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Series HHT - Explosion-Proof & Intrinsically Safe RH/Temp Transmitter



Series DPT-Flow – Aerosense Differential Pressure cum Air Flow Transmitter



Series Floaxis – Aerosense Multipoint Averaging Flow Sensor with 'K' Factor



Series SBLT – Dwyer Submersible level Transmitter



Series EDPT-Aerosense make Differential Pressure Transmitter.



Series TTE – Aerosense Temperature Sensors & Transmitter



ISDP: Intrinsically Safe Differential Pressure Transmitter



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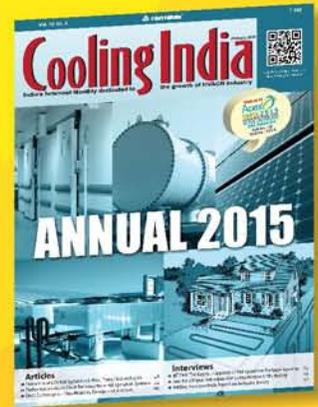
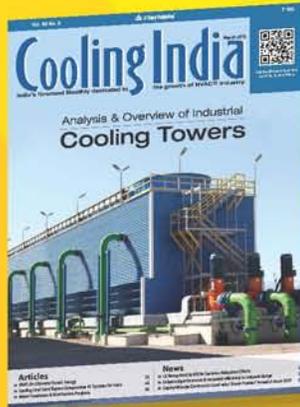
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Publisher's Letter



Publisher's Letter

New Spirit in New Financial Year

Although there is no doubt that the current focus in the HVAC&R industry is towards energy saving, the issue is not only limited to the improvement of the electrical components, but also there are many other areas where even an incremental modification can make a big change in the overall O&M (Operation & Maintenance) cost. When aggregated, those small and normally neglected areas may produce a big impact on the plant owner's finance.

To be more specific, high level of humidity and temperature can change the dielectric property of the PCB materials inside a datacenter. If the owner or manager of a datacenter is aware of this, then through a little and timely modification in his HVAC&R installation, which may not be very costly, he can prevent a big crash that is much costlier.

How easy it is to find out an HVAC&R component vendor, who maintains a huge catalogue of alternative products – where new variants are added almost daily – it is next to impossible in the real world, but it is not so in the emerging virtual market. Looking at things with a bit of shift in paradigm can yield several beneficial effects. Say, designing a pipe-joint with a new concept... it can fetch several benefits like time saving, faster expansion...

Considering the above thoughts and some more aspects like those, we have compiled the April 2015 issue of your favourite magazine "Cooling India." Peak summer days are coming, I hope, before that this cool issue will reach you and fill you with several new ideas.

I'm also glad to inform you that P. K. Chatterjee (PK) has joined our team recently as the Editor of Cooling India. PK has almost two decades of experience in various B2B publications. I firmly believe that his versatile exposure, long experience and proven leadership quality will definitely add values to your favourite magazine.

Please send your comments at pravita@charypublications.in

Pravita Iyer
Publisher & Director





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High Efficiency Mist Cooling System as an Alternative to Cooling Tower - Makarand A Chitale

There is an urgent demand from the industry for a water-cooling system, which will operate with high efficiency even in adverse climatic conditions, and maintain cold water temperature in closed vicinity to WBT...



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Electronic Control Advances in Refrigeration and Air Conditioning Units
- Dr S S Verma



Innovative Refrigeration Technology
- Deepak Kumar D Desai, Writdhma G Prasad & Rajesh R Vaghasia



Selecting the Right Leak Detection Tools
- Paul Appler



Identifying the Energy-Loss due to Under-Loading
- Ashok Sethuraman



Need for Smart HVAC Control Systems
- Norman D'souza



Remote Temperature Monitoring of Reefer Containers
- Chilukuri Maheshwar



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installations

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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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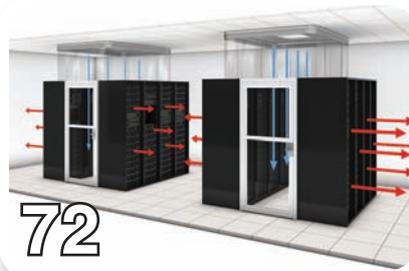
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- Albert Ciuffreda



Advanced PCM Technology for Hybrid Reefer trucks
- Vishnu Sasidharan & Paramjot Singh



Biofouling Treatment with Chlorine Dioxide for Cooling Towers
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- Stuart Corr
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V5 X Series

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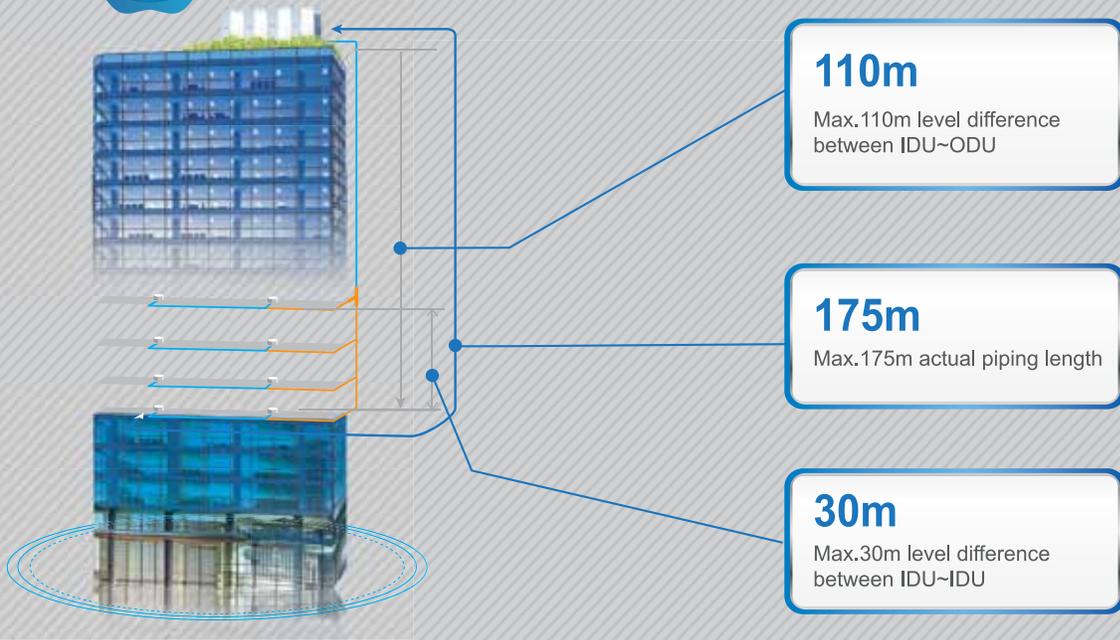
88HP



Diamond Shaped Design

1000m

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



FROM THE EDITOR



Deploying the Latest Technologies in HVAC&R Sector

Rapid development, in the fields of IT, Telecom and Automation, is creating more and more visibility these days, which is in turn offering opportunities for better control of the HVAC&R systems. 'Control' in terms of plant load management, air temperature and flow management, leak detection, gas and water flow monitoring, energy conservation, safety evaluation, carbon footprint reduction etc. – the list is increasing every day. But the question is how far are we capitalising on these opportunities?

Around two decades back or so, VFDs (Variable Frequency Drives) were introduced in the HVAC&R plants and machinery. They have a great influence as far as the overall plant power saving is concerned. Although in some cases, there may be some harmonics related problems that may affect smooth running of other nearby equipments. There are remedies available to manage that. However, still in many places, two speed motors are being used.

With advancement of the wireless technology, by dint of the automated components, today it is possible to study the entire performance of an HVAC&R plant from anywhere in the world at the real time. Thus, for the plant managers or owners decision making has been far easy with the information displayed on their mobile phones.

Intelligent instruments can now communicate on real time basis, which is a great boon for the industry. A few companies have developed very nice software for this purpose, which are very easily working on multiple platforms.

Although, all these technologies are available in India, and they have enough to contribute to our national growth mission, many of our plant owners are still hesitant to accept them. I feel the ice needs to be broken ASAP, and the technology vendors have a big role to play in that process. They have to be more active in generating awareness about their technologies and their verified benefits.

P. K. Chatterjee

“
Advancement of the wireless technology, has made it possible to study the performance of an HVAC&R plant from anywhere at the real time...”



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Editor: P K Chatterjee (PK)

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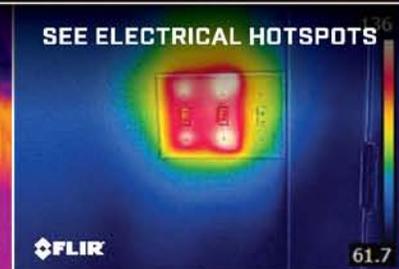
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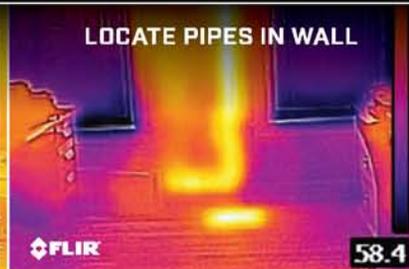
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Alfa Laval to supply OLMi heat exchangers to petrochemicals



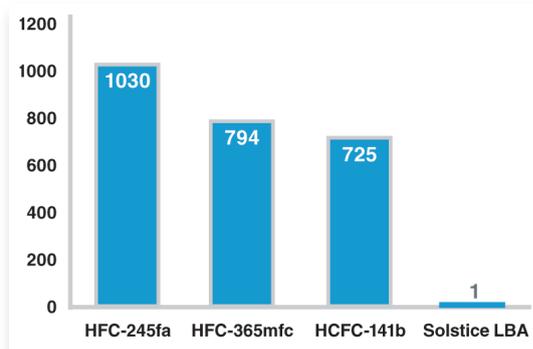
Alfa Laval, a world leader in heat transfer, centrifugal separation and fluid handling – has won an order to supply Alfa Laval OLMi heat exchangers to a petrochemical plant in Turkmenistan. The order, booked in the Energy & Process segment late March, has a value of approximately SEK 70 million and delivery is scheduled for 2016.

The Alfa Laval OLMi heat exchangers will be used to increase the yield and recover energy in the production of ethylene, an important ingredient for the manufacturing of industrial chemicals and plastics products.

"We are pleased to have booked another large order for our OLMi heat exchangers," says Lars Renström, President and CEO of the Alfa Laval Group. "It confirms that our OLMi products are very well suited for the petrochemical industry's demanding applications."

Alfa Laval OLMi heat exchangers can handle temperatures up to 1100 degrees Celsius. ■

Hisense adopts Honeywell's Low-GWP Insulation Material to reduce global warming impact



Honeywell Solstice Liquid Blowing Agent has a GWP equal to 1

Honeywell announced that Hisense, a leading Chinese appliance manufacturer, will begin using Honeywell's low-global-warming-potential (GWP) insulation materials in its refrigerators and freezers to reduce the global warming impact of its insulation while increasing its energy efficiency. Hisense will implement Honeywell's Solstice® Liquid Blowing Agent (LBA) widely.

Solstice LBA is a non-ozone-depleting blowing agent that has an ultra-low global warming potential of 1, which is 99.9 percent lower than HFC-245fa, a commonly-used blowing agent. Blowing agents allow closed-cell polyurethane foam insulation, used in the walls of refrigerators and freezers, to expand while providing the majority of the foam's excellent insulating properties.

"Solstice LBA can help appliance manufacturers achieve an 8 to 10 percent improvement in energy efficiency compared with alternative blowing agents," said Sanjeev Rastogi, business director for Honeywell Fluorine Products. "Hisense's decision to adopt this new blowing agent demonstrates their innovation leadership in the appliance industry and builds on the long-standing strategic partnership between our two companies."

Hisense was the first to adopt Honeywell's prior-generation Enovate® 245fa blowing agent, which provided Hisense refrigerators and freezers with improved energy performance and reduced ozone impact. "We are excited to lead the way again by implementing Honeywell's innovative and cost-effective low-GWP Solstice LBA at manufacturing locations in China. Through this collaborative effort, we stand at the forefront of the latest global technologies and we are helping advance environmentally-preferable technology in China," said Hisense. ■

CAREL launches exclusive solutions for China



Image Courtesy: Carel Industries S.p.A.

In the lead-up to China's largest HVAC trade show, CAREL participated in Shanghai from 30 March to 2 April at the HDD exhibition for the catering and hospitality industry. Carel presented their high-efficiency solutions designed especially for professional kitchens and catering applications.

At the show, CAREL launched its solutions designed especially for Chinese market, such as the new line of RCEZ 30A thermostats, including a new electronic thermostat designed expressly for China. The RCEZ line is a range of electronic microprocessor controllers with LED display for the management of refrigerating units, cabinets and showcases. Different models are available, for controlling refrigerating units with or without on-board fans, operating at low or above-zero temperatures.

Important new technology EVD ice invented for cold environment and IR33 + FMC was introduced at the event. It is designed especially for cold rooms, EVD-ice is the evolution of the electronic valve driver designed to operate in extreme conditions,

directly inside the cold room evaporator. Ir33 + FMC for Embraco Fullmotion compressors, on the other hand it simplifies the operation and management of variable-speed compressors in refrigeration applications. By simply setting just a few parameters, significant variations in compressor capacity can be implemented, with huge energy savings.

Also there was a display of Carels' solution with constant temperature and humidity control for wine coolers and chocolate display cases. The CAREL range of solutions is HACCP International* certified to ensure food safety, voluntary quality certification that means added value. ■

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EPEE side event to debate on reduction of HFC emissions



EPEE will be holding a side event in Bangkok during the OEWG on 23 April between 1 to 3pm. The will take the form of an open debate on global trends and developments to reduce HFC emissions - an industry perspective. The will take the form of an open debate on global trends and developments to reduce HFC emissions - an industry perspective. Political leaders from around the world have emphasised the need for global action to reduce HFC emissions. Initiatives under the Montreal Protocol, such as the North American Proposal and the more recent EU discussion paper, have further stimulated discussions. Despite ongoing discussions, achieving a global agreement is a challenge. This is due to various factors, such as significant differences between regions in the world in terms of their climate, economy, and market dynamics, lack of information, data, and evidence about the feasibility to take global action on HFCs. EPEE's workshop aims at providing input from the perspective of industry in Europe – the first region in the world that has binding legislation stipulating a phase-down of HFC consumption. ■

Solenoid valve series from Gems Sensors and Controls



F-Series from Gems Sensors & Controls

Gems Sensors & Controls, a leading oil and gas industry supplier of liquid level, pressure and flow sensors, as well as fluid control devices, has announced the global market introduction of its F Series.

The F Series is a family of ruggedly designed solenoid valves, offering high-reliability for flow rate applications (orifices up to 2.5" and Cv up to 800) with a lifespan of up to 10 million cycles. The series is available in a variety of configurations, all with bubble tight shutoff.

Customers can choose from a broad range of 2-way normally open, 2-way normally closed and 3-way valve types, with choice of stainless steel or brass wetted parts and housings. An expanded range of port sizes, pressures and electrical connector types are also available as standard. Explosion proof certifications are available upon request.

Gems F Series configurations includes, High flow, 2-way direct acting solenoid valves are normally closed with 1/2" - 1" line sizes, 9 g shock and vibration resistance, and speed capacities of up to 100 cycles per minute. Their durable construction features non-reactive stainless steel housings, a wide variety of wetted parts and seals, and an array of available electrical connections.

High flow, 2-way diaphragm operated solenoid valves are available in both normally closed and normally open types. They offer the highest flow capability of the series (orifices up to 2.5"), with a reliable service life exceeding 2 million cycles. This F-Series version features an all stainless steel body, with availability in a variety of wetted parts and electrical connections. This configuration is especially well suited for Compressed Natural Gas (CNG) compressors at wellheads and transit boost stations. High flow, 3-way direct acting solenoid valves feature 3/2 universal operation and life expectancy in excess of 10 million cycles. ■

FLIR Systems introduces new Thermal Camera for building professionals



FLIR C2, the first full-featured, pocket-sized thermal camera

FLIR Systems Inc., announced at the 2015 International Consumer Electronics Show (CES) the release of the FLIR C2, the first full-featured, pocket-sized thermal camera designed to help building professionals find and see hidden heat patterns that can clearly show where problems such as sources of energy waste, signs of structural defects, plumbing issues and so on.

Its compact and slim design enables the C2 to fit comfortably into any pocket, available for immediate use to uncover invisible building issues and to show customers where potential problems are located. In fact, at 4.9 x 3.1 x 0.94 inches and .13kg, the sleek architecture makes the C2 the most convenient, full featured thermal camera to carry available on the market.

Featuring FLIR's patented MSX® real-time image enhancement and a brilliant, simple-to-use touch screen with auto orientation, the camera creates thermal images with stunning details to help identify problem locations easier. MSX adds key details (captured by the onboard visible camera) to the C2's thermal images so numbers, letters, texture and other features are clearly recognizable without compromising the thermal image. With simple point-and-shoot operation, the C2 can store radiometric JPEGs with the push of a button. The images can be downloaded later using the free FLIR Tools software that allows the user to adjust thermal image levels, isolate and add temperature

measurements, change colour palettes, and create persuasive reports.

"The C2 is not only a convenient tool to help you get more done and take advantage of every opportunity to uncover issues, but also helps you verify the success of completed repairs for your customers," said Rickard Lindvall, FLIR Vice President and General Manager of FLIR's Instruments business segment. ■

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Nortek offers Inverter-Driven Split-System AC



Nortek Global HVAC introduces a new inverter-driven split-system air conditioner that achieves 20-SEER cooling in all sizes and matches. iQ Drive® model FS4BG is powered by an inverter-driven rotary compressor for ultra-high energy efficiency and ultra-quiet operation. The new iQ Drive air conditioner modulates from approximately 49% to 118% of capacity in five steps and it operates as quietly as 59 dBA. "Inverter-driven products operate very quietly and create exceptional indoor comfort," says Tim Alford, product manager at Nortek Global HVAC. "That's why we've developed a robust line of inverter systems. It's a way for contractors to differentiate themselves in the home and provide consumers with a high level of system performance." Installation is simplified with the new iQ Drive FS4BG model. This air conditioner operates with most two-stage thermostats and does not require shielded thermostat cable. ■

Making Duct Sealing even more Profitable



New Wireless Duct Sealing System

Aeroseal unveiled HomeSeal PRO, the next generation residential duct sealing system, at the ACCA Conference and IE3 Expo. Designed with wireless technology and new remote management capabilities, HomeSeal PRO can significantly increase the productivity and profitability of licensed residential aeroseal dealers.

"HomeSeal PRO can instantly cut the number of man-hours required to aeroseal a home by 50% or more," said Aeroseal's Scott Mueller, Director of Residential Sales. "Not only do the new remote management tools significantly reduce the time required to complete a duct sealing project, but, thanks to HomeSeal PRO's new integrated wireless capabilities, a procedure that used to require a minimum of two workers can now easily be accomplished with just one".

Using the Aeroseal wireless system, a technician is no longer tethered to the equipment to monitor and manage the process. Now a single worker can facilitate the entire computer-controlled duct sealing process via a tablet from anywhere in or around the house. All system monitoring and adjustments, including process pause, can now be performed remotely, allowing the technician to do ongoing inspections, as needed. Much of the on-the-job system setup time can also be eliminated with HomeSeal PRO. Using the system's long-range wireless capabilities, all of the duct sealing equipment can remain in the truck, pre-assembled and ready for HVAC hookup. The added mobility provided by HomeSeal PRO not only reduces required man-hours to set-up and manage the duct sealing process, but also frees up time to allow the Aeroseal rep to better engage with the homeowner.

HomeSeal PRO's portable tablet-based control system comes pre-loaded with a complete library of Aeroseal sales and marketing material, including videos and brochures. With this information it is easier to show the benefits of effectively sealing ductwork. ■

Carrier opens CO₂OLacademy training facility in Germany



Top brasses from Carrier Commercial Refrigeration Europe during the inauguration of CO₂OLacademy... (L2R) Bart Driessens, Director, Service Operations; Bertrand Gueguen, President; Sean Chapman, Director, Engineering; and Gunter Von Starck, General Manager Field Operations...

Carrier Commercial Refrigeration has opened its CO₂OLacademy field training facility in Germany, its first in a live-store environment. The CO₂OLacademy facility aims to increase the technical knowledge and practical competencies of Carrier Commercial Refrigeration field technicians in Europe. Carrier is a part of UTC Building & Industrial Systems, a unit of United Technologies Corp.

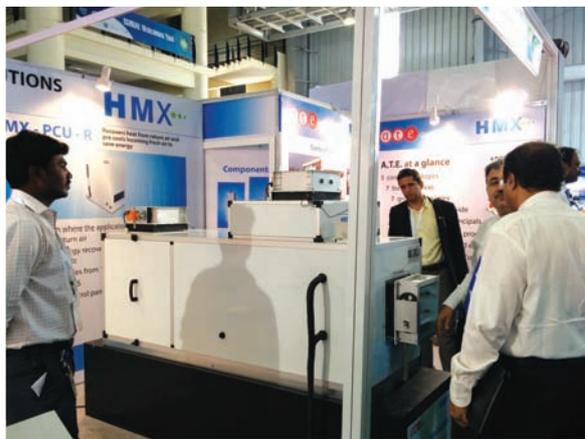
CO₂OLacademy officially opened on 25 March at Carrier's Research Development Center. The CO₂OLacademy facility will serve as the central training site for Carrier Commercial Refrigeration's service and installation technicians from across Europe, who will participate in practical training and exercises to improve skills and root cause analysis efficiencies, while sharing best practices. Assigned technicians will be trained on specific carbon dioxide (CO₂) refrigerant technologies, while supplemental local training initiatives will also continue.

"Participating in internal training activities under best-in-class conditions enables our field technicians to gain and apply the latest knowledge on how to install and service CO₂OLtec® turnkey projects with the highest level of quality and reliability," said Bart Driessens, director, service operations, Carrier Commercial Refrigeration Europe. The new facility features a training room as well as an operational cold room and freezer room. A CO₂OLtec refrigeration system is installed and connected with remote cabinets to create a fully operational CO₂ supermarket where scheduled service and other necessary repairs, can be simulated. ■



HMX promotes Fresh Air Air Conditioning concept at ACREX 2015

At the recently concluded ACREX 2015, following its theme of "Save as u cool!" HMX (a Business Unit of A.T.E. Enterprises Private Limited) showcased its innovative and environmentally friendly products for the cooling of people and processes. Based on its patented DAMA (Dry Air Moist Air) technology, HMX caters to the applications of a number of industries such as auto & auto ancillaries, pharmaceuticals, FMCG, plastics & moulding, printing & packaging, and the like. With an installation base of 20 million CFM covering around 4 million square feet of area, the company is a well-known and established cooling solutions provider.



The HMX-FAAC concept on display at the HMX stall at ACREX 2015

One of the key attractions at the HMX stall that drew a large number of visitors – many of who were industry experts – was the new HMX-FAAC (Fresh Air Air Conditioning) concept. The HMX-FAAC is an all-weather unit that can function in a number of alternative modes such as ventilation, indirect and direct evaporative cooling, fresh air pre-cooling, air conditioning, heating, and heating with humidification. The HMX-FAAC brings together the productivity and health-enhancing benefits of indirect and direct evaporative air cooling and the extra temperature control that heating and air conditioning can provide while overcoming the limitations of these products due to its versatile modes of operation. The HMX-FAAC is suitable for any HVAC application in warehouses, factory sheds, fringe areas, office areas, and residences. ■

Greenheck introduces the eCAPS® Fan Application Suite



Greenheck's new eCAPS® Fan Application Suite is an online fan selection program designed specifically for HVAC engineers. eCAPS allows engineers to easily compare multiple fan models simultaneously based on fan performance, sound levels, operating costs or first costs. The program automatically cautions users when selections are close to maximum RPM or when the selection is close to being unstable ensuring accurate fan selections. Product selections can be easily shared with others and custom equipment schedules can be created. A Toolbox feature in eCAPS includes a Systems Effect Simulator that shows how the selected fan will perform under various inlet and outlet conditions. The Toolbox also provides a convenient source for the latest fan application technology such as EC motors, airflow monitoring, & Greenheck's Fan Fundamentals online courses. Greenheck is the leader in manufacturing and distributing air movement & control equipment. ■

Johnson Controls launches new Training Center in Pune

Johnson Controls, a global multi-industrial company, unveiled a new training center in Pune. The Building Management System (BMS) Training Center was developed in partnership with Dr. D.Y. Patil Institute of Engineering and Technology (DYPIET). Students at DYPIET will contribute to the research and development of new BMS solutions.

The training center located with the DYPIET campus is equipped with Johnson Controls' entire range of BMS control systems, including fire alarm and security controls, an AHU and DX unit and a chilled water system. It was inaugurated by Dr. Anil Keskar, management consultant of Dr.D.Y.Patil Vidya Pratishthan Society and Sudhi Sinha, vice president of product development in Johnson Controls, who helped conceptualize this collaboration. The center is the latest development in Johnson Controls' partnership with DYPIET under its Academic Interface Program (AIP). Highlights of the Program include certified and customized courses on BMS, which are designed and taught by experts from Johnson Controls, as well as a regular student internship program, which has been running since 2012.

Subrata Bhattacharya, General Manager and Managing Director of the Center of Engineering Excellence at Johnson Controls, said, "At Johnson Controls, we believe that nurturing and developing the next generation of talent for the building sector is critical to helping India achieve its dream of developing smart cities - through greener and smarter buildings. The AIP was designed not just from the angle of employability but also the possibility of advanced research activities in the future." ■



Ribbon-cutting ceremony marking the opening of the Building Management System (BMS) Training Center



GCREM demands to reach \$38 bn in 2018



The commercial refrigerant products and its modernisation are in demand at Global Commercial Refrigerant Equipment Market (GCREM). It is evaluated by Report buyer that the “Global demand for commercial refrigeration equipment will grow to \$38 billion in 2018”.

During the phase of 2003-2008, the industry faced a Global Economic Downturn due to which the purchase of Commercial Refrigerant Equipment (CRE) was suspended. But the constant changes and regulations sparked the sales of Commercial Refrigerant

Equipment (CRE) in most of the world’s market. Though there is a global demand for GCREM, one major aspect is to be considered by all the consumers and manufacturers, that certain refrigerants are phased out and commercial settings look to reduce their power usage which means there will be regulatory changes to favour new equipment sales. The advances that are taking place rapidly will support the ongoing industrialisations and food retail modernisation efforts in many developing countries like India and China. The primary commercial refrigeration products, reach-in and walk-in refrigerators and freezers

will record some of the fastest gains in demand through the forecast period. Also it will promote the retrofitting of current equipment to be more energy efficient and by the maintenance of existing stock resulting in robust gains in the commercial refrigeration parts.

Even though China will continue to be the world’s fastest growing market for commercial refrigeration equipment. India and many of the world’s other developing countries are also prioritising cold chain development through construction of warehouses and other facilities for freezing or chilling food awaiting transport. ■

Global market for Air Filters to surpass US\$19 bn



Major swing like green solutions, shift from conventional bag house filters and adoption of nano-technology are some of the reasons behind the rise in the demand for Air Filters – that are surging on account of stringent standards. Also, it is focusing on new installations as well as retrofitting of existing systems with quality air filters to comply with the industrial dust emission standards. Although, Global Air Filters Market (GAFM) noted a sluggish growth post global

recession and Eurozone crisis, the market is expected to witness moderate growth through 2020, owing to economic recovery and increase in disposable income of consumers.

“Global market for Air Filters is projected to surpass USD19 billion through 2020”, Although, air filters penetration remained highest across Americas during the initial years of their development, over the last few years, Asia-Pacific has emerged as the most prominent market for air filters across the globe – and is currently dominating the market on account of growth in end use

segments. Asia-Pacific has also been witnessing entry of giant pharmaceutical players in the market to cater to the domestic and export demand.

Booming construction industry with new construction projects, in addition to renovation projects, has been adding to the growth in the market for medium efficiency filters. Moreover, a large number of construction projects are being undertaken across the world, affecting air quality and thereby escalating demand for air filters, globally. ■

(Source: Research and Markets)

Indian Water Heaters' market to cross USD330 mn in 2015



Water Heaters Market (WHM) is the need of the hour in India. The major factors driving the sales of WHM in India are increasing disposable income, growth in construction sector and increased adoption in commercial and residential spaces. WHM in India is emerging with innovative products. This can be attributed to the increase in housing projects in the country – as the residential sector is dominating as the largest revenue contributor.

According to a research report by TechSci, “India Water Heaters Market Forecast & Opportunities, 2020,” the water heaters market in India is expected to cross USD330 million in 2015. It has estimated the future growth

potential of WHM in India besides market structure, technology, essential drivers, challenges, investment & opportunities in India.

However, water heaters use in India is no longer restricted to the residential sector only – as they are increasingly being adopted in industrial and commercial sectors as well. Electric water heaters are currently the most popular ones among the consumers. Also, as they are already stepping towards continuous innovation, maturity on the part of the manufacturers is driving growth in the Indian market. In addition to that, because of the government’s constant efforts and consumers demand for eco-friendly products, it is anticipated that Solar Water Heater will gain importance in the Indian water heater market

over the next five years. Similarly, Gas Water Heaters are still in a nascent stage and is estimated to pick pace soon.

Stiff competitions from the unorganised sector and Chinese imports that provides cheaper products – and limited awareness of technology are some of the major challenges faced by the WHM. However, this trend is changing because of safety awareness. Over the next five years, there will be ample opportunities for the market players. The market is currently dominated by Racold followed by Bajaj and Venus. Moreover, foreign companies like Ferroli are entering the market with innovative products. Other small and medium sized companies also hold a significant share of around 25% in the market. ■



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Electronic Control Advances in Refrigeration and Air Conditioning Units

Innovations like smart thermostats and geothermal heating systems show that homeowners are becoming more conscious about being environmentally friendly and using energy-efficient technology...

Use of refrigeration and air conditioning (HVAC/R) systems in daily personal life as well as in various industrial processes have already become an integral part of present generation. The HVAC/R industry is changing. This change may not be rapid, but it's visible. With the growing demand of these utilities, companies are coming out with latest developments making use of advanced electronic controls – in order to make these units more durable, economic and safe. Innovations like smart thermostats and geothermal heating systems show that homeowners are becoming more conscious about being environmentally friendly and using energy-efficient technology. Solid state electronic controls are commonly used in refrigeration and air conditioning applications viz., operation and troubleshooting of assembled components such as circuit boards, time delay relays, and programmable controllers. Today, companies all over the world supply electromechanical and electronic controls for the domestic refrigeration, HVACR, food service equipment and automotive climate markets. This article will highlight the development and use of such electronic control advances with respect to versatile use of refrigeration and air conditioning units by making them user friendly with other desired characteristics.

Electronic control

The process of controlling an HVACR system involves three steps. These steps include first measuring data, then processing the data with other information and finally causing a control





action. These three functions make up what is known as a control loop. The control loop consists of three main components: a sensor, a controller and a controlled device. These three components or functions interact to control a medium. The sensor measures the data, the controller processes the data and the controlled device causes an action. The sensor measures the controlled medium or other control input in an accurate and repeatable manner. Common HVACR sensors are used to measure temperature, pressure, relative humidity, airflow state and carbon dioxide. Other variables may also be measured that impact the controller logic. Examples include other temperatures, time-of-day or the current demand condition. Additional input information (sensed data) that influences the control logic may include the status of other parameters (airflow, water flow, current) or safety (fire, smoke, high/low temperature limit or any number of other physical parameters). Sensors are an extremely important part of the control system and can be the first, as well as a major, weak link in the chain of control.

The controller processes data that is input from the sensor, applies the logic of control and causes an output action to be generated. This signal may be sent directly to the controlled device or to other logical control functions – and ultimately to the controlled device. The controller's function is to compare its input (from the sensor) with a set of instructions such as set point, throttling range and action, then produce an appropriate output signal. This is the logic of control. It usually consists of a control response along with other logical decisions that are unique to the specific control application. How the controller functions is referred to as the control response. A controlled device is a device that responds to the signal from the controller, or the control logic, and changes the condition of the controlled medium or the state of the end device. These devices include valve operators, damper operators, electric relays, fans, pumps, compressors and variable speed drives for fan and pump applications.

User-friendly controls

While smart, Wi-Fi-connected thermostats promise significantly increased energy efficiency, the real draw for homeowners

Sensors are an extremely important part of the control system and can be the first, as well as a major, weak link in the chain of control...

seems to be how easy the interfaces are to operate. Sometimes thermostats are programmed by the user to remember his preferred temperature settings. If the user prefers the thermostat to kick in a faster, warmer temperature, on cold, wintery mornings, the thermostat will store that information and adjust the temperature accordingly. The thermostat also monitors temperature with humidity and activity sensors, and it can determine regional climate by the user punching in their zip code. Furthermore, it can be accessed remotely through the internet or using a smart phone app, giving the user the ability to control the heat even when out of town. Wireless-controlled thermostats present HVAC data in a language that contemporary consumers understand. Homeowners, especially the younger ones, are accustomed to easily digestible, visual representations of information and data. The reporting tools that smart systems include take the mystery - and obscurity out of an industry that has been thriving on overall complacency from its customers.

Application of electronic controls

Electronic controls must be applied and installed in line with appliance manufacturer instructions, local approvals and practices. Suitable earthing must be made by appliance manufacturer and installer. Here, some of the advances in electronics control techniques applied in HVAC systems are discussed.

Air conditioner controllers

Air conditioner controllers have evolved to become more advanced in tandem with the advancement made in the field of microcomputer. These days, most window air conditioner and room air conditioner in homes or offices have electronic controllers in them that make the units more user friendly, intelligent and feature-rich. Some of the

HAVCR systems with electronic control are being discussed in the subsequent paragraphs.

Control of on/off compressor: The compressor is the most important component of a vapour compression refrigeration system. The ON/OFF type of compressor used to be popular in the past – but DC Inverter type of compressor is the latest technology in the market though more costly.

The ON/OFF compressor will totally ON or totally OFF depending on the set temperature and the ambient temperature. Usually, there is a dead band of about 1.5 to 2.0°C to prevent ON-OFF cycling of compressor that will reduce its lifespan.

In cooling mode, the compressor will turn ON when the ambient temperature of the room is higher than the set temperature by 0.75°C (different manufacturer will have different value). It will only go off when the room temperature drops below 1.25°C (different manufacturer will have different value).

Control of ac/dc inverter compressor: The DC Inverter or AC Inverter type of control (obviously the compressor will also be of DC or AC Inverter type) has better control in that it does not have to turn off totally.

The frequency of the rotation of the compressor can vary depending on the load required. Hence the room temperature of the space being cooled can be very close to the set temperature most of the time with some slight variation.

This type of air conditioner controllers provide a more comfortable cooling to the occupants as the temperature is constant most of the time. It is also more energy efficient and environmentally friendly as most of the refrigerant used is ozone-friendly.

Mode setting: The mode setting button at the remote control usually enables you to set the mode of operation. It can be set to COOL mode, HEAT mode (if your unit is a heat pump unit), DRY mode, AUTO mode or FAN mode.

Look at the manual provided to see the symbols of each mode. COOL mode is the default setting that you will use if you want to cool the room upon entering it. The air conditioner will regulate the temperature to achieve the setting temperature of your remote control. A temperature setting of 24°C is a good setting to save energy. HEAT mode is the mode that you will use when you need to heat up the room during winter. In this mode, the





automation and control

evaporator effectively becomes a condenser and vice versa by using a reversing valve to reverse the flow of the refrigerant.

A temperature setting of 28°C is a good setting to save energy. In heat pump model, AUTO mode is a mode that will automatically change the mode between COOL and HEAT by sensing the temperature in the room.

If the room temperature is low, HEAT mode will operate and if it goes up to a certain temperature, it will switch to COOL mode.

In air conditioning model and depending on the maker, the AUTO mode is actually operating in COOL mode but with a lower set temperature to cool down the room quickly before reverting to the set temperature of the user.

DRY mode is a variation of COOL mode where the compressor will cycle on and off (or low speed – if inverter model) for a few minutes each depending on the temperature of the room.

By this cycling, the moisture will be removed from the room, hence the humidity of the room will drop. This is basically a dehumidifying function.

FAN mode exists in some model. This mode is hardly used as there is no cooling effect to the room. Only the indoor fan is on.

Economical Mode: Most air conditioner controllers have the built-in economy or sleep mode function. This function is used when one is going to sleep.

When activated using the remote control, the air conditioner unit will raise the set temperature in steps after a period of time. This is because the required cooling will reduce when one sleeps.

Depending on manufacturer, the set temperature could increase by 1°C after 1 hour of operation, 1.5°C after 1.5 hours of operation and 2.0°C after 2 hours of operation. Use this mode to save energy.

Fan Speed: Usually the fan speed can be changed to Low, Medium, High or Auto. The Auto mode has a built-in intelligence that determines the speed of the fan depending on the room temperature and set temperature. Higher speed is used if the difference between these two temperatures is high and lower if low.

Timers: Most unit will also have timers that you can use to ON or OFF the unit based on the clock of the remote control. Some simpler units do not have clocks – but has

delay timers that allow you to set the number of hours elapsed before the unit is turn ON or OFF.

Auto Random Restart: The auto random restart is a feature that will retain the settings of the controls in the event of a power failure. Once power is restored, the air conditioner will restart to its last settings with the compressor being powered up randomly. This is a good feature to look out for – before you purchase the unit.

Ionizer: Ionizer is now a basic feature in most room air conditioner unit. It is located at the indoor unit and has a high voltage electronic module that ionized the surrounding air with negative ions.

These ions will attract dust and other contaminants from the return air to ensure that only fresh and clean air is discharged from the fan coil unit. Take note that the module will have to be changed after a certain hours of operation to ensure its continuous efficiency.

Air Louver: Air louver function helps in directing the air flow in the direction of your choice. Most controls have a least up and down control of the air. Some units may have left and right louver control as well.

Refrigeration controllers

Defrosting: Defrost timer used in domestic and commercial application is a single cam control that activates a SPDT switch. Its cycle consists of transferring the switch of a preset duration once every 4, 5, 6, 8, 10, 12, 16 or 24 hours. Both the operating cycle and switch transfer duration are pre-set at the factory and are not adjustable.

The cycle will repeat as long as the motor is energized. An internal clutch mechanism permits initial adjustment of the cycle starting time. It is a solution for the needs of an intelligent flexible product in a compact size.

Disadvantages

- The disadvantage of this type of compressor is that the temperature range of the space being cooled is too big causing discomfort to the occupants during the time the compressor is either ON or OFF.
- The other disadvantage is the starting current of easily few times of the steady current every time the compressor starts.
- The disadvantage with electronically

controlled inverter compressor unit is higher cost compared to the ON/OFF type.

Future

Efforts of scientists and engineers as well as manufacturers of HVAC/R systems are always directed to make use of advanced electronic controls in order to make these systems more reliable, durable, user friendly, economical and eco-friendly. Some of the possible breakthrough in near future are summarized in the following paragraphs.

Zero-energy Buildings: Buildings that produce energy instead of just using large quantities of energy will gain traction with companies that target eco-friendly employees and consumers.

Many businesses are already headed in this direction with geothermal heating and cooling, solar-powered systems, and white roofing.

If HVAC manufacturers can work to design structures with advanced electronic controls that are both energy efficient and comfortable for their residents, it is sure to see some fresh companies take on this challenge.

Economical and efficient fan and pump control: Electronic control techniques (packaged products) have features to control and automatically transfer to bypass on Variable-Frequency Drives (VFDs) fault to provide the flexibility to meet the most demanding installations without adding options.

These techniques are highly reliable in case of fan and pump control packages that feature a three-contactor electronic bypass control and an affinity for easy-to-use HVACR control – so that the system has a graphical status display, dedicated alarm display, and Hand/Off/Automatic controls.

Energy Management System: An Energy Management System (EMS) is defined as a fully functional control system. This includes controllers, various communications devices and the full complement of operational software necessary to have a fully functioning control system. ■

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Innovative Refrigeration Technology

With enhanced economical activities, the energy demand as well as commercial energy consumption have been increasing at ~6 % during last two decades; India ranking 5th in the world...

The milk production of India has reached 140 mn tons/ annum in the year 2013-14. About 60% of milk is consumed in liquid form, while the remaining 40% is used for the production of butter, cheese, curd, paneer, ice cream, dairy whiteners and traditional sweets (Vijayaraghavan et al., 2011). Bennan et al. (1989) found that dairy industries have 60% of total energy consumption in refrigeration plants and the rest is consumed in other plants. So, energy conservation in refrigeration plant has more value with respect to the economics of the plant and for reducing the production cost.

Most commonly used refrigeration and AC systems for industrial and commercial requirements are Vapour Compression Refrigeration Systems (VCRS) and Vapour Absorption Refrigeration Systems. The first known machine to produce continuous cooling was invented by the Frenchman Ferdinand Carre in 1859. It was the earliest version of 'aqua ammonia' absorption system. But, commercially viable compression refrigeration system working with NH₃ was introduced in 1875.

Although, the dairy industry is not identified as an energy intensive industry, to be competitive in today's global business environment, effective and efficient use of energy as well as its conservation is pivotal to the productivity and profitability. Energy conservation is closely related to the environmental issues in terms of polluting effect caused by emission of CO₂ and other GHGs. Moreover, with the increasing fuel prices and global warming, there is an urgent need to conserve energy and manage energy consumption across all facets of dairy industry (Singh et al. 2010).With enhanced economical activity, the energy demand as well commercial energy consumption has been





increasing at ~6% during last two decades; India ranking 5th in the world. The sector wise energy consumption details are indicated below: agriculture (5%), residential (10%); transport (22%); industry (49%); others (14%). Import dependency is 9% for coal, 77% for crude oil and petroleum product and 31% for natural gas (Desai and Zala, 2010). The recent trend is to change over from VCERS to waste heat assisted Vapour Absorption Refrigeration System (VARS). It utilises the waste energy efficiently and helps in reducing the consumption of electric grid supply. VARS is widely used in dairy industry to utilise the waste energy generated by various operations to save electricity and help in minimizing green house effect problem over the world.

Vapour Absorption Ref. System

VARS is widely used in industry when low grade thermal energy is available and fuel is cheaper than electricity. This system replaces the compressor with a generator and an absorber. The absorber acts like the suction side of the compressor, it draws in the refrigerant vapour to mix with the absorbent. A pump pushes the mixture of refrigerant and absorbent up to the high-pressure side of the system. The generator delivers the refrigerant vapour to the rest of the system. The refrigerant vapour leaving the generator enters the condenser, where heat is transferred to water at a lower temperature, causing the refrigerant vapour to condense into a liquid. Therefore, it produces refrigeration effect in evaporator (Butz et al., 1989; Fan et al., 2007).

Ammonia-Water VARS

In industry to maintain the below sub zero temperature and freeze milk products the ammonia-water system is used. The boiling point temperature difference between ammonia and water is not very high, both ammonia and water are generated from the solution in the generator. Properties of ammonia are not compatible with materials such as copper or brass, normally the entire system is fabricated out of steel. Another important difference between this system and water-lithium bromide systems is in the operating pressures. While water-lithium bromide systems operate under very low (high vacuum) pressures, the ammonia-water system is operated at pressures much higher than atmospheric (Modahl et al., 2002). It is also important

A car air-conditioning system based on an absorption refrigeration cycle is using energy from exhaust gas of an internal combustion engine...

unlike water, ammonia is both toxic and flammable. Hence, these systems need safety precautions. In an ammonia-water absorption refrigeration system compared to water-lithium bromide systems, three additional components are used: a rectification column, a dephlegmator and a sub-cooling heat exchanger.

Water-LiBr VARS

VARS using water-lithium bromide pair is extensively used in dairy industry. Water is used as refrigerant; using these systems, it is not possible to provide refrigeration at sub-zero temperatures. A twin drum system consists of two vessels operating at high and low pressures. The cooling water flows first to absorber, extracts heat from absorber, and then flows to the condenser for condenser heat extraction. This is known as series arrangement. This arrangement is advantageous – as the required cooling water flow rate will be small and also by sending the cooling water first to the absorber, the condenser can be operated at a higher pressure to prevent crystallisation (Young et al., 1997). A refrigerant pump circulates liquid water in evaporator and the water is sprayed onto evaporator tubes for good heat and mass transfer. Heater tubes (steam or hot water or hot oil) are immersed in the strong solution pool of generator for vapour

generation. Pressure drops between evaporator and absorber and between generator and condenser are minimized, large sized vapour lines are eliminated, and air leakages can also be reduced due to less number of joints. In multi-effect systems a series of generators operating at progressively reducing pressures are used (Kang et al., 2008).

The effects of the inlet concentration of lithium bromide solution on the heat transfer. In the range of the inlet solution concentration between 60% and 64%, the heat transfer coefficients increase with the increase of the solution concentration.

A car AC system based on an absorption refrigeration cycle using energy from exhaust gas of an internal combustion engine...

The choice of Ammonia-water combination is not made without considering certain disadvantages: ammonia attacks copper and its alloys when it has been hydrated. Therefore, all components are made from mild steel or stainless steel. The American National Standards Institute (ANSI) (King, 1977) classified refrigerants into three groups considering their safety in use. Ammonia, due to its toxicity, falls into group 2, which means it cannot be used in AC systems in direct expansion in the evaporator coil. Equipment must be installed outside of the inhabitant space. To circumvent the toxicity problem, water or glycol is used as a secondary fluid to transfer the heat from the passenger space to the evaporator. Thus, the chance of ammonia contact with the passengers is minimized.

Design of the Prototype System

Preliminary analysis (Wang, 1997) showed that an absorption refrigeration plant with a 2 kW cooling load at 0°C and with water as a

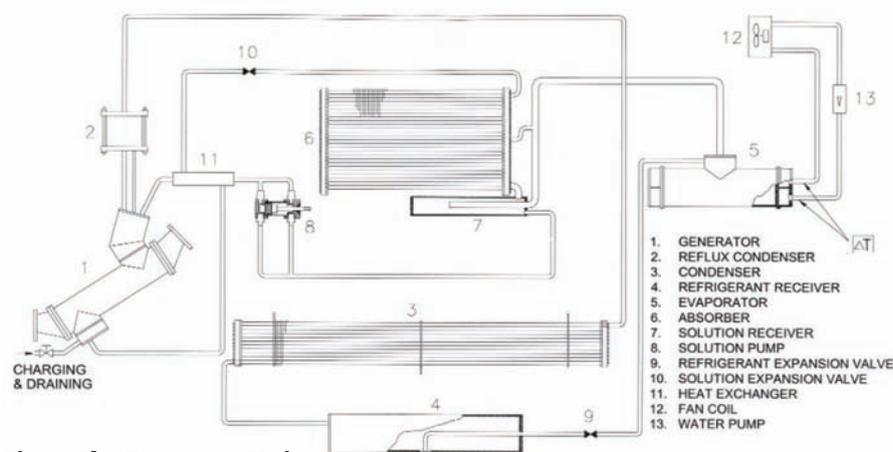


Fig.1: The Prototype Unit





energy conservation

secondary fluid, is more than sufficient to air-condition the passenger space of the NISSAN 1400 truck.

This prototype unit shown in Fig. 1 consists of the generator and analyser

- Reflux condenser
- Condenser
- Accumulator
- Evaporator
- Absorber
- Solution pump
- Expansion valve
- Solution expansion valve
- Heat exchanger
- The fan coil
- Serves for both heating and cooling of the passenger's space

The theoretical analysis, is verified by both laboratory and road tests through the results obtained. This work results from a prototype which will have to be improved for further development. The claim that is made from this work is that it has shown the feasibility of such a system in a positive frame.

- In the exhaust gases of motor vehicles, there is enough heat energy that can be utilized to power an air-conditioning system. Therefore, if air-conditioning is achieved without using the engine's mechanical output, there will be a net reduction in fuel consumption & emissions.
- Once a secondary fluid such as water or glycol is used, the aqua-ammonia combination appears to be a good candidate as a working fluid for an absorption car air-conditioning system. This minimizes any potential hazard to the passengers (Vicatos et al.,2008)

Solar Assisted Cooling

The 1st cooling system assisted by ARUN solar boiler has been installed at the office building of Turbo Energy Limited (TEL), Paiyanoor, near Chennai.

TEL has successfully installed one ARUN solar boiler system for fulfilling its hot water requirements for operating a Vapor Absorption Machine (VAM) for air-conditioning/comfort cooling for its administrative block. It is in the process of installing another dish for increasing its air-conditioning capacity. The process of hot water generation for operating the Vapour Absorption Machine for air-

conditioning with the help of ARUN solar boiler is as explained in the figure below:

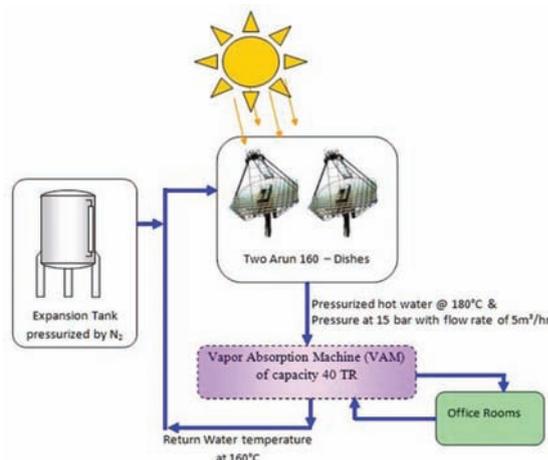


Fig.2: AC with Solar Boiler

Description of Schematic

The vapour absorption machine (VAM) installed at TEL, is hot water driven. Pressurized water at 180°C is required for the machine to operate at an optimal level. The return temperature of the hot water is 160 °C. The machine with 40 TR capacity requires 5 m³/hr of the pressurized hot water which can be catered to by 2 ARUN dishes. The solar circuit is kept pressurized at 15 bar using the nitrogen pressurization system. The nitrogen cylinders are connected to the expansion tank in the circuit for this purpose. The cooling system is used for air conditioning of the administration office at the plant.

Operation Philosophy

The system is kept pressurized at 15 bar pressure to avoid steam formation within the circuit. The water at 160°C, from the VAM, is taken as inlet to the ARUN@160 dishes and it is heated to 180°C. The average heat output from the two dishes is about 1,00,000 kcal/hr, which is sufficient for the heat requirement of the vapor absorption machine.

Cooling At NTPC

Thermal enabled air-conditioning / comfort cooling system with storage, developed by Clique Solar. This Solar Thermal air-conditioning or solar thermal air cooling system consists of two dual-axis tracking solar concentrator of Fresnel design, named ARUN. The ARUN solar boiler provides dry saturated steam at 180°C at about 200kg per hour. The steam is fed to a 50 TR (i.e. about 175 kW of cooling) Vapour Absorption Machine (VAM). In turn, the VAM utilises the thermal energy of the steam to

produce the cooling effect. The distinguishing feature of the system is the storage tank that can store up to 2 days of chilling capabilities. Offices are generally closed on weekends. To avoid wasting the solar energy, this 2-day storage facility has been included. This stored energy can be utilised to provide AC during lean/non-solar periods or to cool a larger area. The system is also capable of running as a heat pump in winter without any alteration of pipe work. This Solar Thermal AC system is a low carbon, green house gas free air conditioning solution. It has an efficiency of 80%, consumes negligible auxiliary power and occupies less area compared to conventional AC system.

Conclusion

- India is among the world leaders in agricultural production however much of our produce goes waste due to absence of proper storage facilities. Refrigeration is thus vitally important for our country.
- Milk produce is also adversely affected due to lack of refrigeration.
- Cool drinking water is unavailable to the people in non electrified villages.
- Medical facilities are also adversely affected due to break in the cold chain as the medicines move from the production zone to the rural areas.
- Usage of CFCs affect the environment adversely. ■

<p>Deepak Kumar D Desai Executive Sumul Dairy, Surat</p>	
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Selecting the Right Leak Detection Tools

Ultraviolet dyes are excellent for reporting intermittent leakage – just don't overdose the system because you are in a hurry to find the leak...

By this time, on your career path as refrigeration and air-conditioning technicians, you should already be aware of all the methods used to find leaks. The choice of tool, whether a straightforward visual inspection, soap bubbles, electronic sensors, ultrasonic detectors, refrigerant dyes, a combination of two, three or all of them, is totally up to you.

The question I am asked is: "which one is the best?" My answer is that there is no best! This is not about being absolute, comparing one to another, using one only because it is the latest and greatest method. The question we ask should instead be: "which tool or tools should I use to be the most effective in my particular situation?"

You always have the first tool with you – your eyes – unless you are blind, then you will need a co-worker that has eye sight. Either way, by all means put them to use. If you can gain access to piping and components to look for those obvious oil stains, then do it. Oil residue can point out where a system may have leaked or is currently leaking. In the same scenario regarding the ability to get up close you can use the soap bubble method. This is an extremely effective method for continuous leakage. Keep in mind, it helps in using the more complex specialty formulations, which offer high sensitivity bubble development instead of your dish soap. But if that is all you have, don't hesitate.

Electronic detectors are precise

instruments – as long as your sensors are replaced at their recommended usage period and the wind is not blowing. One of the many observations that I have deduced from these past thirteen years of studying refrigerant leaks, their disorder, and numerous exit paths, is that it's easy to understand why it could turn into an extremely frustrating task. I have found that the best way to improve efficiency, when using sniffers, is to visualize a plane of leakage anywhere along the radius of a semispherical dome. Move your electronic sensor in a pattern that would reflect this half ball model by using a circling motion covering the points of radius as you move along the pipe's surface. This method allows you to detect those leaks which are not exiting in what we like to imagine as a



45° vertical plane from the pipes horizontal surface.

Ultrasonic detectors are ideal for targeting leak sites because they are not affected by air currents. But remember, when used in commercial and industrial settings they lose their edge. This is because of the multitude of other frequencies being generated by compressed air, steam movement through pipes, in addition to leakage.

Ultraviolet dyes are excellent for reporting intermittent leakage – just don't overdose the system because you are in a hurry to find the leak. Putting ultraviolet dyes in the system as an early detection method avoids this situation. Too much dye will affect performance output of a unit along with making it very messy when you attach or disconnect manifold gauge sets

and auxiliary equipment. A case-in-point to be mentioned is that most dyes will react to internal moisture. They will crystallize losing their ability to be carried by the refrigerant and oil. Look for UV dyes which offer moisture resistance capabilities, fast acting injection, and low product volume to system oil ratio.

So, which is the best for the right application? Let us first define the two types of leaks: intermittent and continuous. Intermittent leakage is due to free flowing internal particulates providing temporary sealing, operation vibrations, varying temperature swings, & load change conditions. Continual leakage is always a factor because everything leaks. It could be in one year, or it could be in twenty years. Just as we are, that is to say humankind far from perfect and in constant

decline, it comes as no surprise then why we can't design and build a perfectly tight system. Damn that entropy! But don't let that stop you! Keep searching for leaks as you would for buried treasure. Use these methods in the same way that our country's military force combines Air force, Navy, and Army to get the job done. So if you are looking to be competitive, efficient, & economical, keeping your business growing and your customers happy, why would you settle with just one method? ■

Paul Appler
 Director
 Research and Development
 Cliplight Manufacturing Co.
 Toronto



HVAC Industrial Campus near Houston, Texas

campus

Ducted systems are typical of conventional North American construction, with VRV and ductless systems being more prevalent elsewhere in the world. However, VRV and ductless systems have gained rapid acceptance in the North American marketplace and represent one of the fastest growing HVAC market segments. The new campus is projected to be operational mid-2016. The full range of energy-efficient ducted residential and light commercial products will be manufactured in the facility, as well as commercial VRV products currently imported from other inter-company business units located outside North America.

The operations that will be relocated to the new business campus include engineering, logistics, procurement, manufacturing and marketing. This consolidation directly reflects Daikin's global commitment to local, in-country manufacturing. Employment figures at the facility are expected to reach up to 4,000. Several senior staff from Houston represented the Daikin, Goodman and Amana brands, and several city council members.



During the ground breaking ceremony in the HVAC industrial campus...

Members of the Daikin team from the home office in Japan were in attendance in support of their largest major investment in HVAC manufacturing operations in North America, totaling approximately \$417M. The world's largest manufacturer of heating, cooling and refrigerant products, recently held their ground-breaking ceremony at the future location of their new, consolidated HVAC equipment engineering, manufacturing and logistics campus in Waller, TX, northwest of Houston.



Takeshi Ebisu
President and CEO
Daikin North America

Daikin recently held their ground-breaking ceremony at the future location of their new, consolidated HVAC equipment engineering, manufacturing and logistics campus in Waller, TX, northwest of Houston. Speaking on this occasion, Takeshi Ebisu, President and CEO of Daikin North America, stated, "The new business campus will provide many outstanding benefits to our customers. The operational efficiencies we achieve will be reflected in the superb quality of our high-efficiency, energy-saving heating and cooling systems. As the leading global HVAC manufacturer, we are excited about the outstanding value that this move will bring to our current and future customers. We see this new business campus as a strong, long-term commitment to our customers in North America." ■





Identifying the Energy-Loss due to Under-Loading

Condition monitoring of any fan as a system is a practical solution to avoid routinely happening problems in the field. But it is practically difficult and costly to monitor the same in small and medium sized running process plant...

The industry is taking care not to overload the equipments in the production and in the utility considering the safety of the equipments. But, is the same industry monitoring to identify the under-loading of their equipments? At least when the equipments are under-loaded, they need to be aware that they lose energy either in that equipment due to its poor loading or in that process loop containing the equipment.

Monitoring of Fans in the Air-Conditioning Loop

Take the case of ventilation and air conditioning systems, the outdoor condenser fans are running at full speed when the heat exchanger fins on the sides of outdoor AC unit is either in clean or choked condition. When the HX fins are clean, the AHU fan takes rated current as mentioned in their commissioning report. If the same HX starts to choke due to dust from ambient outside, the fan current drops by say 10%.

When commissioning, simulate the choke by just spreading a hessian cloth on the fins, we will see the fan current drops by say 10%. Then retrofit this Under-Current relay in the fan control circuit and set the current setting to say, 90% of condenser fan motor rated Amps. When the current drops less than 90%, audio or visual alarm can be given to prompt the user to take up cleaning work. Otherwise the cleaning service gets tough when the same fins are choked heavily with dust gum. This can be avoided by condition monitoring of the utility.

Condition Monitoring of Fans

As well to prevent this to happen, the user can

Comprehensive protection in the outdoor equipments is the need of the hour in unmanned areas.





think of doubled area V shape filter as pre-filter outside the existing fins on the outer cover of the outdoor unit. The user, by this, can prolong the choking of the condenser fins from outside, throughout the season. The user can clean the pre-filter once in a week or month suitably.

Condition monitoring of any fan as a

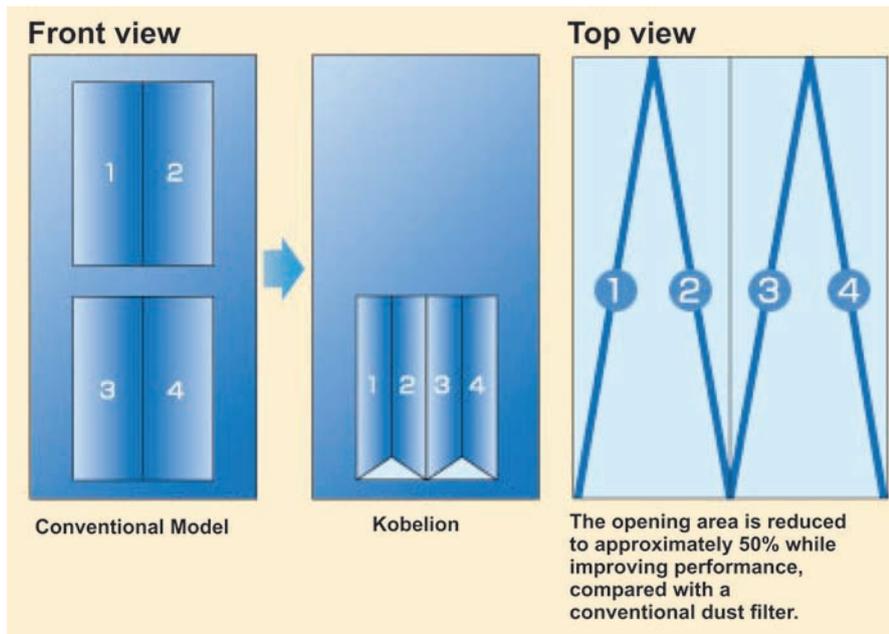


To improve the efficiency of the coil cooler, many industries are retrofitting in their existing coil cooler, a mist array of water spray so as to approach near the ambient wet bulb temperature...

the alarm to the user to show the reduction in flow across the fan, pump, blower etc due to filter clog or restricted air or liquid flow through the system, this din mounted relay can be

loading and the current unbalance etc., don't get noticed and this leads to motor failure. Here we can think of adding to the existing control circuit, the Electronic Motor Protection relay at a very low cost of less than Rs.3000/- only.

This will definitely replace our conventional thermal relay which frequently fails to respond or fails in safe mode. So, the AC equipment OEM can mandatorily fix this Electronic total protection device in their outdoor equipments. The industry faces motor burnouts at the unexpected time during peak hot season at the unexpected location. The retrofit of the low cost electronic protection relay is also indirectly saving to the industry.



Condition Monitoring of the Coil Cooler Utility

Take the coil cooler in the industry utility, the fins often get totally choked within a month and when the HX fins start to choke from outside, the top condenser fan current reduces. We see many times, the condenser fans will be running ineffectively due to choked fins. The image shows visible block in fins and we need not allow this to happen if we provide daily cleanable V type Pre-filters, to be fitted on the hood. When this outdoor AC unit is burdened to remove the total heat load from the premises, it is practical thinking to comfort the units by putting under sun shade shelter adequately.

To improve the efficiency of the coil cooler, many industries are retrofitting in their existing coil cooler, a mist array of water spray so as to approach near the ambient wet bulb temperature. This will definitely make the coil cooler utility more efficient in achieving a wider temperature difference in the heat transfer function. When running in dry ambient outside, this mist spray also aids in clogging of the dust on the fins. So pre-emptive cleaning frequently either daily or weekly; the pre-filter and then the heat transfer fins very much helps to sustain the AC heat transfer efficiency at the outdoor.

system is a practical solution to avoid the above routinely happening problems in the field. But it is practically difficult and costly to monitor the same in small and medium sized utility equipments in a running process plant by retrofitting the pressure or temperature sensor, Delta P (ΔP) or Delta T (ΔT) sensor, etc to primarily sense the amount of air flow to the fan inlet to alarm the user. Alternatively, we can add on the existing control circuit, the derivative sensor to check the same by continuously monitoring the running fan motor current using CT/Hall effect current sensors to the fan wiring protection circuit.

Under-Load Setting to Indicate Refrigerant Gas Leaks

The Under Current Relay – nowadays that is costing much less than Rs.2000/-, can give

inserted in the machine control panel effectively as a Condition Monitoring Tool.

The refrigerant used in the split AC, package AC etc., sometimes gets leaked minutely over a period. This may happen over a season or few depending on the Freon gas leakage quantity. If the same compressor motor rated current is set in the under current relay say at 80%, the Freon gas leak will be indicated by this U/C relay and can give audio visual alarm to the user.

Comprehensive Protection to Outdoor AC Units

Comprehensive protection in the outdoor equipments is the need of the hour in unmanned areas. When the compressor / fan motor is under loaded, the other unsafe parameters of occasional overloading, single phasing, under

Monitoring of Heat Exchanger Fans in the Equipment Sub Systems

Take the air compressor utility, the user industry argues with the compressor vendor about the input KW to the motor/CFM delivered from the compressor based on the main motor loading, which is practically loaded around 110 to 120% only catering to the compressed air





energy management



The images above show visible blocks in fins, we should not allow this to happen...

demands from process and more significantly from compressed air leakages. But the same industry will be surprised to find their oil & air heat exchanger fan motor loading is LESS due to heat exchanger fins choking but the motor will be hotter at 80°C when viewed on the thermal imager. This fan motor current can be monitored by adding the Under-Current relay in the circuit.

Air Compressor in a Hood Generates Only Hotter Air

How many of industries monitor the effectiveness of the heat evacuation system of this fan and exhaust duct in the air compressor system? Because the choked oil & air heat exchanger restricts the air passage to exhaust, we find always the air entrapped in the air compressor hood is always hotter by 5 to 10°C than ambient. This automatically increases the KW of compressor by 2% due to hot air intake. That is why, they practically keep the air compressor hood side panels fully open always. Here it is likely to choke the HX so it is preferred to retrofit V type filters on all sides to the hood.

So the post air cooler by way of HX inside the hood working is very poor in the industry. This is a neglected area in compressor house – and so the industry has overloaded their refrigerated dryer and thus the very hot skin of the main air receiver in the compressor house is the symptom of poor heat exchanging happening inside the compressor hood. The compressed air to all the pneumatic equipments needs to cool near to the ambient and dry for healthy pneumatic workings.

Pump Dry-Run Protection

Similarly, in the pump applications in various models like the mono-block pump, submersible pump, centrifugal pump etc., it can also be retrofitted with the under current relay in their panel to alarm or trip the pump on less flow, no flow due to air lock etc. What is happening now, is that the pump fails due to overheating of poor water flow, air lock etc.

The pump needs fool proof protection against Single Phasing, Reverse phasing, Over Load, Under Load – and the current unbalance sensing and control.

Govt to Approve Electronic Protection Relay

In fact, the Govt can approve of this Electronic Pump protection relay in electronic current sensing mode (instead of thermal sensing type), as the cheap & best mode of fool-proof protection and costing only less than Rs.3000/- including the current sensors in all the agriculture, industry and commercial establishments.

This relay is an add-on type in the panel. The farmers in the agriculture segment have made use of this relay since decades, because they too had realised after burning out their deep sub pump motors few times due to the above said reasons. Decades back, the farmers fixed voltage sensing preventers and since they didn't protect the pump motor against all the above failures, they had adapted now, to the Electronic current sensing devices to protect their pumps against miscellaneous failures.

Cheap & Best Option Now

The industry gives the 'CHEAP & BEST' weightage thinking, only when they procure the gadgets in the protection & ECON segment. 'Cheap & Best' Terms: they never come together, but here it is! Here, in the above applications, the protection relay based on the above short cut principle is low cost, easy-to add-on, and this relay too can be used as a protection tool – to identify the inefficiency of equipment indirectly running at the under-loading level. ■

Ashok Sethuraman
BEE Accredited Energy Auditor
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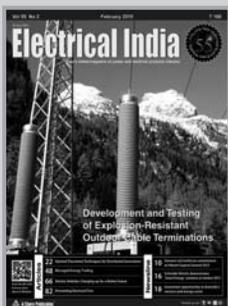
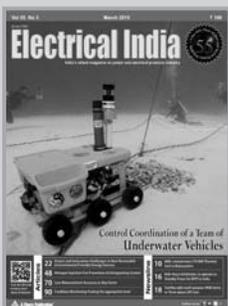


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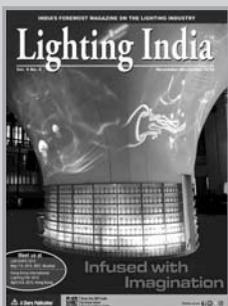
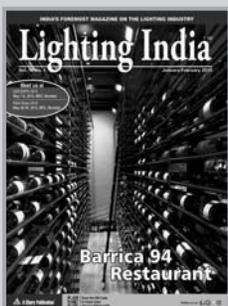
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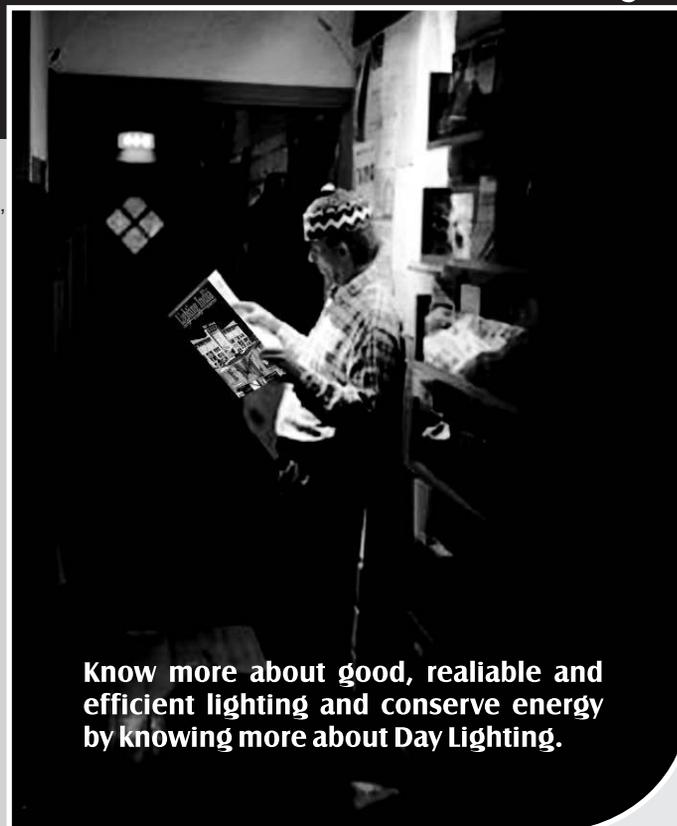
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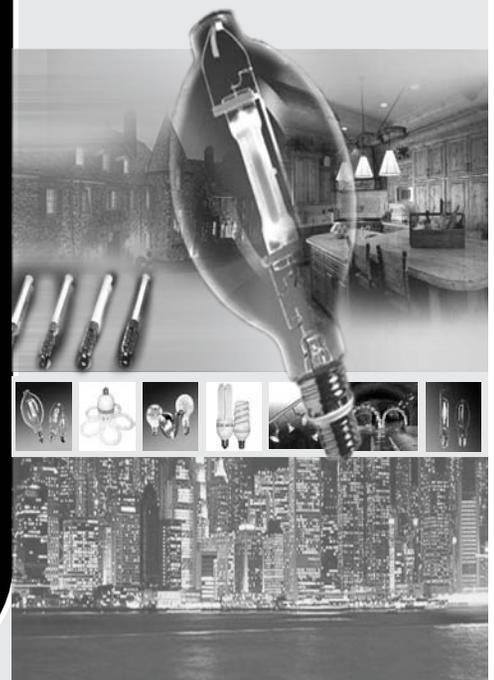
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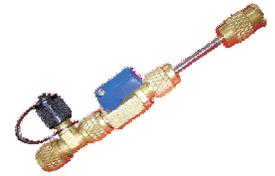
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Need for Smart HVAC Control Systems

The Smart HVAC Controls Systems are definitely more energy-efficient compared to the existing HVAC Controls, either by having sensors that can communicate to the thermostat or with the ability to access a home HVAC system over the cloud using a smart-phone application or a web browser...

Controls for heating ventilating and air conditioning cover a broad range of products, functions, and sources of supply. Controls are the starting stopping or regulation of any heating, ventilating, and air conditioning. The application of HVAC controls starts with an understanding of the building and HVAC systems, and the use of the spaces to be conditioned and controlled. The type of HVAC system determines the control sequence. Several types of control products such as pneumatic, electric, analog electronic, or electronic direct digital control are available.

At one time, draft dampers followed by thermostat control of the dampers controlled heating. The use of mechanical stokers for coal firing required another step in the use of control. When oil burners were introduced, the concept of combustion safety control became necessary. This involved the sensing and proof-of-flame in the proper time sequence of introducing draft, fuel, and ignition.

The use of steam and hot water radiators led to the concept of zone control and individual room control. Forms of zone control included closed loop control using zone thermostats and open loop control with outside conditions setting the rate of heat delivery to the zone. Both of these forms of control were used to regulate the delivery of heat. The means of regulation included the following: Valves to control the flow of steam or hot water, controlling pumps to circulate hot water, and controlling boiler operation. When IRC was used the central supply was maintained and radiator valves were controlled by room thermostats.





The use of fans to deliver ventilation as well as heated air was controlled by dampers, which varied the source and volume of air. The typical control of unit ventilators was by pneumatic controls and included the following features: minimum outside air, discharge air, low-temperature limit, and thermostats with lower night settings activated by compressed supply pressure level. The increased usage of air conditioning led more complex control sequences in larger systems to central monitoring and control.

The development and use of computers and microprocessors has caused great changes in the HVAC controls industry. Minicomputers were installed on jobs to collect data to provide centralised control. Then, microprocessors were used for remote data-gathering panels to gather data – and provide direct digital control. Computers are now used as on-site central controllers with operator interfaces and as computer assisted engineering tools in the design of system programs, databases, and documentation. Microprocessors are still used in remote data gathering, yet also in small unit controllers and in smart thermostats.

HVAC systems are classified as either self-contained unit packages or as central systems. Unit package describes a single unit that converts a primary energy source of electricity or gas and provides final heating and cooling to the space to be conditioned. Examples of self-contained unit packages are rooftop HVAC systems, air conditioning units for rooms, and air-to-air heat pumps.

Central systems are a combination of central supply subsystem and multiple end use subsystems. End-use subsystems can be fan systems or terminal units. If the end use subsystems are fan systems, they can be single or multiple zone type. With central systems, the primary conversion from fuel such as gas or electricity takes place in a central location, with some form of thermal energy distributed throughout the building or facility.

There are many variations of combined central supply and end use zone systems. The most frequently used combination is central hot and chilled water distributed to multiple fan systems. The fan systems use water-to-air heat exchangers called coils to provide hot and/or cold air for the controlled spaces. Another combination central supply and end

When there are multiple chillers or boilers, an optimising strategy would be to choose the most efficient equipment, which has the capacity to meet the load at any given time...

use zone system is a central chiller and boiler for the conversion of primary energy, as well as a central fan system to deliver hot and/or cold air. The multiple end use zone systems are mixing boxes, usually called VAV boxes. The typical uses of central systems are in larger, multistoried buildings where access to outside air is more restricted. Typically central systems have lower operating costs.

Besides packaged unitary and central systems, there are a variety of special-purpose systems. These include the following:

- Heat pump cycles on chillers that use rejected heat or tower cooling
- Thermal storage
- Cogeneration of electricity and heat

Basic control regulates the amount of heating or cooling necessary to meet the load in conditioned spaces. Minimum outside air needed for ventilation is provided whenever a space is occupied. When outside air temperature is a suitable source for free cooling, it is controlled as needed at values greater than the minimum.

The approach in packaged unitary equipment is to control the generation of heating or cooling by space thermostats. The approach in central systems is to control the delivery of heating and cooling by the end use zones to match the load in the space. The supply is controlled to match the load imposed by all the zones. A typical method of doing this is for room thermostats to control zones, and discharge controllers to control central supplies. Discharge temperature controllers control the rate of primary conversion of chillers or boilers, and pressure controls determine the delivery rate of the pumps or fans distributing the central supply. In many cases, there are multiple boilers and/or chillers and pumps, which are put on or off line as necessary to provide proper capacity. Those online are modulated as necessary to meet load needs. The controls to put units

online and off-line would normally be applied to meet the system needs.

Direct digital control, is sometimes used to describe everything a computer or microprocessor-based control system does. The original use of the term signifies closed-loop control of local loops by a digital computer or microprocessor.

Energy management application programs are different than local loop control – and are named for their specific functions, such as start or demand control. The considerations of which energy management application programs should be used rely upon the type of building and HVAC system. For instance, optimum start-stop programs are not appropriate for a hospital that has 24-hour operation. Load reset of supply temperatures is appropriate for systems that supplying heating and cooling simultaneously, such as reheat systems or hot and cold deck mixing box systems.

The concept of optimising control is not only to control space conditions, but also to do it in a manner that minimises the energy and costs when different forms of energy are available. An optimising strategy is generally to improve the efficiency of primary supply equipment or to reduce the losses of energy in end-use systems. The sizing of equipment is to meet maximum loads, but the equipment is usually run at less than maximum load. This means that the part load characteristics of the equipment determines the efficiency in meeting a given load.

When there are multiple chillers or boilers, an optimising strategy would be to choose the most efficient equipment, which has the capacity to meet the load at any given time. Also, with some types of end use systems, energy wasted by bucking heating against cooling can be minimised by resetting supply temperature levels to be no more than that is necessary to meet a given load condition. Another way to optimise is to use the thermal storage of a building to make use of energy stored at low cost and used when needed. Moving heat from one area of a building to another can be an optimising opportunity as well.

These optimising principles are used for specific types of HVAC. The variable in all of these circumstances is the amount of heating or cooling load and the control action to make some change in the way a load is





automation & control

supplied. This process has led to the use of the terms load reset and dynamic load control to describe this general approach to optimising control. The selection of the most efficient combination of chillers to supply a cooling load has been called optimised chiller selection.

Before World War II, the main suppliers HVAC controls in commercial buildings were companies that promoted pneumatic controls. The predominant idea at that time was that controls for commercial buildings were too complicated to sell over the counter – and had to be installed and supervised by the controls manufacturer. This concept included having branch offices with installers and service people.

Electric control systems for commercial buildings were modulating type controls. They were sold on a supervised basis. When several other companies entered the commercial controls market with electric and electronic controls, some of their distribution was through distributors and branches. Some of the newcomers, who started with electric and electronic controls, expanded into pneumatic controls – either by their own development or by association with foreign companies.

When computer-based supervisory control systems came to market, some larger companies with computer-based products entered the HVAC controls market; but eventually gave up. As international business developed and companies became multinational, some foreign-based controls companies expanded into the U.S. markets directly or through associations with smaller U.S. control companies. During the 1970s, some small companies evolved with limited product lines for energy management functions. When DDC became accepted, some small companies developed microprocessor-based DDC controllers and supervisory systems.

The full line control companies that started out as major players currently remain as major players – but with more competitors that have limited systems. Some major HVAC systems manufacturers have acquired or developed control capabilities. They market packaged HVAC systems with controls and supervisory control systems. Some companies provide products for specific applications. The selection of a source of

supply should consider the life cycle needs and costs as well as the track record of suppliers.

The mounting of room thermostats and room humidistats has been the subject of much discussion, and for many years the industry standard has been for the thermostat to be mounted near the door of a room 5 ft from the floor. The problem is that if the room is full of children, the thermostat is not controlling the temperature where the occupants are.

It's important to study the location of the room thermostat or humidistat as to the effect of conditions at the thermostat. Remember, the thermostat responds only to what is going on at its location. If there is a ceiling diffuser blowing air at the location where the thermostat is mounted, there is going to be cycling of the system.

When computer-based supervisory control systems came to market, some larger companies with computer-based products entered the HVAC controls market; but eventually gave up...

Sometimes, installers and others are concerned about the way thermostats and humidistats are mounted on the wall; that is, whether they should be mounted in a horizontal or a vertical position. Generally, aside from writing on the unit's face, either horizontal or vertical mounting is fine. There is, however, one important exception: when the thermostat is electric and has a mercury bulb switch contact. This type is common in residential and commercial buildings and requires the thermostat to be mounted a certain way. Some of these require the installer to use a level to mount it properly.

Room thermostats and humidistats are devices that control automatic valves and dampers in a control system. These devices have built in sensors as well as moving parts that control the device. An example is a pneumatic thermostat that has a bimetallic sensor and a relay. Usually the complete

package is under one cover on the wall, and all action takes place at the thermostat. There are, however, sensors that are mounted under the cover in the room that have no actuators relays under the same cover. They usually transmit the temperature information to another device at a remote location that does the controlling with relays, and so on. Normally, this principle is used in electronic control systems involving a wire wound resistor mounted under a cover, which reads the temperature in the space and transmits that information to an electronic controller in an equipment room.

Often, there is confusion with the terms thermostat and sensor. The concept of a sensor under a cover in the room is new and came about because of the advent of electronic control systems. Room sensors are used with other control systems and are sometimes called transmitters.

In the case of pneumatic controls, the transmitters use a sensor and a special relay that transmits a pneumatic air signal proportional to the medium being sensed. An example is a transmitter under a room thermostat cover that transmits an air signal based upon the temperature being sensed in the room.

The transmitter may look like a thermostat, but it does no controlling by itself, it depends upon a receiver controller in a different location to take the action on the controlled device. The dials of these devices are only used for calibration, and are not moved. These transmitters come in standard ranges and send out a signal based on the medium being sensed.

Thus, we understand that Building Automation & Control System plays a vital role in integrated building planning. The system provides energy savings, greater comfort, safety and better operational efficiency. In India, the rising concern for Greenhouse Gases along with rapidly increasing power demand-supply gap are contributing to the growing adoption of the automation & control systems in the buildings – through electronic security & safety, HVAC and lighting control equipment. Majority of the building automation solution & system integration companies, are focusing towards new buildings and not on retrofits. This is on account of higher energy saving potential in the new buildings.





According to India Building Automation & Control Systems Market Forecast & Opportunities, by 2019 the market of India Building Automation & Control System is projected to grow at around 21.7% during 2015-19. The demand for BACS systems is majorly driven by commercial building segment, due to increasing number of shopping malls, office buildings, educational institutes, hotels, hospitals, etc.

The market is further supported by mandatory regulation of energy efficiency in commercial buildings. The policy & regulatory support such as building codes, incentive schemes and labeling schemes such as LEED rating scheme and BEE star rating scheme are expected to continue driving the BACS market over the next four years. The market growth is further supported by emerging trends of cloud based energy control solutions, ESCO schemes and automated demand response in building automation system. With the huge growth in the technological advancement, fast technology, and accepting such developments by the consumers, the currently available

HVAC Controls are smart in many ways. Environmental concerns have forced some government to make regulations, which essentially requires the use of smart HVAC controls. The Smart HVAC Controls systems are definitely more energy-efficient compared to the existing HVAC Controls, either by having sensors that can communicate to the thermostat or with the ability to access a home HVAC system over the cloud using a smart-phone application or a web browser. The concept of Modular Approach is also expected to play a vital role in Smart HVAC controls market.

The market is segmented in terms of product type such as Temperature Controls, Ventilation Controls, Humidity Controls, and a mixture of two or more controls as an Integrated Controller to provide the required environment in a cost effective manner. Also, the smart HVAC controls report is segmented in terms of various components such as sensors, controllers, controlled devices, and smart vents. It is very important to differentiate the modes of operation of any

smart HVAC controls, which otherwise are segmented by Wireless Controls, Programmable Controls, Weather Compensating Controls, and Remote Access Controls. The Smart HVAC Controls Market is further segmented according to Verticals which include: Residential and Commercial sector, and Geography which include: The Americas, Europe, APAC and Rest of the world. Various smart HVAC controls market trends such as Digital and IP Based systems, BACnet and LonWorks controls from major players like Honeywell International, Inc., Johnson Controls, Inc., United Technologies Corporation, Siemens AG, Daikin Industries, Lennox International, Hitachi, Ingersoll-Rand Inc., Schneider Electric SA and Emerson Electric Company. ■

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Remote Temperature Monitoring of Reefer Containers

The number of refrigerated containers being used in maritime transport is rapidly increasing. Huge Container Ships of 15,000 TEU and above are being built today with reefer container plug capacity of above 1,500 TEU. This has resulted in the necessity for devising innovative and effective ways of monitoring these containers.

Since the daily inspection of the large number of refrigerated containers carried on board a vessel takes a significant time, a number of shipping companies have started to use systems which enable remote monitoring of the containers. Data is exchanged between the ship's computer and the containers. As a result, the crew is in a position to react to problems more quickly. When relying only upon daily rounds, it is possible that a container has had an alarm for 24 hours earlier, and which gets noticed at the time of the rounds. Using a remote monitoring system can drastically cut down the time and cost of inspecting the containers – and enables the crew to react more rapidly to potential problems in the event of a refrigeration unit failure.

These systems could be wired systems or wireless systems. The information may be about current temperatures, any alarms that have occurred etc. Printed logs generated as a result of this exchange can effectively replace manually recorded temperature data.

Types of Remote Monitoring Systems

There are two basic types of Remote Monitoring Systems:

Four Wire System

Here, a separate monitoring cable with four wires is used to record the status messages "Compressor running", "Defrost" and "Temperature in range". Around 80-90 % of all refrigerated containers have a socket to connect them to this type of monitoring system.

Four-wire (4-pole) monitoring system consists of a cable with three individually insulated wires which are used to transmit three signals as active

Fig. 1: Large Container Ship



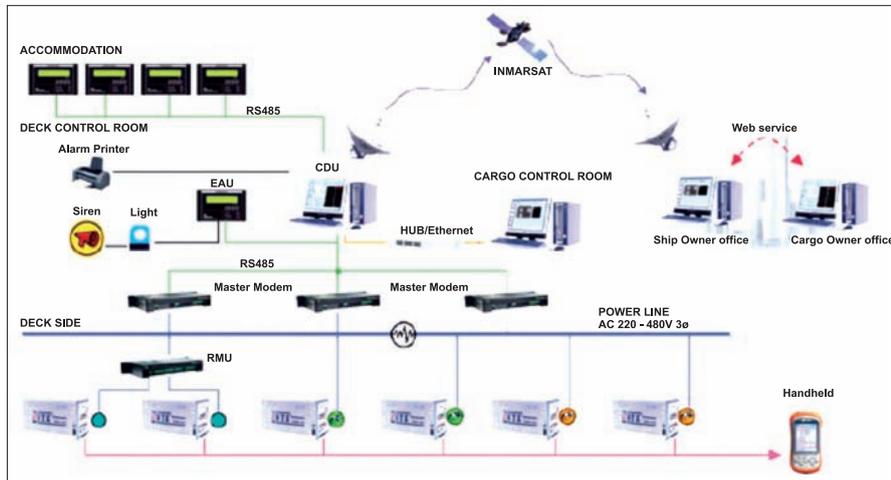


Fig. 2: Remote Monitoring System General Layout

24 V signals. A fourth common return wire is connected to the chassis of the container. It is possible to determine whether a container is connected to the four-wire monitoring system by checking for a connection between this return wire and the ground wire of the container.

the caps after disconnecting the cables. The cables are also prone to damage as they are often subjected to rough treatment when twist locks and lashing rods are dropped. Sometimes the cables are also simply torn off, because no-one bothered to remove them before

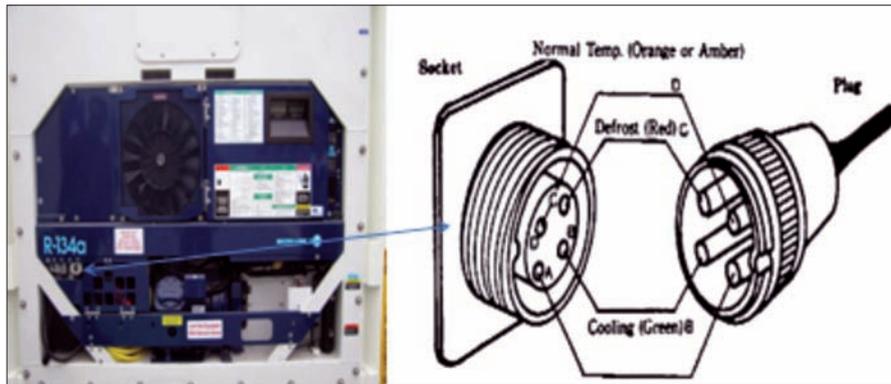


Fig. 3: Four Wire System

The main disadvantage with this system is contact problems. The signal sockets on the containers and on the ships are equipped with protective flaps, but the sockets still regularly suffer from corrosion damage due to the rough environment or carelessness in not replacing

unloading the containers. The signals are transmitted as voltage signals with the status 0V and 24V, so it becomes impossible to determine whether or not there is a reliable electrical connection.

Three signals are provided by four-wire

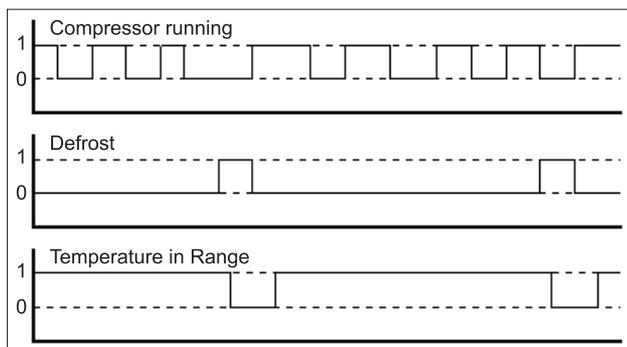


Fig. 4: Typical Signal Behaviour (4 Wire System) of a Refrigerated Container

technology, the most important signal is undoubtedly "Temperature in range". If this is not issued, an alert is triggered. Very simple monitoring systems can therefore only evaluate this signal. The other two signals are "Defrost" and "Compressor running", which are status signals which are required to provide further

There is a tremendous cost-saving potential offered by the option of making remote PTI of the containers on board or in the terminal and to read out data logger info after a loaded passage...

information. For example, the "Defrost" signal, can be used to suppress a temperature alarm as during defrosting, the temperature is expected to deviate from the nominal value. A cooling compressor which is constantly running (Compressor running) in low-temperature mode can indicate a fault in the container. During normal cooling operation, the cooling compressor runs in on/off mode. During defrost, the compressor is switched off and switched on again after defrosting. The "Temperature in range" signal will not be issued during defrosting, since the air in the cooling unit is being heated, but must be issued again, later.

Power Cable Transmission System (PCT)

In this system, data is transmitted via the three-phase power cable of the containers. This enables an unlimited amount of data to be transmitted between the container and the receiver on board or on land. Since data can be exchanged in both directions, it is possible, for instance, to change the set point value of the temperature of a container from the remote location. There is a tremendous cost-saving potential offered by the option of making remote Pre-Trip Inspections (PTI) of the containers on board or in the terminal, as well as to read out data logger information after a loaded passage.

PCT system is currently available in two types: Narrowband transmission, which operates at a fixed frequency to modulate data on to the power supply system, and Wideband transmission, in which data is transmitted over a frequency spectrum. These systems are not compatible with each other. So, depending on what modems are fitted to the containers, both systems have to be installed on board to be able to communicate with all containers. By 1997, about 6.6% and 5.3% of reefer containers were equipped with narrowband modems and wideband modems, respectively, depending



upon the choice of the shipping line and the route. All the problems that arise from using an extra cable in the four-wire monitoring system are eliminated by use of PCT. Since it merely depends upon the transfer protocol used, PCT also has a significantly larger range of functions, since any data can be transmitted. The data is modulated onto the three-phase power supply system of the ship or the terminal as a high-frequency signal and received by one or more master modems. It is then transmitted from there via a bus system to the control computer.

Long Distance Systems

The following different types of technology are used by different providers to cover longer distances.

Single Master Modem System

A system with a capacitive network only needs one master modem which, is connected to the three-phase power supply system over a kind of signal line and one or more Capacitive Bridge Units (CBUs). Transformers are bridged by use of Transformer Bypass Units (TBUs).

Multiple Master Modem System

This system uses a number of master modems, which are connected to each other

via a field bus. Depending upon the network configuration and the distances to be covered, the number of master modems required has to be decided. However, this system is not without its disadvantages. The first of them is that no more than one master modem may be running at a time, which significantly reduces the effective average data transfer rate in the event of several master modems. Additionally, it is possible that some containers are positioned in the catchment area of a number of master modems, meaning that, the same data is transferred several times unnecessarily, needing to be filtered out.

Data Transmission via Narrowband

This is the older of the two methods. Data is modulated onto the power supply network at a fixed carrier frequency of approximately 55 kHz. It is transmitted at a rate of 1200 baud, which is why this system is often also referred to as a "low data rate system".

Sealand were already carrying out their first trials with PCT at the end of the 1970s. At the beginning of the 1980s, Thermoking collaborated with Sealand to develop the first marketable system, known under the name of ThermoNet. Sealand and Matson were the first to use this system on a large scale, principally

in the relatively closed refrigerated container trade routes in the Pacific.

Data Transmission via Wideband

In the middle of the 1980s, the wideband system arrived, transmitting data in a frequency spectrum of approximately 140-400 KHz. Transmission over a number of frequencies was intended to ensure reliable transmission even with interference frequencies such as those generated by frequency converters. By distributing the signal over a frequency spectrum, the strength of a signal on any frequency is lowered than with narrowband laying claim to a greater range. Since the data transmission rate on wideband systems is theoretically 19,200 baud, it is also known as a "high data rate system", though in practice this speed benefit is barely discernible.

ISO Protocols

An ISO sub-committee was set up between 1987 and 1990 to define a standard as it was discerned that a monitoring system is useful only when there is a standard for data exchange – and genuine saving effects can only be achieved if all refrigerated containers can be monitored by PCT as far as possible. The set of Standards was published as ISO 10368. Due to the non-commonality of interests among the various participating companies, no consensus was reached regarding hardware (i.e., the transmission frequency), and consequently there are still two systems available in the market. The frequency ranges for each system were defined, so that they could both be operated simultaneously.

Additionally, the standard primarily regulates the data transmission protocol (i.e. software) and defines the minimum range of functions for Remote Communication Devices (RCDs) comprising of the following:

Standard Prescribed Functions

- Identification number of the container or clip-on unit
- Porthole container number (for porthole containers refrigerated with a clip-on unit)
- Date and time of any change to the porthole container number
- Current return air temperature
- Current supply air temperature
- Manufacturer/type

Important Optional Functions

- Operating mode (Full Cool, Partial/Lower capacity cool, Modulated Cool, Fans only, Defrost, Heat)

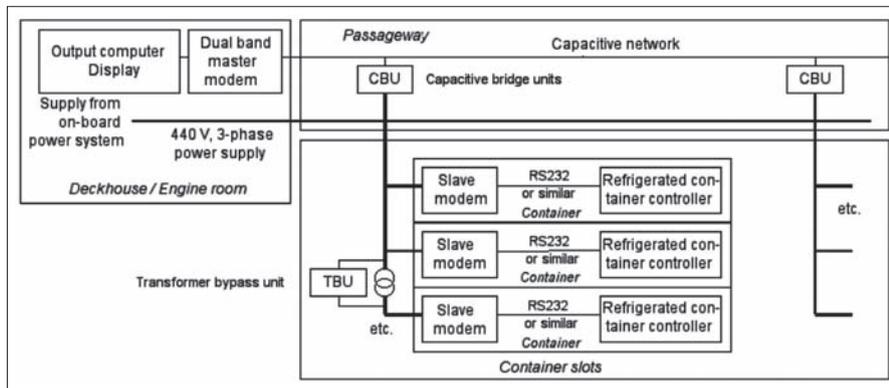


Fig. 5: Schematic Diagram of the Dual Band Power Line Transmission System

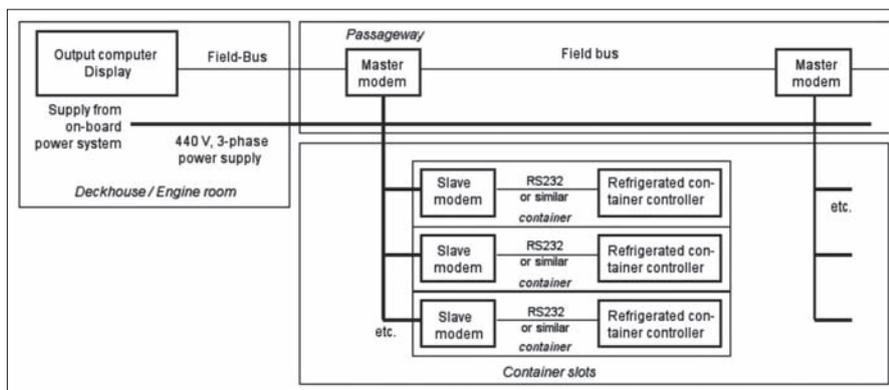


Fig. 6: Schematic Diagram of the Wideband Power Line Transfer System



- Nominal temperature
- Alarms (status query)
- Current alarms (in the order in which they occurred)
- Product temperatures
- Data logger interval
- Power consumption
- Port of destination of the container
- Port of discharge
- Origin
- Results of the self-check (PTI)
- Commands for controlling & programming (in so far as the controller of the refrigerated unit supports them):
- Change the nominal temperature
- Start self-check (PTI)
- Change the identification number
- Change the data logger interval
- Set the date and time of the data logger
- Change the operating mode
- Download data logger information
- Change the porthole container number
- Change the destination

As the standard had not defined precise data protocols for all commands, room was left for subsequent extensions in the form of "private sessions", which can be used by individual manufacturers to transmit proprietary data, which was used extensively by certain manufacturers. The stage has reached that many functions available today are transmitted within these non-standardized protocol sections. Disagreement still persists on which of the protocols should be put in the public domain and therefore be made available to competition for this type of transmission, and under what conditions of usage. The ISO Standard has only documented the two existing systems and prescribed some very basic queries. Even if all transmission protocols were put in the public domain it would mean today, that a separate software driver would have to be available for every modem type. Because the controllers of the refrigeration units and the data loggers which are used also have different ranges of functions and data formats, there is a need for a large number of drivers to support all potential configurations.

Data Protection

Data Protection was another issue which was not dealt with by ISO. Practically, and also in accordance with ISO, all data on all containers equipped with modems is available on the power supply network. Therefore, it is

theoretically possible for third parties with access to the power line network via a master modem to read out and even change information on the containers (e.g., the nominal values). This was never a problem while shipping companies were only using PCT on board their own ships and terminals. However, once it began to be used on multi user terminals, the network operators (terminal operators) have had to ensure that only authorised persons have access to information on containers which pertains to them.

Limitations of Remote Data Transmission Systems

Power cable transmission usage has generally been restricted to shipping companies with a high proportion of refrigerated containers. There is no evidence of all refrigerated containers being generally equipped with modems. Two different systems will still be deployed, which means that the evaluation installations used on ships and terminals must be able to cope with both systems for the foreseeable future in order to effectively exploit the savings potential. Though it appears that recent investments are generally being made in wideband, there are still too many narrowband containers to expect them all to be converted to wideband. However, as a first step in the long term, the modems of the first generation will have to be upgraded, since the impedance values are too low and this interferes with dual band line transmission.

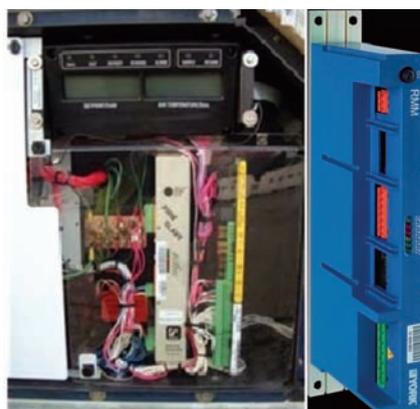


Fig. 7: Location of Remote Monitoring Modem inside Reefer Container Control Panel

Already four-wire monitoring technology has become extinct and we do not see much of its application on board. It has been replaced by power line transmission systems. On a ship or at a terminal, every refrigerated container

slot must have the relevant sockets available to connect the signal cable. These sockets are often integrated directly into the refrigerated container power outlets. The signals from the individual containers are transmitted from there either via a field bus system or via the available power networks to the evaluation computer. The signal cables themselves must also be available.

Looking at the Future of Recording Systems

It is now possible to transmit data by radio frequency, e.g., using "Wireless LAN" technology, as this promises higher transmission rates and lower interference.

Originally, it was thought that using satellites to monitor refrigerated containers generally fails, because when the containers are stacked they cover the antennas of the containers below them, thus making data transmission impossible. The same applies when containers are stowed below deck. However technology has now made available this facility at a reasonable cost. Orbcomm has at present made commercially available Low Earth Orbiting Satellites (LEO) and Tri-mex has designed cargo tracker service for temperature-regulated cargo. It has integrated its Windows-based tracking and monitoring technology with Orbcomm LEO communicators and has generated a service where a cargo can be tracked and monitored anywhere in the world - whether on land or at sea. For the perishables transportation industry a new age has dawned. Low-cost technology is allowing tracking, monitoring and intervention on all classes of cargo. This increases the information available to the client and improves the delivered quality of the goods. For the first time, conditions being experienced by cargoes in reefers can be monitored remotely - and responded to in minutes in many cases electronically. This will improve the service record of movements of perishables and will bring down operational costs - to the benefit of shipper and customer alike. It is also likely to bring down the insurance costs significantly. ■

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The Hybrid System and More

With the advent of variable speed products, many heat pumps approach more acceptable temp even at extremely low outdoor conditions. It's a boon for designing "Integrated Systems"...

A recently published article about the Hybrid HVAC system expounded upon the consumer acceptance of this approach. After all, the auto industry is making sound inroads with sales of their hybrid cars. So, why shouldn't the HVAC contractor? The article went on to say that a Hybrid HVAC system coupled a heat pump with a gas furnace and provided considerable savings to the homeowner. "Old Timers" recognise this Hybrid as a new name for "Dual Fuel" systems. However, the consumer may now be willing to accept the 'Hybrid' term rather than the confusing "Dual Fuel" name. The contractor surely deserves recognition for bringing this concept into the 21st century.

Since the introduction of dual fuel in the HVAC industry as far back as 1974, the concept has been confusing to most consumers and turned many off – when simply promoted as a heat pump first with a fossil fuel back up. The new Hybrid term is readily grasped and accepted by the consumer as not only a fuel savings product but also an environmentally friendly product. So, why not to dress up your sales approach, as well as your profits, and promote this Hybrid product to your customers.

If you're still doubtful about the comfort level of heat pumps, consider 2 things. First, the heat pump will not be operating at extremely low temp as the fossil fuel heat will be operating and providing the higher leaving air temp that customers may be more comfortable within their homes. Second, with the advent of variable speed products, many heat pumps approach these more acceptable temp even at extremely low outdoor conditions. Variable speed allows for decreased airflow until full demand is required and the higher leaving air temperature can be demonstrated as follows:



Temperature Rise can be expressed as the "Delta T" (the temperature difference between the return air and the leaving air).

Delta T = Btuh divided by 1.08 Times the cfm. So, a three-ton heat pump without variable speed with 36,000-btuh capacity and operating at 1200 cfm would provide a temperature rise of 27.8 and with a return air temperature of 70 degrees would provide a 97.8 leaving air temperature or not much above body temperature. But, with variable speed the airflow might be as low as 960 cfm and the resultant air temperature would be 34.7 degrees and provide a leaving air temperature as high as 104.7 degrees with the same 70-degree return air temperature.

In any event, if you were truly into "Green", you might ponder the true reduction in particulates with this system. However, just as with the hybrid car, the heat pump will be operating on electricity most of the time and electricity does not contribute to air pollution. Or does it? If the electric plant is operating on fossil fuels for generation, it could be argued that there is no real reduction in particulates to the atmosphere. However, keep in mind that electricity is 100% efficient as there are no waste products going up the flue of the home and most generating plants are government regulated as to the amount of particulates they may put into the atmosphere – and even coal generating plants have greatly reduced their particulate output. So, there is every reason to accept the idea that this hybrid HVAC system is more environmentally friendly. In any event, that argument is up to the EPA (Environmental Protection Agency), and does it really matter how "Green" the concept is as long as the consumer is willing to accept the idea?

What about the fuel savings aspect of the hybrid system? Electricity costs more per btuh than fossil fuel, or does it. Everyone knows that the new gas furnaces are 80to 90% efficient, but did you consider that a heat pump is 300% efficient? That is right because electricity is 100% efficient (no products of combustion going up the chimney), and the typical heat pump has a coefficient of performance of 3.0 or better and that is 300%! Simply put, for every 1 dollar of electricity used to operate the heat pump, you get 3 dollars of usable heat. So how much could a consumer expect to save?

Using the ENERGY STAR HVAC formula from the EPA website for comparisons with the following assumptions yield some interesting

Just for those who came in late, an integrated system uses the standby heat (heat normally wasted up the flue) from the domestic water heater...

figures. We'll compare an existing 80% AFUE furnace and a 10 SEER AC to a new 80% AFUE furnace with variable speed, night set back stat and a 13 SEER Heat Pump in the Mid Atlantic.

Assumptions

- 36,000 btuh Heat Gain
 - 60,000 btuh Heat Loss
 - Natural Gas per therm @ \$1.15 (probably a low figure)
 - Electricity .095/kW summer and .085/kW winter
 - 2250 hours of heating & 1000 hours of cooling
 - 75% of heating hours by the heat pump*
 - 25% of heating hours by the furnace
- *Typical winter average temp. in the Mid Atlantic region is > 30 deg 80% of the time, and the balance point in this example would be @ 30 degrees. However, some defrost will occur, thus we might safely assume 75% of the heating hours would be by the heat pump.

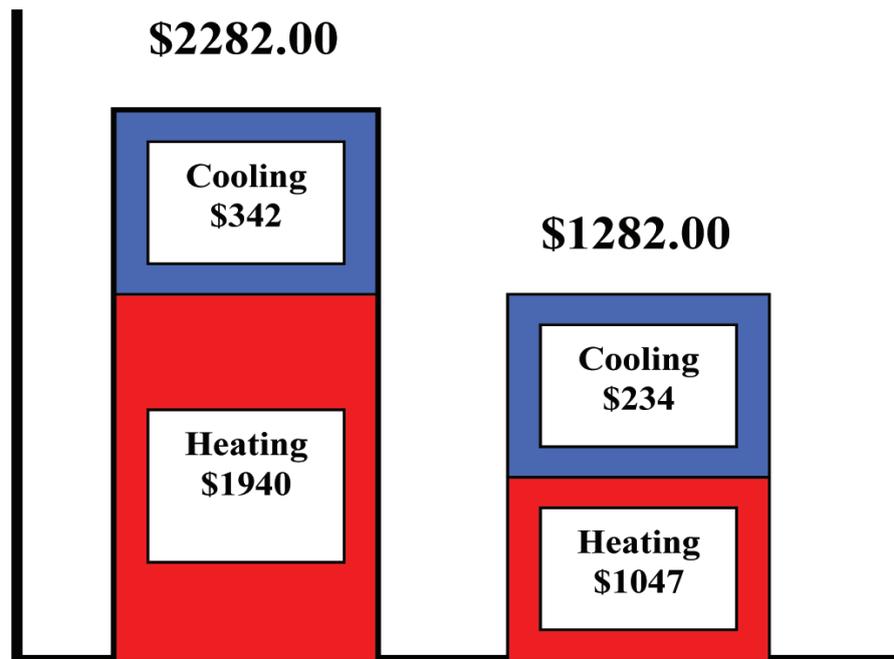
So, a typical three ton system with natural

gas in the Mid Atlantic area could save as much as \$1000 a year (\$2282 - \$1282)! Assuming that our example demonstrates the typical heating and cooling bills to be about \$2282 annually in the region, this would be a realised savings of about 40%. Additionally, if you're really into being "Green", the website said that the environmental impact would be like planting some 500 trees or not driving some 95,000 miles.

The Integrated System

If "Dual Fuel" can be dressed up under the name of a "Hybrid HVAC" system and readily accepted by the consumer then why not an integrated system as well! Just for those who came in late, an integrated system uses the standby heat (heat normally wasted up the flue) from the domestic water heater. This system eliminates the gas furnace and uses a hot water coil. The savings here could be another 10 to 20%. This could cut the Homeowner's utility bills by 60% or more and have an equal or greater impact on the environment.

Essentially the integrated system was promoted in the late 1970's and early 1980's and was commonly known as the "Appollo" system. The system was primarily used for multi-family projects (apartments), as the heat loss was usually less than 30,000 btuh. This being the case, it made sense to use the domestic hot water heater with a pump and



A typical three ton system with natural gas in the Mid Atlantic area could save as much as \$1000 a year...



hybrid product

coil to provide the heat and straight air conditioning for cooling. I'm not sure if that much thought was initially given to the energy savings as was the cost. After all, why have a 50,000-btuh-gas furnace with a 40,000-btuh output when there was going to be a hot water heater right next to it with about 35,000 to 47,500 btuhs available. Remember that during these early stages, these hot water heaters were vented by B-vent. Today, we have direct vent hot water heaters that greatly reduce the amount of heat being wasted up an open vent.

In either case, there does exist an energy savings as the water heater is constantly maintaining 125-degree domestic water temperature and is only used sporadically. Keep in mind that there may be considerable loss up the flue – when the domestic water was not being used and even some with a direct vent water heater.

So, the integrated system would be using some of this wasted heat to provide space heating. Additionally, Appollo recommended increasing the water heater size to reduce complaints of lack of hot water when demanded for domestic use. Thus the entire heat loss could easily be off set when space-heating demand was required.

The use of a heat pump instead of the straight AC with the Appollo concept was introduced in California by "CALERDA", an energy-regulating program, which eliminated, by law, the use of any electric resistance heat in multi-family applications. So, it made perfect sense to use this concept. Many multi-family units used such systems in California, and probably still do so. The point is, this is really nothing new. However, let us consider the actual operation and make some estimates of possible energy savings.

The heat pump portion of the integrated system functions exactly as any straight heat pump. It is in the "back up" heat operation that the integrated system begins to make a considerable difference. Back up heat is required during two separate operations. First, during a defrost cycle some additional heat is required even though the typical defrost cycle is usually only 3 to 5 minutes. Without some additional heat there would be a "cold blow" throughout the home and this would result in discomfort and homeowner complaints. Second, when the outdoor temp drops below the balance point (the temp at which the capacity of the heat pump can no longer

maintain set point temp in the home) the back up heat will be required, same as "Dual Fuel".

The domestic hot water heater with the integrated system handles both of the above requirements. The amount of heat needed to off set the defrost cycle is very minimal – and because the duration is so short it may never require the water heater to initiate operation. The heat required once the heat pump is no longer capable of supplying adequate heat (commonly called second stage operation) will take advantage of the stand-by heat of the water heater as well and it will require a considerable operating cycle before the water heater will actually begin to heat the water. This is when true savings come into play, as there will be no resistance heater operation (the most costly part of heating with a heat pump).

Additionally, the hot water coil will provide water temp of at least 125 degrees and when added to the heat out put of the heat pump during 2nd stage demand, the leaving air temp may typically be in excess of 125 degrees. More importantly, this will not only tend to shorten the second stage heat operation as the mass of the hot water coil will provide higher leaving air temperatures even after termination. This means far greater comfort levels.

Okay! This is all fine as long as there is a low heat requirement as in a multi-family application. Yes, but the principle works equally well in single-family home applications. Consider that the typical system in the mid Atlantic is a three-ton heat pump with a fifteen kW back up resistance heater. Well 15 KW is about 50,000 btuh ($15 \times 3413 = 51595$ btuh). So, the hot water heater needs only to provide about 50,000 btuh and most 50-gallon water heaters (gas or oil) will meet this requirement. Admittedly, a home with two heat pump systems might require two water heaters or a larger water heater, which might not be a bad thing. However, the principle remains sound.

So what products would actually be needed? Obviously a properly sized heat pump and duct distribution system would be required. A water heater with the capacity needed for back up heat, and again some consideration for domestic hot water needs. This is not a big thing – as most water heater manufacturers have manufactured double walled hot water heaters for this application for some years – and even have separate inlet and outlet connections for the hot water coil. A hot water coil with the required heating capacity and a

matching pump assembly (usually a three gpm Grundfos or Taco pump) to supply the coil would also be needed. What would not be needed is another number 8 wire and 60-amp breaker as there would be no resistance heater.

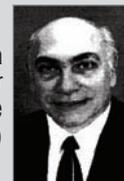
I would also recommend a "Hot Water Re-claim" unit be installed. These products take advantage of the waste heat from the compressor and heat the domestic water – and remember we're using the domestic water heater for space heat. During the summer season the re-claim unit might easily supply all or certainly most of the heat required for domestic hot water usage.

There is some concern that the re-claim unit, when operating in the heat mode, might reduce the heating capacity of the heat pump at extremely low temp. However, what does it matter if we are using the water tank for back up heat when required? Heat is heat and does it really matter where it comes from! Additionally, the re-claim unit raises the SEER during the cooling season. This is true as normally an outdoor unit is working with refrigerant temp approaching 300 degrees but the reclaim unit portion is only working against 125-degree water temp in the hot water heater. You shouldn't be surprised if the amp draw is reduced by 30 or 40% or increasing the SEER by two or three points over the cooling season.

So, what might we expect for savings on the overall utility bill. How about 40 to 50% in heating and another 20% in cooling! Keep in mind that no comparisons are available today, so I must go by the savings I have experienced with this system in my own home over the past 20 years. I've operated this system consistently and currently spend about \$1200 annually for heating and cooling 2880 square feet of living space. Further, my back up source is LP Gas at over \$2.95 per gallon. Neighbors with similar homes in my area spend over \$3,000 annually for their heating and cooling bills, so I save 60% annually.

So, dress up your sales presentation with the new HYBRID HVAC System and increase your profits as well! And don't forget about the "Integrated Systems" for your next project. ■

Albert Ciuffreda
Founder
Customer Choice
(A Consulting Firm)





Third Edition
COOL
STRATEGIES SUMMIT
CHAIN

29th May 2014
The Westin Mumbai Garden City

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Moving away from Ozone Depleting HCFC Products

Mexichem Fluor, part of **Mexichem**, is a global chemical business supplying fluorine-based products, technologies and services to a wide range of industries. In an exclusive interview with **Cooling India**, during ACREX India 2015, **Stuart Corr, Techno Commercial Director** of the company is giving an account of their global business. Excerpts...

Stuart Corr

Techno Commercial Director
Mexichem Fluor

Q What business activities are you into?

A We are the largest fully integrated manufacturer and supplier of refrigerant gases to the automotive, commercial refrigeration and air conditioning industries.

Q I am seeing two companies at the moment one is Mexichem Fluor and the other one is KLEA, how are they associated?

A Our business is called Mexichem Fluor and KLEA is our brand of ozone-friendly hydrofluorocarbon (HFC) refrigerants.

Q So, what kind of refrigerant are you dealing with?

A We produce a range of refrigerants for the major application sectors such as air conditioning and commercial refrigeration. Products you may be familiar with include KLEA 134a, KLEA 407A, KLEA 407C and KLEA 410A.

Q What about the 'fluorinated', does this fluor word come from fluorine?

A We are the largest producer of fluorspar in the world. This mineral form of fluorine is key in the production of a huge range of products, including HFC refrigerant gases. We are the largest business of our type in owning the process from mine right through to market – meaning we are in a very strong position to ensure quality and security of supply for the Indian market.

Q What about HFC utilisation?

A HFCs remain the principal mechanism for moving away from ozone depleting HCFC products such as R-22, and are vital in ensuring compliance with the Montreal Protocol. They have zero ozone depletion potential and significantly lower Global Warming Potential (GWP) than the CFCs that they have replaced. The success of HFCs as CFC and HCFC replacements has led to a rapid growth in their consumption across the globe.

However this growth has raised some concerns since some HFCs, particularly R-404A and R-507 are perceived to have relatively high GWP, which has meant in areas – such as Europe – moves to limit the GWP impact of HFCs through encouraging the use of lower GWP HFC products.

Whilst some of these products are already available, including R-407A and R-32, there is considerable activity in the development of even lower GWP product such as the hydrofluoroolefins (HFOs) including R-1234yf and R-1234ze.

However, the widespread adoption of HFOs faces some challenges in the form of higher prices and restricted availability. HFCs remain as safe and energy-efficient alternatives to CFCs and HCFCs.

Q Basically, where is your company situated?

A Mexichem is a worldwide leader in plastic pipes, and one of the largest chemical and petrochemical companies with

more than 50 years of experience, it has two main chains: Fluorine and Fluent Conductions. Mexichem Fluor is based in Cheshire UK, with facilities in the UK, Japan and the USA.

Q What about the refrigerant market globally?

A As I said earlier, speaking broadly the move is away from HCFC refrigerants – which are already banned in Europe – under the Montreal Protocol towards zero ozone depleting potential solutions that offer lower and low global warming potential.

We should also remember that energy efficiency is also a key driver in ensuring that the environmental footprint associated with the use of refrigeration and air conditioning is minimised.

Q How are you finding the responses in this exhibition (ACREX India 2015)?

A The show has been very positive, with lots of questions on the best refrigerants for the transition from R-22 – both from equipment manufacturers and engineers involved in the maintenance and servicing of equipment.

Q You mean to say that these refrigerants are used and conventional equipment is there and you want to use this? Are there retrofit possibilities?

A In high-ambient climates such as India, it is a challenge to reproduce the performance of R-22 using existing technology and equipment designs. As a result, manufacturers must look to technology optimisation that makes effective use of the non-ozone depleting refrigerants available such as R-410A.

In the meantime, they must also consider the best way to manage their existing equipment production processes

R-134A IS PROBABLY THE MOST COMMON MEDIUM-PRESSURE CHILLER

REFRIGERANTS IN EUROPE, JAPAN AND THE UNITED STATES. IN THE TRANSITION

FROM R-11, MANY SYSTEM MANUFACTURERS MADE A STEP CHANGE IN

TECHNOLOGY AND MOVED FROM LOW PRESSURE DESIGNS TO THOSE DESIGNS THAT

CAN ACCOMMODATE R-134A...

– and technology without having R-22 available. The HFC product R-407C has been specifically developed for this application – providing an effective replacement for R-22 in broadly existing system designs requiring relatively little work to adapt the technology. This allows manufacturers to continue selling R-22 technology – without having to make significant and expensive changes to the technology or their production equipment.

Q Out of these refrigerants 404, 407, 134A, which one has got the more market potential?

A It is about choosing the right product for specific applications now and into the future – which particular products that prove to be – will be in part governed by the nature of legislation that is introduced. For example, in Europe we are seeing increasing demand for KLEA 407A because in comparison to R-404A products, it offers a lower GWP (approximately half that of R-404A) – and significantly improved efficiency for a range of commercial refrigeration applications in existing equipment and designs.

R-134a remains as a safe, cost-effective and efficient refrigerant across a range of applications.

Q I saw that the chillers in some booths of this exhibition are using 134a.

A Yes, R-134a is probably the most

common medium-pressure chiller refrigerants in Europe, Japan and the United States. In the transition from R-11, many system manufacturers made a step change in technology and moved from low pressure designs to those designs that can accommodate R-134a.

Q So what scope do you see for your refrigerant in Indian Market as a company?

A We are looking to help and guide the Indian market during the transition away from R-22 – both in terms of the retrofit options to maintain existing equipment, and also supporting the implementation of new technology – that makes best use of low and lower GWP products.

For each application, it is about balancing environmental, technological and commercial requirements to find the best solution.

Q What do you think about hydrocarbon refrigerants?

A Whilst some ‘natural’ refrigerants, including hydrocarbons, are a potential option here, they require a very high level of training in safe handling – and use due to either high pressure (CO₂) or very high flammability (hydrocarbons).

Further, some of the technologies to use these refrigerants are at a relatively early stage of development and – may not be suitable for the high ambient climate of India. ■

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High Efficiency Mist Cooling System as an Alternative to Cooling Tower

There is an urgent demand from the industry for a water-cooling system, which will operate with high efficiency even in adverse climatic conditions, and maintain cold water temperature in closed vicinity to WBT...

In process or chemical plants, product vapour generated in the process is condensed in a heat exchanger and is recovered back.

The condensation of steam / Vapour requires a cooling medium. In early days, this was achieved by using water from a river, a basin or seawater. The cold water is pumped through a heat exchanger and the warm water is discharged back to the water source. This is called ONCE THROUGH cooling system.

A ONCE THROUGH system is an open loop system. The need to reduce the huge amount of water gave birth to the idea of closed loop system. Thus, the WET COOLING system came into effect.

In a wet cooling system, water is circulated to condense the steam in the same type of heat exchanger that is used in the ONCE THROUGH cooling. The warm water, instead of being returned to the water source, is cooled in a cooling tower using air as the cooling medium. Only the water carried away due to evaporation, drift and blow-down needs to be replenished by make-up water. Thus, requirement of water quantity is vastly reduced.

Wet Cooling Systems

Wet Cooling Tower System

We will first consider the Wet Cooling Tower System. The wet cooling tower system is based on the principle of evaporation. The heated water coming out of the surface condenser is cooled as it flows through a cooling tower, where air is forced through the tower by either mechanical or natural draft. Nowadays, mostly, all wet cooling towers are mechanical draft cooling towers, where the air flow is accomplished by fans.

Louver Type MCS



The principle cooling devices used in an Induced or forced draft cooling tower are fans, which run at the top of the Cooling Tower (CT). Air enters through side louvers and escapes from the top. H₂O enters at the top and trickles down while getting cooled by the air draft.

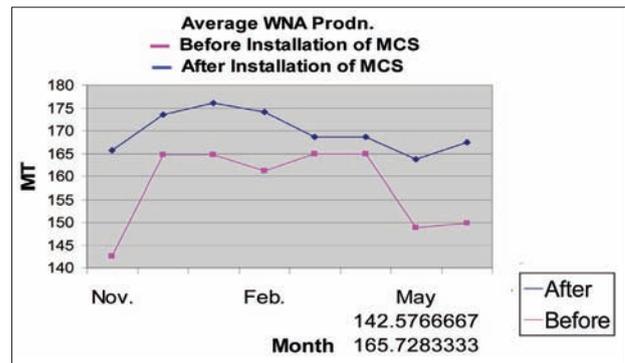
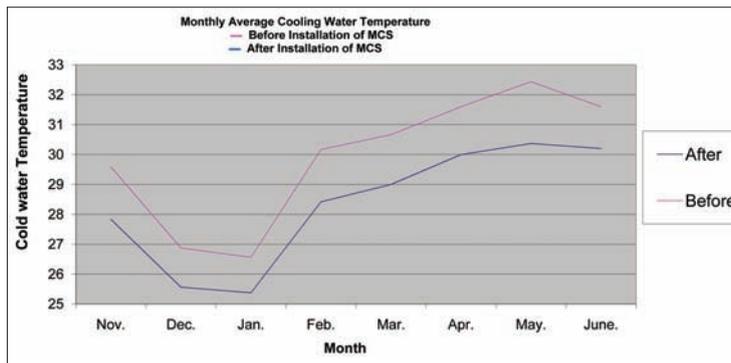
A correctly designed induced draft CT can give an approach of 4 to 6°C to wet bulb temperature with a temperature drop of 10°C. Even a very highly efficient CT cannot give an approach less than 4°C to WBT. Moreover, if ambient temperature or humidity levels rise, efficiency of CT reduces.

The MIST COOLING SYSTEM (MCS) is a high efficiency system and ensures an approach of 1°C to prevailing wet bulb temp – with a temp drop of 12 to 15°C even in adverse climatic conditions..."

Mist Cooling System

MREPL has come out with a solution by designing a MIST COOLING SYSTEM, which is a high efficiency system and ensures an approach of 1°C to prevailing wet bulb temperature – with a temperature drop of 12 to 15°C even in adverse climatic conditions.

In tropical conditions, worst wet bulb temperature – even at coastal applications – is maximum 30.5°C. Hence, MCS will always maintain cold water of around 31°C±1°C throughout the year. No other cooling system can operate with such efficiency, and it



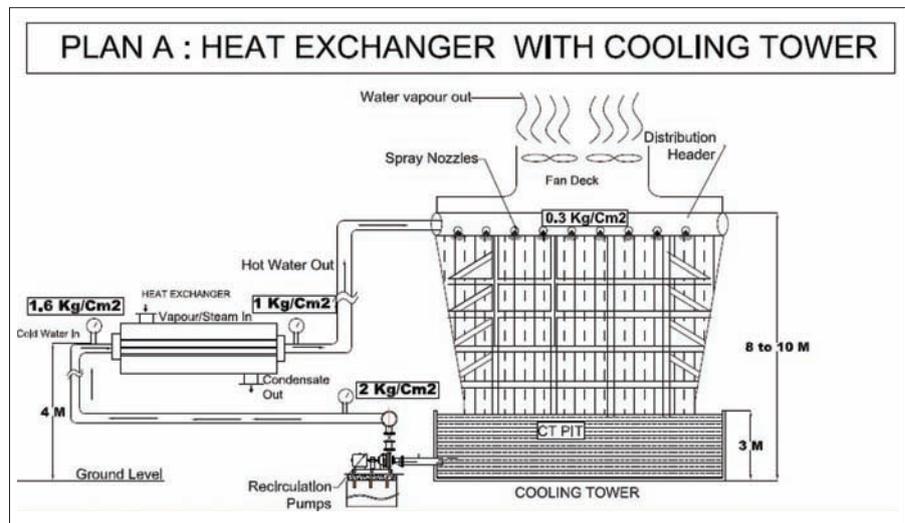
Graph A & B: Results from a chemical unit in Andhra Pradesh

Let's consider this through in example

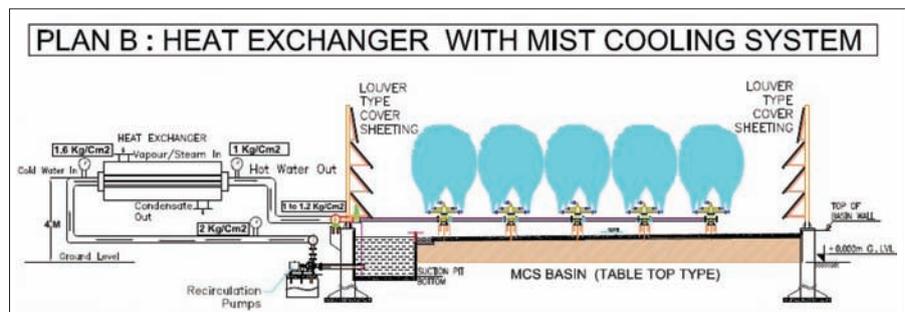
For a chemical plant, an induced draft cooling tower is designed to maintain cold water temperature of 32°C at a WBT of 28°C with an approach of 4°C. The CT performs as desired during winter and the early summer months. But during peak summer or monsoon, efficiency of the cooling tower reduces as humidity rises and its approach to WBT reaches beyond 6°C from designed 4°C. Thus, due to this rise in cold water temperature, these industries always experience loss in production by at least 5 to 7%. These losses do not occur in winter months. This means that the plant will operate at a reduced efficiency for almost 5 to 6 months in a year (Please refer Graphs A & B).

Also due to use of fans, CT consumes a lot of power. It is observed that the efficiency of CT reduces over a period of time due to wear and tear of moving parts, fills, fins etc, which invites heavy maintenance.

Hence, there is an urgent demand from the industry for a water-cooling system, which will operate with high efficiency even in adverse climatic conditions and maintain cold water temperature in closed vicinity to WBT.



Circulation Water Cycle in Cooling Tower Plan A



Circulation Water Cycle in MCS Plan B



alternative idea

makes the CT or spray pond systems obsolete.

Salient Features of Mist Cooling System (MCS)

Cold Water Temperature

Mist Cooling System ensures an approach of 1°C to WBT with a temperature drop of 12°C to 15°C.

Energy Savings (Please refer diagrams Plan A & B)

Due to such high temperature drop obtained, water quantity required at the process side is much less.

MCS requires water pressure equivalent to the height of cooling tower (as shown in the diagrams). Hence, considerable amount of energy is saved on circulation water

pumping. Also, MCS does not require any fans for cooling. Thus, a huge amount of energy is saved on circulation and cooling.

Process Benefits

Mist Cooling System will supply cold water at a temperature very close to WBT (Approach of 1°C) as against an approach of 4 to 5°C in CT. This will reduce the product vapour losses in shell & tube type heat exchangers. Also, this will make sure that your plant operates at an enhanced yield in summer and monsoon—giving stable throughout through out the year.

Maintenance

MCS has no moving parts. It does not use any fills and fins for cooling. Also material used in the MCS is special grade saran polymer, a highly non-corrosive material having a life of more than 10-15 years.

Chokeless Design of Nozzles

MCS operates with a chokeless design. Size of smallest opening in MCS is more than one inch (25 MM) in diameter. Hence, chances of particles choking the system are remote. This makes MCS absolutely maintenance free.

Various Designs of MCS to Suit Site Conditions

- **Open Type MCS:** Here, MCS ensures an approach of 1°C to WBT with a ΔT of 12 to 15°C. Water loss due to drift is 0.1 to 0.25% depending on wind load.
- **Louver Type MCS:** Here, the MCS basin is closed from all sides, up to a height of six mtrs. by louver type cover sheeting. MCS ensures an approach of 2°C to WBT with a ΔT of 12 to 15°C. Drift loss can be limited up to 0.002% – and also space requirement reduces considerably.
- **Table Top Design to Prevent Algae Formation:** The latest table top design does not allow formation of water level inside the basin – and all water passes to suction pit that is covered from top, thus minimising chances of algae formation.
- **MCS Design for Working in Dusty Environment:** The unique suction pit design does not allow dust to pass to the inlet of circulation pumps. Dust is drained from drain valve, while only clear water passes to the circulation water pumps.

System Flexibility (Capacity Turn Down Ratio)

MCS is offered with individual line isolation valve. It is the only system, which gives such a high flexibility in operation.

Hydro-Balance Valve

A Hydro-Balance Valve (HBV) is provided to take care of sub-cooling, which may happen in winter season, and also is helpful to release excess pressure – which may develop on system at times.

Chemical Treatment

Chemical dosing requirements are similar to that of the cooling tower – as the same hold up of water is maintained in suction pit of table top MCS.

Make-up Water Requirement

Due to the latest “Louver Type” design, drift loss through MCS can be limited to less than 0.002%. Hence, Overall make-up water quantity required is approximately the same as compared to the cooling towers.

Pay Back Period

The Pay Back period of the MCS, in most of the cases, will be obtained in less than ONE year only.



Open Type Design



Terrace Top MCS Design





Comparison Table Between Induced Draft Cooling Tower/Fan Less Cooling Tower & Louver Type Mist Cooling System				
Sr. No.	Feature	Induced Draft Cooling Tower (IDCT)	Fan less / Jet Cooling Tower	Louver Type Mist Cooling System
1	Approach to WBT	4 to 5 degrees.	6 to 8 degrees.	1 to 2 Degrees.
2	Temperature Drop	8 to 10 Degrees	6 to 8 Degrees	Regular: 12 Degrees. Advanced Model guarantees up to 40 Degree C in a single stroke
3	Power Consumed (Comparison for a 1000 m3/hr circulation flow assuming IDCT's Total Power as 100%) (Please refer Diagram PLAN-A & PLAN-B)	(100 HP : 100% 70 HP : 100% on Pumping & 30 HP: Fan)	(100 HP : 100% 100 HP : 140% on Pumping & 00 HP : Fan)	(70 HP : 70% 70 HP : 100 % on Pumping & 00 HP : Fan)
4	Nozzles	Ordinary type which choke frequently	Ordinary Jet type which choke frequently	Special whirling type, choke-less design incorporating non-moving parts with 25 mm bore opening.
5	Water droplet size	5 mm	2 to 3 mm	Atomized to 5 to 50 Microns
6	Travel time	Less due to Downward fall only.	Less due to Downward fall only.	Two time travel due to upward & downward travel leads to Double air retention time
7	Fills/ fins	Various types used - prone to scaling, need Periodical changing	Various types used - prone to scaling, need Periodical changing	Absolutely No Fills / No Fins Required.
8	Drift Loss	Same	Same	Same
9	Make Up Water	same	same	Same due to similar hold up.
10	Flexibility	Limited	Limited	Individual Line Isolation offers max. flexibility to use capacity as per requirement.
11	Standby	Required	Not Required.	Not Required.
12	Erection/delivery	Substantially high	Low	Fairly less
13	Maintenance	Very high due to replacement of fills/ fins/ fan blades etc. Also due to deposition of dust on fills, efficiency reduces with time.	Very high due to replacement of fills/ fins etc. Also due to deposition of dust on fills, efficiency reduces with time.	Negligible maintenance due to choke less operation and non-moving parts.
14	Aesthetics	Bulky, Generally most neglected part in a Plant	Untidy	Appears Fresh and Dynamic resembling active water like fountain
15	Civil Construction	Heavy due to static and dynamic load	Less	Simple due to table top construction with static load
16	Total Footprint	Less	Higher than CT	*More by 2 to 4 times to IDCT

***Note: As capacity (Flow, M3/Hr) through MCS increases, ratio of area required between MCS and CT reduces**

MCS Matches the Design as per need

MCS can be put to use in Open Type or Louver Type MCS designs to suit the need. Open Type design ensures an approach of 1 deg.C to WBT while Louver Type MCS design ensures an approach of 2.5 deg.C to WBT. Space requirement of Louver Type design is

only 65 to 70% of Open Type design. Also, there is an option of Advance MCS – best suitable for plants where there is space limitations. Considering the need for high efficiency system required by the various industries, MCS surely meets the demand at an extremely affordable price. ■

Makarand A Chitale
Director (Technical)
Mist Resonance
Engineering Pvt. Ltd.







refrigerated vehicle

Advanced PCM Technology for Hybrid Reefer trucks



There are around 7,000 to 8,000 refrigerated vans or trucks having a total carrying capacity of 3.6 million tonne in India. However, this is far below the requirement...

The cost of a reefer truck is on an average about 60% higher than a normal truck varying slightly depending on different capacities. Reefer trucks form a crucial part of cold chain for both short and long duration transport. Cold chain refers to the storage, transport and various processes involved in supply chain of products that need temperature control. Agriculture crops, fruits, vaccines, vials, biological products form 90% of the products that need temperature control during transportation.

With rise in gross income level, there is a rising trend in demand of fresh fruits, vegetable,

meat and dairy products. Upcoming initiatives in health care to eradicate disease calls for a safe transport of vaccines, drugs and biologics without losing its efficacy. This calls for capacity building of the cold chain sector. To achieve this result, NCCD, a cold chain development and awareness organisation, headed by the Ministry of Agriculture is investing heavily in capacity building. Cold chain is expected to grow at a CAGR of 28% for the next four years. (Analysis, 2014)

Temperature control within a range of 2 to 8°C is largely required to keep fruits and vegetables fresh and reduce the rate of its



Various Processes in Transport of Temperature Sensitive Products

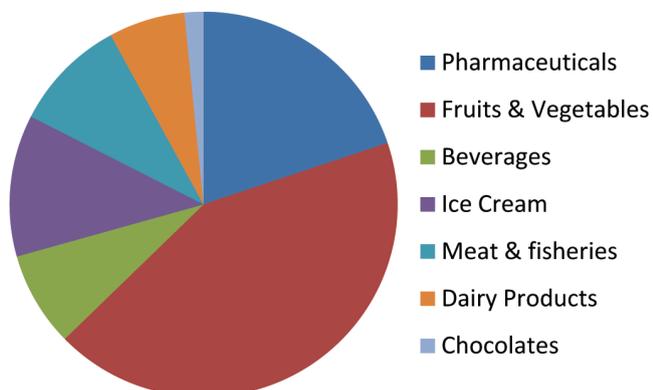




refrigerated vehicle

decay. Inadequate infrastructure and transport facilities are the reasons for loss of 70 to 80% of the agricultural produce. Similarly, vaccines are sensitive to temperature excursions – hence, resulting in a loss of efficacy if exposed to a temperature higher than the desired range.

Government and private players are on the lookout of technologies that could make the endeavour an economically feasible solution. Phase Change Material based reefer trucks is a recent addition to innovation in the cold chain sector. Utilisation of PCM has shown a substantial decrease in high operating costs of reefer trucks, thus reducing the overall refrigerated transport cost by 80%.



Market Distribution of Reefer Trucks

Refrigerated Trucks in India - 'Reefer trucks'

Refrigerated transport caters mainly three broad temperature ranges: 'CRT' (18 to 25°C), 'frozen' (-20 to -25°C), and 'Chilled' (2 to 8°C). The conventional cooling unit in a reefer truck needs constant running of the diesel engine to maintain the temperature of the product. This use of diesel generator greatly increases the operating cost.



Products That Require Temperature Control

In India (as per the official records), there are around 7,000 to 8,000 refrigerated vans or trucks having a total carrying capacity of 3.6 million tonnes. However, this is far below the actual requirement, given that India is the world's 2nd largest producer of fruits and vegetables after China, and the country produces around 263 million tonnes of these items in a year (Agriculture, 2014).

Pharma sector, growing at a CAGR of 17% (2015-17), is another critical sector that relies on refrigerated transport to ensure movement of temperature sensitive drugs and vaccines. The current demand for refrigerated transport can be fulfilled by around 20000 to 25000 trucks.

Challenges being faced by the Indian refrigerated transport sector:

- High operating cost due to high diesel prices
- Lack of awareness
- Higher emissions

Hybrid Reefer Trucks Using PCM Technology

Hybrid Reefer trucks enable a way to eliminate the use of diesel to run the cooling unit. It is important to note that the refrigeration unit is used to maintain the temp range of product load, but it does not cool it down. Thus, passive cooling solution makes it possible to use Phase



Reefer Trucks designed by TESSOL using saveE... The PCM is being charged using electricity as a power source.

Change Materials to maintain the desired temperature. Phase Change Materials are thermal storage chemicals that can absorb a large amount of heat in the form of latent heat, while it changes phase. Pluss Polymers has pioneered in the field of PCMs in India that are designed to cater to a wide range of temps between -33 to +89°C.

In a hybrid reefer truck, the cooling is provided by a number of plates filled with PCMs that are permanent fixtures inside the container. The cooling unit is a detachable independent unit, which performs the function of charging the PCM using electricity. The difference between a reefer truck and a PCM based truck is: the latter can be charged for about 4-5 hours using a 3-phase power source consuming about 8 to 9 units. One of the early innovators – TESSOL Pvt. Ltd. specialises in providing the PCM integrated reefer system. The shift from usage of diesel generator has reduced the overall transportation cost by 50% for the end user.

Government's Initiatives to Promote Usage of PCM

The government has introduced subsidies and capacity building initiatives to satiate the growing demand for fresh food vegetables, frozen meat, drugs etc. The National Horticulture Board recommends that investment worth INR 550.74 billion in new cold storage capacities are needed by 2015-16 to keep up with the increasing production of fruits and vegetables – this is according to a report published in "Food wastage and cold storage infrastructure relationships in India" (Balan, 2013). The integration of PCMs in reefer trucks has provided a novel solution to control the prevailing operating costs. Refrigerated transport in India is at its nascent stage, and has a huge market potential with rise in demand. Preventing huge wastage of food, demand for fresh fruits, dairy products, frozen meat, and a concern for health safety are major forces boosting the cold chain sector. In addition to existing subsidy schemes, the government needs to motivate people and spread awareness regarding the cold chain. The proactive measures at an early stage would help keep in control the food wastage and GHG emissions.

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Paramjot Singh
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Pluss Polymers Pvt. Ltd.





Biofouling Treatment with Chlorine Dioxide for Cooling Towers

Chlorine dioxide is environment-friendly, and in fact, it is a pollution free technology, that assists in protecting the environment and human health, from bacteria and by-products generated from other disinfection methods...

In Industrial Cooling Towers (CTs), biofouling is a major concern as they can have a crippling effect on cooling water circuits. Bio films are layers of bacterial colonies, which form saccharide or 'sugar' linkages between these colonies. This results in the formation of a film or slime layer on the substrate or any surface in the water circuit.

They utilise nutrients and other microbes present in water to propagate and increase in thickness. Biofilms are the result of evolution by microorganisms to survive in fast moving streams of water. They use the linkages to strongly adhere to any surface or substrate. The structure of these biofilms is referred to as "Woven Matrix Colony". This makes their removal a major challenge in CTs.

The matrix is basically water. The microbes are dispersed in this matrix of water. Biofilms are made up of 85 to 95% water. The temperature and free nutrient availability in cooling towers make them ideal for biofilm growth. The protection afforded to the microbes by the slime allows for rapid multiplication in the numbers of bacterial colonies – causing the biofilm to increase in thickness, and it results in various problems in the cooling circuit.

Economic effects

Reduction of heat transfer efficiency

Biofilms have one-fifth the conductivity value of carbonate scale. Hence, 1mm of bioslime has the same effect as a 5mm carbonate scale layer. Carbonate scale of around 5 mm thickness reduces the heat transfer efficiency by at least 27%.

Since biofilms have one fifth the conductivity of a carbonate scale, it can be inferred that a 1mm layer of bio slime causes the same decrease in heat transfer efficiency.

Fig. 1: A typical industrial cooling tower system...



Hence, for the same circulation rate ΔT will be reduced by the same amount. Conversely, for the same ΔT , the circulation rate required will increase by an equivalent amount.

Increase in Corrosion: Sulfate and Iron Reducing Bacteria in the circuit can greatly increase the corrosion rate in the pipelines. If unchecked this can even result in the need for changing of the entire pipeline.

Friction Loss: Biofilms function as stagnant films of Water. This reduces the effective pipe diameter, resulting in the increase of friction losses leading to higher head requirements. For power plant and Industrial cooling towers, the circulation rates are so high that even a marginal increase in head loss or pump head requirement leads to a huge increase in BkW and energy costs.

Shut Down for Cleaning: If biofouling reaches an alarming level where shut down and cleaning of the cooling towers is required, then the process shutdown costs in the industries or the zero power generation costs in power plants are enormous. If not properly controlled, this can occur with greater frequency causing huge losses.

Complex Biocide Programs: If disinfection is not satisfactory, complicated biocide programs with frequent change in biocides become necessary. These result in high chemical costs.

Use of Surfactants, Cleaning Agents: The need for surfactants, cleaning agents etc., are increased with increase in fouling and this also leads to higher chemical costs.

Health effects

Circulating water systems operate mostly between 30 to 40°C. These are ideal breeding grounds for various pathogenic and resistant bacteria. Bacteria like Legionella residing in the biofilm can reach critical pathogenic concentrations and result in outbreaks of Legionnaires disease. It is essential to keep biofilms under check to prevent any such outbreaks.

Conventional treatment and its problems

Chlorine is most commonly used for the treatment of biofouling. Disinfection effect of chlorine is highly pH dependent – almost nil beyond $\text{pH} > 8$. Chlorine has limited action against biofilm and Blue Green Algae. It is ineffective against certain deadly pathogens like Legionella, which are the most common

**Chlorine dioxide is
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to penetrate tough biofilm
layers...**

problems in CTs. If sodium hypochlorite is used then the degradation of its concentration is much faster. In case of chlorine gas, there is a high risk in storing and handling. Also, statutory regulations are high in storing chlorine tonnes. When organic biocides are used, certain bacteria and pathogens become resistant over the period of time, and hence, the treatment programme needs to be continuously revised. Biocides are generally proprietary, and hence expensive.

Biofouling treatment with ClO_2

Chlorine dioxide (ClO_2) is a highly effective, environmentally friendly microbicide. It is a selective oxidant that eliminates both planktonic and sessile bacteria, disinfects surfaces, and destroys biofilms very rapidly. Chlorine dioxide is a stable, dissolved gas that is a strong bactericide and virucide at concentrations as low as 0.1 ppm. With minimal contact time, it is highly effective against many pathogenic organisms – such as Legionella, amoebal cysts, Giardia cysts, E. Coli, and Cryptosporidium. ClO_2 destroys biofilms, and therefore bacterial regrowth is significantly impeded.

Chlorine dioxide is becoming increasingly popular in the field of water treatment as the disinfectant of choice for many water treatment applications. The chemical formula for Chlorine Dioxide is ClO_2 . The properties of ClO_2 seem to be an ideal mix of the salient properties of ozone and chlorine.

Chlorine dioxide is environment friendly, and in fact, is a pollution free technology, that assists in protecting the environment and human health, from bacteria and by-products formed from other disinfection methods.

Effective even at wide range of pH

Unlike chlorine and bromine, it does not form weak acids in aqueous solution. For example, in case of chlorine it forms hypochlorous acid (HOCl) in aqueous solution

which actually is the disinfectant and not the chlorine as such. This reaction is highly pH dependent. The formation of HOCl is highly pH dependent, at lower pH (< 4) value it remains as chlorine. When the pH goes beyond 7 it starts forming hypochlorite ion.

Hypochlorite ion is a weak disinfectant. Especially, for CT applications where the pH is maintained between 7.8 and 8.2, only 65 to 85% of chlorine dosed will remain as hypochlorous acid (HOCl) to do the disinfection – rest will be as weak hypochlorite ion. In other words, to have desired result, we may end up dosing 3 to 4 times of the actual demand.

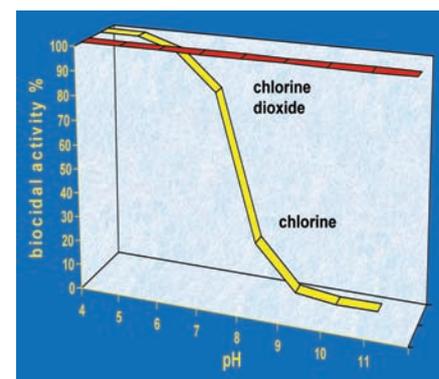


Fig. 2: A graphical representation showing how the pH affects the biocidal activity...

Since chlorine dioxide is a dissolved gas, this allows ClO_2 to be effective over a wide pH range. ClO_2 being a neutral species with rapid disinfection kinetics, is 100% available for disinfection in hard or soft water. So, in case of ClO_2 , we just need to dose what exactly is required. Fig. 2 is a graphical representation showing how the pH affects the biocidal activity.

Mechanism of disinfection by ClO_2

Chlorine dioxide disinfects by disrupting metabolic cycles of microorganisms due to its effect on DNA. This makes it very effective even against virus spores.

This characteristic of ClO_2 also ensures perfect disinfection of the water eliminating bacteria, viruses, fungi, algae, protozoa etc. It is approximately 2.5 times more oxidizing than chlorine and hence is able to penetrate tough biofilm layers. This makes chlorine dioxide the ideal disinfectant for biofilm removal.

The mechanism of disinfection coupled with its very strong oxidizing nature allows chlorine dioxide to destroy chlorine resistant biofilms, and many other chlorine resistant germs.

Biocidal effect

Biofilm is similar to a spider web in design and function. When certain microbes reach a surface, they attach themselves by producing polysaccharides (the web). This material is sticky and very difficult to remove.

Channels are formed in this film, through which water flows. The sticky web catches nutrients and other microbes that pass by, providing food and a quick growth mechanism. Once a biofilm is established it is very difficult to remove, often requiring manual cleaning.

It forms a habitat for pathogenic organisms. Even if all water-borne microorganisms are eliminated, regrowth quickly occurs due to bacterial communities and nutrients in the biofilm. The microorganism in biofilm is often vastly in excess of the quantities of those in the planktonic phase.

penetration. No biocide has proved to control biofilm better than ClO_2 .

In terms of stability, ClO_2 is much better than Cl_2 or ozone. The residual ClO_2 remain in a longer time compared to that of chlorine or ozone in a closed environment. Fig. 3 shows how stable ClO_2 is in comparison with chlorine.

Selective oxidant

Unlike chlorine, ClO_2 is very selective in its reaction. It does not unnecessarily react. For example, if the water has got ammonia and urea, in case of chlorine it gets consumed, so the dosage goes higher than the demand. In case of chlorine dioxide, it does not react with ammonia and urea, hence, we dose only for the biocidal and disinfection activities, which make it ideal for fertilizer plants.

Also, chlorine dioxide does not react with

oils that makes it suitable for applications in petrochemical industries.

Minimize corrosion

In early part of this article, we have seen sulfide and iron reducing bacteria in the circuit can greatly increase the corrosion rate in the pipelines. In addition to this, if we dose more oxidants than the demand – it will worsen the situation and cause more corrosion that happens more often with chlorine.

In case of chlorine dioxide, it can oxidise sulphide and iron reducing bacteria, and prevent corrosion that are caused only by this. Secondly, the dosage rate requirements are very less compared to chlorine, and hence there is no additional corrosion associated with excess dosing. In other words, chlorine and chlorine dioxide have similar effects in causing corrosion, but as the dosage rate of chlorine dioxide is very less compared to that of chlorine, corrosion rate will also be proportionately less.

Human friendly

Though the cooling waters are not in direct contact with humans, there are health issues related to poor treatment of cooling water through Legionnaires.

Legionnaires' disease is a potentially fatal pneumonia caused by Legionella bacteria. Infection is caused by breathing in small droplets of water contaminated by the bacteria. The disease cannot be transmitted by physical contact.

Everyone is potentially susceptible to

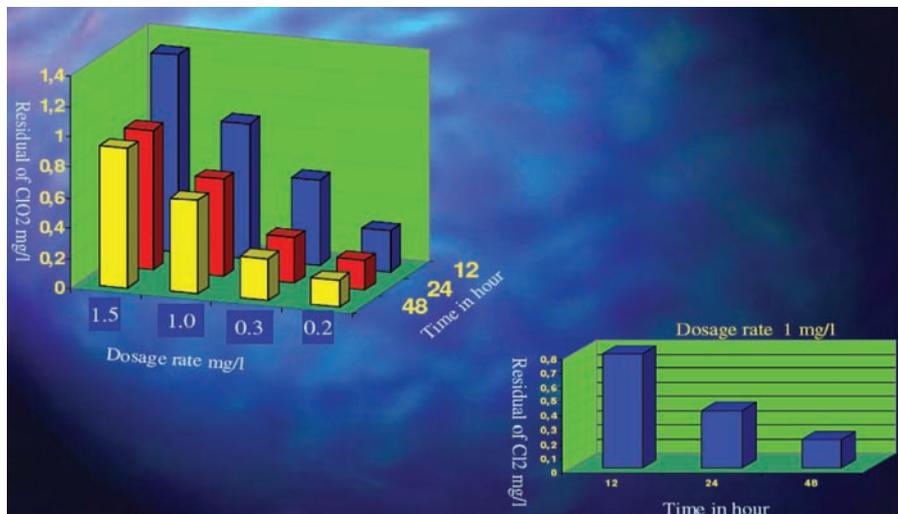


Fig. 3: Stability of Active Chlorine and Chlorine Dioxide at 50°C into reservoir after evaporation...

Chlorine, by and large, is a good disinfectant (when we use around the pH of 7). However, chlorine cannot be used as a substitute to biocide. Biocidal activity of chlorine is very less. In presence of biofilm, chlorine also loses effectiveness as disinfectant – as it cannot penetrate biofilm cells and kill the pathogens that are underneath the biofilm.

ClO_2 , like ozone, is a dissolved gas that penetrates biofilm by molecular diffusion. However, unlike ozone ClO_2 is stable and soluble, allowing it to travel to the base of the film – where it attacks microorganisms and destroys the biofilm at its point of attachment. Other oxidizers react mostly on the surface of the biofilm to form an oxidized layer, like charring on wood. This precludes further

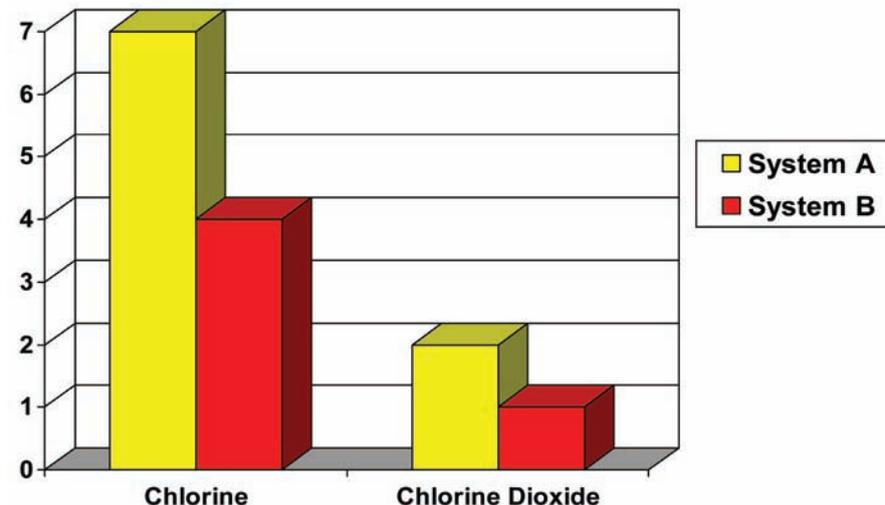


Fig. 4: Ashland Chemical Company and a Southeastern United States Chemical Manufacturing plant Presented by Scott A. Marchini at International Water Conference in 1996...



infection. But some people are at higher risk, e.g., those over 45 years of age, smokers and heavy drinkers, those suffering from chronic respiratory or kidney disease, and people whose immune system is impaired.

Legionella bacteria is common in natural water courses such as rivers and ponds. Since Legionella are widespread in the environment, they may contaminate and grow in other water systems – such as cooling towers and hot and cold water services. They survive in low temperatures and thrive in temperatures between 20-45°C, if the conditions are right, e.g., environments present with nutrients such as rust, sludge, scale, algae and other bacteria. They are killed by high temperatures.

Awareness about Legionella in India is slowly rising, and awareness is needed further. In some of the developed countries, they monitor the deaths due the Legionnaires as we do the same for road accidents. Some of the countries have made some guidelines for the employers to understand the health risks that are associated with Legionella – and how to control them.

Chlorine dioxide is very effective against this deadly bacterium. Secondly, in case of ClO₂, there is no hazard of storing deadly chemicals such as chlorine gas, since ClO₂ is generated onsite and dosed immediately.

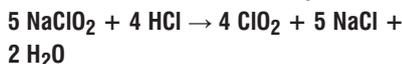
Generation of ClO₂

Chlorine dioxide cannot be transported or stored for longer periods, and it needs to be generated on site using safe generation methods with the required safety tips and monitoring systems.

Chlorine Dioxide can be generated by various methods, however for industrial applications, the below methods are used:

Generation from chlorite and hydrochloric acid

This process is most commonly used in the field of drinking water disinfection given the reliability of its operation and no problems associated with chlorine handling.



Generation from chlorite and chlorine

There are two processes for the production of chlorine dioxide by means of oxidation of sodium chlorite with chlorine: the first uses chlorine in aqueous solution in the form of hypochlorous acid, while the second one uses chlorine in molecular gas form. The first

system for the production of chlorine dioxide consists in pumping a sodium chlorite solution into a chlorine aqueous solution.

The two solutions react as follows:



Generation from chlorite, hydrochloric acid and hypochlorite

In this process chlorine dioxide is generated using three chemicals. Because of the volatile nature of hypochlorite, purity and yield of the ClO₂ is not so consistent in this method of generation.



Though the chemistry looks very simple, the equipment part of generation is not as simple as the chemistry. Yield and safety are the most important parameter of equipment performance.

Yield is the ratio between theoretical and actual amount of ClO₂ generated. On the safety front, ClO₂ can be explosive above a concentration of 30 g/l in water, and so the safety interlocks should be fool proof to ensure the maximum concentration in any part of the system is well maintained within this.

There are basically 2 types of generators available: Surface mounted and Underwater.

Surface mounted

In this type of generator, the reactor and chemical dosing pumps are mounted on a common skid with all safety interlocks hooked up – to a Programmable Logic Controller (PLC) to ensure safe and efficient generation.

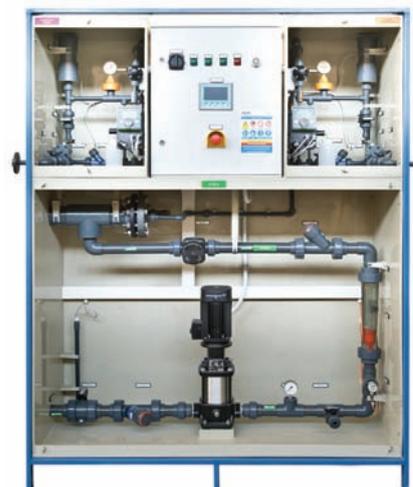
These types of generators are best suited for smaller amount of ClO₂ generation say up to 500 g/hr, which are the most common requirements in food, beverage and pharmaceutical water disinfection.

Underwater reactors

In this type of reactors, the formation of chlorine dioxide takes place only in the water, and it is not present in any other part of the plant.

For capacities higher than 500 g/hr, we can say it is a safe generator – because there is no possibility for ClO₂ to be released to the atmosphere. Also, the size of the reactors are much compact and the yield is 95% +/-2 compared to 80 to 85% for the surface mounted reactors.

Dosing pumps used for chemical injection into the reactors play a major role for the high yield. The latest technology-based Grundfos Digital dosing pump, that uses stepper motor



Generator with underwater reactor...



Generator with surface mounted reactor...

technology has got high accuracy of +/-1% with very low pulsation, and is best suited for this application.

The other alternatives such as electromagnetic or mechanical dosing pumps, which are having accuracy level between 4 and 8%, will reduce the yield and thereby increase the operating cost substantially.

Operational cost

In terms of operating costs, with high yield ClO₂ generators, the operating cost will be lower than that of conventional systems for cooling tower applications – and offers high degree of environmental safety – and better life for the capital equipments.

Grundfos has got highly reliable, safe and efficient ClO₂ generators. The Grundfos team, with its vast experience and expertise, can provide effective solution to your cooling tower biofouling problems. ■



Feroz Khan
Technical Support Manager
Grundfos India





Saving Time in Joining Pipes

Grooved mechanical pipe joining system delivers time-savings at the world's most technically-advanced research centre for animal epidemics...

The Friedrich-Loeffler-Institute (FLI), founded in 1910 by the German bacteriologist and physician Friedrich Loeffler, is located on the Isle of Reims in Mecklenburg-Western Pomerania. At the centre of its work are the health of agricultural livestock and the protection of humans against zoonoses (infections transferrable from animals to humans).

The FLI is part of the departmental research facilities of the Federal Ministry for Food, Agriculture and Consumer Protection (BMELV), which publishes its research findings and cooperates with other national and international institutions and organisations.

As the responsible federal facility the FLI operates more than 50 national reference laboratories for notifiable animal epidemics. With the new building the FLI has L4 laboratories, with the highest global security level for laboratories. Here, the institute researches highly infectious animal diseases, which are also dangerous to humans.

The new complex of laboratories and animal stables cost a total of 260 million Euros to construct. Housing the 450 employees who work at the institute and the animals they work with, it is one of only three such complexes worldwide with the highest microbiological security level.

Security and Design

Cofely Germany, one of Germany's largest specialists in building equipment and energy efficiency, was awarded the construction of the energy supply centre and all its subsections (piping, electrical, cooling, steam) as well as the sanitary system, fire extinguishing technology MSR/GLT and airlock technology, totalling 50 million Euros. BLS Energieplan GmbH was commissioned with planning the technical building installations of the new institute buildings. Cofely was involved right from the design phase and is also a member of the working group FLI Riems which is seeing the project through.

Cofely selected Victaulic from a shortlist of companies to provide a grooved mechanical piping solution. The company was familiar with Victaulic systems and was convinced of the company's capability as the right supplier for this mammoth task. Victaulic was able to offer transparent calculations and provide Cofely with clear installation instructions, thereby avoiding many potential technical issues right from the word go. Throughout the project's progress, Victaulic was on site once a week to help oversee the installation and to provide technical help on the ground.

This high security complex of laboratories and stables, which houses 89 laboratory rooms and over 150 stable units, features an



Cooling water, heating water, compressed air and various types of treated water are generated in the institute's media centre and distributed through 600 metres of mains piping.





uninterruptable power supply for all media, giving the piping and pipe connections a special role in the transportation of energy. Cooling water, heating water, compressed air and various types of treated water are generated in the institute's process centre and distributed through 600 metres of mains piping to the research laboratories and animal stables in the individual buildings.

The Victaulic piping solution was also installed in the drinking water piping, the cold water and cooling water generation pipes, and the hot water and steam boiler system for heating pipes and condensation pipes. Victaulic couplings are also installed in the reverse osmosis line used to disinfect wastewater.

Not only was this project a key one for Victaulic and its client Cofely due to the sheer scale of the project, but also because of the



Grooved piping systems provide a union at every joint for ease of system maintenance and expansion.

high safety standards required for its successful completion. The island location and the threat of storms and severe weather meant that a back-up plan was necessary in the case of adverse weather conditions. Victaulic couplings are also installed in the emergency fuel storage, which, equipped with six underground tanks, keeps the whole complex running for a week in the case of a complete power failure.

Benefits of Grooved

Thanks to the time savings Cofely made using Victaulic mechanical products and the smooth overall running of the project, work was completed four months ahead of schedule.

For engineers, the benefits of the Roll Grooving system are; the design versatility of the joint allows rigidity and flexibility throughout a system; a mechanical joint provides noise and vibration attenuation, seismic relief, and it accommodates thermal expansion and contraction...

The transition from the old building to the new was seamless and research has continued throughout the refurbishment work.



Thanks to time savings made using mechanical products and the smooth overall running of the project, work was completed four months ahead of schedule.

Peter Weiss, Territory Manager, Key Account Manager OEM, North Germany at Victaulic commented, "Not having to weld and x-ray 5,000 pipe connections clearly saved a lot of time and increased on-site safety."

When asked why he had selected Victaulic, Ortwin Hess, Project Manager at the TGA FLI Riems Working Group/Cofely commented: "In a building with such strict security requirements, the quality of the Victaulic duct connection was important for us. By saving on welding, we could maintain very high levels of safety and consistent quality and also saved four months of construction time."

Roll Grooving Explained

Roll grooving was invented by Victaulic in the 1950s & is used on 90% of grooving applications. The method uses a bespoke tool to cold form a groove onto the end of the pipe to prepare it for joining with a coupling. Fast & clean, roll grooving is used on a wide variety of pipe sizes and standard wall thicknesses.

For engineers, the benefits of the system are; the design versatility of the joint allows rigidity and flexibility throughout a system; a mechanical joint provides noise and vibration attenuation, seismic relief, & accommodates thermal expansion and contraction. The system also provides a union at every joint for ease of system maintenance and expansion.

Roll grooving can be used on carbon steel, stainless steel, copper and aluminium pipe or tubing as well as PVC pipe. Victaulic also provides roll-grooving equipment based on customers' requirements.

Used as a reliable & rugged component for a wide range of mission-critical applications, including data centres and flammable liquids, mechanical grooved systems have also met the rigorous system demands required for high pressure performance in power applications and in hydraulic pipes.

Finally, summing up the relationship with Victaulic, Herr Hees added "The quality of the product and services form the basis of this cooperation, but the personal interaction must also be right. This is important when you spend so much time together – here, the Cofely/Victaulic relationship simply works."

Michael Kröger, Senior TGA Project Manager of the FLI Riems Working Committee, added: 'The fact that we finished the project four months ahead of schedule was partly thanks to the fast installation time of the piping systems with Victaulic. Coupled with the fact that we would have had to x-ray welds, the mechanical pipe delivered additional benefits.'

Pankaj Soni
Country Manager
Victaulic
India





Designing in the Eco-Friendly Way

When you think about it, the most primal source of cooling in the world is Evaporative Cooling. Humans would celebrate rainfall because the falling of water on their bodies, combined with the breezy wind, made them feel so fresh that they realised that this is the best way to keep things naturally cool. Centuries hence, the technology is still one of the world's most effective ones.

But like every technology, this one too has undergone its developments. With the passing years, the development has leaped from basic systems to ones with increased heat transfer surface, having better fans, having a better water dispersion system etc.

Güntner, a company which firmly believes in the philosophy of constantly improving, took a look at some of the best evaporative condensers in the world and then went ahead & made it better.

galvanized steel has been around since the 1950s, and owing to the material's large presence and lower price, is a very widely preferred base material for the manufacturing of an evaporative condenser. Some of the issues faced are:

- More water usage is an expensive and environmentally harmful endeavour
- Chemicals used in passivation, maintenance and water treatment
- Heat transfer area reduces over time due to the scale build up on coil by water. It increases the maintenance cost
- Onsite installation is tedious and start up passivation is a necessity
- Energy consuming belt driven fans, which have a lower efficiency
- Controls are more complicated
- Overall running costs are high.

Evaporative cooling technology has leaped from basic systems to ones with increased heat transfer surface, having better fans, having a better water dispersion system etc...



Stainless Is Better

Traditional systems in the world today include a galvanized steel unit with a serpentine coil in the case of a condenser and a mesh in the case of a cooling tower. The use of





Güntner Development

- Use stainless steel
- Make a more efficient system, which uses less water and can run at higher cycles of concentration
- Superior material, which is self passivating, can work with less treated water and eliminates usage of chemicals
- Stainless steel 304 has a low propensity to scale, so water treatment and maintenance costs are significantly reduced
- Onsite installation is very easy (eliminates a lot of equipment and procedures needed)
- Highly efficient direct drive fans
- Intelligent Güntner Motor Management.

The Güntner ECOSS stainless steel evaporative condensers are a proof of our

ecological commitment to environmental and industrial concerns.

Galvanized coatings incur the requirement of a lot of chemicals in the water treatment programmes, and new laws and more stringent regulations regarding the discharge of chemical waste means that the



maintenance of the evaporative condensers has become difficult and expensive. Owners of the units have to keep all the above costs and regulations in mind while planning their facility and the decisions are made easier with the ECOSS.

The Güntner HydroBLU control technology addresses the economic and environmental impacts of diminishing water resources. This eco-friendly design minimizes water treatment requirements and allows for operation at higher cycles of concentration with reduced blow-down and lower make up water requirements.

The star of the unit's design is in the

304L stainless steel coil and casing, which nullify any zinc or lead in the blow-down. There is no white or red rust and thereby a major reduction in chemical cleaning agents usage.

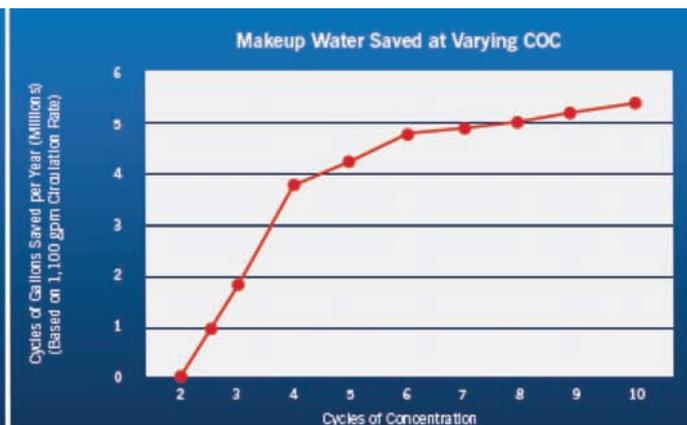
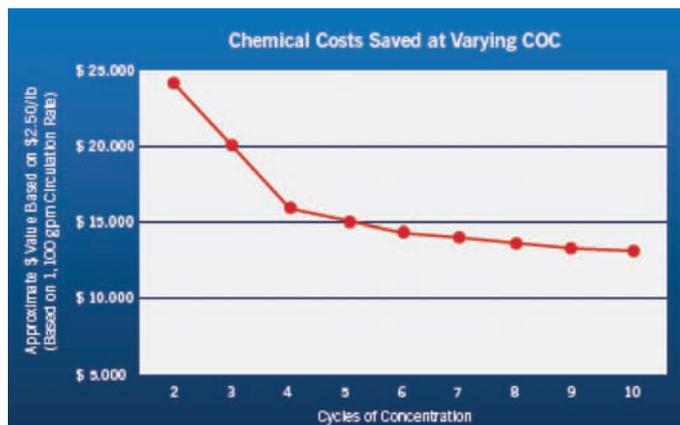
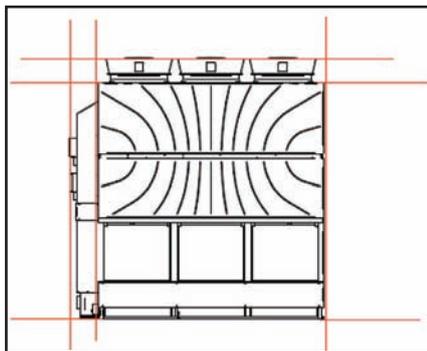
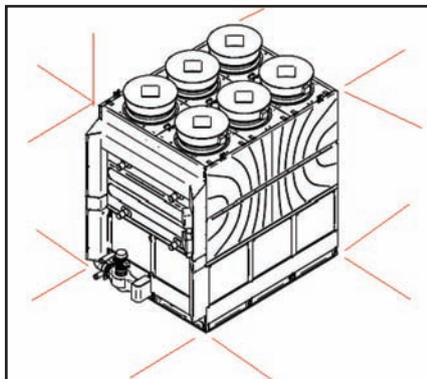
The fans of the unit are single axis, direct drive fans. The motors being mounted directly on the impellers means taking out the transmission losses and degenerative losses incurred with a dual axis belt driven fan.

Belt tightening, replacement and bearing and greasing of the motors are a thing of the past as the direct drive motors are self-lubricating with high efficiency bearings. The motors are available in both AC and EC technology and have a very good acoustic characteristic. The multiple fan motors provide increased redundancy and the openable fan decks are extremely ergonomic for maintenance and checks.

Installation of the huge units is one of the most key factors to consider in a project setup. The ECOSS comes in 2 parts, which are easily mounted without the requirement of sealer tapes, drift pins, screw tappers and the extra workload that comes with them. The Coil-Fan and the basin sections can be easily aligned and mounted with a smaller crane than usual.

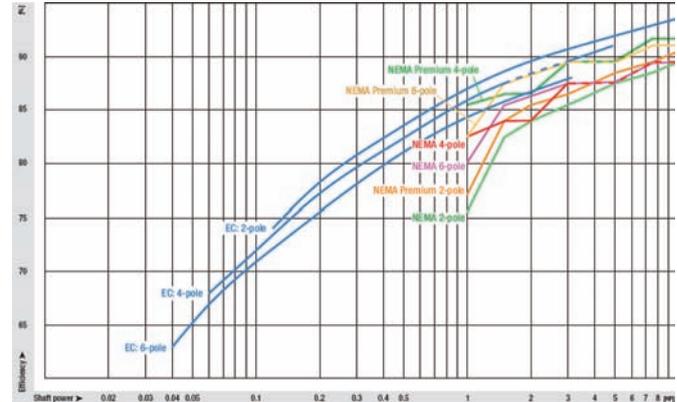
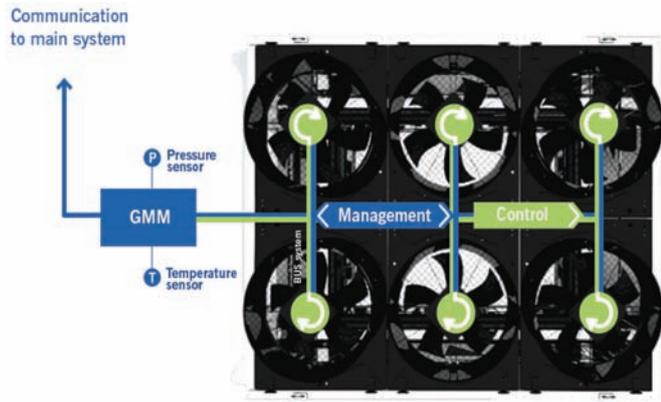
EC Fans are optionally available on all units. Compared to conventional systems, it is possible to save energy using the EC fans with the Güntner Motor Management (GMM).

EC motors are equipped with optimized power electronics, especially designed and developed for these motors. Compared to an AC motor, the motor of the EC fans have no windings in the rotor but instead have a permanent magnet. Due to this, there are no induction and slip losses in the rotor. Especially, for speed controlled applications, the EC technology offers a larger variety of





design & innovation



	10x12'	12x12'	10x18	12X18'
Power Spectrum in TR	212 - 328	304 - 414	288 - 475	456 - 633
Refrigerant	R717, R22 R134a, R507, R404a	R717, R22 R134a, R507, R404a	R717, R22 R134a, R507, R404a	R717, R22 R134a, R507, R404a
Range of Condensing Temp.	60°F - 110°F	60°F-110°F	60°F-110°F	60°F-110°F
Range of Wet Bulb Temp.	50°F- 86°F	50°F-86°F	50°F-86°F	50°F-86°F
Rows (no.)	6, 8, 10, 12	8, 10, 12	6, 8, 10, 12	8, 10, 12
Tube diameter	3/4"	3/4"	3/4"	3/4"
Coil Material (Tubes, bends, headers, connection)	304L Stainless Steel	304 L Stainless Steel	304L Stainless Steel	304 L Stainless Steel
Applicable Standards	ASME B31.5, CRN, ISO 9001	ASME B31.5, CRN, ISO 9001	ASME B31.5, CRN, ISO 9001	ASME B31.5, CRN, ISO 9001
Base Footprint (L x W x H (Ft.))	11'11-3/4" x 9'9-3/4" x 13'10-3/4"	11'11-3/4" x 11'10" x 13'10-3/4"	18'4" x 9'9-3/4" x 14'10-3/4"	18'4" x 11'10" x 14'10-3/4"
Shipping Weight (lbs.)	7751-9615	9924-11152	12195-160610	15481-18411



benefits like low capacity motor management, automatic parameterisation, function and selective fan shut down. The flexibility of this on the ECOSS can be set by the factory itself so that the unit you get is a plug and play.

Taking developments into consideration, the Guntner ECOSS advantage can be seen to be almost 70% more economically viable than the competition. ■

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Taking the Hot Air out of Baking Bread

A recent field study shows that improved ventilation in ovens, through the use of Variable Speed Drives (VSDs) and sensors can lead to significant energy efficiency improvements...

Carbon Trust, an independent company with a mission to accelerate the move to a sustainable, low carbon economy, has recently conducted some industry trials in bakeries. They have found that ovens are responsible for 35 to 45% of total site carbon emissions of a bakery. In a typical direct-fired gas oven, around 20% of the gas use is wasted – when hot air exits the flues. This energy makes no contribution to heating bread dough and is a direct loss.

As per the industry trials, it has been found that improved ventilation in ovens, through the use of Variable Speed Drives (VSDs) and sensors can lead to significant energy efficiency improvements. Analysis has shown that dynamically matching exhaust fans to the volume of gases produced within an oven could provide energy savings of nearly 5%. This equates to savings of up to £14,000 per site per year, with payback times varying from one to five years depending on the condition of the existing oven.

Currently gas flow through ovens is not optimised for efficiency. To investigate the potential for improvement the Carbon Trust conducted two trials with Campden BRI and Spooner Industries. The trials measured gas volumes produced during baking, both from combustion and from the product itself, and the effect on oven efficiency of improved management of flue gas.

Gary Tucker, Head of Baking and Cereal Processing Department, Campden BRI Group, said, “The Carbon Trust project showed that

Analysis showed that dynamically matching exhaust fans to the volume of gases produced within an oven could provide energy savings of nearly five per cent...

improved exhaust gas control has potential for cost savings. This can be implemented by installation of VSDs to exhaust fans with links to burner fire rate. Further savings are possible by balancing gas flow rates in and out of the oven. One of the unquantified gas flows during baking is the volumetric flow rate of gases released from products. Campden BRI demonstrated that this was of similar magnitude to that from combustion products – but increased towards the end of baking time as more steam was released. Further research is required before this can be taken into account using a gas flow optimisation algorithm.”

Dan Kirk, Research & Development Manager at Spooner Industries, said, “Spooner has long championed energy efficiency across all of the industrial markets that our technology supports. The drive to save energy, to be more environmentally friendly and ultimately to reduce operating costs makes energy efficient operation of process machinery such as ovens a real priority for our customers.

“Combining pilot machine tests conducted in our state-of-the-art R&D centre with our engineering expertise enables us to model relevant industrial processes and to develop bespoke, innovative solutions. Collaboration with Campden BRI and the Carbon Trust on this initiative enabled us to examine in greater detail the cost saving potential and environmental advantages of improved mass-balance in ovens. Ultimately, it is the financial payback for customers together with Corporate Social Responsibility (CSR) programmes, which are the driving forces for these improvements.”

Al-Karim Govindji, Senior Manager at the Carbon Trust said, “Improvements in industrial processes have the potential to make significant cross sector savings. The results of these trials are really positive, and show that taking steps to improve ventilation in ovens thus optimising the gas flow rate can result in real financial savings.” ■





cold chain

Product design and development firm Cambridge Consultants is revolutionising cold-chain logistics for the healthcare industry – with a new service based on its DropTag condition monitoring technology. Temperature, vibration, humidity and shock can be continuously monitored throughout a pharmaceutical package’s journey from the manufacturer to the point of care in a hospital or doctor’s surgery.

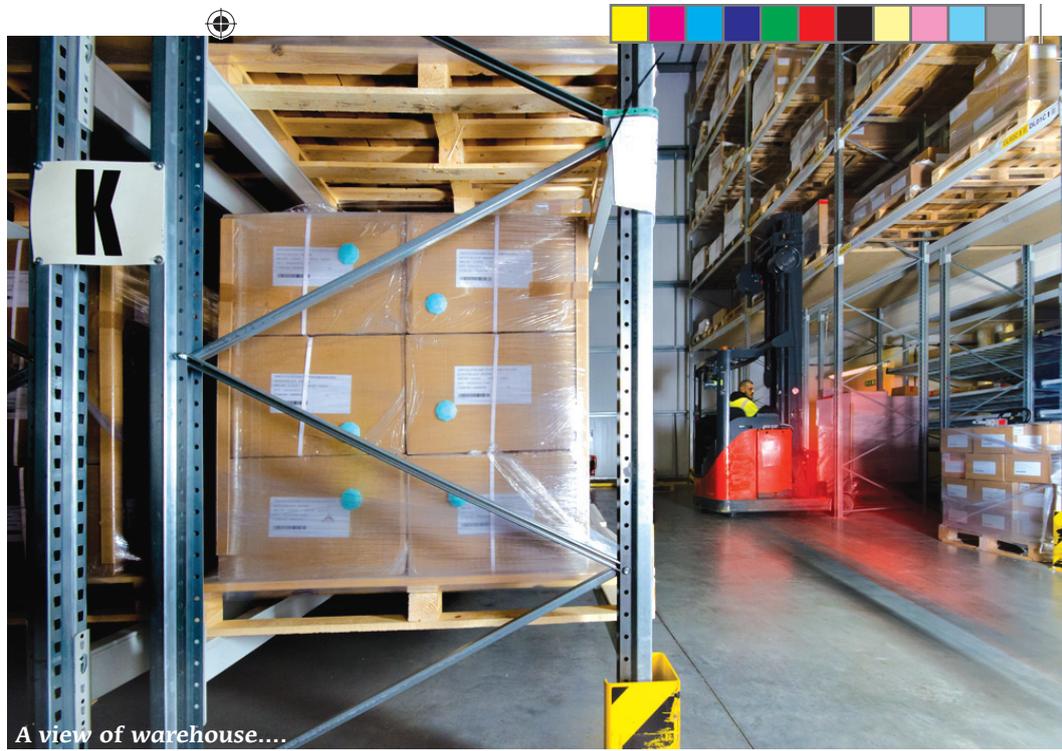
By tracking the complete journey, DropTag helps ensure drugs are kept within their optimum temperature range – reducing spoilage and giving patients the best chance of effective treatment. The simple-to-use, low-cost system uses Bluetooth Smart technology and connects to any smartphone, making it a quarter of the cost of existing products.

With new industry regulations coming into force – such as the European Commission’s new Good Distribution Practice (GDP) guidelines for medicinal products - end-to-end monitoring of drugs in transit is growing in importance. It is particularly crucial when there are multiple carriers, transport modes and climates involved, as even a small change in environment can sometimes have a large effect on a product.

When drugs are shipped, for example, they often need to be kept between 2°C and 8°C. If the temperature during transit goes above or below this range, products like biological vaccines can deteriorate and become less effective. This has a knock-on effect for patients as it can lead to shipments being rejected and delays in receiving their medication.

Journey loggers do already exist – but one in five either get lost en route or don’t have their data uploaded. As DropTag is a wireless, app-based solution, it does away with the extra step of uploading the data and provides continuous monitoring throughout a journey. Having wireless data transmitted from inside packages allows logistics companies to intervene during the distribution process if a problem is flagged up.

“No other mobile monitoring solution for the healthcare cold-chain logistics industry can match DropTag’s price point, ease of use or ability to monitor the entire journey,” said Jon Edgcombe, software group leader at Cambridge Consultants. “These factors are absolutely critical in such a device – not only for streamlining processes but also for quality



A view of warehouse....

Improving cold-chain logistics

Simple cost-effective way to constantly monitor the condition of drugs in transit

assurance to ensure medicines are fit for patients’ needs. Cambridge Consultants’ unique combination of expertise in low-power electronics, connected systems, end-to-end security, mechanical design and sensing

technologies has made this novel device a reality.”

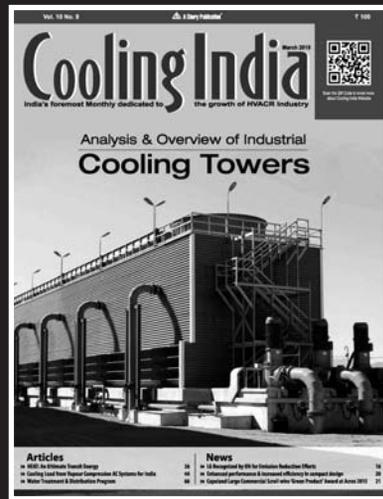
Pharmaceutical company Accord Healthcare has been involved in the DropTag trials. “We strive to be ahead of the game in improving our processes and ensuring quality assurance – and this new DropTag application has been a tremendous enabler of that,” said Tony Cordrey, Senior Director European strategic operations. “It’s revealed some opportunities for real improvements in our shipping process – by improving the transparency of information where temperature variations are most likely to occur during a journey and giving us the confidence to safely optimise our use of shipping routes.”

By capturing essential data during day-to-day shipments, the DropTag system enables companies to match shipping lanes to the profiles of specific drugs – giving greater flexibility and reducing costs. It allows more robust drugs to be safely transported via cheaper, longer routes. “When something goes wrong, there are a myriad of questions about how and why,” added Cordrey. “The use of DropTag speeds up decision making by providing additional information to better understand how processes can be continually improved for the benefit of patients.” ■



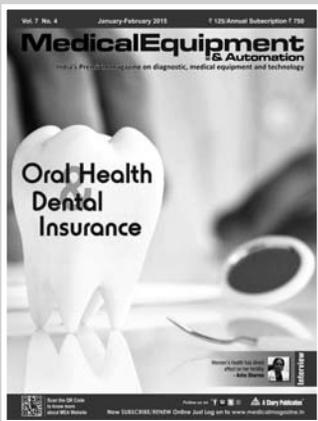


An Exclusive Magazine on the
Air Conditioning &
Refrigeration Industry



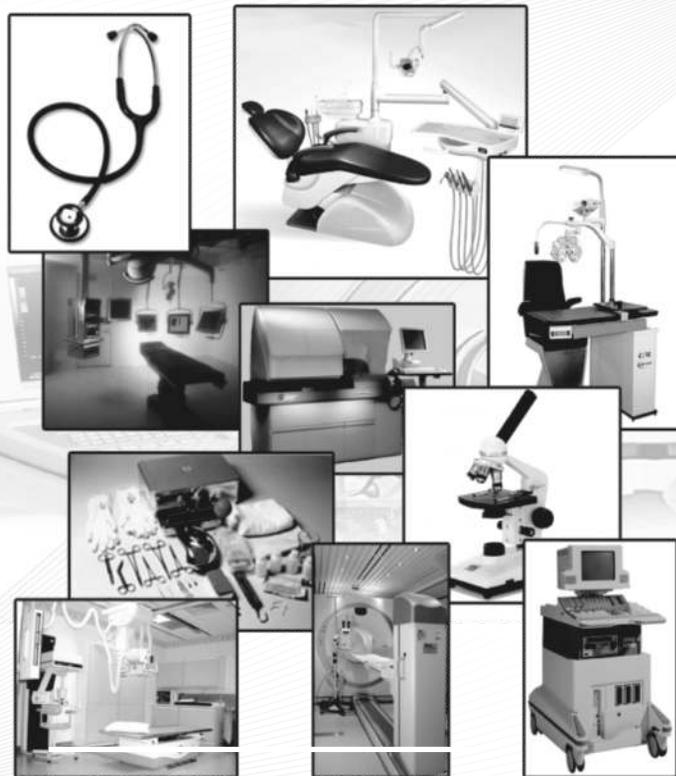
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Air-Fi Wireless technology for Building Controls

Trane, now offers Air-Fi™ wireless technology for building controls. Air-Fi wireless replaces the need for wired building controls, allowing installations to be completed quickly with less disruption to occupants in existing buildings, while also providing greater reliability, simplified installation and more flexibility as building spaces change.

Many building owners face challenges connected to maintenance and repair with traditional wired building controls systems, which fail when wires are cut, disconnected or damaged. Air-Fi can help optimize any building's performance with less risk, due to self-repairing mesh technology that features redundant signal paths to help prevent communication failures. Trane offers a typical 200-foot indoor signal range, with up to four times the number of paths, extending up to half-mile when unobstructed for even greater levels of signal reliability.



Trane® Air-Fi™ wireless technology replaces the need for wired building controls, allowing installations to be completed quickly and on time, and with less disruption to occupants in existing buildings...

With a battery life that is three times what other system providers offer, the lifetime

sensors are easy to move or replace, as needed, to resolve issues related to



Trane® Air-Fi™ wireless technology can help optimize building performance with less risk, due to self-repairing mesh technology that features redundant signal paths to help prevent communication failures...

battery* eliminates the need to replace batteries over the life of the system in most installations and saves time and money.

“Trane Air-Fi is a reliable, flexible solution that frees building owners from the hassles associated with traditional wired systems for building controls. Air-Fi offers easy problem solving, efficient performance and cost savings over the life of the equipment,” said Dave Molin, vice president of control products for Trane North America. “Trane understands that building owners want a system that works as expected from day one and continues to provide reliable performance for years down the road.”

Air-Fi is a ZigBee® Certified Building Automation solution, and the system is built on a platform that supports BACnet® open standards. This allows customers to integrate devices in the future when the building expands or changes. Wireless

sensing accuracy, aesthetics or reconfigured spaces.

Trane Air-Fi wireless also conforms to the IEEE 802.15.4 standard, so customers get a wireless BAS communication system that reliably coexists with other wireless systems, including Bluetooth® and Wi-Fi® — without interference. There's no security risk with Air-Fi, which uses a separate, secure network from those used by a building's IT system. Air-Fi secures building automation networks by the use of AES-128 encryption, keys and device authentication.

The Trane Air-Fi interface is available factory-installed and addressed to expedite installation and reduce labor and upfront costs. It also ensures higher installation quality that results in better building performance for customers because the work is done in a controlled environment, making it more repeatable and consistent. ■





Data Centre HVAC Operations - Difference in Approach

Disturbance in the temperature set points could result into server failure, and it also contributes to the higher energy consumption of the PAC machines. Thus, approach towards managing airflow should be the same as we do to manage temperature and humidity...

In today's scenario number of Data Centres is increasing day by day due to the ever increasing boom in the IT industry. IT is the back bone of every business, every business needs virtual presence over Internet, business operations require faster Internet connectivity, and data storage requirement is also increasing, for such requirement businesses around the world are either building their own data centers or they are acquiring space in big data centers to cater the IT requirement of their businesses.

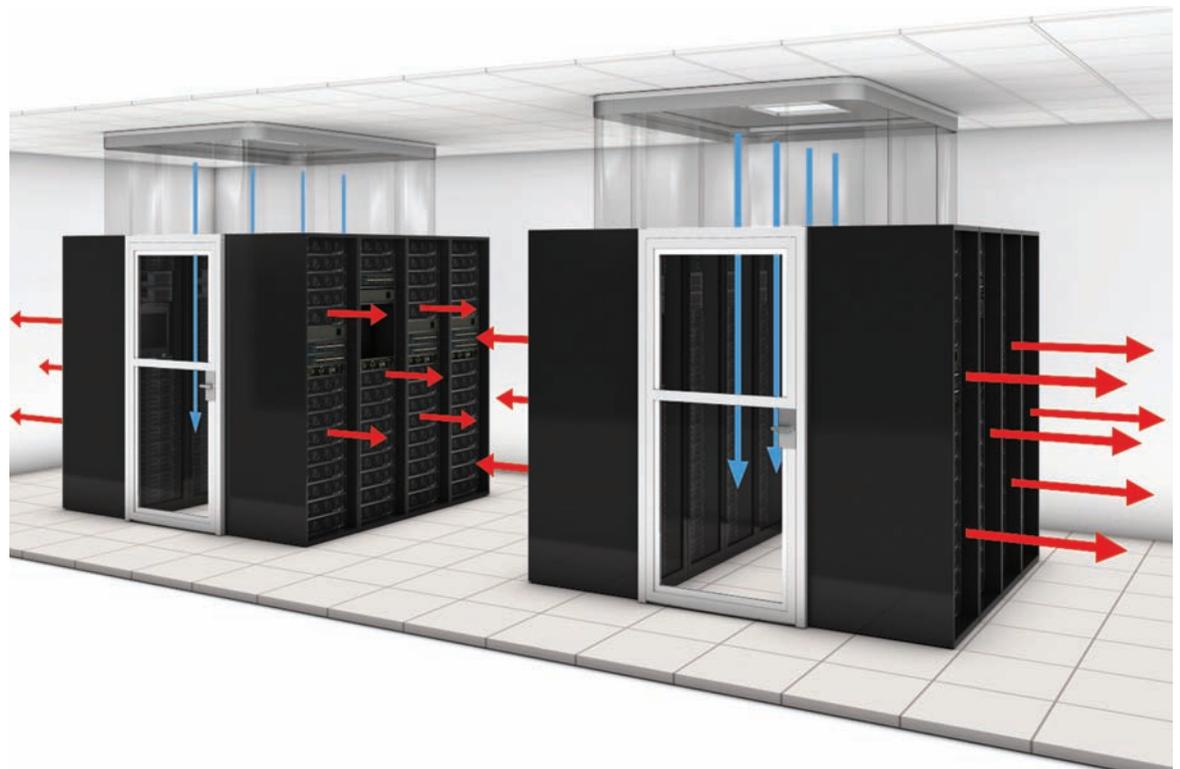
One very critical aspect of the data centre is managing its electromechanical operations. In this article, we will discuss, how different it is to manage data centre operations in comparison with normal building operations.

Differentiation of electromechanical operations of data centre from building operations is the main objective of this article, where we will look into the different aspects of electromechanical operations, and try to distinguish the significance of each aspect in data centre environment as well as in building operations environment.

Managing and maintaining the health of all critical equipment, maintaining the clean environment of the premises and doing this in the cost effective manner – are the main aspects of electromechanical operations – and these aspects can be categorised into the following functions:

- HVAC operations
- Environment
- Cost effectiveness of operations

Although these functions remain same for Data Centre as well as building operations, but there is a difference in approach. You cannot have the same





approach for Data Centre and building operations. Once we go through the content of this article, we will come to know about the right approach.

Air-Conditioning Operations

Air-conditioning is a critical component of electromechanical operations. In today's scenario air-conditioning is an extremely critical factor in building as well as data centre operations – because besides maintaining an interior climate it also contributes to the major portions of the operations cost, so it becomes increasingly important for operations team to maintain the air-conditioning operations more efficiently and in cost effective manner. Modern air-conditioning technology provides the precisely tuned solution for different operational requirements and different indoor ambient

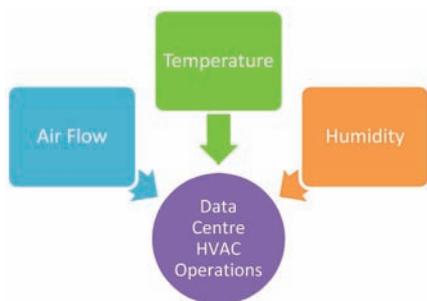


Fig. 1: Aspects of HVAC Operations in a Data Centre

types. To discuss different operational requirements (Data centre and building operational requirement) let's categorize Air-Conditioning operations into three different categories as shown in Fig. 1.

Temperature

In normal buildings, we are maintaining temperature as per comfort level of the people occupying the working floors. Generally, 24-26 degree celsius has been maintained.

In any data centre, we need to maintain the temperature as per the comfort level of the servers or switches housed there. What is the correct set-point of the data centre – is the most common question.

Earlier each IT equipment manufacturer defined its own thermal requirement of IT equipment, which were in the range of 20 to 21 degree Celsius. These set points are more stringent in nature, and results into lower data center operating efficiency. In desire of increasing the operating efficiency it becomes essential to increase the temperature and humidity ranges.

Operational efficiency of the data centre, where cold air containment arrangement has been made is much higher than elsewhere...

To increase operating envelope of temperature and humidity, in 2008 thermal guidelines have been revised by ASHRAE. As per the provided guidelines the temperature set- points, which are used to be 20 to 21⁰C are now 18 to 27⁰C.

This new envelope has helped data centre operators run their operations in more efficient way (Fig. 2).

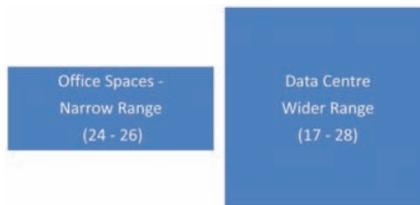


Fig. 2: Temp Range Differences

Humidity

Humidity is another important factor in HVAC operations, and has significant difference in data centre operations as compared to normal building operations.

Humans can be comfortable within a wide range of humidity depending on the temperature - from thirty to seventy per cent - but ideally between 50 to 60%.

Maintaining a right range of humidity is very critical for IT equipments. High Level of humidity and temperature can affect dielectric properties of PCB dielectric materials. The dielectric provides the electrical isolation within board signals. With either increased humidity or higher temperature levels transmission line losses increases, which results in signal degradation. In addition to these, higher humidity level causes condensation that may result into failure of electrical and mechanical devices due to short circuiting and corrosion.

Whereas low level of humidity can cause Electrostatic Discharge (ESD), which can cause electronic equipment failure.

Air Flow

The air should reach where it is intended to be!!!! Well let's analyse why?

Air flow plays a vital role in providing the

comfortable temperature to the building occupants. As long as air flow distribution is consistent throughout the air-conditioned area the comfort level of occupant will remain high. If air flow distribution is not consistent we are bound to have hot pockets inside the air-conditioned area, by hot pockets we mean, the small area of the floor – where comfortable temperature is not maintained despite the right set-points and equipment is in healthy state.

The main reason of hot pockets is modification in floor layout, in modifying the floor layout people generally forgets about how we maintain the temperature in that modified area. While doing a modification of floor layout, we just need to focus on the air flow, whether or not we have sufficient air flow to get the cooling of the modified area – or we need to lay additional duct for the cooling to avoid the creations of hot pockets.

As we need to cool the servers in data centre, the air flow is very critical. In data centre generally racks placed in rows adjacent to each other and – we need to provide cool air at the inlet of the rack whereas cooling fans inside the servers throws the hot air from the back side. To get the consistent distribution of the cold air at the inlet of the racks is extremely important – and for doing this we need to contain the cold air. Cold air containment is the hot topic of data centre industry.

In cold air containment the infrastructure of the data centre is such that – the area from where cool air is reaching the servers is contained (Cold Aisle) in such manner that should be separated from the area where server fans are throwing the hot air (Hot Aisle) as shown in the Fig. 3.

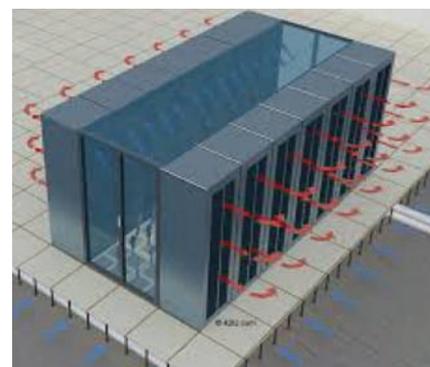


Fig. 3: Air Flow in a Data Centre

What happens if we are not containing the cold air? Generally, in typical data centre the supply of cold air is from bottom and as stated earlier hot air is at the back side of the rack, in





datacentre cooling

the scenario where cold air is not contained, the cold air mixes with hot air which increases the temperature at the server level. At the return path of the air that goes to the sensors at the PAC (Precision Air Conditioning) senses the mixed air, which disturbs temperature set points. Disturbance in the temperature set points could result into server failure and it also contribute to the higher energy consumption of the PAC machines.

Thus, approach towards managing airflow should be the same as we are managing temperature and humidity. Most importantly airflow is vital in improving operational efficiency of data centre. Operational efficiency of data centre where cold air containment arrangement has been made is much higher in comparison with the data centre where cold air containment is not implemented.

Environment

Environment is another very critical aspect of operations. In normal building scenario, operations team needs to maintain the environment, which is healthy for the people of the building. In general, indoor air quality tests being conducted in normal buildings – where point analysis is that there should not be any toxic gaseous particulates in air, which are harmful for humans.

For indoor quality, ASHRAE has defined permissible limits for different parameters. If range of these parameters remain within the permissible limits defined by ASHREA, we safely assume that indoor air quality of the building safe for humans. (Refer ASHRAE 62.1.2007 for further details)

Toxic gaseous particulates in air lead to copper and silver corrosion, which in turn affects the server and computer equipment. In fact, higher level of corrosion can lead to failure of IT servers. This issue of toxic environment is very common in India, especially in those places where you've open sewers and gutters.

The impact of toxic environment is visible especially after RoHS (Restriction of Hazardous Substance) compliance is implemented.

RoHS (Restriction of Hazardous Substance) compliance came into effect from 1st July 2006 in EU markets for electrical and electronic components – when lead was replaced by silver as a soldering medium. Lead is poisonous in nature and hence is hazardous for human health – but this is highly resistant to corrosion. On the other hand, silver is non

toxic but gets corroded in presence of some toxic gases (like H₂S) in environment with high humidity (> 50%).

Studies and analysis have proved that the hardware failure in data centre has two main reasons. One of them is bad/toxic environment. The other being the poor power quality.

The focus of analysis remains on presence of hydrosulfide in atmosphere. Commonly Reactivity testing is being carried for the analysis of pollutant air inside the data centre. In this analysis as the name suggests, reaction of hydrosulfide is measured on copper and silver. Coupons of copper and silver are installed inside the data centre and after a particular time period, generally after one month, decomposition of copper and silver has been measured for the conclusion.

Instrumentation Systems and Automation Society (ISA) standard ISA - 71.04 – 1985, which is on environmental conditions for process measurement and control systems, air borne contaminants have provided the general guidelines of permissible limits of contaminants in space, and classifies the environment into 4 broader categories:

- **G1** - Mild < 300A/month
- **G2** - Moderate 300 - 1000A/ month
- **G3** - Harsh 1000 - 2000A/month
- **GX** - Severe > 2000A/month.

We can argue here, that why we have a pollutant air when we have our data centre air-conditioned and dust free. The answer is air leakage inside the data centre. When air from outside environment is getting into the data centre, it actually pollutes the internal environment of the data centre. So, the very first step is to seal every point from where outside air coming into the data centre. This exercise is called creating a positive pressure inside the data centre.

Air purification machines are installed to purify the pollutant air inside the data centre. To get the best possible results from air purification machines, positive pressure has to be maintained inside the data centers.

Cost Effectiveness

Cost of operations is a very important indicator of operations' effectiveness. Electricity and diesel consumptions are believed to be the main operations expenses. The most important factor of cost effective operations is the upkeep of all critical equipments. When all critical equipments are healthy and in good condition,

they will give you the best operating efficiency, which in turn reduces the cost of operations. We can refer the below example for better understanding:

We measure chiller (Chiller Capacity 200 TR) efficiency in IKW/TR that is indicated kW consumed per TR.

- (A) Suppose we have designed IKW/TR of chiller is 0.65 that means chiller needs 0.65 kW to produce one TR
- (B) And after few years of operations IKW/TR is 1.1. Similarly, chiller needs 1.1 kW to produce one TR.

For A power consumption will be

$0.65 * 200 = 130 \text{ kW}$ or 3120 kWh for one day.

For B power consumption will be

$1.1 * 200 = 220 \text{ kW}$ or 5280 kWh for one day.

Difference is 2160 kWh just when we are calculating for one day operations. It is to be noted here that it is very difficult to maintain the efficiency as per design of the equipment – as there are lot of factors on which efficiency depends. If we take the chiller example, the major hurdle, we face in maintaining the chiller efficiency is quality of water that we are using for the condenser cooling. But still by taking proper measures and doing timely maintenance, we can maintain the equipment efficiency, which is very close to design efficiency.

When we talk about cost of operations in data centre, we generally calculate two important factors:

- PUE (Power Usage Effectiveness)
- DCIE (Data Centre Infrastructure Efficiency)

PUE is a measure of how efficiently a computer data centre uses energy; specifically, how much energy is used by the computing equipment (in contrast to cooling and other overhead).

PUE is the ratio of total amount of energy used by a data centre facility to the energy delivered to computing equipment. It's developed by a consortium called The Green Grid. PUE is the inverse of the Data Center Infrastructure Efficiency (DCIE). An ideal PUE is 1.0. Anything that is not considered in a computing device in a data centre (i.e., lighting, cooling etc.) falls into the category of facility energy consumption. Although, ideal value of PUE is 1.0, even after considering all the external factors, it's very difficult to maintain 1.0 PUE. As we discussed earlier, equipment health and upkeep helps in maintaining the PUE nearer to 1.0.





Data Centre Infrastructure Efficiency (DCIE), is a performance improvement metric used to calculate the energy efficiency of a data centre. DCIE is the percentage value derived, by dividing information technology equipment power by total facility power.

Conclusion

Now, we've understood different aspects of operations and their significances in data center and building operations environments.

We also want to keep one very important thing in mind while managing (although different people keep on reminding you about the same) data center i.e., what is the impact of downtime? When you are managing a data center a downtime means a big financial loss to the organisation.

So, we need to take different approaches while managing data centers. Also, we should not put ourselves under lot of pressure – as managing data centre is not a rocket science,

it's just few aspects of the operations which're different and need thorough understanding. As we all know basics of electrical and mechanical engineering will remain the same. ■



Mohd. Hashim
Data Centre Specialist
CBRE South Asia Pvt. Ltd.

Springtime AC and Heat Pump maintenance tips for homeowners

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) reminded homeowners that the spring season is the ideal time to prepare cooling equipment for the hot summer months and ensure it operates at its highest efficiency.

"Heating and cooling is the single biggest energy consumer in a home, and accounts for about 65 percent of all the energy used by homeowners," said Stephen Yurek, AHRI President and CEO. "That's why taking steps to ensure your units are running as efficiently as possible can help offset cooling costs this summer."

AHRI offers homeowners the following tips to keep their central air conditioning and heat pump units running efficiently:

- Check the air filter and change it if it's dirty, or according to the manufacturer's recommendation, to keep dust from collecting on the evaporator coil fins. Keeping your filter clean can cut energy consumption 5 to 15 percent. Turn off the power to the air handler before pulling the filter out so that the fan doesn't turn on and blow dust throughout your home. Be sure to position the new filter according to the manufacturer's instructions.
- Clear away leaves, grass, weeds, plants, and other debris that block airflow through the outdoor condensing unit, which is the large metal box in yard next to home. Anything that collects on the unit's fins will block airflow and reduce its efficiency. Grass clippings thrown by the lawn mower are particularly common offenders.
- Occasionally clean the outdoor condensing unit by spraying it with a water hose. Do not use a pressure washer, as damage could occur.
- Check to make sure air vents inside home are not obstructed by furniture. Air inside home needs to circulate easily through the vents. The air conditioner works less when air can circulate freely.



Stephen Yurek
AHRI President and CEO

"With proper maintenance, central air conditioning and heat pump units should last at least 12 to 15 years"

It is also suggested that the homeowners hire a professional to service their equipment. A well-trained technician will find and fix problems in the system. Look for a technician that is certified by North American Technician Excellence (NATE). One can find a NATE-certified technician online. Be sure to insist that the technician:

- Checks for the correct amount of refrigerant and test for refrigerant leaks.
- Captures any refrigerant that must be evacuated from the system.
- Checks for and seals duct leakage in central systems.
- Measures air flow through the evaporator coil.
- Checks the accuracy of the thermostat.
- Verifies the correct electric control

sequence and makes sure that the heating system and cooling system cannot operate simultaneously.

- Inspects electric terminals, cleans & tightens connections, and applies a non-conductive coating if necessary.
- Checks belts and oil motors for tightness and wear.

Finally, AHRI recommends that homeowners establish a service agreement with a reputable contractor that will take care of regular spring and fall maintenance to ensure maximum efficiency and catch problems early, before they can become bigger and more expensive. A service agreement also ensures that the homeowner has priority during the hottest and coldest months, when problems are most likely to emerge.

"With proper maintenance, central air conditioning and heat pump units should last at least 12 to 15 years," said Yurek. "Homeowners need to regularly service their heating and cooling equipment to keep them running smoothly. Spring is a great time to think about getting service before hot weather arrives and the rush for maintenance is in full swing," he added. ■

tips



Frigesco's pioneering flash defrost system has won the 'cooling industry triple', securing the top refrigeration accolade in all three of the industry's major national technology awards.

Crowning a remarkable year of recognition and achievement, the company was presented with the Refrigeration Product of the Year Award at a star-spangled evening by celebrity entertainer Jimmy Carr, who hosted the ACR News Awards 2015. It follows similar accolades for Frigesco's innovative flash defrost technology in the recent Cooling Industry Awards and National ACR Awards 2015.

The technology uses a phase-change material to capture waste heat from refrigeration systems and carry out high efficiency defrosts of evaporators, in the process reducing supermarket refrigeration running costs by up to 20 percent. Flash defrost is now also being developed for use in air-source heat pumps.

David Walter, managing director of Frigesco, said, "By any standards, winning the industry's

Frigesco crowns remarkable year of achievement by winning the Cooling Industry Triple

top three national awards is a remarkable achievement. However, it is particularly significant given the UK's extremely high standards of technical innovation.

"Britain is recognised as a world-leader in cooling technology, and the judges view is that Frigesco is ahead of the pack in an extremely competitive field. It is testimony to the creativity and dedication of everyone on the team who has worked to develop flash defrost over the past few years. He added, "After substantial investment and development work, we are now moving forward to the final phase of commercialisation of the technology. We expect to be able to make further announcements in the near future."

In addition to reducing electricity consumption and cutting refrigeration running costs, flash defrost improves the stability and resilience of refrigeration systems, extends plant life, safeguards food hygiene, and improves safety for store staff.

The Frigesco system has been developed by a team headed by Professor Tom Davies. ■



National ACR Awards 2015 - Frigesco winner - withlogo



ACR News Awards 2015 - logo inset



Cooling Award presentation



Frigesco system

Ziehl-Abegg achieves five business titles at the German Stevie Awards

Ziehl-Abegg, based in Southern Germany, has won five prizes at the German Stevie Awards for business. A jury of 50 awarded the industrial company gold, silver and bronze: for new products, the management and the company as a whole, in special recognition of the performances achieved by Ziehl-Abegg.

The German Stevie Awards is a business prize that was presented in Germany for the first time. The award is internationally recognised, especially in the United States and the Pacific region. The award ceremony was held at the Ritz-Carlton Hotel in Berlin. Renowned companies such as Hewlett Packard, Deutsche Post DHL or Coca Cola and Metro stood on the winner's podium. "We are delighted that the inaugural German Stevie Awards are honouring such an outstanding group of winners," says Michael Gallagher, President of the Stevie Awards. He described the award ceremony in German capital as an historic event".

The broad range of products from the industrial company in Southern Germany is reflected in the "New products" category: Ziehl-Abegg received a bronze Stevie for the bionic bio-fan and a gold one for the gearless electric drive for city buses ("ZAwheel"). "We are pleased to have been successful in such an environment," emphasised Peter Fenkl, Chairman of the Board. He was presented with his own silver Stevie for his performance as "Manager of the Year". Ziehl-Abegg as a whole also earned silver in the "Company of the year" category, just behind the sporting goods manufacturer Adidas which took gold in this section. Rainer Grill, Head of PR at Ziehl-



Michael Gallagher - left - hands over Peter Fenkl Stevie Awards - ZIEHL-ABEGG

Abegg, also received a silver Stevie as PR Manager of the Year. Fenkl is particularly pleased that the Stevie Award Organisation approached Ziehl-Abegg on its own initiative without any active promotion on the part of the company itself.

Stevie Awards

The Stevie Awards are presented in six programmes: the Asia-Pacific Stevie Awards, the German Stevie Awards, the American Business Awards, the International Business Awards, the Stevie Awards for Women in

Business and the Stevie Awards for Sales & Customer Service. The Stevie Awards Programme receives well over 10,000 applications each year from organisations in more than 60 countries. Outstanding companies are also contacted directly by the jury. By honouring companies and organisations of all sizes and types, as well as the people behind them, the Stevies are recognising exceptional achievements in the world of work. The name of the award, also affectionately known as "The Stevies", is derived from Greek word "Stephanos" meaning "The Victor". ■



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garage cooling

Ideal climate in the MERCEDES AMG PETRONAS Formula One Team garage

ebm-papst has been an official Team Partner of MERCEDES AMG PETRONAS since 2014 and has developed a special cooling and heat extraction solution for the garage of the 2014 FIA Formula One World Constructors' Champions. Ambient temperatures and humidity are very high in Malaysia and Singapore, and the working temperatures in the team garage can reach up to 40°C. An efficient and effective cooling system in the garage therefore critically improves the working conditions for the team.

MERCEDES AMG PETRONAS will be using the ebm-papst garage cooling system for the first time this season at the Sepang International Circuit in Malaysia. "We are really looking forward to having the ebm-papst cooling system operational in our garage this weekend



Air flow channels of ebm-papst garage cooling...



ebm-papst garage cooling...

in Malaysia. During the race weekend, the pace of work is extremely hectic, and it can be a really tough challenge for the drivers, engineers and mechanics in the particularly high heat and

humidity locations. It will be a huge help to us if the temperature in the garage is comfortable, enabling the team to perform to the best of our ability" emphasises Paddy Lowe, MERCEDES AMG PETRONAS Executive Director (Technical).

The garage provides space for the team's two race cars, mechanics, aerodynamic, electronics and IT specialists as well as car parts and tyre storage areas. It's a large area that is completely open at the front, allowing heat to come in. The specially developed water-cooling system cools the critical working areas of the garage down to room temperature. With dimensions measuring 1 m by 2 m by 90 cm and a modular air distribution system, the cooling unit can be configured for use in garages at the different Formula One circuit around the world, where dimensions and layouts can vary quite significantly.

Gareth Jones, Managing Director of ebm-papst Automotive & Drives (UK) Ltd,

who was responsible for developing the garage cooling system, adds "During the preparations for the garage cooling I always joked with the team that it is our mission to make MERCEDES AMG PETRONAS officially the coolest team in Formula One".

ebm-papst, a global technology leader in ventilation and drive engineering, became an Official Team Partner of the MERCEDES AMG PETRONAS Formula One Team last year. Prior to this, Formula One had changed its rules for the 2014 season to incorporate greater energy efficiency and hybrid technology.

Fan specialist ebm-papst has since developed energy-efficient attachment cooling solutions for the MERCEDES AMG PETRONAS F1 W05 Hybrid and F1 W06 Hybrid cars, which cool the temperature-sensitive components of the vehicles down to the optimum operating temperature. These fans in the side pods and roll hoop openings of the car are an essential component of the car's temperature management system. ■

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Buy HVAC Tools from anywhere, anytime...



Online shopping is continuously becoming more and more popular and safer. There has been tremendous growth in the online shopping industry in just a few years in India. More and more people are realising the advantages of purchasing online at their convenience.

A few of the advantages

- **Save precious time and energy:** If you already know the specific things you wish to buy, e.g., a specific product or brand then online shopping is a convenient choice. Save your time and energy for other tasks.
- **Save money:** You can get the best offers online – as well as compare prices across sites in just a few clicks. You also save the cost of travelling to a store to buy items.
- **Secure payment systems:** Online purchase has become safer and secure due to progress in technology.
- **At your convenient time:** Online stores are available 24/7, so you can shop at your own convenient time.
- **Compare prices and features:** It is very simple to compare products across various sites with a few clicks.

Infinity HVAC Spares & Tools has been a leading supplier of high quality tools for the last two decades all over India. Infinity also has exclusive retail outlets in Dadar, Thane, Pune and Nashik.

Over the years, Infinity has developed a reputation for dealing in great products at

reasonable prices. www.hvacmall.in is an extension of the same. Here, we are enabling the customer to purchase online from the comfort of their home globally tested products of reputed brands. Your online shopping experience at www.hvacmall.in is easy, enjoyable and secure. It has a wide range of products from thermometers, vacuum gauges, vacuum pumps, data loggers, measuring instruments, manifolds, hand tools, water pressure pumps etc.

A few of its benefits for you

- **Our best prices:** Infinity offers their best prices at www.hvacmall.in.
- **Free shipping:** You get free shipping and that saves you more money.
- **Cash on delivery:** COD option is available within the city limits of Mumbai, Thane, Pune and Nashik.
- **Secure payments:** www.hvacmall.in is tied up with Infibeam, one of the largest online retailers and a premier technology provider in India.
- **Company backing:** The online portal is run by the reliable and trusted Infinity HVAC Tools, so you have the backing and after sales support.
- **Top brands:** All the best brands - Supco, Sievert, Refco, Mighty Mounts, Rex, Kyowa, Bacharach, which are well known in the industry for years.
- **Way to the future:** The online retail industry is the way of the future, so step in and reap the benefits... ■



Electrical India

Weekly e-Newsletter





Philip Whitaker
CEO, AAF International

“I am honored and excited to accept this new role as Chief Executive Officer of AAF International”

AAF International appoints new CEO for AF Division

AAF International, announced the appointment of Philip Whitaker as Chief Executive Officer on March 1, 2015. In this role, he is responsible for AAF’s day-to-day business operations, with a key focus on improving business performance to be in line with strategic business objectives. Whitaker reports directly to the Global Operations Division, Daikin Industries Ltd.

Whitaker brings over 25 years of global HVACR experience to AAF, including 13 years in Asia Pacific, China, and Middle East. Prior to this appointment, Whitaker was President of Camfil Farr Asia and Middle East. While there he also served as a member of the top executive team.

“Phil possesses broad experience in the air filtration industry and brings valuable insight to the AAF team. He is an experienced and trusted leader who consistently delivers results. Phil will be a key asset to AAF in achieving our goal to be the preferred supplier of clean air solutions,” states Yoshihiro Mineno, General Manager, Global Operations Division, Daikin Industries, Ltd. “I am honored and excited to accept this new role as Chief Executive Officer of AAF International. I look forward to expanding our global operations, introducing new, innovative products and continuing to meet our customers need for clean air wherever in the world they may be,” said Philip Whitaker, CEO AAF International, AF Americas. ■



Hakan Erdamar
President,
Asia & Middle East,
Emerson Climate
Technologies

“My first priority is to enhance communications with our Asian and Middle East region’s customers”

Erdamar takes over as president of Emerson Climate Technologies, Asia and Middle East

Emerson Climate Technologies, has announced the appointment of Hakan Erdamar to president of Asia and Middle East. In his new post, Erdamar will supervise all operational affairs for Emerson Climate Technologies including sales, marketing, engineering R&D, production, quality management and financial operations for Asia, Middle East and Africa.

Erdamar joined Emerson in 1989 as a project engineer for Power & Water Solutions in Pittsburgh, Pa., U.S. and held a series of positions within Emerson Process Management. He most recently served as Vice President, Asia Pacific, Flow.

“I’m honored to be appointed president of

Emerson Climate Technologies, Asia and Middle East” said Erdamar. “Emerson Climate Technologies maintains a leadership position in the heating, ventilation, air conditioning and refrigeration (HVACR) industry, and represents a significant portion of Emerson’s business in this region as well. The company has a comprehensive strategy for the market which, I believe can be a strong foundation for sustained growth in the region. My first priority is to enhance communications with our Asian and Middle East region’s customers, as well as with our employees, to explore how we can further promote technology innovation and improve service levels to gain a higher level of growth.” ■



Tom Dowling
VP, Commercial
Business
Mitsubishi Electric US

“The value Tom brings to the division is exemplified by his record of success”

Mitsubishi hires Dowling as new vice president for Commercial Business

Mitsubishi Electric US, Inc. Cooling & Heating Division (Mitsubishi Electric), North America’s has announced the hiring of Tom Dowling as vice president, commercial business.

In this role, Dowling is responsible for developing and executing business strategies that will strengthen valuable relationships, generate sustainable revenue and expand market share in the commercial HVAC sector. He oversees the commercial sales managers in the division’s six business units, managing communication between the regional teams to ensure that all core business operations are unified and in line with corporate sales and marketing goals.

Dowling previously worked at Lennox International, Inc., Richardson, Texas. He first joined the company as a market research analyst in 1985. Dowling was promoted to several managerial roles over the next two decades.

“The value Tom brings to the division is exemplified by his record of success,” says Mark Kuntz, senior VP, sales, marketing and operations, Mitsubishi Electric US, Inc. Cooling & Heating Division. “We are confident that his proven skills, widespread knowledge and industry experience will guide the division to unprecedented success and expand Mitsubishi Electric’s footprint in the commercial HVAC market.” ■



Demand for Cleanroom Components is on Growth Path

There is a growing demand for Cleanroom applications in various industrial sectors. Technical requirements for components used in these environments are therefore also increasing steadily.

In any industry, where small (mainly) air-borne particles can disturb the process of manufacturing, Cleanrooms are used. Their presence is quite prevalent in industries like semiconductor manufacturing, pharmaceuticals, biotech, medical device etc.

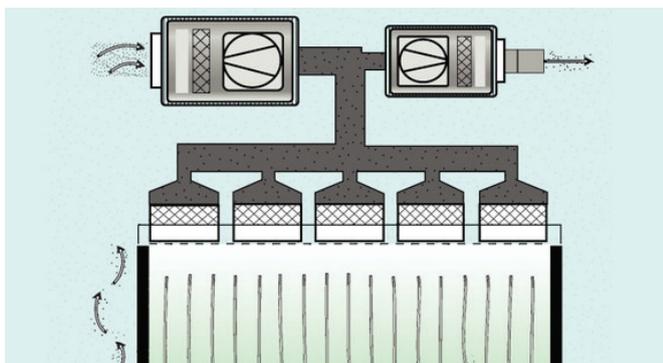
Although, depending on the requirement, the size and shape of the Cleanrooms may vary, there is one common condition in all of them – every Cleanroom is meant to reduce particulate contamination. It is a confined zone where environmental parameters like temperature, humidity and pressure are kept under control as per requirement.

Types of Filters Used

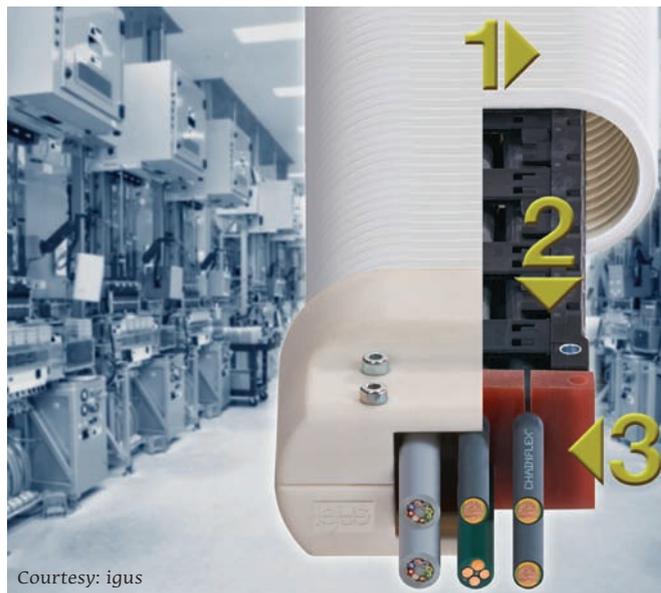
Most commonly either HEPA (High Efficiency Particulate Air) or ULPA (Ultra Low Particulate Air) filters are used to trap the airborne particles, which may be in solid or liquid form. Laminar or turbulent air flow principles are followed there. The air flow systems are employed across 100% of the ceiling to maintain continuous and unidirectional flow.

Nature of Materials Used

An abrasion-resistant energy supply is an essential part of any moving Cleanroom equipment. Materials that are used in clean rooms



The clean air flows with low turbulence vertically into the Cleanroom, thus contamination of sensitive work areas and machines is kept as low as possible.



Courtesy: igus

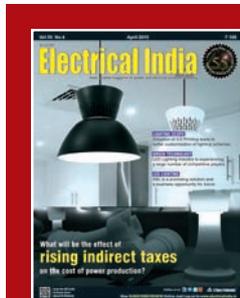
A fully sealed and abrasion resistant – new ISO Class 1 Cleanroom e-chain from igus.

must have abrasion-proof surfaces. Systems and units in the room may disturb the laminar air flow to a minimum.

Parts and machines which are to be brought into the Cleanroom must be cleaned beforehand. Normally, a Cleanroom is charged with overpressure (overpressure ventilation). In special cases, those are operated with low pressure preventing dangerous substances or germs from reaching the outside.

Future Prediction

According to a new report, by Allied Market Research titled, "Europe Cleanroom Disposable Gloves Market - Size, Industry Analysis, Trends, Opportunities, Growth and Forecast, 2013-2020," the market for disposable gloves in Cleanroom settings is forecast to reach \$265.1 million by 2020, registering a CAGR of 7.9% from 2014 to 2020. Nitrile Gloves and Vinyl Gloves currently accounted for about half of the market revenue; however, Neoprene gloves will consolidate its share with fastest growth during the forecast period.



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product profile

Jiangsu offers box type water-cooled chiller exclusively for electroplating industry



Jiangsu Huazhao Refrigeration Equipment company introduces box type water-cooled chiller has three series products, including, water-cooled (mainly is applied in small central air conditioning and industry refrigeration cooling, supply 12/7⁰C cooled water). Box type acid and alkali water-cooled chiller (designed specifically for electroplating industry, the sour alkali liquor directly into unit cooling, keeping the tank liquor temperature at 20⁰C needed or - 5⁰C necessarily). Box type lower temperature water-cooled chiller (meet the technology temperature demands of small cooling capacity between 0⁰C~25⁰C).

Features and Benefits

- This serial unit applies for Europe and America imported full-closed, low noise, high-efficiency scroll compressor, imported digital thermostat.
- It has unit with one or two or three refrigerating loop circuit, which can interchangeable & independently run. It has perfect safety protection systems and failure electronic signal assure that unit operates without damage and run safely. ■

Website: www.szhuateng.com

Yihai brings motorized modulating valve



YH7X series motorized modulating valve from Yihai Controls Valves Co Ltd is made of actuators of force 1800N or 4000N with DN200 valve body. It is widely used in air conditioning, refrigeration, heating and building auto control system, can adjust the medium flow precision, achieved goal to control temperature, humidity, pressure and energy saving.

Features and Benefits

- Die-casting aluminum shell and frame are small, light and high strength.
- PMSM motor equip limit switch, actuators auto stop.
- The valve structure is two way single base, two way balance, three ways divert, three way mix.
- The valve material can use cast steel and cast iron to fit different working medium and temperature.
- Configuration stroke self-adaptation, easy to install and test. ■

Website: www.yihai.zj.cn

Titan Containers ArcticStores to bring new dimensions for cold storage

Designed and built with the user, reliability, performance and running costs in focus ArcticStores bring a new dimension to the temperature controlled, portable cold storage market. For customers who do not need 3 or more palletwide cold stores, ArcticStores deliver an extremely cost efficient alternative to all other products available in the market.



Features and Benefits

- It has flat anti-slip aluminium floor with internal door opening. It has modern power efficient machinery (many with datalogger).
- Maximum air temperature fluctuation 0.5⁰C from set point after pull down (most models).
- It has hygienic stainless steel interior panels or aluminium floor with robust MGSS stainless steel exterior.
- It has 380/440V 3 phase heavy duty cable with 5 pin/32A CE plug.
- The average age of their rental fleet is less than 5 years. Foundations or even ground is not required and has self bearing on the 4 corners. ■

Website: www.ctcontainers.in





Taizhou Leak Detector to detect all halogen refrigerants

Taizhou Langxun Machinery Co Ltd leak detector detects all halogen refrigerants. It has sensitive manual adjusting function makes it convenient to use. The product is well designed and it has exquisite circuit. It also has a sound and light alarming indicator. Excellent sensor to detect subtle leak halogen gases. Portable design with suitcase. Flexible long handle to detect leak source at any place. The power supply of this product is DC6V size 7 Alkaline batteries.

Application

- It detects leak in air-conditioner and other refrigerant systems. It will respond to all halogen gases (including Chlorine and Fluorine).
- Detects Ethylene Oxide gas leaks in hospital sterilizing equipment (it will detect the homogenate carrier gas).
- Gases including Chlorine, Fluorine and Bromine (halogen gases) are detected.
- Cleaning agents used in dry cleaning applications such as perchloroethyl are also detected. ■

Website: www.langxun-copper.com



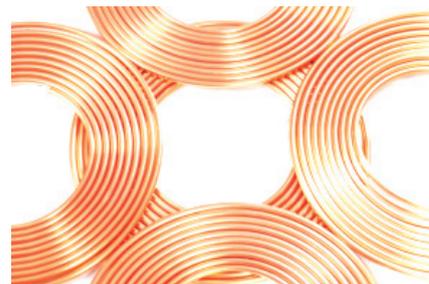
Copper Tubes from UTC

Uniflow Copper Tubes (UCT) was established in the year 2008, is one of the leading manufacturers of copper tubes in south of India. UCT produces seamless copper pipes and tubes made to exacting ID, JIS, ASTM, BS and other national and international standards. It extends its supplies to condenser & cooling coil manufacturers, solar water heater manufacturers, reticulated gas pipeline, contractors, radiator manufacturers etc.

Features and Benefits

- DHP grade with copper purity of 99.9% minimum and phosphorus purity of 0.015% - 0.040%.
- Soft copper tubes are bright annealed and are made with floating mandrils thus having uniform grain size and can be easily bent and brazed.
- The hard copper tubes are bright and concentric. The inner surface is clean and is compatible with all gases including new generation gases R-134a, R-404a, R-407c and R-410a. ■

Website: www.uniflowcoppertubes.com



Jupiter Electronics launches humidity & temperature calibrator

HygroGen2 has become the benchmark for transportable RH and temperature calibrators. It generates stable humidity and temperature conditions. Transportable calibration solution humidity equilibrium typically in 3 minutes. Calibrate up to five RH probes simultaneous Integrated touch screen PC and USB hub. External heated sample loop for reference hygrometer connection.

Features and Benefits

- HygroGen2 has a control range of 0...60°C.
- Its improved mechanical design provides better thermal performance in terms of speed of response, control stability and temperature gradients.
- It has temperature control stability at equilibrium is better than or equal to ±0.05K.
- Humidity generation is by a piezoelectric element with digital PID control allowing optimized response across the temperature range.
- The internal water reservoir now incorporates on screen level monitoring so the user can monitor and control the water level for the duration of a calibration. ■

Website: www.jupiterelectronics.com



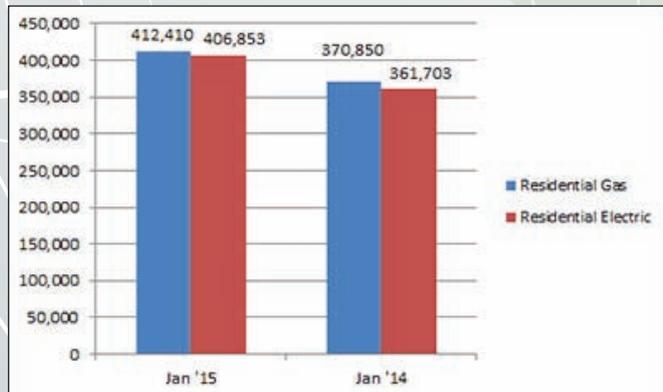
Heating, Cooling Equipment Shipment Data of the U.S. for January 2015

The latest U.S. shipment data of the heating and cooling equipment mostly indicate a healthy demand.

Air and water heaters find versatile applications in industrial, commercial and residential setups. With improvement in the global economic situation, there is a change in the shipment of different kinds of heating devices, similarly, changes in the oil market also has an impact on it, both are being reflected in the findings of the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), which is an internationally recognised advocate for the air conditioning, heating, commercial refrigeration and water heating equipment. Following figures highlight the segment-wise changes...

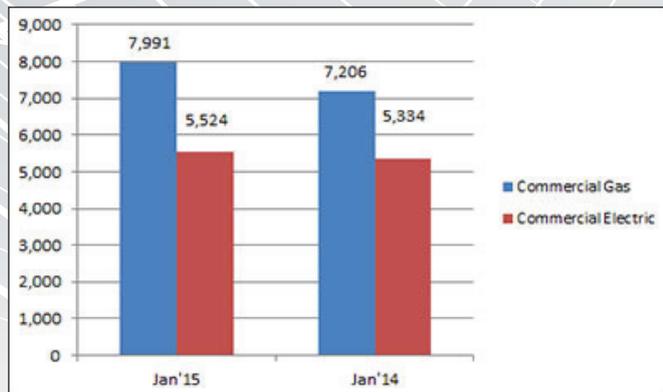
Residential storage water heaters

The U.S. shipments of residential gas storage water heaters for January 2015 increased 11.2 per cent, to 412,410 units, up from 370,850 units shipped in January 2014. Residential electric storage water heater shipments increased 12.5 per cent in January 2015, to 406,853 units, up from 361,703 units shipped in January 2014.



Commercial storage water heaters

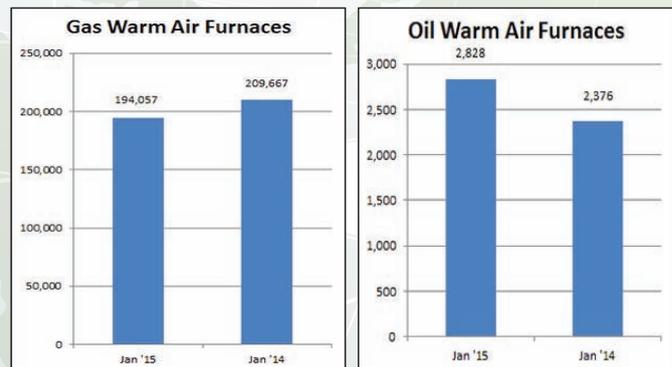
Commercial storage water heaters shipments increased 10.9 per



cent in January 2015, to 7,991 units, up from 7,206 units shipped in January 2014. Commercial electric storage water heaters shipments increased 3.6 per cent in January 2015, to 5,524 units, up from 5,334 units shipped in January 2014.

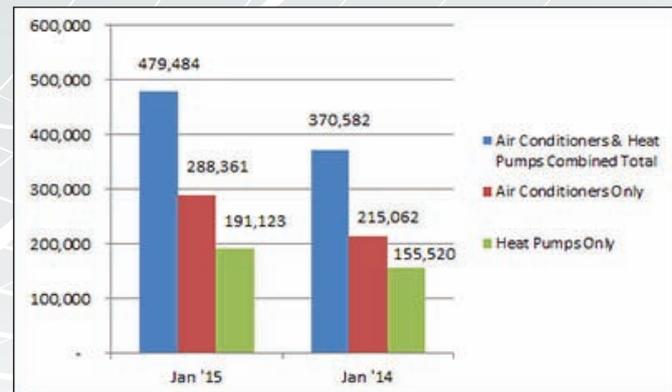
Warm air furnaces

The U.S. shipments of gas warm air furnaces for January 2015 decreased 7.4 per cent, to 194,057 units, down from 209,667 units shipped in January 2014. Oil warm air furnace shipments increased 19.0 per cent, to 2,828 units in January 2015, up from 2,376 units shipped in January 2014.



Central air conditioners and air-source heat pumps

The U.S. shipments of central air conditioners and air-source heat pumps totaled 479,484 units in January 2015, up 29.4 per cent from 370,582 units shipped in January 2014. U.S. shipments of air conditioners increased 34.1 per cent, to 288,361 units, up from 215,062 units shipped in January 2014. The U.S. shipments of air-source heat pumps increased 22.9 per cent, to 191,123 units, up from 155,520 units shipped in January 2014.



The U.S. manufacturers' shipments of central air conditioners and air-source heat pumps

Size Description (000) BTUH	Month	
	Total	% Change from 2014
Under 16.5	14,956	+6
16.5-21.9	64,654	+90
22-26.9	95,691	+41
27-32.9	71,137	+28
33-38.9	90,826	+21
39-43.9	35,490	+17
44-53.9	48,093	+15
54-64.9	42,004	+18
65-96.9	6,918	+10
97-134.9	4,346	-4
135-184.9	2,787	0
185-249.9	1,125	-1
250-319.9	650	+2
320-379.9	191	+1
380-539.9	190	-19
540-639.9	175	-8
640 & Over	251	+1
TOTAL	479,484	+29

Size Description (000) BTUH	Year-to-Date	
	Total	% Change from 2014
Under 16.5	14,956	+6
16.5-21.9	64,654	+90
22-26.9	95,691	+41
27-32.9	71,137	+28
33-38.9	90,826	+21
39-43.9	35,490	+17
44-53.9	48,093	+15
54-64.9	42,004	+18
65-96.9	6,918	+10
97-134.9	4,346	-4
135-184.9	2,787	0
185-249.9	1,125	-1
250-319.9	650	+2
320-379.9	191	+1
380-539.9	190	-19
540-639.9	175	-8
640 & Over	251	+1
TOTAL	479,484	+29

(Industry figures are estimates derived from the best available figures supplied by a sample of AHRI member companies and are subject to revision. Year-to-date figures are correct as issued.) ■

Source: *The Air-Conditioning, Heating, and Refrigeration Institute (AHRI)*

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Clasimat® verticle automated Storage system



Clasimat® Vertical Lift Module

The Clasimat® Vertical Lift Module (VLM) from Mecalux, it is designed to maximise warehouse storage capacity by optimising storage space through extendable heights in a compact manner which can drive down warehouse costs by up to as much as 30%. And it is completely enclosed space-saving vertical automated storage system, marketed, sold and serviced in southern Africa by APC Storage Solutions SA. This unique storage system uses compartments within the VLM which can reach heights of 15.4 m. As the VLM is a sealed unit, controlled via the Mecalux EasyWMS software, security and safety are enhanced beyond conventional storage. In addition to this, limited human interaction decreases any possible security issues as only one machine operator is required. This means that the goods stored inside are protected from possible accidental impact and improper handling. The door, which opens only when merchandise is picked or delivered, consists of two downward sliding panels preventing access to the shuttle from the front.

Fred Albrecht, APC Storage Solutions SA Managing Director points out, "The totally sealable unit also prevents stored items from gathering dust and grime." The Clasimat® can be used for storing all types of products generally stored in boxes, such as tools and electric components. ■

WI-FI enabled commercial HVAC systems

Whether one is planning a new construction or just renovating existing office, It is essential to consider the latest advancement in HVAC technology that is - A Wi-Fi enabled system.

With the arrival of new technologies, the HVAC process is becoming more efficient & person-friendly. The wi-fi version of a commercial air conditioning system is gaining a growing reputation among business owners. The wireless sensors are set round in the industrial building. They're adjusted in keeping with the necessity of the environmental temperature. Not only is it easy to use, they are cost effective as well. These technologically-advanced systems interpret the needs of the environment. One will require fewer parts & spend far less money on annual services as well.

Wireless commercial HVAC systems work more effectively than the traditional counterparts. These HVAC systems are far more environmentally friendly than other brands on the market. Because they have sensors, these systems are tuned to exactly which area needs heating or cooling, therefore, one won't be regulating an unused zone of the building. Since it's wireless, it's flexible. The motion sensors may be adjusted anywhere according to the needs. One can take the the Wi-fi enabled system along if there is any plan to relocate the work place. ■



Granbury-TX-Air-Conditioning

Sound absorber for small Centrifugal Fans



kleines FlowGrid

FlowGrid for centrifugal fans reduces the blade passing noise by 15 dB. The air inlet grille is ebmpapst's efficient noise protection measure for ventilation and air conditioning. Up to now, the grille has been used on larger axial and centrifugal fans up to size 990. ebm-papst has recently started offering the sound absorber for smaller centrifugal fans with sizes from diameter 190 to 250 mm.

The problem is the noise and additional sounds that arise when the inlet flow to the fan is disturbed, for example due to a narrow installation situation. This leads to air vortexes, also known as vortex string formations that create noise. The FlowGrid counters this by evening out these turbulences and dividing them into small portions before they hit the blades of the impeller. The grille on the intake side reduces the noise emissions and minimises disturbing individual frequencies. These narrow-band tonal noises, often referred to as propeller noise or blade passing noise, are drastically reduced.

In a size 190 centrifugal fan fitted in a ventilation unit, the intake-side sound power level was reduced by over 2 dB(A) and the blade passing noise by 15 dB, simply by using an air inlet grille. Using these grilles can help to reduce or even avoid entirely the use of cost-intensive, passive noise-reduction measures.





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