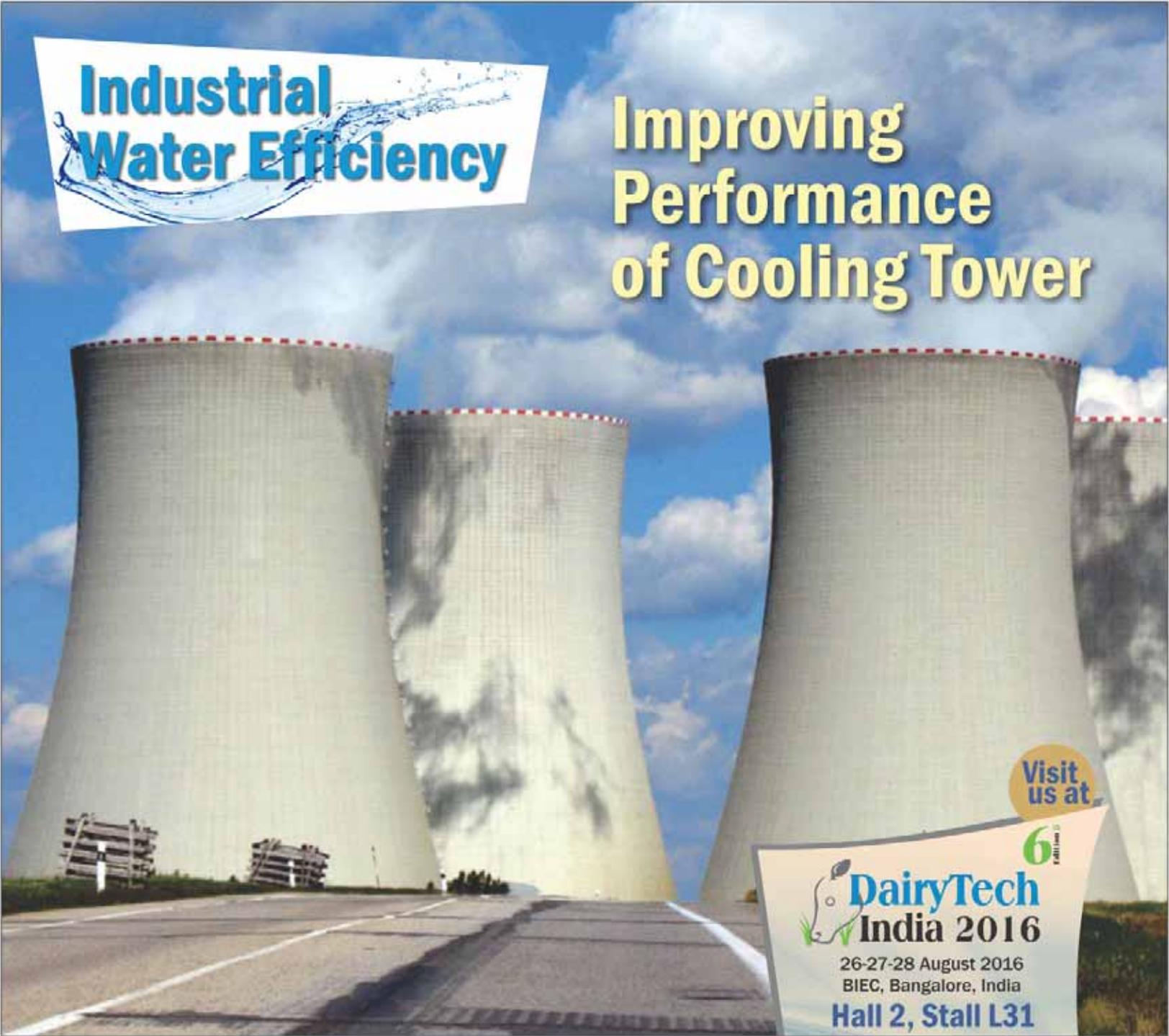


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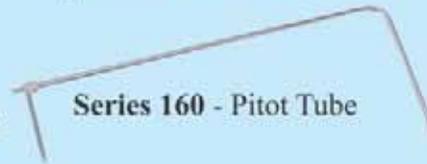
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Publisher's Letter



Publisher's Letter

Water And HVAC&R Industry

Readers often ask me why we do talk about water systems and all in this magazine, which is dedicated to HVAC&R industry. Let me be a bit narrative. Basically, when we look at it from the residential perspective, HVAC&R is a native of the comfort zone. However, comfort is incomplete without water. When we focus on industries, the co-relation is clearer, in the sense in various industrial processes: for example – air washing or inside the condenser; presence of water is obvious. So, the connection between the HVAC&R industry and water is inevitable.

World's biggest and most prestigious sports event Rio Olympic is going on in full swing. According to a NY Daily News report dated July 05, 2016, i.e., just towards the final round of the Olympic's arrangement, Brazilian researchers had discovered a great setback. Yes, I am talking about the discovery of spread of the drug-resistant 'Super Bacteria' in Guanabara Bay and Ipanema, Lebon, Botago, Flamengo and Copacabana beaches, where some of the water and wind sports events of Rio Olympic were scheduled. Obviously, it was a great risk to the the participants, organisers and spectators.

Coming back to the industry: we all know that Cooling Towers are the integral parts of the industrial cooling systems. How many of us are aware of the need to control Legionella bacteria that may grow in Cooling Towers. Any operator of Cooling Tower may get infected to Legionnaires' disease just by inhaling small droplets of the tainted water, which are often seen near Cooling Towers. Legionella Disease Bacteria, (*Legionella pneumophila*) also called LDB, grow vigorously when the water temperature is between 25°C to 45°C. According to OSHA, "Temperatures of 32°C-40°C are ideal for (LDBs') growth. Rust (iron), scale, and the presence of other microorganisms can also promote the growth of LDB."

In June (this year) the health department of New York announced a comprehensive plan to lower the risk of Legionnaires' disease outbreaks in the city. According to a communiqué from them, "The cornerstone of the City's preparedness is rigorous oversight and enforcement of the new cooling tower requirements outlined in Local Law 77, which focuses on preventive maintenance of the city's cooling towers, which took effect on May 9, 2016."

Thus, obviously, water and HVAC&R are two inseparable 'fields', in our jargon 'beats'.

Please send your comments at pravita@charypublications.in

Pravita Iyer
Publisher & Director





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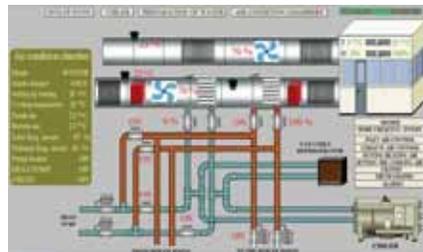
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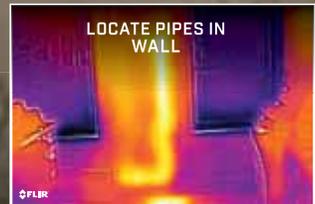
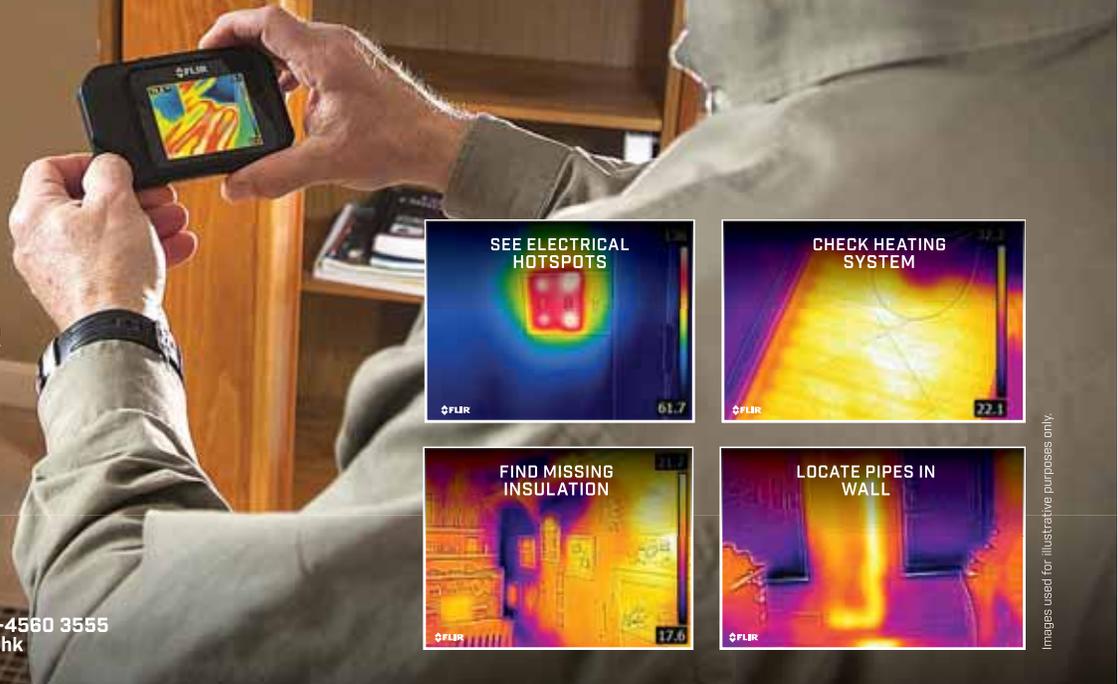


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FROM THE EDITOR



Cooling Tower Management

Keeping the Cooling Tower (and the circulating water) clean, in the sense, scale-free, dissolved particles free, TDS free, bacteria free and so on... is a big challenge today. Being generally kept outside the refrigeration room and /or premises, the cooling towers are often not paid proper attentions, however their contributions in the entire cooling circuit is very significant.

Formerly, (say) even three decades back, Feed & Bleed of the circulating water was quite common to maintain the quality of the circulating water. However today, when the entire world – especially the developing countries – are experiencing threatening water scarcity, the plant operators and the plant management have to be very careful as far as the waste of water is concerned.

Keeping the cooling tower clean improves the efficiency of the heat removal process, which decreases the energy cost of the business. Besides, it also saves several other costs such as frequent replacement of the corroded components in the water circuit. Under today's pollution-infested scenario, it's a big challenge for every plant owner. Maintenance of water turbidity, dissolve O₂, conductivity, pH, alkalinity, hardness, bacteria etc., within the specified (prescribed) limit is not so easy. The situation becomes more complicated because of flying dust particles in today's polluted environment.

Although technological progress has made available many state-of-the-art instruments – for example: pH meters, Dissolved Oxygen (DO) meters, Turbidity monitors (Nephelometric and Surface Scatter types) etc., and most of them can now send online information, managing cooling towers most efficiently and effectively is still a matter of good and timely human judgement – especially in developing countries – where cash crunch often diverts priority.

Coming back to the water conservation point: cooling tower basin corrosion leading to leakage is not very uncommon in the developing countries, mostly untreated or under-treated water leads to such a situation. Although many plant owners install several modern monitoring instruments in their plants during commissioning, regular monitoring & maintenance of the instruments themselves is absent, which leads to wrong indications.

Thus, to maintain the cooling tower in its best performance level, not only we need to commission the best quality instruments – but also we must focus on their regular maintenance that includes sensitivity check, calibration and test for (online) signal transmission. Am I right?

Pl. send your views at pkchatterjee@charypublications.in

P. K. Chatterjee



Not only we need to commission the best quality instruments – but also we must focus on their regular maintenance...



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905-906, The Corporate Park, Plot No. 14 & 15,
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Vashi, Navi Mumbai - 400 703.
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Samsung India shifts its corporate headquarter

Samsung India has recently moved to its new Corporate Headquarters at Two Horizon Center, Gurgaon, Haryana. The office spread over five floors with a carpet area of 232,000 sq ft. is now home to 1,500 employees.

The event was graced by Kalraj Mishra, Minister for Micro, Small and Medium Enterprises, Govt of India; Cho Hyun, Korean Ambassador to India;

Santosh Gangwar, Minister of State for Finance, GoI; Kiran Rijju, Minister of State for Home Affairs, GoI, and Vipul Goel, Minister of Industries and Commerce, Environment and Industrial Training, Government of Haryana; and other senior government dignitaries and partners.

HC Hong, President and CEO, Samsung Southwest Asia along with his senior executives hosted the event on behalf of Samsung India.

While addressing the gathering during the inauguration ceremony, Minister Mishra said, "We will like to extend our best wishes to Samsung India on moving to their new office. Over the years, Samsung has won the trust and confidence of the Indian consumers and has emerged as the largest mobile and CE player in the country. Samsung India's tie up with MSME (Ministry) as part of their Corporate Social Responsibility initiatives will go a long way in harnessing the skill potential of Indian youth."



Union Minister for MSME Kalraj Mishra is inaugurating the new office in the presence of other dignitaries...

Carrier introduces the newest generation of Aquaforce

Carrier has launched the newest generation of AquaForce chillers and heat pumps that are using HFO R-1234ze. HFO R-1234ze is a very low Global Warming Potential (GWP) refrigerant and part of the Carrier PUREtec family of long-term refrigerant solutions. Carrier that operates in France as Carrier France is a part of UTC Climate, Controls and Security, a unit of United Technologies Corp.

The selected refrigerant for screw chillers, HFO R-1234ze has a GWP of less than 1 [Based on IPCC 5th assessment report (GWP 7 according to the 2010 assessment of the SAP of the Montreal protocol)] and is not subject to the Hydrofluorocarbon (HFC) phasedown needed by the European Union's F-gas regulation.

Didier Genoix, Director, Engineering and Marketing, Carrier HVAC Europe, said, "AquaForce with PUREtec refrigerant is a trusted product already used in several installations throughout Europe, which has received a seal of approval from the segment. There already are more than 20 projects using AquaForce with PUREtec refrigerant in Switzerland, Norway and France."

Comserve bags a three-year contract from Allied Irish Bank

Comserve, a mechanical and electrical maintenance and installation services arm of Incentive FM Group has bagged a 3-year contract to provide services to Allied Irish Bank at its 22 sites across the UK. The contract covers both office buildings and high street branches – and is designed to make sure a compliant and comfortable environment for both employees and customers. As per the deal, Comserve will be accountable for all heating, AC and lighting equipment across the sites, in addition to undertaking minor fabrication repair and refurbishment.

Comserve's 70-strong mobile engineering team will provide a fully planned maintenance programme including all statutory testing and inspections. Moreover, it will provide a 24/7, 365 emergency call-out services with pre-agreed response times to support the demands of AIB's stakeholders and customers.

Tim L'Angellier, Property and Facilities Manager, Allied Irish Bank, said, "During the tender process, the team at Comserve was able to demonstrate that they could deliver high levels of customer service whilst also ensuring overall value for money."

Danfoss, Sondex sign agreement targeting better market position

Recently, Danfoss and Sondex entered into an agreement for Danfoss to acquire full ownership of privately-held Sondex Holding A/S, which is well known for heat transfer technologies. Sondex represents an ideal match to the Danfoss' heating business segment – as it develops, produces and markets heat exchangers. Hence, the acquisition confirms Danfoss' strategic focus on building leading positions and accelerating profitable growth.

The collaboration of these two businesses will be an important lever to develop the already strong market position in district energy and HVAC, and to increase relevance within industries – such as marine, food and beverage, off-shore, and industrial refrigeration. The company becomes part of the Danfoss Heating business, upon regulatory approval of the transaction. The parties have not disclosed the purchase price or other conditions of the transaction.

Niels B Christiansen, President and CEO, Danfoss, said, "Sondex is a well-performing company with a second-to-none heat exchanger expertise, which perfectly fits our ambition to further strengthen our position within heat transfer solutions. By joining forces we are able to offer a broader, even more competitive and innovative product and service portfolio within heat transfer to the benefit of our customers."

Age Søndergaard Nielsen, CEO, Sondex, said, "Sondex and Danfoss both come from positions of strength and we already enjoy a strong and long-standing relationship in key areas. Now, we combine our businesses to make an even bigger impact in the markets we serve."



(L2R) Age S Nielsen and Niels B Christiansen

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You Still can't beat the System when it's all FRICK INDIA

Cool-Therm supplies HFO refrigerant-based chiller to Nottingham University

Cool-Therm is pioneering in a new direction with the application of HFO refrigerant in a traditional reciprocating compressor-based chiller.

The company has supplied an HFO-based reciprocating chiller to the University of Nottingham. The purpose of it is to cool the university's new Centre for Sustainable Chemistry, which has been built by Morgan Sindall and designed to be carbon neutral and has exceptional environmental credentials. The refrigerant HFO1234ze has been chosen due to its very low global warming potential (around 5-6) that attracts additional BREEAM and LEED credits.



The HFO chiller...

The 60 kW ducted VHR chiller, manufactured by Italian company Geoclima, is equipped with refrigerant leak detection and an automatic pump down system, to separate the plant from the building in the event of a leak. Noise emissions are also an important design consideration. Acoustic control is used on both the intake and discharge sides of the plant with special air intake louvres, designed and installed by the contractor on the project, Imtech Engineering Services Central.

Martin Sharman, Head of Cool-Therm's Midlands office, said, "The project demonstrates the increasing interest in the market for low GWP cooling solutions. There is no doubt a change taking place among forward-thinking consultants and end users. As a result of the new F-Gas Regulation, and the question mark over the long-term future of traditional HFC refrigerants, people are understandably looking for alternatives." ■

Daikin to establish its first production base in Vietnam

Daikin Industries, Ltd. has decided to invest approximately 10 billion yen in the Thang Long Industrial Park II situated in the suburbs of the capital of Hanoi in the Socialist Republic of Viet Nam.

The investment will establish company's first production base in Vietnam. With operations scheduled to commence from April 2018, the factory is slated to manufacture residential-use air-conditioners and join existing Daikin production bases in Thailand, Malaysia, and India as the newest factory in Asia.

Increases in population and higher income levels have led to expansion of the air conditioning market. As a result, the company is expanding its sales network and strengthening its after sales service system in Asia. Sales are steadily growing in countries as Vietnam, Indonesia and Thailand.

Demand for ACs in Vietnam has experienced speedy growth centring chiefly on residential-use ACs owing to the country's remarkable economic development and growing middle class. Demand continues to grow and has become the biggest market in Asia for air-conditioners. ■

Eaton's new version of MV AFD will help customers reduce costs

Eaton, the power management company has launched a new version of its medium-voltage SC9000 Adjustable Frequency Drive (AFD), which has been designed to assist its customers to support energy efficiency, reduce ownership costs and enhance power system reliability. The SC9000 General Purpose (GP) drives are designed for an extensive range of Original Equipment Manufacturer (OEM), water and wastewater, utility, industrial and Heating, Ventilation And Air Conditioning (HVAC) applications.

The SC9000 GP, based on the enhanced design can be maintenance-free for up to 10 years. These drives have a low part count topology, and are standard-equipped with a redundant cooling system to help improve reliability.

Customers can shift from low-voltage to medium-voltage drives for applications at lower power ranges. Presently, medium-voltage drives are typically used in applications starting at 300-500 hp range. Depending on overall system characteristics, the drivers can be used cost-effectively in applications starting at 100 hp. They are tested to Underwriters Laboratories (UL) and Canadian Underwriters Laboratories (CUL) standards for medium-voltage power conversion equipment. These solutions are designed to help customers choose the solution that fits specific application requirements. ■



Eaton's Adjustable Frequency Drive (AFD)...

Air Products to supply oxygen to KCC Corporation on a long-term basis

Air Products, a well known supplier of integrated solutions to the global glass industry, has been awarded a long-term contract by KCC Corporation, a glass maker and the largest construction material manufacturer in South Korea, to supply oxygen to the new glass wool production line at its Gimcheon facility. The new production line is scheduled to come onstream in 2017.

Air Products will install a PRISM Vacuum Swing Adsorption (VSA) oxygen generator at KCC Corporation's Gimcheon site – to supply on-site gaseous oxygen to the furnace for full oxy-fuel combustion, an advanced technology proven to make glass manufacturing cleaner. By maximising efficiency and significantly reducing energy requirements, the PRISM product line provides reliable, economical and eco-friendly on-site supply solutions.

"We have been supplying different offerings to KCC Corporation, including at the Gimcheon site, and are honoured to have won their continued confidence. Our longstanding relationship, as well as the latest contract with this strategic customer, demonstrates Air Products' capabilities in supporting the growth of a leading glass maker and also the industry as a whole," said Kyo-Yung Kim, President of Air Products Korea.

Air Products is a leading supplier of integrated solutions to the global glass industry, from gas supply to combustion systems, technology, customised control systems etc. ■

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I-SENSE, Dioxide Materials partner to conserve energy

Florida Atlantic University's Institute for Sensing and Embedded Network Systems Engineering (I-SENSE) and Dioxide Materials have formed a unique partnership to develop and evaluate a novel low-cost, low-power, wireless CO₂ sensing system for Heating, Ventilation and Air-Conditioning (HVAC) applications. The technology that emerges from this joint project will facilitate to considerably lower the amount of energy businesses and homes use for HVAC.

Dioxide Materials, in collaboration with FAU's I-SENSE, has received a Small Business Technology Transfer (STTR) grant from the U.S. Department of Energy to work on the project. This project builds on a private/public partnership that leverages the complementary skill sets and associated innovations of both organisations.

Dioxide Materials has developed low-cost, low-power CO₂ sensors for building HVAC applications. Their technology employs electrochemical sensors, similar to those in a household Carbon Monoxide (CO) alarm, making the sensor sensitive to carbon dioxide rather than carbon monoxide. The sensors can be manufactured much less expensively than the current generation of CO₂ sensors and can run on batteries.

Presently, Dioxide Materials has operational sensors, but needs the electronics and communications systems to unite the sensors to a building's Direct Digital Control (DDC) systems. I-SENSE is a leader in the design and application of low-cost, low-power telemetry platforms and sensor network systems. Collectively, the team will develop the electronics and software necessary to interface Dioxide Materials' sensors to a building's DDC system. This new technology will help in lowering the amount of energy that homes and businesses use for HVAC based on whole-building CO₂ monitoring without the need for expensive building rewiring. Most recent HVAC systems are designed to supply constant ventilation based on the design occupancy of the space. However, this method often results in significant wastes of energy and energy dollars. Demand Control Ventilation (DCV), the automated process that adjusts the volume of fresh air or outside air into a building, saves energy and electricity costs by using CO₂ sensors to measure the air quality and occupancy in each room, and adjusting the HVAC system accordingly. Although DCV is often seen in the construction of new multisensory LEED buildings, it has been slow to be adopted in commercial retrofits or remodeling projects. ■

CIMCO Refrigeration teams up with Mayekawa Manufacturing



The NewTon refrigeration system utilises ammonia and CO₂ refrigerants...

CIMCO Refrigeration Inc., Southern California Edison (SCE) and Mayekawa Manufacturing Company are collaborating to develop, build, install, and research natural alternatives to Chlorofluorocarbon (CFC) refrigerants.

Of late, the team installed a novel, high-efficiency industrial refrigeration system at a food manufacturing facility in Irvine, California. Researchers anticipate the system to provide a 20 to 50% energy savings and be less impactful to the environment.

The NewTon refrigeration system utilises ammonia and CO₂, two natural refrigerants, to attain a higher level of efficiency and energy savings than normal refrigeration systems in the market today. ■

Australian households help Panasonic bag five stars

During Canstar Blue's annual survey in Australia, hundreds of households who of late purchased and installed new air conditioning units, were asked to rate their brand on a number of important variables, including ease of use, reliability, quietness and value for money.

Panasonic scored five stars for overall customer satisfaction, in addition to every other category among seven big name brands featured in the final results. Hence, the company joins Daikin and Fujitsu General in claiming the award for air conditioners twice in the six years of these ratings. It last topped the ratings table in 2014.

Head of Canstar Blue, Megan Doyle, said, "Panasonic is a pioneer of air conditioning innovation, with its broad range of products coming equipped with a number of highly impressive features."

He further added by saying, "No doubt these features are impressing consumers, but Panasonic is also still delivering on the basics – namely that its air conditioners are easy to use and reliable, while also representing good value for money." ■

Axiom raises money to scale up thermal energy storage solution

Axiom Exergy; in order to bring dynamic energy storage to both utilities and facilities with large refrigeration needs; has raised \$2.5 million from notable investors. The list of investors include the Element 8 Fund, Victory Capital, the MIT Angels, angel investors on the Propel(x) platform, the Sierra Angels, JB Straubel (co-founder and CTO of Tesla Motors), and other undisclosed investors. The company's growing pipeline includes over \$5 million in orders.



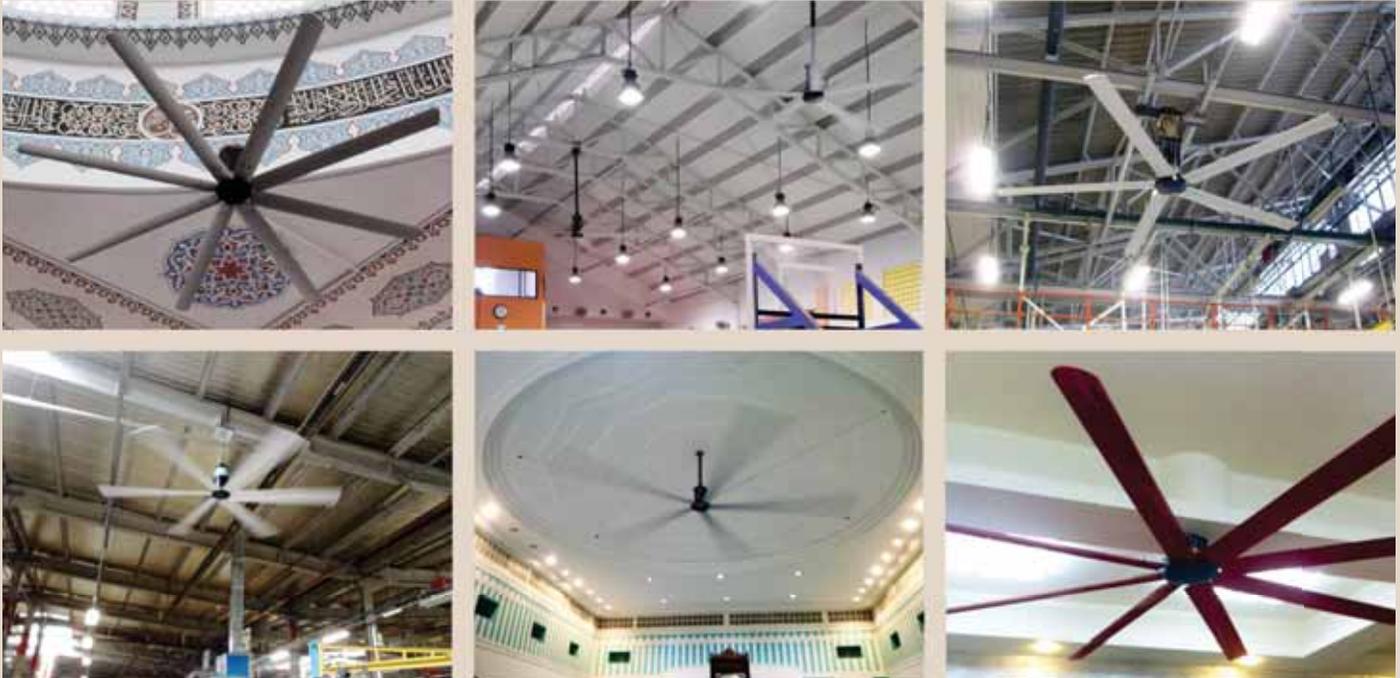
A screenshot of Axiom's solution...

The funding will assist the company in scaling its thermal energy storage solution in the grocery store and cold storage facility markets. By utilising Axiom Exergy's Refrigeration Battery, facilities and businesses like supermarkets and food distribution centres can reduce their peak energy demand by up to 40% and protect perishable inventory from spoiling during power outages with dedicated backup cooling.

The Refrigeration Battery can shift six hours of a building's refrigeration-based electricity loads, providing the host and utility with a unique, long-duration, behind-the-meter asset. The technology works by using the existing refrigeration system's excess capacity to "store cooling" at night by freezing a tank of salt water. During afternoon peak hours, the Refrigeration Battery uses the frozen tanks to supply refrigeration services to the building, eliminating the need to run energy-intensive compressors and condensers. A non-invasive, modular, retrofit, the Refrigeration Battery operates in parallel with existing refrigeration systems to shift daytime energy loads to less expensive off-peak hours. ■

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Kelvion to introduce heat exchangers to reduce pollution

Under the motto "Green is the color of our solutions," Kelvion at this year's trade show SMM (to be held from 6 to 9th September, at Hamburg) will present components to enable the merchant-marine industry to enhance its efficiency and/or to reduce NOx and SOx emissions. For example, MGO plate heat exchangers, pre-assembled on a rack, serve to cool low-viscosity gas oil – which minimises the formation of sulfur compounds in fuel tanks.

In addition, high-pressure exhaust gas recirculation coolers effectively reduce nitrogen oxides in the exhaust of large diesel engines. The filtering of exhaust gases from gas turbines is, in turn, successful with Kelvion shell-and-tube seawater coolers with vacuum systems – which function as surface condensers.

The Kelvion Marine Gas Oil Cooling System (MGO) also serves to enhance efficiency: it filters gas oil and moderates its temperature, which increases its viscosity and improves its calorific value.

Presentations will be rounded out with the Bloksma FlowBox, at its world premiere. This maritime cooler for tugboats, freighters, dredges, and supply ships develops greater cooling effect than do conventional box coolers, thanks to demand-controlled forced circulation of the cooling seawater. ■



Exhaust gas recirculation cooler...

EPTA is gearing up to cater to the future trends

What is the future of refrigeration? What are the new ideas for natural refrigerants? Epta will respond to the requirements of the future by presenting at Chillventa, along with the major experts from the sector, the driving forces behind innovation in the coming years.

Chillventa, the leading biennial fair for refrigeration, air-conditioning, ventilation and heat pumps, is scheduled to take place from 11 to 13 of October in the Nuremberg Exhibition Centre.

It is an important opportunity for producers, associations and universities to discuss and share best practices in the design of extremely efficient solutions that are geared towards ecosustainability.

With more than 31,000 visitors expected and about 1,000 registered exhibitors, the three-day event, which is now in its fourth edition, looks set to be the most popular edition of all. Moreover, the exclusive Chillventa CONGRESS and the numerous meetings that have been organised, including the Refrigeration Forum, further contribute to the attractiveness of the event. ■

Phononic's products to offer better temperature control

Phononic, the company revolutionising cooling and heating with solid-state technology, pico-TEC series, a high-performance solid-state Thermoelectric Module (TEM) designed to provide precise temperature control in order to meet the unique thermal management requirements of optoelectronics and fiber optic modules.

The company's pico-TECs are manufactured using advanced automated semiconductor fabrication technology and provide superior performance and reliability with ultra-thin form factor flexibility.

"This new generation of ultra-thin semiconductor technology removes barriers to miniaturization and enables higher data rates and operating speeds in a whole range of electronic applications," said Michael J. Bruno, Vice President and General Manager of Phononic's electronics cooling business unit.

Bruno further added, "Optoelectronics and fiber optic communication devices, such as Fiber To The X (FTTX), CATV and optical LAN requiring active cooling in an extreme form factor can immediately benefit from our pico-TECs." ■

Trane's Compact Vertical Blower Coil to improve energy efficiency by up to 66%

Trane, a brand of Ingersoll Rand and a well known provider of indoor comfort solutions and services, has introduced a new compact vertical blower coil to its terminal products portfolio – a complete family of products that deliver improved efficiency, ease of installation, acoustics and temperature control.

Available as a single-zone Variable Air Volume (VAV) system with Tracer UC400 controllers, the blower coil can deliver up to 66% higher efficiency, temperature stability, quiet operation and dehumidification advantages for varying-occupancy space, ensuring occupant comfort.

Trane Single Zone VAV systems combine Electronically Commutated Motors (ECM) and factory programmed variable speed controllers – that adjust the speed of the unit's motor and its air volume to meet unique load requirements in various spaces of a building. Because it precisely matches load requirements, the motor's variable speed technology is ideal in partial load conditions.

"For applications, like schools, where available space is a concern, the new Trane compact vertical blower coil is a low profile air solution able to fit in small spaces that can be easily relocated, as building needs change," said Eve London, terminal products manager for Trane Service. "The blower coil is designed with the service panels located in the front of the unit to provide customers with an easy installation, startup and services process." added London.

Additional flexible design and configuration options include simple or complex controls, coil options and piping packages, making it an affordable system solution for a variety of building applications.

Terminal products also feature soft ramp technology that slowly increases and decreases fan speeds, adjusting to maintain temperature settings while dehumidifying the air. This improves indoor air quality by reducing the potential for mold or harmful bacteria in the building. Soft ramp technology also improves system acoustics by providing minimum air volume and eliminating noisy on and off cycling. ■

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Sheila Hayter

Hayter's role is the beginning of a three-year commitment to industry leadership...

ASHRAE appoints Sheila Hayter as its new Treasurer

Sheila Hayter, a Group Manager in the Integrated Applications Centre at the Energy Department's (DOE) National Renewable Energy Laboratory (NREL), has been officially appointed as Treasurer of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) at its 2016 annual conference in St. Louis, Mo.

Her role as Treasurer is the beginning of a three-year commitment to industry leadership, culminating in serving as the President of ASHRAE during the 2018-2019 term. She will serve on the board of directors and ASHRAE's Executive Committee, Chair the Finance Committee and serve as Vice Chair of the Members Council, the President-

Elect Advisory Committee and the Grassroots Government Advocacy Committee.

At NREL, she leads a team of tech. and policy experts who support federal, state and local entities on renewables and energy efficiency topics with the goal to make significant reductions in non-renewable energy consumption through energy efficiency and the increased use of renewable technologies. Since beginning at NREL, she has led DOE's Solar America Cities technical assistance activities. Now she's a part of the DOE SunShot Initiative's Solar Energy Resource Centre, to assist municipalities in incorporating strategies into projects that result in widespread use of solar technologies. ■



John Smith

John has been in the RAC industry for over 30 years in a variety of technical sales roles...

John Smith becomes President of British Refrigeration Association

John Smith, Group Technical Director for Beijer Ref UK & Ireland, has taken over the role of President of the British Refrigeration Association (BRA). He succeeds Mike Lawrence – a stalwart of the BRA, who has held the position since 2014.

The trade associations rely on individuals volunteering to take on such roles, supported by their companies, and Mike has epitomised this in his years of service with the BRA. The handover took place at the recent FETA Strategy Forum, held in Marlow.

John has been in the RAC industry for over 30 years in a variety of technical sales roles, and has been an active member within the BRA. He is currently the Chairman of the Equipment and Components section, and has been Vice President since 2015.

John commented by saying, "I would like to pay tribute to the sterling work Mike has done for the BRA in

his time as President, and I look forward to taking on the role in what will be challenging times for our industry."

The British Refrigeration Association (BRA) is the only trade association representing manufacturers, importers, wholesalers, distributors, contractors, specifiers and end-users of refrigeration plant, equipment and components.

It also includes producers of refrigerants and lubricants, colleges and training establishments. It works closely with government, public bodies and other organisations, both in the UK and overseas, to further the interests of the refrigeration industry.

BRA was originally formed in 1940 under the name "Commercial Electric Refrigeration Association." It has worked continuously since 1940, as CERA, BRA, BRACA and now again BRA to promote the interests of the refrigeration industry. ■



Malcolm Thomson

Thomson is a former Chairman of the BESA South Midlands Regional Branch...

BESA elects Malcolm Thomson as the President for 2016-17

Building Engineering Services Association (the BESA) has elected Malcolm Thomson as the President for 2016/17 at its annual general meeting on 7th July 2016. In 1972, Thomson began his career as a technician apprentice with Sadia Airofreeze, studying at Willesden College of Technology. After completion of his training, he installed and serviced supermarket display cabinets and cold rooms for BOC Linde – later joining Subcool that focused in commissioning large centrifugal and absorption chillers, where he rose to the position of Director.

He became a Director and Co-owner of Halcyon Air in 1985, before founding Enigma Environmental Services that provides a range of cooling and associated building engineering services, in 1999. He is also a co-owner of Kelvin Ross Engineering that specialises in marine AC.

A Fellow of the Institute of Refrigeration and a Director of the AC and Refrigeration Industry Board, Thomson is a former Chairman of the BESA South Midlands Regional Branch and Vice Chairman of the Refrigeration, Air Conditioning and Heat Pump Group, and a member of the Membership Committee. ■

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Powerhouse Dynamics receives 'IoT Evolution Business Impact Award'

Powerhouse Dynamics, inventor of the SiteSage enterprise asset and energy management system has been honoured with the Internet of Things (IoT) Evolution Business Impact Award for 2016. The award was presented at IoT Evolution Conference in Las Vegas. The Business Impact award recognises companies and business leaders who have successfully implemented IoT solutions.

The Business Impact award recognises the company's groundbreaking work in connecting equipment in commercial facilities into a single platform that delivers a range of benefits including improved equipment maintenance, reductions in energy and water usage and, in the case of food service organisations, enhanced food safety. SiteSage delivers a broad solution that fully leverages the IoT.



Above all, the award honours the company's achievements with Arby's Restaurant Group, Inc., where SiteSage technology has been rolled out across all 1,000+ Arby's company-owned restaurants. At Arby's, the SiteSage platform connects HVAC, refrigeration, cooking, and irrigation equipment to cloud-based analytics and controls to make sure operational efficiencies and energy and water savings, along with enhanced food safety, consistent product quality, and reduced product shrinkage.

Powerhouse Dynamics, CEO Martin Flusberg, said, "This award is particularly special because it recognises the very real impact of SiteSage implementations. We are turning the promise of the Internet of Things into reality at restaurants and retailers every day, driving practical change with cutting-edge tools." ■

Bath College's student wins the second SkillFRIDGE regional heat

Steven Monk, an air conditioning and refrigeration student from Bath College has been named the winner of the second SkillFRIDGE regional heat. He is a Level 2 first year apprentice studying at Bath College and working as an apprentice at Bath-based Company Ambient Engineering Limited. He waits to see if he has won a place to compete in the national finals at the Skills Show in November.

Monk says, "I wasn't expecting to win at all, and I'm over the moon. It was tougher than I expected. Although I'm studying air conditioning and refrigeration, I was out of my comfort zone because I normally do air conditioning (rather than refrigeration) in my day job. It's good to challenge yourself and set yourself goals."

SkillFRIDGE is a national competition for apprentices studying air conditioning and refrigeration from Level 2 to Level 3. The aim of the competition is to improve students' knowledge and experience, and to promote career opportunities within the industry. It is organised

by Data team Business Media and WorldSkills, which is responsible for running the international WorldSkills Competition every two years.

The top scorers from three regional heats go through to the final – where they could be selected for the WorldSkills UK training squad.

Head judge Mark Forsyth said, "This competition is held to raise the standard of professionals in the industry. This should be a benefit for employers, who will see the level of delivery to their clients improve." ■



CLEANPAK system named '2016 Laboratory of the Year'

The CLEANPAK system is a product offered by Nortek Air Solutions. This product is a complete air distribution and filtration cleanroom system. It plays a vital role in the University of Illinois Electrical and Computer Engineering (ECE) Building. Of late it was named R&D Magazine's 2016 Laboratory of the Year. As the receiver of this award ECE was recognised for its status as a teaching and research facility designed to encourage interdisciplinary interaction in a net zero-ready facility.

It was designed and constructed to set new standards in building energy use and invest in renewable energy, including a planned solar array. It utilises 50% less energy than the minimum building energy efficiency standards established in ASHRAE Standard 90-2007.

The CLEANPAK cleanroom system at the ECE Building includes Recirculation Air Handlers (RAH) using Nortek Air Solutions' patented FANWALL TECHNOLOGY features for air handling systems to supply the large volume of distribution air for the

cleanroom. Its further benefits include reduced noise levels, consistent airflow, improved energy efficiency and redundancy for reliable operations.

Harry Scott, Regional Manager for CLEANPAK products, said, "This product has been utilised by many universities wanting the state-of-the-art cleanrooms such as Princeton, Carnegie Mellon, Harvard, the King Abdullah University & Science Technology (KAUST), the Masdar Institute of Technology & Science (MIST) and most recently has been selected for MIT, Brown University and the University of Southern California." ■



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Cool-Therm presents award to E3 Consulting, Archetype

Cool-Therm has presented a major CIBSE award at a glittering event held at The Grosvenor on London's Park Lane, before an audience of several hundred leading consultants and end users.

The company's Managing Director Ken Strong presented the award for Project of the Year – Public Sector to E3 Consulting and Archetype, the designer and architect responsible for the Wilkinson Primary School, Wolverhampton.

The school has been built using recycled and reclaimed materials to reduce the overall embodied carbon of the building. A central heat recovery ventilation system helps reduce heating demand to less than 10% of a conventional school.

Mixed-mode ventilation means classrooms benefit from CO₂ levels five times lower than required by regulations, aiding children's well-being and concentration. In summer months, the building's internal environment is maintained using a passive, fabric-first

approach with mechanical cooling only required in the WC areas and kitchen.

The school achieved an A-rated Energy Performance Certificate without the need for renewables.

Strong said, "The awards reflect our values as a company. We have championed the adoption of new technology and approaches that make a real difference to both society and the environment. We are pleased to be able to present this award to such an excellent project, and continue our strong association with CIBSE, whose members do so much to promote and push forward the boundaries of heating, ventilation and air conditioning." ■



Chillventa AWARD: Coming For Four Categories

Chillventa is far more than just a trade show; this is where projects are brought to life, trends are set and innovative products are presented to the market...

Chillventa is without question the world's largest and most important trade fair today for the refrigeration industry with the air-conditioning, ventilation and heat pump sectors. For 2016, all the indicators are once again pointing towards success. The event organisers are already expecting an increase in both floor area and exhibitor numbers. Chillventa is far more than just a trade show; this is where projects are brought to life, trends are set and innovative products are presented to the market.

This is also where the community meets and where experts from around the world come together: Chillventa Connecting Experts. It was thus an obvious decision for NürnbergMesse to work together with a strong partner, Bauverlag, to launch the Chillventa AWARD. The prize is awarded in the four categories of commercial refrigeration, large-scale refrigeration, air-conditioning and heat pumps in recognition of special and exemplary expert team projects.

"We are very pleased that we will be awarding the Chillventa AWARD this year for the first time. There are not many sectors of industry that are as innovative and inventive as the refrigeration, air-conditioning, ventilation and heat pump community, and it is only right to highlight and pay tribute to this. At Chillventa, experts from around

the world meet, develop projects together and set them on track. It was therefore an obvious opportunity to invite entries for a high-quality competition to evaluate the best, most exciting and most innovative projects in four categories and to present them with the Chillventa AWARD. Chillventa is an ideal platform for a prize of this quality," stated the Chillventa AWARD initiators, Christoph Brauneis, Senior Editor KKA, tab and Jury Member, and Daniela Heinkel, Director Exhibition Chillventa, NürnbergMesse.

The Chillventa AWARD – paying tribute to expert team achievements

The Chillventa AWARD is presented by NürnbergMesse in cooperation with the Bauverlag publishing house, with its trade journals "KKA Kälte Klima Aktuell" and "tab – Das Fachmedium der TGA-Branche". It honours teams of experts (planners, system builders, principals/operators), who, in an exemplary collaboration going beyond normal technical standards, have realised a project that excels in terms of functionality, energy consumption and technical innovations. In evaluating the projects, the jury – in line with the Chillventa motto of "Connecting Experts" – will focus in particular on the interplay between the people involved in the project, from conceptual formulation, through planning and system construction to the operation of the system.

Alongside these points, the Chillventa AWARD will also consider the above-mentioned aspects of the system's functionality, energy consumption and technical innovation. Other aspects, such as compliance with the planned budget and timetable, environmental safety requirements, certifications, etc., will be integrated into the jury's assessment. The Chillventa AWARD considers any form of refrigeration, air-conditioning or heat pump system (new or refurbished) that has been carried out in Europe. ■



Epta France Wins Janus de l'Industrie

Epta's 'E-Lockers' is a complete system that makes the company an ideal partner for retailers who are focused on a multi-channel approach...

Epta's commitment to make a material contribution to each client's business and future success through the most effective enhancement of his/her store's appearance and originality is a real identifying asset for the group, which has once again been verified by Epta France's winning of the prestigious Janus de l'Industrie for the third consecutive year for its innovative E-Lockers.

These are refrigerated lockers that can be installed along the route between people's homes and workplaces, for example in stations or in company's premises, to enable consumers to collect the fresh and frozen products they purchased on line from retailers' websites. This is a revolutionary solution that guarantees to conserve items for more than 24 hours and enables retailers to get even closer to their customers, while reducing their carbon footprint by eliminating home deliveries.

Moreover, as a guarantee of the highest level of ergonomics and safety, the E-lockers comply with the PMR and VIGIPIRATE regulations.

This year the ceremony in honour of the lauréats will be held at the Hôtel du Ministre and will be chaired by Matthias Fekl, Secretary of State at the Ministry of Foreign Affairs and International Development, who is responsible for International Trade, as well as the Promotion of Tourism and French overseas.

It is an opportunity to reward 16 original products in the Industry & Commerce sector, which include Epta France's E-lockers.

Christian Le Gousse, General Manager of Epta France says, "We are proud to have been awarded the



EPTA France wins the Janus De l'Industrie once again for its E-Lockers...

exclusive Janus de l'Industrie for the E-lockers project, a revolutionary solution we developed by integrating our expertise in commercial refrigeration with the skills of our new Pole for Digital Innovation. Specifically, it wasn't just the design and production of the first refrigerated lockers that Epta dealt with in-house, as we also produced the dedicated software for the distance monitoring of the E-lockers (ordering of the products and verification that the lockers are functioning correctly), the communication screen on the E-lockers (for the collection process) and the interface program with the Retailers' websites."

He further adds, "It is a complete system that makes us the ideal partner for retailers who are focused on a multi-channel approach in order to expand the potential of their businesses."



www.drirotors.com



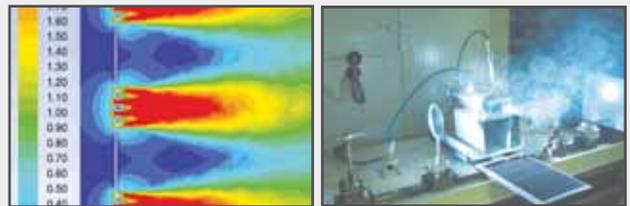
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Best Practices In Operation & Maintenance

It is not uncommon to find system valves either not working, or if they are operational, they are not able to perform the function they have been installed for. So, what should be done?

HVAC systems are an integral part of all modern work spaces as the nature of work has changed dramatically over the last 2 – 3 decades. IT/ITES would not have been possible without the availability of large, thermally stable work environments for the thousands of software developers business processing operations that we see in the IT developments around us. Air conditioning has enabled work to be carried out 24x7, irrespective of the weather outside or the time of the day, which in turn has enhanced the productivity of the users who contribute to such developments.

A key component in any HVAC system is the system valve. Water cooled systems in particular have a large number of valves that enable the system to function effectively and as per design. In addition, Valves also allow system operators to undertake repairs to the required sections of the system without effecting the overall system, thus reducing maintenance load and increasing system availability.

While the system valves are important components of the water cooled system, they do not get as much attention as they deserve from the Operations and Maintenance teams. It is not uncommon to find system valves either not working, or if they are operational, they are not able to perform the function they have been installed for.

Overview of HVAC valves

A valve is primarily designed to regulate the flow of fluid in a piping system, including stopping, changing direction and pressure of the fluid. Valves in HVAC system can be either manual or automatic, depending on the function that the valve serves. Table 1 lists the main types of control valves used in HVAC systems.

Table 1: Main types of valves in HVAC systems...

Type of Valve	Function	
Ball Valves	General purpose	
Butterfly Valves	Isolating system sections	
Globe Valves	Modulating System pressure / Flow	

Control valves

There are two types of control valves commonly used in HVAC systems – the 2-way and 3-way control valves. 2-way control valves are used in applications where there is a variable flow while the 3-way valves are used in constant flow systems. Figure 1 shows the typical arrangement of 2- and 3-way valves.

The key characteristics of control valves are the amount of fluid flowing through the valve and the travel of the valve stem. The flow is typically expressed as a percentage of the full flow whereas the amount of travel of the stems as a percentage of travel. These two characters are plotted on a graph to give the valve characteristics curves that are used for valve selection. Figure 2 shows the types of flow characteristics. The flow across the valves is classified into:

- Linear flow where the flow is directly proportional to the amount of opening of the valve or the travel of the stem.
- Quick opening valves allow a higher amount of flow at the initial travel of the stem, with the flow plateauing towards the full length of travel. Butterfly valves are quick opening and are used in applications requiring quick shut off.
- Equal Percentage Valves – In these valves, equal percentage of valve travel will result in an equal increase or decrease of flow. Ball and globe valves are equal percentage valves.

Flow control valves are specified based on the following parameters:

- Amount of flow across the valve and the pressure drop experienced across valve. The flow coefficient is used to link these two parameters.
- Maximum pressure that the valve can withstand when closed.
- Pressure drop across the valve in the system.

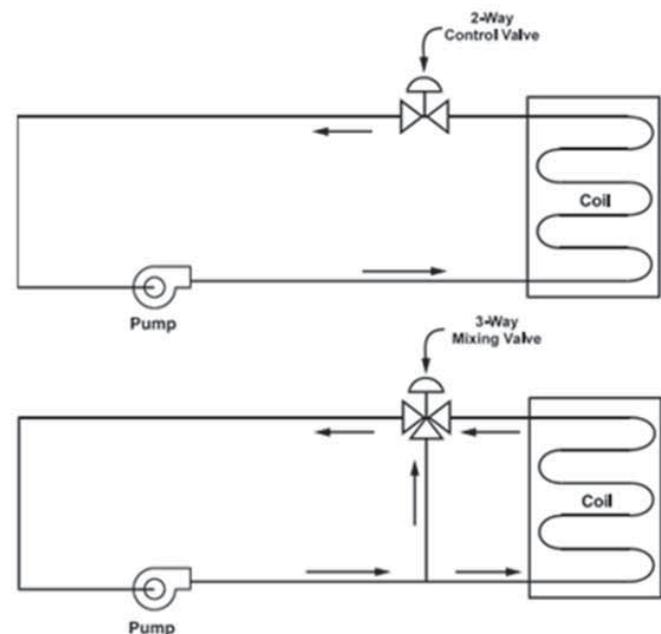


Figure 1: 2- and 3- way valve arrangements...

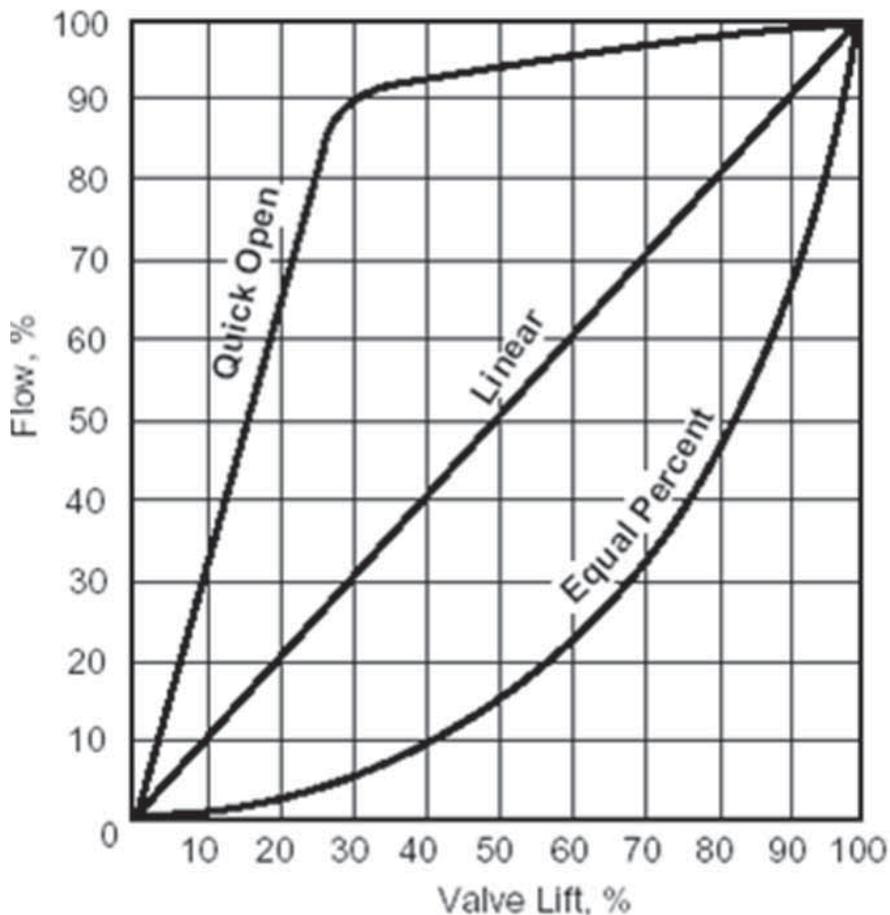


Figure 2: Valve flow characteristics...

- Parameters of the fluid – Temperature and pressure – that the valve can withstand.

HVAC system valve maintenance

The design of modern valves is quite robust, and hence they are highly reliable and rugged. When a system is commissioned, due to the valves design, there are very limited breakdowns and difficulties in operations. This invariably leads to a lower emphasis on maintenance of the system valves by the O&M team. In commercial and retail buildings,

since the operations are nearly 24x7, the valves are typically left in the open conviction and not operated in the normal course of operations. But when there is a defect in the system, and a section has to be isolated – does the valve get operated? Invariably, at this time, due to the valve not having been operated and maintained effectively, the valve does not function and the valve manufacturer is blamed for giving a low quality component.

Maintenance of valves is relatively easy but is still not undertaken. The cost to repair a

valve is up to 30% of the cost of a new valve. Replacement valves are also not easily available as the valves can sometimes be custom built.

In addition, spare valves cannot be stored for all the different valves that are used in the HVAC system of a building. Thus, an effective maintenance plan for valves will be essential to keep the stem functioning at full capacity. The main maintenance activities that are required for HVAC system valves are:

Daily Checks

- Visual inspection for any loose bolts, flanges
- Greasing of drive mechanisms
- Listening for abnormal noise, which is an indication of fault inside the valve casing

Periodic Inspections

- Six monthly testing of the valve for leakage should be undertaken.
- Valves that are not operated frequently should be operated through the full travel at least once a month.
- Where pressure gauges are provided at the upstream and downstream of a valve, the pressures should be compared to the valve manual to detect any wear in the valve body.
- Annual shut down of HVAC systems should include a check of large valves as the shutdown gives an opportunity to carry out the repairs, which would not be possible during the system operation.

Conclusion

Valves operating at the design parameters in an HVAC system are as critical for the system to work efficiently. A defective valve will lead to higher losses in the system, which in turn will result in higher pumping power and cost.

The cost and effort to maintain control valves is very minimal but is often neglected by the O&M team. A simple valve maintenance program, with a focus on basic maintenance practices is all that is needed to keep the valves in a healthy state.

The impact of a defective valve is unfortunately only felt when the valve is required to close – and it does not! The O&M team should thus include valves' maintenance as part of their planned preventive maintenance schedule, which will minimise the potential for system failure as well as lower maintenance costs. ■



Aneesh Kadyan
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Smaller Diameter Copper Tubes

Smaller Diameter Copper Tube heat exchangers enable high efficiency to be realised in diverse and dissimilar products, from cold vending machines and cold display cases to clothes drying heat pumps and mobile refrigeration systems...

Smaller Diameter Inner-Grooved Copper Tubes technology is expanding into all sizes of heat exchanger coils from small to very large. Not many years ago, there were just a handful of smaller diameter copper tube applications, but that is no longer the case. Smaller-diameter copper tubes can be found in a myriad of products, with tube lengths ranging from a few inches to several metres; and capacities ranging from hundreds of watts to hundreds of kilowatts.

Smaller Diameter Copper Tube heat exchangers enable high efficiency to be realised in diverse and dissimilar products, from cold vending machines and cold display cases to clothes drying heat pumps and mobile refrigeration systems; and Smaller Diameter Copper tubes are being used in large commercial and industrial systems too.

Once the small diameter tubes are interlaced with aluminium fin plates and mechanically expanded, the ruggedness of the Round Tube Plate Fin (RTPF) heat exchangers is remarkable. Such are highly valued for their corrosion resistance. Unlike systems made from aluminium, the high nobility of copper compared to aluminium results in the sacrificial corrosion of aluminium fins rather than the copper tubes. Consequently, there is scant chance of a leak even under harsh environmental conditions. That means Smaller Diameter Copper Tube designs are favoured in outdoor condensers and process cooling equipment.



Small Smaller Diameter Copper Tube Coils

Amongst the smallest-sized applications are the condensers and evaporators for bottle coolers and cold display cases, especially those using R290 as a refrigerant. R290 has an ultralow Global Warming Potential value (GWP) of 3, which makes it highly desirable as a refrigerant.

However, R290 is flammable, so minimising the actual volume of refrigerant needed is a must. Smaller-diameter tubes reduce the volume of refrigerant and increase the heat transfer efficiency, making it not only possible but also economical to use propane in eco-friendly applications.

Midsize Smaller Diameter Copper Tube Coils

Smaller Diameter Copper Tubes have been used in residential air-conditioning now for several years.

For example, of the total China's room air conditioner production, which amounts to 117 million units in 2014, 21.87 million units are with 5 mm inner-groove copper tubes based heat exchangers. In terms of growth, this is an impressive 55.7% growth as compared to 2012 – where the production of air conditioners with 5 mm inner grooved copper tube heat exchanger stood at 14.04 million units.

Very Large Smaller Diameter Copper Tube Coils

Companies such Lordan, LU-VE, Spirotech and Super Radiator Coils have developed expertise in the manufacture of large coils and condensers that use small-diameter copper tubes. These condensers typically are used in the air conditioning of commercial buildings or in process cooling.

LU-VE for example offers a standard line of condensers made from 5-mm coils, including three basic classes based on fan diameters of 350 mm, 500mm and 630 mm.

It is blue skies for the construction of heat exchangers for outdoor condensers using Smaller Diameter Copper Tube copper tubes. In



other words, heat exchanger designers just begun to tap into the potential of Smaller Diameter Copper Tube for such applications.

Reduced refrigerant volume is a very important factor considering the flammability of low-GWP refrigerants. Smaller Diameter Copper Tube helps in meeting the safety codes that may be developed for such systems while not compromising on the cooling capacity. Candidate refrigerants include Low Global Warming Potential (GWP) hydrofluorocarbons (HFCs) such as HFC-32 and ultra-low GWP Hydrofluoroolefins (HFOs), such as HFO-1234yf and HFO-1234-ze. Scores of refrigerants that are blends of HFCs are HFOs are also under consideration for various applications. Such refrigerant blends can be tailored to the application by making tradeoffs between performance, cost, GWP and flammability. ■

Avinash Khemka
Chief Manager-HVAC
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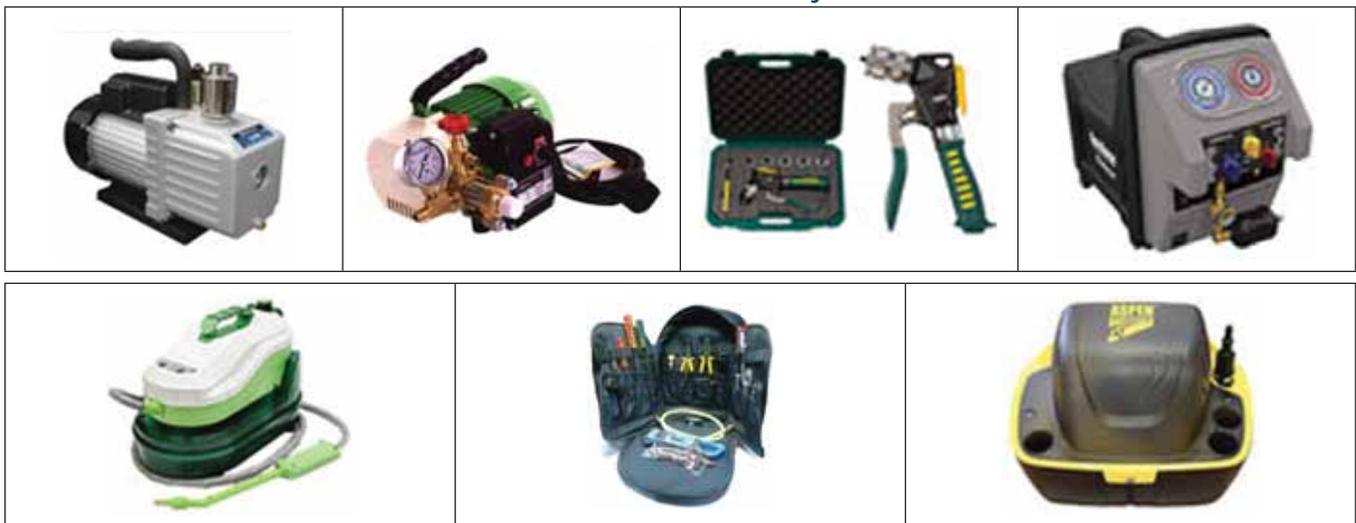
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Improving Performance Of Cooling Tower



With limited water resources available, more efficient cooling tower using nanofluids can save lot of water, increase cooling range and reduce heat exchanger size and footprint...

Nowadays, urgency in energy and water conservation in industrial processes is an essential issue because of the scarcity of energy and water resources. Among different cooling processes, evaporative cooling by using a cooling tower is an attractive and efficient option. However still there is a large potential to improve the efficiency of cooling towers to conserve energy and decrease water consumption. A cooling tower is a heat rejection device which rejects waste heat to the atmosphere through the cooling a water stream to a lower temperature level. Cooling towers are widely used in thermal power plants, air conditioning systems, oil refineries, petrochemical units and other chemical plants. Based on the contact between warm water and air flow, cooling towers are categorized to dry cooling towers and wet cooling towers. In dry cooling towers warm water is passed through tubes, and the air flow is passed between the tubes. As a result there is no direct

contact between water and air flows and heat transfer occurs only due to the temperature difference between air and water flow and as a result – have high capital costs, energy penalties, and operations and maintenance (O&M) impacts. On the other hand, in wet cooling towers there is direct contact between air and water. In these cooling towers because of temperature difference between water and air flow, sensible heat transfer takes place, while latent heat transfer is induced by differences in the relative humidity of the air and saturated air at the surface of the water drops. Due to combined sensible and latent heat transfers, wet cooling tower is much more efficient and preferable. However, as the moisture, produced due to evaporation of water, is removed and as a result, water use rate at plant with closed-cycle wet cooling increases, which may not be sustainable in many locations due to limited water storage and under water use restrictions. Hence, advanced technologies for reducing the water requirements of closed-cycle wet cooling tower represent a critical industry need.

The efficiency of cooling towers can be improved by optimising working parameters such as flow rate and temperature of water, flow rate, temperature and humidity of air, packing type and characteristics and geometry of the cooling power. Some of these parameters are not

controllable or cost-effective to change, while some are not applicable for working cooling towers. On the contrary, if a fluid with better thermal properties than those of water is used, it would be possible to increase the energy efficiency of working cooling towers as well as conservation in the water consumption, leading to tremendously cost reduction of the system. Adding heat absorption nanoparticles to the water is expected to significantly increase its heat transfer coefficient, heating capacity, and heat of vapourization. Hence, the use of nanofluids in the cooling tower instead of water may improve the performance.

Nanofluid as heat transfer fluid

A nanofluid is an engineered colloid suspension made up of a base fluid and nanometer-sized particles (nanoparticles). Nanoparticles have thermal conductivities, typically an order-of-magnitude higher than those of the base fluids and with sizes significantly smaller than 100nm. The introduction of nanoparticles enhances the heat transfer performance of the base fluids significantly. The base fluids may be water (generally used in cooling tower), organic liquids (e.g., ethylene, tri-ethylene-glycols, refrigerants, etc.), oils and lubricants, bio-fluids, polymeric solutions and other common liquids. The nanoparticle materials include chemically stable metals (e.g., gold, copper), metal oxides (e.g., alumina, silica, zirconia, titania), oxide ceramics (e.g., Al_2O_3 , CuO), metal carbides (e.g., SiC), metal nitrides (e.g., AlN, SiN), carbon in various forms (e.g., diamond, graphite, carbon nanotubes, fullerene) and functionalised nanoparticles. The nanofluid does not mean a simple mixture of solid particles and base fluid. In order to prepare the nanofluids by dispersing the nanoparticles in a base fluid, proper mixing and stabilisation of the particles is required. Normally, there are three effective methods used to attain stability of the suspension against sedimentation of the nanoparticles, which are summarised as follows: (1) control of the pH value of the suspensions, (2) addition of surface activators or surfactants and (3) use of ultrasonic vibration. All of these techniques aim at changing the surface properties of the suspended nanoparticles and suppressing the formation of clusters of particles in order to obtain stable suspensions. Compared to conventional solid-liquid suspensions for heat transfer intensifications, properly engineered nanofluids possess the following advantages: (i) High specific surface area and therefore

more heat transfer surface between particles and fluids, (ii) High dispersion stability with predominant Brownian motion of particles (iii) Reduced pumping power as compared to pure liquid to achieve equivalent heat transfer intensification, (iv) Reduced particle clogging as compared to convention slurries, thus promoting system miniaturisation.

The preparation of nanofluids is the key step in the use of nanoparticles to improve the thermal conductivity of fluids. Two kinds of methods have been employed in producing nanofluids. One is a single-step method and the other is a two-step method. The single-step method is a process combining the preparation of nanoparticles with the synthesis of nanofluids, for which the nanoparticles are directly prepared by Physical Vapour Deposition (PVD) technique or liquid chemical method.

In this method, the processes of drying, storage, transportation, and dispersion of nanoparticles are avoided, so the agglomeration of nanoparticles is minimised and the stability of fluids is increased.

But a disadvantage of this method is that only low vapour pressure fluids are compatible with the process. This limits the application of the method. The two-step method for preparing nanofluids is a process by dispersing nanoparticles into base liquids. Nanoparticles, nanofibers or nanotubes used in this method are first produced as a dry powder by inert gas condensation, chemical vapour deposition, mechanical alloying or other suitable techniques, and the nanosized powder is then dispersed into a fluid in a second processing step.

This step-by-step method isolates the preparation of the nanofluids from the preparation of nanoparticles. As a result, agglomeration of nanoparticles may take place in both steps, especially in the process of drying, storage and transportation of nanoparticles. The agglomeration will not only result in the settlement

and clogging of microchannels, but also decrease the thermal conductivity. Simple techniques such as ultrasonic agitation or the addition of surfactants to the fluids are often used to minimise particle aggregation and improve dispersion behaviour. Since nanopowder synthesis techniques have already been scaled up to industrial production levels by several companies, there are potential economic advantages in using two-step synthesis methods that rely on the use of such powders. But an important problem that needs to be solved is the stabilisation of the suspension prepared.

Nanofluid exhibit enhanced thermal conductivity and the convective heat transfer coefficient compared to the base fluid. Nanofluids have the potential to reduce such thermal resistances, and the industrial groups that would benefit from such improved heat transfer fluids are quite varied. They include transportation (coolant, fuel, and oil), power plant, industrial chiller, HVAC systems, electronics, medical (nanodrug delivery, cancer therapeutics, cryopreservation, nanocryosurgery, sensing and imaging), food, defense, nuclear, space and manufacturing of many types.

Performance improvement

Use of nanofluids in cooling tower is an excellent option to improve the performance. Nanofluids can improve the heat transfer performance of cooling tower in two ways: by increasing the sensible heat transfer as well as the evaporating heat transfer. Hence, inserting nanoparticles in the cooling fluid of cooling tower can significantly reduce the consumptive water use of conventional power generation and industrial refrigeration applications.

Figure 1 shows the layout of industrial refrigeration system with nanofluid cooled condenser, where the nanofluid is used as a heat carrier between condenser and cooling tower.

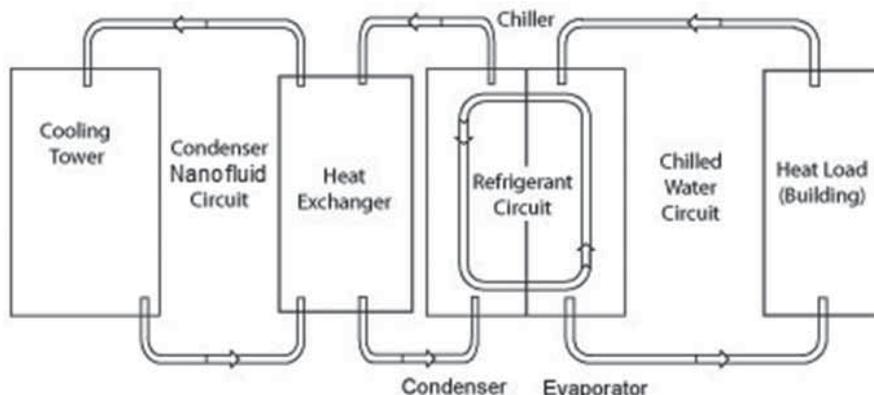


Figure1: Cooling tower using nanofluids in industrial refrigeration system...



Recent researches showed that the use of nanofluid improves the performances of both condenser and cooling tower leading to reduction of sizes of both.

The reason can be attributed to the fact that by dispersing nanoparticles in water, the surface area for heat transfer increases and the temperature gradient between different layers of fluid decreases (due to increased thermal conductivity).

Based on recent researches, the various advantages of using nanofluid in cooling towers may be summarised as systematically as given hereafter.

- i. Increase in heat transfer performance of cooling tower as well as condenser
- ii. Increase in efficiency of cooling tower as well as whole system
- iii. Reduction of water loss through evaporation
- iv. Increase in cooling range of cooling tower
- v. Enhancement of cooling tower characteristic (KaV/L)
- vi. Reduction of water consumption in the cooling tower
- vii. Reduction of sizes of both cooling tower and condenser

Challenges and future direction

Challenges to use nanofluids include long term stability of nanoparticles dispersion, increased pressure drop and pumping power, high cost of nanofluids and difficulties in production process. One of the main challenges in application of nanofluids in the industry is the stability of nanoparticles in the base fluid.

Use of surfactants can help to stabilise the nanoparticles in the base fluid. Thus finding the most suitable nanoparticle and surfactant for each system is of great importance. In recent years much attention has been given to the use of carbon nanomaterials including carbon nanotubes, graphene and carbon nanofibers as additives to improve the heat properties of fluids.

These nanomaterials have lower density, lower cost and higher thermal conductivity compared to many other nanoparticles. Practical methods must be developed for adding nanoparticles to industrial cooling circuits to replace losses through drift, evaporation, and blowdown. Also, impacts on economics, operation and maintenance need to be assessed, and environmental health and safety risks associated with nanoparticle releases need to be evaluated. Ultimately, full-scale field demonstrations will be required. ■

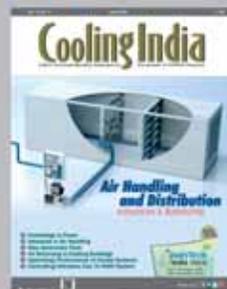
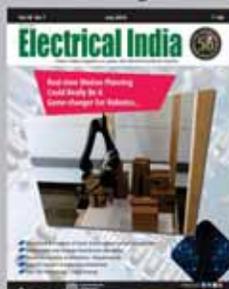
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Designing for Easier Handling

During development of the 4STQ – a double mechanical seal module – KSB's engineers strove to ensure that its installation and removal remained as straightforward as possible...

Frankenthal-based pump manufacturer KSB, the 145-year-old company is a well known supplier of pumps, valves and related systems. These industrial items are used in a large variety of applications ranging from building services, industry and water transport to waste water treatment and power plant processes.

The company has developed a new double mechanical seal in tandem arrangement, which is especially well suited to the particular requirements of dry-installed and wet-installed waste water pumps.

During development of the 4STQ – a double mechanical seal module – KSB's engineers strove to ensure that its installation and removal remained as straightforward as possible. Assembly fixtures and fastening bolts are not required, and the seal's modular design minimises downtime during maintenance inspections as well as preventing faulty reassembly.

A multi-spring arrangement provides required pre-loading for the primary rings themselves. The multiple springs are located outside the

fluid handled in the oil reservoir so that the individual springs are protected from contamination. As the seal installation space and the mechanical seal are optimally matched, the seal faces are exposed to minimal wear and the sealing elements offer long service lives.

The primary rings are made of silicon carbide as standard, with tungsten carbide also available on option.

All metal components are manufactured from corrosion-resistant stainless steels such as 1.4122 or 1.4571. FKM elastomers are used for the O-rings. The new 4STQ is suitable for all operating conditions permitted for the pump on which it is fitted.

As per KSB, seals of this type are already being used with great success in waste water treatment plants in Germany and South America. ■



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Industrial Water Efficiency



Conduct a facility audit to quantify water use: understanding water use will identify savings opportunities, allow appropriate savings targets to be established, and serve as a benchmark from which water savings can be tracked...

In approximation, industry uses roughly twice as much water as households. As of 1999, industrial water use accounted for 5-10% of global fresh water withdrawals. The majority of all industrial water use is from the cooling of power plants. Reducing industrial water consumption is a means of addressing the global water crisis. In addition to water scarcity, industrial-based water efficiency initiatives are also driven by financial concerns and corporate water reduction targets, with pursuits in water efficient measures differing around the globe according to varying economic and regulatory factors.

Optimise water use in industries

Industry puts pressure on water resources more by the impact of waste water discharges and their pollution potential than by the quantity used in production. Optimisation of water use by industries is important because it can lower water withdrawals from local water sources – thus increasing water availability and improving community relations, increasing productivity per water input, lowering waste water discharges and their pollutant load, reducing thermal energy consumption and, potentially, processing cost.

Water savings can be achieved in industry through a combination of changing behaviour, modifying and/or replacing equipment with water saving equipment to reduce overall water consumption and increase internal reuse. To assure the strategies, optimise water and minimise costs, it is important to assess current water use and set goals. With potentially devastating impacts from sudden shortages in water supply, an increasing number of industrial-sector companies are exploring and implementing water-efficiency projects, strategies and programs to help streamline their water usages. Such measures can effectively mitigate risks against increasingly unstable water resources.

General operations

Conduct a facility audit to quantify water use: understanding water use will identify savings opportunities, allow appropriate savings targets to be established, and serve as a benchmark from which water savings can be tracked. This should be the first step in a water efficiency programme. It may be cost-beneficial to hire a

professional with expertise in industrial water use efficiency to carry out an on-site survey.

Compare water use to industry benchmarks if available: water use benchmarks provide an estimation of the average water use for specific industrial sectors – and can be used as a tool to evaluate current consumption patterns among peers.

Learn from water saving success stories of industry peers: case studies from industry peers will provide insight into what works, what doesn't, and what efficiency solutions are most cost-effective. These details can often be found in sustainability reports or annual reports.

Possible options in ongoing industrial operations

- Reduce the flow of water
- Modify the equipment or installing water saving devices
- Replace existing equipment with more water efficient equipment
- Water treatment, recycling, and reuse
- Change to a waterless process

Educate employees about the importance of using less water: creating a workplace culture that focuses and takes pride in efficiency can be a very beneficial component of a water conservation plan. Increased awareness will ensure more staff members are monitoring water use.

Things that can be done include:

- Give recognition to those who initiate water-efficiency procedures and processes.
- Make resource conservation part of performance reviews, especially for line manager

Use non-potable water for industrial process use: potable water is often not required for many industrial uses and can be substituted with non-potable or reused water. Sources include but are not limited to air conditioner condensate, cooling tower blow down, and rainwater.

Cooling

Improve cooling tower efficiency. Cooling towers often represent the largest percentage of water consumption in industrial operations. Some ways to improve the efficiency of cooling towers and reduce water use have been highlighted hereafter.

- Eliminate once-through cooling
- Install a conductivity controller on each cooling tower
- Equip cooling towers with overflow alarms
- Use high-efficiency drift eliminators
- Install submeters to monitor make-up and bleed on each cooling tower
- Properly train and educate cooling tower operators.

Replace water-cooled equipment with air-cooled equipment when feasible: water use is often a hidden component of industrial and commercial equipment as it is used for cooling purposes. Often this equipment is available with technology that uses air for cooling. The pros and cons of each should be determined before switching. A couple of factors to consider are energy efficiency and performance. Equipment that falls into this category include: air compressors, vacuum pumps, ice machines, refrigeration condensers, hydraulic equipment etc.

Advances in water control

Advancements in membrane technology and specifically reverse osmosis represent the most significant progress in the industry towards achieving higher levels of water efficiency. Companies see these approaches as very important in terms of helping reduce their dependency on outside water sources. One technology showcasing the advancements in water recycling is Newton, Mass.-based Closed Circuit Desalination (CCD) reverse osmosis system, a high-recovery treatment solution that extracts purified water from industrial, brackish and wastewater sources. But while innovations in reverse osmosis have provided opportunities for more reuse and recycling options across manufacturing industries, the strategies and projects are still highly specific to each unique situation and driven by factors such as location, wastewater composition and source-water quality. In some cases, the manufactured product can be a limiting factor. Beyond water reuse and recycling projects that leverage reverse osmosis and other treatment technologies, higher levels of water savings are also being realised through a wide variety of water efficiency approaches at the process level and generally in any area where water is used in facility operations. The strategies being employed depend on the industrial process and the location and can include the use of high-pressure, low-volume trigger hoses, automatic shutoff systems, low-water consumption sprays, spray balls for tank cleaning, and



substituting hot-water washing with steam or ultrasonic cleaning. Some other innovative technologies are summarised below.

- **Dry-machining:** need to utilise new technological process known as Minimum Quantity Lubrication (MQL), or dry-machining for low water use. This process involves the lubrication of cutting tools with a slight amount of oil sprayed directly on the tip in a finely-atomized mist, rather than using the conventional “wet-machining,” which requires large amounts of metal-working fluids and water to cool and lubricate the tools.
- **Cooling towers using air:** with substantial amounts of water dedicated for cooling in industrial plants, more efforts are focusing on water-efficiency improvements for cooling towers, including utilizing recycled water for cooling as well as capturing and treating blow-down water for reuse in other plant processes. The move to air cooling is often a way to reduce water consumption, but this approach also needs to be balanced against the cost of energy as air cooling tends to be less energy efficient.
- **Hybrid dry coolers:** the next paradigm shift will be to use processes that do not require water. As an example, evaporative cooling towers in a plant can be replaced with highly-efficient hybrid dry coolers that use air for cooling during cold and moderate seasons and only use water during the hot summer season.

- **Water-energy nexus:** an increasingly important consideration with water-related projects is the inextricable relationship of those projects with energy usage and this linkage – known as the water-energy nexus – is becoming a significant, driving factor in the pursuit of water-efficiency-related projects across the industrial economy. More emphasis is being placed on water-efficiency gains in terms of its effect on energy consumption. For example, zero-liquid discharge with evaporation and crystallisation technologies can enable facilities to achieve extremely high levels of water recovery and reuse, but in many cases, the expenses have escalated to a point that makes these investments cost prohibitive. The challenge is in balancing the water-saving benefits against the energy considerations.
- **Smart monitoring:** it is estimated that a large amount of water is being lost every day in distribution networks only. Leaks are not only costly for companies, but increase pressure on stretched water resources and raise the likelihood of pollutants infiltrating supplies. New monitoring technologies help companies ensure the integrity of their vast water supply networks. Electronic instruments, such as pressure and acoustic sensors, connected wirelessly in real time to centralised and cloud-based monitoring systems will allow companies to detect and pinpoint leaks much quicker.

- **Mobile recycling facilities:** an unexpected by product from the explosion of the global hydraulic fracturing industry has been demand for highly mobile water treatment facilities. Investment is being channeled into reverse osmosis units that will allow companies to treat high volumes of water to extract gas and injected into the subsurface. The level of water efficiency that can be achieved also depends on cost inputs and margins on sales. Hence, inexpensive water generally does not encourage water efficiency.

Bottlenecks towards water management

- There is a need for water-efficient strategies across its manufacturing lines based on more technology, less water
- Treatment and reuse is made more

attractive when water sources are more expensive or when fees for wastewater discharge are based on volume and pollutant loads.

Conclusion

Water efficiency is reducing water wastage by measuring the amount of water required for a particular purpose and the amount of water used or delivered.

Water efficiency differs from water conservation. In that it focuses on reducing waste, not restricting use. With increasing water scarcity especially water-sensitive industries need to review their water processes and treatment technologies that lead to higher efficiency, availability and resilience of water processes.

This delivers improved quality, cost efficiency and risk reduction of production

processes. By identifying potential risks, implementing best practices, managing water usage and meeting national and international quality standards, any industry can increase its efficiency and resilience while promoting sustainability.

Solutions for water efficiency focus not only on reducing the amount of potable water used, but also on reducing the use of non-potable water where appropriate. It also emphasises the influence consumers can have in water efficiency by making small behavioural changes to reduce water wastage and by choosing more water efficient products. ■

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EPA Acts To Curb Pollution Generated from Aircraft

Aircraft are the third largest contributors to GHG emissions in the U.S. transportation sector, and these emissions are expected to increase in the future. EPA is now taking steps to improve this area...

Around 5,000 planes fly in the US sky at any given point of time. Obviously, such a massive operation has quite a huge detrimental effect on the climate that needs to be checked. Considering this, recently the U.S. Environmental Protection Agency (EPA) has finalised a determination under the Clean Air Act that Greenhouse Gas (GHG) emissions from certain types of aircraft engines contribute to the pollution that causes climate change and endangers Americans' health and the environment. The findings are for carbon dioxide (CO₂), methane, nitrous oxide, hydrofluorocarbons (HFCs), PerfluoroCarbons (PFCs), and sulfur hexafluoride (SF₆), all of which contribute to GHG pollution that represents the largest driver of human-caused climate change. These particular GHGs come primarily from engines used on large commercial jets.

"Addressing pollution from aircraft is an important element of U.S. efforts to address climate change. Aircraft are the third largest contributor to GHG emissions in the U.S. transportation sector, and these emissions are expected to increase in the future. EPA has already set effective GHG standards for cars and trucks and any future aircraft engine standards will also provide important climate and public health benefits," said Janet McCabe, EPA's Acting Assistant Administrator for Air and Radiation.

The agency is not issuing emissions standards for aircraft engines in this action. The final endangerment and contribution findings for aircraft engine GHG emissions are an important step that EPA must take prior to adopting domestic GHG engine standards.

EPA anticipates that the International Civil Aviation Organization (ICAO) will formally adopt its environmental committee's February 2016 agreement on international aircraft CO₂ standards in March 2017.

EPA also anticipates moving forward on standards that would be at least as stringent as ICAO's standards.

The rulemaking process for aircraft GHG emissions will provide opportunities for industry, NGOs and other interested parties to provide their input through public review and comment.

In 2009, EPA issued similar findings regarding GHG emissions from new cars and light trucks. The agency determined that those vehicles contribute to GHG pollution that threatened Americans' health and welfare by leading to long-lasting changes in their climate that could have a range of negative.

Since then, the science on human-induced climate change has strengthened, further supporting this final determination. ■



Space Agencies Unite To Mitigate Climate Challenge

A never-seen-before kind of initiative has been taken up by the Indian Space Research Organisation (ISRO) and the French Space Agency (CNES) to persuade space agencies of more than 60 countries to engage their satellites, to coordinate their methods and data to monitor human-induced greenhouse gas emissions...



can be combined and compared over time. In other words, it is to make the transition to be closely coordinated and easily accessible 'big space data'.

"It is overwhelming to see the unilateral support of all space agencies to use space inputs for monitoring climate change. Earth observation satellites provide a vital means of obtaining measurements of the climate system from a global perspective.

Two space agencies, the Indian Space Research Organisation (ISRO) and the French Space Agency (CNES) have initiated a motion to engage space agencies of more than 60 countries to utilise their satellites to coordinate their methods and their data to monitor human-induced greenhouse gas emissions.

The COP21 climate conference held in Paris last December acted as a wake-up call in this context. Without satellites, the reality of global warming would not have been recognised and the subsequent historic agreement at the United Nations headquarters in New York on April 22, 2016 would not have been signed. Out of the 50 essential climate variables being monitored today, 26 – including rising sea level, sea ice extent and greenhouse gas concentrations in all layers of the atmosphere – can be measured only from space.

The key to effectively implementing the Paris Agreement lies in the ability to verify that nations are fulfilling their commitments to curb greenhouse gas emissions. Only satellites can do that. Invited to New Delhi by ISRO and CNES on April 3, 2016, the world's space agencies decided to establish 'an independent, international system' to centralise data from their Earth-observing satellites through the 'New Delhi Declaration' that officially came into effect on May 16, 2016.

The goal now will be to inter calibrate these satellite data so that they

ISRO is committed for the continuity of earth observation data, through the thematic series of satellites, with improvements en-route, to meet contemporary as well as future needs. ISRO is also engaging with CNES, JAXA and NASA for realising joint missions for global climate observation with advanced instruments," said ISRO Chairman AS Kiran Kumar.

Earth observation satellites provide a vital means of obtaining measurements of the climate system from a global perspective. ISRO is committed for the continuity of earth observation data, through the thematic series of satellites, with improvements en-route, to meet contemporary as well as future needs. ISRO is also engaging with CNES, JAXA and NASA for realising joint missions for global climate observation with advanced instruments.

In the words of CNES President Jean-Yves Le Gall, "This is a historic event that reaches far beyond the space sector and is a perfect example of the kind of success that can only be achieved through international cooperation. With this consensus among space agencies from more than 60 nations, including the world's leading space powers, the international space community and scientists now have the tools they need to put their talent, intelligence and optimism to work for the good of humankind and our planet." ■

Enhancing Performance Of HVAC Systems

There is a misconception in the commercial controls and HVAC industry today that SCADA (Supervisory Control and Data Acquisition) systems are not applicable, nor are they cost effective in this marketplace...



HVAC (heating, ventilating and air conditioning) systems are used for controlled maintenance of indoor ambient characteristics in optimal manner, with regards to outdoor ambient characteristics. The objective of these systems is to achieve comfortable and pleasant sensation of people staying in the conditioned area. To accomplish the established requests, understanding of intensity and dynamics of thermal effects on objects, physical characteristics of objects and requirements for heating and Cooling energy is needed.

Climate chambers and chillers are the base elements of ventilating and conditioning system – where air is prepared to reach purity, temperature and humidity of air. It is accomplished by filtering, heating, cooling, mixing and wetting/drying of the air. In this article, I'll discuss the basic elements (industrial climate chambers and chillers), working principles of HVAC systems with control and monitoring configurations based on PLC, and SCADA can perform at optimal efficiency and most effectively.

There is a misconception in the commercial controls and HVAC industry today that SCADA (Supervisory Control and Data Acquisition) systems are not applicable, nor are they cost effective in this marketplace. Typically, these systems come with a high price tag and feature rich technology, which for many of the smaller HVAC market applications, is

truly not cost effective. But in the larger markets, such as high-rise office buildings and multiple building systems (including schools, colleges, data centres, and government facilities) they actually make more sense.

One of the most attractive financial features of these products is that they are supported by organisations that are truly 'Systems Integrators.' This is defined as an organisation whose sole purpose is their procurement and pursuit of new business and service work; whose success does not rely on a single vendor's product. Instead, it is dependent on their employee talent pool and their technical ability to provide value-added features and application services to help their customers to be more productive.

How is this different from the typical HVAC system with DDC Controls? Unlike the traditional DDC system from any of the manufacturers, the SCADA systems truly empower the end users (owners). They have a choice on who performs services on those

systems, based on quality and price, rather than being held captive to the proprietary systems of the past, where the tools and application databases were held by the manufacturer's branch office or a single authorised representative.

The technology exists today to allow owners to have a truly open system in the same manner as the PC industry today allows us to purchase a PC from one vendor, an Ethernet card from a second, and printers and peripheral devices from others, and have them seamlessly interoperate using a common platform. SCADA systems provide a better environment to accomplish this than any of the HVAC manufacturers can, using their 'Front End' software.

If you take the time to analyse the features and power of these SCADA systems, you will realise that these systems are actually a perfect fit for these types of applications in the HVAC environment. These were never considered in the past since all DDC systems for the HVAC industry were strictly proprietary with custom code and protocols developed by the manufacturers from the controller level to the enterprise level as one system. There weren't any opportunities for owners, nor

integrators for that matter, to even consider looking into any type of driver development since there would certainly be nothing but resistance from the manufacturers, and perhaps ensuing legal action.

The industrial market has had open systems for over 20 years and all of the manufacturers develop products and services to complement these systems.

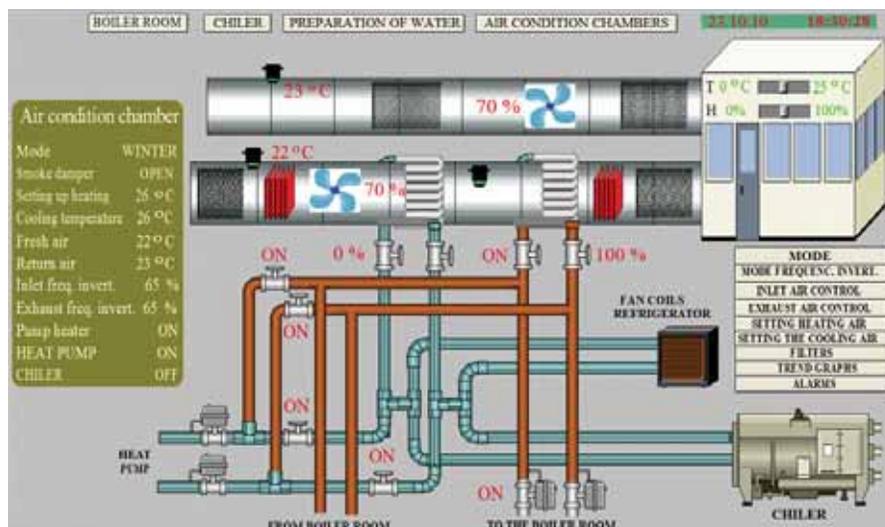
In many cases, it's a specialty item that is developed using standard protocols – so that customers will welcome the opportunity to add this to their network. It was a common practice for integration companies to bid on projects for services against each other for the same customer over and over again, unlike the commercial controls industry where the contractor who won the first phase of a project typically 'locked in' the customer for a 10-15 year period.

This practice goes against our core values of what we believe in as individuals, owners of businesses. Our nation is one that awards us choices in everything we do, so it is a natural progression to provide for this in our Facility Management Systems. Today, contrary to what some companies would like you to believe, that means open systems utilising protocols such as BACnet, LonTalk, and Modbus on the device level, with SCADA Enterprise level systems at the top of the network architecture.

These systems are made handle a wide array of real-time data throughput while, at the same time, offering common database structures for alarming and historical data archiving. Because of this, it's a natural progression to have an owner integrate accounting systems, automate work orders, order entry, security, and even point of sale systems into this architecture through the use of open database structures, which are already built-in.

In summary, owners of larger facilities as well as multiple building owners will surely benefit from the SCADA Systems once thought of as only for industrial process control. These systems have the speed and horsepower to accommodate all types of applications. It also allows the owner to take advantage of building an architecture that is 'truly open' and will provide the protocols, software, and hardware tools to offer choices on vendors, contractors, and service organisations. This must start at the design level. To guarantee that you will get what you paid for, partner with a Master Integrator before the project begins.

Pleasant sensation of people residing in a certain area are provided by constant bringing



SCADA screen of air conditioning chamber..

of fresh air into that space, where at least three air exchanges within one hour are required. Fresh air, which is used for ventilation, is also a carrier of heat for local regulation of ambient temperatures in winter and summer conditions.

Ventilation with 100% fresh air is energy efficient only in case of realisation based on device equipped with feedback sensors of air temperature and humidity, especially at low outdoor air temperature. The air conditioner, in cooling mode, decreases humidity of inflowing air to make better condition in residing area during extreme summer temperatures. Implementation of HVAC system and efficiency evaluation need data about the degree and dynamics of thermal effects on objects, as well as insulation characteristics and needs for heating and cooling. The majority of modern commercial and public buildings are fully or partially air conditioned. Typically, there is central preparing of heating and cooling energy conveyed by water thermal exchangers for a particular area – and air systems for bringing fresh air conditioned in air chambers.

The main objective of an air conditioning system is to fulfill the requirements in terms of air quality (temperature, humidity and air purity degree) to create the comfort and suitable conditions for living and working in an air conditioned environment. This is achieved by a combination of basic air processing, different options for managing air and using the related elements of automation and control laws.

Chiller is a cooling device. It is a complex system of exceptional performance in terms of efficiency, especially the new series, which can be used by low ambient temperature throughout the year. They provide high reliability in housing, technological and industrial applications.

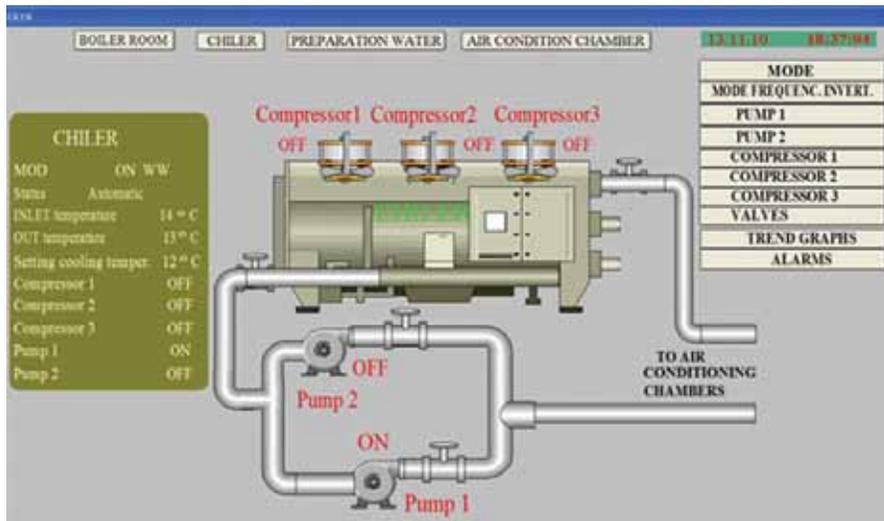
Chillers are used in the ceramics industry, food industry, printing industry, machines for plastic injection and extrusion, shopping and business centres, sports facilities and so on.

These systems can operate in free-cooling mode, exploiting the temperature of the outside air for cooling water that is used. A special control valve turns a certain amount of the feedback water from the system. In this way, appropriate conditions of temperature of the outside air cool the water before its return, resulting in delayed activation of the cooling device.

Free-cooling control exploits the temperature of the outside air to assist in the cooling of the utility water. Special valve deviates a certain quantity of return water from the system. The favourable outside air temperature conditions thus cool the water prior to its return, and the activation of the cooling devices is therefore delayed. Free-cooling is envisaged for air/water units in internal free-cooling mode, that is, the free-cooling coil housed inside the unit near the condenser coil/coils, with which it shares the control of the condenser fan/fans.

Communication Protocols

A very important issue in the design of a system for building management, and therefore the management of HVAC systems, is the choice of communication protocols. The dilemma is whether to choose an open protocol or protocol with limited access. Previous experience shows the advantage of open protocols. Here again the question of what to choose arises: LonWorks (Local Operating Network) or BACnet (A Data Communication Protocol for Building



SCADA screen of chiller...

Automation and Control Networks). The leading companies, which among other things, are engaged in the production of building management systems, such as Siemens, Honeywell, Invensys, Johnson and TAC are the main sponsors of LonWorks.

On the other hand, the BACnet is supported by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers - Association of Engineers in America, dealing with issues related to HVAC systems). BACnet is a generally accepted world standard in building management systems.

Only a SCADA based system can offer a Multi-Sensor Based Occupancy Estimation Model for Supporting Demand Driven HVAC Operation.

A SCADA system performs four functions

1. Data acquisition
2. Networked data communication
3. Data presentation
4. Control

These functions are performed by four kinds of SCADA components

1. Sensors (either Digital or Analog) and control relays that directly interface with the managed system.
2. Remote Telemetry Units (RTUs). These are small computerised units deployed in the field at specific sites and locations. RTUs serve as local collection points for gathering reports from sensors and delivering commands to control relays.
3. SCADA master units. These are larger computer consoles that serve as the central processor for the SCADA system. Master units provide a human interface to the system and automatically regulate the managed system in response to sensor inputs.
4. The communications network that connects the SCADA master unit to the RTUs in the field.

SCADA: Widely used in power systems

The applications for SCADA keep increasing day after day.

Some of the applications are:

- Comprehensive operational planning and control
- Fuel resource scheduling
- Optimum power flow
- Network security
- Economic dispatch
- Demand based comfort control

Expected benefits of SCADA for power systems

- Improved quality of service
- Improved reliability
- Reduced operating costs
- Maintenance /expansion of customer base
- Ability to defer capacity addition projects
- High value service providers
- Improved information for engineering decision
- value added services
- Flexible billing option
- Improved customer information access
- Reduced system implementation costs
- Reduced manpower requirements

There are many objectives of SCADA system

- Improved overall System efficiency (capital & energy)
- Increased penetration energy sources including renewable energy sources
- Reduced energy requirements in both the Transmission and Generation

Conclusion

The exploit of modern materials and equipment with the implementation of appropriate algorithms, produce modern HVAC systems that belong to the ENERGY SAVING systems, i.e., systems with maximum performance, which save energy and protect the environment.

A system for monitoring and control provides management and visualisation of the object and display the current value of significant parameters in the form of appropriate tables and graphics, the acquisition of relevant data and archiving, statistical data processing, data transfer to distributed locations in the network, linking with other programs in real time (DDE, ODBC, OLE, etc.) and generating various reports. ■



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 Renewable Energy and
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The new Ruby Hall Clinic multi-specialty hospital in Hinjewadi chose grooved mechanical couplings and pipe-joining systems...

Installation-Ready systems

Ruby Hall Clinic installs grooved piping system in new Hinjewadi hospital...

Engineers and contractors working on the new Ruby Hall Clinic multi-specialty hospital in Hinjewadi required a piping system that could be installed fast to reduce downtime and interruptions, and that featured components that could be easily maintained in the future.

They chose Installation-Ready systems from Victaulic, the world's leading producer of grooved mechanical couplings and pipe-joining systems, to join the hot and chilled water piping systems, providing fast, clean and safe installation in the mechanical room, while flexible couplings were installed to accommodate expansion and contraction on pumps and chillers.

Ease of installation and maintenance – to minimise patient disruption – were critical factors in the selection and Installation-Ready systems

proved fast, clean and safe. With no noxious fumes or flames to consider, the rapid joining grooved piping system provided a major advantage over other traditional joining methods such as welding.

"In today's healthcare facilities there is no time for downtime, especially when it comes to vital systems such as HVAC, plumbing and fire protection," says Pankaj Soni, Victaulic Country Manager India. "As the pace of the healthcare construction industry continues to grow, there is a necessity to look to building methods that make maintenance and facility expansion easier to implement, with minimum disruption to the peaceful healing environment."

In recent years, timescales for construction and repair have become increasingly tight with patient needs at the forefront. Grooved piping system assembly requires no hotworks and eliminates many of the risks traditionally associated with joining pipe, and even allow healthcare or other activities to carry on unhampered in surrounding areas of a facility. For instance, work can continue safely with patients still in beds, and only the need to empty the most nearby wards. ■



“Our innovativeness is what has got us this far...”

A.S. Controls started business as a small level controls manufacturer in 1986. Today, they take pride in their technological innovation that puts them in the forefront of the refrigeration and air-conditioning control industry in India. The company has two established brands: **Castle and Subzero**. Both these brands have grabbed attention in the Indian market. Today, the company has industry giants like Blue Star, Kirloskar, Reliance and others in their Clients' list. In an exclusive interview with **Cooling India**, **Guru Deshpande, Head of Business Development** in the company, is talking to **PK Chatterjee** on the Indian market and their plans. Excerpts...

What is the most prominent trend in the Indian HVAC&R industry, as far as control & automation is concerned?

Electronic controls & automation for the HVAC&R industry in India has progressed very well in the past few years. The trend is to have more sophisticated controllers that can offer several safety features, computer connectivity for monitoring and user-friendly user interfaces with colour LCD touch screens, smartphone apps.

What are the emerging areas where control devices have great potential?

Cold storages based on Ammonia, which were mostly reliant on manual controls, are now emerging as a potential for automation. The government in its 12th five year plan (2012 to 2017) has focused on the development of cold storages. Government institutions have made it mandatory to automate the facility in order to gain subsidy. These factors make cold storages an important areas for automation.

How is AS Controls contributing to accelerate the growth momentum in the HVAC&R industry?

Our focus this year is to introduce specialised controls for the food and hospitality industry. Blast freezer, heat pump and data logging are some of the controls that we will introduce this year. These will be designed keeping in mind Indian operating conditions.

What are the new products that you have introduced or planning to introduce in the Indian market in 2016?

At the end of August 2016, we are planning to introduce controllers with a Touch Sensitive Keypad. This will be the first time when an Indian manufacturer will roll out such a product in the 71x29 mm cutout format. Apart from having a great touch experience, these controllers are CE marked – and will be packed with new features by way of software and hardware. In September,

at Cold Chain exhibition, we are planning to introduce colour touch screen LCD controllers & data loggers in display sizes of 4.3, 7 and 10 inches.

How are the demand and acceptance of innovative control devices increasing in the Indian market?

Our innovativeness is what has got us this far. Customers are constantly in discussion to increase features in controllers. They want innovative products along with increased functionalities. Innovation in the controller makes a great USP for the equipment manufacturer.

How strong is your nation-wide sales network?

We have always supported our dealers. Our dealership network is present all over the country, and caters from small to medium OEMs.

The major dealers have a good sub-dealer network, which caters to the smallest of cities in most states of India. Large OEMs are dealt

We have local engineers in the North, South and West of India. We have now trained some of our dealers to extend mid-level support to customers so that their issues are resolved within 24 hours...

with directly by us.

What kind of after-sales support does AS Controls offer?

We have local engineers in the North, South and West of India. After-sales support has been one of our major advantages. In fact, we have now trained some of our dealers to extend mid-level support to customers, so that issues are resolved within 24 hours.

What is your suggestion to the HVAC&R system integrators, and how do you foresee the future?

'Customisation' is the Mantra. Every customer wants something different than his competitor. We help customise controllers as per customer needs. This is not something every HVAC&R controller manufacturer does very easily.

With the government's 'Make in India' strategy, we hope to deliver a world class experience in controls and automation for the HVAC&R industry in India. ■

Uniquely Different Solutions

Testo now offers portable and stationary measurement solutions for almost all areas of application from one provider for HVAC/R...

After intensive research and development work, Testo AG has now reached its target to provide an all round solution to the HVAC/R sector by introducing first of its own set of electrical measuring instruments, backed by latest German technology. With them, the company tries to provide uniquely different solutions with advanced features to their customers. These intelligent electrical measuring instruments from Testo makes it possible for the users to carry out their daily measurement tasks more easily, safely and efficiently than ever before. In contrast to many products in the market, the measuring instruments from Testo show many differentiating benefits and an excellent price-performance ratio. Added to this is the advantage, that

with 12 products, Testo India completes its basket of necessary tools for measuring needs of HVAC/R.

The objective is to make HVAC/R measurements easier

The market for electrical measuring instruments today already offers a multitude of solutions for many different measurement parameters. This is the reason why Testo did not want to simply launch yet another measuring instrument on to the market, but to provide a real added value for the target group. In particular, Testo wants to provide innovative technology to enable efficient working of HVAC/R sector than with existing measurement solutions. The new instruments are extremely user-friendly: they are easy and intuitive to use, save many work steps, offer the highest level of safety, and are suitable for various applications.

Five product families for all important measurement tasks

Testo is launching a total of five product families for all important measurements on electrical appliances and systems. These include a digital multimeter in three versions, which automatically recognizes the measurement parameters by socket use, and which can be more safely operated using function buttons than with the usual rotary dial. Three clamp meter models with a unique clamp mechanism for measuring tight-fitting cables. This allows current cables to be grabbed precisely. It is available with two current-voltage testers which fulfil the newest voltage tester standard, and allows selection of measurement parameters automatically and without the danger of confusion. Completing the range are three voltage testers – all equipped with an all-round LED display which can be read from any position – and a non-contact voltage tester with a filter for high-frequency interference.

Testo 760 – the first automatic multimeter

The Testo 760 digital multimeter family comprises three models for all important electrical measuring tasks. Function keys replace the traditional dial on all three instruments, which means easier operation and greater reliability. Incorrect settings are now impossible, because the measurement parameters are detected automatically via the assignment of the measuring sockets and also shown by the illumination of the appropriate function keys. The Testo 760-1 model is the standard version for almost all daily measuring tasks. The Testo 760-2 is differentiated by a larger current measurement range, the true root mean square measurement - TRMS - and a low-pass filter – for VFD output voltage measurements accurately. The Testo 760-3 is the model with the highest specification and, in addition to the features of the other two models; it has a voltage range of up to 1,000 V, along with higher measuring ranges for frequency and capacitance. In addition, μ A current measuring range is also available.





Testo 770 – grab cables without touching

The three instruments in the Testo 770 clamp meter family are ideally suited for non-contact current measurement in switching cabinets with a unique feature of inrush current measurement as well. One of the two pincer arms can be fully retracted into the instrument. This unique grab mechanism means that cables in tight switching cabinets can be easily grabbed.

The automatic measurement parameter detection also ensures reliable work: in the current and voltage area, all three instruments detect direct and alternating current and select other parameters such as resistance, continuity, diode and capacitance automatically.

The Testo 770-1 model is the standard version for daily measuring tasks, including starting current measurement. The Testo 770-2 also has a μA range as well as an integrated temperature adapter for all type K thermocouples. In addition, the Testo 770-3 offers a power measurement function, along with Bluetooth.

Testo 755 – the first voltage tester measuring current

Both instruments in the Testo 755 current/voltage tester family are the first of their kind: voltage testers which meet the latest standard and which can also measure current. This means they are suitable for virtually all daily electrical measuring tasks. Each time they are used they automatically



select the right settings and therefore prevent dangerous incorrect settings. Both instruments have all the important functions for determining voltage/de-energization, for measuring current and resistance, as well as for continuity tests. In addition, the integrated flashlight enables dark spots to be illuminated. The measuring tips can be changed easily, so that the whole instrument does not need to be replaced in the event of damage. The Testo 755-2 model is differentiated by the larger current range of up to 1,000 V and special functions, such as the single pole phase testing and rotating magnetic field measurement. In addition, it is also certified according to voltage tester standard DIN EN 61243-3:2010.

Testo 750 – the voltage tester with all-round LED display

The three models in the Testo 750 voltage tester family are the first instruments with an all-round LED display. The display can be seen from any position and guarantees an ideal voltage indication thanks to its unique fibre optics. All three models meet the latest voltage tester standard EN 61243-3:2010 and have a safety specification according to CAT4. They have the



most important functions for voltage testing, continuity testing and rotating magnetic field measurement. The Testo 750-2 is also suitable for single pole voltage testing and has a flashlight along with an RC trigger function. Vibrating load buttons ensure that trigger tests cannot be carried out accidentally. In addition, the Testo 750-3 is fitted with an LC display to show the current reading.

Testo 745 – the non-contact voltage tester

The Testo 745 non-contact voltage tester with a voltage range of up to 1,000V is particularly well-suited to fast initial checking of any suspected fault sources.

When the presence of voltage is determined, the Testo 745 gives a warning via a clear visual and acoustic signal.

In order to increase reliability, the voltage tester has a filter for high-frequency interference signals and is also waterproof and dustproof according to IP 67.

With the introduction of the electrical measuring instruments, Testo now offers portable and stationary measurement solutions for almost all areas of application from one provider for HVAC/R. ■

For further information: E-mail: info@testoindia.com

Energy Efficiency For Heat Exchanger, Refrigeration And Air Conditioning

This article describes the different methods and techniques for providing energy for heating and cooling systems. It also, covers the optimisation and improvement of the operation conditions of the heat cycles and the performance of the Ground Source Heat Pump Systems (GSHPs)...

With the improvement of people's living standards and the development of economies, heat pumps have become widely used for air conditioning. The driver to this was that environmental problems associated with the use of refrigeration equipment, the ozone layer depletion and global warming are increasingly becoming the main concerns in developed and developing countries alike. With development and enlargement of the cities in cold regions, the conventional heating methods can severely pollute the environment.

In order to clean the cities, the governments drew many measures to restrict citizen heating by burning coal and oil and encourage them to use electric or gas-burning heating. New approaches are being studied and solar-assisted reversible absorption heat pump for small power applications using water-ammonia is under development.

An air-source heat pump is convenient to use and so it is a better method for electric heating. The ambient temperature in winter is comparatively high in most regions, so heat pumps with high efficiency can satisfy their heating requirement.

On the other hand, a conventional heat pump is unable to meet the heating requirement in severely cold regions anyway, because its heating capacity decreases rapidly when ambient temperature is below -10°C . According to the weather data in cold regions, the air-source heat pump for heating applications must operate for long times with high efficiency and reliability when ambient temperature is as low as -15°C .

Hence, much researches and developments have been conducted to enable heat pumps to operate steadily with high efficiency and reliability in low temperature environments. For example, the burner of a room air conditioner, which uses kerosene, was developed to improve the performance in low outside temperature.



Figure 1: Using the soil, bedrock or groundwater as the heat source...

Similarly, the packaged heat pump with variable frequency scroll compressor was developed to realise high temperature air supply and high capacity even under the low ambient temperature of -10 to -20°C . Such heat pump systems can be conveniently used for heating in cold regions. However, the importance of targeting the low capacity range is clear if one has in mind that the air conditioning units below 10 kW cooling account for more than 90% of the total number of units installed in the EU.

Conventional heating or cooling systems require energy from limited resources, e.g., electricity and natural gas, which have become increasingly more expensive and are at times subjects to shortages. Much attention has been given to sources subject to sources of energy that exist as natural phenomena. Such energy includes geothermal energy, solar energy, tidal energy, and wind generated energy. While all of these energy sources have advantages and disadvantages, geothermal energy, i.e., energy derived from the earth or ground, has been considered by many as the most reliable, readily available, and most easily tapped of the natural phenomena.

Ground source based geothermal systems have been used with heat pumps or air handling units to satisfy building HVAC (heating, ventilation, and air conditioning) loads. These systems are favoured because geothermal systems are environmentally friendly and have low greenhouse emissions.

The installation and operation of a geothermal system of the present invention may be affected by various factors. These factors include, but are not limited to, the field size, the hydrology of the site the thermal conductivity and thermal diffusivity of the rock formation, the number of wells, the distribution pattern of the wells, the drilled depth of each well, and the building load profiles.

Undersized field installations require higher duty cycles, which may result in more extreme water temperatures and lower HVAC performance in certain cases.

Oversized field designs, on the other hand, require more wells, pumps and field plumbing and therefore will be more expensive, albeit adequate to handle almost any load circumstances.

The detailed knowledge of the field rock (e.g., porosity, permeability, thermal diffusivity, heat capacity, or other aquifer parameters) may facilitate the determination of the appropriate drilling depth for each well, as well as the number and position of such wells needed at that site. Some of this information may be obtained during the drilling operation.

Earth-Energy Systems (EESs)

The earth-energy systems, EESs, have two parts; a circuit of underground piping outside the house, and a heat pump unit inside the house. And unlike the air-source heat pump, where one heat exchanger (and frequently the compressor) is located outside, the entire GSHP unit for the EES is located inside the house.

The outdoor piping system can be either an open system or closed loop.

An open system takes advantage of the heat retained in an underground body of water. The water is drawn up through a well directly to the heat exchanger, where its heat is extracted. The water is discharged either to an aboveground body of water, such as a stream or pond, or back to the underground water body through a separate well.

Closed-loop systems, on the other hand, collect heat from the ground by means of a continuous loop of piping buried underground. An antifreeze solution (or refrigerant in the case of a direct expansion 'DX' earth-energy system), which has been chilled by the heat pump's refrigeration system to several degrees colder than the outside soil, circulates through the piping, absorbing heat from the surrounding soil.

In some EESs, a heat exchanger, sometimes called a "desuperheater", takes heat from the hot refrigerant after it leaves the compressor. Water from the home's water heater is pumped through a coil ahead of the condenser coil, in order that some of the heat that would have been dissipated at the condenser is used to heat water. Excess heat is always available in the cooling mode, and is also available in the heating mode during mild weather when the heat pump is above the balance point and not working to full capacity. Other EESs heat domestic hot water (DHW) on demand: the whole machine switches to heating DHW when it is required.

Hot water heating is easy with EESs because the compressor is located inside. Because EESs have relatively constant heating capacity, they generally have many more hours of surplus heating capacity than required for space heating. In fact, there are sources of energy all around in the form of stored solar energy, which even if they have a low temperature, can provide the surroundings with enough energy to heat the soil, bedrock and ground water as a heat source for domestic dwellings as shown in Figure 1, for example.

Some emphasis has recently been put on the utilisation of the ambient energy from ground source and other renewable energy

sources in order to stimulate alternative energy sources for heating and cooling of buildings.

Exploitation of renewable energy sources and particularly ground heat in buildings can significantly contribute towards reducing dependency on fossil fuels.

The Cooling Cycle

The cooling cycle is basically the reverse of the heating cycle. The reversing valve changes the direction of the refrigerant flow. The refrigerant picks up heat from the house air and transfers it directly in DX systems or to the ground water or antifreeze mixture. The heat is then pumped outside, into a water body or return well (in the case of an open system), or into the underground piping (in the case of a closed-loop system). Once again, some of this excess heat can be used to preheat domestic hot water.

Unlike air-source heat pumps, EESs do not require a defrost cycle. Underground temperatures are much more stable than air temperature, and the heat pump unit itself is located inside; therefore, problems with frost do not arise.

Function of the GSHP Circuit

The collector liquid (cooling medium) is pumped up from the borehole in tubing and

passed to the heat pump. Another fluid, a refrigerant, circulates in the heat pump in a closed system with the most important characteristic of having a low boiling point.

When the refrigerant reaches the evaporator, which has received energy from the borehole, and the refrigerant evaporates. The vapour is fed to a compressor where it is compressed. This results in a high increase in temperature. The warm refrigerant is fed to the condenser, which is positioned in the boiler water.

Here the refrigerant gives off its energy to the boiler water, so that its temperature drops and the refrigerant changes state from gas to liquid. The refrigerant then goes via filters to an expansion valve, where the pressure and temperature are further reduced.

The refrigerant has now completed its circuit and is once more fed into the evaporator where it is evaporated yet again due to the effect of the energy that the collector has carried from the energy source (Figure 2).

Efficiencies of the GSHP systems are much greater than conventional air-source heat pump systems. A higher COP (Coefficient of Performance) can be achieved by a GSHP because the source/sink earth temperature is

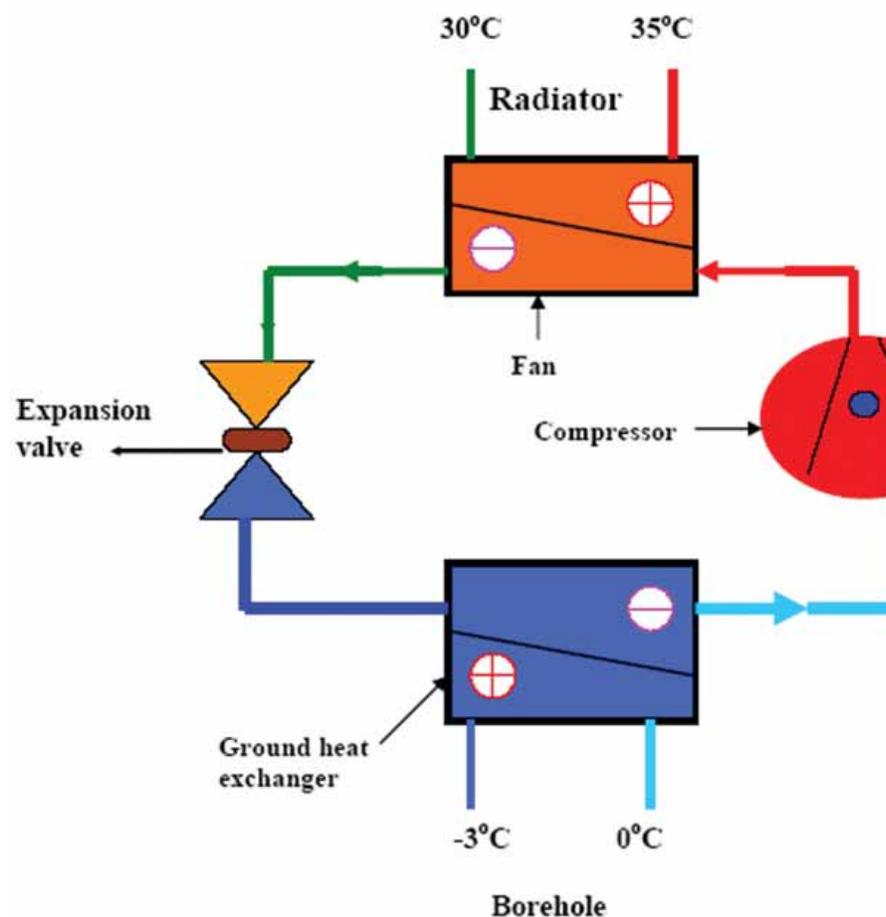


Figure 2: Details of the GSHP circuit...

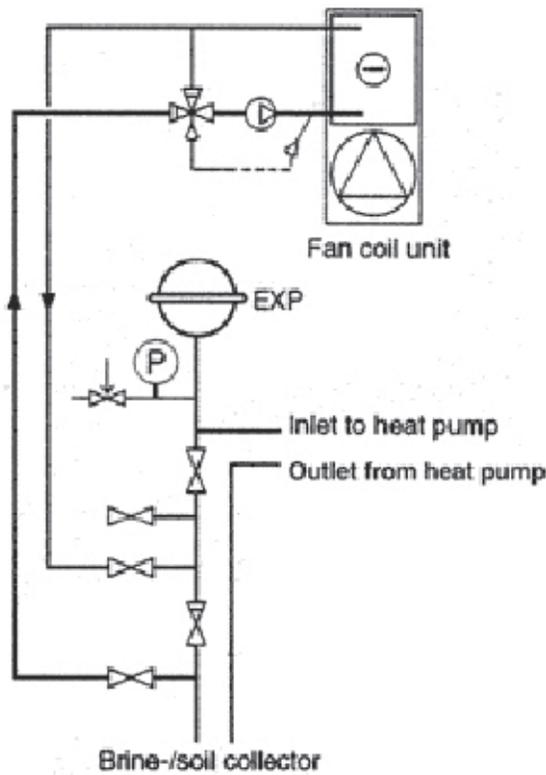


Figure 3: Diagram of cooling system...

equal to the average annual air temperature. Above this zone (less than about 20 feet (6.1 m) deep), the earth temperature is a damped version of the air temperature at the earth's surface. Below this zone (greater than about 150 ft (45.7 m) deep), the earth temperature begins to rise according to the natural geothermal gradient.

The storage concept is based on a modular design that will facilitate active control and optimisation of thermal input/output, and it can be adapted for simultaneous heating and cooling often needed in large service and institutional buildings.

Loading of the core is done by diverting warm and cold air from the heat pump through the core during periods with excess capacity compared to the current need of the building.

The cool section of the core can also be loaded directly with air during the night, especially in spring and fall when nights are cold and days may be warm.

Free Cooling

The installation can additionally be fitted with fan convectors, for example, in order to allow connections for free cooling (Figure 3). To avoid condensation, pipes and other cold surfaces must be insulated with diffusion proof material.

Where the cooling demand is high, fan convectors with drip tray and drain connection are needed.

Refrigeration and Heat Pumps

The pressure (p_s) is a function of how rapidly vapour can be removed through suction or formed through pressure. At equilibrium, the

rate at which vapour is formed (determined by Q) equals the rate at which it is removed. Therefore, both the heat transfer rate into the liquid (Q) and the vapour removal rate (suction pump capacity) determines the pressure and hence $T_{sat}(s)$ (Figure 4). This is governed by the following set of equations.

$$Q = m h_{fg} \tag{1}$$

$$m = \rho g V \tag{2}$$

$$Q = \rho g V h_{fg} \tag{3}$$

$$Q = V h_{fg}/v_g \tag{4}$$

Both h_{fg} and v_g depend on the saturation temperature (or pressure) as assumed in Figure 5, which describes the relationship represented by eqn. 4.

The RHS of the Figure 6 is the 'converse' of the LHS, and constitutes a heat pump. Heat is 'pumped' from the LHS to the RHS.

The main difference is that the vapour, after compression, will almost certainly be superheated and must cool to $T_{sat}(c)$ before condensing will occur.

The same reasoning (in converse) applies to the RHS as previously applied to LHS. Obviously, with the above system, the entire refrigerant would eventually end up on the RHS, and the heat pumping (& refrigeration) effect would cease.

Clearly, to ensure that the system can operate continuously liquid refrigerant needs to be fed from the RHS back to the LHS. This can be achieved by simply allowing it to flow back under its natural pressure difference.

In this way a continuous closed circuit refrigeration (Or heat pump) system is obtained, as shown in Figure 7.

Control of the liquid flow rate is needed to ensure that it equals the vapour formation rate, and an appropriate balance of liquid quantities in the evaporator and condenser is maintained.

When the liquid passes through the expansion valve it experiences a sudden drop in pressure, which causes instantaneous boiling (known as flashing).

relatively constant compared to air temperatures. Additionally, heat is absorbed and rejected through water, which is a more desirable heat transfer medium because of its relatively high heat capacity.

The GSHP systems rely on the fact that, under normal geothermal gradients of about 0.5°F/100 ft (30°C/km), the earth temperature is roughly constant in a zone extending from about 20 ft (6.1 m) deep to about 150 ft (45.7 m) deep.

This constant temperature interval within the earth is the result of a complex interaction of heat fluxes from above (the sun and the atmosphere) and from below (the earth interior). As a result, the temperature of this interval within the earth is approximately

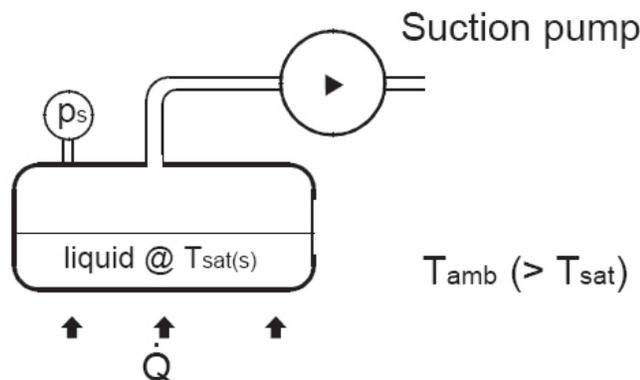


Figure 4: Refrigeration cycle...

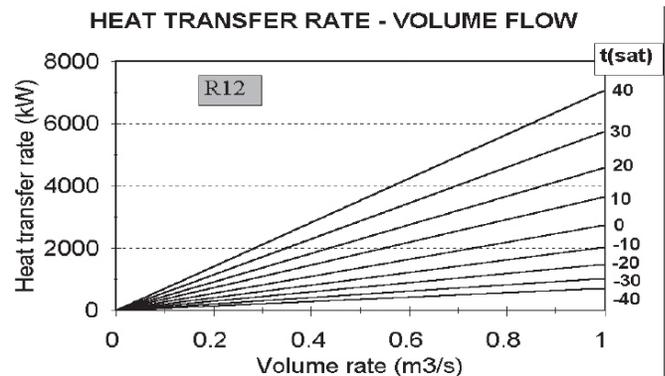
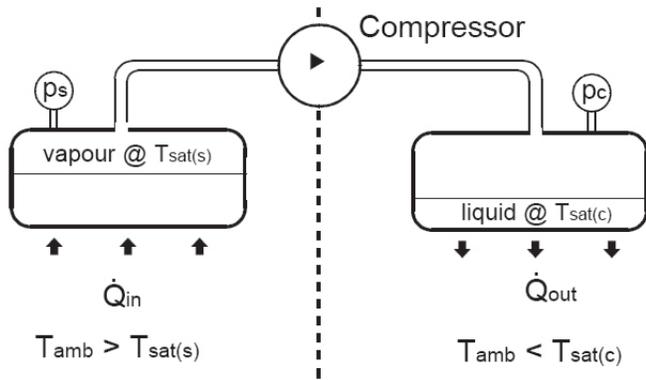


Figure 5: Heat transfer rate versus volume rate...



pc = Condenser or 'high side' pressure; ps = Evaporator, 'low side', or suction pressure.

Figure 6: Heat pumps...

Vapour is formed using the liquid's sensible heat, which causes the liquid to drop in temperature to T_{sat(s)}.

A saturated liquid/vapour mixture will enter the evaporator. Figure 8 explains this cycle in practice.

System Performance

The system balance requires the overall work done to be equivalent to the net energy used by the system. Hence,

$$Q_{out} - Q_{in} = W_{in} \tag{5}$$

For operation as a refrigerator, a measure of system performance is the amount of heat absorbed per unit work supplied to drive the system. This is known as the Coefficient of Performance.

$$COP_{ref} = Q_{in} / W_{in} \tag{6}$$

For operation as a heat pump, a measure of system performance is the amount of heat delivered per unit work supplied to drive the system. This is known as the Coefficient of Performance.

$$COP_{hp} = Q_{out} / W_{in} \tag{7}$$

It follows that (for the same system):

$$COP_{hp} = COP_{ref} + 1 \tag{8}$$

Vapour Compression Refrigeration

The term "vapour compression refrigeration" is somewhat of a misnomer, it would be more accurately described as 'vapour suction refrigeration'.

Vapour compression is used to reclaim the

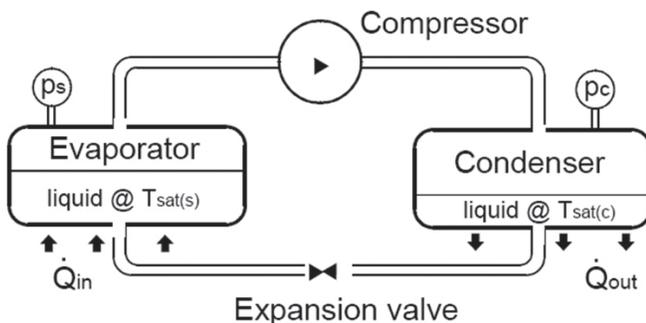


Figure 8: Heat pump refrigeration cycle...

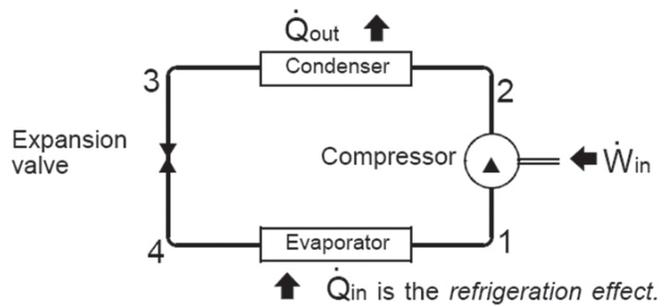


Figure 7: Simplified refrigeration system diagram...

refrigerant and is more aptly applied to heat pumps. Vapour compression refrigeration exploits the fact that the boiling temperature of a liquid is intimately tied to its pressure.

Generally, when the pressure on a liquid is raised its boiling (and condensing) temperature rises, and vice-versa. This is known as the saturation pressure-temperature relationship.

Refrigerant Properties

In practice, the choice of a refrigerant is a compromise, e.g., Ammonia is good but toxic and flammable while R12 is very good but detrimental to the ozone layer.

Figure 9 shows some commonly used refrigerants and their typical ranges of usability.

Ideally, a refrigerant will have the following characteristics:

- Non-toxic - for health and safety reasons.
- Non-flammable - to avoid risks of fire or explosion.
- Operate at modest positive pressures – to minimise pipe and component weights (for strength) and avoid air leakage into the system.
- Have a high vapour density – to keep the

compressor capacity to a minimum and pipe diameters relatively small.

- Easily transportable – because refrigerants are normally gases at SSL conditions they are stored in pressurised containers.
- Environmentally friendly – non-polluting & non-detrimental to the atmosphere, water or ground.
- Easily re-cycleable, and relatively inexpensive to produce.
- Compatible with the materials of the refrigeration system – non-corrosive, miscible with oil, and chemically benign.

Cooling Mode

In the cooling mode, cool vapour arrives at the compressor after absorbing heat from the air in the building. The compressor compresses the cool vapour into a smaller volume, increasing its heat density.

The refrigerant exits the compressor as a hot vapour, which then goes into the earth loop field. The loops act as a condenser condensing the vapour until it is virtually all liquid.

The refrigerant leaves the earth loops as a warm liquid. The flow control regulates the flow from the condenser such that only liquid

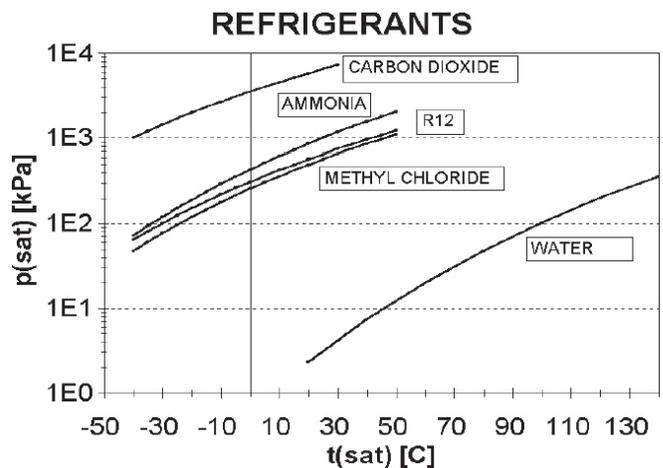


Figure 9: Refrigerant chart...

Table 1: Cost and risk factors for heat pump antifreeze...

Factor	Antifreeze					
	Methanol	Ethanol	Propylene glycol	Potassium Acetate	CMA	Urea
Life cycle cost	3	3	2	2	2	3
Corrosion risk	2	2	3 ^a	2	2	1
Leakage risk	3	2	2 ^a	1 ^b	1	1
Health risk	1	2	3	3	3	3
Fire risk	1 ^a	1 ^c	3	3	3	3
Environmental risk	2	2	3	2	2	3
Risk of future use	1	2	3	2	2	2

Notes: Ratings- 1 means potential problems and cautions required, 2 means minor potential for problems, 3 means little or no potential problems.

a) DOWFROST HD; b) GS-4; c) Pure fluid only. Diluted antifreeze (25% solution) is rated 3.

refrigerant passes through the control. The refrigerant expands as it exits the flow control unit and becomes a cold liquid.

Heat Pump Antifreeze

A potential negative effect of all geothermal heat pumps is the release of antifreeze solutions to the environment.

Antifreeze solutions are required in colder climates to prevent the circulating fluid from freezing.

Antifreeze chemicals include methanol, ethanol, potassium acetate, propylene glycol, Calcium Magnesium Acetate (CMA) and urea.

These chemicals are generally mixed with water whenever they are used as a heat exchange fluid.

These chemicals can be released to the environment via spills or corrosion of system components.

Approved antifreezes include methanol, ethanol, propylene glycol, calcium chloride, or ethylene glycol.

These antifreezes must be mixed with water, at concentrations of 20% or less.

Geothermal heat pumps for a single-family residence and the antifreezes for these units were evaluated by Heinonen et al., (1996).

These authors evaluated total energy consumption, corrosion due to the antifreeze, and the operational and environmental effects of six antifreeze solutions, namely methanol, ethanol, potassium acetate, propylene glycol, CMA and urea.

However, the excluded salt solutions, such as sodium and calcium chloride, from their

study because they pose serious potential corrosion problems.

The differences in total energy consumption for the studied antifreezes were considered minimal.

Nevertheless, Heinonen et al., recommended that propylene glycol was a good choice based on its low health, fire, and environmental risks (Table 1).

Unfortunately, these authors did not assess the leak potential of these antifreezes in the plastic pipe (e.g., HDPE & CPVC SDR-11) commonly used for the ground loop.

However, the bond between the grout and borehole can be compromised by desiccation of the geologic materials near the borehole, as the heat from the borehole lowers the moisture content of the geologic materials and these materials contract.

In areas with thick unsaturated zones, the bentonite grout may dry out over time, compromising the seal.

To improve heat exchange, some advocate the use of spacers, which moves the heat conductor pipe to the side of the borehole, putting it in contact with the geologic materials.

However, the use of spacers appears to increase the environmental risk of antifreeze leaking into groundwater, by reducing or removing the bentonite between the heat conductor pipe and geologic materials.

Conclusion

A geothermal heat pump can transfer heat stored in the earth into a building during the winter season, as well as it can transfer heat out of the

building during the summer season. Furthermore, special geological conditions, such as hot springs, are not needed for successful application of geothermal heat pumps.

The GSHPs are receiving increasing interest because of their potential to reduce primary energy consumption and thus reduce emissions of the GHGs.

The GSHP is generally recognised to be one of the most outstanding technologies of heating and cooling in both residential and commercial buildings, because it provides high Coefficient Of Performance (COP), up to 3-4 for an indirect heating system and 3.5-5 for a direct heating system.

The main benefit of using the GSHPs is that the temperature of the subsurface is not subject to large variations experienced by air.

It is currently the most common thermal energy source for the heat pumps, and so would allow construction of more efficient systems with superior performance.

The GSHPs do not need large cooling towers and their running costs are lower than conventional heating and air conditioning systems.

As a result, the GSHPs have increasingly been used for building heating and cooling with annual rate of increase of 10% in recent years. ■

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A Time Machine For Damp Diagnosis

The stand-out benefits of thermal imaging for Brick Tie Preservation is its ability to reveal missing or wet insulation and areas at risk of condensation...



Brick Tye (salt band)...



While invasive testing methods may sometimes be necessary to determine the source and extent of damp problems in buildings, there is a variety of frontline tools to assist in the initial diagnosis. Electronic moisture meters, surface thermometers, hygrometers and data loggers all have their part to play. For experts like Brick Tie Preservation in Yorkshire (UK), these are indeed standard tools-of-the-trade. The company also has its own salts analysis and gravimetric testing lab for masonry samples. So with all these options available why did it choose to add thermal imaging to its arsenal?

The answer is the ability to see the 'big picture' in an instant and to factor in hidden features and defects that have a bearing on the damp problem; these can easily be seen on a thermal image through differences in heat transfer and heat retention. Brick Tie Preservation's MD, Bryan Hindle, compares his thermal imaging camera to a time-machine that can help him see the building's history.

Bryan Hindle had been interested in thermal imaging for some time and having canvassed the opinions of other professionals in the business he decided to enrol on a thermal imaging course with Thermographic Consultancy Limited (TCL) in Swindon to learn more about the technology.

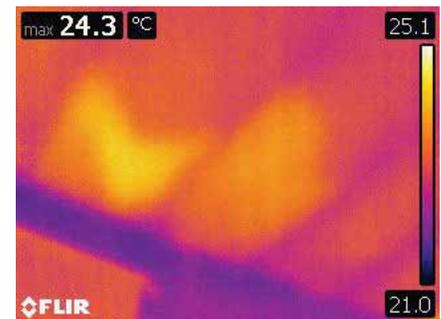
"Although building thermography isn't rocket science, it does require sound understanding of how it works and what influences equipment and results. I think a Level 1 thermography qualification is perfect for anyone starting out in thermography and I refused to contemplate using an IR camera in my work without it," Hindle explained.

Next step was to decide on the most suitable thermal imaging camera and as a result of his training, Bryan realised that an entry-level model would be false economy for his business. Whilst they are a good choice for basic troubleshooting they do not have the performance and functionality needed to see complex problems evidenced by subtle temperature differences.

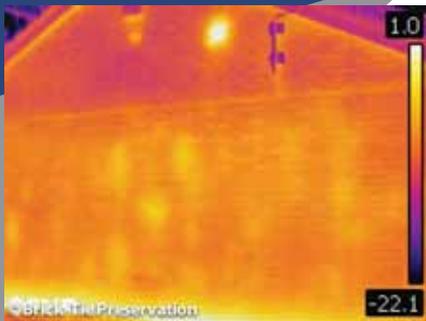
With expert guidance from Stuart Holland of TCL, himself a Level III thermographer, Hindle ultimately chose the FLIR T420bx with an additional wide angle lens as much of the company's work is performed indoors.

"FLIR makes quality products and has good connections with training professionals. I like that in a manufacturer, it's responsible and proactive. I looked at other brands but the FLIR T420bx provided the ideal combination of functionality, sensitivity and resolution. Having tried cheaper 'pistol grip' type units I find the ergonomics of the swivel lens and hand grip much better in use," Hindle confirmed.

He further added, "Good sensitivity is a particularly important criterion as I can't count on high temperature differentials and I need to deal with conditions as I find them. Preparation



A tool for all seasons... Bryan's FLIR T420bx is sensitive enough to 'see' warm areas in summer, where missing insulation is allowing heat in the roof void to radiate from the bedroom ceilings...



Gaps in cavity wall insulation identified using the FLIR T420bx for further investigation via boroscope, without the need to drill many holes...



Bryan Hindle's FLIR MR77, used to transfer the psychrometric data to the FLIR T420bx via meterLink...

counts for little if, for example, the doors and windows of a building are open when I arrive making the measurement conditions far less than ideal."

Minimising Destructive Testing

Although thermal imaging does not directly diagnose conditions such as rising damp, it helps Hindle refining the judgements he makes in respect of the problem. He says it adds another layer to his diagnosis. This is important as many damp problems are influenced by work carried out in the past which is often hidden behind plaster or other finishes and of

which the building owner or tenant may be completely unaware.

"Thermal imaging helps me make an informed decision on whether time consuming and destructive testing is necessary. I am able to get this information on site and usually with immediate results. Thanks to the technology I was recently able to show a surveyor that a house didn't require a full damp proof course, and lots of work, as the problem was simply one of condensation," Hindle added.

In this particular instance, Hindle used his FLIR T420bx in combination with his FLIR MR77 moisture meter. Both are equipped with MeterLink, a function that allows measurements from the moisture meter to be embedded in the associated thermal image.

Hindle continued, "I'm able to give my clients an image with dew points and relative humidity overlaid on a colour isotherm taken of the property so they can see the result of the live readings from the moisture meter. It's a priceless communication tool and, in truth, I wouldn't consider buying a camera without this function now. I hate reports that bamboozle clients, so being able to supply the IR image with a clear explanation of what is going on works extremely well."

Building Knowledge

As well as being an important aid for diagnosis, Brick Tie Preservation's FLIR T420bx is also helping in building the company's scientific knowledge. For example, it was recently used to provide a deeper understanding of how salts can affect the thermal characteristics of masonry and also how saturated air, common in winter, affects rising damp.

For this particular project Hindle used FLIR Systems' patented multispectral imaging

technology, MSX, to help visualise thermal effects. MSX captures visual data from the built-in digital camera and radiometric data from the thermal camera. Internal software then analyses the image and superimposes key elements from the visual image as a high-contrast 'skeleton' on the thermal output.

"The path edge, bed-joints and path/wall junction are all clear in the image thanks to MSX. I have also used FLIR Systems' excellent FLIR Tools to plot some measurement lines to highlight the temperature gradients and plot the maximum and minimum apparent temperatures on each," Hindle explained.

Wide Application Scope

The stand-out benefits of thermal imaging for Brick Tie Preservation is its ability to reveal missing or wet insulation and areas at risk of condensation; also for locating cold bridges such as blocked cavities. In traditional buildings it also helps the company find hidden timber frames and members, bricked-up openings and leaks. Indeed the flexibility of the camera also recently enabled the Bryan Hindle to find a



The use of a FLIR T420bx. Combined with MeterLink via a FLIR MR77 moisture meter in a damp investigation. Areas at and below the dew point (13.0°C) are highlighted in blue automatically, clearly identifying the areas where condensation is happening in real time. FLIR Tools software can be used to model changes based on expected changes following heating, insulation and ventilation interventions...

leak in a central heating system, comprising around 100 metres of pipework under the ground floor screed. "I was able to find the anomaly within a few minutes with my thermal imaging camera. When the heating was turned back on, the client and I watched as the patch grew and then cooled as new cold water was flushed in. All this was detected without any disturbance to furniture, carpet or underlay. The client was delighted as the repair could be localised without the need to strip out lots of finishes and screed," Hindle added.

He concluded saying, "I did without thermal imaging for years but now, I wouldn't be without it." ■



The FLIR T420bx offers sharp thermal resolution at 76,800 pixels for solid accuracy from farther away...

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Refrigeration *And* Personal Safety



In case of refrigeration, most of the accidents are not due to the refrigerant itself. There are some accidents more directly connected to refrigeration per se, which include pressure explosions and refrigerant vapour explosions, asphyxiation risks (from virtually all refrigerants), and specific hazards of refrigerant decomposition products...

Refrigeration preserves food and provides comfort. However, it is not totally accident-proof. Myriads of accidents have been reported during the use of refrigeration and running of the refrigeration equipment and some of them were fatal. The refrigeration industry is relatively safe, and most of the hazards are common to many work situations, rather than specific to refrigeration.

Most of the accidents are not due to the refrigerant itself. Most accidents in the refrigeration industry are attributable to mechanical or general causes and include accidents to eyes, electrocution, erection and dismantling of equipment and structures.

There are some accidents more directly connected to refrigeration, which include pressure explosions and refrigerant vapour explosions, asphyxiation risks (from virtually all refrigerants), and specific hazards of refrigerant decomposition products. Refrigeration is generally not lethal, and with common sense and proper care, it should never be lethal.

Hazards generally associated with refrigeration

Asphyxiation accidents

Due to leaking refrigerants:

- i. In 1991, a 24-year-old male assistant manager for a shopping mall ice skating rink was asphyxiated inside a compressor room while attempting to shut off a refrigerant gas (R-22) leak. A total of 3,200

pounds of refrigerant had leaked out of the refrigeration system. The medical examiner listed the cause of death as asphyxiation by oxygen displacement with refrigerant (R-22).

- ii. A junior officer in a ship became unconscious while asleep because of leaking refrigerant vapour from the AC Blower Room which got drawn into the Evaporator Blower and was carried along with the cold air into the accommodation spaces. His cabin was the closest to the Blower Room.
- iii. A reefer mechanic became unconscious immediately after entering AC Blower Room as the room was having dangerously low oxygen content due to leaking refrigerant vapour from the reefer machinery.
- iv. In 1989, an ammonia release in a frozen pizza plant led to the evacuation of nearly all of the 6,500 residents of the town where the plant was located. The release started when an end cap of a 16-inch suction line of the ammonia refrigeration system was knocked off. Up to 45,000 pounds of ammonia was released, forming a cloud 24 city blocks long. About 50 area residents were taken to hospitals, where they were treated with oxygen and released, while dozens of others were treated with oxygen at evacuation centers.

Due to release of gases from refrigerated products

Cold Rooms, Reefer Containers, Refrigerated Cargo holds on ships are to be treated like enclosed spaces. Fruit cargoes, continue with the respiration process throughout their passage time on board, consuming oxygen in the refrigerated space and liberating carbon-di-oxide. To make up for the consumed oxygen, voyage instructions include periodic ventilation of the cargo spaces. On reefer containers, air vents are kept partially open either continuously or periodically throughout the voyage to allow the fruit cargo to breathe.

There is a category of reefer spaces and containers, which maintain Controlled Atmospheres within the refrigerated spaces. The space is filled up with nitrogen, which is supplemented by the carbon di oxide gas which is liberated due to respiration of the fruit cargo. Special Personal safety Precautions have been outlined to be followed before exposing technicians to these spaces. These spaces are to be treated as Enclosed Spaces.

Case: The dead body of a stowaway was found inside the cargo hold of a reefer vessel when the hatch covers were opened for cargo discharge at the discharge port. The ship was carrying bananas inside the hatch. The stowaway was overcome by the carbon di oxide and other gases liberated by the bananas and lost his life.

Poisoning – Toxicity and personal exposure

All substances are poisonous in sufficient amounts. Toxic effects have been observed for such common substances as water, table salt, oxygen, and carbon dioxide in extreme quantities.

The difference between those regarded as safe and those viewed as toxic is the quantity or concentration needed to cause harm and, in some cases, the duration or repetition of exposures. Substances that pose high risks with small quantities, even with short exposures, are regarded as highly toxic. Those for which practical exposures cause no harm are viewed as safer.

Case: On the 11th of November 1998, there was a leak of refrigerant gas from an air conditioning system in use in a factory in Grimsby, a large town on the East Coast of England. Approximately 120kg of R22 had leaked from a small hole in the high pressure pipeline. R22 is heavier than air and so a cloud sank to floor level where air currents pushed it from the site of the leak and into a different part of the factory. Eventually, the cloud reached a part of the factory where a large industrial fish fryer was in use. The fryer was heated by gas burners. The R22 came into contact with the naked flame of the burners causing thermal decomposition. Thirteen employees were exposed to the thermal decomposition products which may have included phosgene. Even though extraction ventilation was in use and so the employees were probably exposed to only low levels of irritant and toxic gases which were still sufficient to produce ill health effects. Some employees required several weeks of medical treatment although, fortunately, none appear to have suffered lasting damage to their health.

Fire hazards Flammability Combustion/Decomposition

Flammable refrigerants present an immediate danger when released into the air. The refrigerant can combine with air at atmospheric pressure and ignite, causing a flame and possibly an explosion to occur. Because of the obvious hazards, the use of flammable refrigerants is restricted to controlled environments that have monitors, proper ventilation, explosion-proof

equipment and generally few people near the equipment (refineries, storage warehouses, breweries, etc.).

Cases: (1) In a 1992 incident at a meat packing plant, a forklift struck and ruptured a pipe carrying ammonia for refrigeration. Workers were evacuated when the leak was detected. A short time later, an explosion occurred that caused extensive damage, including large holes in two sides of the building. The forklift was believed to be the source of ignition. In this incident, physical barriers would have provided mechanical protection to the refrigeration system and prevented a release.

(2) On Sunday 24th October 1999 an explosion took place in the machine room of chiller of a refrigeration plant. At the time, 14 people were working in close vicinity of the compressor, where the explosion occurred and seven people were hospitalised for smoke inhalation. Two possible explanations for the explosion emerged.

(i) Air entered the compressor and a high-temperature-high-pressure mist comprising of HFC134a, oil and air ignited resulting in the explosion.

(ii) A second possibility is that the pressurised HFC134a and oil mist escaped past the red-hot journal bearing metal of the damaged compressor and mixed with the surrounding air. Under these conditions, the mixture ignited causing an explosion.

Frost bite

Direct exposure of body tissues to refrigerant can cause frostbite. Liquid refrigerant suddenly released from high pressure to atmospheric pressure will flash and boil to vapour. Naturally, the temperature of the refrigerant will drop quickly to the boiling point, and the refrigerant will quickly absorb heat from whatever it is touching. If the refrigerant is touching skin, it absorbs body heat from that area and causes local overcooling. This can cause frostbite.

Frostbite occurs when tissues freeze. This condition happens when you are exposed to temperatures below the freezing point of skin. Frostbite damages skin by freezing water inside the skin cells, which can expand and burst the cell walls. To treat frostbite cover the exposed area with warm (not hot) water or a wet compress. The skin must recover slowly or more damage can occur. Do not rub the affected area to try to warm it as it may inflict more damage. Protective clothing, gloves and eye protection are effective at preventing

frostbite by keeping liquid refrigerant away from the skin.

Overpressure: Rupture of tank or system

Cylinders or systems without pressure relief devices could break if the refrigerant pressure inside were to exceed the strength of the cylinder or system component. This type of failure can be quite hazardous if the refrigerant is at a high pressure or solid material is blown loose. Containment failures are caused by one of two things: The refrigerant pressure has increased above the pressure rating of the cylinder or system, or something has happened to the cylinder or system so that it will no longer hold normal refrigerant pressure.

Elevated refrigerant pressure can be caused by exposure to heat. Refrigerants with pressures similar to R-12 will develop more than 500 psia at temperatures above 200° F. Refrigerants with pressures similar to R-502 will achieve the same pressures at about 150° F. Hydrostatic pressure also can develop quickly in a confined volume that has been completely filled with liquid refrigerant, for example liquid-full hoses between shut valves or an overfilled recovery cylinder.

Refrigerant tubing, hoses, system components and some refrigerant cylinders surely would fail at some elevated pressure without certain safety provisions. Various pressure relief devices are used to lower the pressure back to safe limits by releasing some or all of the refrigerant.

Injuries from flying objects

This is applicable to not only refrigeration equipment, but also to any other pressurized equipment.

A chief engineer while working on a cargo reefer compressor in a ship got his heart pierced and died instantly. While attempting to check the operation of a valve on the refrigerant discharge line, the valve spindle came loose and flew off under great pressure. Unfortunately, the chief engineer was in the straight line flight path of the flying spindle.

Trip/Slip/Fall injuries

Accidents at work involving trips, slips and falls (TSFs) happen very frequently and the resulting costs are high, both for employers and employees. The risk of getting seriously injured in a TSF accident is 1.4 times higher than for all other types of accidents.

In the meat industry, it is four times more likely to be seriously injured from a TSF

accident than from all other types of accidents. The study of the friction coefficients of the floor surfaces indicated particularly low values in the refrigeration rooms. Similarly, a study of the footwear worn during the accidents showed that these often remained in use long after their recommended life cycle.

Hypothermia (Loss of Body Heat)

Hypothermia is a condition in which core temperature drops below that required for normal metabolism and body functions, which is defined as 35.0 °C (95.0 °F). Body temperature is usually maintained near a constant level of 36.5–37.5 °C (98–100 °F) through biologic homeostasis or thermoregulation. If exposed to cold and the internal mechanisms are unable to replenish the heat that is being lost a drop in core temperature occurs. As body temperature decreases characteristic symptoms occur such as shivering and mental confusion.

Prevention

Appropriate clothing helps in preventing hypothermia. Synthetic and wool fabrics are superior to cotton as they provide better insulation when wet and dry more quickly. Some synthetic fabrics, such as polypropylene and polyester, are used in clothing designed to wick perspiration away from the body, such as liner socks and moisture-wicking undergarments.

50/50/50 rule: If someone is in 50 °F water for 50 minutes, he/she has a 50 percent better chance of survival if wearing a life jacket. The heat escape lessening position can be used to increase survival in cold water.

1. Persons can become trapped inside freezers, cold stores or similar cold areas if the exit door cannot be opened from the inside. The following precautions can be adopted to prevent this.
 - a) Doors in cold areas should be openable from the inside under all conditions. It may be necessary to fit local strip heaters to ensure that the door hinges, slides and securing devices are free-moving at all times.
 - b) Doors should open outwards, be unobstructed and illuminated on the inside.
 - c) Instructions for the door release device should be clearly shown inside the cold area.
 - d) An audible alarm actuator should be provided inside the cold area and the alarm itself should be so located that it will attract the maximum attention.

- e) Before persons are allowed to enter a cold area they should be instructed in the use of the means of escape and warning devices, or should be accompanied by someone who has been instructed.
2. Additionally, there are various ways of ensuring that someone locked within a cold area can escape.
 - a) A hatch may be fitted into the door retained by an easily removable fastening, such as a bolt or bar, which is accessible only from the inside. These hatches are sometimes fitted into the wall of the cold area, however there is a danger of the hatch becoming obstructed by goods. Inspectors finding the wall type hatch should advise the employer to ensure that both sides are kept clear of obstruction and that the area around it is clearly marked.
 - b) An alternative method of allowing easy exit from a locked cold area is to ensure that the strike plate located on the door surround can be easily released from the inside.
 - c) Another method, commonly used, consists of a specially designed latch with a door opening lever, which can be locked. The latch is secured to the door and its corresponding strike plate is secured to the door surround as is normal. A push rod extends from the latch release mechanism, passes through the door and terminates in a mushroom head extending some 2 to 3 inches into the cold area.

The only difference between this latch and the conventional type is a special release mechanism inside the latch housing. If the door is locked for security reasons (either by means of a padlock or by a cylinder lock, which prevents the raising of the opening lever) it can still be opened from the inside by pushing on the mushroom headed rod which acts on the special latch bolt release mechanism.

3. Where power operated doors are used they should be openable from the inside even if the power supply is interrupted.

Refrigerant hazards

- Freon cannot be seen or smelt!
- Freon is heavier than air so it will settle and remain at the bottom of the compartments.
- Freon is extremely harmful if it comes into contact with the eyes.
- Freon is suffocating because it displaces air.

- If you inhale high concentrations of Freon, it attacks the nerve system.
- When Freon comes into contact with hot surfaces and starts to burn, it can give off poisonous gases.
- Freons, if released into the air, may cause depletion of the Ozone Layer, which contributes to the greenhouse effect. Refrigerants are not to be released into the atmosphere. They must be drawn into the condenser/receiver or into a separate cylinder.
- Most refrigerants mix with oil so oil drained from a refrigeration system must be clearly labelled and disposed of separately.
- Refrigerants must not be mixed.

If you start feeling faint or dizzy as you enter a compartment - don't think twice - evacuate!

If a refrigerant leak occurs

- Evacuate compartment immediately.
- Sound alarm and get crew in an up-wind position.
- If leak is in engine room shut down machinery.
- Turn vessel into wind if still possible.
- Do not enter compartment without ventilating the compartment.
- Ventilate compartment. Remember Freon sinks to the bottom of the compartment and is very hard to remove. Try to force airflow down into the bottom of the compartment to force the Freon upwards.

Maintenance points

- Refrigerant pipes are lagged and constantly damp. This means that pipe coatings and surface can deteriorate relatively quickly. Check pipes regularly and make sure the coating is maintained.
- Inspect Blower Rooms regularly and keep them clean and dry. Often, they are neglected areas. It is a great idea to fit an exhaust fan for the blower room and start the same and wait for a few minutes before entering.
- When entering compressor rooms, start the exhaust fan and wait for a few minutes before entering.
- Where flexible hoses are used, only use refrigerant tolerant hoses. Try to avoid using flexible hoses wherever possible.
- Maintain fittings such as valves and gauges in good order.
- Mark pipes to show what type of refrigerant they have in them.
- Refrigerants are supplied in metal cylinders, which will corrode in the salt

environment. Make sure these are left in dry storage (preferably ashore).

- When working on compressor crankcase, for draining/changing oil, ensure the crankcase is totally depressurised. Retain a firm grip on the drain plugs and other connections so that they do not fly off uncontrollably.

Safe handling of refrigerants

- Ensure that personnel who handle refrigerants are properly trained in their safe use and handling, and have reviewed the MSDS for the refrigerant used.
- Wear safety goggles and gloves at all times when handling refrigerants or servicing a refrigeration system.
- Wear the proper respiratory protection while working with refrigerants. Check the MSDS for the proper level of protection required.
- Proper ventilation or respiratory protection is required for any work on equipment in an enclosed area where a leak is suspected.
- Always ventilate or test the atmosphere of an enclosed area before beginning work. Many refrigerants which may be undetectable by human senses are heavier than air and will replace the oxygen in an enclosed area causing loss of consciousness.
- Inhaling refrigerants can cause sudden death. Intentional inhalation of refrigerants to produce intoxication can cause the heart to cease functioning properly and may be fatal.
- Be certain that the Refrigerant Recovery Cylinder being used is the Refillable Type and has the capacity to contain the refrigerant to be added to its contents.
- Refrigerant cylinders should never be filled over 80% of their capacity (liquid expansion may cause the cylinder to burst).
- Label the cylinder with the contents using the appropriate colour code
- Check the I.C.C. cylinder stamp to ensure the cylinder is safe. Always check the refrigerant number before charging to avoid mixing refrigerants.
- Always check for the correct operating pressure of the refrigerant used. Use gauges to monitor the system pressure.
- Always charge refrigerant into the low side of the system to avoid damaging the compressor, or causing the system to rupture.
- R-717 and R-764 are very irritating to the eyes and lungs. Avoid exposure to these refrigerants.

- R-717 is slightly flammable and mixed with the proper proportions of air may form an explosive mixture.
- Fluorocarbon refrigerants should be treated as toxic gases. In high concentrations, these vapours have an anesthetic effect, causing stumbling, shortness of breath, irregular or missing pulse, tremors, convulsions, and even death.
- Ammonia is a respiratory irritant in small concentrations and is a life threatening hazard at 5,000 parts per million (ppm).
- Ammonia is also flammable at a concentration of 150,000-270,000 ppm.
- Always stand to one side when operating an ammonia valve. Ammonia can burn and damage the eyes, or cause loss of consciousness. Ammonia leaks may be detected by their smell, or with a sulphur candle or sulphur spray vapour.
- Refrigerant oil in a hermetic compressor is often very acidic causing severe burns. Avoid skin contact with this oil.
- Liquid refrigerant on the skin may freeze the skin surface causing frostbite. If contact with the skin occurs, wash immediately with water, treat any damaged skin area for frostbite, and seek medical treatment.
- Never cut or drill into an absorption refrigeration mechanism. The high pressure ammonia solutions are dangerous and may cause blindness if the solution contacts your eyes.
- Ensure that all liquid refrigerant is removed and the pressure is at 0 psi before disassembling a system.
- Do not smoke, braze, or weld when refrigerant vapours are present. Vapours decompose to phosgene acid vapours and other products when exposed to an open flame or hot surface.
- When soldering, brazing, or welding on refrigeration lines, the lines should be continuously purged with low pressure carbon dioxide or nitrogen.
- Following work, the lines should be pressure tested with carbon dioxide or nitrogen.
- If refrigerant makes contact with the eyes, immediately wash with mineral oil as this absorbs the refrigerant. Then wash your eyes with a prepared boric acid solution.
- If the refrigerant is ammonia, wash with water for at least 15 minutes. Seek medical attention as soon as possible.
- Purged refrigerants must not be released into the atmosphere. Federal law governs

their disposal, and they must be collected and disposed of properly.

- Do not allow temperatures where refrigerant cylinders are stored to reach 125 degrees F. Temperatures can easily exceed 125 degrees F in your vehicle during hot weather.
- Inspect refrigerant cylinders regularly. Do not use the cylinders if they show signs of rust, distortion, denting, or corrosion. Store cylinders secured and upright in an area where they will not be knocked over or damaged.
- Beware of valve spindles and other components which can fly off because of high pressures.

Enough fatal accidents have been reported which have occurred because of personnel coming in direct line of loose flying off parts fitted on pressurised equipments.

Special Note: Always check MSDS before handling any refrigerant and follow all safety requirements.

Exposure to large concentrations of fluorocarbon refrigerants can be fatal. In high

concentrations, these vapours have an anesthetic effect, causing stumbling, shortness of breath, irregular or missing pulse, tremors, convulsions, and even death. Take care and be safe.

Personal Safety Precautions when working in Refrigerated Spaces

- a. Keep refrigerated spaces dry and free of water and condensate accumulation due to choked drains.

Moisture inside refrigerated spaces will reduce the efficiency of refrigeration by accumulating on the evaporator coils as frost. It will also make the floor slippery and can cause accidents due to slips, trips and falls.

- b. Take all personal safety precautions not to inhale any refrigerant vapours, which could have possibly leaked out into the chamber, which can also cause chemical poisoning of the human system. Refrigerant vapour under high temperature can liberate phosgene gas, which is highly poisonous.
- c. Always vent refrigerated spaces for sufficient duration before personnel entry.

- d. When working in refrigerated spaces with frozen cargoes, wear protective warm clothing.
- e. When working in refrigerated spaces with chilled cargoes, especially fruits, beware of accumulated pockets of carbon-di-oxide and ethylene, which could cause an oxygen deficient atmosphere. This is particularly applicable for controlled, regulated and modified atmospheres.
- f. It is safer always for at least two persons to enter and work in refrigerated spaces at a time.

It's very important that all personnel should be aware of the push button alarms, nearest escape routes, lighting arrangements and emergency exits (their opening methods) from refrigerated spaces. ■

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Carrier Transicold To Launch Telematics Solution

ORBCOMM Inc., a global provider of machine-to-machine and Internet of Things (IoT) solutions, has been selected to develop the system...

Basically, Telematics is the branch of information technology that deals with the long-distance transmission of computerised information. However, in parlance with Logistics, Telematics refers to connected fleet management. It's a boon to the fleet managers as it helps in detailed tracking of the position of the vehicle, routes taken, its status and the driver's activities on real time basis.

Now, Carrier Transicold, a part of UTC Climate, a company that helps improve transport and shipping of temperature controlled cargoes with a complete line of equipment and services for refrigerated transport and cold chain visibility, will start offering a customised telematics solution. The solution will deliver advanced capabilities for its Transport Refrigeration Units (TRUs).

The new telematics solution will help fleets manage their refrigerated assets by enabling remote refrigeration unit monitoring, control and diagnostics, data management and other value-added capabilities.

"We are excited about the opportunity to provide an advanced two-way wireless communications system, uniquely qualified for truck and trailer units and backed by our comprehensive dealer support network. Adoption of telematics by the transport industry has evolved rapidly and is now an important tool for fleet management," says David Appel, President, Carrier Transicold & Refrigeration Systems.

ORBCOMM Inc., a global provider of machine-to-machine and internet of things solutions, was selected to develop the system

according to design and qualification requirements specified by Carrier Transicold.

"We launched this initiative in response to customer demand for an original equipment manufacturer-provided system for TRUs," reveals Appel.

He further adds, "The system can be factory-installed and will be supported by our authorised dealer network. ORBCOMM's experience with remote monitoring and control solutions for mobile assets complements our expertise in transport refrigeration systems. Its expansive satellite and cellular capabilities provide the scale needed to support Carrier Transicold TRUs."

"We are pleased to have been chosen to support global refrigerated transport leader Carrier Transicold. ORBCOMM's technologies and knowledge will provide Carrier Transicold's customers with tools to better track and monitor their shipments," comments Marc Eisenberg, CEO, ORBCOMM.

With field trials nearing completion, Carrier Transicold anticipates the full release of its telematics solution in North America in 2017, followed by rollouts in Europe and other regions around the world. ■



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Remedies To Increasing Water Demand In Commercial Buildings



Any commercial building is going to have air conditioning system to provide comfortable atmosphere to its occupants. The first step an MEP Engineer should do is to reduce the heat load. It will directly reduce electrical power consumption and water demand...

The need to conserve water, its high scarcity and undependable supply in many parts of the country has made MEP design engineers study each new building project carefully to evaluate the possibility of maximum water savings. All the Municipality norms, Eco Housing and green building guide lines also give higher priority to water efficient building service features.

Background

Any commercial building is going to have air conditioning system to provide comfortable atmosphere to its occupants. The chart (next page) will give you the water chart of any commercial building.

Now, once the water requirement is clear, the designer or client has to submit water demand at Statutory Authority. Simultaneously, various options have to work out to use STP water, ground water and rain water harvesting, which we all know.

Now, let's discuss, how we can save the water demand itself, which again has various sub categories such as:

- Defining fix and floating population.
- Proper calculation of domestic and flushing water requirement.
- Proper land cap irrigation and
- Of course water requirement for services.

All of us know that we should not do any compromise on fire fighting water requirement, but of course value engineering is required to reduce water requirement of air conditioning units.

As shown in the (next page) chart, Chiller Units needs a good quantum of potable water, the designer has to think various ways to tackle this issue. The services consultant has to take the first step on how to reduce the potable water requirement by a chilling plant of course with a techno-commercial comparison of availability and cost of water versus the same of electricity.

Reducing the heat load

The first step an MEP Engineer should do is to reduce the heat load. It will directly reduce electrical power consumption, and water demand. All the green building bodies always give priority to reduce heat load of the building.

Various ways to reduce heat load:

1. Roof insulation is the first on the list. Roof can be laid with brickbat coba waterproofing, screed, white China mosaic tiling and good SRA materials. Again it can be fully covered with PV (photo voltaic) cells, over head tanks, chilling units etc resulting in a U value of 0.21 W/cm.K.

Water Demand Chart for Few Buildings

WATER DEMAND CALCULATION									
Description	Total Carpet Area (sqft)	Pop	Domestic	Flush	Total Water Requirement (Litr/Day)	Balance Treated water	HVAC Load (TR)	Water Req per day Litr/Day	Total Water Requirement Litr/Day
			Water @ 20L/P/D	Water @ 25L/P/D		excl. flush			
IT Park	1,00,000	1,250	26,688	32,375	59,063	15,978	500	58,800	69,510
Shopping Mall	1,00,000	1,667	35,583	43,167	78,750	21,303	625	52,500	66,780
Hospital	1,00,000	1,667	35,583	43,167	78,750	21,303	833	49,000	63,280
80% of domestic Water can be re used in flushing									
With more treatment, rest balanced treated water can be used for air conditioning									
AC water requirement in percentage over total water requirement							40.00		
Note: Water Req per day with 24 hours operation for IT Park and Hospital , 12 Hr for shopping Mall									
Note: Permanent Population @1person / 80sqft in IT park , @1person/60 Sqft in shopping Mall and Hospital									

If we put the same assumption in above water demand chart:

WATER DEMAND CALCULATION									
Description	Total Carpet Area (sqft)	Pop	Domestic	Flush	Total Water Requirement (Litr/Day)	Balance Treated water	HVAC Load (TR)	Water Req per day Litr/Day	Total Water Requirement Litr/Day
			Water @ 20L/P/D	Water @ 25L/P/D		excl. flush			
IT Park	1,00,000	1,250	26,688	32,375	59,063	15,978	125	14,700	25,410
Shopping Mall	1,00,000	1,667	35,583	43,167	78,750	21,303	160	13,440	27,720
Hospital	1,00,000	1,667	35,583	43,167	78,750	21,303	210	12,348	26,628
80% of domestic Water can be re used in flushing									
With more treatment, rest balanced treated water can be used for Air Conditioning									
AC water requirement in percentage over total water requirement							14.58		
Note: Water Req per day with 24 hours operation for IT Park and Hospital, 12 Hr for shopping Mall									
Note: Permanent Population @1person / 80sqft in IT park , @1person/60 Sqft in shopping Mall and Hospital									

Note: Water requirement for Air Conditioning system got reduced from 40% of total building water requirement to 14%.

- Wall insulation was then added on all sides of the bedrooms, using 25 mm glass wool covered with Gypsum board.
- Glass windows can be of double glazed sandwich type with a U value of 2.1 W/m.K.
- The light fittings should be LED type fixtures.

Note: In each case several different materials have to be considered to evaluate the best alternative.

With all these measures the final heat load can be reduced up to 675 sq ft/ton, instead of 150 sq ft/ ton of normal practice. The reduction of heat load can help in reducing demand of potable water up to one fourth of the total requirement. In the same way, the total electrical demand of the building also gets reduced.

Source of water for services

Although domestic water has to come from municipal supply, where 100% guarantee

is there for availability but rain water stored in a tank and STP water with proper treatment can be used for Cooling Tower but the cost is very high in both the options.

Selecting the AC system

Now that the plant capacity is determined, various options are considered, and a central chilled water system is selected for maximum flexibility.

- Water Cooled VRV Units also save water demand compared to water cooled chillers with better power consumption benefit.
- Air Cooled units (VRV and Chillers) can be fruitful, if requirement is less or when portable water is not available.
- Geothermal Air Conditioning System stands first in the row. It uses ground water for air conditioning system.
- Ground water cooled chiller Units are also good alternatives. Unused Bore well

has a water temperature in the summer months of 26°C maximum. Further cooling of this source of water to 8°C through a small capacity water-cooled packaged chiller can give us the chilled water required for the Fan Coil Units in the air conditioning areas.

Conclusion

Water scarcity is a global problem, and we all designers and planners have to work together to sort it out. Air Conditioning engineer with good coordination with Plumbing Engineer can definitely save up to 25% of total water demand of a building. ■



Firoj Kumar Jena
CEO
Clancy Global Consulting
Engineers

UV Analyzers To Monitor Dissolved Gases

Each parameter is analysed based on the measurement of UV absorption in the sample...



Water engineers responsible for municipal or industrial water and wastewater will find the new versatile single or dual parameter CA-6 UV Analyzers from Electro-Chemical Devices (ECD), which can monitor any two selected parameters in separate measurement ranges for ammonia, nitrate or chemical oxygen demand (COD 254 nm).

According to ECD, their CA-6 UV Analyzer Family provides a highly accurate, reliable and economical on-line sampling system that's designed with UV absorption sensor technology to monitor harmful pollutant parameter levels. The CA-6 Analyzer's sensors are available in multiple parameter measurement ranges: Ammonia from 0-10 mg/L or 0 to 1000 mg/L; Nitrate from 0-30 mg/L, 0-100 mg/L, or 0-250 mg/L and COD 254 nm from 0-200 mg/L or 0-20,000 mg/L.

Each model is easy to order with either a single parameter or dual parameters in the factory pre-calibrated measurement ranges. Everything needed comes in one box ready to install and start-up. A single technician can complete the installation process in 15 minutes by connecting the sample, waste and cleaning solution (reagent) lines and

powering up the analyzer. Accessing the chosen factory pre-calibrated parameter data or customising an analysis routine is easily done with user-friendly intuitive menus and a touch screen display.

Each parameter is analyzed based on the measurement of UV absorption in the sample. The absorbance of the solution or gas is measured through a quartz flow cell at a specific wavelength using a long-life Xenon lamp and photo detectors. The absorbance level is directly related to the sample concentration according to Beer-Lambert's Law, which correlates the attenuation of light to the properties of the material through which the light is traveling.

To measure Ammonia, a reagent is added to the liquid sample and converts the ammonia to gas for measurement by the CA-6's UV sensor with a fast Fourier transform algorithm that provides a measurement equivalent to the level of Ammonia. A water temperature probe performs automatic temperature compensation for high accuracy.

In measuring the Nitrate found in turbid, organic rich waste water, the CA-6 UV's advanced self-cleaning design relies on the strong absorption of UV light by the chromophore N-O, which again is according to Beer-Lambert's Law. Automatic internal linearization compensates for high concentrations of Nitrate. A second wavelength and detector compensates for dirty matter in the flow cell to ensure high accuracy and reliability.

For the measurement of COD 254 nm, the CA-6's sensor detects UV light absorption by unsaturated organic molecules at the 254 nm wavelength. COD 254 nm levels in river water and municipal wastewater are closely correlated to the permanganate and dichromate water standard methods. Measurement is extremely responsive, less than 10 seconds and requires no reagents or calibration solutions.

Accuracy is 5% for the measurement of Ammonia, Nitrate and COD with the CA-6 UV Analysers, based on a sample temperature range of 0 to 80°C, but the sample must be liquid and not frozen. Repeatability varies based on the parameter chosen and the single or dual parameter configuration, ranging from 0.15 to 3%.

The versatile CA-6 UV Analyzers are designed with four alarm relays. A single 4-20 mA analog output is included with 12-bit resolution. RS232 communications are provided for data download to a CSV file, with an optional RS485 MODBUS communication module available. ■

For further information: Eric.Kim@ecd.com

Forum To Focus On Emerging Trends, Regulatory Challenges

Emerson Climate Technologies, a business of Emerson, will host its next E360 Forum in support of its E360 platform on August 24, at the Renaissance Newark Airport Hotel in New Jersey...

The Forum will feature a keynote session from Jon Melchi, HARDI VP of government affairs and business development, and Valerie Briggs, NATE Director of marketing and business development. Melchi will cover top HVACR industry issues in an election year and provide updates on legislation impacting the HVACR industry along with the latest activity on Capitol Hill. Briggs will highlight the importance of setting your business apart through industry certification.

Also during the general session, a focus on innovation, refrigerants, regulations, applications and trends will be presented by Emerson Climate Technologies experts Don Newlon, Vice President/General Manager, refrigeration marketing; Kurt Knapke, Vice President, engineering and electronics; and Dean Landeche, Vice President of marketing, retail solutions. The presenters will highlight market dynamics associated with Environmental Protection Agency (EPA) refrigerant delistings and Department of Energy (DOE) energy reduction regulations; trends in new alternative synthetic refrigerants that promise lower global warming potential; and the Food Safety Modernization Act's new requirements related to food quality, safety and integrity.

Following the general session, the afternoon will feature interactive breakout sessions on a variety of relevant topics. Sessions are divided

into three tracks – foodservice, food retail and industrial refrigeration – to give attendees opportunities to discuss the issues that are impacting them the most. Breakout sessions include:

- **How Can Refrigeration Architecture Help Improve Operating Efficiencies?** (food retail track) — Howell Feig, National Sales Manager of AHT Cooling Systems USA, will outline options for improving energy efficiency and reducing carbon footprint to comply with upcoming DOE and EPA regulations.
- **Introduction to Combined Heat and Power** (industrial track) — Matt Lensink, COO of CEM Engineering, will lead an informative session on the financial and energy-related advantages of adopting combined heat and power in applications with a high demand for steam and hot water or hot air.
- **How to Meet 2017/2020 Energy Regulations** (foodservice track) — Allen Wicher, Director of Marketing, foodservice for Emerson Climate Technologies; and Ani Jayanth, Foodservice Marketing Manager of Emerson Climate Technologies, will address the implications of the DOE regulations related to energy consumption for walk-in coolers and freezers; reach-in, self-contained systems; and ice machines. ■

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CII Chairman Visits Emerson Climate

While addressing the audience, Dr PC Jain urged the youth and the young professionals to draw inspiration from India's glorious past of over 5000 years in developing holistic solutions...

Visit of Dr PC Jain, Chairman, Confederation of India Industry (CII) – Indian Green Building Council (IGBC) to Emerson Climate, was a momentous occasion. It was truly, a meeting of two institutions that think alike. Dr PC Jain and Emerson share an abiding concern for a greener, healthier environment. Both are forward thinkers in their own right, committed to bringing innovation and creativity into every aspect of the HVACR industry. His visit further cemented the decade long Emerson-IGBC association.

Dr. Jain, has been credited with launching IGBC, a branch of the US Green Building Council (USGBC) and is one of the biggest proponents for using green technology to reduce carbon footprint. He is also the Founder & President Emeritus of ISHRAE and was honoured by ISHRAE & ASHRAE India with the Life Time Achievement Award.

Dr. PC Jain, while addressing the audience, urged the youth and the young professionals to draw inspiration from India's glorious past of over 5000 years in developing holistic solutions that are suitable for India's

environment. He outlined his vision in setting up the CII-IGBC center at Hyderabad and the efforts that went in towards making it India's first LEED certified building. He was all praise for Emerson

Climate's initiatives in supporting the green building movement and impressed upon the audience to take forward and implement the same thought processes in their daily lives too.

It was indeed an inspirational, enlightening and a memorable experience for all present. ■



Symposia: A Seminar On Non-conventional HVAC Systems

More than 300 delegates attended this programme from various industries and sectors...

On 17th June 2016, the ISHRAE Mumbai Chapter in association with the ISHRAE Thane Chapter and the ASHRAE Mumbai Chapter organised its annual National Program 'Symposia' in Mumbai. This event was supported by some of the prestigious institutions in the country like Indian Green Building Council (IGBC), Refrigeration and Air Conditioning Manufacturers Association (RAMA), The Refrigeration & Air-Conditioning Trades Association Ltd (RATA) and so on.

Energy Efficiency Solutions) was invited to share a product presentation on 'Multi-stage Evaporative Cooling Systems.'

More than 300 delegates attended this programme from various industries and sectors. HMX's cooling solutions found wide interest from HVAC consultants (both from Mumbai chapter and other Indian chapters), HVAC contractors, architects, builders (IT, malls, other commercial complexes), end users (corporate, industries, PMCs, system integrators, consultants), electrical, monitoring system providers, safety solution providers etc.

This event helped in reinforcing HMX's reputation as a leader in Indirect Evaporative Cooling in India. ■



Alfa Laval offers Gasketed Plate Heat Exchangers

High efficiency and versatile design make the Alfa Laval FrontLine and BaseLine Gasketed Plate Heat Exchangers (GPHEs) solid choices for a wide range of hygienic heat transfer applications. The premium Alfa Laval FrontLine range is preferred by many users for their demanding hygienic applications, for applications that require gentle product handling, and for heat-sensitive media or media containing particles and fibres. The As per the company, BaseLine range is a competitive heat exchanger for less demanding hygienic processes and utility applications.

Both heat exchangers are available with two different plate types:

- The standard Chevron-type plate, which is used in a wide range of applications, provides good product distribution as well as high thermal efficiency making it suitable for pasteurisation of milk and cheese milk.
- The Gemini double wall plate consists of two plates pressed together, which prevents the cross contamination of fluids in the event of leakage through the plates. Gemini plates are not welded, making it easy to open and inspect them during service.

In addition to these two plate types, the Alfa Laval FrontLine range also offers the Alfa Laval Wide Stream Plate for products that contain particles and/or fibers, making it ideal for processing juices. ■

Website: www.alfalaval.com



Bell Technologies launches MPT- a High-Pressure Flow Meter

The Bell Technologies has introduced, Multiphase Toruswedge (MPT) – a high-pressure flow meter for safely measuring multiphase volumetric flow rates for wellbore processes.

The meter is designed to provide high accuracy volumetric flow measurement on drilling rigs and can be utilised for multiple applications ranging from low to extremely high pressure. The MPT is chiefly suited to mud flow where fluid is injected into the well through high-pressure high volume injection pumps.

Mud is then returned to the surface through the bell nipple where it flows through the shaker for cleaning prior to being re-circulated back to the wellbore. The product handles demanding applications that require robust performance combined with low maintenance. The MPT will allow operators to confidently monitor mud flow. ■

Website: www.belltechnologiesllc.com



Danfoss stretches the ICF Flexline range of Valves

The blooming modular ICF Flexline valve range for industrial refrigeration combines the freedom of configuration with fewer weldings in compact and robust valve housing. Danfoss introduces two new larger valve types to make the ICF Flexline range complete: A DN 50 valve with four modules, and a DN 65 valve with three modules.

The company's ICF Flexline range of valves for industrial refrigeration has seen an unequivocal success. So far, the company has focused on smaller dimensions from DN 15 up to DN 25, which is sufficient for most refrigeration systems. With the DN 50 and DN 65 valves, Danfoss expands the ICF family upwards in scale and capacities to cover applications where large dimensions are needed. The ICF range now comprises the new ICF 50-4 and the ICF 65-3. ■

Website: www.belltechnologiesllc.com



Fujitsu strengthens its Product lineup

Fujitsu General Group has strengthened the product lineup (26 models) of commercial use air conditioners including ceiling cassette and ducted types as well as large size wall-mounted type and multi air conditioning system for buildings, realising the industry's top (as of April 8, 2016, according to the company's survey) energy saving performance for 2016 season in Europe.

They are releasing 26 models of commercial use air conditioners, which correspond to various needs of designers and construction companies – as well as users by considerably enhancing energy saving performance, comfort and ease of installation compared to their company's conventional models sequentially from January, 2016.

As per Fujitsu, in recent years, the energy saving regulations have become tighter in various areas in the world for the measures against global warming. Especially, European countries are positively promoting the energy saving policy by setting Minimum Energy Performance Standards (MEPS) and establishing Labelling System to promote the understanding for consumers quickly. Therefore, the products of high energy saving performance are required. Also, in the commercial use models, it is necessary to respond to various requirements for each property including installation place and check of operation status after installation. ■

Website: www.fujitsu-general.com



The GEA offers patented Self-limiting Automatic Purger

Non-condensable gases cause considerable loss of efficiency. Air or other non-condensable gases can dissolve in the refrigerant and come into circulation in the refrigeration system, causing (even in small concentrations) a significant increase in condensing pressure due to their different/higher partial pressures. Refrigeration systems must therefore be kept as free as possible from non-condensables.

The most effective way of doing this is by automatic purging, as this responds immediately to any entering of non-condensables in the system. The Self-limiting Automatic Purger is a purging device, which reduces the concentration of non-condensables to a negligible percentage, with a just as negligible loss of refrigerant. This patented self-limiting Automatic Purger starts only when the concentration of non-condensables in the liquid receiver is 2% or more and stops when this concentration has dropped to below 1%. Since, in the entire installation, the average concentration of non-condensable gases is much lower, this represents an average concentration in the installation of less than 0.1%.

The features are as follows:

- Minimising plant power consumption.
- Hermetic internal cooling system.
- Capacity of the refrigeration plant restores to maximum level.
- More safe for operators (no interference with the system).
- Increased safety for the total plant.
- Less or no plant breakdowns during hot summers.
- Plug and play with only one connection to main refrigeration plant.
- Self contained, independently operating refrigeration unit also functions when the main plant has stopped.
- Guaranteed final concentration of non-condensables in the condenser lower than 2%.
- Saving more than 95% of refrigerant when compared with manually purging.
- Suitable for any size of refrigeration plant; even on a 6000 kW installation.
- Suitable for ambient temperatures up to 45°C. ■

Website: www.gea.com



We are moving...

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Greenheck offers Low Sound Condenser Fans

Greenheck, a well known manufacturer and distributor of air movement, conditioning and control equipment is currently offering low sound condenser fans. It is offering this as a standard contribution on its Model RV and RVE pre-engineered packaged rooftop ventilation systems.

Condenser fan noise levels can be a challenge with air-cooled packaged rooftop equipment installations. If the equipment is too loud, or placed too close to other buildings, corrective actions are time consuming and costly.

The company's low sound condenser fans offer a sound power reduction on average of 5 to 8 decibels when compared to standard condenser fans resulting in perceived sound levels being reduced by up to 50%.

An optional electronically commutated motor is also available for increased system efficiency and provides additional sound power reduction at part load conditions.

With performance capacities up to 13,500 cfm, up to 45 tons of cooling and 800 Mbh heating, Greenheck's Model RV and RVE meet the demands of today's heating, cooling, dehumidification and ventilation requirements. ■

Website: www.greenheck.com



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Renovated 'Is Molas Golf Resort' uses Climaveneta heat pumps



The first step of the development is composed by 15 villas now under construction...

Is Molas Golf Resort is situated 30 km far from Cagliari airport, in the south west of Sardinia, one of the most charming coastline of the island, characterised by a wild and suggesting landscape between the mountain park and the sea side. The resort is now under up-grading, following a prestigious project signed by Fuksas architect. It is based on the construction of a new 80 rooms hotel, a 39 suites boutique hotel and some residential villas for a total of 300 beds, in addition to a restaurant, a boutique, a wellness centre and an exclusive private beach club.

The first step of the development is composed by 15 villas, now under construction on an area between the mountain park and the 'Championship Course', that will be delivered in October 2016. The villas, designed by Massimiliano Fuksas and his wife Doriana, represent the best of the 'made in Italy' style and gather famous partners in terms of architecture and plant design.

To grant a perfect comfort in the first 15 villas the M&E designer has selected 15 WWR DHW2 heat pumps, by Climaveneta. ■

Chengdu IFS earns LEED EBOM Platinum certification



Chengdu IFS has become a new landmark of sustainability in southwest China...

Chengdu International Finance Square (Chengdu IFS), a flagship project by the Wharf (Holdings) Limited, has earned LEED EBOM (Existing Buildings: Operations & Maintenance) Platinum certification, the first in southwest China. With energy efficiency at 35% higher than average, Chengdu IFS has become a new landmark of sustainability in southwest China.

Johnson Controls, specialising in energy consulting, integrated HVAC (Heating, Ventilation and Air-Conditioning), building controls products, as well as operations and maintenance services, joined hands with Wharf in a bid to fulfil their commitment to green buildings.

A flagship commercial complex of Wharf in Mainland China, Chengdu IFS is located in the most coveted location within the Chunxi Road's core business district in the heart of Chengdu. It comprises a flagship shopping mall, two premium Grade-A office buildings, Niccolo Hotel and luxury residence. Chengdu IFS is committed to build the most premium urban complex in western China, offering the most optimal and superior experience to shoppers, visitors and tenants.

"We recognise the professionalism of Johnson Controls, and we also highly appreciate its contributions in realising our commitment to green building and sustainability," says Christina Hau, General Manager (Operations) of Wharf China Estates Limited. ■

City Multi solves the ventilation challenge of the Herb Garden restaurant



A single City Multi outdoor unit is sending simultaneous heating and cooling to the indoor units...

An artisan pizza restaurant under railway arches in central Newcastle has solved the problem of summer overheating with the installation of a heat recovery VRF air conditioning system. The Herb Garden is one of Newcastle's quirkiest, fine food restaurants. The venue is also renowned for its feature lighting and is tucked away in Arch 8 of Westgate Road, just beside Central Station and Newcastle Castle Keep.

Siting a pizza oven inside a metal-clad railway arch had previously caused problems with a build-up of heat in the summer, and the site had limited space for any plant, alongside restrictions on internal fittings because of the metal cladding.

Tyne and Wear-based ADS Air Con Ltd., were called in to install a system whilst working around the restaurant's opening hours. A single City Multi outdoor unit has been installed in an empty space to the rear of the building. That can send simultaneous heating and cooling to the indoor units installed throughout the restaurant to maximise the efficiency of the whole system. "The arches are listed and owned by Network Rail and there were restrictions on the type of solution that we could install. That's why the 2-pipe solution from Mitsubishi Electric has worked so well," said D Short, Director of ADS Air Con. ■

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Sr. No.	Parameter	Cooling Tower (Induced Draft)	LTMCS
1	Wet Bulb Temperature	29°C	29°C
2	Chilled Water Temp in °C (Assumed)	5°C	5°C
3	Supply Temp. from CT / LTMCS	33°C	30°C
4	Approach to WBT	4°C	1°C
5	ΔT for Chiller	28°C	25°C
6	Chilled Water Compressor Motor Kw for 1200 TR	720	643
7	Energy Saved in %	-	10.7%
8	Energy Saved in Kw	-	77 Kw/Hr
9	Total Running Hours per Annum	8640	8640
10	TOTAL POWER SAVED PER ANNUM	-	6,65,280 Kw



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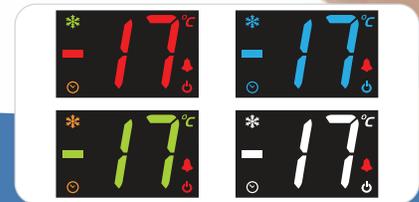
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