking that make the field better. Women in STEM is therefore vital! On the positive side, we have noticed a significant increase in women in the process engineering field in the last couple of years, which shows that the industry is changing and people are changing their way of thinking. I believe a number of other engineering fields are seeing a similar change. Having good female role models in this field is an important part of this!

My gender did not in the slightest influence my choice of career and indeed my actual career. I was fortunate to have access to strong mentors and role models, both male and female. I have never felt that my gender held me back or influenced my decisions in this field. This is actually what we want – for females to feel that they have freedom of choice in what they want to do with their lives and for discrimination and bias to be a non-issue!

As consulting engineers, we work in an industry that is constantly changing. New technologies, new legislation, new risks and priorities for clients drive the types of projects that the market needs. This means that we constantly need to improve ourselves and adapt to changes in the industry. Lifelong learning is a reality in this field, where deep expertise and relevant skills are values. This is both a challenge and a great opportunity. For myself, I make sure that I interact with other experts on a daily basis to keep learning and adapting. I have never stopped studying and am currently busy with a PhD. RACA

All images supplied by Maninga Engineering

MANINGA ENGINEERING ASSISTS WITS IN ITS STRATEGIC VISION

By Phuti Sheela, engineer at Maninga Engineering, edited by Eamonn Ryan

The University of the Witwatersrand's Commerce Law and Management (CLM) Building is an award-winning facility that features both a Thermally Activated Building System (TABS) system and chilled technology.

The project stands out for incorporating energy saving methods for heating and cooling. All these were achieved while meeting the acoustic requirements of the building. Wits University had a requirement to free up academic and office space for various schools in anticipation for increased enrollment of post-graduate students as per Wits 2022 Strategic Vision.

The precinct redevelopment was through a space optimisation strategy which included the development of a new building to accommodate its administrative function in a new centralised location. The architects had created a three-story office building with a magnificent atrium to accommodate Wits' requirement, which was to adhere to its urban design framework. Construction started in March 2021, and it was commissioned in December 2022.

The university requested a highly energy-efficient building which incorporated the latest technology to heat and cool offices.

The professional team has explored the use of radiant heating and cooling system by using TABS to control the internal environment of the new building. The system must significantly reduce operating costs for the university.

The proposed design solution takes into place the health and safety of the occupants in the building. The success will be

measured by the level of comfort, making the environment conducive to end-users.

DESIGN CRITERIA

The following design criteria were applied in the design and configuration of all technical systems and services:

- **Adequate capacity:** load handling capabilities to meet present and future requirements.
- **Reliability:** under all circumstances.
- **Adaptability:** ability to cater for changes in future technology and expansion without infrastructure modifications.
- **Flexibility:** simplicity of operation and ability to cater for changes in occupancy.
- **Maintainability:** ease of maintenance and totally serviceable with locally available components.
- **Cost-effectiveness:** minimised capital and long-term operational costs.
- **Energy efficiency:** the systems must operate at optimum efficiency and minimum energy costs.
- **Sustainability.**
- **Safety:** the designs must be performed with due consideration given to the circumstances of the occupants and the environment.
- **Security:** consideration must be given during the design process to potential incidents of equipment vandalism and improper use and handling.

1. *TABS Chiller.*
2. *Temperature monitor.*

The HVAC system comprises two elements: the ventilation element and the temperature control element. The ventilation requirement is a compulsory element which is essential for building occupation. The rooms' ventilation design was guided by SANS 10400 Part O Table 1, which tabulates the minimum air required which was used in heat load calculations. The room population was calculated in accordance with the class occupancy of each building as stipulated in Table 1 below.

TABLE 1: DESIGN POPULATION

The below table tabulates the occupancy class for each room aligned to the population.

Class of occupancy of room, storey or portion thereof	Population
A1, A2, A4, A5	Number of fixed seats or 1 person per m^2 if there are no fixed seats
E1, E3, H1, H3, H4	2 persons per bedroom
E4	16 persons provided that the total number of persons per room is not more than 4
H5	16 persons per dwelling unit provided that the total number of persons per room is not more than 4
G1	1 person per $15m^2$
J1, J2, J3, J4	1 person per $50m^2$
C1, E2, F1, F2	1 person per $10m^2$
B1, B2, B3, D1, D2, D3	1 person per $15m^2$
C2, F3	1 person per $20m^2$
A3, H2	1 person per $5m^2$

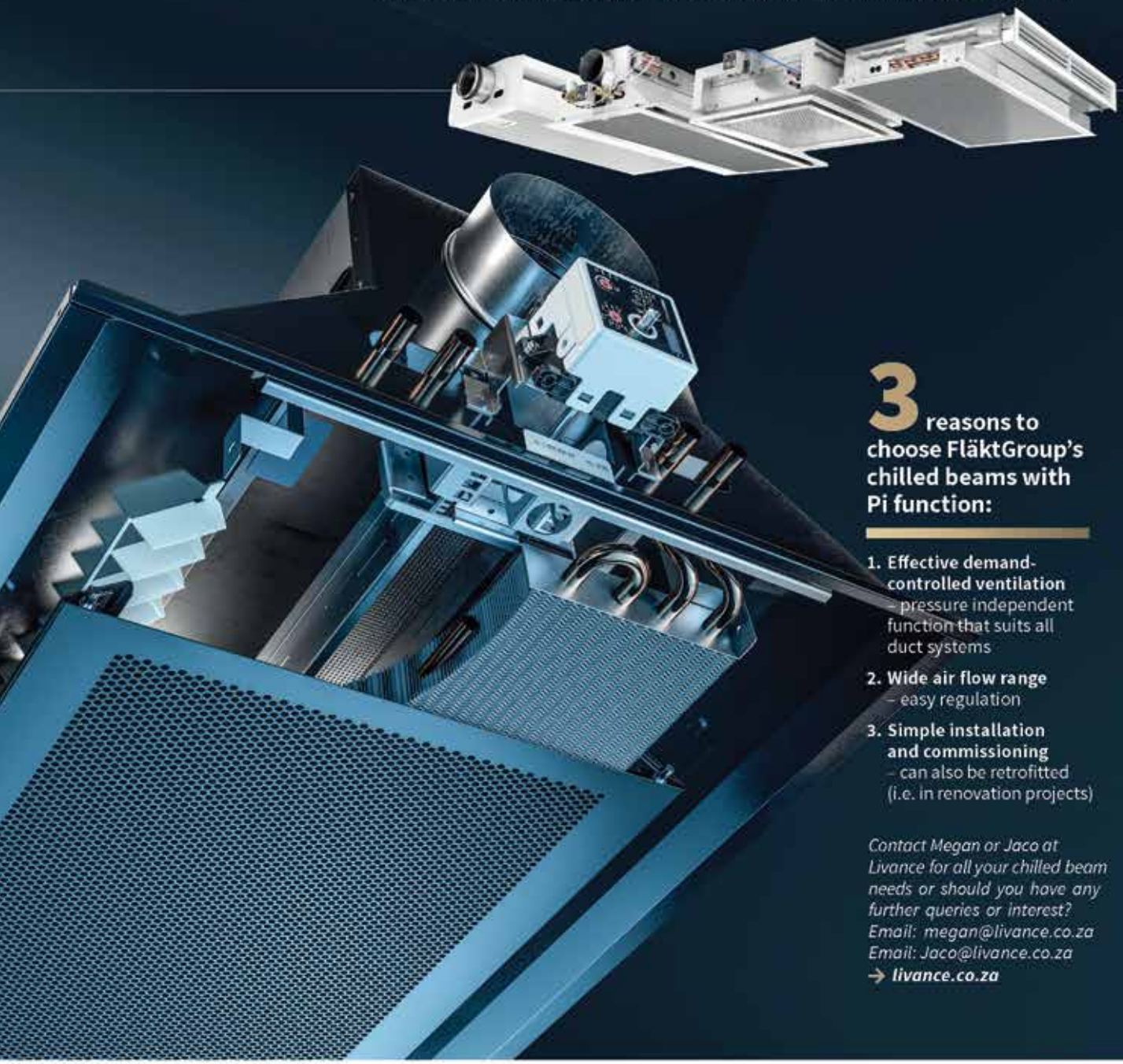
livance

FläktGroup

CHILLED BEAMS WITH PI

Flexible cooling/heating for modern indoor environments

With FläktGroup's range of chilled beams, you get a cooling/heating solution adapted to modern dynamic environments. It adjusts the premises' comfort system to changes in the interior which is just as important as energy-saving technology and a healthy indoor climate.



3 reasons to choose FläktGroup's chilled beams with Pi function:

1. **Effective demand-controlled ventilation** – pressure independent function that suits all duct systems
2. **Wide air flow range** – easy regulation
3. **Simple installation and commissioning** – can also be retrofitted (i.e. in renovation projects)

Contact Megan or Jaco at Livance for all your chilled beam needs or should you have any further queries or interest?
Email: megan@livance.co.za
Email: Jaco@livance.co.za
→ ***livance.co.za***

Filtered fresh air was to be introduced to all spaces according to the National Building Regulations. The fresh air systems consist of weather louvers, attenuators, filters, fire dampers, fresh air fans diffusers, ducting and volume control dampers. Various extraction systems are also included in the scope of works.

The second part of the HVAC system is the temperature control. This element is purely for comfort purposes. Hourly Analysis Program is software that is used to calculate the amount of cooling and heating energy required in a space. The system factors both sensible heat and latent heat. To achieve the cooling and heating of the CLM building, an HVAC system consisting of the following was installed:

- Chilled beams
- Mini VRV outdoor unit
- Two air-cooled chillers
- Rooftop package unit
- An extraction system
- All these systems form part of a complete HVAC system for the building.

MEETING ROOMS' AND OFFICES' AIR-CONDITIONING SYSTEM

The CLM building is a three-story building which has meetings and boardrooms placed on the west side of the building throughout the three floors. In the meeting rooms and board rooms, a chilled beam system is used to achieve the required heating and cooling through chilled water. The chilled water is generated from the chiller which is placed on the roof and is dedicated to supply all the meeting rooms and boardrooms placed on the three floors. The chiller uses an R32 refrigerant gas which is able to achieve heating in the cold months and cooling in the hot months.

The roof-top package unit supplies fresh air into the area using ducts. The fresh air is dehumidified to prevent the formation of condensate. Hence the chilled beams do not require any condensate drain pipe.

The fresh air from the roof-top package unit extends through the building to supply offices located in the centre of the building. This is because the offices in the middle of the building do not direct fresh air from the outside. It is worth noting that fresh air supply is necessary as per SANS 10400 Part O. In the atrium, there are two extraction fans that ensure there is air circulation throughout the building. Temperature control is achieved through TABS. The design for the TABS system is guided by ISO 11855-4. The standard gives guidance as to how the TABS system should be designed for optimum performance.

TABS is a system comprising of pipes installed in the slabs of the building and a chiller to supply chilled water into the pipes. Water is circulated through the pipes, and in turn conduction

1. *Wits CLM east elevation.*
2. *Atrium extraction fans.*
3. *Chilled beam booster pump.*

> *"The chiller uses an R32 refrigerant gas which is able to achieve heating in the cold months and cooling in the hot months."*

takes place to transfer energy onto the slabs. Emissivity then occurs with the aid of air circulation. For the offices located on the perimeter of the building, windows need to be opened for the TABS system to take effect. For the offices located in the middle of the building, the fresh air supplied from the roof-top package unit aids in the transfer of temperature from the slabs into office spaces. The communication between the chiller and the TABS control unit is through sensors that are installed in the slabs throughout the building. This in turn communicates as to how much chilled water can be generated from the chiller and in turn, the chiller does not run at 100% capacity – to save energy consumption.

ELECTRICAL ROOM AND SERVER ROOM AIR-CONDITIONING SYSTEM

The electrical room and the server room require cooling at all times to prevent overheating of the equipment being stored in the rooms. The cooling is achieved by means of two midwall split units installed in each room. An outdoor VRV system was ideal in this case as it reduced the need to have two outdoor units. This reduced the footprint of the installation. Furthermore, this meant that longer pipe runs could be achieved.

All floors at the CLM building have toilets. Due to space constraints, the system was forced to use one extraction air fan for both sides of the toilets. That is, one fan extracts from the male and female sides of the building.

SUNDRY FACTORS AND RISK MITIGATION

During the design phase, Maninga Engineering highlighted that the TABS system uses thermal comfort as a way of temperature control. As part of risk mitigation, the design opted for the route of increasing the fresh air system air flow in order to increase the system's efficiency.

For the server room and the electrical battery room, a VRF system was ideal because it has longer pipe run allowance. This was crucial in a sense that otherwise the façade of the building would be tainted with pipes running from the roof plant.

The usage of chilled beams eliminated the noise generated by conventional HVAC systems. The chilled beams seamlessly met the requirements of the acoustic engineer for the meeting rooms and the recording room. The chilled beams, coupled with the roof-top package unit, also eliminated the formation of condensate.

The two chilled beams used on this building are hydronic module chillers and they use R32 refrigerant gas. The refrigerant gas meets the Global Warming Potential (GWP) requirement as it is not part of the group of hydrofluorocarbons (HFCs) refrigerant gases.

Occupants' thermal comfort is the primary objective in radiantly heated or cooled space. To provide an acceptable thermal environment for the occupants, the requirements for general thermal comfort shall be taken into account by using the index of predicted mean vote (PMV) or operative temperature (OT), and local thermal comfort, for example, surface temperature, vertical air temperature differences, radiant temperature asymmetry and draft.

Fresh air supply system.

The operative temperature range corresponds to 20-24°C for cooling season and 23-26°C for heating season in spaces with sedentary activity.

The main advantages of using the TABS system are:

- Reduced building height (saving 500-600mm per story of building height)
- No suspended ceiling is needed to cover air ducts which results in a significant saving of building materials
- It is also possible to operate the system at 30-50% lower peak loads allowing reduced plant sizes and possible operation of heating/cooling systems with temperatures close to room temperature – allowing increased plant efficiency
- No noise levels. RACA

Chilled beam chiller.

Roof-top package unit for tempering fresh air.

Project name: Wits CLM		
List of professionals:		**Name of company:**
Owner		University of the Witwatersrand
Developer		University of the Witwatersrand
Architect / designer		MMA architects
Project manager		BVI Consulting
Consulting engineer	Electrical	Delta BEC
	Mechanical	Maninga Engineering
	Wet services	Delta BEC
Contractor	Main building	Tri-Star
	HVAC & R	Ductech and eesco
	Electrical	Venom electrical
HVAC and associated product suppliers		Daikin
		Clivet
		Flakt Group
		Systemair
		Electrovent
		Trox
		Systemair
		Electrovent Taconova

GRANT LAIDLAW

Grant Laidlaw is currently the owner of the Air Conditioning and Refrigeration Academy (ACRA) in Edenvale. He holds a Bachelor of Business Administration and an associate degree in educational administration. He has a National Technical Diploma and completed an apprenticeship with Transnet. He has dual-trades status: refrigeration and electrical. He has been involved with SAIRAC for over two decades and served on the Johannesburg committee as chairman and was also president between 2015 and 2018. Currently he is the SAIRAC national treasurer.

WELCOME TO THE SOLUTIONS PAGE

Contributed by Grant Laidlaw

Many people ask for assistance in the understanding of theoretical and practical aspects of the industry. I will endeavour to enlighten. We are going back to basics as I have questions coming in that indicate that the basic understanding necessary to work in industry is not in place.

David asks: Hi Grant. I would like to ask a question about all the types of filters we can expect to find on a central air-conditioning plant. We are expanding our maintenance into this area only to find quite a diverse range of filters, nothing like one would see on a mid-wall split unit.

Hi David, I would imagine moving from a split unit environment to a central plant situation could be somewhat eye opening. Let us consider the air itself as a starting point.

Air is a mixture of gases. Normal atmospheric air consists of 21% oxygen, 78% nitrogen, 1% argon and 0.03% carbon dioxide. There are also small quantities of other gases such as hydrogen, neon, helium, ozone and xenon and varying amounts of water vapour.

We depend on air to survive and any substantial differences in the percentage composition of normal air makes it unsuitable. Oxygen concentrations of less than 12% and carbon dioxide concentrations of less than 5% – even for short periods – are dangerous. Over long periods, even smaller variations in the composition of the air may be dangerous.

A human being uses approximately 30 litres of oxygen per hour. The air requirement is thus in itself quite small, 150 litres or about 0.15m^3 per hour. However, the carbon dioxide produced by humans means that the air required to keep the carbon dioxide concentration below the danger level rises to about 5m^3 per person per hour. Greater air flows may however be needed in order to control heat, cooling or contaminants.

In addition, air contains various foreign materials, both from natural processes such as wind erosion, evaporation from the sea, earthquakes and volcanic eruptions and from industrial activities, such as products of combustion from industrial processes.

Atmospheric dust consists of a mixture of mist, fumes, dry granular particles and fibres. An analysis of the air usually reveals soot and smoke, quartz, clay, traces of decomposed animals and plants, organic material in the form of cotton and plant fibres and metallic fragments. It also contains organisms such as bacteria, spores and plant pollen. Such floating particles mixed in air or gas are often called 'aerosols'.

Despite the fact that these impurities occur in small concentrations in ordinary air, they have a decisive effect on our environment. Electrical effects in the atmosphere, absorption of solar radiation and cloud formation are all affected to some degree by the impurities in the air. What is perhaps more evident is the effect of atmospheric air pollution on materials and living creatures.

The concerns of particulate matter and gases – which influence our health or comfort and contaminate the spaces we occupy, or which affect the products and components we manufacture – are very real and not unique to specific areas, but rather standard elements in the atmosphere irrespective of location. All that really changes are the concentration levels.

Although great strides have been made to identify the hazardous particulate matter in the atmosphere, the reality of it all is that the air we breathe is not very clean at all.

Contaminants originate from the outdoor air and from building contents such as furniture and furnishings and from processes and materials used within the building. Many of these are nuisances such as cooking odours, but others are identified as causing discomfort and even illness for some (if not all) of the building occupants.

David, let us move on to the contaminants. An aerosol is a suspension of solid or liquid particles in the air. The size of an aerosol is usually measured in microns. One micron is one millionth of a metre or one thousandth of a millimetre. Under the International System Units (SI) the term 'micron' is being replaced by 'micrometer'. However, we will use the term micron due to it being the most popular term in industry. The abbreviation for micron is 'µ'.

Image supplied by Grant Laidlaw

Size in microns of some small particles.

Dusts are solid aerosols generated from the reduction of larger solid materials.

David, the size of particles is often stated in µ (micrometers), i.e. 1µ = one thousandth of a millimetre.

The particles in the atmosphere may vary in size from less than 0.01µ up to the sizes of fibres, leaves and insects. Almost every conceivable shape and size is represented. Dust is normally taken to refer to particles of less than 100µ. The smaller aerosol particles are produced by condensation or sublimation of the smoke from processes of combustion, or direct from gases in physical or chemical processes.

Larger particles are formed by the erosion of the earth's surface and spread by the wind. They may, however, also be formed in the actual atmosphere by the agglomeration of smaller particles. Similar phenomena occur in clouds, where the particles form the condensation for water droplets.

Natural cleaning of the atmosphere is affected by rain. Opinions differ, as there is a balance between dust generated and returned. Certain measurements of solar radiation, for example, suggest that the total dust concentration in the atmosphere has increased during the last few decades.

Particles smaller than 0.1µ in size begin to behave like gas molecules, with a Brownian motion and have no definite or measurable setting velocity.

Particles in the 0.1 - 1µ range have a setting velocity, which can be calculated, but is so low as to be negligible for practical purposes. Normal air currents counteract the precipitation tendency.

Particles in the range 1 - 10µ settle with a constant and calculable velocity. Normally, air current tends to keep them floating; however, particles which are larger than 10µ fall fairly rapidly and can float only in the vicinity of the source under certain wind conditions. Exceptions to this include cotton and other light fibrous materials such as parts of certain weed seeds, which may float for long periods.

Some particles of 10µ can be seen with the naked eye under favourable lighting conditions. Smaller particles become visible in high concentrations. Cigarette smoke with an average particle size of 0.5µ is an example of this.

The term 'smoke' is usually used for a mixture of solid, liquid and gaseous products. Smoke consists of extremely small particles – solid or in fluid form – which arise from incomplete combustion of organic substances such as tobacco, wood, coal, oil and the like. Smoke particles vary considerably in size. Most of them are less than 1µ and are often between 0.1 - 0.3µ. Viruses vary in size between 0.005µ and 0.1µ

The size of most bacteria is between 0.4 and 5µ. They are usually dust-borne on larger particles; however, the size of fungus spores is between 10 and 30µ, while that of pollen is between 10 and 100µ.

Mist and fog consist of small airborne droplets, usually formed by condensation of vapour, or fine dispersion and liquid spraying, or vapourisation.

As we can see, David, air pollution is a growing problem, mainly because of the increase in population and industries. Thus, cleaning air of foreign matter has become an important part of air-conditioning. The total distribution and concentration of atmospheric dust varies greatly, depending on factors such as the place, season and time of day. The air of industrial areas and cities normally contains soot and other products of combustion, and the dust concentration is higher than in the country.

Efficient air-conditioning systems should remove between 75% and 95% of contaminants out of the air. Such contaminants could be:

- Pollen, mold and dust carried by the wind, or dust created by mining activities etc.
- Fumes from motor exhausts, or from industrial or chemical processing etc.
- Smoke and soot caused by fire and the use of tobacco etc.

There are many more air-contaminants such as mists that are mechanically ejected into the air by splashing or atomising and bacteria (micro-organisms) that are responsible for the transfer of many diseases.

Air may be cleaned in many ways, depending on the contaminants to be removed. The following are a few examples:

- Large air-conditioning systems use water sprays to remove liquid contaminants, water soluble gas contaminants and water absorbent solid contaminants. Some of the gasses that water can remove are sulphur dioxide, nitrogen oxides and carbon monoxide. Water will not remove soot. This process of cleaning the air is known as 'washing the air'.

- Adhesive filtering for removing dust and pollen etc. They are made of various fibres such as glass, cotton, synthetic material and aluminium. The fibres are coated with an adhesive liquid or oil. Air is forced to change direction and lose speed as it passes through the filter. This results in trapping particles such as dust and pollen, as they make contact with the adhesive surfaces of the filter.
- Electrostatic filtering for removing very small particles. This type of filtering electrically charges the particles to be removed and adheres them to a surface having an opposite charge. Electrostatic filters are normally used as secondary filters to screen or adhesive filtering to clean the air for computer rooms and the like.
- Ultraviolet lighting will kill most bacteria in a fraction of a second. The lamps are installed in the return air duct in such a way that the rays cover the full cross-section of the duct to make it effective.
- Filters made of activated carbon will remove solid particles as well as certain gases that cause bad smells. They will also remove a limited amount of bacteria.
- Paper filters are sometimes used to remove finer dust or pollen particles.

More than one type of filter is sometimes used on one air-conditioning system. For example, the return air in a hospital may first pass through a primary screen type filter made of a fibrous material to remove large particles. The air then passes through a secondary paper or electrostatic filter to remove fine particles. Finally, at the end of the duct where the air enters the room, the air passes through ultraviolet lighting to kill bacteria.

Air filtration supplies the means to obtain the level of particulate cleanliness required by any definition of 'air-conditioning'. It extends from the simple task of preventing lint and other debris from blocking heating/cooling coils to remove particles as small as 0.1 micron which could cause a short circuit on a microchip.

In addition to the reasons given above, air filters are used for a wide variety of purposes, some of which include:

- Protecting the general well-being of the occupants of spaces or buildings.
- Protecting the decor of occupied spaces by removing the staining portion of airborne dust.
- Reducing maintenance of building interiors by reducing the frequency of cleaning such as Venetian blinds, fluorescent bulbs and furnishings and equipment.
- Protecting other contents of occupied spaces including paintings, tapestries and other items of historic value.
- Elimination of fire hazards by removing lint and other materials which might accumulate in ductwork.
- Extension of shelf life of perishable dairy products by removing airborne mold during processing operations.
- Removing airborne bacteria from operating rooms air to help prevent postoperative infection.

In the ideal world, outside (fresh) air is free of all dust and gases which could affect a space's occupants, decor or contents. In the real world, it is rarely deserving of the description 'fresh' and must be filtered to remove the contaminants it would bring inside.

Return air contains the particulate material, which was generated within the space plus that which was not removed from the supply air by the filters, which are part of the conditioning system.

Supply air, as delivered to the space, should be of the cleanliness necessary to achieve the objectives of the space. However, once this supply air reaches the diffuser, its utilisation depends on the air diffusion system. If this clean air is not distributed properly throughout the space, comfort may not be achieved.

David, I hope that this increases your understanding of air filtration.

Thanks to everybody for the overwhelming response. I receive an average of over 60 questions a month and cannot publish all of them. But keep them coming, as I may answer you directly. Looking forward to hearing from you. RACA

Grant Laidlaw

REFERENCES

1. *SETA training*
2. *ASHRAE*
3. *ACRA*

MICHAEL YOUNG

Michael Young is a trainer, coach and a pre-sales engineer in the HVAC industry. He graduated from the University of the Witwatersrand in the field of Mechanical Engineering (B.Sc Mech Eng) in 2008 and qualified as a Professional Engineer (Pr.Eng) in 2013. Michael is passionate about promoting knowledge and helping other young engineers grow within the industry through his training workshops and coaching sessions.

HOW TO COOL THE DATA CENTRE IN THE 21ST CENTURY

Contributed by Michael Young, Pr. Eng.

Part 3: The impact of using a "greener" refrigerant in a cooling system.

The focus of sustainability within the data centre industry has led to the implementation of new cooling technologies and the use of alternative and green refrigerants.

Use of a specific refrigerant within the data centre space needs to consider flammability and toxicity while capacity difference needs to be considered within the design of the central cooling unit.

The design of a cooling unit that uses an alternative refrigerant can become a complex exercise as the condenser, evaporator and compressor need to be reassessed.

So how does the use of an alternative refrigerant impact the compressor? The compressor can often be described as 'the heart' of the HVAC system, whereby the compressor moves the refrigerant through the system and also raises the pressure of the refrigerant gas once it leaves the evaporator.

When suppliers select a specific compressor, they first define the operating evaporating and condensing temperature. These temperatures are selected according to the type of cooling application.

A data centre cooling system is designed to provide sensible cooling and will operate at a higher return air condition compared to comfort cooling. To accomplish this requirement, the evaporating temperature of the compressor will also be higher.

To reduce energy consumption, the condensing temperature of the compressor will be as low as possible, taking into consideration the ambient air temperature on site and the optimal size of the condenser.

Once the condensing and evaporating temperatures have been defined, the operations of the compressor are reviewed by looking at the compressor envelope. The goal is to find the optimal condensing and evaporating condition that meets the requirements of the data centre while operating with the lowest energy consumption.

So how does refrigerant play a role within the operation of the compressor? Each refrigerant has a different density and pressure-temperature relationship. Density influences cooling capacity while pressure-temperature changes the operating point on the compressor envelope.

Therefore, it is possible that a specific compressor will operate efficiently with R134A but cannot be used with R410A due to operations outside of the compressor envelope or excessive operating pressures.

Cost also needs to be taken into account as loss of cooling capacity means the units have to increase in size which results in a higher capital cost. While it is desirable to develop low GWP, low flammable and low toxicity refrigerants, the impact on the cooling performance, energy consumption and capital cost for the data centre application needs to be considered.

It is not easy to replace the refrigerant within a cooling system as there are many factors to consider, and this is the primary reason why the use of a newly developed refrigerant can take months or years to implement.

To learn more on how refrigerants impact a cooling system drop us an email on michael@myengineeringcoach.co.za and I look forward to seeing you in next month's publication.

Wishing you a successful month ahead. RACA

"The compressor can often be described as 'the heart' of the HVAC system whereby the compressor moves the refrigerant through the system."

THE CRUCIAL ROLE OF PROJECT MANAGEMENT IN ADDRESSING KEY CLEANROOM PROJECT CHALLENGES

Contributed by Ryan Rennie, from the Spada-Rennie Group

Cleanrooms stand as the backbone of industries where precision, hygiene and controlled environments are paramount.

From pharmaceuticals to electronics and healthcare, the demand for cleanroom facilities continues to rise. However, the successful execution of cleanroom projects is no small feat, requiring meticulous planning, adherence to regulations, and effective project management. In this article, we will delve into the multifaceted world of cleanroom projects, emphasising the indispensable role of project management in overcoming challenges related to client process equipment requirements, facility HVAC, process equipment qualification, and the integration of Building Management Systems (BMS) and Energy Management Systems (EMS).

- **Understanding cleanroom projects:** Cleanrooms, characterised by stringent environmental controls, are designed to maintain low levels of particulate contamination. These controlled environments are critical in industries where even the smallest impurity can have significant consequences. Cleanroom projects present unique challenges, necessitating a comprehensive understanding of project management principles. The complexities involved in these projects extend beyond the structural components of cleanrooms; they encompass the integration of specialised process equipment, compliance with regulatory standards, and the management of intricate HVAC systems.
- **Their complexities:** Cleanroom projects are inherently intricate due to the need for precise control over environmental factors. From temperature and humidity to particle counts, every element must align with industry-specific standards. Achieving this precision requires a thorough understanding of the client's process equipment requirements, an aspect that significantly influences project planning and execution. The challenge lies not only in meeting these requirements but also in anticipating and adapting to potential changes throughout the project lifecycle.
- **Project management principles:** Project management serves as the guiding force that ensures cleanroom projects progress seamlessly from conception to completion. Key principles such as scope definition, scheduling, budgeting and risk management play a pivotal role in achieving project goals. In the context of cleanroom projects, adherence to these principles is essential for aligning activities with client expectations, maintaining project timelines, and mitigating potential risks that could compromise the integrity of the cleanroom environment.

Ryan Rennie

Ryan Rennie, from the Spada-Rennie Group.

- **Understanding client's process equipment requirements:** At the heart of successful cleanroom projects lies a deep understanding of the client's process equipment requirements. The timing, size and utility specifications of these requirements are critical factors influencing project timelines and resource allocation. A failure to grasp the intricacies of the client's needs can lead to delays, increased costs, and compromised project outcomes. Thus, effective project management must include robust mechanisms for gathering, analysing and adapting to evolving process equipment requirements.
- **Facility HVAC challenges:** The cornerstone of any cleanroom project is the HVAC system. Designing and implementing them so they meet the stringent requirements of cleanroom environments poses considerable challenges. The HVAC system's performance directly influences the cleanliness and functionality of the cleanroom, making it a critical element in project success. Project managers must therefore navigate challenges such as achieving and maintaining specific temperature and humidity levels, controlling particle counts, and ensuring proper air exchange rates. Furthermore, the HVAC system must be designed to accommodate the unique spatial and operational requirements of the cleanroom, adding an additional layer of complexity to project planning.
- **Process equipment qualification challenges:** Qualifying and validating process equipment within the cleanroom environment is a meticulous and intricate process. Regulatory

requirements and industry standards mandate thorough documentation and validation to ensure the equipment functions as intended and meets the specified cleanliness standards. Project managers must contend with challenges related to co-ordinating qualification activities, adhering to rigorous validation protocols, and ensuring that the entire process aligns with regulatory expectations. Failure to meet these challenges can result in non-compliance, project delays, and increased costs.

- **BMS and EMS integration challenges:** In the era of smart buildings, the integration of BMS and EMS adds another layer of complexity. BMS and EMS are critical components that contribute to the overall efficiency, energy conservation, and performance monitoring of the cleanroom facility. However, integrating these systems seamlessly requires careful planning and co-ordination. Challenges include ensuring real-time monitoring and control; as well as addressing potential conflicts between energy efficiency goals and the stringent environmental requirements of the cleanroom.
- **Customisation and adaptation:** One size does not fit all in the realm of cleanroom projects. Each project comes with its unique set of challenges and requirements, necessitating a customised and adaptable approach to project management. From the intricacies of process equipment to the nuances of HVAC and system integration, project managers must tailor their strategies to address the specific needs of each cleanroom project, extending to project timelines, resource allocation, and risk management.
- **Collaboration with clients and stakeholders:** Effective collaboration is the linchpin of successful cleanroom projects. Engaging clients throughout the project lifecycle, especially in the context of understanding process equipment requirements, is crucial. Collaborating with HVAC specialists, validation experts, and BMS/EMS professionals ensures that the project benefits from a diverse range of expertise. Transparent communication and active involvement of stakeholders fosters a collaborative environment where potential issues can be identified and addressed promptly.
- **Risk management:** Cleanroom projects inherently carry a level of risk due to their complexity and the critical nature of the controlled environment. From the early stages of project planning to the qualification of process equipment and integration of BMS/EMS, project managers must conduct thorough risk assessments. This includes anticipating changes in client requirements, potential HVAC system failures, validation discrepancies, and unforeseen issues in BMS/EMS integration. In this manner, project managers can enhance the project's resilience and minimise the likelihood of disruptions.
- **Regulatory compliance:** Adherence to industry regulations and standards is non-negotiable in cleanroom projects. Regulatory compliance spans every facet of the project, from the design and construction of the cleanroom facility to the qualification of process equipment and integration of BMS/EMS. Project managers must stay abreast of evolving regulations, ensuring that project activities align with the latest industry standards. Doing so not only safeguards the integrity of the cleanroom environment, but expedites the regulatory approval process, preventing delays and potential setbacks. RACA

CTR ELECTRIC EXPANSION VALVES, TRANSCRITICAL CO_2

CTR is designed to allow full proportional control of the surplus heat from compressor pack into the heat exchanger of transcritical heat reclaim solutions.

The three-way electrical CTR valve marks a break-through in the configuration of the heat reclaim solution, replacing the ball valves that have so far been used to regulate the flow of surplus heat from compressor pack to heat exchanger. CTR prevents pressure peaks in the system, eliminating costly system down-time and the risk of insufficient heat supply for store heating and hot water. At the same time, the proportional control guarantees availability of sufficient heat and hot water at any time.

CTR is guaranteed leak-tight due to its integrated design with valve and motor built into one compact unit. The cartridge design of the component means that all functional parts are easy to service and replace using only a spanner. The valve is available with weld connections or for solder/braze.

The CTR can be used in refrigeration systems of any size, from very small applications to large systems.

FEATURES AND BENEFITS:

- Safe: eliminates pressure peaks
- Convenient: ensures sufficient heat and hot water at any time in any climate
- Fully serviceable: easy to disassemble
- Simple, compact and leak-tight: integrated design with valve and motor built into one unit
- Long service life

For more information call 801 999 4220

VERTEX EVAPORATIVE CONDENSER

This new benchmark combines what you like most about legacy BAC evaporative condensers with new innovations for the future. The Vertex Condenser offers maximum uptime with easy and safe accessibility. It also has the lowest total cost of ownership with the lowest installation, maintenance and operating costs. And of course, the Vertex Condenser uses evaporative cooling, so it is an inherently sustainable solution for your industrial refrigeration and other industrial process applications.

MAXIMUM UPTIME AND RELIABILITY (YEAR-ROUND OPERATION)

- Maximise reliability and minimise unplanned downtime with the EC Fan System (direct-drive fan system with EC motors and axial fans)
- Enjoy peace of mind and uninterrupted operation with multiple fans and motors
- Perform through the harshest conditions with a durable and robust industrial design
- Increase reliability, corrosion resistance and longevity with superior material options

For more information call +27 (0) 821 0738

DEKA CONTROLS BALL SHUT-OFF VALVES DBV

Compact housing for operating pressures up to 45 bar:

- Optimum flow rate with low pressure drop
- Connections in metric and imperial design
- CE marking according to the Pressure Equipment Directive 2014/68/EU
- With threaded hole for fastening
- Hermetic design
- Valves can be sealed
- Pressure-relieved cap for safety when opening
- Seat seal, filled PTFE for low frictional forces
- Spindle sealing by means of O-rings and PTFE Flat gasket (additionally reduces the required torque)
- 100% testing with helium for external tightness
- Optional: type DVB-xxxS with Schrader valve (7/16"-20 UNF)
- Also for natural refrigerants and in high-pressure version DBVH up to 120bar
- Also with stainless steel connection on request

PRODUCT HIGHLIGHTS:

- Precise trouble-free operation due to pressure detection by load cell with powerful output signal
- Absolute pressure measurement by comparison with sealed reference pressure standard
- Output signal 4 to 20 mA
- Calibrated pressure ranges for specific temperatures and for refrigeration and air conditioning applications
- Immune to vibration and pulsation
- CE mark in compliance with EMC Directive
- Protection class IP 67
- Quick-action connection with M12 plug connector and pre-assembled connecting cable with different lengths

For more information call +49 7141 702063

THE DAIKIN R-32 VRV CHILLER – AVAILABLE IN SPLIT VERSION WITH R-32 REFRIGERANT

New split-version models have been added to the Daikin R-32 VRV Chiller series in late summer 2022. This addition to Daikin's extensive portfolio of VRV chillers uses climate-friendlier R-32 refrigerant.

EFFICIENT HEATING AND COOLING

The inverter-controlled heat pump is available in 21-64kW capacity classes and can be used for heating and cooling buildings of different sizes. The Daikin R-32 VRV Chiller easily adapts to different cooling and heating requirements with supply temperatures of +60 °C for heating or -15 °C in cooling mode. With a SEER (seasonal energy efficiency ratio) as high as 5.7 and a SCOP (seasonal co-efficient of performance) up to 4.2, this heat pump delivers remarkable efficiency with low running costs. Thanks to its compact design and integrated safety system, the heat pump can be installed in tight spaces.

FOCUS ON SUSTAINABILITY

Daikin is planning to convert its entire portfolio of chillers that use R-410A refrigerant to the more climate-friendly R-32 refrigerant. While R-410A refrigerant has a GWP (global-warming potential) of 2 088, the GWP for R-32 is only 675 – which significantly reduces CO_2 emissions. Following the introduction of a compact version of the R-32 chiller in October 2021, the entire production of the corresponding R-410A series was relocated from Ostend in Belgium to Italy.

The same process is being carried out for the split version of the chiller. By switching its entire product range to R-32 refrigerant, Daikin is setting a benchmark for sustainability and the future-focused development of the industry.

For more information call +27 (0) 11 997 4400

AIR CONDITIONING

airstream
LIVING TECHNOLOGY

Airstream Components Africa (Pty) Ltd

Unit 17, 178 Barbara Road, Elandsfontein
Tel: 011 8221486 | Fax: 011 8221493
Email: cliff@airstreamafrica.co.za

AIR CONDITIONING

Specialists in repairs, maintenance and installation of all makes of HVAC equipment including:

Chiller plants | Package & rooftop units
VRV systems | Fan coil units | Cooling towers
Air handling units | Consoles | Split units

Tel: 016-341-3485 / 082-562-6535
Fax: 016-341-3486
E-mail: conair@lantic.net
E-mail: info@conair.co.za
Web: www.conair.co.za

ConAir

AIR CONDITIONING

IQ® COMFORT AT YOUR FINGERTIPS

Unit C 82 Lechwe Street, Corporate Park South, Randjespark, Midrand 1685, JHB, SA.
T: +27 (0) 10 493 8746
E: iqaccounts@iqairconditioners.co.za
E: iqadmin@iqairconditioners.co.za

www.iqairconditioners.co.za

AIR CONDITIONING

Authorised distributors to approved Airconditioning Dealers Nationwide

Alliance SAMSUNG fourways

JHB & Cetral:	(011) 704-6320	W & N Cape :	(021) 556-8292	East London:	(043) 722-0671
Pretoria:	(012) 643-0445	Kwa-Zulu Natal:	(031) 579-1895	Gqeberha (PE):	(041) 484-6413

PLEASE CONTACT FOURWAYS GROUP FOR MORE INFORMATION:

AIR CONDITIONING

HCM
AIRCONDITIONING / REFRIGERATION ENGINEERS & EQUIPMENT SUPPLIERS

www.hcm.cool info@hcm.cool
011 672 3950

ROOFTOPS • CLIP ONS • CLOSE CONTROL • OPERATING THEATRE E-HOUSES • T3 SPLIT SYSTEMS

AIR CONDITIONING

Concept Clean Africa

The Indoor Air Quality Specialists

Tel: (011) 418 1860
Fax: 086 512 2999
Email: info@conceptcleanafrica.co.za

Contact:
Chris Greenwood 082 886 5691

www.conceptcleanafrica.co.za

AIRCONDITIONING CONTRACTOR

ARCTICOOL CC

Air-conditioning, Refrigeration, Ventilation
Sales, Service, Repairs and Design
Industrial, Commercial and Domestic

P.O.Box 54024, Ninapark, Akasia, 0156
Tel: (012) 565 4872 • 546 0496
Fax: (012) 546 6728
Cell: 082 550 6946 • 082 550 7809
info@arcticool.co.za

AIRCONDITIONING CONTRACTOR

AIRE-ZA

Heating | Ventilation | Airconditioning | Refrigeration | Electrical | South Africa

031 569 1223 | www.aire.co.za

AIRCONDITIONING DIFFUSERS

RICKARD

VAV & CAV DIFFUSERS • GRILLES
FCU, AHU, DIFFUSER CONTROLS
HEATER BANKS • DAMPERS • FLEX

CPT : 021 704 1533 • GP : 012 804 5488
EC : 041 487 1781 • KZN : 074 169 6168
sales@rickardair.com • www.rickardair.com

AIR CONDITIONING

Medical Air PRO

The Maclaren Medical Air pro is the only product on the market, in a transportable and single-module form capable of purifying the air of indoor environments with medical grade air, certified by autonomous laboratories.

Maclaren Medical air pro is the only mobile unit that uses a five-stage filtration system with an ESP filter at the heart to produce medical grade air quality. The unit was developed especially for all airborne viruses and was found to be effective in deactivating these pathogens.

Thanks to its efficient characteristics in the filtration of PM 2.5 particulates and its virucidal and bactericidal action and neutralisation of formaldehyde, often used in hospital processes, is a device particularly suitable for:

- Safeguard the health of operators in the medical sector
- Reduce contamination in waiting rooms of doctors' practices and hospitals
- Minimize bacterial spread from centralised air ducting systems in boardrooms and office environment.

Maclaren Air | Tel: 011-315 4348 | Email: Maclaren@ust.co.za

AIRCONDITIONING INSULATION

isover
SAINT-GOBAIN

INSULATE YOUR DUCTS WITH

ISOVER's wide range of glasswool products, ensuring optimal thermal and acoustic performance while maximising energy efficiency.

- Ductwrap – external wrap around metal air-conditioning ducts
- Sonic Liner – an internal acoustical insulation liner for sheet metal ducts
- Snap on Pipe – specifically designed for hot and cold service piping systems.

0860 476 837
www.isover.co.za

SAINT-GOBAIN

EVAPORATIVE COOLERS

TURBOVENT
THE AIR QUALITY COMPANY

TURBINE VENTILATORS • EVAPORATIVE COOLERS
AIR CONDITIONERS • HEATING
PARTS & ACCESSORIES • SOLAR POWER

Email: sales@turbovent.co.za
Tel: +27 11 613 6921 | **Cell:** +27 76 812 4063
Website: www.turbovent.co.za
Address: No.98 Newton Road, Unit 3, Meadowdale, Germiston,1614

HUMIDIFIERS

HUMIDAIR
condair
Swiss Humidifiers
Dehumidifers/Cooling
Tel: 011 781-1577
info@humidair.co.za www.condair.co.za

PUMPS

BLUEDIAMOND
CONDENSATE REMOVAL PUMPS
Whisper quiet ultra reliable pumps - can run wet or dry
3 YEAR WARRANTY
+27 11 674 4011 info@consultaire.co.za www.consultaire.co.za

EVAPORATIVE COOLERS

COOLBREEZE
AIR CONDITIONING
• Imported Evaporative Coolers
• Full Range of Accessories
• Free Design Service
• Evaporative Cooling Pads - All sizes
Tel: 011 887 8985 • info@coolbreeze.co.za
www.coolbreeze.co.za

INSTRUMENTATION

ame
air movement equipment
Tel: (021) 551 4540
Fax: (021) 552 9809
www.grilles.co.za
Commitment is the difference

PUMPS

eckerle
condensate removal pumps
+27 11 674 4011 info@consultaire.co.za www.consultaire.co.za

FANS

hyair
Tel: (021) 551 4540
Fax: (021) 552 9809
www.hyair.co.za
New force in Ventilation

INSTRUMENTATION

Be sure. testo
Isn't it time for something better?
Durable, future-proof smart tools
www.testo.co.za
info@testo.co.za

REFRIGERATION

ENERGY PARTNERS REFRIGERATION
www.energypartners.co.za
refrigeration@energypartners.co.za
+27 (0)10 276 0125
Energy Partners HVAC & R (PTY) LTD
Unit 5 & 6, Samrand Business Park
2 Sterling Street, Samrand, Centurion

FANS

FAN MOVEMENT
AIR AND GAS MOVEMENT SOLUTIONS
Donkin Fans | SODECA | VORTICE | ÖSTBERG | NICOTRA Gebhardt

REFRIGERATION AND AIRCONDITIONING

KOVCO
• Commercial Refrigeration
• Airconditioning
• Dry Coolers
• OEM Manufacturers

Refrigeration, Heating and Airconditioning Wholesalers

Cape Town	Tel: 021 511 0866
Durban	Tel: 031 569 6382
East London	Tel: 043 722 1760
Johannesburg	Tel: 011 493 8734
Nelspruit	Tel: 013 752 4656
Pietermaritzburg	Tel: 033 342 4244
Port Elizabeth	Tel: 041 453 4407
Pretoria	Tel: 012 327 5585
Randburg	Tel: 011 791 6090

FILTRATION

ALPA
Office: +27 64 870 5046
Mobile: +27 71 613 5183
Email: sales@alpa.bz
Website: www.airlabproducts.com

PIPES AND FITTING

Copper Tubing Africa
Johannesburg: +27 11 615 7193 | info@cta.co.za
Cape Town: +27 21 951 8855 | cta-ctn@cta.co.za
Durban: +27 31 461 4662 | cta-dbn@cta.co.za
Port Elizabeth: +27 41 486 3589 | cta-pe@cta.co.za
www.coppertubing.co.za

FILTERS

Filtaire S.A.
A filter to suit every application
Tel: +27 11 609 8961 • Fax: +27 11 609 8963
Email: sales@filtaire.co.za
P.O. Box 9178, Edenglen, 1613

REFRIGERATION SUPPLIES

Refrimate
Great Quality at a Great Price!
WHOLESALE & RETAIL REFRIGERATION
Main Branch: 20 Fiat Street, Aureus, Randfontein, Gauteng, RSA
Tel: +27 11 692 2782 /412 3639 / +27 68 289 6402
JHB Branch: Unit 13-15 Goldreef Business Park, 119 Booysens Reserve Road, Theta Ex3, JHB, RSA | **Tel:** +27 11 496 1418 / +27 65 925 9497
Email: jhb.refrimate@mweb.co.za
Botswana: Plot 1231 Unit:- F1, Haile Selassie Road, Gaborone | **Tel** - 00267 72100282
Email: refrimate@mweb.co.za / fsoil@yebo.co.za | **www.refrimate.co.za**

HEAT EXCHANGERS

AFCOOL HEAT EXCHANGERS
25 YEARS
ONDA
Specialists in plate heat exchangers, coils & condensers.
www.afcoolheatexchangers.co.za
neil@afcool.co.za
+27 31 303 6323

TOOLS

ROTHENBERGER
pipetool technologies at work
We connect people with water and energy. Safe. Sustainable.
Tel: 011 372 9631 | 079 508 1679 | info@rothenberger.co.za | www.rothenberger.com/za

SUBMIT YOUR 'INTERESTING INSTALLATION PHOTOS' TO BE PUBLISHED IN THE *RACA JOURNAL* FINAL FIX

Have you seen any installations like this lately? (The good, the bad, and the downright illegal?) Send them to **editorial@interactmedia.co.za** with a description and a comment… it's easy!

FINAL FIX

Here a fire exhaust system vertical discharge unit (VDU) has been weighed down with floor tiles on top of the dampers to stop them from opening – presumably they were leaking water. In case of emergency, this will affect the essential need for exhausting the building with potentially disastrous consequences. RACA

BJ Cooling and Heating

Yes, some weight will close these...

SAIRAC

FRIGAIR EXHIBITION 2025

4-6 JUNE 2025

GALLAGHER, CONVENTION CENTRE, JHB

THE LARGEST HEATING, ENERGY, REFRIGERATION, VENTILATION, & AIR CONDITIONING EXHIBITION IN AFRICA

Showcasing the **HERVAC industry's** crucial role in the rapid development of **energy efficiency** and **sustainable technologies** for the future.

H E R V AC

BOOK YOUR STAND TODAY!

GRAB THIS OPPORTUNITY WHILE IT'S HOT! DON'T MISS OUT!

CONNECT	LEARN	NETWORK
with over 3 000+ visitors	about the latest ideas and innovations	with key industry players to grow your business

Frigair 2022

+ 3,004
Total visitors

+ 127
International visitors

+ 28
Different countries were represented by visitors

96%
of visitors either had purchasing decision power or strongly influenced the decision making process

102
Total exhibitors

CONTACT
Dale Macnamara, Exhibition Manager
Email: dale@interactmedia.co.za | **Tel:** +27 (0)11 579 4940

Charlene Hefer, Portfolio Director
Email: Charlene.Hefer@montgomerygroup.com
Tel: +27 10 003 3039 | **Cell:** +27 84 401 2158

#Frigair25 #VisitFrigair

www.frigairexpo.co.za

Owned by: SAIRAC

Endorsed by: SAIMS, S.A.R.S.A., SARACCA, SAREA

Brought to you by: CONFERENCES EXHIBITIONS WORKSHOPS

In partnership with: MONTGOMERY GROUP SPECIALISED EXHIBITIONS

TRANE

Building Controls & Automation

- **Building Controls**
- **Equipment and Unit Controls**
- **Energy Management Systems**
- **Integration Solutions**
- **Wireless Communication**
- **Web and Mobile App Interface**

Install building controls from Trane. Gain a partner in making your buildings better for life.

Cape Town
T: 021 704 1570
sales@sfirst.co.za

Durban
T: 031 579 4280
sales@sfirst.co.za

Johannesburg
T: 011 704 2024
sales@sfgp.co.za

Unitary
T: 011 704 2024
unitary@sfgp.co.za

trane.com

TRANE TECHNOLOGIES