Vol. 11 No. 3 October 2015 ₹ 100

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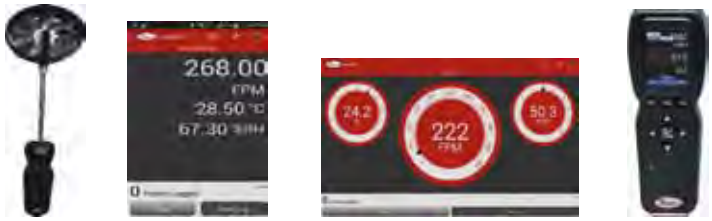

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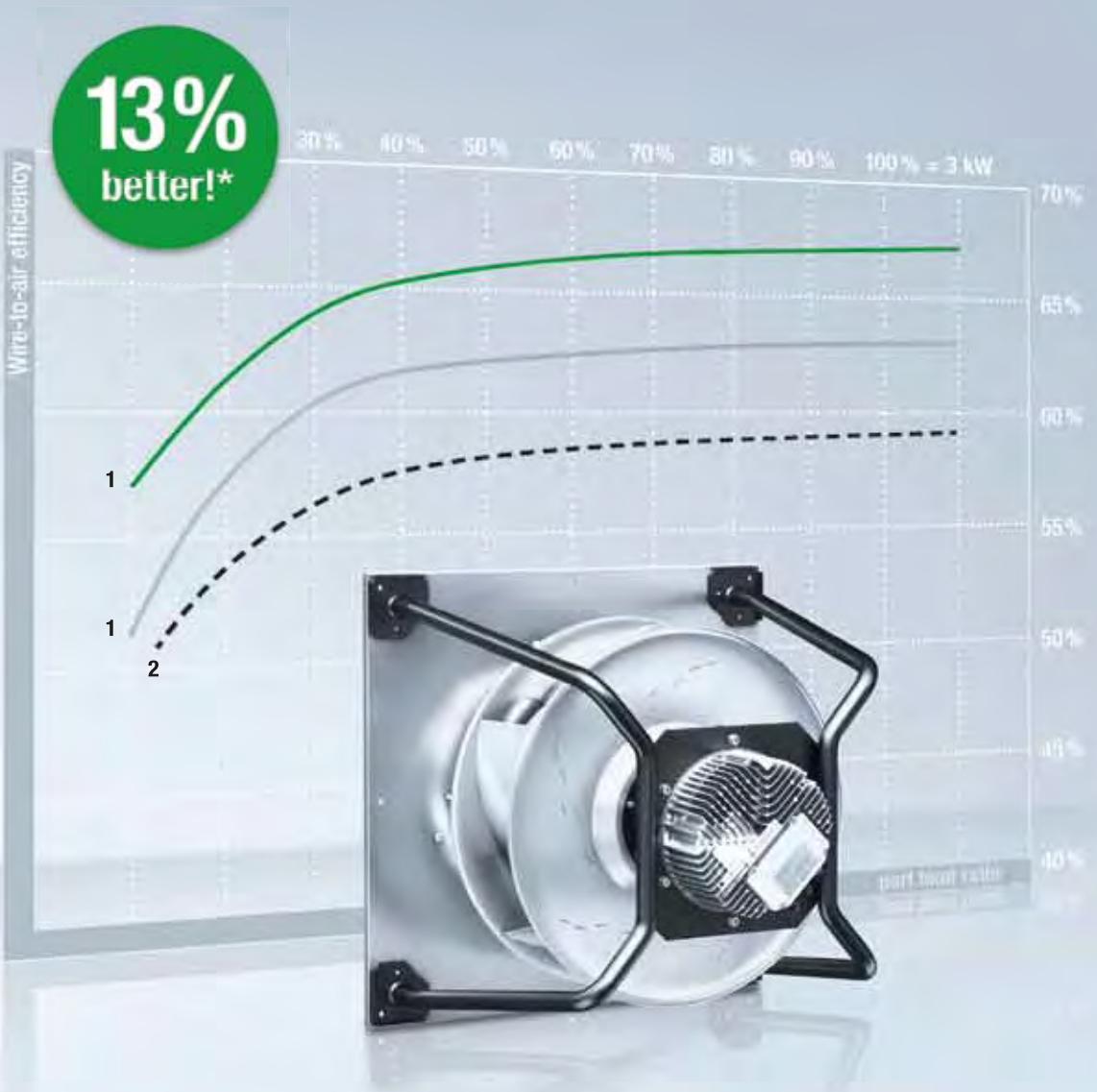
A cut above: the new RadiPac.



* Comparison of first- and second-generation size 400 RadiPac.
The results are [1] from the ILK-B-31-15-3981a technical report (dated 9 March 2015) by the Institute of Air Handling and Refrigeration (ILK) in Dresden and [2] our own laboratory measurements. For more information on the study, see www.ebmpapst.com/ilk

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Publisher's Letter

Combined Approach Is Essential

Significant developments and innovations are continuing worldwide in the components of HVAC&R systems including the control systems. At present, globally, energy efficiency, and mitigation of GWP (Global Warming Potential) and ODP (Ozone Depletion Potential) are being held as the topmost priorities, thus most of these improvements are focused in those directions. For example, recently, Emerson Climate Technologies' business segment, has announced a new feature to the company's top rated Sensi Wi-Fi programmable thermostat. This new feature will allow homeowners to remotely lock the thermostat keypad to prevent adjustments to the thermostat's programmed settings. All of us know that an accidental or unwanted change to the thermostat can lead to higher heating and cooling bills. There is no doubt that this additional feature will fetch a big advantage to the homeowners to keep the energy bill under control.

CAREL's HECU, the high energy efficiency solution for condensing units with DC compressors is another good development. The target applications for this solution are convenience stores, minimarkets and corner shops, a segment in which the refrigeration industry needs to respond to the latest challenges by providing high energy efficiency solutions. The load profile in these applications varies quite considerably, and DC compressors – by offering wide capacity modulation, ensure excellent energy efficiency in any conditions, and especially at low load, when compared to other technologies. Integration of the main unit controller with each refrigerated unit in the store (showcases or cold rooms) and continuous communication between the various units allow the system to implement intelligent algorithms, by adapting operating conditions in order to achieve the highest performance at all times.

There are many such examples. All the stakeholders are trying to achieve their climate goals with individual efforts. However, consortium-led developments can further accelerate the process to a great extent. Are we seriously thinking about that?

Please send your comments at pravita@charypublications.in

Pravita Iyer
Publisher & Director

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V5 X Series

ALL DC INVERTER VRF

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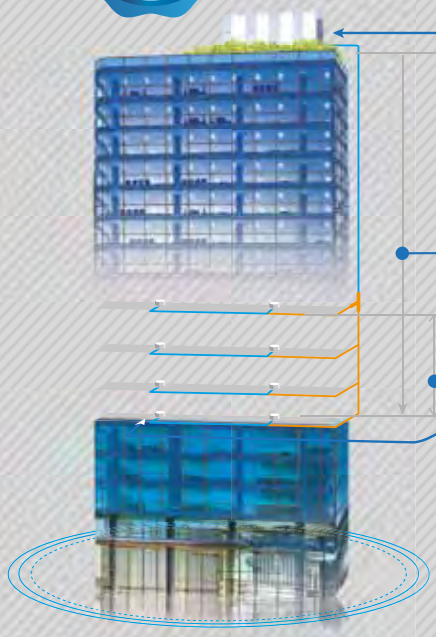
R410A

Diamond Shaped Design

1000m The solution offers a piping length of 1,000m and level difference of 110m, making it perfect for large projects.



110m
Max.110m level difference between IDU~ODU

175m
Max.175m actual piping length

30m
Max.30m level difference between IDU~IDU

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FROM THE EDITOR

Solar Cooling

Owing to the geographic condition of our vast country, power transmission to all remote areas is an all-time challenge from the technical as well as economic angle. However, people stay even at the remotest parts of this country, and we need to reach them the facility of artificial cooling – not only for their physical comfort but also for helping them for preserving perishable food and beverage items. Yet another important task that solar refrigeration can accomplish for the people staying at far off places is preserving their medicines and other temperature-sensitive healthcare items. Thus, obviously, our nation needs to be more focused on deploying solar refrigeration at least at all those places where reaching conventional electricity is still a dream.

Our country is blessed by plenty of sunlight, on an average almost 300 days in each year, we find bright sun that is useful for production of solar energy, which can be used for solar refrigeration. When it comes to the question of night time or days of low sunshine, apart from direct storage technologies (batteries), new technologies are also developing rapidly to store energy for refrigeration (cooling). For example, NASA's patented solar-powered refrigeration system eliminates reliance on an electric grid, requires no batteries, and stores thermal energy for efficient use when sunlight is absent. The innovation uses a variable speed, Direct Current (DC) vapour compression cooling system, connected to a Solar Photovoltaic (PV) panel via novel electronic controls. This environmentally friendly system is ideal for use in commercial or household refrigerators, freezers, vaccine coolers, or solar ice-makers. It is particularly ideal for off-grid applications.

It is pleasing to note that in India, some companies have already started working on solar cooling facilities. They have installed several adsorption chillers in the country that are working with good efficiency. However, more involvement and innovation in this area is necessary.

Pl. send your views at pkchatterjee@charypublications.in

"Our nation needs to be more focused on deploying solar refrigeration at all those places where reaching conventional electricity is still a dream...

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Editor: P K Chatterjee

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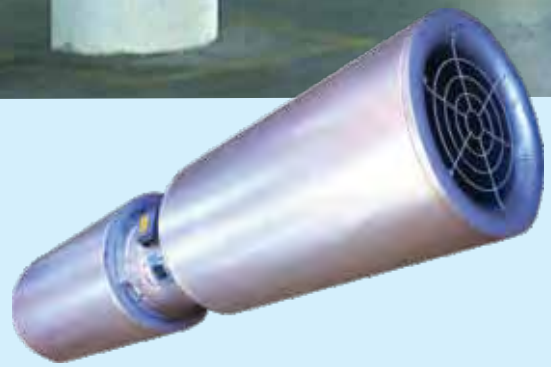

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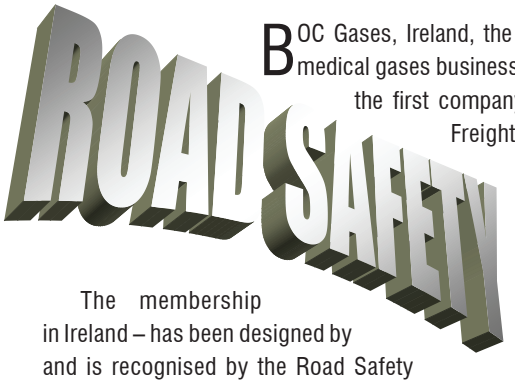
FTAI recognises BOC Gases' road safety practice



BOC Gases, Ireland, the UK & Ireland's leading industrial gases and medical gases business and a Member of The Linde Group, has been the first company to achieve silver level of accreditation by Freight Transport Association Ireland (FTAI), recognising its high standards of safety and compliance. The award was announced at FTAI's council meeting on 29th September, 2015.

The membership accreditation scheme – the first of its type in Ireland – has been designed by FTAI with input from members themselves and is recognised by the Road Safety Authority (RSA).

Sally Thornley, FTA's Director of Standards, Audit and Accreditation, said, "This is a significant achievement for the FTAI accreditation scheme and its members. The scheme was introduced to improve compliance levels and industry image, both within Ireland and abroad. A silver accreditation means that the organisation has not only put in place a broad range of safety-related standards by way of an annual audit, but also that those systems are being implemented through additional vehicle and driver encounters as well as a site implementation audit. This important milestone shows that, through this voluntary scheme, industry can recognise good practice and make a positive contribution to improving road safety."

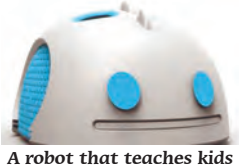
Niall Cotton, Head of Deliver Ireland, BOC Gases, said, "I am delighted that BOC has been awarded this Silver standard following a very comprehensive audit and accreditation process. For BOC and our parent company, The Linde Group, road transport safety is paramount, safety at BOC means 100% of behaviour 100% of the time. This achievement is well-deserved recognition of the ongoing efforts the entire team here at BOC Gases in Ireland has invested in safety over a number of years." ■

Faiveley Transport receives contract from CRRC

Faiveley Transport has been awarded a contract by CRRC Corporation Limited (China Railway Rolling Stock Corporation) to supply HVAC systems (heating, ventilation and air conditioning) for MBTA's Orange and Red line cars in Boston. The group will support the Chinese Rolling Stock manufacturer in its first US project. MBTA will use 284 CRRC metro cars, 152 for the Orange Line (Oak Grove station to Forest Hills station) and 132 for the Red Line (Alewife station to Mattapan / Braintree stations), with an option for 58 additional cars for the Red Line.

The contract awarded to Faiveley Transport, worth more than 15 million Euro, covers the supply of compact saloon HVAC systems (heating, ventilation and air conditioning). It includes the study, design, manufacture and delivery of the equipment and involves two of the group's sites worldwide. Engineering and manufacture will take place in Shanghai (China). Project management will be handled by the Shanghai (China) and Greenville (US) sites. ■

Six participants reach the final for Design Lab 2015



A robot that teaches kids the importance of taking care of their clothes...

Electrolux has revealed the six finalists in its popular global design competition Design Lab. The theme for this year's competition was 'Healthy Happy Kids.' The brief from Electrolux covered new solutions and bold ideas that would help improve the everyday lives of families with kids.

The six student finalists come from universities in Mexico, South Korea, Hungary, Lithuania, UK and Russia. The winner of Design Lab 2015 will be chosen after the finalists present their concepts to a jury at the awards galain Helsinki, Finland.

The 2015 competition attracted total of 1,500 submissions and after rounds of public voting and decisions from Electrolux experts, the finalists have been narrowed down to six, including Voris: a robot that teaches kids the importance of taking care of their clothes. ■

Johnson Controls, Hitachi complete global air conditioning joint venture

Johnson Controls, Hitachi, Ltd., and Hitachi Appliances Inc., have completed their global joint venture agreement and will immediately commence operations of Johnson Controls-Hitachi Air Conditioning to provide global customers with a full range of world class air conditioning products and technology.

Through the agreement, Johnson Controls has acquired a 60% ownership stake of the new entity, which has more than ¥350 billion in sales annually (approximately $2.8 billion). Hitachi Appliances retains ownership of the remaining 40% of the company. The joint venture has approximately 14,000 employees and 24 global locations dedicated to design, engineering and manufacturing throughout Asia, Europe and Latin America. It will build on both organisations' technology, research and development leadership, as well as expanding marketing channels.

Customers globally will now have the most diverse range of air conditioning products in the industry, including Hitachi's world-class variable refrigerant flow systems, residential air-conditioning solutions, high-efficiency chillers and leading-edge rotary and scroll compressors – in addition to Johnson Controls' industry leading HVAC and building automation solutions.

The joint venture's management team will be led by Franz Cerwinka, Chief Executive Officer, and Shinichi Iizuka, Chief Operating Officer and President. Cerwinka has 20 years of experience with Johnson Controls, including four years in Japan as Vice President of Finance with the company's automotive business and work with more than ten joint ventures. Iizuka has been with Hitachi for over 35 years, having spent eight years in India as the President of Hitachi Home & Life Solutions India Ltd. He has led Hitachi's air conditioning business since 2013. ■

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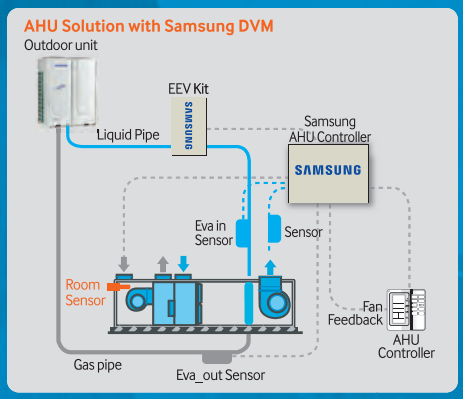

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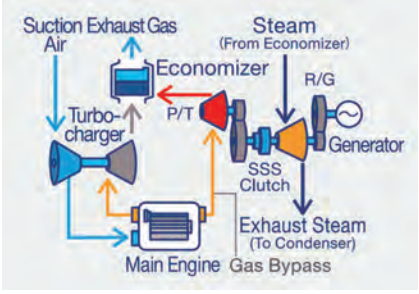
MHI-MME receives order for waste heat recovery systems



Mitsubishi Heavy Industries Marine Machinery & Engine Co., Ltd. (MHI-MME) has received an order from Daewoo Shipbuilding & Marine Engineering Co., Ltd. (DSME) of Korea, for Waste Heat Recovery Systems (WHRS) to be installed on eleven 19,600 TEU (Twenty-foot Equivalent Unit) Mega Container Carriers (MCC) being built by DSME for Maersk Line of Denmark.

The WHRS on order is MHI-MME's proprietary system for marine use that efficiently generates electric power by maximising recovery and utilisation of exhaust gas waste energy from marine diesel engines.

With this order, the cumulative number of WHRS units ordered since the system's market introduction in 2010 has now become 87. The WHRS is a system that optimally controls exhaust gas turbines and steam turbines, enhancing fuel efficiency by recovering waste heat across a wide range of engine loads. In this way, the system contributes to reductions in environmental impact.

Prior to the current order for installation on eleven MCCs, MHI-MME's WHRS equipment previously was installed on Maersk Line's Triple-E series (18,300TEU), the world's largest at that time and still considered the most efficient. The new WHRS order will bring the number of installations on Maersk vessels to 69, in four series.

The WHRS, MHI-MME's best-selling product, was developed through the integration of the MHI Group's marine technology and expertise accumulated through a long history of operations in this field. Of the 87 units of WHRS ordered for installation worldwide, 64 are already in service. MHI-MME accounts for a greater than 90% share of the WHRS's global market. ■

Toshiba appoints new Chairperson and MD for UEM

Toshiba Corporation (Toshiba) has acquired the majority control in UEM India Pvt. Ltd. (UEM). Now, Koichi Matsui, 41, from Toshiba Corporation has been appointed as the Chairperson and Managing Director of UEM. Matsui will assume responsibilities for managing UEM including – developing, driving and implementing business strategies and solutions, along with Krishan Kshetry, Promoter, UEM, to expand the company's business in India and abroad.

Matsui said, "I am very much looking forward to spearhead UEM Group, an international multi-disciplinary environmental services company. With the synergy between Toshiba and UEM, we have a unique opportunity to deliver breakthrough technologies and quality control that will bring greater value to our clients, employees, investors and other stakeholders. UEM's strong brand, together with positive market development and the excellent momentum in our existing operations form a solid platform for continued good growth going forward." ■

Konvekta's new product requires 10% less refrigerant

With its second generation range of airconditioning units - the UltraLight range (UL II) - Konvekta AG is providing an intelligent solution for bus airconditioning that delivers greater efficiency in terms of time and cost. Thanks to an extremely tough construction material developed in-house, the new model range is considerably more lightweight, economical and low-noise.

The UltraLight model range (UL model range) is based on a simple, installation-friendly and modular building block system. The new airconditioning range is characterised by a highly modern design that takes aerodynamic and aesthetic aspects into consideration and is extremely lightweight. Indeed, the lightest design of the newly developed UltraLight II weighs approximately just 103 kilograms.

In addition, the engineers working on this model range have achieved reductions in the noise level by 5 dBA through the use of a special construction material. ■

Polypipe Ventilation launches new products

Polypipe Ventilation, a manufacturer of energy saving domestic ventilation systems, has launched an innovative new Silavent air management controller, AMIE – and a new range of Domus duct sound attenuators – designed to provide residents with greater control and comfort over their indoor environment.

The stylish Silavent AMIE (Air Management for Indoor Environments) controller provides enhanced control of Polypipe's award winning Silavent Green Line HRX and HRX2 Mechanical Ventilation with Heat Recovery (MVHR) systems. A compact, wall mounted unit, AMIE enables the resident to directly manage the humidity and ambient air temperature of their dwelling through two main MVHR functions: extract fan boost speed operation, to help remove humid, unhealthy air and heat exchanger (summer) bypass to stop the unit from supplying pre-warmed air into the home; making AMIE ideal for summer and night time cooling. There are often times within a domestic property when increased ventilation (boost rate) is required to remove excess humidity and temperature. Silavent AMIE provides the resident with the ability to boost the air flow through the MVHR system either automatically by humidity level sensing or manually using an external switch or push button. In the case of the latter, the MVHR unit will return to background speed after 15 minutes.

The second most recent key product launch for Polypipe Ventilation is the Domus duct sound attenuators, often referred to as silencers, which offer improved sound attenuation and thermal insulation. Domus rigid duct sound attenuators provide a simple, cost-effective solution to reduce nuisance noise from whole house mechanical ventilation systems, which connect to a centralised appliance ducted to a number of different room outlets (such as an MVHR system). They effectively absorb sound over a range of audible frequencies, e.g., traffic or fan noise. ■

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Volution Group wins a new contract for ventilation

Volution Group, a well known supplier of ventilation products to the residential construction market, has won a contract to supply its products to a major retirement accommodation project. Located in Lancaster conveniently situated only a couple of miles from the coast and nestled between Manchester and the Lake District, the retirement development will combine independent living with the peace of mind of on-site support including: 24-hour emergency call systems; first-rate facilities; and high tech security systems as standard.

Constructed by McCarthy & Stone, the largest developer of privately owned retirement property in the UK, the project will offer 54 one and two-bedroom assisted living apartments exclusively for the over 70s.

Volution's Vent-Axia division is supplying 41 Sentinel Kinetic 200ZPs ventilation units for the one-bedroom apartments and 13 larger 200Z ventilation units for the two-bedroom apartments, to help provide good indoor air quality and comfort for occupiers.

The Sentinel Kinetic Horizontal 200ZP is a pioneering mechanical ventilation with heat recovery (MVHR) system designed for new build properties. A whole house, multi-room ducted solution, this MVHR system combines supply and extract ventilation in one unit.

Warm, moist air is extracted from 'wet' rooms through ducting and passed through the heat exchanger before being exhausted to the outside. Fresh incoming air is preheated via the integral heat exchanger, which recovers more than 86% of the heat energy that would otherwise be wasted. With comfort key for occupants, the system also features a 'summer bypass' to prevent warm air being re-introduced in summer months and an integral humidity sensor to control air humidity levels.

Ronnie George, Chief Executive of Volution Group plc, said, " McCarthy & Stone leads the way in retirement housebuilding in the UK. Heat recovery ventilation is essential for an energy efficient and healthy living environment, reducing excessive moisture in the air, combating condensation and providing good indoor air quality and comfort for occupiers." ■

GEA Heat Exchangers Group goes slow with new companies

The former GEA Heat Exchangers Group, which is separated in Heat Exchanger Systems and Power Cooling Solutions will in stages transform its complete corporate image. 'A brand change in heat exchange' is the motto.

The internationally active mechanical engineering companies' Heat Exchanger Systems and Power Cooling Solutions will not appear in a new image from one day to the next.

Rather, they will offer their customers and staff a transitional phase to lead up to the new brand environment.

In this way, the companies highlight their conviction that a good B2B brand consists of far more than a name and a logo: company staff and products make the deciding difference and have assured the success of these companies for many years now.

The coming weeks will additionally be used to develop mutual consciousness for the brand, before this process is concluded with publication of the name and the logo. ■

HVAC&R technicians to find huge demand in next 7 years

According to the recent reports published by the HVACR Workforce Development Foundation (WDF), USA, demand outstrips the supply of heating, ventilation, air conditioning, and refrigeration (HVAC&R) employees. In particular, mechanics and installers are in critical shortage in most areas of the nation.

Due to increased growth in the sector and the ongoing retirement of Baby Boomers, HVAC&R programs in technical and community colleges are not filling the seats needed to meet the current and anticipated demand.

Almost half of all mechanics and installers will retire in the next decade, according to the research. HVAC&R employers are having a difficult time filling positions, especially for refrigeration and HVAC technicians – 44 and 36 days longer, respectively, than the national average of 29 days for similar positions. "HVAC&R programs in the US and Canada are seeking new students, from recent high school graduates to veteran or 2nd-career adults," said KM Arfstrom, Exe. Director WDF. ■

Ventilation improved for Brembo brake discs

Brembo has introduced the latest addition to its family of pillar venting technologies, employing pillars that dramatically improve the cooling performance of the system. Even though they don't reach the 1200^{0} Celsius of a Formula 1 car, the braking systems on street cars can also overheat – a drawback potentially causing thermal cracks to appear on the surface of the disc.

The new ventilation system is characterised by a pillar structure designed specifically for each individual system. The pillars are arranged in three bands on the braking platform. They increase resistance to thermal cracking by up to 30%, guaranteeing a longer disc lifespan. There is a different pillar structure on every band of the disc, designed to achieve the optimum benefit from the dynamic flow of air. The improved air flow also contributes to a drop in operational temperature of up to 30%, ensuring a longer life for the brake pads.

Another important advantage is a reduction in the weight of the disc, which can be up to 10%. This decreases both fuel consumption and emissions of pollutants and, most importantly, the reduction in unsprung weight increases performance, driving comfort and handling.

This new ventilation system is the result of two years of dedicated research by Brembo at its Kilometro Rosso site, where it has been tailored to the specific needs of individual braking systems.

In 2010, Brembo innovated further with the introduction of Star Pillar ventilation which employs star-shaped pillars to disperse the heat better, once again reducing the risk of thermal shock of the disc and guaranteeing longer pad life. ■

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SPIE shows its commitment to fight against global warming

With the unprecedented goal of reaching a universal binding agreement in order to effectively fight climate disruption, COP 21 will be the major environmental meeting in 2015. As a player in the transition to a low-carbon society, the SPIE group will naturally be at this event to showcase its contributions in the Solutions Gallery organised on the fringes of the summit meeting.

While the diagnosis of climate change and its anthropogenic nature appear to be unanimously accepted, the implementation of solutions calls for convergent action by several types of players, such as businesses, NGOs and countries.

As a responsible company, SPIE plays an active part in several joint professional bodies to further debate and prepare for the future. In this context, the group is supporting The Shift Project (TSP), a European think-tank supporting transition to an economy freed from its dependence on fossil energy sources.

40% reduction in greenhouse gases, 27% of European energy consumption from renewable sources by 2030: these are targets, set by the European Commission, which SPIE aims to support by proposing innovative solutions in its business fields (Smart city, e-fficient buildings, Energies, and Industry services).

In the building sector, representing the largest portion of energy consumption in Europe - accounting for nearly 40% of final energy consumption and 36% of greenhouse gas emissions, SPIE proposes a comprehensive approach combining energy transition and digital technologies.

The primary objective is to improve buildings' energy and environmental performances, while ensuring the comfort of occupants. This approach was illustrated by work carried out on the D2 tower in La Défense business district, near Paris, where SPIE teams provided comprehensive services in 2014 for the installation of the tower's high and low voltage electrical power systems, generators sets, building management system, energy efficiency system and fire safety system. ■

Companies covered in this issue

Firms go for technology partnership

Dearman, the clean cold technology company, has formed a technology partnership with Hubbard Products, Europe's leading designer, manufacturer and supplier of commercial cooling equipment.

The partnership will see both companies work together to further develop and bring to market a highly efficient and cost-effective zero-emission transport refrigera-tion system based around the revolutionary Dearman engine. They have worked together for a number of years and are both members of an Innovate UK funded consortium to develop zero-emission auxiliary power units for buses and HGVs.

This agreement cements their relationship and confirms that both companies will work together, not only to continue to develop technology, but also to bring it to market in multiple countries. Pat Maughan, Managing Director of Hubbard Products, said, "Revolution is crucial for the future of transport refrigeration." ■

F&S commends AIRSYS for their all-round cooling solutions

Based on its recent analysis of the cooling solutions market, Frost & Sullivan recognises AIRSYS with the 2015 Global Frost & Sullivan Award for Product Line Strategy Leadership. AIRSYS' industry-leading product line addresses all the cooling requirements of both commercial and industrial businesses with its superior reliability, energy savings, extensive working range, precise control and extended lifetime. The company has fully leveraged the technological advantages and breadth of its products and solutions to expand its geographic footprint outside of China, its home market.

AIRSYS' product line comprises computer room AC (CRAC) units, free cooling chillers, free cooling dry coolers, ice storage tanks, in-row units, in-rack units, adiabatic cooling units and monitoring systems.

They have found application in data centres, telecom, healthcare, manufacturing and industrial process control centers, and are ideal for precision environment facilities such as museums, wine cellars, libraries, laboratories, calibration chambers and machine shops. Strategically, AIRSYS has sharpened its focus on the data centre and telecom segments by developing new products with advanced technologies for them.

"AIRSYS has a truly optimised product portfolio, as its products have the prices and functionality range to suit every business need. It offers both cost-effective products targeting customers in developing economies as well as highly sophisticated, energy-efficient, and intelligently controlled products for customers in developed countries," said Frost & Sullivan Senior Industry Analyst Gautham Gnanajothi.

The company has specifically engineered products for markets such as India and Africa at nearly half the price of competing products without compromising quality and reliability. Simultaneously, it has highlighted its technology and innovation prowess in its products for customers in developed countries such as the US, UK and Germany. ■

HITACHI

Hitachi's range of cooling products for an array of building projects and all kinds of end-to-end solutions.


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Clayton Noble
MD, A&NZ
CEVA Logistics

"I am excited to join CEVA in A&NZ at such an important time in the company's evolution..."

CEVA Logistics appoints a new MD for A&NZ

CEVA Logistics, one of the world's well known non-asset based supply chain management companies, has appointed Clayton Noble as the new Managing Director of its Australia and New Zealand (A&NZ) operations. Noble joins CEVA from Fuji Xerox Australia, where as Chief Operations Officer he was responsible for running the business' operational functions, including supply chain, customer support, managed services, professional services and business outsourcing services. He also has experience in senior executive positions leading supply chain and logistics functions, with organisations including Dell (Asia Pacific & Japan), BAX Global & the Coles Myer Group.

Xavier Urbain, CEVA's Chief Executive Officer, said: "I am thrilled that Clayton has joined CEVA, bringing both us and our customers his diverse skill set, strategic vision, and strong track record of achieving value and creating growth through innovation and the implementation of sound strategies."

Noble said, "I am excited to join CEVA in A&NZ at such an important time in the company's evolution. CEVA already has an excellent reputation in the industry, and I look forward to helping drive further growth, built on operations excellence, outstanding customer service and the delivery of innovative solutions." ■

Angus Jones
General Manager, Marketing
LG

"From what I have observed so far, the LG range of products, both current and planned across all categories, has and will continue to turn many heads in the industry..."

Angus Jones joins LG as General Manager, Marketing

LG Electronics Australia (LG) has appointed Angus Jones as the new General Manager of Marketing for LG Australia. Angus has spent more than 25 years working in marketing across consumer electronics, telecommunications and IT. With the past eight years spent in international roles, Angus joins LG Australia most recently from Dell, where he served as the Global Marketing Director leading a diversity of teams ranging from Consumer to B2B.

"I am excited to be starting my journey with LG. As a great believer in work and life balance, it is especially important to me to be working with a brand that focuses on technology that helps make people's lives better. I am especially looking forward to collaborating with the team and bringing new ideas to the table in support of that goal. From what I have observed so far, the LG range of products, both current and planned across all categories, has and will continue to turn many heads in the industry," said Jones.

"We are very excited to have a marketeer of Angus' calibre join LG Australia. He brings with him many years of technology marketing expertise and we look forward to working with him. As a keen family man that enjoys scuba diving, cycling and generally keeping active, we believe there is a great synergy between the LG brand philosophy of Life's Good and the passionate approach that Angus has demonstrated throughout his career," said Youngik Lee, Managing Director, LG Australia. ■

Stéphane Bessette
Executive VP, HR
Ipsen

"Stéphane will bring his strong international Human Resources expertise to us...," said Christel Bories, Deputy CEO, Ipsen...

Ipsen inducts an Executive VP for its HR department

Ipsen has appointed Stéphane Bessette as Executive Vice President, Human Resources (HR) of the Ipsen Group. He will report to Christel Bories, Deputy CEO of Ipsen, and will sit on the Executive Committee.

Christel Bories, Deputy Chief Executive Officer of Ipsen stated, "We are very happy to welcome Stéphane Bessette at Ipsen. Stéphane will bring his strong international Human Resources expertise to us, acquired across multiple industries, most notably in the health industry. He will support the group's transformation and contribute to the development and enhancement of skills and talent throughout our organisation." Stéphane has over 11 years of experience in the medical device sector, working for Sorin Group. Since 2007, he was leading its global Human Resources function, based in Milan, Italy and made a large contribution to Sorin's expansion worldwide.

Prior to this, he held several leadership positions of increasing responsibility and acquired solid managerial experience in human resources at Alcatel Telecom, Alstom and Guerlain. Stéphane graduated from the ECAM (Lyon), IGS (Paris) and INSEAD (Fontainebleau). ■

THE EMERSON CUP 2015

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The Emerson Cup Awards is the culmination of the Emerson Cup, an annual competition instituted by Emerson Climate Technologies to reward outstanding designs and innovations in the Air conditioning, Refrigeration and Cold Chain industry in India. These Emerson Cup Awardees have been chosen by an elite panel of judges from across the country and they truly deserve a resounding applause for their efforts.

The Emerson Cup will celebrate the genius and the achievement of these sterling performers, Let's all get together and laud this extraordinary talent.

The Emerson Cup Awards Night - 6.30 pm onwards | Friday, Nov 20, 2015 | Mahatma Mandir, Gandhinagar

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CALEFA
Wins The Prize
For Heat Pump
City Of The Year

For the fifth time, the European Heat Pump Association (EHPA) has awarded the internationally coveted prize of Heat Pump City of the Year. This year (2015), BITZER's customer Calefa Oy has won the award for a project in Mäntsälä, Finland...

Calefa has won the prize for Heat Pump City of the Year with an innovative and environmentally friendly project using 24 BITZER ECOLINE compressors. The system will start in October 2015 where CO_2 emissions will be about 40% lower.

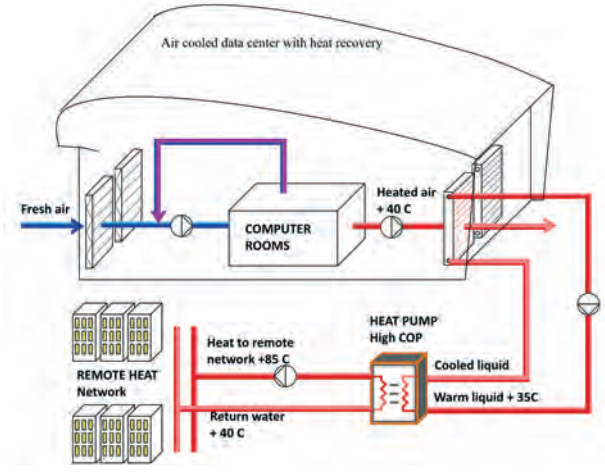
The aim of the project is to efficiently exploit the waste heat from a computing centre for district heating and to protect the environment. Heat exchangers first use the hot air extracted from the computing centre to heat water. In the next step, heat pumps in a district heating facility then raise the temperature of the water from 40 to 85°C. In this way, 75% of the energy originally used can be reused. This is not just very efficient, it also protects the environment. In the first phase, the CO_2 emissions will be reduced by 4,000 metric tons per year and, when the project has been completed, this will be up to 11,000 metric tons of CO_2 every year. Calefa's role in this is to enable the entire technical conversion of waste heat into useful heat.

One special feature is that this is the first time when such a large amount of waste heat from a computing centre can be directly

Calefa has won the prize for Heat Pump City of the Year with an innovative and environmentally friendly project – using BITZER ECOLINE compressors...

exploited for district heating. To increase the water temperature to 85°C, particularly powerful and efficient heat pumps are required.

This process is supported by 24 six-cylinder ECOLINE compressors from BITZER at the heart of the heat pump system, which can each offer flow rates of up to 150 m^3/h (at 50 Hz).



The aim of the project is to efficiently exploit the waste heat from a computing centre for district heating and to protect the environment…

Confidence due to past performance

Currently, with a total capacity of four megawatts, the heat pumps supply about 1,500 homes with energy. Subsequently, this will rise to about 4,000 homes.

Today, this system already complies with the environmental targets of 40% lower CO_2 emissions specified by the EU for 2030. "We chose compressors from BITZER because they have stood for high quality, reliability and good performance for decades. That builds confidence where the long service life of the compressors is absolutely vital for us.

We also know from experience that we can work together well with BITZER – and can rely on their service. Our team has been successfully using BITZER compressors since 2007," said Vesa Tamminen, CEO of Calefa.

On schedule

The tight schedule was a real challenge. Work began in June 2014 and the system to recover the waste heat had to be completely installed by December. This worked out due to the excellent cooperation between the operator of the computing centre (Yandex Finland), the district heating company (Mäntsälä Sähkö Oy) and the contractor (Calefa Oy).

Work has progressed well and the entire system will go into operation in October of this year (2015). The heat recovery unit in the computing centre is already operational – and can be connected to the heat pump system. The installation of the heat pumps started as soon as the building was finished in the middle of June. Early in June, the work on the necessary pipework has also begun. "We would like to offer hearty congratulations to all of Calefa's staff on their great performance and their well-deserved award. We are very happy about the confidence placed by Calefa in BITZER and that our ECOLINE compressors could contribute to the success of the project," said Ralf Gasper, BITZER Director Sales Northern Europe and Baltic States. ■

Frick India Receives Award From **IACC-NIC**

J. Singh, MD, Frick India (L) is receiving the award from Hon'ble Minister for CIT, R.S. Prasad (R)…

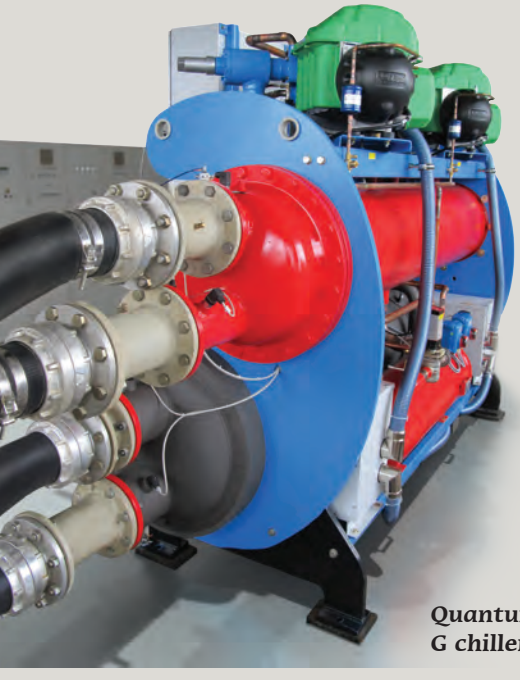
Frick India Limited has been awarded 'COMPANY OF THE YEAR AWARD' by Indo-American Chamber of Commerce (IACC-NIC) at their 'Business Leadership Awards and Fellowship Night' on 14th September 2015, at Hyatt Regency, Bhikaji Cama Place, New Delhi.

The Chief Guest of the event, Ravi Shankar Prasad, Hon'ble Minster for Communications and Information Technology (CIT), presented the award to their Managing Director, Jasmohan Singh in the presence of Lalit Bhasin, Regional President and the Members of the Regional Council. ■

Quantum chiller...

E-Shelter Chooses Chillers From Cofely Refrigeration

As per Cofely, both Quantum and Quantum G operate without oil, thus removing the need for an oil separator, Quantum chillers are particularly space saving and also require less maintenance…



Quantum G chiller...

Cofely Refrigeration GmbH provides the refrigeration for the data centres of e-shelter in Rümlang, Switzerland, and at Campus Frankfurt. In Rümlang, the refrigeration specialist from Lindau is installing two Quantum G chillers, while in Frankfurt-Rödelheim, e-shelter has decided on two water-cooled and two air-cooled Quantums. Therefore, the entire Quantum series is being used at e-shelter.

As a service provider, e-shelter develops and operates state-of-the-art data centres for customers from different industries. Its customers include financial service and telecommunication companies, as well as IT and cloud service providers. Cofely Refrigeration has been providing climate control and refrigeration at the data centres of e-shelter since 2011. Now the company has opted for a further six chillers from Cofely Refrigeration, choosing various models from the wide-ranging Quantum portfolio. In particular, the excellent energy efficiency of the Quantum chillers was a deciding factor for e-shelter.

Quantum G for Switzerland, Quantum for Rödelheim

In Rümlang, Switzerland, an additional two air-cooled Quantum G chillers, each with one megawatt (MW) of cooling output, are now providing even better cooling. QUANTUM G uses the environmentally friendly refrigerant R1234ze, which has a GWP value (Global Warming Potential) of less than 1. With a total of six chillers from Cofely Refrigeration – four classic Quantums were already installed in 2011 – the data centre in Rümlang is now comprehensively supplied with refrigeration. Cofely Refrigeration is also installing a total of four Quantums in the new F and G buildings at e-shelter's Campus Frankfurt headquarters: two water-cooled Quantums with an output of 1,080 kW (kilowatt) each and two air-cooled Quantums with 1,250 kW.

Many advantages for data centres

Both Quantum and Quantum G provide numerous advantages – especially for data centre operators. As they operate without oil, thus removing the need for an oil separator, Quantum chillers are particularly space saving and also require less maintenance. The integrated open flash economiser maximises energy efficiency. The chillers are also distinguished by their low noise level and their high reliability. "Quantum has already proven itself many times in the refrigeration of data centres, and now we can demonstrate that Quantum G is also ideal for this sensitive area of application," says Jochen Hornung, CEO of Cofely Refrigeration. ■

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Diesel Engines Emit Dangerous Fumes

Research finds that when engines are first turned on, diesel cars are much more polluting. The levels of pollution measured are much worse than is being suggested by current tests...

A team at The University of Manchester is testing a Volkswagen diesel engine to try to get an accurate picture of how polluting it is. Even before the recent scandal erupted over software that fakes tests, research results from Manchester were starting to show the true picture of just how dirty diesel engines can be.

The team has attached the engine to a specially made atmospheric chamber, which can accurately monitor exactly what emissions are coming from it and, crucially, how these particles react with sunlight to create unhealthy dirty air, known as secondary pollution. They have presented their preliminary findings at conferences in Milan earlier this month, and in the USA last year.

The key findings are:

- High levels of Nitrogen Oxides and particulates emitted at elevated levels under conditions not represented in the current testing protocols
- These emissions react strongly with sunlight to create secondary pollutants such as ozone and particulate matter, which are known to be hazardous.

The team also found that the engine was much more polluting when it is first turned on and then when rapidly accelerating, two elements that are not used when engines are being tested for emissions. It all adds up to further evidence that a new testing regime reflecting real-world driving conditions is required.

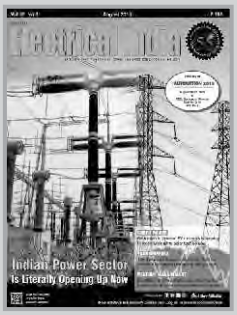
Research fellow Dr. Rami Alfarra, a member of the National Centre for Atmospheric Science, is managing the work, which has been funded by the Natural Environment Research Council (NERC) and is a collaboration with Birmingham and York Universities.

Rami said, "It has been known for a while that diesel engines were emitting more dangerous fumes than the tests were picking up. And it has not been adequately considered what happens to the pollutants once they get into the atmosphere. That is the key to our work. We want to know how these components of pollution are reacting in the real world – and just how much additional pollution they are causing in our towns and cities. We have found that pollutants such as ozone and particulate matter are being produced as a result of further reaction of the emissions in the atmosphere and these would be at street level so would be breathed in by everyone."

"We are the only researchers in the UK looking at this aspect of the engines and hopefully our work will inform and help make engines cleaner in the future. Before catalytic converters have a chance to warm up they are not very effective. This means that when engines are first turned on diesel cars are much more polluting. In general, the community has become aware that the levels of pollution measured are much worse than is being suggested by current tests. There has been a mismatch. What we need is real world testing of these engines," he added.

Dr. James Allan, another scientist working on the project, connented, "This experiment is allowing us to look at the composition and properties of exhaust particles and gases on a level of detail not previously possible – and it really is striking to see the differences once the engine is taken outside of its comfort zone. If we are to understand the real impact of these engines on air quality, we must perform experiments like this, rather than rely on standard test cycle data that give an incomplete and misleading picture."

"These independent experiments allow us to investigate a range of conditions so we can say something about the consequences of traffic pollution. It is important to consider both realistic engine conditions as well as changes in ambient atmosphere. Working with our collaborators, we have the expertise to tackle these largely neglected but important problems," said Prof. Gordon McFiggans, Lead Investigator of the current collaboration. ■



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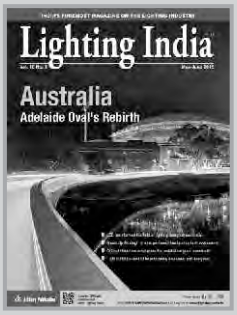

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Monitoring Dew Point

The Only Way To Prevent Mold

Dew point measurement besides mold control has proved to be a better tool for controlling all aspects of building operations from cooling, to economizer control to dehumidification control…

Mold is a fungus. Outdoor mold breaks down dead trees and fallen leaves, and hence plays an important role in nature. However, mold growing indoors should be avoided, because it can damage carpets and weaken floors and walls.

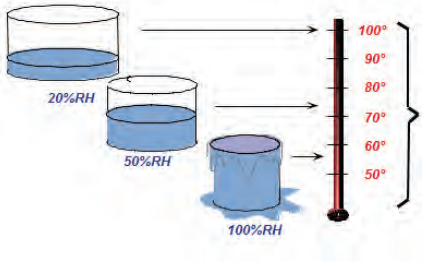
Mold requires a nutrient source, proper temperature and moisture to grow. Mold does not require light to grow. It does not produce food, instead adsorbs nutrients by breaking down hydrocarbons. It will grow on any organic building material such as paper, adhesives, resins, etc. or even grow on the patina of dust that collects on surfaces. Nutrients to support mold growth are ubiquitous in the building environment. The temperatures required for mold growth are in the same range as indoor building environments. Most molds grow in the temperature range of 15°C to 30°C (59° to 87°F). Control of moisture is the only practical way to control mold growth.

Relative humidity reflects the relative amount of water that air can hold at a given temperature. Change the temperature and the humidity will change – even if net amount of moisture in the air remains the same.

Pic. 1 : Mold development on the ceiling…

In fact a 1ºF change in room temperature can change the relative humidity by 2%. If outside air at 85ºF (29.5ºC) and 60% RH is cooled to 72ºF (22ºC) degrees without any moisture removal, the RH will increase toalmost 90%. This temperature effect on Relative humidity makes it useless as a moisture control parameter.

Relative Humidity is a confusing term, especially when we are talking about controlling mold.



Pic. 2: RH changes widely and constantly with temperature…

The question raised then is whether controlling relative humidity is the right way to control mold.

First we have to understand that mold formation is always on a surface. Also, for the mold to develop the 'moisture content' of the surface has to be in a certain range.

What is moisture content?

Moisture content is not relative humidity. Moisture Content (MC) is the mass of the moisture in a material relative to the dry mass of the material, expressed as a percentage. For example if there is 17 grams of water in a piece

of wood that weighs 100 grams when dry, then the wood has a Moisture Content (MC) of 17%.

That implies that the Rh and temperature of the space in which we are actually making all the measurements is giving us no indication of the surface conditions. Hence, the water condensate on the surface of a material is a good indicator of mold growth, RH in the space cannot be used to predict or control the moisture content on mold vulnerable surfaces. This surface may be in the ductwork, in carpet or on the inside of walls and at a very different temperature than what we would typically measure in the space.

We must therefore measure and control the temperature at which the water condenses on the surface, thereby controlling mold conditions.

This temperature is called dew point. Instruments that monitor dew point directly can be used for direct control, as usually the coldest surfaces in a building are known.

Dew point instruments are even now considered complicated, expensive devices. Contrary to this belief, the new technologies

Pic. 3: Telaire NDIR DEW point sensor…

have made these instruments very compact, user-friendly and maintenance free. Unlike the RH sensors, which cannot be calibrated the Dew point sensors offer calibration possibility and an enhanced design life of over 15 years. These devises come in wall mount and duct mount designs.

Dew point measurement besides mold control has proved to be a better tool for controlling all aspects of building operations

Image Courtesy: Telaire

Pic. 4: Protimeter Mini & Psyclone for measuring MC% & Dew Point…

from cooling, to economizer control to dehumidification control. Alternatively one can also measure the surface moisture content % and absolute humidity or dew point as part of the preventive maintenance. ■

Sarfraz Panjwani
Managing Director
ALM Engineering and
Instrumentation Pvt. Ltd.

Optimising Healthcare Environment Spaces

Although the designed layout has a big impact, the effectiveness of an airflow design boils down to the velocity of the air through the space and what direction it is flowing....

Designing for healthcare patient and critical environment spaces is strongly dictated by strict environmental and safety standards. However, possibly one of the most important components that must be taken into consideration is the one you can't see. Effective Airflow Design (EAD) not only helps meet airflow change and industry standards, but is critical in limiting the contraction of airborne illnesses and can reap considerable cost savings for facilities. When designing for healthcare facilities, it is important to abide by airflow and air quality standards, in particular for three priority rooms: Hybrid operating rooms, Patient rooms and Isolation rooms.

Standards and Approaches

To determine what airflow plan is right for a space, engineers first meet with a designer and give them a general layout for the room, diffuser size and placement, requirements for airflow and other details. Although the designed layout has a big impact, the effectiveness of an airflow design boils down to the velocity of the air through the space and what direction it is flowing. In majority of the spaces within the Healthcare environment

the primary objective is to ensure the cleanest air is supplied first to the patient then into the remainder of the room and that it's filtered before it circulates back into the area.

As for requirements, most states (42) have adopted some version of the Facility Guidelines Institute (FGI) recommendations for healthcare facilities, but each administration has its own rules and regulations so it's critical for those involved to be aware of what standard(s) they're designing to. Though it would not be a drastic shift, this individualistic approach among states to regulations may change within the next two decades as results of research projects that are adopted into code. This research, commissioned by ASHRAE, FGI, and others, entails determining how much airflow is needed to prevent contamination in certain spaces based on evidence rather than conjecture, which has been the standard practice. The International Code Council (ICC) has formed an Ad Hoc Committee on Healthcare that is working to ensure standards and codes are not increasing the cost of construction and operation purely based on assumptions or outdated practices. This is a key area of focus, since 9% of the annual energy usage in the United States is dedicated to healthcare spaces; of that usage, HVAC is responsible for half.

The diffusers introduce highly filtered air into a space – right above where critical work is happening. This air then expands out and pushes the contaminants away...

Fig. 2: The particular piece of imaging equipment in this example does not allow for any air distribution devices to be installed within the area shaded in Figure 2, making it much more complicated to comply with the array size requirements from ASHRAE 170-2013...

Finally, thermal comfort is addressed in ASHRAE Standard 55. Since most regulations are concerned with airflow and air quality, thermal comfort is not a priority. However, a room's temperature and humidity is important because it can impact recovery time of patients as well as the performance of the facility's staff – an overly cold or warm environment makes it difficult for surgical staff to perform at the highest level. ASHRAE Standard 170 also has stipulations as far as minimum and maximum humidity temperatures. While the scope of Standard 170 includes occupancy comfort, it should not be assumed that meeting the prescriptive design minimums will ensure compliance with ASHRAE Standard 55. Appropriate step must be taken to realise thermal comfort in the space for patients, as well as for visitors.

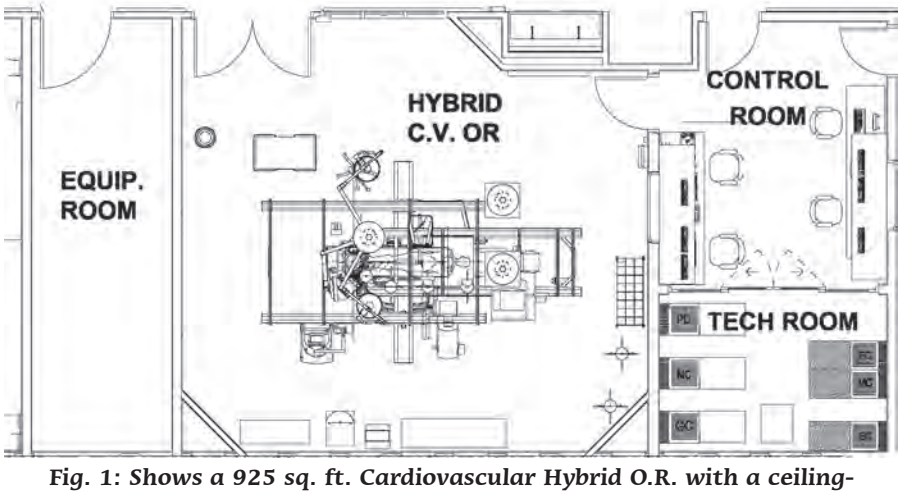


Fig. 1: Shows a 925 sq. ft. Cardiovascular Hybrid O.R. with a ceiling-mounted, rotational angiography. To satisfy the minimum air-change requirements, at least 3,084 cfm must be supplied to the space, which has a 10 foot ceiling. In order to supply this amount of air within the specified velocity range, a minimum diffuser area of 88 sq. ft. is necessary...

Hybrid Operating Rooms

Hybrid Operating Rooms (Hybrid ORs) are surgical areas equipped with advanced medical imaging devices – such as CT and MRI scanners. Incoming air should be HEPA-filtered to minimise the pathogens entering the space. Hybrid ORs have 30% more Air Changes per

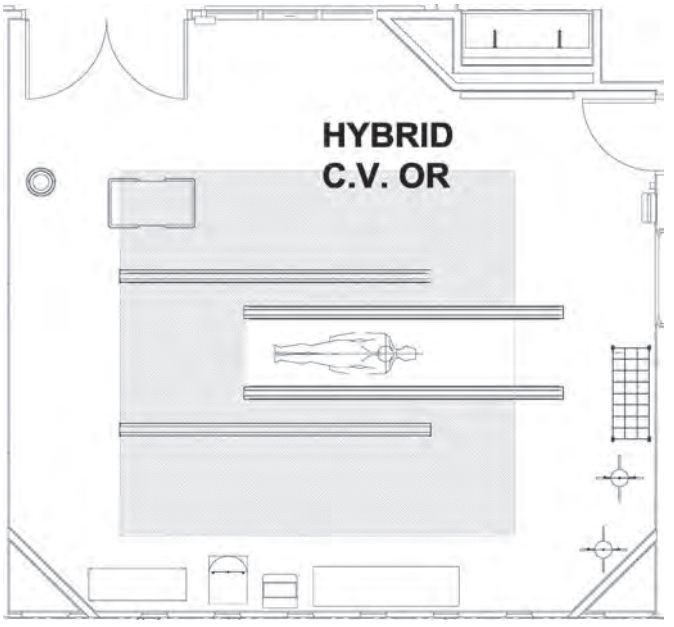


Fig. 3: Highlights the region that must be covered by diffusers...

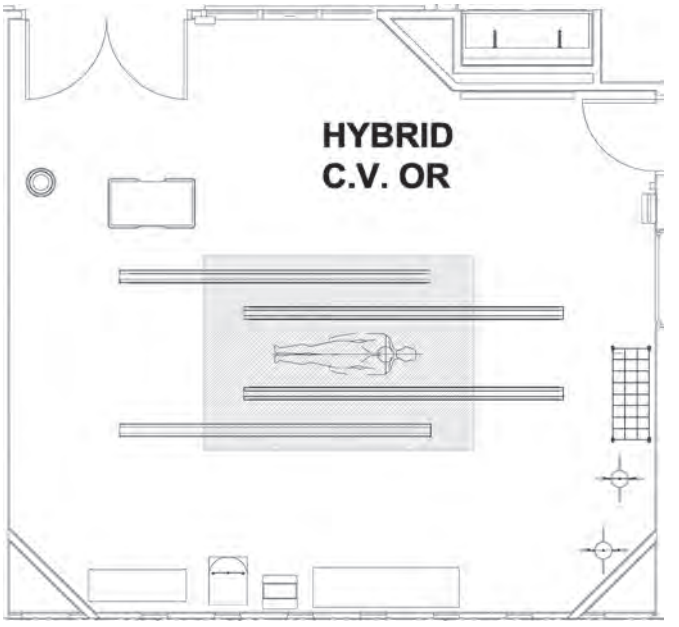


Fig. 4: Shows the minimum size the array could be if this restriction was not in place...

Hour (ACH) than catheterization labs. The increased airflow and type of procedures in the space dictate a different approach to EAD. Rather than conventional or radial flow diffusers, Hybrid ORs utilise unidirectional diffusers so air comes straight in one direction.

These diffusers introduce highly filtered air into a space – right above where critical work is happening. This air then expands out and pushes the contaminants away. A body's natural convection can also protect itself from unclean air, so it is a best practice for diffusers to have very low velocities that do not disrupt the wound's convective plume. Recent studies have shown that in some surgery types there is not a thermal plume generated at the wound site. In these instances delivering clean air at very low velocity is critical to minimising entrainment of contaminants since the natural defence does not always occur.

Design specifications for Hybrid ORs, call for diffusers to be located right over operating tables, and to satisfy ASHRAE Standard 170 the diffusers must cover at least one foot beyond the table and emit no more than 25-35 CFM/ FT2. ASHRAE Research Project 1397: EXPERIMENTAL INVESTIGATION OF HOSPITAL OPERATING ROOM (OR) AIR DISTRIBUTION results showed that the unidirectional airflow collapses in towards the table and accelerates into the operating room – as a result of buoyant and gravitational forces.

The amount of collapse and acceleration is affected greatly by the temperature difference between supply air temperature and room air temperature. Titus recommends that the diffuser array extend two to three feet. Doing so will allow for a smaller temperature difference, limiting the collapse and acceleration – so patients, nurses, surgeons and all surgical instrumentation are covered by the sterile field. This practice helps reduce costly Surgical Side Infections (SSIs), which make up about 30% of all Healthcare Acquired Infections (HAIs).

Patient Rooms

Like Hybrid ORs, patient rooms are critical spaces that require a high standard of air quality. Designers do not typically have major issues designing these rooms. However, when using chilled beams and displacement ventilation systems, intuitive designs can lead to airflow patterns that are less than ideal. This can be a concern as an inefficient airflow design fails to minimise the amount of potential particles and pathogens in the air being circulated or re-circulated through the room, translating to higher levels of airborne contaminants potentially leading to HAIs, and thereby raising costs. An EAD in these spaces means lower costs because patients recover more quickly and there is a higher turnover rate. Facilities also do not have to treat or retreat patients for something they acquired during their stay.

Use of chilled beams can be a useful means of developing an EAD within patient room spaces. The most intuitive design is to place a 2-way active beam near the patient bed with the throw – introduced into the room perpendicular to the patient's bed. This is typical for most active beam designs, placement over the occupant seeks to minimise air velocity and create a uniform temperature around the patient for thermal comfort. Recently, the result a CFD study (Comparative Analysis of Overhead Air Supply and Active Chilled Beam HVAC Systems for Patient Room) showed that placement of a 1-way beam over the head of patient could potentially create an airflow pattern that results a single pass system in regards to airborne particulate in the room. A single pass airflow pattern or reduced pass airflow patterns strive to minimise the airborne particulates in the space to reduce HAIs.

Displacement ventilation design also presents a challenge in some cases. The size and floor level installation of these diffusers can lead to their installation in corners – where they can be easily blocked by furniture or belongings, significantly reducing their efficacy. Placement of diffusers on the wall adjacent to the foot of the bed results in the most effective airflow pattern. Placing the exhaust above the patient's bed at a 15 degree angle away from the head of the bed and towards the foot will be most effective in removing aerosolized saliva containing potentially viable viruses and bacteria from the space. Additionally, it is critical to have the transfer grille to the toilet space

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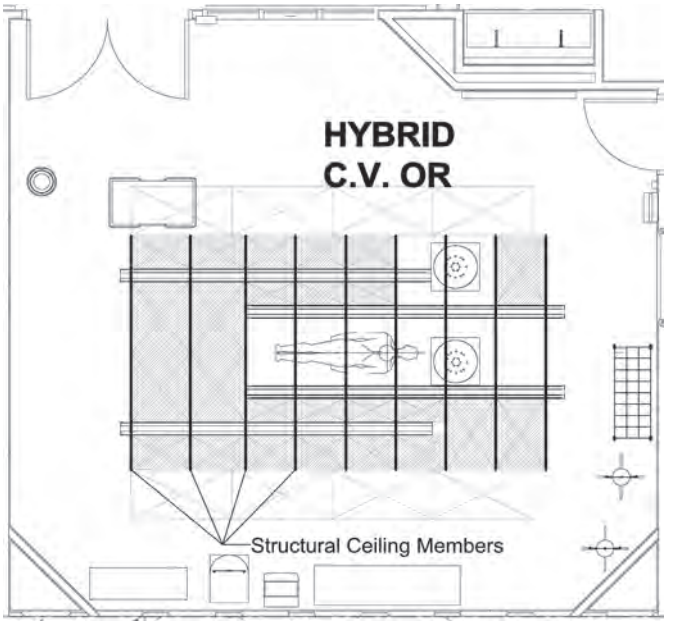

Fig. 5: Ceiling-mounted equipment is suspended from structural members that are incorporated into the monolithic ceiling or integrated ceiling system. The location and spacing of these members prevents use of standard sized diffusers offered by HVAC manufacturers, but early coordination with the HVAC equipment manufacturers allows custom sized unidirectional diffusers to be designed. Use of custom sized diffusers (shaded in Figure 5) shrinks the non-diffusers space within the array, minimizing the overall array size...

installed at least 6 feet above the finished floor to prevent short circuiting. Since the toilet room is to be negatively pressurised and has a high air change rate, a low level transfer grille could lead to the low velocity air discharged from the displacement ventilation unit being exhausted – from the patient room without addressing the load in the space. So, why are more facilities implementing displacement ventilation and chilled beams for projects? Both systems are very effective at getting air into spaces at the right temperature, exhausting and/or recirculating it without bringing contaminants back into the occupied space – the primary goals of EAD. In addition, displacement ventilation systems are extremely effective in removing pathogens from patient's bedside areas.

Isolation Rooms

There are some specialised types of patient rooms that rely heavily on EAD to achieve their individual goals. These are Airborne Infection Isolation (AII) Rooms and Protective Environment (PE) Rooms. PE is specifically designed to prevent patients with suppressed immune systems (i.e., chemotherapy patients, bone marrow or other organ transplant recipients, AIDS patients). All rooms are designed to minimise transmission of airborne infectious diseases from an infected patient to staff, visitors, and other patients.

To prevent infections in isolation rooms, ASHRAE Standard 170-2013 stipulates requirements to help achieve EAD. These requirements include room pressurisation, filtration, air change rate, and use specific diffuser type and their location. To prevent migration of particles into the isolation rooms a minimum requirement is – the room must maintain differential pressure +/-0.01 in wc to the adjacent spaces. However, ASHRAE Research Project 1344: Cleanroom Pressurization Strategy Update – Quantification and Validation of Minimum Pressure Differentials for Basic Configurations and Applications has shown that even when maintaining a pressurisation of +/-0.01 in wc – particles can migrate into the room as people enter and exit the rooms. To minimise transmission of particles into or out of isolation rooms, differential pressurisation of at least +/- 0.04 in wc or use of a anteroom is recommended. All air supplied to PE rooms must be HEPA filtered. To further develop air distribution to reduce the chance of Healthcare Acquired Infections (HAIs) use of non-aspirating, unidirectional diffusers are to be installed directly over the patient with exhausts/returns grilles located near the door the patient room. This is to create an airflow pattern within the space where the cleanest air possible flows over the patient first before moving into the rest of the room.

However, to achieve effective airflow design in PE room thermal comfort of the patient must also be considered. Patients are going to have very low clo (clothing) levels and met (metabolism) rates, so additional diffusers must be used to keep the volume and velocity of the air flow out of the non-aspirating diffusers to a comfortable level. Displacement ventilation would complement the non-aspirating diffusers best in this space – as it would not disrupt the airflow pattern that is to be developed by the non-aspirating diffuser. In all rooms, the goal is to prevent transmission of infections from the patient to staff, visitors, or other patients. As such, the location of the exhaust is to be directly over the patient's bed or in the wall at the head of the bed, and all air must be exhausted out of the building. To establish effective air distribution in all rooms, supply diffusers should be installed near the entrance to the room with throw patterns directed towards the patient.

Combination AII/PE isolation rooms are allowed by ASHRAE Standard 170-2013. Combined Isolation rooms must have an anteroom and must be pressurised to both the corridor and the isolation room itself. The differential pressure must be at least 0.01 in wc, and can be either positive or negative. In combined isolation rooms, air distribution must follow the same guidelines as PE rooms with diffusers located over the patient and exhaust by the anteroom door. And, as with the all rooms – all of the air must be directly exhausted out of the building.

Conclusion

Appropriate use of chilled beams, displacement ventilation and non-aspirating diffusers play a pivotal role in establishing Effective Airflow Design across many different critical and non-critical spaces.

Designing a system that utilises each piece in the best way possible not only creates an environment that is safer and more comfortable, but is also good for a facility's bottom line.

Lowering re-admission rates and reducing the number of Healthcare Acquired Infections are goals – for which all healthcare buildings should strive for; EAD helps make that happen. Be sure to consult a designer before embarking on your next project – to determine which layout makes the most sense for your spaces. ■

Written by: Matthew McLaurin, Product Manager, Titus HVAC

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Evolution And Transformation Of Refrigeration

The first practical vapour compression refrigeration system was built by James Harrison, a British journalist, who had immigrated to Australia. His 1856 patent was for a vapour compression system using ether, alcohol or ammonia....

Refrigeration is a process of moving heat from one location to another, and this has had a large impact on industry, lifestyle, agriculture and settlement patterns. The idea of preserving food dates back to the ancient Roman and Chinese empires. However, refrigeration technology has rapidly evolved in the last century, from ice harvesting to temperature-controlled rail cars.

The seasonal harvesting of snow and ice has been an ancient practice estimated to have begun earlier than 1000 B.C. It became a mass-market commodity by the early 1830's with the price of ice dropping from six cents per pound to a half of a cent per pound leading to artificial refrigeration.

It began when Scottish professor William Cullen designed a small refrigerating machine in 1755 using a pump to create a partial vacuum over a container of diethyl ether, which then boiled, absorbing heat from the surrounding air to create ice.

In 1758, Benjamin Franklin and John Hadley, professor of chemistry, collaborated on a project investigating the principle of evaporation as a means to rapidly cool an object. Their project confirmed that the evaporation of highly volatile liquids drives down the temperature of an object past the freezing point of water.

Then in 1820, the English scientist Michael Faraday liquefied ammonia and other gases by using high pressures and low temperatures, and in 1834, an American expatriate to Great Britain, Jacob Perkins, built the first working vapour-compression refrigeration system in the world. It was a closed-cycle that could operate continuously. His prototype system worked, although it did not succeed commercially.

The first practical vapour compression refrigeration system was built by James Harrison, a British journalist who had immigrated to Australia. His 1856 patent was for a vapour compression system using ether, alcohol or ammonia.

He built a mechanical ice-making machine in 1851 on the banks of the Barwon River at Rocky Point in Geelong, Victoria. His first commercial ice-making machine followed in 1854, followed by the first gas absorption refrigeration system using gaseous ammonia dissolved in water – referred to as 'aqua ammonia.'

This 'aqua ammonia' was developed by Ferdinand Carré of France in 1859. His new process made using gases such as ammonia, sulfur dioxide and methyl chloride as refrigerants possible, and they were widely used for that purpose until the late 1920s.

The new refrigerating technology first met with widespread industrial use as a means to freeze meat supplies for transport by sea from the British Dominions and other countries to the British Isles. The first to achieve this breakthrough was an entrepreneur who had immigrated to New Zealand.

William Soltau Davidson thought that Britain's rising population and meat demand could mitigate the slump in world wool markets that were heavily affecting New Zealand. After extensive research, he commissioned the Dunedin to be refitted with a compression refrigeration unit for meat shipment in 1881. On February 15, 1882, the Dunedin sailed for London with what was to be the first commercially successful refrigerated shipping voyage, and the foundation of the refrigerated meat industry.

By the 1890's, refrigeration played a vital role in the distribution of food. The meat-packing industry relied heavily on natural ice in the 1880's and continued to rely on manufactured ice as those technologies became available by 1900. By the middle of the 20th century, refrigeration units were designed for installation on trucks or lorries having a maximum payload of around 24,000 kg gross weight.

Although commercial refrigeration quickly progressed, it had limitations that prevented it from moving into the household. First, most refrigerators were far too large. Some of the commercial units being used in 1910 weighed between five and two hundred

By the middle of the 20th century, refrigeration units were designed for installation on trucks or lorries having a maximum payload of around 24,000 kg gross weight...

tons. Second, commercial refrigerators were expensive to produce, purchase, and maintain. Lastly, these refrigerators were unsafe. It was not uncommon for commercial refrigerators to catch fire, explode, or leak toxic gases. Refrigeration did not become a household technology until these three challenges were overcome.

So in 1930, Frigidaire, GE's main competitor, invented a Freon based synthetic chlorofluorocarbon (CFC) refrigerant – a chemical that led to the development of smaller, lighter, and cheaper refrigerators for home use without danger.

These CFC refrigerants answered that need. In the 1970's, though, the compounds were found to be reacting with atmospheric ozone, an important protection against solar ultraviolet radiation, and their use as a refrigerant worldwide was curtailed in the Montreal Protocol of 1987.

The introduction of refrigeration and evolution of additional technologies drastically changed agriculture's role in developed countries in the last century. It reduced humidity levels, avoided spoiling due to bacterial growth, and assisted in preservation.

A trip to the market before refrigeration would have been different from a trip today. In the late 20th Century and into the very early 21st Century, other than staple foods, diet was dependent heavily on the seasons and what could be grown relatively close. These are no longer restrictions or limitations.

Probably the most widely used current applications of refrigeration are for air conditioning of private homes and public buildings, and refrigerating foodstuffs in homes, restaurants and large storage warehouses. The use of refrigerators in kitchens for storing fruits and vegetables has allowed adding fresh salads to the modern diet year round, and storing fish and meats safely for long periods.

In commerce and manufacturing, there are many uses for refrigeration to liquify gases such as oxygen, nitrogen, propane and methane. For compressed air purification, it is used to condense water vapour from compressed air to reduce its moisture content.

In oil refineries, chemical plants, and petrochemical plants, refrigeration is used to maintain certain processes at their needed low temperatures, like in alkylation of butenes and butane to produce a high octane gasoline component.

Metal workers use refrigeration to temper steel and cutlery. In transportation of temperature-sensitive foodstuffs and other materials by trucks, trains, airplanes and seagoing vessels, refrigeration is a necessity.

All mthods of refrigeration can be classified as non-cyclic, cyclic, thermoelectric and magnetic.

A refrigeration cycle describes the changes that take place in the refrigerant as it alternately absorbs and rejects heat while circulating through a refrigerator.

It is also applied to heating, ventilation, and air conditioning work, when describing the 'process' of refrigerant flow through an HVAC&R unit – whether it is a packaged or split system.

Vapour absorption cycle

In the early years of the twentieth century, the vapour absorption cycle using water-ammonia systems was popular and widely used.

After the development of the vapour compression cycle, the vapour absorption cycle lost much of its importance because of its low co-efficient of performance – about one fifth of that of the vapour compression cycle.

Today, the vapour absorption cycle is used mainly where fuel for heating is available but electricity is not, such as in recreational vehicles that carry LP gas. It is also used in industrial environments where plentiful waste heat overcomes its inefficiency.

The absorption cycle is similar to the compression cycle, except for the method of raising the pressure of the refrigerant vapour. In the absorption system, the compressor is replaced by an absorber which dissolves the refrigerant in a suitable liquid.

A liquid pump which raises the pressure and a generator which, on heat addition, drives off the refrigerant vapour from the

high-pressure liquid are also parts of this system. Some work is needed by the liquid pump but, for a given quantity of refrigerant, it is much smaller than the amount needed by the compressor in the vapour compression cycle. In an absorption refrigerator, a suitable combination of refrigerant and absorbent is used. The most common combinations are ammonia (refrigerant) with water (absorbent), and water (refrigerant) with lithium bromide (absorbent).

When the working fluid is a gas that is compressed and expanded but doesn't change phase, the refrigeration cycle is called a gas cycle.

Air is most often this working fluid. As there is no condensation and evaporation intended in a gas cycle, components corresponding to the condenser and evaporator in a vapour compression cycle are the hot and cold gas-to-gas heat exchangers in gas cycles.

Gas cycle

The gas cycle is less efficient than the vapour compression cycle because the gas cycle works on the reverse Brayton cycle instead of the reverse Rankine cycle.

As such, the working fluid does not receive and reject heat at constant temperature. In the gas cycle, the refrigeration effect is equal to the product of the specific heat of the gas and the rise in temperature of the gas in the low temperature side. Therefore, for the same cooling load, a gas refrigeration cycle needs a large mass flow rate and is bulky.

Because of their lower efficiency and larger bulk, air cycle coolers are not often used nowadays in terrestrial cooling devices. However, the air cycle machine is very common on gas turbine-powered jet aircrafts as cooling and ventilation units. This is because compressed air is readily available from the engines' compressor sections. Such units also serve the purpose of pressurising the aircraft.

Thermoelectric refrigeration

Thermoelectric cooling uses the Peltier effect to create a heat flux between the junctions of two different types of materials.

This effect is commonly used in camping and portable coolers, and for cooling electronic components and small instruments.

Magnetic refrigeration

Magnetic refrigeration, or adiabatic demagnetisation, is a cooling technology based on the magneto-caloric effect – an intrinsic property of magnetic solids.

The refrigerant is often a paramagnetic salt, such as cerium magnesium nitrate. The active magnetic dipoles in this case are those of the electron shells of the paramagnetic atoms.

A strong magnetic field is applied to the refrigerant, forcing its various magnetic dipoles to align, and putting these degrees of freedom of the refrigerant into a state of lowered entropy.

A heat sink then absorbs the heat released by the refrigerant due to its loss of entropy. Thermal contact with the heat sink is then broken so that the system is insulated, and the magnetic field is switched off. This increases the heat capacity of the refrigerant, thus decreasing its temperature below the temperature of the heat sink.

Because few materials exhibit the needed properties at room temperature, applications have so far been limited to cryogenics and research.

Other methods of refrigeration include the air cycle machine used in aircraft; the vortex tube used for spot cooling, when compressed air is available; thermo-acoustic refrigeration using sound waves in a pressurised gas to drive heat transfer and heat exchange; steam jet cooling (popular in the early 1930s) for air conditioning large buildings; thermo-elastic cooling using a smart metal alloy stretching and relaxing.

Many Stirling cycle heat engines can be run backwards to act as a refrigerator, and therefore these engines have a niche use in cryogenics. In addition, there are other types of Cryo-coolers such as Gifford-McMahon coolers, Joule-Thomson coolers, Pulse-tube refrigerators and, for temperatures between 2 mK and 500 mK, dilution refrigerators.

Fridge Gate method

The Fridge Gate method is a theoretical application of using a single logic gate to drive a refrigerator in the most energy efficient way possible, without violating the laws of thermodynamics. It operates on the fact that there are two energy states in which a particle can exist: the ground state and the excited state. The excited state carries a little more energy than the ground state, small enough so that the transition occurs with high probability. There are three components or particle types associated with the fridge gate. The first is on the interior of the fridge, the second on the outside and the third is connected to a power supply which heats up so often that it can reach the excited state and replenish the source.

In the cooling step on the inside of the fridge, the ground state particle absorbs energy from ambient particles, cooling them, and itself jumping to the excited state. In the second step, on the outside of the fridge where the particles are also at an excited state, the particle falls to the ground state – releasing energy and heating the outside particles. In the third and final step, the power supply moves a particle at the excited state, and when it falls to the ground state it induces an energy-neutral swap where the interior excited particle is replaced by a new ground particle, restarting the cycle.

A refrigeration system's coefficient of performance is very important in determining a system's overall efficiency. It is defined as refrigeration capacity in kW divided by the energy input in kW. While CoP is a very simple measure of performance, it is typically not used for industrial refrigeration. Owners and manufacturers of these systems typically use performance factor. A system's PF is defined as a system's energy input in horsepower divided by its refrigeration capacity in TR. Both CoP and PF can be applied to either the entire system or to system components. For example, an individual compressor can be rated by comparing the energy needed to run the compressor versus the expected refrigeration capacity based on inlet volume flow rate.

It is important to note that both CoP and PF for a refrigeration system are only defined at specific operating conditions, including temperatures and thermal loads. Moving away from the specified operating conditions can dramatically change a system's performance. ■

Norman Dsouza
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Selection Of Suitable Refrigerant Pair For Cascade System

Synthetic refrigerants are being phased out worldwide to combat the twin menace of the ozone layer depletion and global warming. Attainment of holistic environmental safety is the call of the day...

A brief selection procedure of suitable refrigerant pairs in cascade refrigeration system along with selection charts based on various performance criteria are presented, which will be very useful for any design engineer to select suitable natural refrigerant pair.

Cascade Refrigeration System

Many industrial and medical applications require ultra-low-temperature cooling, which cannot be achieved effectively by single-stage or multistage systems due to individual limitations of the refrigerant, hence, a cascade system is the best alternative in these situations. Suitable selection of refrigerants used in high-temperature (HT) and low-temperature (LT) cycles – can provide the required low temperature while attaining good system efficiency. For cascade systems, the lower temperature limit of the HT side is termed as the intermediate temperature (IT); the system performance depends upon IT and hence, it needs to be optimised to obtain maximum performance. A schematic diagram of a two-stage cascade refrigeration system is illustrated in Figure 1.

The HT and LT circuits are thermally connected to each other through a cascade-condenser, which acts as an evaporator for the HT cycle and a condenser for the LT cycle. In practice, there is a certain overlap between IT and condenser temperature of LT circuit and the difference between these two temperatures is called the Overlapping Temperature (OT).

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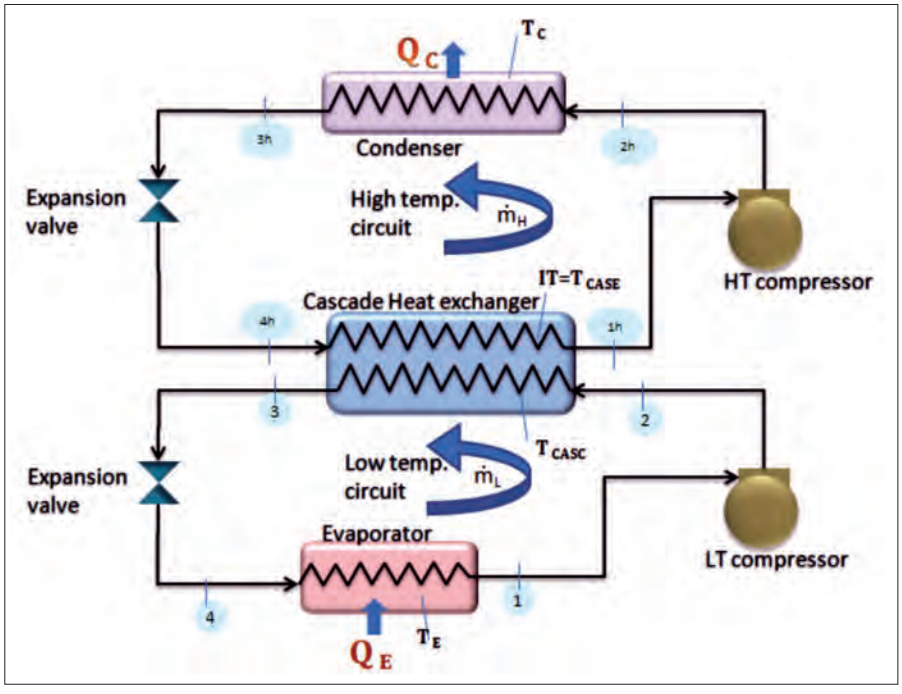

Fig. 1: Schematic of a two-stage cascade refrigeration system...

holistic environmental safety is the call of the day, and this has facilitated the recent emergence of natural refrigerants as the more benign working fluid in refrigeration and heating systems. Several natural refrigerants are regaining their importance and are on a path of revival.

Hence, the cascaded systems based on natural refrigerants are offering good potential for research in these circumstances for HT lift. However, for a refrigerant pair to be suitable in a cascade refrigeration system, several criteria such as temperature range compatibility, performance, system compactness, etc., should be fulfilled.

Basic Properties of Refrigerants

Selection of suitable refrigerant mainly depends on its thermodynamic properties, physical properties and chemical properties. The refrigerant that satisfies all the desirable thermodynamic properties, physical properties and chemical properties can be called as ideal.

However, different refrigerants seem to satisfy different requirements and sometimes only partially. A refrigerant which is ideally suited in a particular application may be a complete failure in the other.

Hence, the refrigerant has to be selected for a certain application in such a way that the most of the basic properties should be favourable for that application. Required properties of the ideal refrigerant can be summarised as:

- The refrigerant should have low boiling point and low freezing point
- It must have low liquid specific heat, high vapour specific heat and high latent heat. This is because high specific heat decreases the specific refrigerating effect and high latent heat at low temperature increases the specific refrigerating effect
- The pressures required to be maintained in the evaporator and condenser should be low enough to reduce the material cost and must be positive to avoid leakage of air into the system
- It must have high critical pressure and temperature to avoid large power requirements
- It should have low specific volume to reduce the size of the compressor
- It must have high thermal conductivity to reduce the area of heat transfer in evaporator and condenser
- It should be non-flammable, non-explosive, non-toxic and non-corrosive
- It should not have any bad effects on the stored material or food, when any leak develops in the system
- It must have high miscibility with lubricating oil and it should not have reacting property with lubricating oil in the temperature range of the system

Due to severe global concern about ozone layer depletion and global warming, the environmental property plays a major role in refrigerant selection...

- It should give high COP in the working temperature range. This is necessary to reduce the running cost of the system
- It must be readily available and cheap.

Environmental Properties of Refrigerants

Due to severe global concern about ozone layer depletion and global warming, the environmental property plays a major role in refrigerant selection. Refrigeration and air conditioning system influences the environment in three aspects: (i) Ozone layer depletion, (ii) Global warming (natural disasters around the world have shown the negative effects of greenhouse gases including various refrigerants) and (iii) pollution due to production of consumed power (harmful to the health of people).

Today, we are again amidst a historical technological shift and this time the need to preserve our global environment is the main driving force. The Montreal Protocol (1987) was the first international agreement to set up a schedule for reduction and phase-out of the production and consumption of ozone depleting substances. The other important international scheme is the Kyoto Agreement, which 10 years later was established to reduce emissions of global warming gases.

Ozone layer depletion

The ozone layer absorbs most of the harmful ultraviolet-B radiation from the sun. It also completely screens out lethal UV-C radiation. Depletion of the ozone layer allows more harmful radiation to reach the earth, resulting in more melanoma and non-melanoma skin cancers, more eye cataracts, weakened immune systems, reduced plant yields, damage to ocean eco-systems and reduced fishing yields, adverse effects on animals and more damage to building materials and plastics.

The ozone hole and ozone depletion result from CFCs, HCFCs, Halons, methyl bromide and other ODS released to the atmosphere. The Ozone Depletion Potential (ODP) reflects

the combination of percentage (by weight) of chlorine atoms and the lifetime of the compound in the atmosphere.

Global warming potential

Greenhouse gases have the potential to increase the earth's average temperature by trapping some of the heat that the earth normally radiates back into space. CO_2, methane, nitrous oxide are the three main greenhouse gases. Fluorinated compounds such as HFCs, PFCs and SF_6 are also greenhouse gases. GWPs (Global Warming Potential) are used to compare the impact on the climate system of emission of different greenhouse gases with respect to carbon dioxide (normalized at 1).

As greenhouse gases differ in their atmospheric lifetimes, GWPs also have a time component. Time horizons of 20 years and 100 years are used in this document to enable the proper evaluation on the environment. The economic and environmental effects considered were refrigerant supply cost, direct Global Warming Impact (GWI), and Total Equivalent Warming Impact (TEWI).

Direct Global Warming Impact (GWI) is the direct effect of released refrigerant emission in equivalent tonnes of carbon dioxide. The GWI is an annual figure obtained by multiplying annual emissions by the reported Global Warming Potential (GWP) of the species. Total equivalent warming impact per annum (TEWI) is the sum of the GWI and the carbon dioxide emitted in the production of energy to run the system (TEWI = direct + indirect emission). Research on TEWI (Total Equivalent Warming Impact) has shown that for most applications the impact on global warming will be greater from energy consumption than from CO_2 equivalent emission (release) of refrigerants.

According to the humanities point of view, the NYAY (Justice) is the use of such technology (here, refrigerant and it system), which is not only human friendly, but also environment or biosphere friendly. It has been shown that all the natural refrigerants (naturally occurring substances) have negligible negative effect on the environment or biosphere. Furthermore, there is no need of production of natural refrigerants, and hence no production related pollution or negative effect. Hence, natural refrigerants can be assumed as next generation refrigerant for cooling and heating applications.

Key Performance and Design Parameters

Coefficient of performance (COP)

COP is generally taken as a main performance parameter in refrigerant selection for any refrigeration and heat pump applications, and hence, obviously for cascade refrigeration system also. Main reason behind that, the higher COP yields lower running cost for certain cooling or heating load. COP is also considered as thermodynamic property of refrigerant as it is mainly dependent on basic refrigerant properties. For cascade refrigeration system, COP is calculated as the ratio of cooling capacity/load and the total/overall electrical energy input through all compressors. Hence, the maximum COP is an essential criterion of refrigerant pair selection for cascade refrigeration system.

Volumetric cooling capacity

The volume of suction vapour required per unit of refrigeration is an indication of the size of compressor. Alternatively, refrigeration capacity per unit volume of suction vapour may be used to estimate how large is the compressor required for same refrigeration capacity

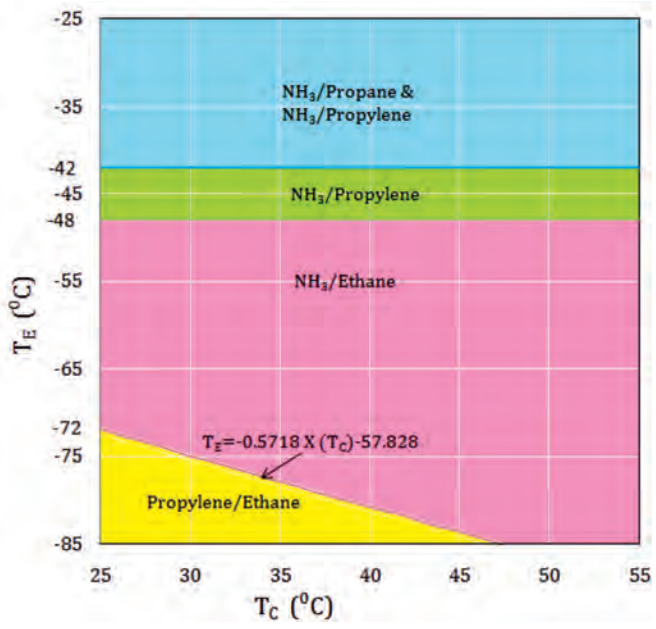

Fig. 2: Chart for best refrigerant pair selection based on maximum COP...

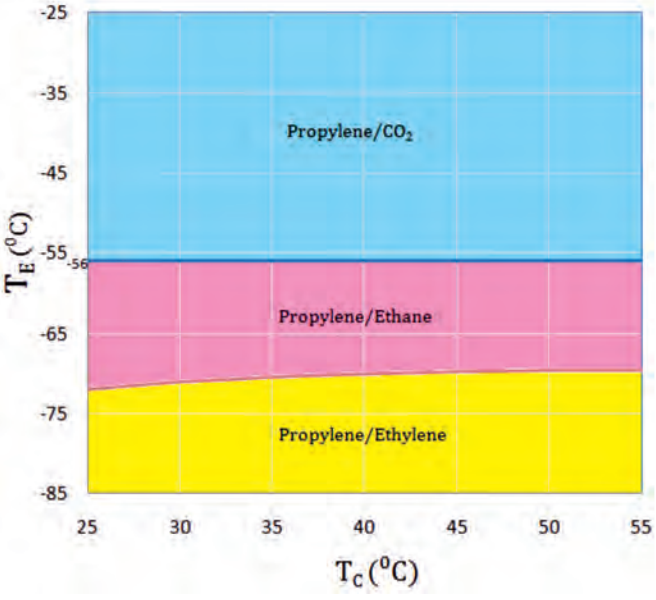

Fig. 3: Chart for best refrigerant pair selection based on maximum volumetric capacity...

for different refrigerants. Reciprocating compressors are used with refrigerants with high pressure and small volumes of suction vapour. Centrifugal or turbo compressors are used with refrigerants with low pressures and large volumes of suction vapour. For a single stage vapour compression cycle, refrigeration capacity per unit volume of suction vapour can be used to estimate the size of compressor and a comparison can be made between various refrigerants.

However, for a cascade system, there are two compressors one in HT circuit and another in LT circuit. Size of a compressor is directly related to its initial manufacturing cost and upto some extend to the running cost (for a reciprocating compressor there will be higher frictional losses for a large sized compressor and more power is required to run it as compared to a small sized compressor). So

compressor size should be as small as possible for unit refrigeration capacity. In view of increasing demand of cooling density (cooling capacity per unit volume), it is now an important criteria.

Heat exchanger size

For design and selection, minimisation of initial/installation cost is equally important as running cost. Installation cost is mainly dependent on size of major components (if we assume that similar materials are applicable for all working fluids), specifically, here, compressors, condensers, evaporators and cascade heat exchangers. Volumetric cooling capacity is related to compressor's size. Combined volumetric refrigeration capacity has been introduced by the author and his group for cascade system, which is the ratio of cooling capacity and combined suction volume flow rate of all compressors.

For a certain cooling load, heat exchanger size is dependent of types, which is dependent on system application as well as heat transfer load. Based on operating condition, heat exchanger configuration and refrigerant properties, the sizes of condenser, evaporator and cascade heat exchanger can be evaluated for certain refrigerant pair. Hence, the sizes of heat exchanger have been also considered as important criteria for refrigerant pair selection.

Refrigerant Pair Selection Guidelines

The refrigerant pair selection procedure involves the following two major steps:

- Screening of refrigerants based on environmental and safety considerations. Sorting of refrigerant pairs based on its operating temperatures, which should be in-between its normal boiling point temperature and critical temperature.
- Optimisation of intermediate temperature leading to maximum cooling COP and final selection of refrigerant pair based on best system performance along with best volumetric cooling capacity.

Case Studies: Natural Refrigerant Pair

The natural refrigerants which have been considered here are: Ammonia, Carbon dioxide, Propane, Propylene, n-Butane, Isobutane, Ethane & Ethylene. Out of these 8 natural refrigerants, there is possibility of using each refrigerant as HT fluid or LT fluid, thus giving rise to 56 possible combinations of HT fluid and LT fluid.

However, few pairs have sorted in initial screening and final screening has been made based on maximum COP and maximum volumetric cooling capacity. All the selections have been made based on an optimum intermediate temperature for an individual pair. Two selection charts for given Evaporator Temperature (TE) and Condenser Temperature (TC) have been developed, one for the highest COP (Figure 2) and another for the highest volumetric capacity (Figure 3). ■

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Solar-Assisted Cooling And Air-Conditioning

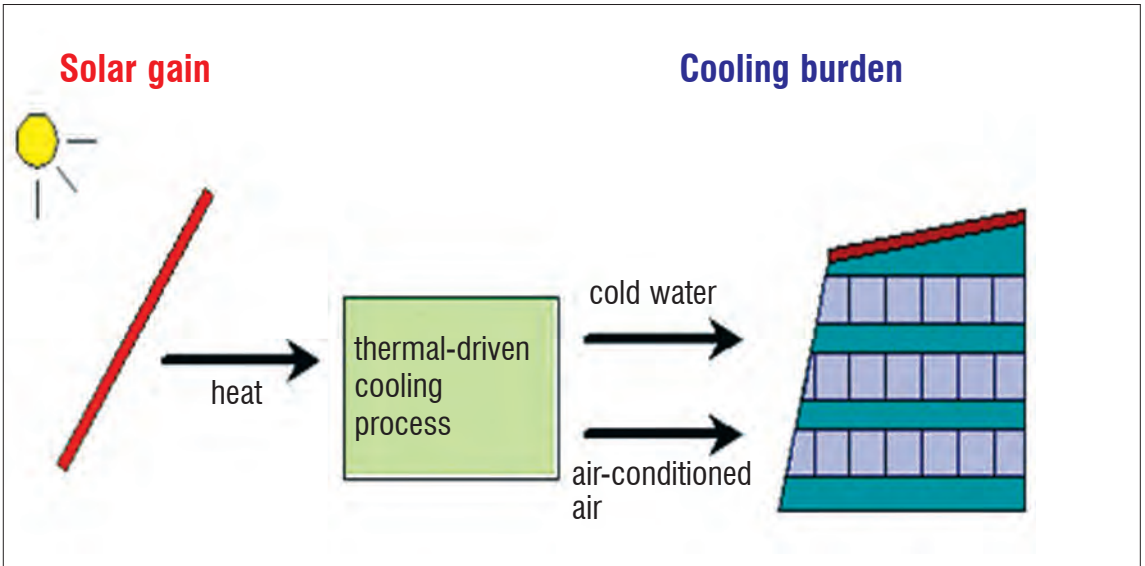
Normal cooling systems use chlorofluorocarbon chemicals that destroy the ozone layer and contribute to greenhouse gases. Maintaining food in places where high temperatures prevail, using little energy at a low cost, is now possible with solar cooling technology...

Solar energy can be used to heat, dry and/or cook things, and to generate steam power, but solar cool technologies harvest the sun's heat to accomplish just the opposite i.e., cooling. Since the changing lifestyle is full of comfort, sunny summer days are beautiful when we have access to cooling; if that cooling comes from the heat of the sun converted directly or indirectly into cooling, then it is like killing two birds with one stone. Sun's heat can be converted into electricity using photovoltaic cells, and this energy can supplement production of cooling or sun's heat can be directly used to generate cooling effects with solar refrigeration techniques based on thermoelectric adsorption or absorption. Solar cooling technologies specialize in developing portable power and refrigeration systems that run off of clean and renewable energy solar energy.

Scientists, engineers and industries are constantly modifying and improving these technologies to bring to the consumers the high quality, reliable and environmentally friendly products they (consumers) need. Recognising and harnessing the 'free' solar energy that surrounds us every day, they promise to provide customers with quality and environmentally-friendly products that power their everyday needs of cooling. This article presents some innovations in the use of solar heat producing cooling directly or indirectly and becoming popular among masses.

Solar Cooler

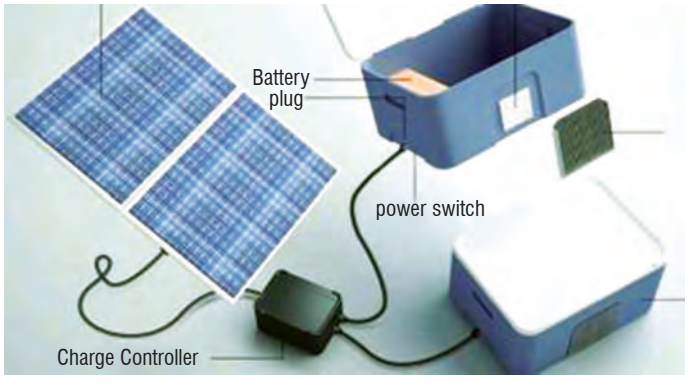
The Solar Cooler is the world's first portable, solar-powered refrigeration cooler. Plugging into the sun can keep food and drinks cool. Not only does the Solar-Cooler provide the convenience of off-grid power and refrigeration, one also has the ability to reduce carbon footprint and to join the



Solar Cooler...

movement toward a greener, cleaner and healthier tomorrow. The Solar Cooler keeps its contents cold using a compact refrigeration system connected to solar panels. According to the designers, the Solar Cooler can hold a steady 42°F (5.5°C) for over 24 hours, depending on how often the lid is opened, but can also go as low as 14°F (-10°C) if needed. The temperature is set precisely using a digital display on the side. Users can also get more power by attaching additional solar panels or pre-charging the batteries through an electrical outlet before going out. The cooler itself measures 16 x 14 x 17 in (41 x 36 x 43 cm) and weighs 55 lb (25 kg). Even with the refrigeration system, this still leaves an interior volume of 40 L (10.5 gal), or enough for 60 12 oz (355 ml) soda cans. And naturally, since it doesn't require ice or cooling packs, that entire space can be completely filled with cold food and drinks. The cooler comes with handles so it's easier to carry, and the whole case features a rugged design – so it can survive numerous trips and parties unscathed. Some models also sport an optional pair of beach wheels that can traverse sandy terrain during a trip to the ocean. As an added bonus, both USB and 12 V outlets are located on the side, which can be used to charge a mobile phone or plug in a blender. The inside lid even contains a small light, so to find what is needed in the dark. The Solar Cooler goes wherever you do with no need to stop for ice – just pack up and go. Plug right in and let the sun provide a little juice; each cooler offsets five thousand pounds of CO_2.

It may look like a simple concept, but getting the right balance of size and power management required some thorough research and testing. The Solar Cooler incorporates some advanced circuitry to collect solar energy from the photovoltaic cells on the lid, store it in the internal batteries, and then distribute it to the refrigeration system – all while taking up a relatively small amount of space. Keeping food and drinks chilled with solar power is handy enough on its own, but the developers have bigger plans for the solar cooler's technology.



Days that have the greatest need for cooling are also the very same days that offer the maximum possible solar energy gain...

If the current recreational version is successful enough, the company plans to manufacture a similar cooler specifically for vaccines. Naturally, a rugged, solar-powered cooler would help preserve any medicine traveling to remote areas of the world. Unfortunately, all that advanced technology may come with quite a hefty price tag. Even with the added convenience and eco-friendliness though, many people may balk at paying over ten times as much as a similar-sized cooler filled with ice. If all goes as planned however, the first batch of solar coolers are expected soon.

Solar Air Conditioning

A hot day can be altogether stressful because productivity can suffer under such conditions. Therefore, more and more buildings are being fitted with air-conditioning systems. This is where solar air conditioning comes in: the summer sun- which heats up offices- can also deliver the energy to cool them. Days that have the greatest need for cooling are also the very same days that offer the maximum possible solar energy gain. The demand for air conditioning in offices, hotels, laboratories or public buildings such as museums is considerable. Under adequate conditions, solar and solar-assisted air conditioning systems can be reasonable alternatives to conventional air conditioning systems. Such systems have advantages over those that use problematic coolants (CFCs), not to mention the incidental CO_2 emissions that are taking on increasingly critical values. Should buildings be cooled with the help of solar energy, then water-assisted air conditioning systems or ventilation systems can be powered with heat that is made available by solar collectors. No long-term intermediate storage is necessary in months of high solar energy gain or in southern lands. The sun can, at least seasonally at our latitudes, provide a substantial part of the energy needed for air conditioning. Combination

water-assisted systems and ventilation systems are also possibilities.

The basic principle behind (solar-) thermal driven cooling is the thermo-chemical process of adsorption or absorption: a liquid or gaseous substance is either attached to a solid, porous material (adsorption) or is taken in by a liquid or solid material (absorption). The sorbent (i.e. silica gel, a substance with a large inner surface area) is provided with heat (i.e. from a solar heater) and is de-humidified. After this 'drying', or desorption, the process can be repeated in the opposite direction. When providing water vapour or steam, it is stored in the porous storage medium (adsorption) and simultaneously, heat is released. Processes are differentiated between closed refrigerant circulation systems (for producing cold water) and open systems according to the way in which the process is carried out. That is, whether or not the refrigerant comes into contact with the atmosphere. The latter is used for dehumidification and evaporative cooling. Both processes can further be classified according to either liquid or solid sorbents. In addition to the available refrigerating capacity, the relationship between drive heat and realised cold energy (coefficient of performance; CoP) is also an essential performance figure of such systems.

Absorption refrigeration: Closed absorption refrigeration machines with liquid sorbent (water-lithium bromide) are most often operated in combination with heat and power generation (cogeneration) (i.e., with block unit heating power plants, district heating), but can also be assisted by vacuum tube solar collectors (operating temperature above 80°C). With a single-step process, the CoP is 0.6-0.75, or up to 1.2 for a two-step process.

Adsorption refrigeration: Closed processes with solid sorbents work with so-called adsorption refrigeration machines (operating temperatures 60° - 95°; COP = 0.3 - 0.7). Solar energy can easily be used in the form of vacuum tube or flat plate collectors. The refrigerating machine is composed of two adsorbers, one an evaporator and the other a condenser. An adsorber chamber takes up the water vapour, which is transformed into the gas phase under low pressure and low temperatures (about 9°C) within the evaporator. Granulated silicate gel, well known as an environmentally friendly drying agent, then accumulates it (adsorbs the water vapour). In the other sorption chamber, the water vapour is set free again (the chamber is regenerated or 'charged') by the hot water from the solar collector (about 85°C). The pressure increases and at the temperature of the surroundings (30°C) the water vapour can be transformed once again into a fluid within a cooling tower (condensed). The water is led back into the evaporator through a butterfly valve and the cycle begins from the beginning. Both the condensed water (low temperature) and the sorption heat (high temperature) are discharged.

In principle, sorption-assisted air conditioning systems can be operated everywhere an air conditioner is wanted...

Sorption refrigeration: Although the process of sorption-assisted air conditioning has been known for a long time, it has only been used for about 15 years. In principle, sorption-assisted air conditioning systems can be operated everywhere an air conditioner is wanted, for example in ventilation control centers. Their economical operation is then possible, if cost-effective heat energy is available, i.e., from co-generation plants, rather than from over loaded district heating systems. Solar thermal systems are new heat systems that offer much promise. Open sorption-assisted air conditioning systems are fresh air systems that dry the outside air through sorption, pre-cool it with a heat reclamation rotor, and finally cool it to room temperature through evaporation-humidification. At present, systems with rotating sorption wheels (sorption rotors) are mostly in use. The sorption wheel has small air channels that create a very large surface contact area, which has been treated with a material that easily takes up moisture, such as silica gel. The inflow air is dehumidified in one of the two sectors of the rotor and heated through the adsorption process (the exhaust air serves to dry the rotor). Finally, the inflowing air is cooled down in a heat reclamation rotor. The heat transfer here is made possible through the contact between the air and the rotor material. The last step in cooling the inflowing air is with conventional evaporation humidification.

Cost Effectiveness

A number of systems that use thermal solar energy to air condition buildings, and that can be technically and economically assessed, have been installed all over the world – but there are still a number of obstacles to be overcome when it comes to the general implementation of solar-assisted air conditioning. Pilot and demonstration programmes are still necessary – so that cost reductions become possible, and so that relevant energy savings can be assured. Standardised programmes, matured concepts and the development of components are starting points that can contribute to improved cost effectiveness and wide applicability of solar-assisted air conditioning. Because solar cooling is based on thermally driven processes instead of the normal electrical cold production, the costs for the used heat plays a central role: a fundamental problem arises from the inherently higher costs of solar heat compared to heat energy produced by fossil fuel systems or waste heat. Their use becomes interesting, if favourable requirements for a high output of solar heat is present, and if the system also delivers energy for heating. The cost of electricity could also pose an argument for solar cooling: The thermally powered cooling process requires only a fourth (absorption/adsorption) or half (sorption-assisted air conditioning) of the electrical power required by the conventional reference system.

Conclusion

Normal cooling systems use chlorofluorocarbon chemicals that destroy the ozone layer and contribute to greenhouse gases. Maintaining food in places where high temperatures prevail, using little energy at a low cost, is now possible with solar cooling technology. The design is inexpensive, easy to manufacture and environmentally beneficial. ■

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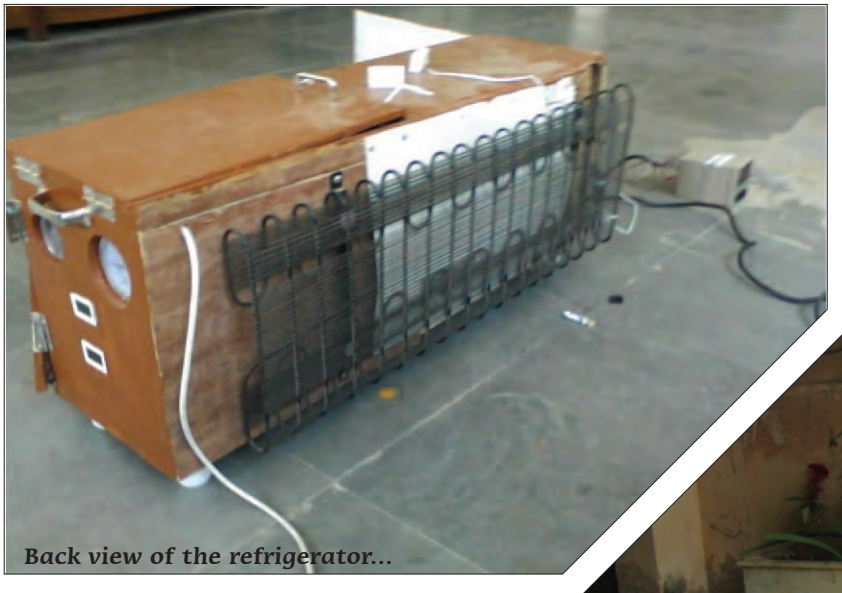
Solar Refrigeration
A Success Model

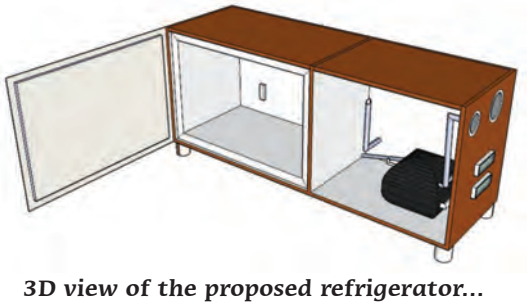
Energetic and Exergetic techniques help in evaluating the performance of the SPV refrigerator with a view to getting better information about useful work and lost work, and design some remedial techniques in future to overcome on these losses...

In current situations, energy demand is increasing with the increase in the population and improvement in the living standard. Energy is the crucial input to the social, economical, industrial and technological development of any country. A rational use of energy brings both economic and environmental benefits by reducing consumption of fossil fuels, electricity and pollutant emissions. The International Institute of Refrigeration in Paris (IIF/IIR) has estimated that approximately 15% of all the electricity produced in the whole world is employed for refrigeration and air-conditioning processes. In a tropical country, like India, refrigeration is most widely used and generally, the most energy consuming process. In general, refrigeration is defined as any process of heat removal from a place for preserving foods and medicines by enhancing their shelf life. Immunization through vaccine prevents illness, disability and death from preventable diseases like diphtheria, measles, pertussis, pneumonia, polio, rotavirus diarrhoea, rubella and tetanus. Immunization currently averts an estimated 2 to 3 million



Back view of the refrigerator...

Installed photovoltaic system used for the experiment...



3D view of the proposed refrigerator...

Front view of the refrigerator...

deaths every year, but an estimated 22 million people from remote area of developing country worldwide are still missing out their routine vaccination programs due to the lack in availability of the safe vaccine. According to WHO guidelines, vaccine should be kept in the temperature range of 0-8^{o}C.

For the storage of life saving drugs or vaccines in the innumerable area of the developing country – where the power supply is still irregular, renewable energy has to be a central part of energy solution. Out of the various renewable sources of energy, solar energy proves to be the best candidate for cooling – because of the coincidence of the maximum cooling load with the period of greatest solar radiation input. Cooling from solar energy has great potential for lower running costs, greater reliability and a longer working life than other conventional cooling systems, whereas it may also contribute in the reduction of global warming.

Hwang and Redermacher (2011), Kim and Ferreira (2008) broadly classified different technologies that are available to use solar energy for refrigeration. The review covers solar electric cooling, solar thermal cooling and solar combined power cooling. A comparison between these different technologies is also described with individual COP value. M.M. Salah (2006) briefly discussed on application of solar power for producing refrigeration effect.

Possible solar power refrigeration system as discussed are - absorption cycle, adsorption cycle, desiccant cycle, ejector cycle, solar mechanical and solar PV operated refrigeration system. Cooling systems based on solar thermal technologies are having less thermodynamic efficiency as compare to vapour compression refrigeration system because it is very difficult to keep the solar thermal system operating at steady condition throughout the day. Solar thermal based cooling systems are commercially available but mostly have the capacity of more than 20TR because a solar collector can't scale down in size. Further because of the small capacity of cooling system, solar photovoltaic vapour compression refrigeration system is deemed to be the most viable route.

Therefore, an attempt has been made in designing and develop solar vapour compression refrigeration systems at the Department of Renewable Energy Engineering, Udaipur. The principle objective of this article is to describe the result of thermodynamic tests conducted on the developed solar vapour compression refrigeration system.

System Description:

The solar photovoltaic based refrigeration system was designed, developed and evaluated by Department of Renewable Energy Engineering, Udaipur under 'no load' and 'full load' conditions. A PV panel consisting of three modules (125 Watt peak each) connected in series was used to obtain the desired voltage and current, respectively. Three 12 V, 7 Ah sealed lead acid battery were used to supply the power at starting time and ensure for the smooth operation. The refrigerator operates on an alternative current based compressor, a compressor used in the common domestic refrigerators. Technical specifications of the solar refrigerator and Balance Of System (BOS) for the power supply are given in Table 1 and Table 2.

System Performance:

Coefficient of performance: The coefficient of performance is an index of performance of a thermodynamic cycle or a refrigeration system. COP is used instead of thermal efficiency. For the vapour compression refrigeration cycle, COP is defined as the amount of cooling produced per unit work supplied on the refrigerant. For a reversible or Carnot refrigeration cycle it is expressed as:

Solar is the best energy for cooling owing to the coincidence of the maximum load with the time of the greatest solar radiation input...

S.N.	Parameters	Specification
1	Storage capacity	20 litres
2	Door	Front opening
3	Type of refrigeration	Vapour compression refrigeration system
4	Compressor	
i	Make	Godrej 90
ii	Power consumption	90W
iii	Refrigerant	R134a
iv	Operating voltage	230V AC
5	Maximum and Minimum internal temperature	-4^{o}C to +4^{o}C
6	Thermostat	3 settings
7	Cut in temperature	9^{o}C
8	Cut out temperature	2^{o}C
9	Insulation	PUF, 2.5 cm thick
	Dimension	37×19×20 cm^3
	Weight	21.2 kg

Table 1: Technical Specification of Solar refrigerator...

S.N.	Parameters	Specification
1	Number of panels	3
2	Make	REIL, Jaipur
3	Max. power output	125Wp
4	Size of the array (L×B)	1.67×3 meter
5	Battery bank	
i	Make	Rocket ES7-12
ii	No. of battery	3
iii	Rated voltage	12V DC
iv	Rating	7Ah
v	Type of the battery	Sealed lead acid
6	Inverter cum charge controller	
i	Make	Radetron UPS
ii	Rated capacity	1KVA
iii	Input voltage	36V

Table 2: Technical Specification of the components for the power supply...

$$COP_{carnot} = \frac{T_e}{T_o - T_e}$$

T_e = Evaporator temperature (°C)

T_O = Ambient/room temperature (°C)

But all the real processes are irreversible process. The actual COP of the refrigeration system was calculated with the help of pressure enthalpy curve produced by Hansen and Artu (Rathore et al). The COP can be evaluated by using the formula-

$$C.O.P = \frac{Refrigeration\ effect}{Input\ compressor\ work}$$

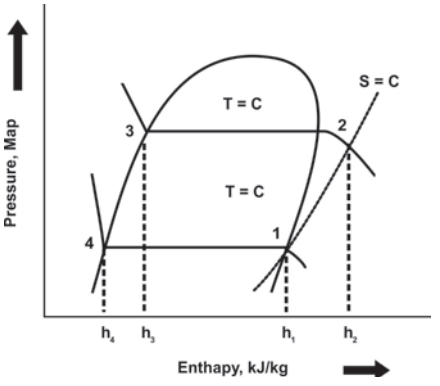


Fig. 1: Pressure enthalpy diagram of operating system...

$$C.O.P = \frac{h_1 - h_4}{h_2 - h_1}$$

Photovoltaic Efficiency:

The efficiency of the solar panels, defined as the ratio of the electrical power produced to the incident radiation.

$$\eta_{pv} = \frac{P_{max}}{S \times A_{pv}}$$

where

n_{pv}= efficiency of photovoltaic system

P_{max}: Maximum power from photovoltaic system (W)

S = Solar irradiance (W/m^2)

A_{pv} = Area of the photovoltaic system (m^2)

Exergy Analysis

Exergy is defined as the maximum amount of work that can be done by a system. Unlike energy, exergy is not subject to a conservation law; exergy is consumed or destroyed, due to the irreversibility's present in every real process.

Photovoltaic Exergy

The energy of a PV module depends on two major components – electrical and thermal. While electricity is generated by the PV effect, the PV cells are also heated due to

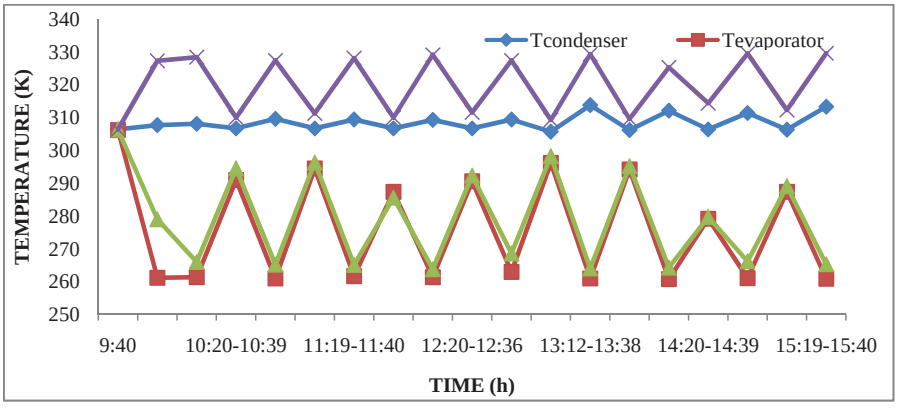


Fig. 1: Cool down and warm characteristics of the refrigerator at no load condition...

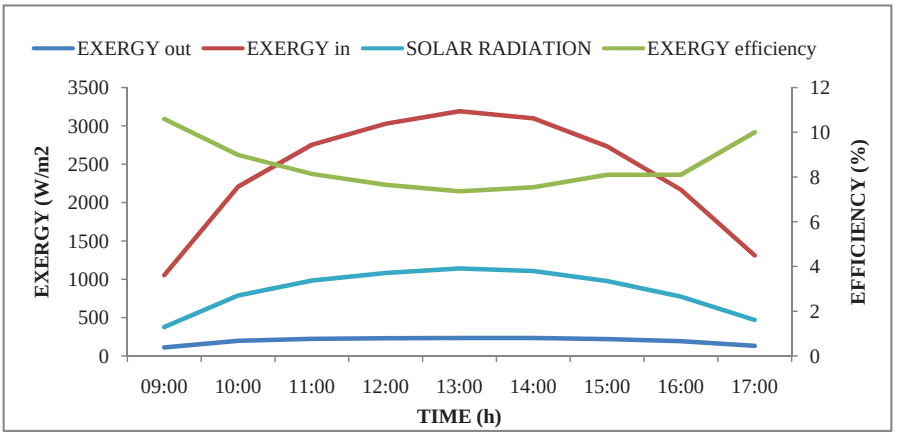


Fig. 2: Variation of solar photovoltaic exergy efficiency with time and solar intensity during no load condition...

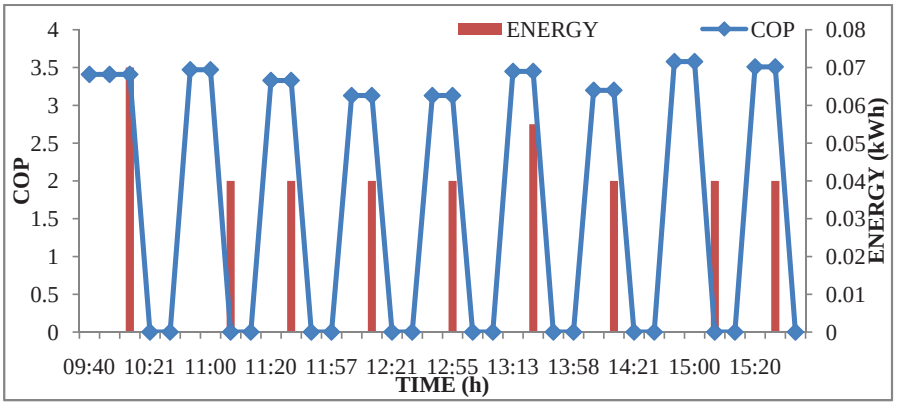
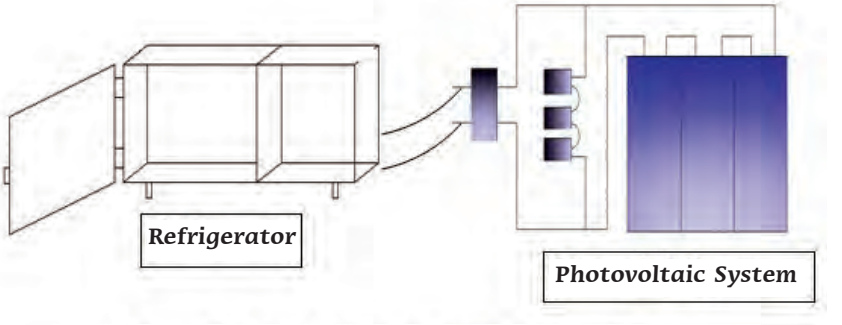


Fig. 3: Variation of energy consumption and COP with time during no load condition...



Connection of solar photovoltaic system to refrigerator...

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the thermal energy present in the solar radiation. The electricity (electrical energy), generated by a photovoltaic system, is also termed 'electrical exergy' as it is the available energy that can completely be utilsed in useful purpose. Since the thermal energy available on the photovoltaic surface was not utilised for a useful purpose, it is considered to be a heat loss to the ambient. Therefore, due to heat loss, it becomes exergy destruction. The exergy output of the photovoltaic system can be calculated as:

$$Ex_{out} = V_m I_m - \left(1 - \frac{T_0}{T_{cell}}\right)[h_c \times A_{pv}(T_{cell} - T_o)]$$

where V_m, I_m h_c, A, T_{cell} and T_o are the maximum voltage and current of the photovoltaic system, convective heat transfer coefficient from the photovoltaic cell to ambient, area of the photovoltaic surface, cell temperature and ambient temperature (dead state temperature), respectively.

Exergy input of the photovoltaic system – which is the exergy of solar energy – can be calculated approximately as below

$$Ex_{in} = Ex_{solar} = A_{pv} \times S \times \left[1 - \frac{4}{3}\left(\frac{T_o}{T_{SUN}}\right) + \frac{1}{3}\left(\frac{T_o}{T_{SUN}}\right)^4\right]$$

where T_{SUN} = temperature of the sun taken as 5760 K

Exergy efficiency of the photovoltaic system is defined as the ratio of total output exergy (recovered) to total input exergy (supplied). It can be expressed as

$$\Psi_{PV} = \frac{Ex_{out}}{Ex_{in}}$$

Scrap water dispenser...

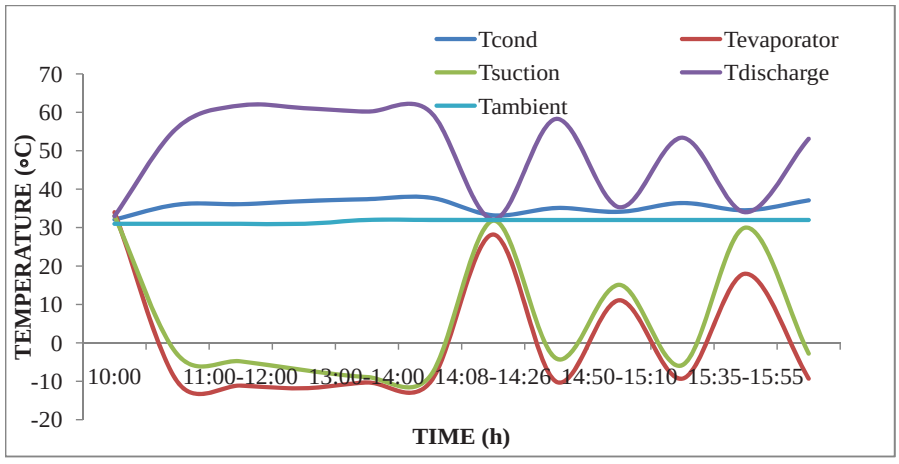

Fig. 4: Cool down and warm characteristics of the refrigerator at full load condition...

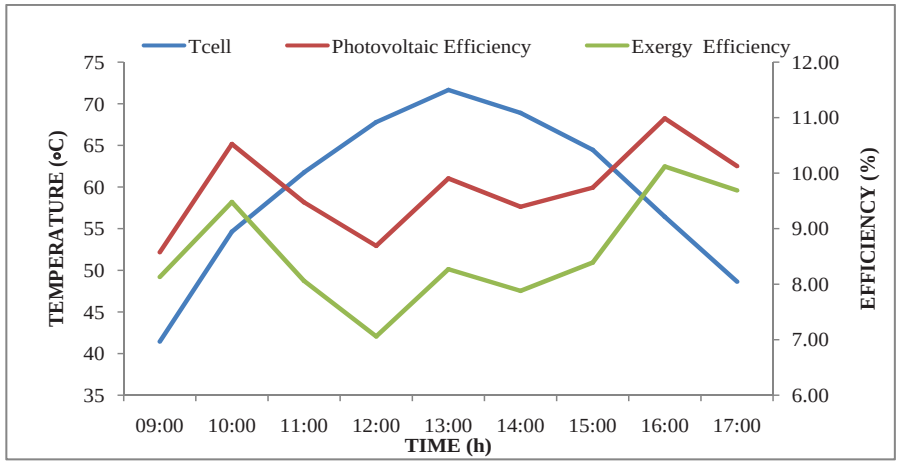

Fig. 5: Energy and Exergy efficiency with time and cell temperature during full load condition...

Conclusions

Energetic and Exergetic techniques help inevaluating the performance of the SPV refrigerator with a view to getting better information about useful work and lost work, and design some remedial techniques in future to overcome on these losses. The installed system of solar photovoltaic refrigerator system is capable for cooling the vaccine for 7 hour in a day. The pull down test indicates that 375Wp photovoltaic capacity and 21Ah battery bank is the least possible configuration required for this converted system. The average COP during 'no load' and 'full load' tests were found high as 3.37. Second law efficiency of the refrigerator system remains close to 55% at no load full load conditions. The photovoltaic conversion efficiency and exergy efficiency found nearer to 10% and 8.5% respectively in both 'no load' and 'full load' condition. This indicates that the product load condition does not affect the PV system. The reason for low overall efficiencies is because both, the energy conversion efficiency and exergy efficiency, of the PV system are low – so that it can be said that exergy is destroyed highly in PV. The payback period of the proposed system was found six months. It is suggested that the design procedure may be improved by a variable speed compressor to cope with the variation of the refrigeration load due to different modes of operation. The performance curves are shown in Fig. 1 to 5. ■

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Dr Surendra Kothari
Professor at Department of Renewable Energy Engineering, MPUAT, Udaipur

Reflective **Insulation**

INSUreflector - Underdeck Insulation 1...

A reflective insulation system is typically formed by layers of aluminium or a low emittance material and enclosed air spaces, which in turn provide highly reflective or low emittance cavities (air bubble film) adjacent to a heated region...

The radiant heat is invisible and has no temperature, just energy. When this energy strikes another surface, it is absorbed – and increases the temperature of that surface. In summer, radiation from the sun strikes the outer surfaces of walls and ceilings and is absorbed causing the surface to heat up. This heat flows from the outer wall to the inner wall through conduction, which is then radiated again, through the air spaces in the building, to other surfaces within the building. Radiation between surfaces is through invisible, infra-red heat rays.

Different types of insulation products reduce the heat transferred by conduction, convection and radiation to varying degrees. As a result, each provides different thermal performance and corresponding 'R' values. The primary function of reflective insulation is to reduce radiant heat transfer across open spaces, which is a significant contributor to heat gain in summer and heat loss in winter.

There are many types of materials that reduce heat gain and heat loss. Some materials provide greater resistance than others, depending on the mode of heat transfer: convection, conduction or radiation. Most insulation materials work on the principle of trapped air gas being a good insulator. Mass insulation like, 'INSUshield'- closed cell, FR crosslinked polyethylene foam, use cellular walls of plastics, Fibre glass wool uses glass fibers to reduce convection – thereby decreasing the transfer of heat. These materials also reduce heat transfer by conduction due to the presence of trapped air. (However, these products, like most building materials, have very high radiant transfer rates. Most building materials, including fiberglass, foam and cellulose have 'E' values in excess of 0.70.

Reflective insulation typically have 'E' values of 0.03 (again, the lower the better). Therefore, reflective insulation is superior to other types of insulating materials in reducing

INSUreflector - Underdeck Insulation 2...

heat flow by radiation. When reflective insulation is installed in building cavities, it traps air (like other insulation materials) – and therefore reduces heat flow by convection – thus addressing all three modes of heat transfer. In all cases, the reflective material must be adjacent to an air space. Aluminium, when sandwiched between two pieces of plywood or between two concrete layers for example, will conduct heat at a high rate. The conductive insulation material should always be in contact with the substrate for better insulation.

Understanding a Reflective Insulation System (RIS)

A reflective insulation system is typically formed by layers of aluminium or a low emittance material and enclosed air spaces, which in turn provide highly reflective or low emittance cavities (air bubble film) adjacent to a heated region.

The performance of the system is determined by the emittance of the material(s), the lower the better, and the size of the enclosed air spaces. The smaller the air space, the less heat will transfer by convection. Therefore, to lessen heat flow by convection, a reflective insulation, with its multiple layers of aluminium and enclosed air space (INSUreflector), is positioned in a building cavity (stud wall, furred-out masonry wall, floor joist, ceiling joist etc.) to divide the larger cavity (3/4" furring, 2" x 4", 2" x 6" etc.) into smaller air spaces. These smaller trapped air spaces reduce convective heat flow.

Reflective insulation differs from conventional mass insulation in the following ways:

- Reflective insulation has very low emittance values 'E-values' (typically 0.03 compared to 0.90 for most insulation) thus it significantly reduces heat transfer by radiation
- A reflective insulation does not have significant mass to absorb and retain heat
- Reflective insulation has lower moisture transfer and absorption rates, in most cases
- Reflective insulation traps air with layers of aluminium and air bubble film plastic as opposed to mass insulation, which uses fibres of glass, particles of foam or ground up paper
- Reflective insulation does not irritate the skin, eyes or throat and contains no substances which will out-gas
- The change in thermal performance due to compaction or moisture absorption, a common concern with mass insulation, is not an issue with reflective insulation.

Supreme's thermal insulation division offers solutions in the following areas:

- Ducting insulation in hospitals, shopping malls, airports, PEBs, IT /BPO etc.
- Pipe insulation for split AC tubings, chiller piping, drain pipes, chilled water lines etc.
- Floor insulation in server rooms, data centres, medical and diagnostic centres, and control rooms for petrochemicals.
- Underdeck insulation in PEBs, textile units, malls, airports etc.
- Overdeck & wall insulation in commercial buildings, residential buildings, cold storages etc.

'INSUreflector' offered by Supreme is made of polyethylene Air Bubble Film (ABF) laminated with aluminium foil on one or both sides. The bright surface of the aluminium foil reflects 96 to 99% infra-red radiation received by the surface of a heated slate roof. It protects the building from undesirable heat gain. The thin reflective foil having low emissivity and high reflectivity – when installed with an air space restricts the transfer of far-infrared radiation making it an ideal material to be used for underdeck application.

'INSUshield' is a non-fibrous, fire retardant, closed cell, tri dimensional chemically cross-linked polyethylene foam XLPE. An ideal environment -friendly insulation material, with a perfect solution for all the insulation needs for ducts, roofs, pipes, vessels, etc. The divergent advantages of 'INSUshield' are ease of installation, low thermal conductivity and good moisture and vapours resistance preventing microbial growth and optimum condensation protection. ■

Atul Khanna
General Manager
Thermal Insulation Division
The Supreme Industries Ltd.

Solar - Powered Cold Storage, Food Preservation & Horticulture

Biomass gasifier based electricity generating systems are a viable option for decentralised electricity production especially in village areas – where grid is not available and lot of stock is readily available...

Solar refrigeration may have applications in both developed and developing countries. Applications in developing countries, such as vaccine storage or large scale food preservation, have been the subject of much research. In developed countries, the main area of interest is air conditioning.

Applications in developing countries

There is a demand for cooling in many parts of the world – where there is no firm electricity supply, and conventional fuels are difficult or expensive to obtain.

Possible refrigeration cycles

There are five classes of cycle that can be used for renewable powered refrigeration systems (Desiccant wheel technology for air conditioning is dealt with later).

- A standard mechanical vapour compression cycle, requiring an electrical input to a hermetically sealed compressor. The electricity is generated by photovoltaic panels. This has the advantage of using off-the-shelf technology, but the disadvantages of high cost and the probable need for an electricity storage sub-system still remain.

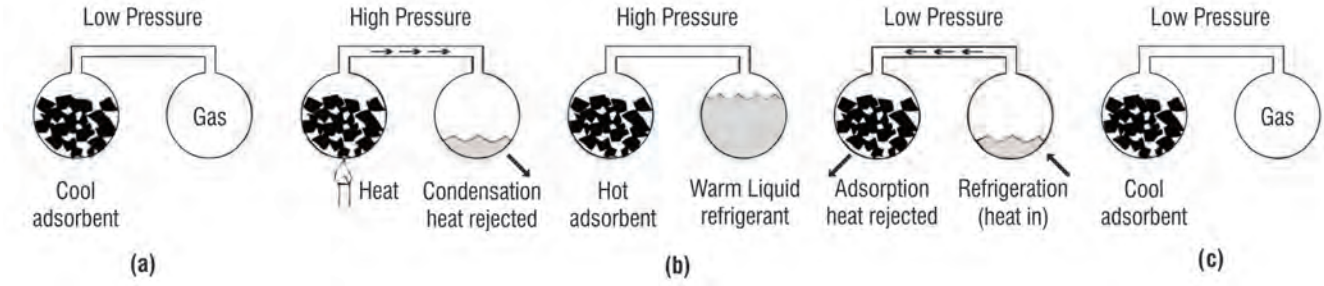


Fig. 1: Process showing intermittent adsorption cycle (solid)...

- **Intermittent adsorption cycles (solid):** Adsorption refrigeration cycles rely on the adsorption of a refrigerant gas into an adsorbent at low pressure and subsequent desorption by heating. The adsorbent acts as a 'chemical compressor' driven by heat. In its simplest form, an adsorption refrigerator consists of two linked vessels, one of which contains adsorbent and both of which contain refrigerant as shown in Fig. 1 above.
- **Intermittent absorption cycles (liquid):** These are thermodynamically identical to adsorption systems – but use liquid absorbents rather than solid adsorbents. Typically, the pair used is ammonia-water, but ammonia-NaSCN, methanol-LiBr and other pairs have been used experimentally.
- A continuous absorption cycle with an electrically driven feed pump eliminates the problems of bulk, but if electricity is available to drive a solution feed pump then it could be argued that it would be better to use a conventional vapour compression cycle. The use of a small amount of photovoltaic electricity to drive a feed pump might be justified.

Integrating renewable energy to cold chain: prospering rural India

Since India is a country where agricultural sector is one of the key contributors in the National GDP, the storage and processing of the harvest is very critical. The cooling of majority of fruits and vegetables needs to be done even before it is transported – so as to maintain the freshness and prevent immediate deterioration.

The cold storage facilities for India's agricultural produce are short by more than 10 million tons. Additionally, the energy expenses account for 28% of costs in cold storages.

A report commissioned by the Planning Commission of India to study the reasons for post-harvest losses in the key agricultural states, like UP and Bihar, points to lack of reliable power supply in these states. It also underlines that the larger cold storages located in city centres have been built primarily to store potatoes. Moreover, the greater the distance between the rural producer and the markets, the greater is the risk of post-harvest deterioration.

Hence, there is a need for self-reliable and sustainable cold storages near the agricultural fields itself. This will reduce the transportation cost and as a result, more farmers will be encouraged to use this facility.

Cold Storage: renewable integration

The cold chain sector is sizable (6,000 units /30,000 metric ton) and fast growing with many key industries critically dependent on it. In the cold chain, we can include renewable energy interventions at various stages to support the development of a self-sustainable model of Green Cold Chain, which requires little or no grid power to drive it. Also, there can be a technological intervention wherein the renewable infrastructure supporting the cold storage facility can feed electricity to the nearby habitat.

This shall safeguard the farmers from unwanted losses due to pilferages, mismanagement of stock and lack of grid supported cold chain infrastructure, also supplying electricity to the villages at the same time.

The renewable energy technologies can be integrated in the existing system or developed in isolation based on the following key factors such as:

- **Type of stock to be processed:** The need of temperature range for various food and produces varies from sub-zero degree to 10°C, and hence, the renewable energy technology shall also vary accordingly to attain the temperature range. Temperature range of various agricultural produces can be seen below at Table 1.

Sl. No.	Fruits / Vegetables	Temperature Range (°C)
1	Apples	-1 – 4
2	Bean/Carrots/Cauliflower	0
3	Lychees/ Orange	4 – 7
4	Onions	0 – 2
5	Strawberries	0
6	Sprouts	0 – 2
7	Potatoes	7 – 10

Table 1: Temperature range for various produces...

- **Load requirement for the desired infrastructure:** The electrical load requirement for various units as mentioned in Table 2 varies, and the load can vary from 3 to 125 kW. The renewable energy technology can be used in stand-alone mode or to supplement the electricity loads of the existing projects.

Technical Parameters				
Capacity (MT)		**Dimensions (m^3)**	**Temp (°C)**	**Electrical load**
Small units	2 – 3	3.8x2.2x2.44	0 to 15	3 kW (with pre-cooling)
	10	6x4.6x2.43	0 to 15	15 kW (with pre-cooling)
Large units	5,000	4x(21x16x13.70)	-4 to + 4	125 kW (without pre-cooling)

Table 2: Cold storage load requirement...

Renewable energy is now becoming technologically and economically sound alternative to grid power and can be deployed in far remote places at competitive price...

There can be multiple solutions like mobile solar powered vans/solar cooled containers for transporting the stock to nearby cold storage, large cold storages driven by solar thermal/solar PV technology. Solar refrigeration engages a system where solar power is used for cooling purposes. Also, renewable energy interventions can be integrated in the existing plants – such as Biomass-Gasifier can be coupled with the diesel gen-sets, this hybrid solution can significantly reduce the cost of fuel.

Renewable energy status: India

The renewable potential in India is estimated to be more than 245 GW with over 100 GW of solar energy potential. Various forms of renewable energies contribute to this massive potential. Many sectors, including food storage/cold chain, can strive for energy security by adopting renewable energy.

Renewable energy is now becoming technologically and economically sound alternative to grid power and can be deployed in far remote places at competitive price and to the required scale.

Renewable energy technological options for cold storage

Solar photovoltaic power pack

Power Pack systems are used to generate electricity for locations where grid is unreachable or the access is expensive.

It is a PV based solar energy system, where solar energy is converted into electrical energy and used for refrigeration – much like conventional methods.

These Solar Power Pack Systems (as illustrated in Fig. 2) can also be used in combination with existing grid for uninterrupted supply of electricity. The power pack consists of Solar PV modules, long life low

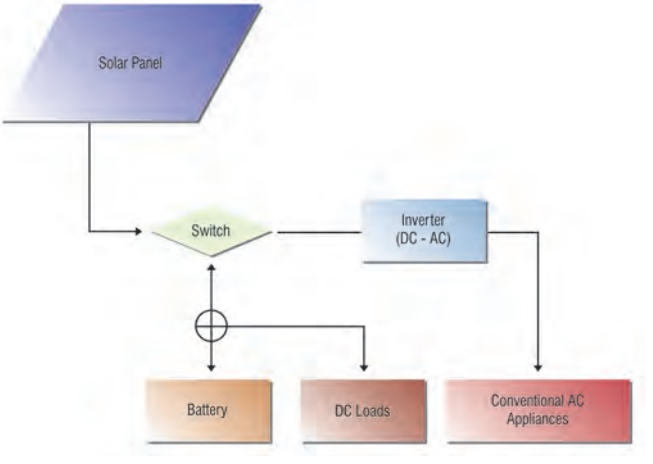


Fig. 2: Solar photovoltaic power pack... model...

maintenance batteries, solar inverter-cum-charge controller and suitable hard-ware. The power from solar photovoltaic cells in case of cold storage chamber/container/van is utilised mainly to drive the compressor of the system.

Solar PV system + diesel gen-set hybrid

A solar PV can be coupled with existing DG set to supply electricity for base load; catering to luminous load. During the non-availability of the grid power, the electrical units generated by solar PV can be utilised, hence minimising the energy cost of the infrastructure. Pilot projects are operational at various locations so as to hedge the cost of diesel consumed for base load. At present, there are over 150 cold storages with solar PV set up – where the cost of diesel consumption has gone down steeply with the help of smart controlling and prolonged temperature maintenance.

Biomass gasifier

Biomass gasifier based electricity generating systems are a viable option for decentralised electricity production especially in village areas – where grid is not available and lot of stock is readily available. As seen in Fig. 3 this setup can provide cold storages with electricity even in stand-alone mode.

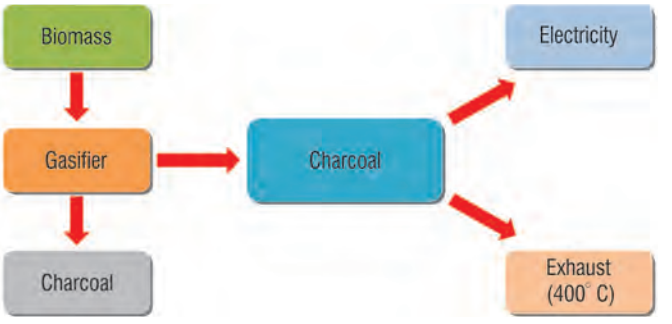


Fig. 3: Biomass gasifier to drive the generator supporting the cold storage...

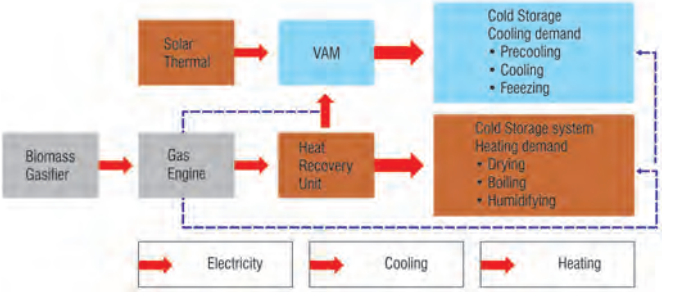


Fig. 4: Block diagram of Solar/Biomass co-Generation...

Solar/biomass co-generation (power and cooling)

In the solar biomass driven cold storage scheme, producer gas from biomass gasifier drives gas engine to produce electricity required to drive the electrical demand of the system. A Vapour Absorption Machine (VAM) is driven on the engine waste heat, which otherwise would have been rejected to atmosphere.

Here, as seen in the block diagram in Fig. 4; the waste heat available from the gasifier engine producing electricity is utilised to power the vapour absorption system. ■

Bandal S D
E&T/C Graduate Engineer
COEP, Pune

The winning design, Cool Beans, used a rotisserie mechanism to remove chaff from the roasted beans...

Capturing Innovative Ideas

FirstBuild hosted the White House Maker Advocate at an all-day hackathon on October 2, 2015, giving makers the opportunity to contribute directly to a real product – an easy way to roast fresh coffee at home...

GE's FirstBuild is a global co-creation community that harnesses the brainpower of the maker movement to change the way major home appliances are conceived, designed and manufactured. A physical state-of-the-art microfactory on the University of Louisville campus and online forum, FirstBuild speeds products from mind to market and enables customisation through small batch production, without the costs and risks of traditional mass manufacturing.

Timed to Manufacturing Day, the hackathon illustrated the opportunities in engineering and manufacturing today, and was attended by local students from Jeffersontown High School's Manufacturing Education program, Jefferson Community and Technical College, The University of Louisville, and Purdue University, as well as makers and engineers from the local community. By focusing on coffee roasting, which is growing in popularity, FirstBuild wants to make freshly roasted coffee accessible to the coffee enthusiast. All you need is a convection oven and FirstBuild's future coffee roaster, which is expected to be produced in the coming months with ideas generated by hackathon participants.

Industry experts on coffee, appliances and product development advised teams as they competed to create the perfect at-home system for roasting coffee beans. A panel of judges awarded the best ideas $1,250 in cash and premium roasted coffee beans, with all entries eligible to win over $10,000 in prizes and software in the Coffee Roaster design competition, which is open to makers worldwide through Oct. 25.

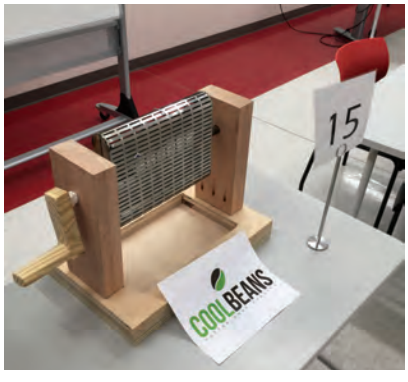
The key challenges for hackathon participants were maximising airflow around beans in a convection oven, removing the chaff from beans after the roast, and fabricating the device using equipment available in FirstBuild's state-of-the-art microfactory. Concepts developed by makers during the hackathon will be considered for inclusion in FirstBuild's final product.

The winning design, Cool Beans, used a rotisserie mechanism to remove chaff from the roasted beans. It was created by a team consisting of college co-op students from Ohio, Illinois, Florida and Indiana – Hunter Stephenson, Diana Alonso, Lydia Pawley, Marcia Suarez, Steven Morse and Trung Doan. Second place went to a team of students from Jeffersontown High School.

Stephanie Santoso, White House Maker Advocate, spoke to more than sixty makers in attendance about the importance of mathematics and science, and the growing maker movement. She also led a roundtable with local manufacturing leaders during the event to discuss how manufacturing is evolving.

The hackathon challenged participants to design and build an in-oven coffee roaster. They learned how coffee is roasted, designed early prototypes and worked in teams of 4 – 6 to build, test & refine the best-performing coffee roasting device for a home oven.

"We opened our doors to makers to showcase FirstBuild's model of manufacturing that embraces the maker movement and speeds products from mind to market in months rather than years. We want to energise the next generation of engineers, designers and makers and show the future of manufacturing is bright. We know coffee is more popular with Americans than soft drinks and tap water – and we see freshly roasting coffee beans at home as a growing trend. Makers and consumers alike can relate to coffee roasting and will benefit from a residential coffee roaster that FirstBuild plans to design and produce," said Venkat Venkatakrishnan, Director of FirstBuild. ■



Hackathon winner Cool Beans consists of college co-op students from Ohio, Illinois, Florida and Indiana: Trung Doan, Lydia Pawley, Diana Alonso, Steven Morse, Hunter Stephenson and Marcia Suarez...

A Professional Multimeter Kit

An advanced kit contains the most commonly used testing tools designed for professionals who service and install Electrical / HVAC equipment.

The kit includes:

- Model EX505 Industrial grade, CAT IV-600V, 4000 count display, waterproof, drop-proof, rugged multimeter with True RMS functions
- Model EX730 800A True RMS 4000 count AC/DC Clamp-on MultiMeter with test leads and temperature probe
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- Model DV20 Non-contact voltage detector detects AC Voltage to 600VAC
- Set of double molded professional test leads
- Type K thermocouple bead probe & Type K to Banana Input Adaptor

- Supplied in a heavy duty hard carrying case that provides protection & organization for the meters whenever they are needed
- Dimensions: 14.5x11x4.5" (368x280x114mm); Weight: 4.5lbs (2kg) ■

Website: www.extech.com

Air-tight, Hygienic Clean Room High Speed Doors

A Clean Room is an environment typically used in manufacturingand scientific research with a low level of environmental pollutants such as dust, airborne microbes, aerosol particles, and chemical vapors. Simply put a cleanroom has a less or no level of contamination.

Usage and benefits of clean room doors

In the pharmaceutical industry, Clean Rooms' Doors play a crucial role in the manufacturing of pharmaceutical products, which require the environment to be free from microbial and particulate contamination and protected from moisture – controlled environment.

Clean Room High Speed Doors designed and manufactured by Gandhi Automations are high in demand in industries – such as Pharmaceutical and Chemical, which require quick open and close applications at the entry and exit points as controlled environment needs to be maintained. These industries make high demands with respect to hygiene, sealing, operating reliability, fitting and a trouble free after sales service. Our Clean Room High Speed Doors satisfy all these requirements and work in strictly regulated operating conditions.

Gandhi Automations offers custom-made solutions for these sectors, while investing a lot of time and money in courses and training for the company's own production staff and technicians.

The key features of Clean Room High Speed Doors offered by Gandhi Automations are briefly mentioned below:

- Clean Room High Speed Doors are designed for inside applications and protect the environment against draughts, humidity, dust and dirt
- Operating speed and superior sealing properties improve traffic flows and provide environmental control and savings on energy costs
- Concept of low air permeability in pressurised rooms with positive and negative air pressure
- High door efficiency and low permeability values
- EN 12426 EN 12427 : < $12 m^3/m^2h$ Δ 50 PA
- High leak tightness is due to curtain being tightly integrated in special SS 316 satin finish side guides
- Bottom safety edges and photocells combine to ensure operator safety at all times
- Heavy duty motor: 230V single phase, opening speed up to 1.5 m/s with inverter system
- Size up to: 4000 mm (W) X 4000 mm (H) ■

E-mail: sales@geapl.co.in

Impact Of Refrigeration, Air - Conditioning On Indian Economy

The Indian Heating, Ventilation and Air Conditioning (HVAC) market is expected to grow by 30% to over Rs 20,000 crore over the next two years. Danfoss engineers technologies that enable the world of tomorrow to do more with less…

Danfoss India, a global player in the climate and energy space, partnered with industry body Indian Society of Heating Refrigeration & Air-conditioning Engineers (ISHRAE), Pune Chapter, to host a two-day national level seminar on Refrigeration and Air Cooling – ACR Trendz 2015. The seminar continued from 11th to 12th September, 2015 at Pune.

Inaugurated by K. Ramachandran, National President ISHRAE, the seminar threw light on HVAC solutions for Pharma industry, integrated facility design, smart project execution and IT including data centres.

"HVAC is an energy guzzler for industries, forming about 40% of electricity costs in industries. Our technological prowess in the field of energy efficiency has helped us in our endeavour to combat climate change by engineering solutions for a better tomorrow," said Rajesh Premchandran, Vice-President, Danfoss Refrigeration and A/C Division.

The Indian Heating, Ventilation and Air Conditioning (HVAC) market is expected to grow by 30% to over ₹ 20,000 crore over the next two years, mainly due to increase in construction activities in infrastructure and real estate sectors. According to industry reports, HVAC sector has grown to over ₹ 10,000 crore between 2005 and 2010 and reached ₹ 15,000 crore in FY'14.

As a well known supplier, Danfoss delivers innovative products that help make a big difference for the citizens and communities of the future. Having an extensive product range and a high level of innovative and technical solutions, Danfoss is a sole and reliable partner with the right mix of components, application knowledge and service needed to meet the energy efficiency requirements of Refrigeration and Air conditioning systems in a cost effective manner.

Danfoss, the reputed provider of climate and energy solutions, showcased its product portfolio that aids in enhancing efficiency and safety of refrigeration plants. Latest cutting edge technology for the refrigeration space like Danfoss Drives and Refrigeration Line components were also displayed at the venue.

Delegates panning various stakeholder communities such as MEP consultants, HVAC&R contractors and system integrators, architects and facility managers and ISHRAE members were present in the conference. ■

Evolving Technology In Cooling

For the 80+ strong audience from the HVAC sector in the Middle East, the seminar provided new insights on the evolving technology in cooling…

ASHRAE's Qatar Oryx chapter organised a seminar on 'Innovative Cooling Solutions with Indirect Evaporative Cooling' on 12th September 2015 at Doha. Sunil Tiwari, Head of Global Sales and Marketing of A.T.E.'s BU: HMX, India, and Sanjiv Sachdeva, Managing Director of Gulf Engineering System Solutions, UAE, were jointly invited as speakers at the seminar to share their knowledge on sustainable non-conventional cooling systems.

The duo, who have considerable experience with eco-friendly solutions for space and process cooling, made an interesting presentation that delved deep into the technologies and processes related to IEC (Indirect Evaporative Cooling). The presentation also highlighted the energy efficient cooling solutions for people's comfort and process efficiency developed by HMX in India. Fast growing HMX has set a benchmark in IEC with the world's largest installed base of 21 million CFM.

For the 80+ strong audience from the HVAC sector in the Middle East, the seminar provided new insights on the evolving technology in cooling – and the capabilities of HMX, India, and GESS, UAE, in deploying technologies that are redefining cooling in eco-friendly and economical ways. ■

A view of the ASHRAE's seminar...

Testo Offers
New Air Capture Hood

Air capture hood Testo 420 has been designed for least weight and increased precision...

Testo, a 100% subsidiary of Testo AG, Germany, offers a new air capture hood for larger air intakes and outlets, with the lowest weight in the market, and a unique level of precision. The Testo 420 redefines previous standards, and stands out – thanks to its easy handling and increased efficiency with an App integration. With it, the company is extending the range of VAC measuring instrument products, establishing itself in volume flow measurement as an innovative world market leader of the field of portable measurement technology.

Light, precise and convenient – the new air capture hood Testo 420 is the leading solution for regulating volume flow at larger air intakes and outputs. With a weight of less than 2.9 kg, the Testo 420 is the lightest air capture hood in the market. With regard to measurement precision too, the product sets new standards. Especially, at swirl outlets, the flow straightener from Testo significantly reduces the usual measurement errors.

When regulating volume flows at larger air intakes and outlets in ventilation and air conditioning systems with the air capture hood Testo 420, users can fulfil hygiene guidelines and Indoor Air Quality stipulations effortlessly, and more efficiently than ever before – for example in industry, office rooms or in clean rooms.

In addition to its uniquely low weight, the ergonomic handles ensure especially easy handling. Funnel-shaped tension rod sockets support easy and quick set-up of the Testo 420. Once compactly collapsed, the air capture hood can be easily and safely transported in the trolley included in delivery.

For more comfortable readout of the measurement values, the measuring instrument can be tilted and removed. Mobile devices such as Smartphones and Tablets can furthermore be used as a second display and remote control via Bluetooth App integration. This makes using a tripod for high ceilings, for example, especially safe and comfortable. In addition to this, users can finalise the measurement report, and send it by e-mail, on site with the App – saving considerable time and increasing efficiency.

The Testo 420 should especially be useful

for monitoring indoor air climate in offices, malls or in production companies – be it food, pharma or others. These must accomplish two tasks. On the one hand, it should guarantee uniform ambient conditions for a faultless production process, and highest product quality while on the other, it may not endanger the health of the staff.

This is why the VAC systems in such rooms are required to adhere to stringent norms and guidelines. The crucial factor is the prescribed air exchange rate. Depending on the VAC system, this rate must be checked several times a year by an air conditioning technician, by measuring the total volume flow at the air outlet or in a duct. In measurements at air outlets, a problem occurs: rooms such as these have large swirl outlets installed as standard, which do not blow the air into the room straight, but instead continually swirl it. The consequence of this swirl: air flows are often incorrectly measured at these locations. And this complicates the determination of the volume flow substantially.

The air capture hood testo 420 significantly reduces measurement errors at larger swirl outlets. The innovative flow straightener converts the turbulence into an almost uniform air flow, leading to a considerably more accurate measurement.

In addition to this, the hood records the ambient climate using an integrated temperature and humidity sensor as well as an absolute pressure sensor. Another advantage of the hood is its low weight of only 2.9 kg. In combination with ergonomic handles, frequent or difficult measurements can therefore be conducted comfortably and safely.

The application is simple too: funnel-shaped tension rod sockets support easy and quick set-up, and the trolley included in delivery ensures safe transport. Mobile devices such as smartphones and tablets can be used as a second display and remote control via Bluetooth App integration – especially useful for the safe use of a tripod for high ceilings.

After the measurement, the App allows the finalisation and sending of the measurement protocol directly on site. Differential pressure and Pitot tube measurements are also possible with the removable measuring instrument, by simply entering the duct geometry.

With the air capture hood Testo 420, users can quickly and accurately fulfil the legal regulations on Indoor Air Quality for ventilation and air conditioning systems in industry. ■

For further information: www.testo.in

FWE's R-AS-10 mobile refrigerated air screen

Now foodservice personnel can experience improved workflow even in confined spaces with FWE's R-AS-10 Mobile Refrigerated Air Screen that features an optional sliding space-saver door. Kitchen workers can fully open the door without requiring a 270º swing radius that overlaps nesting equipment units. Just open the door to 90º and simply tuck it into the side of the Air Screen – where it virtually disappears. It's perfect for foodservice kitchens that use a tray line configuration or pod-style assembly.

FWE's R-AS-10 Mobile Refrigerated Air Screen is designed for hospitals, nursing homes, schools, in-flight and other tray line operations. Its multi-fan system provides fast cool-down times and maintains cabinet temperatures with the door open for up to 90 minutes. ■

Website: www.fwe.com

Heatcraft launches quick response controller

Heatcraft Worldwide Refrigeration introduces the Quick Response Controller, the newest addition to the Heatcraft Controls portfolio. The Quick Response Controller is a factory installed control solution that provides automatic superheat, room temperature and intelligent defrost control for refrigeration unit coolers.

Utilising innovative, leading edge technologies, the Quick Response Controller delivers reliable operation and system performance while saving energy compared to traditional electro-mechanical refrigeration controls. The Heatcraft Quick Response Controller combines Electronic Expansion Valves (EEV's), superheat control, defrost algorithms and fan cycling that result in faster temperature pull downs, stable operating temperatures and overall energy efficiency. ■

Website: www.heatcraftrpd.com/qrc

GEA Küba gastro slim FM: low silhouette coolers

With its GEA Küba gastro slim FM air coolers, GEA Heat Exchangers meets the demand from large numbers of customers for extra-slim design and the use of natural refrigerants as well as HFCs in cooling counters, food storage units, and cooling tables. Food and beverages are subject to strict regulations: not only in production, but also in handling during storage and stocking. In dining areas and in catering kitchens, beverages, cooking ingredients, salad dressings, sauces and ice cream must be kept under carefully observed conditions for hygiene and refrigeration.

Bottles and kegs are usually kept at +6°C in cooling counters so that guests fully enjoy cold drinks. Cooking ingredients, in contrast, often require temperatures in the range of +2° C to – 20°C. In all cases, it is essential to maintain the stipulated storage and stocking temperatures. The gastro slim FM is the mighty mini for those particular operating conditions in cooling counters, food storage units, and cooling tables. ■

Website: www.gea-heatexchangers.com/

Easiest way to clear condensate drain lines

Are you tired of cleaning choked drains? Is your running cost increasing because of repeated maintenance activities? Here is assurance from Infinity HVAC Tools: No more choked drains; No more cutting and repairing the drain lines…

Infinity is offering the Jones Valve (Patented in USA), which addresses all the above challenges. You just

- Flush the drain lines with compressed air supply with this unique Jones valve
- Remove clogging from upside and downside with the same valve.

Features:

- 1/4" hose connection, male flare with Schrader
- 3/4" condensate line
- durable, schedule 40 PVC material
- it a attaches to CO2 or Nitrogen tanks
- smallest and easiest to use of all available drain line valves
- Most economical solution for HVAC & R drain lines.

Free delivery is available from **website: www.hvacmall.in** ■

Carrier offers Cor thermostats

The Cor thermostat promises to redefine the way homeowners interact with their home comfort systems by focusing on three key areas:

Features

- Efficiency: The Cor thermostat reduces home comfort costs by an average of 20%
- Simplicity: Seamless system management with the mobile app or desktop interface
- Carrier expertise: Leveraging more than a century of experience in heating and cooling translates into a truly smart thermostat.

Through guided programming options, homeowners can maintain control of their home comfort system, or simply let the Cor thermostat do all the work for them. To maximise energy efficiency, the Cor thermostat offers advanced features like smart setback, which automatically determines the optimal temperature for home comfort and energy savings. Wi-Fi connectivity, compatible with 802.11 b/g/n wireless routers, allows remote access to the Cor thermostat from virtually anywhere. Homeowners can wirelessly control home temperatures and energy savings via mobile and tablet apps. ■

Website: www.carrier.com

Alfa Laval redefines adiabatic cooling

With energy and water becoming very precious resources, applications in heat rejection are facing increasing challenges to achieve both economical and ecological sustainability. Customers in various industries are on the search for alternatives to open cooling towers due to the high water consumption and treatment required, as well as risks of Legionella contamination. While dry coolers might seem like a perfect solution for most applications, certain limitations appear when it comes to some specific duties with a narrow temperature approach and challenging climates.

Alfa Laval Abatigo utilises a unique method of cooling by spraying a fine mist of water to cool the air before it enters the heat exchanger coil. This significantly reduces energy and water consumption, and is highly adaptable to different applications and climates. ■

Website: www.alfalaval.com

Avago unveils ultra-low power fast ethernet transceiver

Avago Technologies has rolled out an ultra-low power Fast Ethernet Small Form-factor Pluggable (SFP) fibre optic transceiver module device, the AFBR-57E6APZ, designed for industrial automation, controls and networking applications. The device features a redesigned chip set for LED control, diagnostic monitoring interface (DMI) and signal processing, which significantly reduces the module power dissipation. Compared with the previous generation device, the AFBR-57E6APZ consumes 42% less in power while delivering superior electrical and optical performance.

Product highlights:

- Industry-leading low power consumption: 255 mW (typ), 405 mW (max)
- Industrial operating temperature: -40 °C to +85 °C
- Link distances up to 2 km using 50/125um or 62.5/125um multimode fiber
- Built-in DMI providing real time information on temperature, LED bias current, LED average output power and receiver average input power
- Compatible with SFF-8074i and SFF-8472 MSA specifications
- Compatible with 100BASE-FX version of IEEE 802.3u
- Robust, long-life LED technology preventing catastrophic failure of the laser like sudden death or mirror degradation. ■

Website: www.avagotech.com

Smart Yet Affordable

ALM makes and imports quality instruments for controlling air quality and pressure, including the popular Telaire Transmitters...

If product quality and timely after service are what you are looking for in an instrumentation supplier, there is no better answer in Indian instrumentation industry than ALM Engineering & Instrumentation. The company, headed by Sarfraz Panjwani, makes instrumentation products related to sensing, measure and control of pressure, including differential pressure, humidity and temperature. It also makes high quality devices for indoor air quality including CO & CO_2, flow, occupancy (motion), smoke and level for normal as well as hazardous areas.

The company, which mainly offers analogue and digital instruments for HVAC, Building Automation, Textile & Industrial Automation sectors, manufactures on its own – and imports as well instruments from the US, Canada and the European Union. ALM markets its products not only in India but in South Asia and the Middle East.

ALM products find applications in industries like HVAC, building automation & green buildings, clean rooms, pharmaceuticals, semiconductors, chemicals, electronics, power plants, nuclear plants, oil & gas sector, pollution control and dust collection systems.

The company provides Transmitters, Controllers, Switches, Dial Gauges, Data Loggers and Manometers for managing air and inert gases pressure as well as Wet Transmitters, Wet Controllers, Wet Dial Gauges and Wet Switches.

In the air quality instruments section, ALM's offers include Wall Mount Carbon Dioxide Transmitter, Duct-Mount Carbon Dioxide Transmitter, Carbon Dioxide/Temperature Transmitter and Carbon Monoxide/Nitrogen Dioxide Gas monitor. It also offers sensors, switches and transmitters for air velocity and flow, and transmitters and switches to manage temperature and humidity.

Telaire T5100 Series CO_2 Transmitters

The Telaire T5100 Series VentostatCO_2 and temperature transmitter is a low-cost wall-mounted sensing solution for demand-controlled ventilation. The Ventostat provides an optional intuitive VLI (Visual Limit Indicator) display for CO_2 thresholds, a passive temperature output (20k Ω thermistor), and a standard analogue 0 to 10 v or 4 – 20 mA (which is to be chosen while ordering) signal to maintain air quality in enclosed spaces (such as school classrooms, offices, gymnasiums and theatres). The T5100 series also offers a digital UIP (User Interface Program) to configure internal CO_2 concentration thresholds (optional accessory cable and software not included). The factory defaults are 1000 ppm and 1500 ppm.

The low-cost, pre-calibrated and reliable Transmitters are maintenance-free and have flexible configurations and an intuitive VLI display. T5100 products have two terminal pins that are connected inside the sensor to a common/ground. They are either 3-wire or 4-wire type configurations, powered by either AC or DC voltage. These are not 2-wire or loop-powered devices. Wiring the units as 2-wire or on loop-power will irreparably damage the sensors and void the warranty. ■

index to advertisers

Krisztina Palace provides all comforts to office workers

Image Courtesy: Krisztina Palace

Krisztina Palace's HVAC design includes a four pipe fan-coil system for fresh air supply. The U value for heat insulation of the facade achieves an overall performance of 1.0 in order to avoid cold shock...

Krisztina Palace, the property of Union Investment Real Estate GmbH was awarded the BREEAM In Use 'Very Good' rating in two categories: Asset and Building Management. There is a continuously growing interest in Hungary towards environmentally-conscious buildings. There are certain financial advantages for the tenants in these buildings, as the leasing and operational costs can be significantly decreased through the more cost-effective maintenance of these buildings.

The Krisztina Palace nicely addresses modern office owners' expectations. All facades allow maximum flexibility for the fitting out and respect the gridline of 1.25 metres facilitating both open space and cellular layouts for occupiers. The U value for heat insulation of the facade achieves an overall performance of 1.0 in order to avoid cold shock. Its HVAC design includes a four pipe fan-coil system for fresh air supply. It assumes high occupancy density. It provides supplementary fresh air supply in reserve to implement several meeting rooms on every floor. Air supply of 50 m^3 per hour per person is ensured. Allowing for energy saving free cooling is previewed and the building is highly insulated. It also provides for adequate humidification. ■

Logistics center exceeds its initial project goal

The U.S. Green Building Council has awarded LEED Gold Certification to Randa Accessories' new Tahoe-Reno Industrial Center facility. The 524,800 square-foot logistics center, large enough to accommodate 9 football fields, exceeded its initial building project goal of LEED Silver Certification.

The new Reno fulfillment centre utilises a state-of-the-art, energy-efficient, lighting system of LED lights combined with both daylight-harvesting and motion sensors technology that automatically turn off the lights when enough natural sunlight passing through the abundance of skylights and/or no activity is sensed. With over 300 days of sunlight a year, the energy-conserving and daylight-harvesting systems reduce the building's carbon footprint by about 1000 tons annually. Many of these latest technology accomplishments began as sustainability-feature evaluations four years ago, using Randa's New Orleans facility as its test bed; testing and phasing in LED light fixtures and light-harvesting technology for example. The LED fixture tests saw a 46% reduction in average energy usage over high-efficient T-5 fluorescent fixtures. LED lighting, together with motion-sensor technology turnes off 50% of the lights when no activity is sensed. ■

Image Courtesy: Randa Accessories

The new Reno fulfillment centre utilises a state-of-the-art, energy-efficient, lighting system of LED lights combined with both daylight-harvesting and motion sensors technology that automatically turn off the lights when enough natural sunlight is available...

Jem: the smart green hub

Image Courtesy: Johnson Controls

Jem has demonstrated its innovation by being the first to use a highly efficient chilled water configuration delivering huge energy reduction...

When conceptualising the development of Jem, the developer Lend Lease wanted the mixed-use property to become a full-fledged green commercial hub – and set the standard for future developments happening in the vicinity. Johnson Controls adopted a design-build approach and delivered its comprehensive Smart Converged Solutions that met the building and business objectives of the owners. The solutions helped Jem create significant energy and cost benefits while establishing itself as a smart green suburban hub in Singapore.

In 2012, Jem won the gold award in the 'Best Innovative Green Building' category at the MIPIM Asia Awards. Before the project kicked off, the Johnson Controls' team held in-depth discussions with various stakeholders of Jem – in order to fully understand the developer's and building's needs and deliver a superior retail experience. Based on that, the final solution strategy was crystalised. Depending on the report, eight key features that would reap the most building and business benefits were extracted. ■

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