

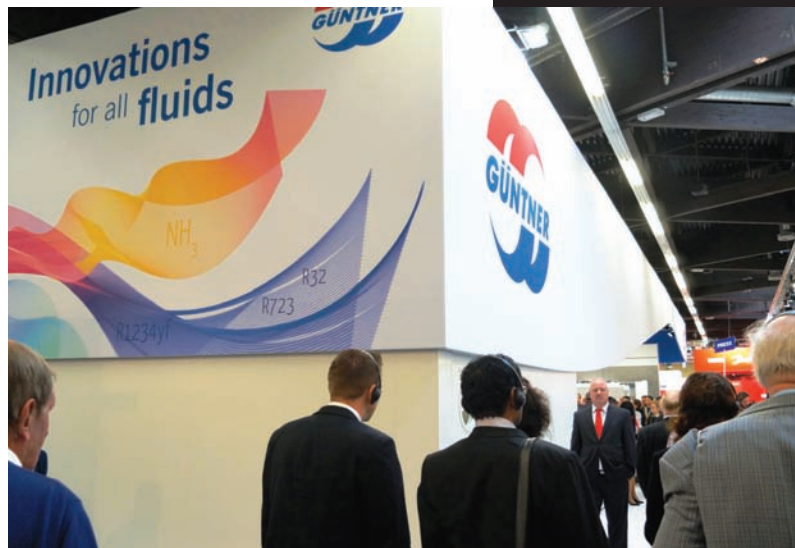
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November 2014

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Publisher's Letter



Publisher's Letter

India wastes 25-30% of valuable produce annually during postharvest operations

India is blessed with diverse agro-climatic conditions and produces a wide variety of fruits and vegetables. It ranks second in production of fruits and vegetables after China. Laying emphasis upon postharvest practices, the article, 'Upgradation of Cold Stores - Energy Management Strategies' mentions, India wastes 25-30% of valuable produce annually during postharvest operations due to lack of infrastructure and awareness about handling, supply, storage and marketing practices.

When we talk about cold supply chain, globally, the most matured market on the basis of adoption of PCM technology is Europe. The write up 'Phase Change Materials Technology- Revolutionizing Energy Consumption in Cold Chain' manifests that this chain is vital to the supply chain which involves production storage and distribution of perishable products. This chain in itself is highly energy intensive and due to unwanted exposure to weather elements about 70-80% of the farm produce goes waste, each year.

Further, foods that have not been stored properly, prepared, handled or cooked; the bacteria in it multiply to dangerous levels. A write-up 'Food safety and Freezers' says food-poisoning bacteria can grow and multiply on some types of food more easily than others. High-risk food should be kept at 5°C or below, and above 60°C to avoid the 'temperature danger zone', where bacteria multiply fastest.

Do visit us during India Cold Chain expo in Mumbai. This issue has coverage of Chillventa 2014 in Germany, where cooling india was the only magazine invited to cover the event.

Please send your comments at pravita@charypublications.in

Pravita Iyer
Publisher & Director



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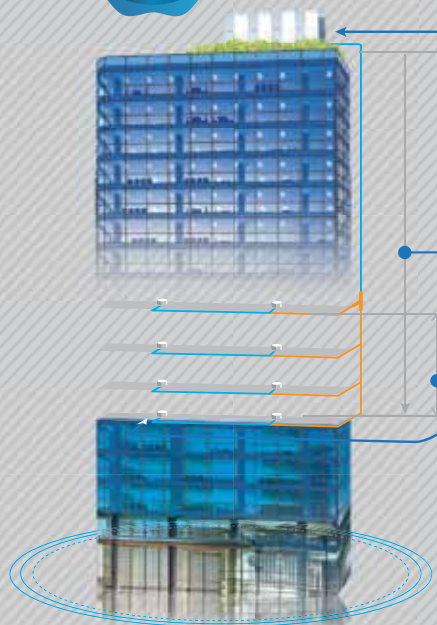
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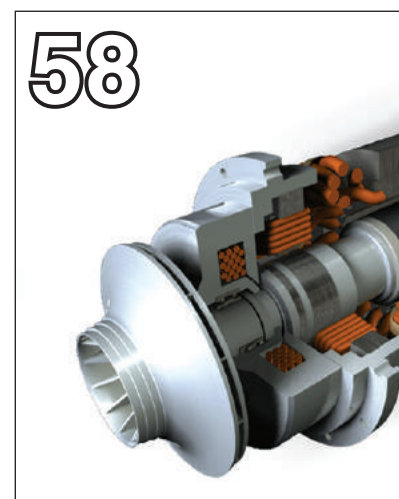
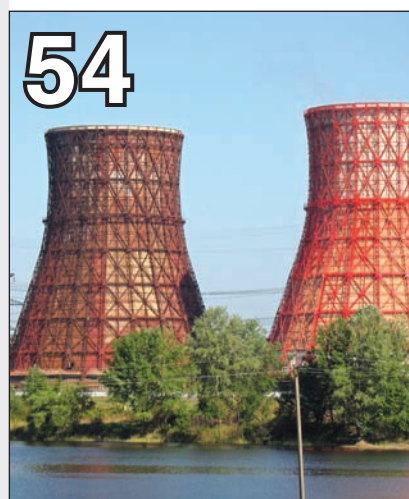
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Anindya Lahiri
President – HMX,
A business unit of A.T.E. Enterprises

Yet another
innovation
from the leaders in indoor air quality

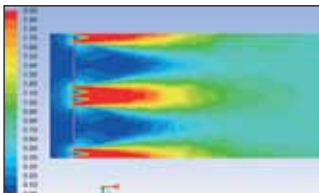


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Editorial

Energy Efficient Cooling Technologies for Enhanced Performance



HVAC industry is realizing benefits of various cooling technologies available but is yet to explore the technology in a comprehensive way. Machines with electronic integration, being intelligently driven, control aspects of cooling and refrigeration. With present refrigerants used in cooling, the energy used is much more than needed or required, and they affect climate change too. For control, and to offset a portion of excess energy utilized solar heating, cooling, and ventilation technologies can be used. Micro channel and trigeneration using waste heat source are evident. Peltier effect - a principle in physics for cooling use - involves thermoelectric materials that have advantages over traditional heating and cooling systems. A Peltier cooler used as thermoelectric appliance can also be used as a temperature controller that either heats or cools.

In refrigeration technology, main advantage of such cooler is its small size and flexible shape. Such coolers do not require refrigerant fluids, such as chlorofluorocarbons and related chemicals, that have harmful environmental effects. The energy consumption of thermoelectric cooling systems is generally high. Times are changing in favour of energy efficient cooling technology such as frictionless and oil free compressors with continual improved performance. Still, more enhancement is needed as refrigeration needs are growing for supermarket chillers and freezers.

A drive to reduce energy consumption improves performance. Energy efficiency is the key. A new range of HFOs being developed have very low GWP. Hydrofluorocarbons, the powerful heat-trapping gases used as refrigerants, can have thousands times more powerful climate change effect than what carbon dioxide does. For air conditioners that use alternatives to high GWP refrigerants, research may lead to the solution to facilitate design changes that yield energy efficiency improvements. Though, refrigerant gases with a lower GWP will continue to develop; non-vapour compression research can be advanced to raise efficiencies. Depending on application, magnetic refrigeration can also be used. We can propitiate change with small cooling technologies in refrigeration and then move to larger applications with objective to enhance energy efficiency.

Gopal Krishna Anand



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Haier to use Honeywell's low-GWP Insulating Material in Refrigerators



Honeywell announced that Haier, the world's largest appliance manufacturer, will adopt Honeywell's new low-global-warming-potential Solstice® Liquid Blowing Agent in China to help insulate and increase the energy efficiency of its refrigerators. Blowing agents such as Solstice LBA allow closed-cell polyurethane foam insulation to expand and provide the majority of the foam's excellent insulating properties. Solstice LBA can help home appliance manufacturers achieve an 8-10% energy efficiency improvement compared with cyclopentane, which is widely used as a blowing agent in appliance insulation. "Honeywell is committed to developing technologies that help our customers produce energy-efficient appliances that are great for consumers and better for the environment," said Sanjeev Rastogi, business director for Honeywell Fluorine Products. "For the past three years, we have been working with Haier under their Open Innovation System to transition to Solstice LBA, and we congratulate Haier on being at the forefront of introducing refrigerators that are both highly energy efficient and low in environmental impact." Solstice LBA has an ultra-low global warming potential of 1, which is 99.9% lower than HFC-245fa, a commonly-used blowing agent. "Our collaboration with Honeywell is more than just a sourcing relationship, our Open Innovation System has created a win-win partnership that is bringing quality and energy-efficient products to customers," said Haier. The foam insulation used in the Haier refrigerators is formulated and manufactured by Dow Chemical. "The use of Honeywell's Solstice LBA in our foam is helping Haier improve the energy efficiency of its refrigerators, which is beneficial not only to customers and manufacturers, but to society as a whole," said Si-Ho Lee, Asia-Pacific technical service and development manager at Dow. Solstice LBA is nonflammable and is not a volatile organic compound. It is approved by the U.S. Environmental Protection Agency under the Significant New Alternatives Policy (SNAP) Program and is also registered under the European Union's REACH program. ■

Plate Heat Exchanger from Alfa Laval

The T35 series represents the next generation of gasketed plate heat exchangers (PHEs), with innovations on many levels. Alfa Laval T35/TS35 is a very versatile heat exchanger. A wide selection of available plate and gasket materials makes it suitable for use in many different positions, from basic water to water duties to tough applications with high temperatures, aggressive media and high pressures. The new, Alfa Laval CurveFlow™ distribution area give Alfa Laval T35/TS35 a highly uniform flow distribution, which eliminates stagnant zones and reduces fouling. CurveFlow plates have an exceptionally low pressure drop over the distribution area. This makes it possible to operate with a higher pressure drop over the main heat transfer area, which increases turbulence and prevents fouling. Servicing a T35/TS35 is simple and effortless due to Alfa Laval's new, patented Alfa Laval ClipGrip™ gaskets. These offer totally glue-free attachment and stay firmly in place during opening and closing. Swing Foot and Bearing Box. their unique solutions that make opening and closing a T35/TS35 easy. ■



Bitzer showcases extensive range of products at Chillventa 2014

BITZER showcased its extensive range of products at the Chillventa specialist trade fair in Nuremberg. Innovations like OS. A95 ammonia compressors, the two CO₂ reciprocating compressor series CME & CKH, and ECOSTAR LHV7E air-cooled condensing unit generated a great deal of interest.



"We managed to make specialist visitors curious about our new products," explains Volker Stamer, BITZER Director Stationary Products. "What really impressed them was that we were able to present major highlights in all our company segments, including reciprocating, scroll and screw compressors and electronics." "We're happy that so many visitors showed an interest in our new products and our product portfolio as a whole," Stamer adds. "Including our new BITZER OS. A95 ammonia compressors, which offer nearly twice the volume flow, customized oil separators and the infinitely adjustable CM-SW-01 control electronics." There were two new CO₂ reciprocating compressor series on display. The eight subcritical CO₂ compressors in the CME series and the five transcritical CO₂ compressors in the CKH series have significantly expanded the range of applications. Visitors appreciated ECOSTAR LHV7E. The new generation of air-cooled condensing units can be adapted using the speed control in order to best suit actual requirements, thus increasing the efficiency of the entire refrigeration system. Another new product at Chillventa was the CRII system for flexible capacity control and optimized system efficiency for ECOLINE reciprocating compressors. The innovative BAHT oil management system for ORBIT scroll compressors in multicompressor units and the BEST service tool for parameterizing and analyzing the VARISPEED and CSV series were presented at Chillventa for the first time. ■



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Daikin India launches VRV IV Technology: next-generation of commercial air-conditioning solutions



Daikin India, the 100% subsidiary of Daikin Industries Ltd, Japan, the world's No. 1 air-conditioning company, drives in the next generation of commercial air-conditioning technologies by launching the pioneering VRV IV system solutions. Announced, this top of the line VRV IV system boasts of combination of advanced technologies to achieve excellent performance for a variety of applications. The new system design at its core offers improved energy savings, more flexible system designs, comfort and ease of installation with outstanding reliability. VRV Technology was introduced in 1982. The Next generation VRV IV is powered by state of the art energy saving feature called VRT technology. With this revolutionary feature, running cost of VRV system is drastically reduced. After revolutionizing the global HVAC industry with its VRV technology, Daikin now introduces VRV IV technology that is suitable for small to large sized buildings. This technology enables greater energy savings as the outdoor units operate up to 4.41 COP thus reducing energy consumption levels. It also makes use of increased higher static pressure for the outdoor unit fan for greater installation flexibility. The VRV IV offers choices between outdoor units having capacities up to 6HP for a single outdoor unit and 60HP for a 3-unit combination. Addition of various advanced features ensure consistent and stable system operation of the VRV IV technology. Daikin Air-conditioning India Pvt. Ltd. also incorporates various technological innovations like Large Capacity Inverter Compressor, Thixocasting process for high strength material, Highly Integrated Heat Exchanger, efficient Automatic Test Operation, Large Airflow, High External Static Pressure and Improve Reliability at High Ambient Temperature feature, that makes the VRV IV by Daikin the most advanced and intuitive technology in the HVAC market of the country. Kanwal Jeet Jawa, MD, Daikin Airconditioning India Pvt. Ltd remarks, VRV IV is a milestone with which we are driving the next generation of commercial air-conditioning technologies into India. ■

Tube connection technology for installation and repair of plug-in refrigerators

The Lokring tube connection is a clean, and purely mechanical connection with a permanent hermetic seal for all refrigeration technology requirements. Vulkan Lokring presented the technology at Chillventa trade fair, Nuremberg, Germany. The solder-free tube connection is based on an axial sliding technology: The two ends of the tubes that are to be connected are brought together in a connection joint and from there two rings are pushed axially onto the joint using a hand assembly tool. Due to the conical inner contour of the rings, the joint is reduced to such an extent that both the tube and the joint create a metallic-hermetic connection through surface pressing. However, there is no measurable drop in pressure or reduction in volume flows in the tube system. As at the present date, more than 1.5 billion Lokrings have been successfully used in the industrial volume production of cooling and freezing units. The Lokring tube connection can be used either when replacing a compressor or a drier or when leaky refrigerant lines or charging tubes have to be repaired. ■



Emerson Climate Technologies launches India-Built Semi Hermetic Condensing units

Emerson Climate Technologies announced manufacture of India Built Semi Hermetic Condensing Units in the range of 5 to 40HP from its Cold Chain & Distribution Center at Chakan, Pune. Emerson offers widest range of condensing units in Semi Hermetic technology for commercial and industrial applications in India.



Semi Hermetic CDUs adds to its existing portfolio of Reciprocating & Scroll Condensing Units that it already manufactures at the plant. The facility was set up as a response to the market's high demand for locally built, branded, quality products, as also a growing trend towards larger Cold Storages. The assembly line is now capable of handling large refrigeration systems like Semi-Hermetic, Scroll & Reciprocating Condensing Units & Multi Compressor Racks, ensuring reduction of delivery time and improved after-sales support. Emerson Condensing Units have been well received in the Indian market and have proven themselves with their robust and reliable design. Long-term engineering and manufacturing experience has led to this complete range of condensing units featuring Semi Hermetic reciprocating compressor technology. These condensing units are equipped with dedicated medium or low temperature compressors which makes them suitable for all general refrigeration applications, supermarkets & hypermarkets, hotels, restaurants & food service, cold rooms/ storages/pre - cooling etc. With local manufacturing & stocking, customers will now get customized units with faster lead times. The air cooled Semi Hermetic condensing units are available with, Copeland Standard Semi Hermetic Compressors (2S & 3S) for 5-20HP With Reed Technology. Copeland Stream four and six cylinders compressors (4M,6M) for 13-40HP With Discus Technology & Coresense Diagnostics. ■

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Elanpro showcases Bio Medical refrigeration products at Asticon 2014

Elan Professional Appliances Pvt. Ltd. (Elanpro) – India's leading Commercial Refrigeration Company, showcased its entire range of Bio Medical Refrigeration products including Pharma Refrigerators, Chest Freezer, Medicine Coolers, Solar & Battery Freezer, Ice Lined Refrigerator and Ice Flakers and Ice Cube machines, at the 38th annual conference of Indian Association of Sexually transmitted disease and AIDS (ASTICON 2014). The expo was recently held in Chandigarh. Elanpro's Biomedical Refrigeration product range provides safe storage, transport & handling of temperature-sensitive preparations in the appropriate optimum conditions without any risks. The company has been supplying its products to leading names like AstraZeneca, Apollo Hospitals, Wockhardt etc. A leading name in the medical refrigeration industry, Elanpro also offers a comprehensive range of commercial refrigeration & food-service products, serving the hospitality, retail and life sciences sector. Sanjay Jain, Director, Elanpro said, "Sexually transmitted diseases are one major group of diseases that make for ongoing hidden epidemics. In medicine, there are new discoveries daily, enabling the protection and preservation of life from STI. Therefore, the challenges for a safe storage, transport and handling of medicines, blood, vaccines and other biological tissues are continually growing. We offer an exclusive range of products catering to the needs of various vaccination programs to fight deadly diseases. Our focus is on Energy Efficiency and Cost Effectiveness." "We also provide secure life sciences solutions. Our product range gives our customers an opportunity to enjoy total confidence when it comes to performance, reliability, design and after sale service", Jain added. The products showcased by Elanpro cover the spectrum of the specific and exacting needs for hospitals, laboratories, pharmacies, blood banks, research centres and universities. Elanpro provides specially designed pharma refrigeration solutions to meet the requirements of civil aid organizations for the transport of temperature sensitive supplies such as blood and blood products, vaccines, plasma, blood samples and pharmaceutical products. Some of Elanpro's products exhibited were: Chest Freezer/Chillers; Solar/Battery Freezer; Ice Line Refrigerator/ Freezer; Medicine Coolers; Laboratory Freezer & Refrigerator – Frostfree, Static; Upright Freezers - Static Frostfree; Ice Cube Machine & Ice Flaker. ■

Greenheck offers adjustable Louver with Drainable Blades

New Greenheck Model EAD-635, an adjustable blade louver in a 6-inch deep frame, incorporates a drainable head member and adjustable drainable blades to channel water to the jambs that guide the water through vertical downspouts for escape at the sill. When open, the drainable blades provide excellent resistance to water penetration and high volume intake and exhaust ventilation. When closed, the optional dual durometer vinyl blade-edge gaskets and stainless steel jamb seals effectively minimize air leakage and water penetration. The adjustable blades can be controlled with manually operated hand-cranks, pull chains, and electric or pneumatic actuators. AMCA Licensed for Water Penetration and Air Performance, Model EAD-635 has the highest intake volume (cfm) in its class and is ideally suited for warehouse distribution facilities. Greenheck louvers can be specified with a variety of options in a broad array of architectural finishes for durability and compatibility with adjacent components. ■



Pre-insulated Plastic Piping solutions for Glycol applications

GF Piping Systems presented energy-efficient, non-corroding, non-dripping pre-insulated piping solutions for indirect cooling applications in Chillventa 2014, Nuremberg. With its portfolio of trendsetting products. The focus of this year's trade show and exhibition appearance of company's energy-efficient piping systems, features COOL-FIT ABS Plus - a fully pre-insulated plastic piping system to be used in indirect cooling. The demand for fresh/cooled food worldwide is steadily increasing as well as the energy



prices. Cooling is nowadays the principal consumer of energy around the world. Energy-efficient piping systems are becoming increasingly important in order to reduce operating costs. Innovative system solutions such as pre-insulated plastic piping by GF Piping Systems combine high quality for consumers with special environment care and operating cost savings. COOL-FIT ABS Plus is a fully pre-insulated plastic piping system to be used in indirect cooling applications. The core pipe is made of ABS, and then insulated with high density polyurethane (PUR). The insulation is protected with a black polyethylene jacket, which is water-tight and UV resistant, and therefore makes the system applicable for outdoor usage. In addition the entire system is completely diffusion and vapor tight - ideal for food production environments. COOL-FIT ABS Plus is suitable for cooling applications with water-based coolants from -50°C to +40°C at an operating pressure of up to 10 bar and within a range of diameters from d25 to d225. The patented jointing technology, the inner nipple, is an outstanding added value of the system. It reduces work effort by avoiding the complex removal of the polyurethane insulation. Furthermore, it allows the system to be quickly and efficiently solvent cemented with Tangit ABS, a bonding technology widely tested and used. ■

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Reverse Engineering Materials for more efficient Heating and Cooling

If you've ever gone for a spin in a luxury car and felt your back being warmed or cooled by a seat-based climate control system, then you've likely experienced the benefits of a class of materials called thermoelectrics. Thermoelectric materials convert heat into electricity, and vice versa, and they have many advantages over more traditional heating and cooling systems. Recently, researchers have observed that the performance of some thermoelectric materials can be improved by combining different solid phases - more than one material intermixed like the clumps of fat and meat in a slice of salami. The observations offer the tantalizing prospect of significantly boosting thermoelectrics' energy efficiency, but scientists still lack the tools to fully understand how the bulk properties arise out of combinations of solid phases. Now a research team based at the California Institute of Technology (Caltech) has developed a new way to analyze the electrical properties of thermoelectrics that have two or more solid phases. The new technique could help researchers better understand multi-phase thermoelectric properties - and offer pointers on how to design new materials to get the best properties. The team describes their new technique in a paper published in the journal *Applied Physics Letters*, from AIP Publishing. Because it's sometimes difficult to separately manufacture the pure components that make up multi-phase materials, researchers can't always measure the pure phase properties directly. The Caltech team overcame this challenge by developing a way to calculate the electrical properties of individual phases while only experimenting directly with the composite. "It's like you've made chocolate chip cookies, and you want to know what the chocolate chips and the batter taste like by themselves, but you can't, because every bite you take has both chocolate chips and batter," said Jeff Snyder, a researcher at Caltech who specializes in thermoelectric materials and devices. To separate the "chips" and "batter" without un-baking the cookie, Snyder and his colleagues turned to a decades old theory, called effective medium theory, and they gave it a new twist. "Effective medium theory is pretty old," said Tristan Day, a graduate student in Snyder's Caltech laboratory and first author on the APL paper. The theory is traditionally used to predict the properties of a bulk composite based on the properties of the individual phases. ■

Innovative solution for Cooling Plants

At chillventa 2014, [energiespar.idea#17](#) GmbH of Nuremberg, Germany, displayed hollandcool, an innovative system that helps increase performance of cooling plants by up to 30% and reduce energy costs, also by up to 30%. hollandcool humidifies the air around the recuperator in the exterior part of cooling plant and uses resulting cool evaporative air to increase the plant's performance while reducing costs. This effect is based on the adiabatic principle - while generating the same output, the capacitors use significantly less energy. Even with extreme outside temperatures, the performance of the cooling plant is increased and the risk of breakdowns is minimized. Developed in Netherlands, the technology has been used in USA for many years and is marketed in Germany by [energiespar.idea#17](#) GmbH. "hollandcool is a turbo charger for cooling systems," says Steffen Neumann, Sales Manager at [energiespar](#), "and a cost-effective alternative to costly upgrades to cooling plants used, for eg., in data centers or in foodstuff production plants." hollandcool is flexible enough to be fitted into any cooling plant on site and in just one day. ■



RDM reports surge of interest in control technology: record showing at Chillventa

Resource Data Management reports interest in its latest control technology, following a record showing at Chillventa which saw company launch no fewer than 25 new products. These included an industry first for its new touchXL, which has fibre-optic connectivity for unmatched speed and power, and a new energy dashboard called Kwheb, which gives users a unique high-level graphical overview over an entire estate. Andrew Chandler, RDM founder and MD, said, "We said this year marked a step change in our global strategy and product R&D programme." The interest from both contractors and end users was phenomenal. It is proof we are on the right track, in terms of our focus on blending ease-of-use, affordability, scalability and power. Together with our use of open protocol systems and end-to-end control solutions, these are the key ingredients that will drive RDM's growth in the future. "This approach, embodied in a record number of innovations, resulted in an overwhelming number of new prospects coming to visit us on the stand." Following recent advances, the only limit to the application of modern control technology was now the human imagination, he said. "The tools are there and proven to work. The next big challenge is expanding people's awareness of what they are capable of achieving, and the range of situations in which they can be applied," he said. A new approach was emerging among enlightened end users and installers, he said, that took a much more holistic view of energy, service and estate management, and which broke through the barriers between traditional disciplines. "That is what RDM's products enable you to do - to take an end-to-end approach across all the energy-using technologies in a building or industrial plant. It is no longer just about cooling or heating or lighting or fire and security systems. It is about integrating all these, but keeping it simple in the process. That is the key." ■



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Schneider Electric introduces FTTH solution to augment its solution in Smart Buildings segment



Schneider Electric, the global specialist in energy management, announced the launch of Fiber to the Home (FTTH) solution in India. (FTTH) is the delivery of a communications signal over optical fiber from the operator's switching equipment all the way to Individual homes, community multi dwelling units or businesses, thereby replacing existing copper infrastructure such as telephone wires and coaxial cable. Elaborating on FTTH, Shrinivas Chebbi, Vice President, India and SAARC, EcoBuildings and Partner Projects, Schneider Electric, said, "Schneider Electric's FTTH solution is a simplified, all-in-one solution that enables wider bandwidth and faster data speeds – This fits best for today's need for high-end digital homes where video on demand and converged Smart homes are a new trend. This solution is an addition to and will enhance our Smart & Intelligent Homes portfolio comprising of Network connectivity, Lighting and Room controls, Building management systems, Home automation, security and surveillance systems. G B Ravi, Director-Network connectivity Solutions, Schneider Electric India said "Catering to existing infrastructure and new buildings alike, our 'connected & converged system' solution optimizes energy use in existing buildings, and guarantees efficiency over time. Schneider Electric's FTTH solution offers Architects and Builders a new benefit and USP for their clients. Having a FTTH home symbolises high end lifestyle. The main advantage of FTTH is that it helps in reducing infrastructure glitches and is the only technology that can meet the needs of foreseeable future". This new FTTH communication medium will be provided by optical fiber systems to residential communities and commercial developments by partnering with multiple service providers. FTTH solutions form the backbone of modern buildings, integrating communications technologies across the four pillars of any construction: structure, systems, service, and management. Through FTTH, Schneider Electric delivers centralized monitoring and control, integrating what was previously multiple proprietary networks into a single IP network. ■

Arkema's Forane solutions display at Chillventa trade show to comply with European regulatory changes

Arkema showcased its refrigerant substitutes at Chillventa 2014, designed to address the definitive ban on recycled R-22 & other HCFCs (2nd generation refrigerant gases) at the end of 2014. Arkema presented its refrigerant solutions to help users adapt to the latest F-Gas regulation.



As 2014 comes to an end, the refrigerant sector is undergoing major regulatory changes in Europe. Firstly, the use of recycled or reclaimed R-22 for the maintenance of existing equipment will be banned in Europe by end of year. A large number of installations running on R-22 are still in good operating order, but after 2014 could no longer be loaded with recycled or reclaimed R-22 fluid in cases of leakage. Changing the equipment entails high capital investments, as well as rather long idle periods between dismantling of old equipment and installation of a new one, which may impose to stop an industrial or commercial activity relying on refrigeration for several weeks. Forane® 427A, is the solution for an easy retrofit of existing R-22 installations in a simple, quick and cost-efficient manner. ■

ASHRAE Conference Workshop: Importance of Refrigeration and Ice cream

Nearly 9% of cow's milk produced in the United States goes toward making ice cream, and America is the number one consumer worldwide. What better way to illustrate the importance of refrigeration technology, than to explore the process of making this country's favourite frozen treat?



Doug Reindl and Dan Dettmers' workshop, "I Scream, You Scream, We All Scream for Refrigeration Basics of Ice Cream," is part of the Technical Program at ASHRAE's 2015 Winter Conference. The Conference takes place January 24-28, Palmer House Hilton, while the ASHRAE co-sponsored AHR Expo is held January 26-28, McCormick Place. The session explores the process of making ice cream, leads attendees through the cooling load calculations and finishes up with a chance to participate in the ice cream making process. One catch, however. Attendees have to correctly calculate the cooling load before they can taste the final product, which will be made cryogenically. The workshop starts at 8 a.m. January 25. "We want to reach a younger audience to interest them in the 'R' in ASHRAE - refrigeration," Reindl, a speaker at the session, said. "We thought this would be an out of the box way to show them about processes, the science, taste and texture of food, home refrigeration." His presentation will focus on the methods and cooling loads encountered in the ice cream industry. Session chair Dan Dettmers notes that while ice cream is one of the simple pleasures of life, it also is one of the most complex frozen products available today. "Unlike ice, which freezes in a crystalline structure, ice cream is an amorphous solid similar to glass," he explained. "Its structure is primarily air held in a complex lattice of sugars and fats. Likewise, the process of producing ice cream is far more complex than most frozen foods with variations from traditional ice cream to frozen novelty bars and cakes." ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. ■

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Importance of Cold Chain for Pharma Products in Emerging Economies

In 1970s, these were known as LEDCs (Less Economically Developed Countries). The term got metamorphosed to Emerging Markets or Emerging Economies indicating those countries in transitional stage between developing to developed countries. As per 2008 Emerging Economy Report, the term denotes regions of the world that are experiencing rapid informationalization under conditions of limited or partial industrialization. By 2010, the distinction became clear, between fully developed and developing countries of the world.



Fig. 1: Emerging Economies

The nomenclature of Emerging Economies also underwent numerous changes over a period of time. What initially started as BRIC comprising of Brazil, Russia, India & China became BRICS with the addition of South Africa. Subsequently when Indonesia joined the group, it became BRIICS. The subsequent changes are BRICKET, BRICM, BRICK. The other names given to Emerging Economies at various points of time are Next Eleven, CIVETS etc.

Importance of Emerging Economies

Emerging Economies are perceived as growth centres of the future and drivers of future economic growth. They are manifested with bullish investor confidence and show higher economic growth rate compared to developed countries. They are expected to play a greater role in areas like financial markets, consumption of goods and services, trade and commerce, sustainable development, innovation, infrastructure development and research. However, they show significantly lower public health spending as they have competing expenditure needs and constrained revenue raising capacity. Asia has lesser public spending ratios because of less extensive public insurance coverage and benefit packages.

Emerging Economies – Challenges and Solutions

Emerging Economies are characterised by lower average life expectancy and higher infant mortality. They have limited funds to improve health standards and less extensive health coverage. They provide ill aligned incentives (motivation) for health care providers. They have a large chunk of informal labour market. There are generally low awareness levels about sanitation and hygiene.

It is imperative for Emerging Economies to increase public health spending and the general health safety net. They should accord the due importance to primary and preventive health care. Improved Incentives for health care providers will help in the expansion of basic health care. They should focus on providing most essential health services. Where already an extensive health care system is in place, improvement in efficiencies can be sought by leveraging economies of scale.

Chilukuri Maheshwar is a practising Marine Engineer, working as Faculty - Engineering at Anglo Eastern Maritime Academy, Mumbai belonging to Hong Kong based Anglo Eastern group. He has MBA, MEE (Masters Degree in Ecology and Environment) and M Phil in Management. He is author of book titled Container Refrigeration, & it is recommended reference book for USCG MARAD's Marine Engineer's Licensing Examination for the subject of Marine Refrigeration and Air Conditioning.



Pharma Business Worldwide

Complex drugs and pharmaceutical products market which was worth \$900 billion in 2012 has grown to \$1.2 trillion by 2014. The market for life-saving products like vaccines is expected to grow to about \$35 billion market by 2015. Development of sub-sectors such as biotech, medical devices, clinical trials and diagnostics are fuelled by high levels of innovation leading to individual customer-centric solutions.

Advantage India

India manufactures and exports medicines from all therapeutics groups. Many original innovator companies source their discovered drugs from Indian companies. India is a world leader in anti-AIDS and anti-TB segments and for some of the newly patented medicines like Glitazones, Celecoxib, Statins, Montelukast and many anti-cancer drugs. India is set to become one of top 5 producers of biopharmaceuticals in the world by 2020. Sub segments like medical devices, biotech, clinical trials etc, to which India contributes about 8% of world's pharma output is expected to grow to a \$ 50 billion market by 2020.

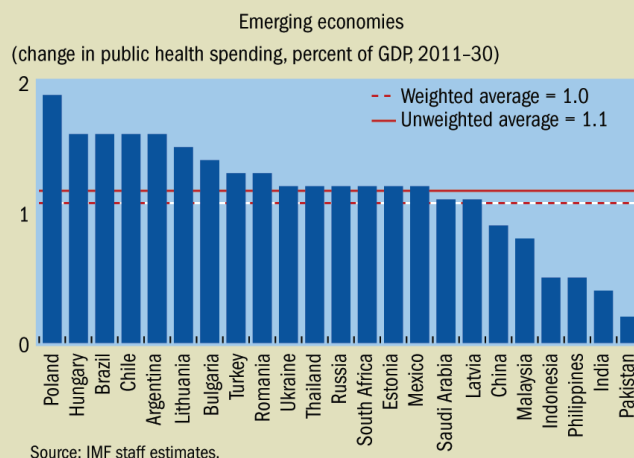
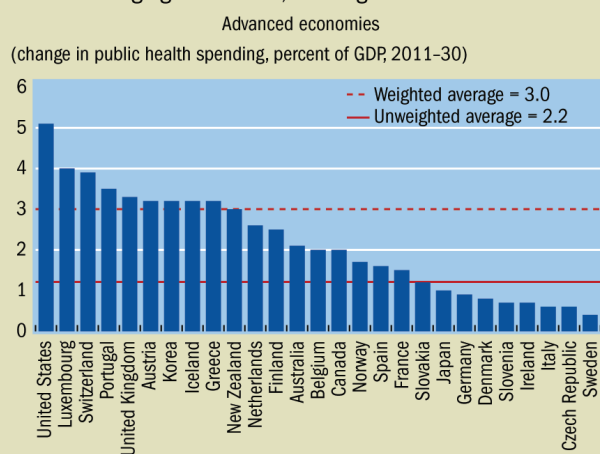
Cold Chain in Pharma

Driven by regulations, more pharma products require temperature control handling from refrigerated to ambient to cold, broadening the cold chain market. Break in cold chain for most products may result in value erosion & financial loss, but break in cold chain of Pharma products (life saving drugs etc) could be fatal for patients. Retailers & Logistic providers may become the weakest link in supply chain of drugs by the time it reaches the end consumer, if proper care is not taken.

Public Health Care Spending – Advanced Economies vs Emerging Economies

Under pressure

Public health care spending is projected to rise by 3 percent of GDP in advanced economies, and by 1 percent of GDP in emerging economies, with regional variations.



**Fig. 2: Public Health Care Spending –
Advanced Economies vs Emerging Economies**

A study by UK-MHRA reveals that 43% of critical and major product deficiencies are related to ineffective temperature control and monitoring during storage and transportation. WHO recently maintained that 25% of all vaccine products arrive at their final destination in a degraded state.

The distribution process must be validated to ensure that there is no negative impact to the safety, efficacy or quality of the drug substance. GMP environment requires that all

processes that might impact the safety, efficacy or quality of the drug substance must be validated, including storage and distribution of the drug substance. More than 50% of the problems faced by manufacturers and retailers in cases of rejections of pharma products as 'not of standard quality' by regulatory authorities is due to not giving due importance to Good Distribution and Storage Practices.

High protection is good, but appropriate protection is better! Majority of commonly recommended vaccines require storage temperatures of 35°F - 46°F (2°C - 8°C) & must not be exposed to freezing temperatures, which can irreversibly reduce the potency of vaccines. Physical changes are not always apparent after exposure to freezing temperatures and visible signs of freezing are not necessary to result in a decrease in vaccine potency. An estimated 17%-37% of providers expose vaccines to improper storage temperatures, and refrigerator temperatures are more commonly kept too cold than too warm. Although the potency of the majority of vaccines can be affected adversely by storage temperatures that are too warm, these effects are usually more gradual, predictable, and smaller in magnitude than losses from temperatures that are too cold.

Pharma Products & Pharma Markets- Characteristics

25% of all healthcare products are temperature-sensitive, meaning they require refrigeration during transportation and storage from manufacturer to end user. It is estimated that by 2015, \$35 billion worth of life saving biological and vaccine shipments will require temperature-controlled

The vaccine-preventable diseases responsible for 1.5 million infant deaths

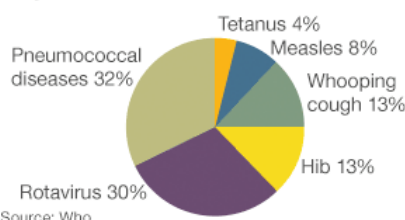


Fig. 3: Vaccine Preventable Diseases

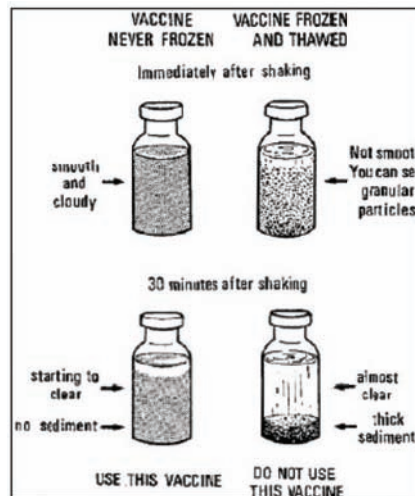


Fig. 4: Determining Usability of Vaccines

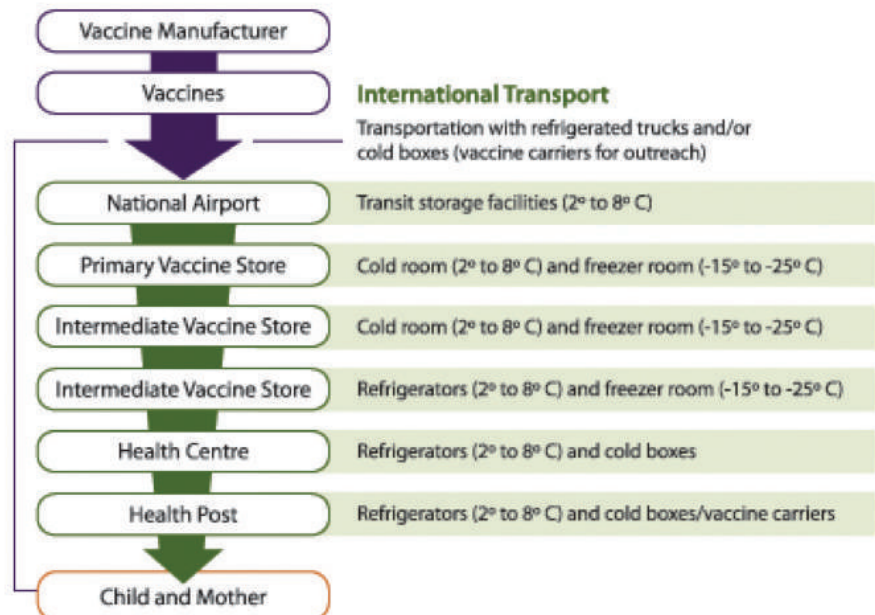


Fig. 5: Temperature Impact on Vaccine Potency

rooms during transit. Pharma Products have short window period of viability, which makes rapid transport essential. Monitoring temperatures & maintaining the proper packaging environment during transport are critical.

Effective cold chain shipping is critical, as pharma and biopharma cold chain shipments in markets worldwide are expected to grow dramatically in future. Emerging Economies are seen as the drivers of volumes. South Asia is projected as the fastest growing cold chain shipment volume region. Cold Chain Infrastructure is less developed here and losses maximum in this region. One of the first and foremost tools for preventive healthcare is vaccination.

Millions of children die every year from vaccine-preventable diseases. The WHO estimates 1.5 million children under the age of five die each year from diseases that could have been prevented by routine immunization.

India: Polio Vaccination Movement

The Polio Eradication Vaccination Movement was started in India in 1996. By 2000, it was expected that Polio would be eradicated globally. However, in 2007 about 866 Polio cases were reported. These Polio cases occurred in regions where the children were already vaccinated against Polio. Till very

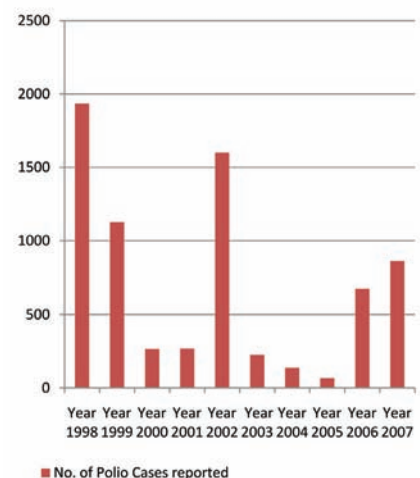


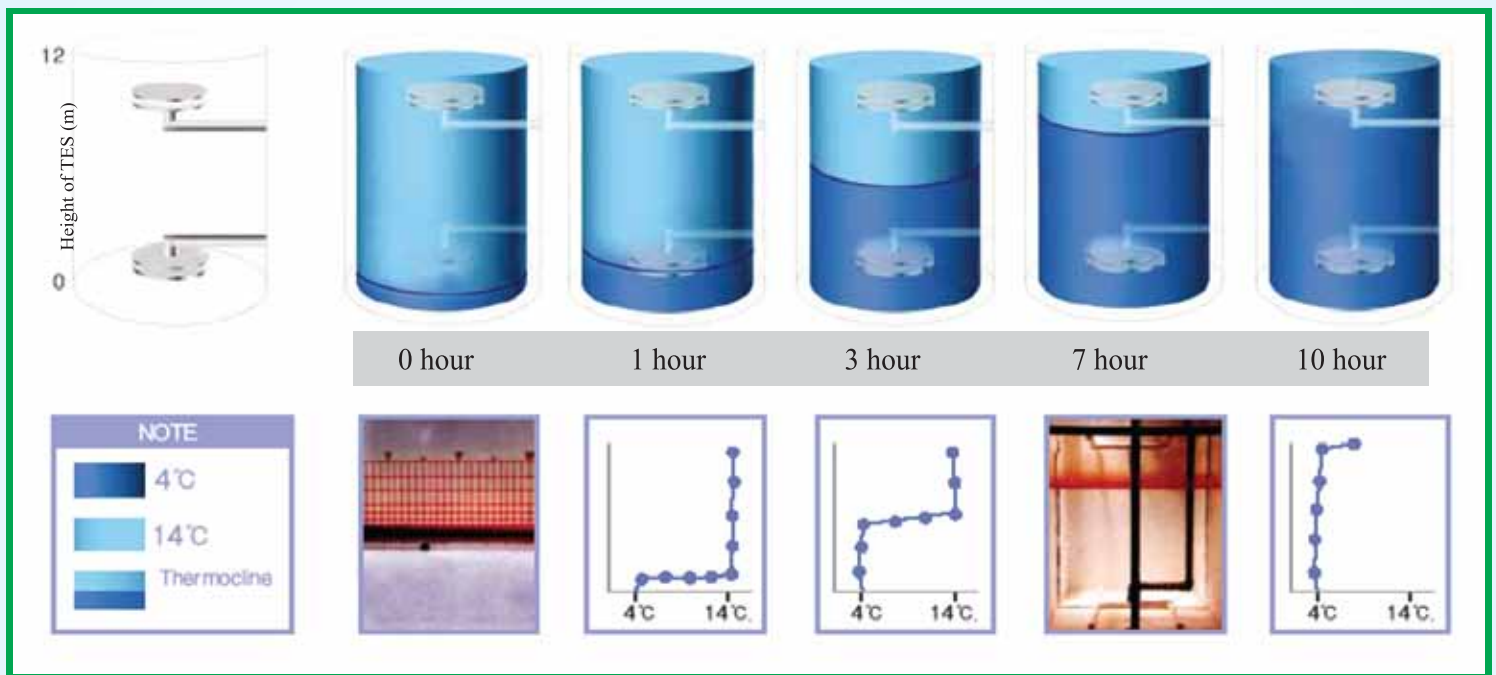
Fig. 6: India: Polio Vaccination Movement



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recently, fresh polio cases were still being reported. One of the reasons for the failure of Polio Vaccination program in India is the absence of an effective cold chain which rendered the vaccine ineffective.

Why such losses in this region?

- High Ambient temperature
- Poor transport infrastructure
- Lack of knowledge and awareness
- Poor roads and poor connectivity
- Dusty atmosphere
- Non availability of refrigerated carriers
- Difficult Geographical terrain
- Cold Chain Infrastructure is a Non priority sector for the administration as there are more important priority areas where funds need to be deployed
- Less evolved cold chain shipment regulations
- Unreliable grid power.

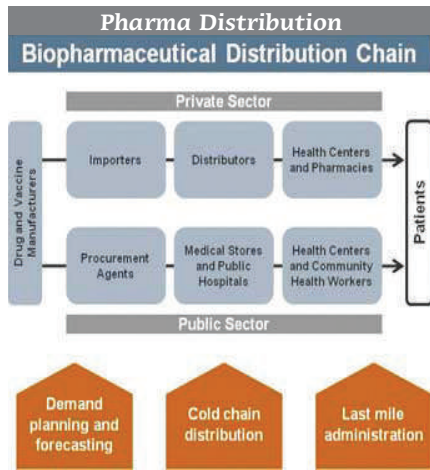


Fig. 7: Pharma Distribution Chain

Distribution Challenges

- Improving forecast accuracy and data reliability for estimating vaccine or drug demand.
- Maintaining product stability throughout the distribution chain, including requirements for cold-chain continuity.
- Managing the dispensing of medical products to patients in the "last mile" of the distribution chain (i.e., the stage where products are delivered from the wholesaler or pharmacy to the consumer).

Handling the Last Mile-Challenges and Opportunities



Fig. 8: Transporting medical supplies in South America



Fig. 9: Transporting vaccines in Bangladesh

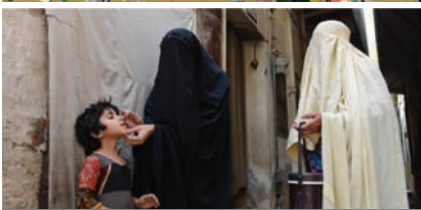


Fig. 10- 12: Vaccination during Kashmir flooding in September 2014

Challenges

- Requirement of Smaller Quantities
- Lack of availability of recognised Cold Chain
- Field Difficulties
- Dusty atmosphere
- High ambient Heat
- Language Barrier
- Social Barriers
- Unavailability of Grid Power.

Opportunities

- Extension of Cold Chain right till the end
- Innovative Methods of Maintaining Cold Chain
- Indigenous Methods of Preservation
- Innovation and use of Technology in communication.

Pharmaceutical Sector vs Agricultural Sector

- Economic Losses more severe in Pharma sector
- Administering a damaged vaccine or drug is far more dangerous
- Erosion of the sense of security in vaccination
- Pharma Volumes smaller to justify air transportation over ocean transportation
- Urgency of requirement in case of vaccines and drugs during natural disasters like cyclones, floods etc.

Features of effective Cold Chain

- Temperature Measurement, Monitoring, Control and Recording
- Traceability

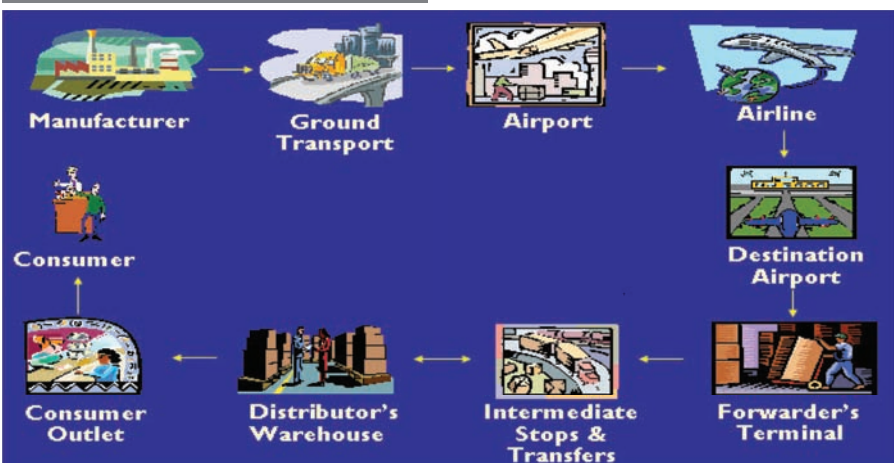


Fig. 13: Pharma Product Transportation Chain

set temperature in style



Honeywell thermostat series

Honeywell's HVAC expertise reflects in the high-end controls that enhance comfort and optimize energy in buildings of all types.

The HALO fan-coil digital thermostat series offers a stylish slim-line design with large green/ blue/ monochrome backlit screen that blend well with aesthetics. With energy saving capabilities, easy installation features, easy-to-read digital display and settable key lock, HALO is perfect for offices, hotels

and residential apartments. These thermostats come in a range of programmable/ non programmable variants.

Besides, Honeywell also offers a range of both digital and electro-mechanical thermostats to suit diverse HVAC applications.

Honeywell

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Various Partners in Temperature Controlled Pharma Products Transportation Process

- Manufacturer
- Ground Transport
- Airport
- Airline
- Destination Airport
- Forwarder's Terminal
- Intermediate Stops & Transfers
- Distributor's Warehouse
- Consumer Outlet
- End Consumer.

Challenges in the Transportation Process – Manufacturers' end

- Good Quality Raw Materials
- Controlled Manufacturing Practices
- Cleanliness
- Dust Free Atmosphere
- Strict Quality Control
- Good Packaging
- Traceability
- Storage in Required Temperature and Atmospheric Conditions.

Challenges – Ground Transport

- Delicate Handling while loading into truck
- Correct Stacking and Stowage inside the Truck
- Transportation under Required Temperature and Atmospheric Conditions
- Prevent deterioration and Ensuring Durability of the Packaging
- Challenges in the Export Process – Departure Airport
- Delicate handling during unloading from the truck
- Storage under Recommended Temperature and Atmospheric Conditions during the waiting period
- Careful handling during transfer into the aircraft.

Challenges – Airline

- Correct Stacking and Stowage inside the Aircraft

- Adequate Lashing and Securing of the Packages to prevent movement and vibration
- Maintenance of Correct Temperature and Atmospheric Conditions during the flight
- Regular Monitoring and Recording of Temperature and other conditions.

Challenges – Destination Airport

- Delicate handling during unloading from the aircraft
- Storage under Recommended Temperature and Atmospheric Conditions during the waiting period of arrival formalities and documentation
- Careful handling during transfer into the Forwarder's Terminal.

Challenges – Forwarder's Terminal

- Maintenance of Correct Temperature and Atmospheric Conditions during the period of stay in Forwarder's Terminal
- Regular Monitoring and Recording of Temperature and other conditions.

Challenges – Intermediate Stops & Transfers

- Careful handling during transfers
- Correct Stacking and Stowage during transfers
- Adequate Lashing and Securing of the Packages to prevent movement and vibration during transfers
- Maintenance of Correct Temperature and Atmospheric Conditions
- Monitoring and Recording of Temperature and other conditions
- Challenges in the Export Process – Distributor's Warehouse
- Maintenance of Correct Temperature and Atmospheric Conditions during storage
- Monitoring and Recording of Temperature and other conditions during storage
- Maintaining Traceability
- Cleanliness and Dust Free Atmosphere.

Challenges – Consumer Outlet

- Maintenance of Correct Temperature

and Atmospheric Conditions during storage

- Monitoring and Recording of Temperature and other conditions during storage
- Maintaining Traceability
- Cleanliness & Dust Free Atmosphere
- Careful handling
- Easy Accessibility
- Simple and Efficient Documentation during Dispensing.

Challenges – End Consumer

- Maintenance of Correct Temperature and Atmospheric Conditions during storage
- Small quantities – easy to store and handle
- Careful handling
- Maintaining the Required Documentation and Records

Remember, the process ends only after the product is finally used by the end consumer.



Fig. 14: The End Consumer

Case A: Developed Countries

To assess the knowledge and practice of vaccine storage and handling in primary care physicians' offices, a cross-sectional study was conducted in Canada from August to December 1992. Staff responsible for vaccine storage were interviewed about their knowledge and practices of vaccine handling and storage. Refrigerators were inspected to document refrigerator temperature and vaccine storage conditions. Out of a total of 135 respondents, less than 7 answered all questions related to vaccine storage and handling correctly, and only 11 refrigerators had thermometers. 1/3 of refrigerators had temperatures outside the recommended range of 2-8°C. Older refrigerators were more likely to have inappropriate temperatures than newer ones. The Study concluded that knowledge and practice of vaccine



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storage & handling are often inadequate in primary care physicians' offices.

Case B: Developed Countries

Maintaining the vaccine cold chain is an essential part of a successful immunization programme, but in developed countries faulty procedures may occur more commonly than is generally believed. A survey was conducted in 1999 in a health district in central Italy to assess the methods of vaccine transportation and storage. Of 52 primary vaccination offices inspected, 39 (76.5%) had a refrigerator for vaccine storage but only 17 (33.3%) kept records of received and stored doses. None of the seven main offices selected for monitoring had a maximum and minimum thermometer and none monitored the internal temperature of the refrigerator. Moreover, other faulty procedures, such as the storage of food and laboratory specimens in vaccine refrigerators and the storage of vaccines on refrigerator door shelves, indicated that the knowledge and practice of vaccine storage and handling were often inadequate.

Case C: Developed Countries

A refrigerator stopped working at the Tuen Mun Hospital, Hong Kong. It wasn't until 2 days after the vaccines were kept out of their temperature range when a nurse realized that the refrigerator wasn't working. During those 2 days, over 40 children were vaccinated with BBC and Hepatitis vaccines that came from that refrigerator. The event is still under investigation, but it was caused by inadequate temperature monitoring during the storage of vaccines.



Fig. 15: Failed Cold Chain - Case C

Developing Countries: Some Inroads

Solar Chill Project

Affordable, easy to use refrigerators

that can keep vaccines at safe temperatures within the infrastructure limitations of developing countries are an important tool in improving vaccine delivery. Already some inroads have been made in the direction. Solar Chill is a global initiative with WHO, Greenpeace, Danfoss, UNEP and many other industry partners that has developed a climate and ozone-friendly portable vaccine cooler that is powered by solar energy and which will directly help improve the health of children in developing countries when used to transport vaccines and drugs to the remote and inaccessible parts.

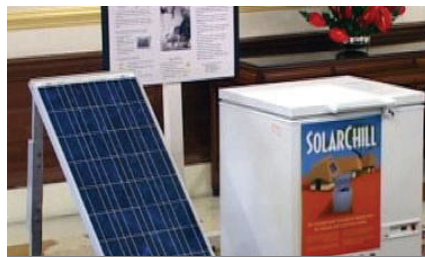


Fig. 16: Solar Chill Project



Fig. 17: Vaccine Vial Monitor

PATH (Programs for Appropriate Technologies in Health)

PATH is an international, nonprofit organization and a partner in Solar Chill project. It develops safer injection technologies such as auto-disable syringes, pre-filled injection devices, and medical waste systems making injection safety an attainable goal for many struggling health systems. It helps in refining the vaccine distribution cold chain including identifying cold chain weaknesses, finding ways to overcome cold chain problems, and identifying improved cold chain refrigeration systems. It has developed affordable, easy to use refrigerators that can keep vaccines at safe temperatures within the infrastructure limitations of developing countries are an important tool in improving vaccine delivery.

Vaccine Vial Monitor

VVM is now used globally to increase vaccine efficacy and reduce wastage. A heat-sensitive label changes color as it is exposed to heat and helps health workers decide whether or not the vaccine has been damaged by heat. It also reveals breaks in the vaccine distribution cold chain.

Energize the Chain

This is a non-profit organization in Zimbabwe which has installed 110 refrigerators which work on energy from

Symbol	Explanation	Stage
	The inner square is lighter than the outer circle. If the expiry date has not passed, USE the vaccine.	I
	As time passes the inner square is still lighter than the outer circle. If the expiry date has not passed, USE the vaccine.	II
	Discard point: the color of the inner square matches that of the outer circle. DO NOT USE the vaccine.	III
	Beyond the discard point: inner square is darker than the outer circle. DO NOT USE the vaccine.	IV

From WHO (www.who.int).

Fig. 17: Vaccine Vial Monitor



Fig. 18: Energize the Chain in Zimbabwe

cell towers. It has managed to vaccinate a quarter of a million children in the region.

Solar Powered Vaccine Refrigerator

A second generation Solar Powered



Fig. 19: Vaccine Refrigerator in Congo

custom built Vaccine Refrigerator has been developed locally in Congo and is used for vaccination in remote corners of the region.

Ebola Virus

Even if we find a preventive vaccine



Fig. 20: The Ebola Virus Impact

cure for the current outbreak of Ebola virus disease, the biggest challenge would still be how to transport and store vaccines in areas of developing countries without reliable access to electricity.

Cold Chain Logistics

It is imperative to have an unbroken, gap-free and seamless cold chain for handling temperature sensitive pharma products and vaccines in particular if the benefits of advancements in medical technology are to reach the far corners of the society.

Social reach of technology is more important than technology itself. ■



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Refrigerating vehicle or refrigerated packaging

How to choose for the transport of health products!



Subject to strict regulations and to stringent requirements, the distribution of temperature-sensitive health products is experiencing strong growth and considerable progress. The distribution players look for the most optimized solutions in terms of performance and cost to secure the cold chain.

The user may wonder which is most suited to transport temperature-sensitive products: refrigerating vehicles or refrigerated packaging. We examine in this article the main parameters that determine the choice: product requirements, logistics constraints, the cost, and the impact on the environment. Refrigerating vehicles are used for national distribution, in the form of grouped transport. Refrigerated boxes are used for national and international distribution requiring air transport, and for various product quantities. Both means can be associated in certain cases

to avoid the cold chain break during transfer and delivery, for temperature profiles containing cold and warm segments, or for extreme conditions.

The requirements of the logistics and transport of health products under controlled temperature are always increasing. This growth is the consequence of progressively stricter regulations and continuous controls over cool chain quality. It is also motivated by the decisions of the participants the cool chain field for health products in order to improve the quality of their services. Pharmaceutical companies, suppliers of equipment,



distributors and service providers are committed to a continuous process of improvement, putting in a lot of effort to meet expectations and statutory requirements, and also to guarantee patient safety.

The objective of this study is to analyse the main parameters that determine the choice between refrigerating vehicles or refrigerated packaging and to present the advantages and the limits of both solutions.

Thermal Balance

The refrigerating capacity of a vehicle or a refrigerated box is calculated on the basis of a heat balance, using coefficient of heat transfer K (W/m^2K).

The main parameters used to size a refrigerated box are:

- Product requirements: temperature range, thermal inertia, dimensions and quantity.
- Logistic constraints: required duration, ambient temperature profile.

The insulated vehicles bodies are classified in into two categories, normal and reinforced, according to their overall

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coefficient of heat transfer. The refrigerating vehicles are classified into six classes (A, B, C, D, E and F), according to their temperature range:

- Class A: between $0^{\circ}C$ and $+12^{\circ}C$. This is the nearest class to $+2/+8^{\circ}C$ pharmaceutical temperature range.
- Class B: between $-10^{\circ}C$ and $+12^{\circ}C$
- Class C: between $-20^{\circ}C$ and $+12^{\circ}C$
- Class D: $-20^{\circ}C$
- Class E: $-20^{\circ}C$ to $-25^{\circ}C$
- Class F: $-25^{\circ}C$ to $-40^{\circ}C$. This class is the most adapted to frozen pharmaceutical products (below $-20^{\circ}C$).

Selection Criteria and Parameters

Between refrigerating vehicles and refrigerated packaging, the user may wonder which is most suited to transport temperature-sensitive products. Let us examine the main parameters which determine the choice.

Product requirements

The temperature range of products and the accepted excursions can often promote one solution over the other. The tolerances are specified by the manufacturer's laboratory, after carrying out stability tests on the product. When both solutions can guarantee the required temperature, the quantity to be shipped is a decisive parameter to choose the shipping solution, because it has a higher impact on the transportation cost.

Logistics constraints

The medicines are initially transferred from the manufacturer's laboratory to a distribution site, then distributed to public and private hospitals or to retail pharmacies, directly or by way of a distributor. The temperature profile expresses the segments of the logistics circuit (duration, temperature), from the shipper's site to the consignee's site. In a closed segment, the temperature is controlled or relatively stable, and does

not follow the climatic temperature directly (cold chambers, temperature controlled rooms, work or storage warehouses and closed vehicles...). In an open segment, the temperature is not controllable and is not stable because it follows directly the climatic temperature (airport tarmac, open loading and delivery zones).

Qualification and validation

The solution must be qualified according to current standards. Several references (standards, guidelines and recommendations) have been established to qualify the thermal performances of refrigerated packaging:

- NFS 99-700: Isothermal and refrigerating containers for health products, Thermal performance qualification method. It is an approved French standard.
- ASTM D3103-07: Standard test method for thermal insulation performance of distribution packages. It is an US standard.
- ISTA 7D and 7E: Thermal controlled transport packaging for parcel delivery system shipment.
- WHO/IVB/05.23: Guidelines on the international packaging and shipping of vaccines.

While waiting for the establishment of a special qualification standard of refrigerating vehicles or health products, the transport companies apply the 'Agreement on the transport of perishables and special vehicles to be used for this transport', the ATP agreement which concerns food.

Costs involved

If two concepts meet the right specifications, the solution which has the lowest cost will be selected. It integrates all the costs engendered by the preparation, the use and the transport (equipment, energy consumption, staff salaries and sundry expenses). The safety margin must be

estimated without exaggeration, to avoid the useless requirements which complicate the solution and increase the cost.

Environmental impact

The impact on the environment is another parameter to be analysed in the evaluation of a solution. The lifecycle analysis for the same provided service (equivalent result) allows us to compare the impact on the environment for each solution. This analysis integrates the systems, the materials and the energy required for a solution throughout its lifecycle, from the extraction of raw materials up to the treatment at the end of life.

Test Results and Discussion

A health temperature-sensitive product must be maintained within a given temperature range to preserve all its properties, during its validity time. It may be degraded by heat cumulative effect, or by cold (freezing). The required temperature range is defined in the marketing authorisation (MA), according to stability tests.

Tests were performed in different situations to analyze the breaking of the cold chain and the temperature excursions in the case of refrigerating vehicles or refrigerated boxes.

Temperature rise of vaccine and water bag: Thermal inertia

The test is performed with a glass vial containing 1.5 g of liquid (vaccine) and a 25 g small water bag. Both products are stabilised at $+5^{\circ}\text{C}$, then removed from the refrigerator and placed at $+21^{\circ}\text{C}$ (-1°C). The temperature of the vaccine increases quickly and crosses $+8^{\circ}\text{C}$ after 3 minutes and reaches $+15^{\circ}\text{C}$ after 12 minutes. The temperature of the water bag crosses $+8^{\circ}\text{C}$ after 9 minutes and reaches $+10^{\circ}\text{C}$ after 12 minutes. The vaccine has a low thermal inertia. The figure 1 gives the temperature rise of both products. It shows the inevitable cold chain failures when a vaccine or another medicine is exposed to heat or cold.

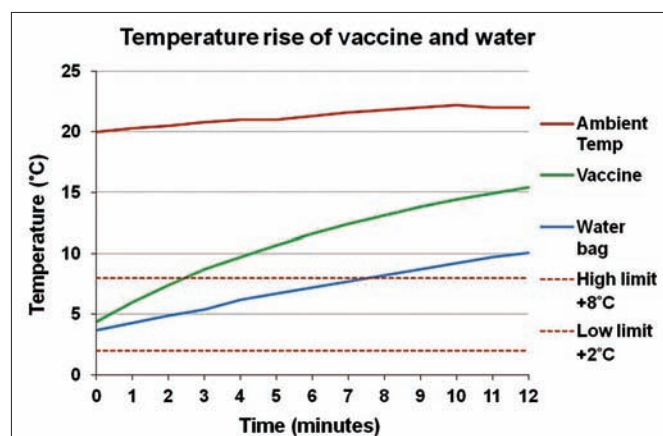


Fig. 1: Temperature rise of vaccine (1.5 g) and water bag (25 g), at $+21^{\circ}\text{C}$ ($\pm 1^{\circ}\text{C}$)

Door opening effect in refrigerating vehicles

The test simulates the door opening of a refrigerating truck, for an external temperature of $+22^{\circ}\text{C}$ (-1°C).

Three probes recorded air temperature; the first is placed 0.8 m above ground and 30 cm close to the door, the second 1.50 m above ground and 30 cm close to the door, and the third in the supply air. Two recorded the product temperature; the first in the middle product and the second in the product near the door. The door is open three times: for 5 minutes, for 1 minute and for 5 minutes. Before opening the door, the supply air temperature is between $+2.6$ and $+6.7^{\circ}\text{C}$, the air temperature near the door is between $+3.3$ and $+6.1^{\circ}\text{C}$, and the product temperature is between $+4.9$ and $+5.8^{\circ}\text{C}$. During and after opening the door the supply air temperature is between $+2.0$ and $+5.5^{\circ}\text{C}$, the air temperature near the door is between $+8$ and $+16.5^{\circ}\text{C}$, and the product temperature is between $+7.2$ and $+9.4^{\circ}\text{C}$. The results show a difference between air temperature and product temperature, and also a difference between air temperatures 0.8 m and 1.50 m above ground. If the opening door is longer than 1 minutes the product temperature may exceed $+8^{\circ}\text{C}$. The figure 2 gives the temperature variations of each probe. It cold chain failures when we open the door of refrigerating vehicle.

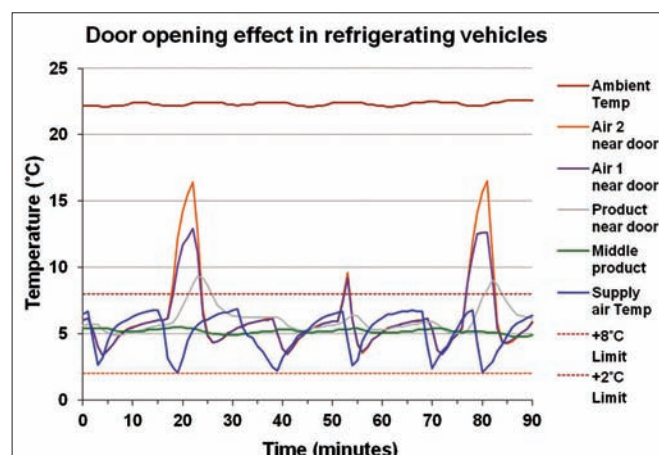
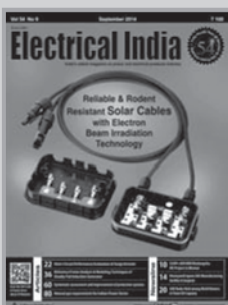
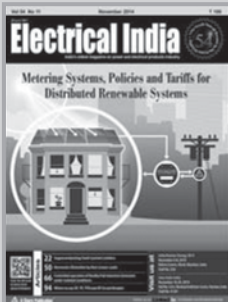


Fig. 2: Door opening effect in refrigerating vehicles

Qual ification tests of refrigerated packaging

Performance qualification tests are performed on a 419L refrigerated box, designed for at least 96 hours. The insulated box is made with 60 mm thick rigid polyurethane panels and refrigerated by eutectic gel packs. Gel packs are frozen at -20°C and then stabilized at -2°C to avoid the freezing risk of products. Three probes are placed to record the product temperatures in the bottom corner, the top corner and the middle.

- Test at $+20^{\circ}\text{C}$ constant temperature: It simulates a transport in air conditioned truck set at $+20^{\circ}\text{C}$. The box maintains products between $+2^{\circ}\text{C}$ and $+8^{\circ}\text{C}$ without excursions, for at least 96 hours (See Figure 3).
- Test at varying temperature profile: This profile includes moderate segments at $+20^{\circ}\text{C}$, hot segments at $+40^{\circ}\text{C}$ and cold segments at 0 and $+5^{\circ}\text{C}$. It simulates a logistics circuit containing air transport leg. $+20^{\circ}\text{C}$ represent air conditioned truck or moderate temperature. $+5^{\circ}\text{C}$ represents a cold room or a refrigerated truck. $+40^{\circ}\text{C}$ and



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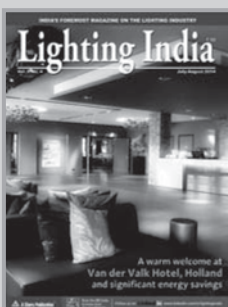
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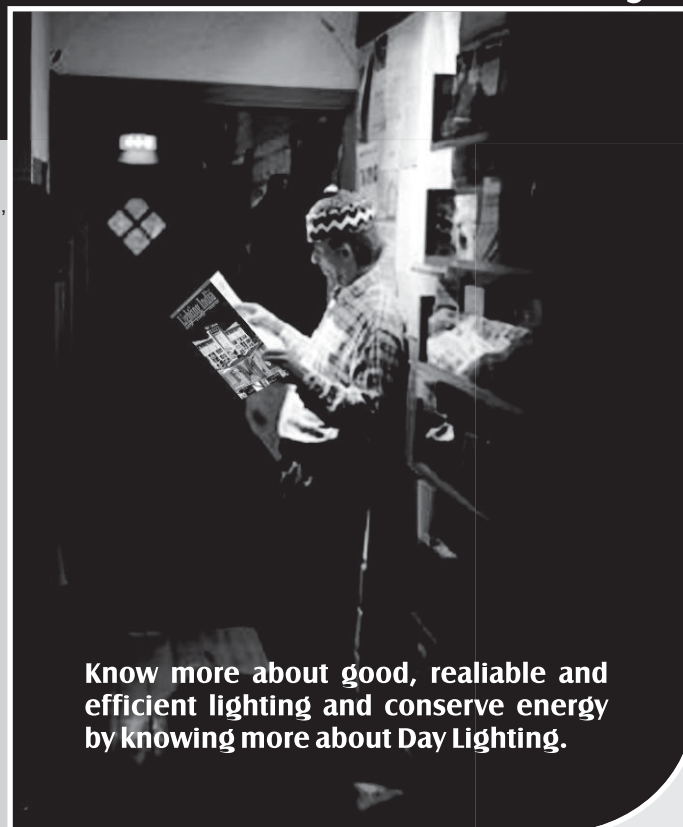
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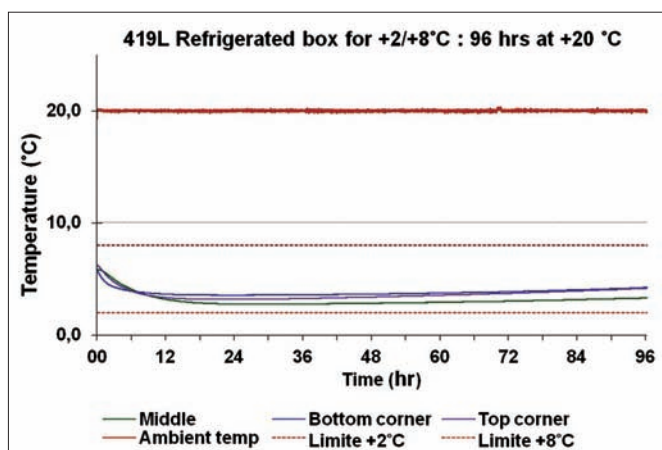
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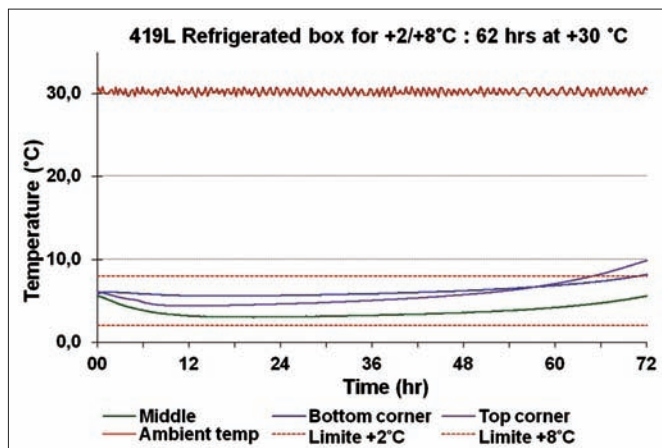
**Fig. 3: Test at constant temperature +20°C:
96 hours at least between +2°C and +8°C**

0°C represent open logistics segments such as airport tarmac. The refrigerated box maintains pharmaceutical products between +2°C and +8°C without excursions, for at least 96 hours (See figure 4).

- Test at +30°C: It simulates a hot temperature profile in a vehicle without air conditioning. The refrigerated box maintains pharmaceutical products between +2°C and +8°C without excursions, for at least 62 hours. The duration is reduced by at least 35% compared to the tests at +20°C (See figure 5).
- Test at +10°C: It simulates a cold middle season profile, in order to analyse the freezing risk. The most disadvantaged probe crosses the low limit +2°C after 10 hours 37 minutes, but the temperature remains above +1°C for all the probes and during 48 hours (See Figure 6).

Results Analysis

The tests results allow the impact analysis of the cold chain parameters and their importance in the selection of the adapted solution (refrigerating vehicle or refrigerated packaging).



**Fig. 5: Test at constant temperature +30°C:
62 hours at least between +2°C and +8°C**

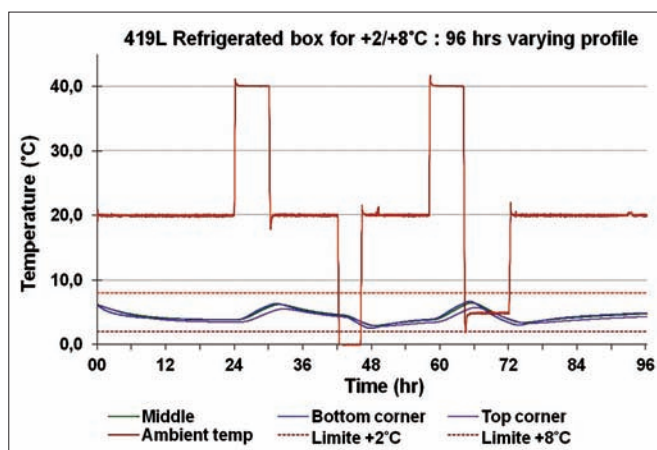


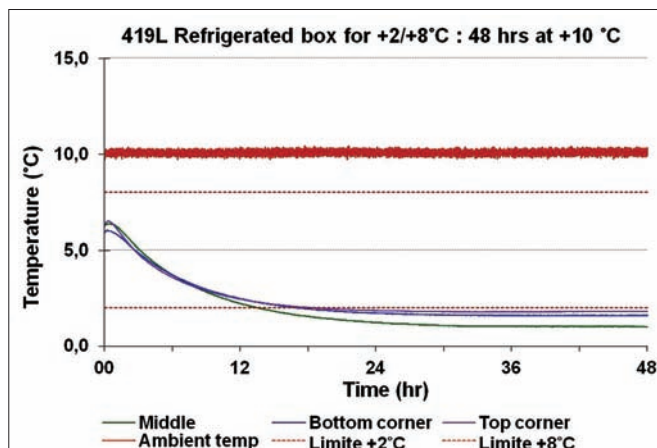
Fig. 4: Test at varying temperature profile: 96 hours at least between +2°C and +8°C

Impact of product requirements

- Refrigerated boxes and refrigerating vehicles are used to transport products between +2°C and +8°C, between +15°C and +25°C, and at -18°C.
- Insulated boxes refrigerated by dry ice are used for very low temperature (below -30°C).
- Accepted tolerances (excursions) allow the choice of solutions with simple configuration and reduced cost. For example, a refrigerated packaging for the strict range between +2°C and +8°C (without excursions) is heavier, larger and more expensive than another qualified between +1°C and +9°C (without excursions).
- The quantity of products to be sent is also an important selection factor. For small quantities, refrigerated packaging is used. The transfer of heat-sensitive pharmaceutical products from the manufacturer's laboratory to storage or to the distribution site is often made by a refrigerating vehicle because several temperature sensitive products for several final consignees can be grouped together easily.

Impact of logistics constraints

The logistics circuit allows an initial selection and the



**Fig. 6: Test at constant temperature +10°C:
48 hours at least between +1°C and +8°C**

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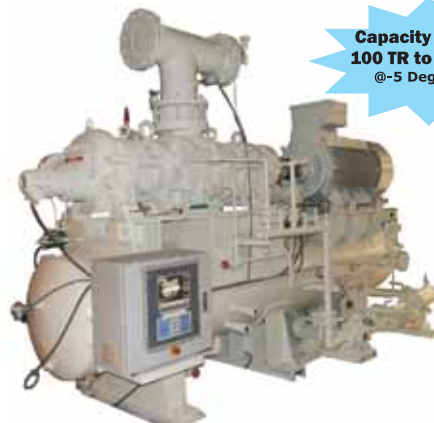
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management of available logistics infrastructures should be adapted to the solution and conversely.

- Refrigerated packaging with frozen packs should not be placed in refrigerated rooms.
- The use of refrigerating vehicles is adapted to the transport from the manufacturer's laboratory to the storage or distribution site, and for groupage transport. In this case, loading and unloading zones and hubs must also be refrigerated to avoid any break in the cold chain.
- Refrigerated boxes are used for logistics circuits containing an air transport leg (international shipping and national shipping for long distances), and when hubs and zones of loading and unloading are not refrigerated.
- In complicated cases, both solutions are combined to avoid the cold chain failures. Refrigerated boxes can be used in association with air-conditioned vehicles.

Qualification and validation

The qualification of the cold chain equipment and the validation of the transport process are required in the pharmaceutical field. The solution must also comply with national and international regulation. Risk analysis will be necessary to identify critical points and possible failures, and also to take preventive measures or corrective actions. The user must choose the most appropriate standard to qualify the solution. The players in the cold chain field are conscious of the importance of a specific standard, to qualify refrigerating

vehicles for pharmaceutical products. Relevant destinations should be selected to validate the transport process.

Good practices

A good qualified solution is not enough if good practices are not applied. Non-compliances are due in large part to human errors. All stakeholders in the distribution chain must be trained and informed. The standard operating procedures should be clearly established and strictly respected. Rules of good practices must be applied to guarantee the efficiency of the temperature-controlled concept.

Refrigerating vehicles: It is necessary to stabilise the insulated body of the vehicle at the required temperature before loading. If the loading and unloading zones of the vehicle are not refrigerated the refrigerating unit must be turned off during loading and unloading. It is recommended to avoid placing products in the cold air flow of the refrigerating unit. When using a multi-temperature vehicle, products must not touch the separation wall of the compartments.

Refrigerated packaging: Insulated packaging should not be stored in a cold room before removing frozen gel packs. For refrigerated packaging, which has different configurations for summer and winter, it is required to make sure of weather forecasts before changing the configuration. The validated operating instructions for the preparation and loading must be respected. The exposure time of the insulated box in open environments must be reduced to the minimum possible.

Conclusions

Refrigerated packaging and refrigerating vehicles are not necessarily in competition, but are complementary resources. Both solutions can be used for cold products, for ambient products and for frozen products. Each solution is adapted for certain cases and for certain stages of the distribution process of medicines. Both solutions must be qualified, and requires precautions and good use practices to guarantee its efficiency. Refrigerating vehicles are used for the national distribution of health products, in the form of groupage transport or of transport of batches. Refrigerated boxes are used for international shipping and for long distances in national distribution, because the logistics circuit contains an air transport leg, and for the distribution of various volumes of products, which do not justify the mobilisation of a refrigerating vehicle.

The combination of both means is the most secure solution to guarantee the cold chain. Insulated boxes without cold source are combined with refrigerating vehicles to avoid a break in the cool chain in the transfer and delivery zones, or to protect the products from the cold air flow (below +2 °C) from the refrigerating unit. Air-conditioned vehicles are combined with refrigerated packaging for temperature profiles containing cold segments and warm segments, or for extreme conditions. The cost and the impact on the environment are also key competitive factors in the selection of the cold chain solution. Well established specifications involve an optimized solution and a reduced cost. ■



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HMX is ISO 9001:2008 certified with high focus towards safety

Anindya Lahiri, President – HMX, A business unit of A.T.E. Enterprises, in an exclusive interview with **Cooling India** says, our technology is unique that has virtually put us in a distinct position as far as the competition goes.



You have had an excellent exposure towards energy and environment. How they are inter-related from the view-point of its significance in the HVAC industry? Also do you think indoor air quality is a big challenge?

Energy-intensive equipment increase CO₂ emissions contributing to the climate change phenomenon. It is true for the HVAC sector as well. In fact, in countries such as India, the fastest growing contributor to electricity consumption and hence to greenhouse gases is cooling through air conditioning. Energy efficient cooling is hence critical to greenhouse gas abatement.

Maintaining good indoor air quality (IAQ) is definitely a challenge to all concerned – manufacturers and end-users. Higher quantities of fresh air and more filtration to ensure better IAQ have the potential to raise capital and operating costs for the end-user. The challenge for the manufacturer, therefore, is to provide most cost-effective solutions that in many cases mean retrofits. However, better indoor air quality has significant positives too. A growing number of studies in the education, healthcare, and manufacturing industries have shown an increase in productivity with higher fresh air content. In a peer-reviewed study in 2003, operators at a call centre in a tropical climate zone performed nearly 9% better when fresh air levels were increased. Offices and dormitories with higher fresh air content have reported lower incidences of flu and respiratory tract infection. A similar study published in 2004 showed investments to upgrade “unhealthy” buildings in Europe had a payback period of less than two years with an improvement in productivity by just 0.5%.

Could you detail us about HMX business unit and your role?

HMX, which was earlier HMX Systems Private Limited, has been in the business of providing eco-friendly cooling solutions since 1999. HMX has been a part of the A.T.E. group since 2008. A.T.E. is a multifaceted engineering group with a legacy of over 75 years offering world-class products and solutions spanning several segments, textile engineering, wastewater solutions, energy efficiency solutions, flow technology, print and packaging solutions, besides the HMX cooling solutions.

I head the HMX business unit overseeing production, sales, marketing, projects, and service. I am entrusted with the responsibility of growing the business by customer satisfaction, market expansion, product development and expansion of application. My wide industry connect and experience in leading start-up business in renewable as well as established businesses in heating and cooling segments in the past is turning out to be very handy in pushing the frontiers of the business of HMX.

What is the product range and cooling solutions under the ambit of HMX business unit?

The HMX product range includes our well-known brand Ambiator of both draw-through and blow-through designs that provide fresh and cool air for both space and spot cooling applications for people comfort and process needs. Based on a combination of indirect and direct evaporative cooling, the Ambiator works on

100% fresh air and has become a household name in sectors where people comfort is key to productivity and which are focused on consistent product quality. Major multinationals and leading Indian companies in automobile, engineering, and food and beverage sectors in India have opted for this innovative cooling technology for factory cooling to get the best out of their workforce, and also for storage and process areas where treated fresh air is a must.

An optional addition of a 3rd stage with chilled water or a DX coil reduces the humidity at our machine outlet wherever required. The HMX pre-cooling units PCU-F and PCU-R are now expanding their base in industry as well as commercial sectors for pre-cooling of fresh air for large, conditioned spaces. Remote monitoring systems installed in our installations such as IT buildings have generated performance data to that show huge energy savings compared to other conventional technologies that are being used for the purpose. Nano and other mini-range of Ambiators are becoming established for residential and commercial complexes, for fringe area cooling like living rooms, common areas, sports halls, cafeterias, etc.

HMX provides application oriented cooling solutions based on two-stage evaporative cooling and HMX-Ambiator is a next-generation two-stage evaporative cooling solution. What are the advantages besides prominent features?

Foremost is the 100% fresh air that the HMX-Ambiator provides. Equally significant is its capability to give better cooling compared to conventional single-stage air washers that are mostly used to provide fresh air ventilation in the industry. With an innovative design of the heat exchanger that is used in the indirect portion of the two-stage machine, it achieves better cooling than the other two-stage machines available in the market, e.g. those based on other designs such as coil. Apart from better cooling, a lower humidity level at the outlet of the two-stage Ambiator compared to that at the outlet of the single-stage design is yet another advantage of this product.

Dry Air Most Air (DAMA) heat exchanger is a patented technology of HMX. Could you brief us about technology? Does it lead to energy saving also?

DAMA is HMX's proprietary modular plate-type heat exchanger used for indirect evaporative cooling. Its unique design and material of construction (substantially polypropylene) ensures that it is the most efficient heat exchanger design. Use of DAMA in various forms to provide customized cooling solutions to customers is the key to product package of HMX. The basic feature of the technology is non-addition of moisture at the outlet of the first stage, comprising a number of DAMA modules.

Energy efficiency is at the heart of HMX's technology. In addition to the obvious advantage of evaporative cooling in areas with favourable wet bulb depressions (WBD), DAMA's unique design also helps reduce the power consumed to achieve the same cooling. Based on a recent study, the specific consumption of the most efficient medium temperature chillers including air distribution, condenser, water and chiller pumps is 0.6 kW/TR. In comparison, in climates with favourable WBD such as in Nagpur, specific energy consumption of HMX-Ambiators was measured to be approximately 0.3 kW/TR. In addition, continuous optimization of its design has resulted in higher wet bulb efficiencies. This leads to very favourable comparisons against other technologies. For example, in a recent case of cooling a factory manufacturing precision components near Ahmedabad, HMX-Ambiators were able to deliver the same indoor conditions as an air-washer with 60% lower CFM, with corresponding savings in energy too.

What is the strategy that puts you on cutting edge against other companies in the similar line of products manufacturing? What do you envision for increasing business?

Our technology is unique that has virtually put us in a distinct position as far as the competition goes. Apart from technology, we have a multi-pronged strategy to drive our business. We focus

HMX Business Unit of A.T.E. Enterprises Private Limited is a part of the A.T.E. group. HMX provides application oriented cooling solutions based on two-stage evaporative cooling. HMX has its manufacturing facility in Bengaluru with all India sales, marketing, projects and service set up. The A.T.E. group is engaged in manufacturing, distribution and service in textile engineering, flow technology, machine-to-machine solutions, cooling solutions, wastewater solutions, energy efficiency solutions, and print & packaging solutions.



Product perfection and project execution have been the two most difficult challenges faced in the installations undertaken by HMX.

on people comfort where the skill level of workers is key to higher productivity. We also target niche segments with customised applications. Commercial applications for PCU-F and PCU-R are the other areas identified for growth. Venturing out of Indian shores has also been taken up as another strategy for business growth. Product upgrading, manufacturing scale-up and automation, team development and marketing collaterals will be the key strategies to sharpen the cutting edge against competition.

Could you detail about some of the challenges faced towards some of the interesting projects undertaken by HMX?

Product perfection and project execution have been the two most difficult challenges faced in the installations undertaken by HMX. Some deterrents like poor quality of water used in the Ambiator, lack of focus from customer on regular maintenance and component failures due to reliability and selection issues have taken up most of the time of the HMX team over the last few years. Most of the problems have now been taken care of and our service team is taking AMCs to ensure continuous operation of the machines at their rated performance. At A.T.E. and HMX we do not want to leave anything to chance when it comes to customer satisfaction.

Could you detail us about the manufacturing facilities and what quality standards does it enjoy?

HMX's manufacturing facility in Peenya Industrial Area, Bengaluru, employs more than 50 skilled people. Manufacture of some non-critical items is

outsourced. DAMA manufacture is one of the highlights of the overall set-up with major initiatives taken up to achieve perfection in fabrication and automation for scale-up. We have standardised the superior make bought-outs for the machines, to ensure higher reliability. HMX is ISO 9001:2008 certified with high focus towards safety in manufacturing as well as at project sites. We continuously meet the quality and safety standards laid down by our MNC customers in manufacturing as well as installation sites.

Are you participating in the coming cold chain event at Mumbai, though ACREX 2015 is not too distant and what new solutions would you be displaying?

Yes, we will be participating in ACREX 2015 after a gap of one year. In fact, HMX had been a regular at ACREX, winning awards for its products for three consecutive years. Cold chain is a new application for us and we are in the process of assimilating this application and finalizing the most appropriate solution for this industry. We will definitely target participation in 2016 after we are ready with our offering.

What are your vision and plans in the next two years?

Scale-up of business by focussing on our strong applications areas, working on new cooling applications like in print and packaging, pharmaceuticals, hospitality, residential, etc., with people comfort, energy saving and higher level of indoor air quality as the major points of focus. Foray into international business is one more area that will get a share of our attention in the coming years. Development of present product range to higher efficiency levels with lower energy band operation, operational efficiency with scale-up, and developing service business to garner higher customer satisfaction will be the major areas of concentration for our management team. In the process, we expect the business volumes to grow at CAGR of around 30% in the next 2-3 years. ■



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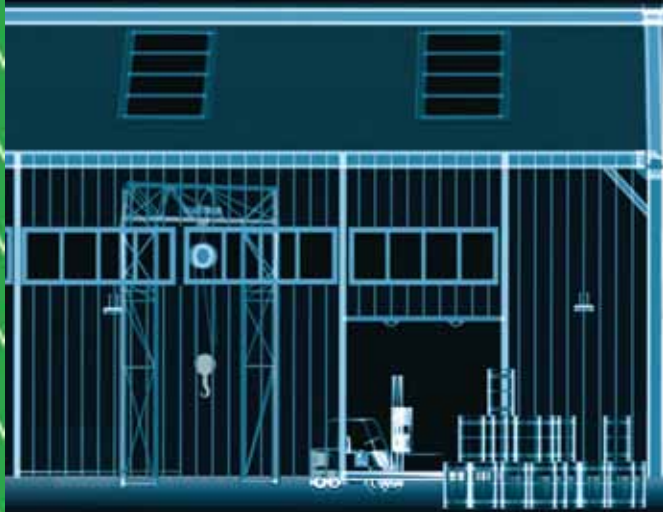
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India is a land of anomalies, on the one hand it ranks second in the production scale of fruits and vegetables and yet each year it struggles to make both ends meet in trying to feed all its citizens and nourish its young. The single most threatening reason behind this inadequacy is the imminent lack of cold chain infrastructure.

The inadequate distribution network has not been able to complement the rising production figures posted by the agriculture sector each year resulting in catastrophic losses in terms of both money and agricultural produce. Energy starvation is another factor adding on to the agony of our hardworking farmers. The farm produce goes through a complicated network of temperature controlled distribution network before it is actually available to the consumer at the retail end. This chain has become a vital subset to the supply chain which involves production storage and

distribution of perishable products. This chain in itself is highly energy intensive and due to exposure to weather elements as much as 70-80% of the farm produce each year goes waste. Agriculture is the principle source of livelihood for more than 58% of India's population and contributes 15% to the country's GDP (CII-FACE, 2014).

Challenge Facing Us

The single biggest challenge facing our largely agrarian economy today is to optimize the available solutions to achieve energy efficiency in such a way that the agricultural produce receives a

Sagar Chatterji, BE in Electronics and Communication Engineering from GautamBuddh Technical University, Lucknow, has experience in Solar PV and Thermal systems. He is currently working with Pluss Polymers Pvt Ltd., as an Executive-Business Development for Phase Change Materials focusing on HVAC/R and Renewable Energy Storage.



Globally the most matured market on the basis of adoption of the PCM technology is Europe. In India Pluss Polymers bears the distinction of pioneering distinction of pioneering Phase Change Materials (PCMs) for a wide variety of applications in India, and is among the distinguished few in the world heading this revolution. The company now has over 25 different PCMs ranging from -33 deg C to +89 deg C under its product portfolio with a mix of organic and inorganic PCMs. In India Pluss's focus is on offering cost effective PCM for the cold chain industry and hence reduce the capital investment associated with importing of PCM.

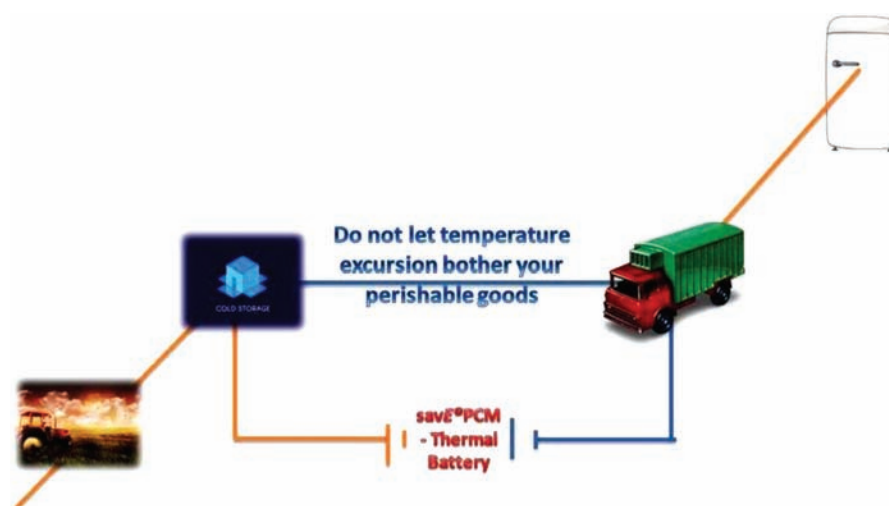
(Livemint, 2013). Cold storages are only as good as their ability to maintain the chilled temperature range required by most products produced at a farm. In the absence of electricity it proves to be a challenge to help maintain this temperature bandwidth.

PCMs can help overcome this problem of electricity cuts by storing the thermal energy when the cooling is available and in the absence of it maintain a crisp 5°C for as long as 6-8 hours providing that crucial fall back in temperature which could mean savings worth millions of Rupees a year in terms of the food grain losses that otherwise would take place.

decent level of temperature controlled storage and transport so that the losses can be cut down to an extent wherein we not only have enough agri-produce for our domestic usage but also surplus to export it and earn valuable foreign exchange. In a literature published by the Confederation of Indian Industries (CII) it says that limited post-harvest infrastructure and weak value chain linkages have resulted in losses amounting to 30% of the annual produce (Industry, 2014).

Phase Change Materials Technology

Phase Change Materials- let us first understand what Phase Change Materials (PCMs) are and how they work? PCMs work on the simple principal of latent heat absorption and emission whenever they change their phase from solid to liquid and vice-versa. PCMs act as reservoirs of thermal energy that can give of this energy later to help maintain temperature passively without an active source or electricity at the point of use. PCMs seamlessly fit into the different stages of the value chain to help preserve produce from the farm to the shop.



PCMs for Cold Storages

A report released in April 2013 by CII and McKinsey & Co. says that a sharp 320% rise in India's per capita GDP by 2030 will spur a growth to 4% consumption of food grains per annum. This would mean a larger consumption of processed food as well. Now in order that the market is able to cater to this demand a large part of the current Rs 11 Trillion market will have to strengthen its existing distribution network- cold storages being a vital cog in the wheel

PCM is a very good option to supplement solar based cold storage as it eliminates the requirement of a battery which has a limited shelf life and the losses during discharge cycle. "We are able to maintain the cold storage temperature from exceeding the desired temperature range of 2 - 8°C for over 15 hours during non-sun hours, making the system 100% independent of the grid" quoted Vivek Pandey – Director, Ecozen Solution Pvt. Ltd.



Micro cold storage by Ecozen Pvt Ltd: The cold storage run on solar energy during the day and PCM energy during the night.

PCMs for Cold Chain Transport for last mile distribution and farm to nearest Satellite Cooling Center

Cold chain would essentially lack its advantage if it were not to be ensured by a proper chain of logistics for inter as well as intra-city transport. In one of her speeches the Minister of Food Processing Industries Smt. Harsimrat Kaur Badal had

quoted that cold chain is a highly "Energy Intensive" sector. The challenge is to turn this "Energy Intensive" sector into an "Energy Effective" one. PCMs encapsulated in temperature control panels referred to as "Eutectic Plates" can help preserve food grains, poultry produce and meat for inter-city transport lasting over 16-30 hours by maintaining the required subzero temperatures without the active engagement of the vehicle's engine hence curtailing the consumption of fuel which is a win-win proposition for both the freight organizers and the consignee ultimately sharing the trickle down



An application of removable PCM plates for last mile delivery of dairy products by Nestle India.



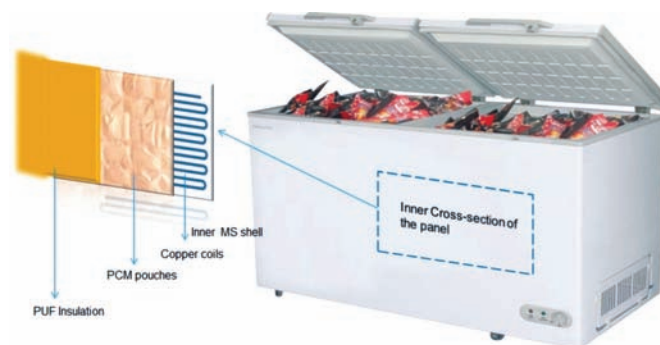
A PLUGn CHILL system by TESSOL Pvt Ltd: The refrigeration is provided by PCMs which is charged overnight using electricity.

profit right to the last customer. Lesser consumption of fuel also means a smaller carbon footprint which is a hugely added advantage. Last mile delivery of dairy products such as- milk, yogurt, butter etc. can immensely utilize the advantage of using PCMs which can be integrated in the vans and trucks with minimal engineering and can simply work as a temperature preservation mechanism without the involvement of a reefer unit.

PCMs for Freezers and Coolers at the Retail

India has the dubious distinction of being the largest producer of fruits and vegetables and yet wastes almost as much food as is being consumed by a country the size of UK annually, this figure amounts to Rs.13,300 crores per year, as reported by Emerson Climate Technologies, India in a report published by them in November, 2013 (Jayshree Bhosale, 2013). Rural sectors are the worst affected by apathetic attitude of the government in being able to provide full time electricity to parts of the country.

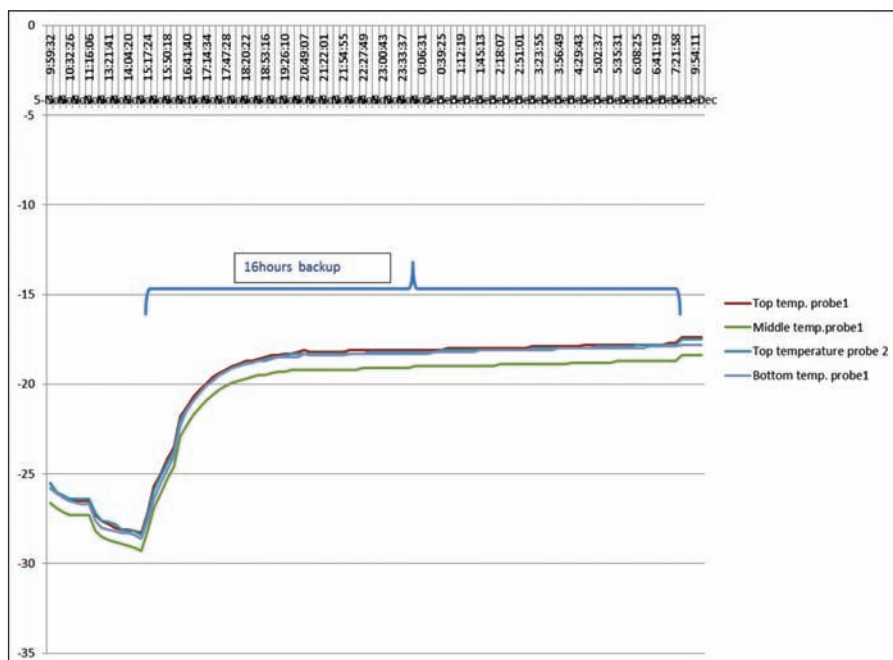
Small time retailers dealing in ice-creams, and other dairy products bear the brunt of the loss of goods as a result of exposure to higher levels of temperature. PCMs have been and can help tackle this problem to a great extent. PCMs have been integrated in chest freezers and chest coolers and have had huge success in helping maintain a temperature of -20°C for up to 16 hours without direct provision of electricity. Certain commodities such as processed peas, ice creams etc. need temperatures to be maintained between -18 and -25°C. PCMs can do so seamlessly even in the absence of electricity simply by acting like "Thermal Batteries". Ice-creams for instance are a high value commodity whose temperature maintenance is imperative to its seller.



The above graph shows how a negative 23°C PCM is helping maintain the required temperature bandwidth without incorporating active cooling for up to 16 hours.

As of 2012, India had approximately 6,300 cold storage facilities, with a capacity of 30.11 million metric tonnes. 12 of the total number of facilities; about 60 percent are located in just four states: Uttar Pradesh, Gujarat, West Bengal and Punjab. Uttar Pradesh has the highest present capacity of 10.187 million metric tons with a gap of 20 per cent pegged at 2.041 million metric tonnes.

According to ASSOCHAM, during the period of 2009-2017, the cold chain industry in India is expected to grow at a CAGR of around 25.8 per cent to reach INR 64 billion. The National



Horticulture Board (NHB) recommends that investments worth INR 550.74 billion in new cold storage capacity 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 relationship

in India" (Balan, 2013). This is according to a report published in "Food wastage and cold storage infrastructure relationship in India". Food preservation and wastage in food grain prevention is undeniably one of the most important aspects that need to be addressed immediately. Integration of PCM can be an answer to the above stated problems, but a conscious effort needs to be made to understand loopholes in the system and innovative products that help optimize the use of energy should be promoted among the industrial magnates to promote adoption of such products.

Introduction of subsidy schemes may not be enough to incentivize the usage of energy storage material and devices, keeping in mind the grim future ahead the government and the authorities need to go the extra mile to help motivate people to use innovative materials to save energy, costs and losses. ■

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Upgradation of Cold Stores -Energy Management Strategies

India is blessed with diverse agro-climatic conditions and produces a wide variety of fruits and vegetables. It ranks second in production of fruits & vegetables after China. Despite second largest producer of horticultural crops, India wastes 25-30% of valuable produce annually during postharvest operations due to lack of postharvest infrastructure & awareness about postharvest handling & marketing practices.

Causes of postharvest losses

- Lack of awareness about post-harvest handling practices;
- Gaps in cold chain like poor infrastructure;
- Insufficient cold storage capacity;
- Unavailability of cold storages in close proximity to farms;
- Poor transportation infrastructure etc.

Cold chain is a subset of the entire supply chain involving the production, storage and distribution of the perishable products that require controlled temperature in order to retain the product's characteristics and nutritive values for prolonged duration. In other words it is a logistics system, which provides & maintains a series of facilities for ensuring ideal storage conditions for the perishables from point to the point of sale.

Availability and efficient use of the cold chain i.e. temperature control, significantly affect food losses and waste. It is estimated that the rate of deterioration of perishables increases two to three fold with every 10°C increase in temperature within the commodity's physiological temperature range. It is also estimated that due to gaps in the cold chain, about 30 percent of the fruits & vegetables grown in India.

The analysis of existing cold storage depicts there are challenges with respect to the commercial viability of cold chain as with any business model. The unique drivers in cold chain is cost of power, driven by unreliable and infrequent power supply, requiring investment in auxiliary power units which raises the expenses approximately by 10%.

Energy consumption emerges as the major concern for cold storage providers considering it make up a substantial portion of operating costs. While the focus on energy consumption itself is not new for cold chain logistics but the tools and strategies to achieve it require innovation.

Cold storage providers are sharply focused on energy efficiency, sustainability, and maintaining a facility that is safe for the products they handle. From new facilities to old, cold storage providers would be incorporating design features and technologies that meet the countless demands of their customers. There are some six thousand potato cold stores in India and 74% of cold storage capacity is used for potatoes alone. The storage period is generally March to end November and due to storage at low temperature of about 2-4 degrees, potato tends to become sweet, there are problems of sprouting and dehydration. From cold stores perspective, these stores are not very energy efficient and with increasing cost of electricity,

their margins are shrinking. While these kinds of cold stores are continuing business as farmers are not willing to pay more tariffs and the large number of cold store owners feel that there is no incentive to modernize. Further, the store owners do not take any responsibility of the weight loss and quality deterioration during storage and generally service levels are poor. Ever since potato processing industry has realized the importance of special types of potato and quality (high dry matter, low sugar, firm and free from other defects) there is increase in cold stores with better storage conditions, the processors particularly large companies like Pepsi, McCain, Balaji and ITC are insisting on the following storage conditions-

- **Use of sprout suppressant:** CIPC which also enables storage of potato between 10-12°C.
- **High humidity:** More than 95% to avoid shrinkage and maintaining firmness of the potato which helps in peeling while processing.
- **Maintaining CO₂ level:** Less than 3000 ppm which avoids black hearts and stress to potato.

In conventional cold stores, the owners have tried implementing these conditions in bits and pieces and maintaining above mentioned accurately is very difficult. The store temperatures are maintained on the basis of air temperature and not the product temperature. CO₂ extraction is done only early in the morning by opening the door and some use CO₂ extraction pump and open the window on top floor. But the CO₂ level during day time is very high and it is not common to run CO₂ extraction during day time as outside air is very hot. In the store the temperature at various places are very high due to lack of proper ventilation and circulation of the air particularly in the stores based on Bunker technology. Due to these reasons the following problems are faced by processors

- Build up of sugar from July onwards which make potato unfit for processing.
- Sprouting of potato in some pockets which makes it unfit for processing.
- Potato become soft during storage due to dehydration and it is difficult to process.
- The rotting and overall losses are very high.

In spite of the fact that companies like Pepsi, McCain, Balaji and ITC who are organizing contract farming and take care during pre and post harvest operations are unable to get good quality potato till November due to not so good storage conditions. Recently looking at Pepsi's experience all over the world, PepsiCo India has introduced Dutch technology in India through world leader in potato storage system Omnivent Techniek. While new bulk stores with high investments have been set up at Kolkata and Gujarat, some more are in the pipeline. However, considering huge requirement of Pepsi and other processors good results of Dutch technology, substantial improvement can also be done in the existing stores.



Fig. 1: A typical traditional potato cold store and common sorting grading activities



Fig. 2: Crude arrangements for introducing fresh air and a CO₂ removal unit in a potato cold store

The Dutch technology involves-

- Regular measurement of critical parameters like- temperature, humidity & CO₂. Temperature based on product rather than air,
- Intervention for high humidity using humidifier,
- Ventilation with use of appropriate capacity of fans & circulation,

Dr Mahesh Kumar, Professor and Member, State level Committee for Establishment and Up gradation of Cold Stores of Punjab, Punjab Horticultural Post- harvest Technology Center, Punjab Agricultural University Ludhiana, Punjab. He has expertise in post harvest handling of Fruits & Vegetables.



Dr B V C Mahajan, Professor and Chairman, State level Committee for Establishment and Up gradation of Cold Stores of Punjab, Punjab Horticultural Post- harvest Technology Center Punjab Agricultural University Ludhiana, Punjab.



Dr W S Dhillon, Director, Punjab Horticultural Post- harvest Technology Center, PAU, Ludhiana, Punjab, developed\ recommended 11 varieties\rootstock of different fruit crops. He has received many awards, recognitions and appreciations, and Life Time Achievements in Sports. He is Founder Secretary of Horticultural Science Society; Executive Councilor of HSI etc.



- Extraction of CO₂,
- Automation for maintaining above parameters in desired range,
- Looking at high cost of electricity, an energy saving device has been very successfully used by Omnivent which through a plate heat exchanger uses the chill of outgoing CO₂ for cooling the incoming fresh air. With use of computer, and internet the data can be accessed anywhere which helps in better monitoring & management of the stocks.

The retrofitting budget for a typical chamber of a traditional cold store for 2000-2500 tonnes is quite high. However the modernization definitely improves the quantity and quality of stored potatoes. But before arriving at this decision, the cost benefit ratio, the use of energy and its potential leakage points be investigated thoroughly. Reducing energy use makes perfect business sense. It saves money, enhances the reputation of your business and promotes the fight against climate change. Energy saving doesn't need to be expensive. Up to 20% can be cut in many refrigeration plants through

actions that require little or no investment. In addition, improving the efficiency and reducing the load on a refrigeration plant can improve its reliability and reduce the likelihood of a breakdown.

Any energy efficiency initiative dealing with refrigeration should start by reviewing the heat gains on your system. If you understand the nature of these gains, you'll be able to manage the amount of cooling that needs to be done and make energy savings. Heat gains include warm air entering cold room and heat produced by electrical equipment within the cooled space. The single largest load on cold rooms is usually caused by warm air getting through open doors. This typically accounts for



Fig. 3: Potential sources of heat addition in a cold store

30% of the total heat gain by a cold room as can be seen in Fig. 3 which also shows the typical heat gain from other sources. Gaps between insulated panels or at points where pipes penetrate the walls can also allow a small but constant stream of warm moist air into the store.

Good operation practices for lowering energy costs

- Introduce good door management and keep the door of your cold store closed whenever possible. This will keep warm air and moisture out, and energy costs down.
- Make sure airflow from the evaporators is not obstructed.
- Run your cold store at the highest possible temperature for the product.
- Ensure the product loaded into cold room has not warmed up by being left in an ambient temperature area.
- Switch off the lighting in your cold room when it is not in use.

Maintenance/ low cost measures

- Repair any damaged door seals. If you have automatic and rapid-closing doors, make sure they are not overridden and are maintained in good working order.
- Fit strip curtains and make sure they are well-maintained. This will keep warm air & moisture out, and energy costs down. Insulated curtains are now available, offering an improved thermal barrier. This makes them ideally suited for freezers.
- Look at the lighting in your cold store. Consider low-power instant-on lighting which switches off automatically if the store is unoccupied.
- Ensure the outside of the cold store is sealed air-tight, with no gaps at panel joints, and is well insulated throughout. This will keep air infiltration & heat gain to a minimum.

Investment measures

- Fit automatic or rapid-closing doors if frequent access to the cold store is required.
- Introduce a defrost-on-demand system which will keep the evaporators in top condition.

- For larger, forklift-accessible cold stores, incorporate an airlock or antechamber with dehumidification into forklift entrances if possible. This will reduce ice build-up and the need for defrosting. Purchasing/ design considerations.
- On new stores, specify sliding doors. These seal better when closed, and the door seals are less likely to get damaged.

Common problems - strip curtains

Where strip curtains are fitted on cabinets or cold rooms, you should regularly make sure that they-

- Are in good condition – replace any damaged or missing strips;
- Are being used properly – operators should be discouraged from holding open strip curtains unnecessarily.
- To minimise heat gains through doorways in cold rooms in general, you should regularly make sure that:
 - Doors are kept closed whenever possible.
 - Doors fit well with good alignment and seal when closed. If a door is knocked, its hinges or slides may be damaged, preventing the door from shutting properly. If so, these should be repaired as soon as possible.
 - Door seals are in good condition. Look for any gaps or damaged rubber. For frozen food cold stores, faulty seals may be indicated by ice or frost build up around the door. Rubber seals commonly deteriorate and may need replacing after a few years of use. Door seals should be replaced by a suitably qualified service technician.

Compressors & Condenser

The compressor is the heart of the refrigeration system. These are always the single most intensive energy consumer in the system. The compressor raises the pressure of the refrigerant from the evaporator to a level that will allow the heat to be rejected to ambient air at the condenser. The difference between the refrigerant temperature in the evaporator (evaporating temperature) and the condenser (condensing temperature) often

determines how hard the compressor has to work Fig. 4. The larger the difference, the more work will be required by the compressor and the more energy it will consume.

In almost all cases, the single most effective energy-saving action you can take is to reduce the temperature difference. For every degree that this difference is reduced, you will save around 4% of the compressor energy. The main method of reducing temperature difference is to lower the temperature at which heat is discharged in the condenser (condensing temperature). Traditionally, condenser control (head pressure control) systems were programmed to run all year round at a condensing temperature designed for summer conditions. Changing the control to allow the temperature to reduce in cooler weather offers a great potential saving.

Tip for energy savings

Find out where your condensers are, and check them out. If they're dirty or blocked with debris, they're costing you money. Keep your condenser area clear of leaves, litter and vegetation. Up to 10% energy saving from cleaning alone. Further 10% saving can be obtained by increasing the condenser size. Water-cooled condensers are used on some larger systems; they should be used in conjunction with cooling towers.



Fig. 4: Water cooling condensing unit and compressor in a potato cold store

Evaporator

An evaporator is so called because the liquid refrigerant inside evaporates at low pressure. This is what creates the cooling effect. It is mounted on the wall or ceiling of a cold room Fig. 5. If the evaporator is blocked or is not controlled properly, the cooling will be inadequate – and your energy costs will rise. Like any heat exchanger, evaporators must be the right size for the job. If an evaporator is too small, the compressor will have to work harder and longer. It will also have to defrost more often, increasing your energy costs. Evaporators in most applications need to be defrosted periodically. While this is usually done with timers, intelligent controls can detect when a defrost is required and will defrost on demand.



Fig. 5: Evaporators (Bunker type & Fin coil type) commonly used in potato cold store

Potential savings

Many cold rooms are set too low – set the temperature only as low as needed. Turning the thermostat up by just 1°C will reduce energy use by up to 2%. The evaporator controller is usually the room thermostat – make sure this is set as high as possible without compromising food or process quality. Keep an eye on your evaporators – if you see a permanent build-up of ice on the coil, something is wrong. Evaporators should be cleaned when they get dirty. They lose performance as dirt builds up. Fans lose performance in the same way. Get your technician to include a thorough deep-clean of the evaporator coils when necessary.

Evaporator fan motors

Evaporator fan motors are another important source of heat gain. Recent advances in fan design and motor efficiency offer good savings for cold rooms. Conventional AC motors can be replaced with DC electronically commutated (EC) motors. This can result in energy savings of up to 65% for the fan motor. Since the fan motor consumes much less energy, there is also less heat for the refrigeration system to remove. A fan assembly integrating the EC motor, impeller and inlet ring mounting can be supplied as a simple drop-in replacement for a standard evaporator fan and motor unit. This increases the efficiency of the fan, giving greater savings than replacing the motor alone. Usually EC motors have a two-speed operational option. By combining an EC motor with a suitable controller, the fan can operate at a reduced speed when the compressor is not operational or when night mode is engaged. At half its full speed the fan motor will use up to 87% less energy.

Pipe insulation

All refrigerated pipe work should be insulated to prevent unwanted heat gain. The colder the pipe, the more insulation is required. Your insulation needs to be sufficient to stop condensation forming on the surface. This is a heat gain in itself. The condensation can also make the insulation wet. Your refrigeration contractor should be able to advise on the how thick your insulation needs to be. Pipe work in sub-zero temperatures requires special care, to stop moisture freezing inside the insulation. Low-temperature insulation has to be airtight as well as thermally sound, or the insulation will break down. To stop moisture vapour from entering the insulation, all seams and joints need to be completely sealed. This is normally done with contact adhesive, which should be applied to both surfaces.

The best chance to get the insulation right is when it is being installed. A little extra attention here will go a long way. Make the quality of insulation a priority for your new refrigeration system. Ensure that your pipe work and insulation are designed for the full life of the system –

typically 15 years for a commercial plant and 25 years for an industrial plant. Even badly applied insulation will look good for the first few months, so have it checked before the warranty expires.

Maintenance

Appropriate regular plant maintenance will save money by ensuring the refrigeration plant operates efficiently, reducing service costs and making interruptions to your business by breakdowns less likely. Maintenance schedule will be determined by the size and complexity of the refrigeration plant. As a minimum the schedule should cover the following points.

- Refrigerant levels in the receiver and the liquid line sight glass.
- Refrigerant leak testing and repair. Condenser cleaning, especially air cooled types (frequency of cleaning will depend on condenser location and its surrounding environment).
- Condenser fan and pump condition and condition of safety equipment such as fan guard.
- Evaporator cleaning.
- Operation of the defrost system. Condition of fans & safety equipment as per the condenser.
- Compressor oil levels and on systems which have suitable gauges fitted, suction and discharge temperatures & pressures. Accuracy of gauges, guards, operation of safety controls.
- Checking of control parameters to the optimum set point. Suction superheat to ensure that the expansion valves operate properly.
- Checks for undue noise and vibration.
- Condition of insulation.
- Condition of door seals on cold stores.

Cost savings of up to 50% are possible by making sure that your refrigeration plant is well operated and maintained. Also, improved reliability will reduce the chance of unplanned stoppages or business interruption. Appointing a good maintenance contractor is key to achieving these savings. Also, it is possible to reduce running costs by up to 15% by re-commissioning equipment, especially multi-compressor systems, so this should be included in your maintenance contract. ■

RDM controls is cutting running costs at fruit and veg cold store by 25%

Intelligent controls from RDM are saving Sharrocks 25% in refrigeration running costs at its fresh produce facility near Preston, UK.



A new cold store at Sharrocks Fresh Produce facility, near Preston, UK, is being cooled with a high efficiency refrigeration system equipped with advanced controls from Resource Data Management.

The custom-built cooling and control solution, designed and installed by Leigh-based contractor Personal Refrigeration Ltd, is estimated to be saving the end user 25% on refrigeration running costs.

Steve Bickett, who headed up the project for Personal Refrigeration, said: "Sharrocks is a major UK supplier of high quality fruit and veg, and imports produce from across the world. The company was relocating into new premises, and wanted an efficient new cold store to maintain product quality and maximise shelf life.

He added, "With the rising cost of electricity, it was also important that the design minimised energy use in order to reduce running costs and protect the environment, while maintaining produce quality."

Tight control of both temperature and humidity within the 28m by 13m cold room space was therefore essential. After calculating the heat load, based on anticipated flows of produce through the facility, Personal Refrigeration designed the refrigeration system with an overarching control solution based on RDM's Intuitive The Data Builder (TDB), with touch screen interface and I/O expansion board.

The contractor wanted to maintain a narrow Delta T of around 6K at all times, to maximise energy savings for the client. Key to delivering tight control was the use of control panels, custom-designed by the contractor, incorporating individual inverter drives for the plant's two Frascold compressors.

The contractor supplied two "tropical" condensing units to

accommodate the inverter-driven compressors. Control is managed by a custom-designed software programme, written by the contractor using the Intuitive TDB. This controls the inverters, which in turn modulate the frequency of power to the compressors, enabling control of pressure within approximately 0.2 Barg (+/- 0.5°C) of evaporating set point.

This in turn also helps maintain high humidity in the storage area, to ensure quality is maintained. Humidity in the store is maintained above 85% most of the time, with more than 90% achieved during times of reduced throughput and product turnover.

Evaporating temperature is set to -3°C, with the inverter drives ensuring this is maintained through modulation via the plc algorithm. The RDM system also monitors and controls





Enrico Mirandola, Group Sales Director at Resource Data Management Ltd has many years' experience in the controls industry, with experience of both the HVAC and refrigeration sectors. He joined the board of Resource Data Management last year, and heads up its global sales and marketing operation.



floating head pressures, to ensure real time changes in load are matched by the cooling plant.

"This gives incredibly fine control, and enables cooling capacity to be precisely matched to changes in heat load," said Steve Bickett. "You can't achieve anything like this with a conventional control solution. We

estimate this approach will save around 25% on energy use compared with a traditional system."

This has now been verified from data from energy monitors, referenced against the standard compressor operating frequency of 50Hz at the design condition.

To ensure resilience, in the event of a failure or trip of either inverter the RDM system is programmed to step in and enable the compressors to start and stop under conventional "part

wind start", bypassing the tripped inverter.

It also monitors compressor run-time and automatically balances usage, ensuring wear and tear on both pieces of plant is equal – extending the working life of the refrigeration system.

"After a few months of operation, the run times for the twin systems was within 0.2 of an hour – which equates to just 12 minutes. This is remarkable



run-time matching, and as well as extending working life means that servicing and maintenance schedules on both systems remain in step," said Bickett.

The RDM control system was programmed to maintain even temperatures throughout the cold room space with the use of an anti-stratification plc algorithm. This controls evaporator fans to ensure effective mixing of air in both horizontal and vertical planes, important for both efficiency and the maintenance of product quality.

Electronic expansion valves help efficiency further and assist in making maximum use of the floating head pressure design. When ambient temperatures fall, it means lower condensing pressures can be used, reducing electrical loads in cooler weather.

The RDM system gives the end user and contractor access to real-time and historical data on the cold store via a web browser on a pc, tablet or smart phone, and offers almost infinite options to expand the system at a later date.

Steve Bickett says, "The RDM system provided an excellent solution, and delivers energy efficiency, plant resilience and produce quality – all key requirements of our customer. It manages to be simple to use and program, while offering extremely sophisticated, flexible and intelligent control in a single package."

John Eastham, sales manager at Sharrocks, said, "Steve and the Personal Refrigeration team provided us with a flexible, accessible and efficient solution with professional support throughout the project.

"Their 'can-do' approach and specialist knowledge, particularly in relation to refrigeration and intelligent controls, have been invaluable."



Desert Coolers

Energy Efficiency & Health



Traditional Desert Coolers affordable by the majorities of homes and small businesses with limited income. In India most of the part is dry zone & Desert coolers are widely used.

The product is not given attention by the experts or by concerned department of State or Central Government nor by the Standards viz. BIS or BEE. Consequently, any roadside Tin Sheet metal workers make them in their own way, any substandard components are used to make it cheap or to earn more profits. This leads to highly energy inefficient performance.

Apart from this, the most important factor to be considered is that those traditional Desert coolers are really harmful to health.

In this article, I have tried to discuss some important factors related to this important issue.

Summer Heat Triggers Migraines, weather-related headaches are not uncommon during the summer months and studies have shown that a rise in

temperature by a few degrees, regardless of the season, can trigger migraines. By taking precautions and being proactive, such as drinking plenty of water and installing an evaporative cooler in your home or work premise, you can beat the summer heat and reduce the occurrence of annoying and productivity-decreasing headaches and migraines.

Need of Evaporative Cooling

Because the body loses fluids at a faster rate in hot weather, evaporative cooling helps in preventing dehydration-related headaches as it cools the inside environment regularly and consistently. When a person is out in the sun and returns inside to a rapidly cooled air conditioned environment the initial shock can cause hypothermia which can lead to fainting and headaches. With evaporative coolers not only allowing for



much better temperature regulation but there is less noise pollution.

Technical Aspects

Direct evaporative cooling (open circuit) is used to lower the temperature of air by using latent heat of evaporation, changing liquid water to water vapor. In this process, the energy in the air does not change. Warm dry air is changed to cool moist air. The heat of the outside air is used to evaporate water. The RH increases to 70 to 90% which reduces the cooling effect of human perspiration. The moist air has to be continually released to outside or else the air becomes saturated & evaporation stops. If properly designed then the desert cooler, can be so efficient that the outside temp 50°C can be dropped to nearly 28°C, the climate of Rajasthan and northern part of India is extremely dry (RH 20 %), it is a technically accepted fact that cooling by humidification is more economical than refrigerant cooling, a drop of 22°C of conditioned air at 20% RH are natural achievements. With the fact that dry natural air caused higher evaporation and the latent heat of water is over 2000 times than sensible

Dr OmPrakash G Kulkarni is recognized as Scientist and as Inventor of World's First Solar Thermal/ Renewable Energy Based AC/ Refrigeration system. He is Advisor invitee to MERC, GoM, Ex. BOS member on Electrical Engg./ E&TC and Instrumentation Science, Referee for PG at Pune University. He is also member of Governing body of more than 13 Engineering Educational Institutions. He has established three industries having footprint at Global level.



heat to drop a degree of air passing through. In tropical countries like India there is huge scope to use maximum of renewable energy and available sub-systems and controls and innovate and complete Evaporative Air Conditions as affordable as are the present Desert Cooler.

Evaporative coolers, better known to some as swamp coolers have been around much longer than their mechanical counterpart. Indeed, there is evidence that the ancient Egyptians employed their own form of evaporative cooling to keep from frying during the summer heat. In 2011 I had an opportunity to visit very remote locations in Rajasthan (where still expect Camel ride there is no other means of transport), it was astonishing to witness their ancient technologies for cooling of huts, refrigeration etc, without use of any power and made up of only local material & skill. (Apart from this I could see many things and one of them as a sound recording & reproduction device made out of clay – there enough room to feel that Edison might have been inspired for invention of Gramophone out of this Rajasthani technology). In fact the Indian government should investigate and promote these technologies.

While evaporative cooling equipment has changed since the times of the ancient Egyptians, the principle remains the same – converting sensible heat to latent heat through the evaporation of water to remove heat from the air. In simpler terms, intake air is passed through one or more wet pads to simultaneously absorb humidity and cool the air. The cool, humid air is then directed to the area where it is needed.

Evaporative coolers are the most environmentally friendly and energy efficient way to cool your home. Evaporative coolers use no CFC's or harmful coolants to produce cool, fresh,

healthy air for your home. With a complete air change every 2 to 3 minutes, evaporative cooling can be healthier than most central air conditioning systems.

Today, many homeowners and business owners rely only on their simple, affordable evaporative coolers to keep them comfortable in the heat. Evaporative cooling also has the advantage of being much less expensive to operate, meaning the home that operates an evaporative cooler probably uses significantly less electricity than the neighbour with the heat pump or the air conditioning system.

Ambient air is dried further and cleaned air by using maximum of concentrated solar energy for raising the amount of evaporative; and chemical dehumidification a/or reheating with healthier humidification when needed using the stored solar energy.

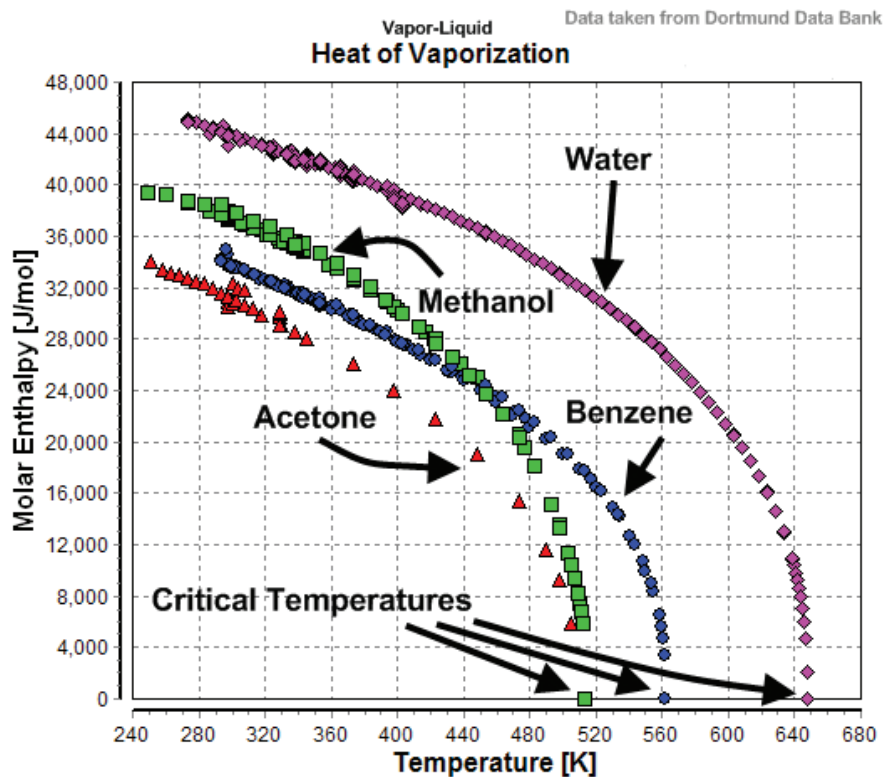
Psychrometry of mixing air with water

The enthalpy of vaporization can be written as

$$\Delta H_{vap} = \Delta U_{vap} + p\Delta V$$

This process is called : Humidification at Constant Enthalpy and if we decrease temperature we shall increase humidity. This process is limited dew point unlike the evaporative cooling process which is limited by wet bulb. Adiabatic cooling using Air to air heat exchangers can cool air to few degrees below the ambient wet bulb.

A suitable combination with chilled water/Dx system can reduce the operating cost by 30 to 50% and the systems can operate virtually in any climate. As the efficiency of Desert coolers varies with the variation of the RH, this application is only useful for very hot and dry climates. We must select as to what is the most efficient and cheap Chemical Drier to dry the air after



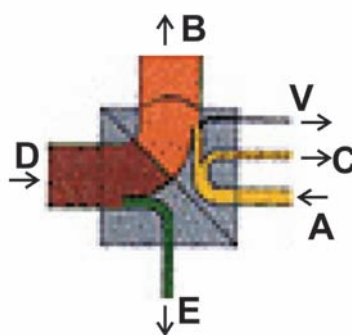
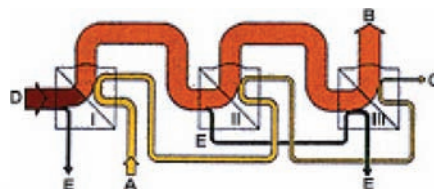
humidification there are dry silica gel (most expensive) calcium chloride, as well as sodium chloride and phosphorus Pentoxide (very efficient and close in properties to silica gel) now we need to study the rate of dehumidification to control the process purifies the air from dust and the out let air does not have an offensive odors ,besides the possibility of formation of Bacteria and fungi will be less

In considering the heat balance for a single-effect evaporator, the heat content (enthalpy) of the evaporated vapour is approximately equal to the heat input on the heating side. In the common case of water evaporation, about 1 lb/hr of vapor will be produced by 1 lb/hr of live steam, since the values for the specific heat of evaporation on

the heating and product side are about the same.

The steam consumption of evaporation plants can be considerably reduced by using the enthalpy (heat of condensation) of the vapour to heat a second effect. The vapor produced in this effect can be further used for heating of a third effect and so on.

As shown in the Figure, 3 lb/hr of water can be evaporated by 1 lb/hr of live steam in a 3-effect plant. This corresponds to a specific steam consumption of 33%. The total temperature difference is that between



A Product to be evaporated
B Vapors
C Concentrate
D Heating Steam
E Heating Steam Condensate
V Heat Loss

the maximum heating temperature in effect 1 and the lowest boiling temperature in the last effect. This is distributed between the individual effects and therefore the larger the number of effects, the smaller the temperature difference for each effect. This in turn increases the heating surface required to achieve a given evaporation rate. Increasing the number of effects increases the complexity of the plant arrangement and renders the operation and control more difficult. The product residence time will also increase.

Health Issues

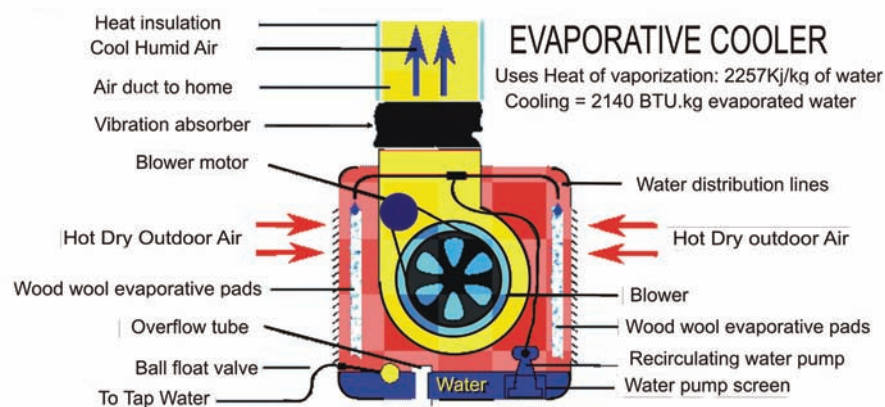
Traditional Coolers have limited range in cooling of water; the drop in temp depend upon Relative Humidity; and too many cases of legionnaires disease are happening found even in developed, Legionnaires' disease outbreak can become a national disaster and if we talk about the pollution of cooled air with some Bacteria collected on wet pads, we can use ultra violet lamps to kill these sorts of germs.

Violet lamps are not installed in present Desert Coolers models sold as affordable to majorities in tropical countries. In addition it also important to consider as to during what period of the year the climate is dry. Air Conditioner system is not just for cleaning of air by dry or wet filtration, cooling by dx coil or chilled water and incidental dehumidification or humidification as additional sub-system. Air conditioner is not that use refrigerant and compressor of any type. Any system which will treat atmospheric air for maximum cleaning through dry filtration; maintain a range of healthier sensible temp; relative humidity and level of freshness within an enclosed area. This system also is and can be promoted as Air Conditioner.

The main problem is due to rotting of wood wool and bacterial growth in wood wool as well as water holding tank. It also best incubation condition for growth of Mosquitoes.

Maintenance of Evaporative Coolers

Summertime is just around the corner and smart home owners will have to start checking up on their home's



ability to cope with the hot scorching summer. Spring is the ideal time to run seasonal maintenance so your evaporative system systems can withstand the long, hot summer and cool your home or business more efficiently.

During the hot weather season, houses with evaporative cooling systems that have been taken care of outperform those that have little or no maintenance. The payoff in energy savings and repair costs from periodic maintenance are well worth the effort, and should be at the top of the spring cleaning list. Twice a year maintenance session is necessary which must include the following:

- Ensure that the evaporative cooler pads are cleaned or replaced.
- Check up on the pad wetting, if there are any dry spots on the pads, this will rob you of cooling and will allow hot air seeping into your home.
- Ensure that the system is putting out enough water to start with and that the water is being distributed

properly so that the pads are wet at all times.

- Make sure that there is no water runoff.
- Make sure that the water level is correct for maximum cooling.
- Ensure that the V Drive system has been replaced and with the proper tension.
- Make sure that the water distribution system is clean and working properly.
- Make sure that the air delivery system is set properly and adjusted so all fittings are tight.
- Check for loose wires and hoses for proper operation.
- Check run system

It should be mandatory for all evaporative cooler manufacturers for evaporative cooling units to be serviced at the beginning and end of the cooling season in order to maintain optimum performance and avoid unnecessary repair or replacement costs due to neglect.

As the summer heat intensifies, evaporative coolers may become ineffective to some home owners. We recommend that you have your central air conditioning system serviced by a reputable air conditioning company.

If done properly, a central air conditioning tune-up should take a well-trained technician anywhere from 60 to 90 minutes to complete. One of the most important things a homeowner can do to ensure proper operation of their home comfort system is to have it serviced twice a year. Many companies offer maintenance programs that offer twice-a-year service, priority service, and discounts on repairs and/or replacement. Maintenance could reduce unnecessary

failures during the extreme hot weather here in the desert. A well-maintained system will not only reduce unwanted repairs, but help reduce cost as well. One of the most common problems we encounter is a dirty or plugged filter which can greatly reduce the efficiency of a system and increase energy costs. Imagine yourself getting ready to run a marathon race with a full-length fur coat on and trying to breathe out of a cocktail straw. How efficient would you be in this race?

Remember your home comfort system, both central air conditioning and evaporative cooler, work harder and longer than your family car. Yet many of us take better care of our car than we do our indoor comfort systems.

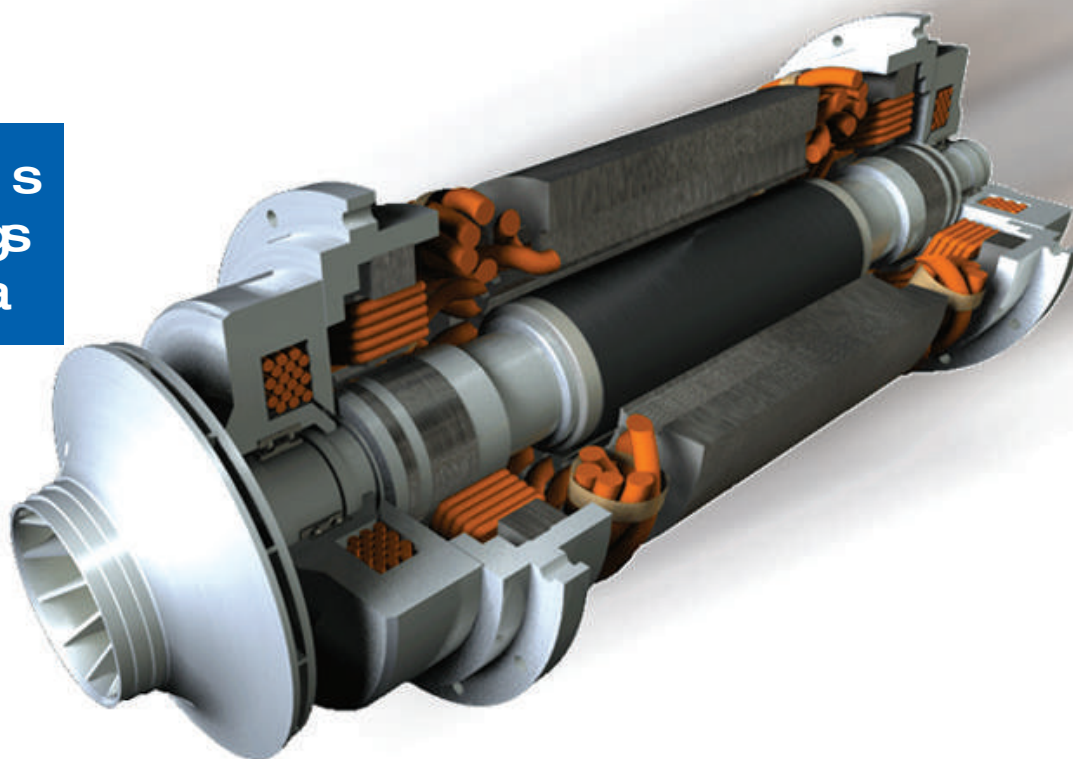
During the hot summer days when temperatures and humidity levels are high, central air conditioning is a must. But as the sun sets over the desert, temperatures and humidity levels drop significantly. This allows those of us who have evaporative cooling or swamp coolers to switch over to enjoy sleeping under fresh clean healthy air, waking up rested, refreshed and ready to take on a new day.

Conclusion

We have enough of updated micro-chip-control sub-systems; most efficient heat transfer materials, abilities to design; most importantly Necessity for Aggressive Commercialization of affordable Air Conditioners for majorities in Tropical Countries. There is no need for any new invention but innovation and modification of present sub-systems to complete demonstrative R&D.

Bureau of Energy Efficiency and Bureau of Indian Standards along with Health Ministry and Energy Ministry (including MNRE) must look into this product and technology and with the support of Academia and CSIR/ DSIR support the strict standards with STAR rating must be developed and should be made open to young Entrepreneurs that too for rural India on priorities and promotional schemes. This will not save energy, mitigate health issues but also bring employment opportunities with skill development to rural sector population. ■

Race to build greener buildings in Asia



As the world grapples to find solutions to reduce our impact on the environment, green buildings represent our best chance to significantly reduce energy consumption and aid in environmental conservation. Globally, buildings account for approximately 40% of total energy consumption, and within buildings, Heating, Ventilation and Air-Conditioning (HVAC) systems account for close to 40% of energy use. This represents a significant amount of opportunity to reduce energy consumption by simply retrofitting outdated HVAC systems, and building facilities with the increasingly advanced and efficient technology available today.

At Johnson Controls, we are seeing a shift in the industry from 'Push' to 'Pull'. Formerly, governments and other organizations made the case for smarter and greener buildings through subsidies and other means to 'Push' adoption. Today, building owners, occupants and communities in general are increasingly demanding smarter and greener buildings as they begin to recognize the business value in going green.

According to a report by McGraw-Hill Construction which surveyed green building activities among businesses worldwide, 76% of respondents reported that green building lowers operating costs. Similarly, a study conducted by the National University of Singapore (NUS) in conjunction with the Building Construction Authority (BCA) on 40 commercial buildings in Singapore found that retrofitted buildings yielded an average of 20% in energy savings. This means that building owners were able to recoup the 3-5% premium in construction cost to build green buildings in the first seven years or less. In fact, over time, all things being equal, green buildings can lead to a 2% increase in property value. These are clear indicators that there is a serious business case for going green.

Next generation chiller technology to spur green building adoption

As a leader in HVAC, industrial refrigeration, building

controls as well as building-related services and consultancy, Johnson Controls is in a unique position to help accelerate the adoption of greener and more sustainable solutions in the drive towards greener buildings. We are constantly improving on our products and solutions to deliver better efficiency, better reliability and lower costs.

First developed by Johnson Controls for the Navy, the YORK® Magnetic Centrifugal Chiller (YMC²) is a next generation chiller that helps to reduce energy consumption and operational costs of commercial and industrial buildings. The YMC² utilizes a permanent-magnet motor and active magnetic-bearing technology that reduces friction and vibration. As a result, the YMC² chiller delivers improved efficiency at all operating points.

YMC² offers following key benefits

Improved Efficiency

YMC² chillers are 10% more efficient than new conventional, variable-speed chillers. The magnetic-bearing technology eliminates mechanical-contact losses in the driveline. In addition, proven energy efficient YORK® features such as the OptiSpeed® variable-speed drive and the optimized centrifugal compressor have been retained and improved on. Proprietary capacity-control logic continually analyzes and adjusts chiller operations to further ensure optimum performance. The efficiency benefits can be greater than 30% when considering replacement of an older existing chiller at end of life.

Reduced Noise

The YMC² chiller is quieter than any water-cooled centrifugal or screw chiller on the market. Driveline vibration is eliminated with the magnetic-bearing technology, while the YORK® OptiSound® control further helps reduce noise. As a result, the YMC² chiller operates at a maximum of 73 dBA at full-load standard conditions (The human ear would perceive the YMC² chiller only half as loud as other magnetic-bearing chillers).

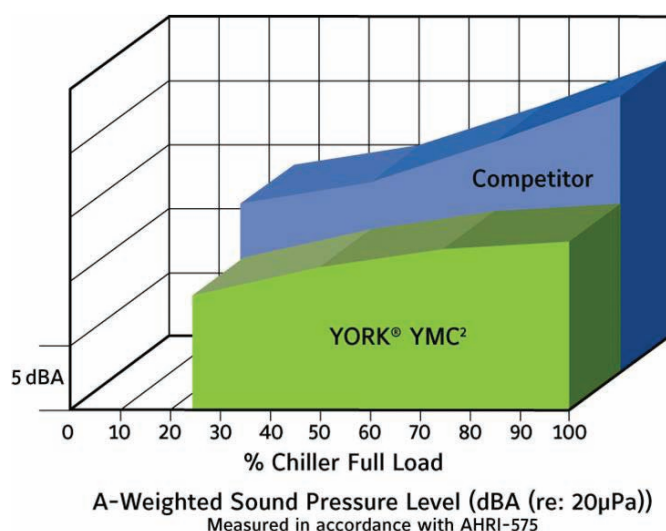


Fig. 1: The YMC² chiller is so much quieter than competitive magnetic-bearing chillers, itsounds about half as loud. * Note: each segment on the Y axis=5 dBA

High Reliability

The design of the YMC² chiller has fewer moving parts, requires less servicing and has a longer motor life. This helps to increase reliability and reduce maintenance costs. The chiller's permanent-magnet motor has an inherently longer life than traditional motors, and the OptiSpeed drive's soft-start sequence helps to further extend motor life.

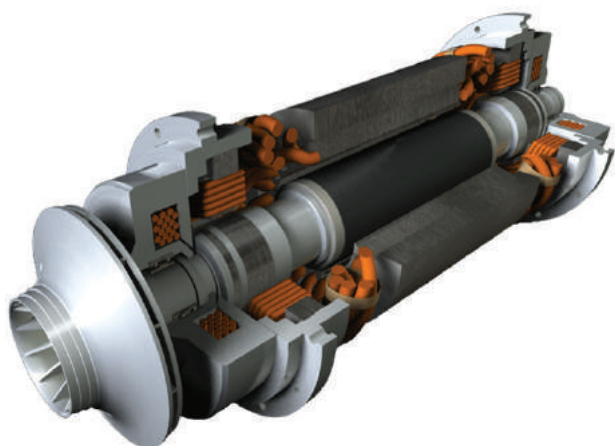


Fig. 2: To eliminate mechanical-contact losses in the driveline, the YMC² chiller utilizes a permanent-magnet motor and active magnetic-bearing technology

Better Sustainability

The YMC² chiller uses refrigerant HFC-134a which has zero ozone-depletion potential. Furthermore, it is designed with 57% less refrigerant-piping connections which drastically reduce the potential for direct global warming caused by refrigerant leakage potential. The 10% to 50% efficiency improvement also reduces indirect global warming caused by greenhouse-gas emissions generated by electric utilities. Indirect impact is typically more than 95% of the chiller contribution to environmental warming impact over the operating life of the chiller.

The YMC²'s energy efficient and sustainable features help existing buildings meet the energy management and environmental targets set out by building owners and governments. Its compact size further makes it ideal for retrofit exercises because it is able to deliver higher efficiency and cater for higher capacity within a small footprint.

A versatile solution, YMC² is suitable for application across a wide range of industries and has been used in about every vertical market, including Apple Headquarters in Cupertino in the United States of America. Given its high reliability and superior sound control, it is also recommended for high performance facilities such as data centers, healthcare facilities, educational institutions and concert halls.

Opportunity in Asia

Rising energy costs and the need to improve productivity and minimize downtime continue to be key challenges for building and facility managers in today. With the increased focus on climate change globally, many countries in Asia are also enacting legislation and providing incentives to modernize and retrofit existing facilities. As such, there is a lot of potential for green building adoption in both the developed and developing markets in Asia.

India, for example, has a significant opportunity to spearhead the global green building movement. With building stock expected to reach 100 billion sq ft from the existing 25 billion sq ft by 2030, it is critical that India starts leveraging advanced green building technology today to ensure business and resource sustainability in the near future.

At Johnson Controls, 'we believe in delivering ideas and designs that match the needs of customers and communities. As such, we are constantly improving on our products and solutions to deliver better efficiency, better reliability and lower costs. YMC² is a great example of Johnson Controls' dedication to innovation. With customers wanting more value and better integration, we are leveraging on our expertise in controls and services to deliver cutting-edge product, systems, and services solutions that are bespoke to different customer segments. In India, the Center of Engineering Excellence in Mumbai and assembly plant in Pune, further provide our customers with quality and innovative products and solutions.' ■

Garry Chui is Product Portfolio Manager of Global Chiller Solutions team of Johnson Controls Inc. He is BE Mechanical engineering, Hongkong with over two decades experience in sales, business development, product management and strategy in global HVAC manufacturers and MNCs. He is responsible for chiller product development and strategies covering Hong Kong, Macau, Australia, New Zealand, Japan, Taiwan, South Korea & Singapore. He is a qualified technical trainer of hydronic disciplines and is engaged with institutions in the region to deliver technical talks on chiller system and energy efficiency.



Performance Improvement Study of a Cooling Tower

This article presents the results of thermal capability test carried out on a cooling tower of a 200 MW coal fired thermal power Unit. The thermal capability was found to be 64.0%. The major deficiencies observed were improper configuration of concrete splash bars (in turn improper splashing) and inadequate air flow.

Major renovation was recommended through use of new configuration to improve the performance.



Cooling tower plays vital role in operation of coal fired thermal power stations (TPS). About 50–55% of input energy in a coal fired TPS is dissipated into the atmosphere through cooling towers (CT). Hence, the performance of CT will have significant impact on the power generated from steam turbine generators. The CT is of counter flow induced draft type with triangular shaped PVC splash bars and PVC drift

eliminators with 10 cells. The test results and the recommended measures are described in the following sections.

Test Results

The design performance curve of the CT at 90, 100 and 110% of design water flow is shown in Figures 1 to 3. The measured hot circulating water (CW) temperature & CT outlet CW temperature and ambient wet bulb temperature (WBT) are plotted in Fig. 4. It is seen that

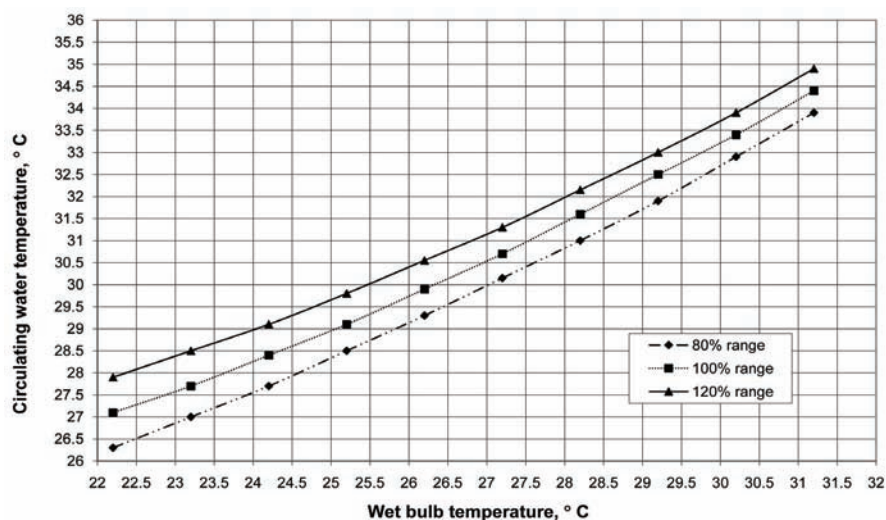


Fig. 1: Cooling tower performance curve at 90% of design CW flow

the average hot CW is 42.8°C, the average cold CW is 33.9°C and ambient wet bulb temp. is 25.1°C.

The measured air and water flow to each cell, power drawn by fan and energy performance of each cell are provided in Table 1. The deviation in air and water flow with respect to design is also presented in the same Table. The

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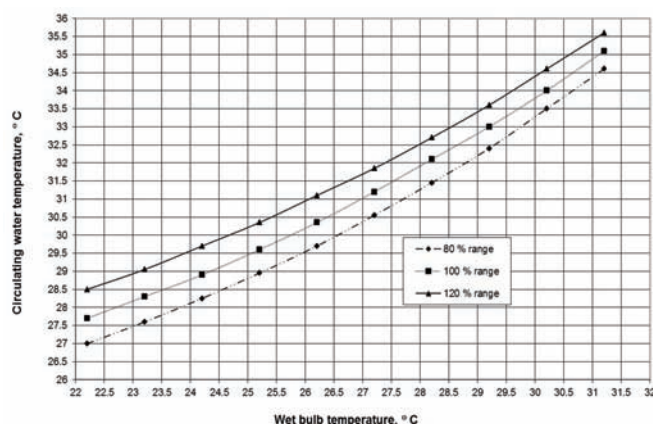


Fig. 2: Cooling tower performance curve at 100% of design CW flow

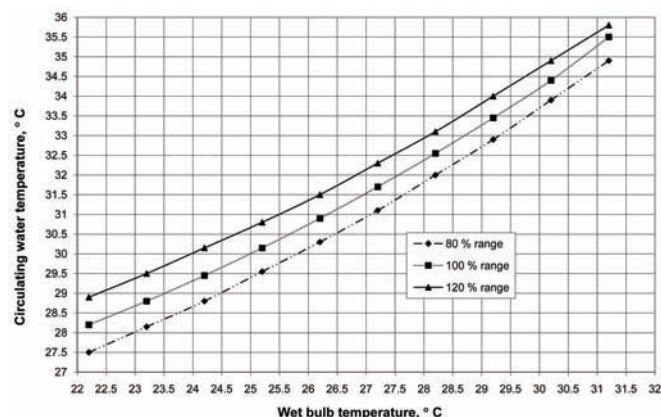


Fig. 3: Cooling tower performance curve at 110% of design CW flow

Cell no	Air flow, t/h	Deviation, %	CW flow, m ³ /h	Deviation, %	Fan, kW	Deviation, %	L/G (wet)	Deviation, %
1	2097.8	-9.2	3836.34	11.2	54.0	-22.9	1.81	21.3
2	1831.1	-20.7	4007.664	16.2	55.0	-21.4	2.17	45.2
3	1993.4	-13.7	3641.232	5.5	55.1	-21.3	1.81	21.2
4	1816.8	-21.3	3463.524	0.4	52.4	-25.1	1.89	26.5
5	2026.5	-12.2	3800.508	10.2	60.7	-13.3	1.86	24.4
6	1867.4	-19.1	3792.864	9.9	51.9	-25.8	2.01	34.7
7	1666.2	-27.8	3634.212	5.3	48.1	-31.3	2.16	44.7
8	1826.6	-20.9	3922.128	13.7	55.7	-20.5	2.13	42.4
9	2018.9	-12.6	3336.036	-3.3	55.3	-21.0	1.64	9.6
10	1927.9	-16.5	2856.144	-17.2	59.1	-15.5	1.47	-1.7
Design/cell	2309.2		3450		70.0		1.49	
Total	19072.7	-17.4	36290.7	5.2	547.3	-21.8	1.89	26.2

Table 1: Energy performance parameters of each cell of the CT

Total hot water flow	35964036.1	kg/h
Water being evaporated	600870.8	kg/h
Moist air flow at CT outlet	19072676.5	kg/h
Dry air flow at CT inlet	18471805.6	kg/h
L/G (dry air basis)	1.947	kg/kg

variation in water flow among each riser is in the range from -17.0 to 16.0%. The operating liquid to gas (L/G) ratio and the deviation is also presented in the Table. It is seen that the L/G ratio is much higher than design.

The thermal capability cross plot 1 & 2 of the CT are depicted in Figures 5 & 6. The overall performance of the CT is given in Table 2. It is seen that the operating range is 8.85°C and the approach is 8.8°C against a design of 8.5°C & 4.0°C respectively. The thermal capability is 64.0% & the short fall in cold CW is 3.3°C. The operating effectiveness is 50% against the design of 68%.

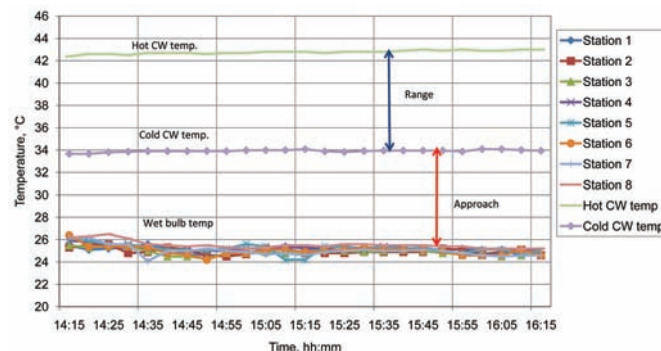


Fig. 4: Variation of WBT, cold & hot CW temp with time

Recommended Measures

The observation and recommended measures from the study are given below.

- **Hot CW flow balancing:** It is seen from the Table 1 that the

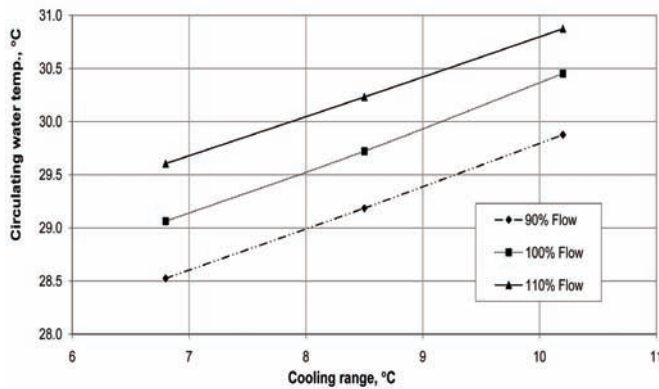


Fig. 5: Cross plot # 1 of the CT

Sl. No.	Parameter	Unit	Design	Operating
1	Cold water temperature	°C	31.2	33.917
2	Predicted cold water temperature	°C	31.2	30.6
3	Shortfall in cold water temperature	°C	0.0	3.3
4	Predicted CW flow into CT	m ³ /h	34500	61545
5	Test hot CW temperature	°C	39.7	42.772
6	Test wet bulb temperature	°C	27.2	25.11
7	Cooling range	°C	8.5	8.855
8	Approach to WBT	°C	4	8.807
9	Effectiveness of CT	%	68.0	50.1
10	Measured CW flow	m ³ /h	34500	36291
11	Average power consumption per fan	kW	70	54.7
12	Adjusted CW flow	m ³ /h	34500	39393
13	Adjusted CW flow % of design flow	%	100	114.18
14	Thermal Capability	%	100	64.01

Table 2: Overall performance of the CT

hot CW flow to each cell is not fully balanced. The variation is in the range of -17 and 16%. It is suggested to limit this variation to less than - 5% by installing ultrasonic liquid flow meter on each riser pipe and by regulating the respective gate / butterfly valves. This will improve the heat rejected.

- Causes for performance deterioration:** The major problem observed with the tower performance is that the cold water temperature from the CT outlet is higher by 3.3°C (in comparison to design curves of CT). The moist air exit from the cells is near saturated (dry bulb temp. & relative humidity measured from 2-3 cells were 34.4-37.3°C & 99.7-99.9%). The only reason for this could be that the air flow through the tower is less than required. It is known that the heat rejected as latent heat (About 1 kg

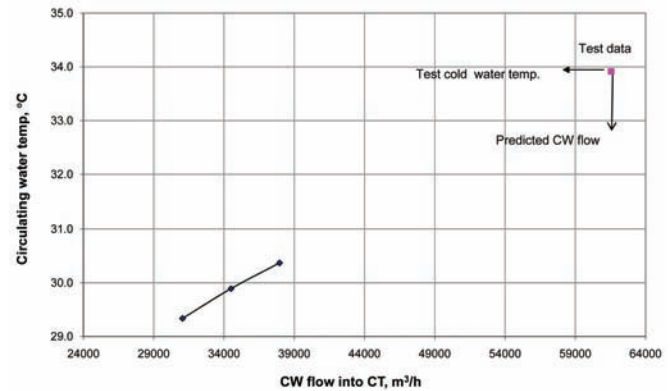


Fig. 6: Cross plot # 2 of CT

from 530 kg of water is to be evaporated to cool itself by 1°C) is much higher than as sensible heat. Presently the moist air exit from the cells is near saturated, which means that it cannot carry further moisture. Hence unless air flow is increased, heat transfer cannot be improved. It is seen from Table 1 that the operating L/G ratio is higher by 26% in comparison with design. The near saturated air at cell exit indicates that there is still scope to reduce the CW temperature by increasing air flow.

Hence to improve the heat rejection, the following are suggested.

- The air flow from the fans needs to be improved as per rated flow. After increasing the air flow, if exit air is not near saturated, then the fill area needs to be modified so that air-water contact area is increased and water is splashed into still finer particles.
- On analyzing the motor loading, it is observed that the motor & fan are capable of taking additional load of 17-25% on continuous basis (considering that the fan drive system is designed for 70 kW load). The air flow from the fans is to be increased by increasing the blade setting angle. Presently it is reported that the blades are failing when set at higher angles. Hence the blades need to be redesigned and used for this specific rating of 70 kW.

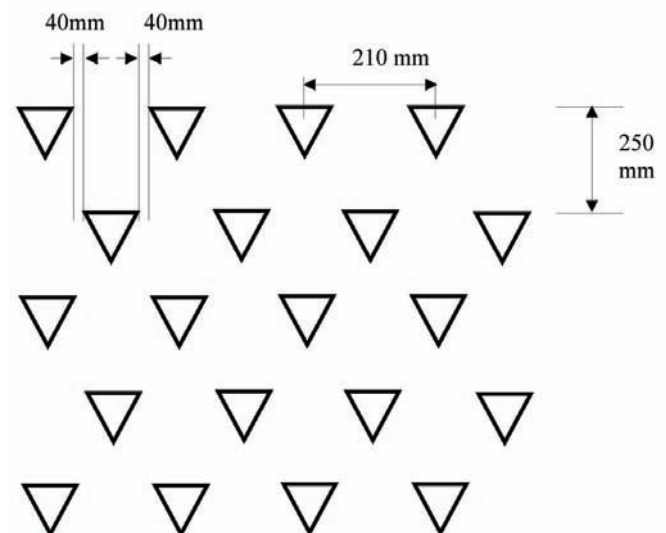


Fig. 7: Schematic present fill configuration

Sl. No.	Particular	Value	Unit
1	Coal cost	3180	Rs. / tonne
2	Coal flow (annual average)	132.8	t/h
3	Plant load (annual average)	200	MW
4	SFC	0.664	kg/kWh
5	GCV	3547.3	kcal/kg
6	Operating overall heat rate	2355.4	kcal/kWh
7	Loss of heat rate due to higher CW temp.	5.25	kcal/kWh/°C
8	Present CW short fall	3.3	°C
9	Heat rate improvement possible	17.3	kcal/kWh
10	Improved overall heat rate	2338.1	kcal/kWh
11	CT operation hours	8500	hours/year
12	Annual coal saving	8302.8	t/year
13	Annual cost saving	264	Rs. Lakhs/year
14	Renovation cost for one tower	300	Rs. Lakhs
15	Simple payback period	14	months

Table 3: Analysis of heat rate improvement through renovation of CT

- The existing triangular plastic bars are placed to have 40 mm direct air gap (in design itself) in between the successive rows (Fig. 7). The effective heat exchange area is only 4 m²/m³ of fill volume. On survey of literature, it is observed that the heat exchange area is supposed to be 30-45m²/m³ of fill volume. Direct air gap between two successive bars need to be completely avoided. When hollow triangular bar is used, only the outer surfaces take part in heat transfer and the inner surface is not taking part in heat exchange. Hence, it is suggested to replace the existing splash bar to 'V' bar type with perforated holes and also to reduce the gap as shown in Fig.8. The splash bar holding arrangement also need to be changed accordingly to have effective heat exchange area of atleast 30m²/m³ of fill volume. When this change is implemented, the resistance to air flow will increase and hence the fan loading will also increase.

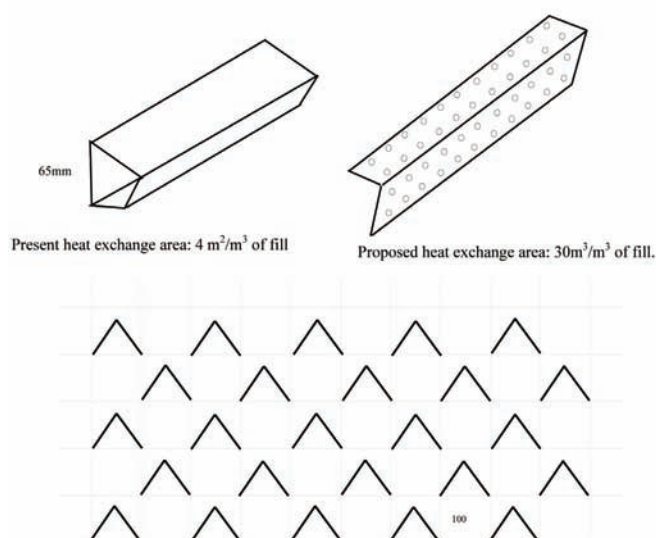


Fig. 8: Schematic of the proposed fill configuration

- The effect of shot falls in cold CW temperature is analyzed with respect to heat rate and the result is given in Table 3. It is seen that the payback period is 14 months only.

Conclusions

The main conclusions from the test results are as follows:

- The operating value of approach of the tower is 8.81°C against the design of 4°C.
- The effectiveness of the CT is 50% against the design value of 68%.
- The thermal capability of the tower is 64% and the short fall in cold CW temperature is 3.3°C.
- To bring down this cold CW temperature short fall, L/G ratio (increasing air flow from the fans) and splashing of water inside the tower need to be improved.
- The effective heat exchange area needs to be improved from 4 to 30m²/m³ of fill volume by changing the fill configuration (having more splash bars of perforated 'V' type and minimizing the air gaps) and the fill holding structure.

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Eco Friendly solution against Lime Scale and Rusting formation in water



Due to unwanted Scaling problems in pipe lines, commercial as well as Industrial sector, spent millions of rupees every year on pipeline maintenance, Descaling and softening of water used for Heat Exchangers, Boilers, Cooling towers, Chillers, Poultry Farms, Agricultural Farms, Hotels, Hostels, Municipality water management system, wastewater treatment plant, Commercial and residential complexes and many more abundant places etc.

Increase Crop /Food Production in Agricultural Area.

* IDEAL FOR PLASTIC & PACKING INDUSTRIES, BOILER, PLY, HOSPITALS

It is found by survey that only 3-6 mm of lime scale can reduce energy efficiency by a surprising 60% in reasonably hard water area, 3-6 mm of layer of lime scale can block pipe of Boiler water tubes, heat exchangers, Chiller pipes gradually in just 2 years. This in turn results in higher running costs. Lacs of rupees are wasted every year in increased power bills, lost production and premature reinstallation of most important equipment.

Every mm of scale build in pipes reduces efficiency by an average 35-60% because of due to Scale effective

Prof Gaurang Sharma, presently serving as Ass. Professor in Dept of Electrical Engineering at Birla Vishvakarma Mahavidyalaya Vallabh Vidyanagar. Previously worked with Design and Development, Switchgears and Shortcircuit Dept in ERDA Vadodara, CNC Metal INC-CANADA, Jyoti Switch Gear Ltd, Elecon Engg. Co. Ltd and Many More MNC. He published more than 13 papers.



D A Suthar, doing Industrial Project work on water Descaller, worked as Chief Project Executive at Advance Magnetronics – Emerging R & D Institute. He looks after Micro Controller and related problems, production of CVT, CT, PT, Reactors, Choke, Induction Heater for Bearings.



Diameter of pipes decrease which reduces pressure increased Fuel consumptions /energy bills.

An enormous region in the nation is polluted with hard water. Almost 70-90 % of ground water has a significant presence of lime scales making water unfit for industrial and other uses. Hard water results in lime scale deposition and also corrode the pipe line and equipment.

How lime scale is formed?

When water-borne minerals, such as calcium bicarbonate, convert / fall in to their solid carbonate state, lime scale is formed in water systems and thus results in.....

- Decrease effective diameter of pipes. Directly reduces thermal efficiency, sluggish the flow.
- Indirectly Increase fuel /Electricity consumptions
- Also provide reproduction medium for Bacteria and Reduce life of equipment.

Scale means indirectly wastage of money, productivity and decrease lifespan of numerous appliances.

Most scale formations are hard and very difficult to clean by observing fixtures such as toilets, bath tubs,

showers and appliances like coffee and ice makers. Swimming pools and spas can experience scale build up on floor and pump equipment.

Cooling towers have tremendous scale problems that alone cause the industry Lacs of rupees. Most scale formations are hard and very difficult to clean. Evaporative coolers, boilers, car washes, irrigation systems, processing equipment, paper pulp mills all experience scale problems. Unfortunately, because of scale it forms a "coating" it can significantly effect thermo transfer and reduce the flow of fluids. The increase of fuel cost due to scale build-up is highly significant.

Classifications of Various Methods of Controlling Scale

There are four basic technologies available to control the effects of hard water.

Ion-Exchange Method: By ion-exchange remove calcium and magnesium ions and replace them, regularly, with salt. Ion-exchange systems need a tank full with exchange resins, a mechanism to regenerate the resins and a tank to store salt water used for regeneration. Ion-exchange water softeners fight the effects of hard water

by removing the calcium & magnesium nutrients. Means there are deficits of nutrients after long time so not preferable for human being.

Limitations of this method are only that you have to maintain system with exchange resins and salt needs lots of running expenses.

Phosphates: Polyphosphates are used as an appropriate agent to control iron and hardness and as coating agents to control corrosion by formation of a thin passivating film on metal surfaces. Polyphosphate crystals are placed inside filter housing; as water flows through the filter the polyphosphate crystals slowly dissolve and are thereby introduced into the water stream. In real meaning, polyphosphates attach calcium and magnesium in solution where they are less likely to precipitate and form calcite. Phosphates are most favorite food of bacteria which offer greater potential for bacteria growth. Polyphosphate crystals must be regularly replaced as they dissolve into solution.

Limitations of this method are only that you have to maintain system with Polyphosphate crystals needs lots of running expenses.

Permanent Magnets: Permanent magnets use fixed energy fields which, under controlled conditions, affect the crystal structure of calcium. Main parameters & conditions for the effectiveness of permanent magnets are Pipe size, flow rates & levels of hardness, magnets field ability to perform.

Unfortunately, improper sizing has happened more than once, and when

coupled with false claims from the manufacturers and dealers, bad word of mouth spreads. The truth is however, magnets have been used widely, and successfully, in the Soviet states and parts of Europe for many decades both in residential applications and in industrial/marine applications. Many manufacturers claim to have thousands of satisfied customers.

Advance Power Electronic based water Conditioning: Electronic water conditioning is relatively new technologies which progress from the use of magnetic fields in water improvement. The beginnings of these systems establish both variable energy and frequency changes. Electronic treatment is based on the principal of creating an oscillating electro-magnetic field of energy with the use of low /high frequency radio or square waves. As water passes through a pipe delivering variable frequencies and energy levels, a physical change in the preferred crystal structure of calcium and magnesium occurs changing the crystalline structure of aragonite rather than the random crystalline structure of calcite.

Aragonite is a form of calcite crystallizing that stays in solution and does not stick to surfaces. This action stops any further build-up of scale and because the solubility of the water is increased, existing scale is taken back into the water and gradually removed. Like the magnets, precise energy and frequency fields are required in order for the electronic water conditioners to work properly. Afterwards this technology become popular as "ADVANCE power electronics based WATER DESCALER"

So many, International & national Company Start Workings on Various principles. But they charged very heavily to Industrial customer, some time even their rent also can not be affordable by Medium scale or small scale Industrial sector but they don't have any options for their unwanted problems of scaling so our aim is make it cost effective and more powerful.

Advantages of AED

- Gives almost Double /Multiple Impacts then available all other devices.

- Maintenance free, "FIT & FORGET", with Approx. 20 + years of life span.
- Chemical Free, Salt free, Eco Friendly.
- Design as per States /Regions / Countries environmental conditions and Properties of water.

Advance magnetronics prepared very cost effective technology & transfer it from "LAB TO LAND" For all users as well as farmers for Growth in Crops, with aim to provide water for all".

Limitations

Effectiveness of physical change in the crystal structure of calcium and magnesium remains up to 48-72 Hours after that it will reform its original structure so not preferable where water can store more than 48 hour, or in this case installed unit near outlet of water tank.

Operating Principle of Advance Electronic Descaling (AED) Technology

This modern artifact create waver electronic meadow using an inimitable

and multifarious revise frequency wave form that they modify the physical contour, dimension and charge of the calcium molecules in addition to causes them to lose their adhesive properties.

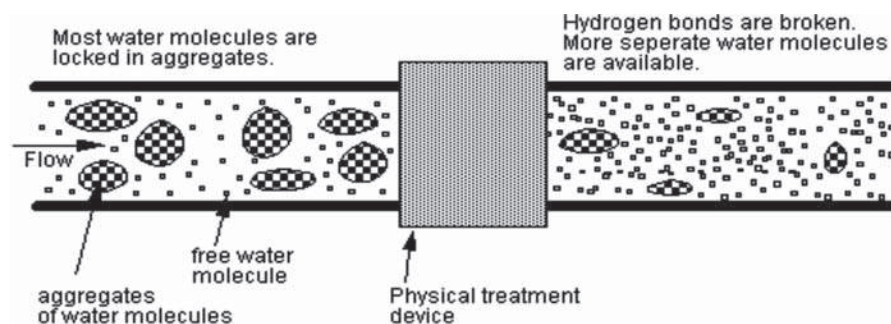
The Four /Two ends of the wire are connected to the AED control unit. The AED unit produces a pulsing current to create time-varying magnetic fields inside the pipe. Subsequently, the time-varying magnetic field creates an induced electric field inside the pipe, a phenomenon which can be described by Faraday's law (for detail description read www.advancemagnetronics.com)

Advance water Descaller is Best Alternative Solution for Indian Industrial, commercial & Residential Sectors, where people can Install Heavy R.O Plant but they can not afford their Maintenance.

Advance Electronic Descaller is mounting between the pipe lines in water flow cycle. In order to maximize the induction, a pulsing current having a square-wave signal is used. The current and frequency of the square-wave signal used depends on Applications, respectively.

Problems in Agriculture

Hard water perform as the water containing toxic material on Soil, Hard water doesn't soak in the deeper layers of soil. The balance water ultimately gets evaporated in heat leaving scales all over the field. And around roots of crops, These scales further reduce soil water



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Hospitals & Nursing Homes	Pumps & Radiators	R.O Systems, Heaters	Water skin texture	Society Buildings
Hotels, Spas & Beauty salon, Bars	Valves & Boilers	Radiant Heat	Marine Applications	Fire Departments
Poultry farms Coffee Shops	Ice Makers Fast Food	Carwashes Centre	Water Parks	Power plant Designers
Wash Rooms & Gyms	Refrigerators	All institutions	Fountains Pipelines	Schools /Student hostels
Water stores Landscapers,	Manufacturing Kitchen, Bath	Dishwashers	Mechanical Engineers	Drinking & Waste Water Treatment plants
Dairies, Apartments	Fabrication & Processing Plants	Canteens	Civil works Town planner	Plumbing & HVAC Contractors

solubility resulting in poor water intake by the roots and dead the crop.

Fertilizers and Minerals: Hard water slow down absorption of fertilizers and minerals present or applied, resulting in poor absorption by the roots.

Bacteria: Hard water forms a ideal home for the useless bacteria and fungi to cultivate.

Advantages in Agriculture, More Crops per Drops, Sprinkler systems as well Public Gardens

Advance Descaller with its ionization technique make the water spongy resulting is more solubility of nearby natural resources. Spongy water gets captivated without problems in the soil resulting into quick absorption by the roots. It has been found that even in soil where germination is poor or negligible; water through Advance Descaller has helped in making the field reusable for germination & crop production Practices.

Also solve deep irrigation trouble by remove Scale Build Up in Irrigation method and Drippers.

Decrease Salt level of bore well water which constructs important nutrients available to plants. Directly reduces the usages of Water & Fertilizers both, and increased Agricultural Productivity.

Various Applications according to Manufactures, from All over world claim that -

- **Elimination of Problems in Water Boiler Systems and Pipe work:** Hard water also contributes to inefficient and costly operation of water-using appliances. Heated hard water

forms a scale of calcium and magnesium minerals (lime scale deposits) that can contribute to the inefficient operation or failure of water-using appliances. Pipes can become clogged with scale that reduces water flow and ultimately requires pipe replacement. Lime scale has been known to increase energy bills by up to 25%.

- **Elimination of Lime scale in Solar Heating Systems:** Solar heating, often used for heating swimming pools is prone to lime scale buildup, which can reduce the efficiency of the electrical pump. This, in turn can cause the overall system performance to deteriorate.

- **Restaurants & Hotels:** Customers will observe an instant difference in the feel of the water. It will be smoother and silkier to the touch. Calcium scale buildup is a breeding ground for bacteria. The calcium in your pipes will begin to dissolve and reduce the risk of bacterial infections.

- **Trade and industry:** You will be saving money on your water-heating bill. As scale is removed from your pipes, your water heater will work much more efficiently. A reduction of 1/5" of scale will save you up to 60% in your heating costs. Once your pipes have cleaned out, the water pressure will return to its maximum flow rate. Even your water will boil faster.

- **Bathrooms:** You will observe a decrease lime scale in toilet bowl, urinal, sink stains and discoloration. The bathroom fixtures will clean easier, saving your money on your maintenance bills.

- **Dishwasher & Laundraments:** Dishwasher will be more energy efficient as the removes hard scale that has formed






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Hard water problems and scaling are never more evident than to owners of evaporative coolers. Better known as “swamp coolers”, most home owners and businesses rely on these systems for air cooling during the hot summer months.

on the rinse/wash jets, pumping and head raising equipment and supply lines. Spotting on dishes and glassware will be reduced dramatically. You will notice that detergent will not clot in conveyor and/or rack type dishwashing equipment. You can expect up to a 20% reduction in detergent use. All of your appliances that are in contact with water will have prolonged life spans.

- **Coffee, Tea Soda & Ice Making Machines:** Will remain cleaner and operate more effectively. The lines will become unclogged and the taste of your beverages will be greatly improved. The overall quality of ice cubes and drinking water will be better.
- **Coffee Vending Machines:** A good hot cup of coffee for its employees is a necessity for any company. Coffee vending machines supply this demand, but often require service calls to clean or replace the heating elements and to unclog the water lines that get full of scale. Coffee vending machine owners had no

alternative but to absorb the cost of service calls & maintenance before the discovery of the electronic descaler, which reduces maintenance and service calls dramatically. Reduces element replacement and cleaning, Eliminates line clogging due to scale build-up, Improves taste of coffee by cleaning out pipes of scale and eliminating bacteria that breeds in the scale. Improves hot water heater efficiency.

- **Evaporative Air Cleaners /Air Conditioners:** Hard water problems and scaling are never more evident than to owners of evaporative coolers. Better known as “swamp coolers”, most home owners and businesses rely on these systems for air cooling during the hot summer months. However, hard water causes severe scaling that requires constant maintenance and replacement of the filter pads. The filter pad is completely scaled up in just one month and needs to be cleaned or replaced periodically. When the pad is clogged up, the air flow reduction

increases humidity which reduces the efficiency and effectiveness of the air cooler. The corrosion rate increases with scale buildup, causing considerable depreciation of all cooler parts including the blower, brackets and pumps.

Conclusion

Advance water conditioners can Eliminate LIME SCALE and HARD WATER troubles but you will experience its effect after 3-6 Months depends on geographical situations and Quality of Water. Water conditioner is not a replacement of R.O System but Effective in removing scaling problems, other benefits are-

- Increase Crop /Food Production in Agricultural Area.
- Reduce Water Heating Energy Up To 40%
- Make Your Appliances long lasting,
- Reduce consumption of Soap, Water, Detergent and Shampoo.
- Environmental Friendly, Reduce Carbon Footprint Saves Energy, Water & Money.
- Saves up to 70% in soap costs and 20% in hot water heating costs.
- Make heating Process Very Fast Effectively.
- Grow More Crops per Drop in Agricultural Industries.
- Remove Scaling and avoid corrosion, Use all water a particle ultimately saves our water consumption and protect environments also. ■

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IPCC Fifth Assessment Report: Climate change threatens irreversible impacts, but options exist to limit its effects

Human influence on the climate system is clear and growing, with impacts observed on all continents. If left unchecked, climate change will increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. However, options are available to adapt to climate change and implementing stringent mitigations activities can ensure that the impacts of climate change remain within a manageable range, creating a brighter and more sustainable future. These are among the key findings of Synthesis Report released by the Intergovernmental Panel on Climate Change (IPCC). The Synthesis Report distills and integrates the findings of the IPCC Fifth Assessment Report produced over the past 13 months – the most comprehensive assessment of climate change ever undertaken.

"We have the means to limit climate change," said R. K. Pachauri, Chair of IPCC. "The solutions are many and allow for continued economic and human development. All we need is the will to change, which we trust will be motivated by knowledge and an understanding of science of climate change."

Synthesis Report: confirms that climate change being registered and warming of the climate system is unequivocal. "Our assessment finds that the atmosphere and oceans have warmed, the amount of snow and ice has diminished, sea level has risen and the concentration of carbon dioxide has increased to a level unprecedented in at least the last 800,000 years," said Thomas Stocker, Co-Chair IPCC Working Group I.

The report expresses, emissions of greenhouse gases and other anthropogenic drivers have been dominant cause of observed warming since mid-20th century. The impacts of climate change has been felt on all continents and across the oceans. Continued emissions of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of widespread and profound impacts affecting all levels of society and the natural world, the report finds.

Synthesis Report makes a clear case that many risks constitute particular challenges for the least developed countries and vulnerable communities, given their limited ability to cope. People who are marginalized are especially vulnerable to climate change. Adaptation is fine but substantial and sustained reductions of GHGs emissions are at the core of limiting the risks of climate change. And since mitigation reduces the rate as well as the magnitude of warming, it also increases the time available for adaptation to a particular level of climate change, potentially by several decades.

There are multiple mitigation pathways to achieve the substantial emissions reductions over the next few decades necessary to limit, with a greater than 66% chance, the warming to 2°C – the goal set by governments. However, delaying additional mitigation to 2030 will increase the technological, economic, social and institutional challenges associated with limiting the warming over the 21st century to below 2°C



relative to pre-industrial levels, the report finds.

"It is technically feasible to transition to a low-carbon economy," said Youba Sokona, Co-Chair of IPCC Working Group III. "But what is lacking are appropriate policies and institutions. The longer we wait to take action, the more it will cost to adapt and mitigate climate change." The Synthesis Report finds that mitigation cost estimates vary, but that global economic growth would not be strongly affected. In business-as-usual scenarios, consumption – a proxy for economic growth – grows by 1.6 to 3 percent per year over the 21st century. Ambitious mitigation would reduce this by about 0.06 percentage points. "Compared to the imminent risk of irreversible climate change impacts, the risks of mitigation are manageable" said Sokona.

These economic estimates of mitigation costs do not account for the benefits of reduced climate change, nor do they account for the numerous co-benefits associated with human health, livelihoods, and development. "The scientific case for prioritizing action on climate change is clearer than ever," Pachauri said. "We have little time before the window of opportunity to stay within 2°C of warming closes. To keep a good chance of staying below 2°C, and at manageable costs, our emissions should drop by 40 to 70 percent globally between 2010 and 2050, falling to zero or below by 2100. We have that opportunity, and the choice is in our hands."

Comprehensive assessment: Synthesis Report, written under the leadership of IPCC Chair R.K. Pachauri, forms the capstone of the IPCC Fifth Assessment Report. IPCC reports draw on the many years of work by the scientific community investigating climate change. More than 830 coordinating lead authors, lead authors and review editors from over 80 countries and covering a range of scientific, technical and socio-economic views and expertise, produced the three working group contributions, supported by over 1000 contributing authors and insights of over 2,000 expert reviewers in a process of repeated review and revision. The authors assessed more than 30,000 scientific papers to develop the Fifth Assessment Report. About 60 authors and editors drawn from the IPCC Bureau and from Working Group author teams have been involved in the writing of the Synthesis Report. Their work was made possible by the contributions and dedication of the Synthesis Report Technical Support Unit. ■

Food safety and Freezers



Food poisoning is frequently caused by bacteria from foods that have been incorrectly stored, prepared, handled or cooked. Food contaminated with food-poisoning bacteria may look, smell and taste normal. If food is not stored properly, the bacteria in it can multiply to dangerous levels.

Food-poisoning bacteria can grow and multiply on some types of food more easily than others. High-risk food should be kept at 5°C or below, and above 60°C to avoid the 'temperature danger zone', where bacteria multiply fastest. High-risk foods include Raw and cooked meat, including poultry such as chicken and turkey, and foods containing these, such as casseroles, curries and lasagna; Dairy products,

such as custard and dairy based desserts like custard tarts and cheesecake; Eggs and egg products; Small goods such as hams and salamis; Seafood, such as seafood salad, patties, fish balls, stews containing seafood and fish stock; Cooked rice and pasta; Prepared salads like coleslaws, pasta salads and rice salads; Prepared fruit salads; Ready to eat foods, including sandwiches, rolls, and pizza that contain any of the food above; Food



that comes in packages, cans and jars can become high-risk foods once opened, and should be handled and stored correctly.

To prevent food spoilage and food poisoning, different kinds and size of freezers are used. In market many freezers depending upon the basic style and commercial use are available like chest freezer, drawer freezer, upright freezers and portable freezers. When choosing a freezer, it is important to check that the freezer part is a proper freezer rather than just a freezing compartment, ideal for the storage of commercially frozen products only.

A freezer is a relatively modern invention, only becoming widespread after World War II. But now-a-days we cannot imagine our home without at least one freezer. These are used to preserve food, meat etc. Freezing foods protects them from bacteria, mold, and rot. Many people prefer to shop

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Dr Namita Joshi is Head and incharge of Department of Environmental Sciences, Kanya Gurukul Campus, Gurukul Kangri Vishwavidyalaya, Haridwar. She is PhD with specialization in Fisheries and Crustacean Toxicology with over two decades research & teaching experience. She has published more than 75 research papers and supervised more than 190 MSc dissertations and guided 10 PhD students.



Dr KK Gangwar, PhD with specialization in Ecology and Biodiversity is working as Environmental Consultant. He has published 4 books, more than 28 research papers, and various book chapters on aspects of environmental sciences. He is a fellow of Indian Academy of Environmental Sciences (IAES), Haridwar and Life member of Society of Environmental Sciences, Dumka.



less frequently & buy large quantities in order to save money and time. A standalone freezer can be a thrifty alternative to purchasing a refrigerator that has a larger freezer section.

Importance of freezing food

Bacteria exist everywhere in nature. They are in the soil, air, water, and the foods we eat. When they have nutrients (food), moisture, and favorable temperatures, they grow rapidly, increasing in numbers to the point where some types of bacteria can cause illness. Bacteria grow most rapidly in the range of temperatures between 40 and 140°F, the "Danger Zone," some doubling in number in as little as 20 minutes. Freezing slows bacterial growth and protect most foods. Perishable food will deteriorate, even at freezing temperatures, due to spoilage microorganisms, enzymes & oxidation. Time and temperature are important factors in food quality.

Freezer Temperatures

Freezer temperatures, however, do not destroy pathogenic or spoilage microorganisms, which will begin growing under warmer temperature

conditions. The lower temperature does, however, slow the growth of microorganisms already in the food. When frozen foods are thawed at room temperature, the surface of the food warms enough for microorganisms to grow and multiply.

Keep your freezer at zero degrees (0°F) or below to maintain the quality of frozen foods.

Most foods will maintain good quality longer if the freezer temperature is -10 to -20°F. At temperatures between 0 and 32°F, food deteriorates more rapidly. Fluctuating temperatures, such as those in self-defrosting freezers, also may damage food quality. Do not plan to store frozen foods for the maximum suggested time if your freezing unit cannot maintain zero degree temperatures. Even foods stored properly will lose color, texture, flavor and nutritional quality but will not cause food-borne illness. Freezer thermometers are available to help monitor the temperature inside the appliance.

Freezer Time

Time is an important factor in maintaining high-quality frozen foods.

Category	Food	Freezer (0°F or below)
Salads	Egg, chicken, ham, tuna & macaroni salads	Does not freeze well
Hot dogs	opened package	1 to 2 months
	unopened package	1 to 2 months
Luncheon meat	opened package or deli sliced	1 to 2 months
	unopened package	1 to 2 months
Bacon & Sausage	Bacon	1 month
	Sausage, raw — from chicken, turkey, pork, beef	1 to 2 months
Hamburger & Other Ground Meats	Hamburger, ground beef, turkey, veal, pork, lamb, & mixtures of them	3 to 4 months
Fresh Beef, Veal, Lamb & Pork	Steaks	6 to 12 months
	Chops	4 to 6 months
	Roasts	4 to 12 months
Fresh Poultry	Chicken or turkey, whole	1 year
	Chicken or turkey, pieces	9 months
Soups & Stews	Vegetable or meat added	2 to 3 months
Leftovers	Cooked meat or poultry	2 to 6 months
	Chicken nuggets or patties	1 to 3 months
	Pizza	1 to 2 months

Frozen foods will not last forever. The chart on the associated page lists the maximum length of storage times to help you maintain quality food products.

Storage times for the Freezer

The guidelines for freezer storage are for quality only. Frozen foods remain safe indefinitely.

Some important thing should be remembered while using freezer to store and preserve our food are-

Freezing food safely

During shopping, chilled and frozen foods should be bought at the end of the trip and after arriving at home, chilled and frozen foods should be kept into the freezer immediately.

Storing cooked food safely

Cooked food should be cooled first. Very hot food into the freezer should not be kept in to the freezer.

Avoid refreezing thawed food

Food-poisoning bacteria can grow in frozen food while it is thawing, so thawing frozen food in the temperature danger zone should be avoided. Defrosted food in the freezer should be kept until it is ready to be cooked. If using a microwave oven to defrost food, cook it immediately after defrosting.

As a general rule, refreezing thawed food should be avoided. Food that is frozen a second time is likely to have higher levels of food-poisoning bacteria. The risk depends on the condition of the food when frozen, and how the food is handled between thawing & refreezing, but raw food should never be refrozen once thawed.

Storage of raw food separately from cooked food

Raw food and cooked food should be stored separately in the freezer.

Bacteria from raw food can contaminate cold cooked food, and the bacteria can multiply to dangerous levels if the food is not cooked thoroughly again. Always raw food should be stored in sealed or covered containers at the bottom of the freezer. Raw foods should be kept below cooked foods, to avoid liquid such as meat juices dripping down and contaminating the cooked food.

Some other points should be kept in mind while storing food into freezer.

- Label frozen food items, maintain a rotation system and use the items with the oldest dates first.
- Allow proper air circulation in the freezer.
- One easy way to estimate the freezer's temperature is to check the consistency of ice cream stored inside the compartment. If the ice cream is not brick-hard, the temperature of your freezer is too warm.
- A warning light or other device may be installed to warn you if the freezer is not operating correctly. A plug protector may be used to keep the electrical plug in the outlet.
- Use food quickly, and don't expect food to remain high-quality for the maximum length of time. Opened and partially used items usually deteriorate more quickly than unopened packages.
- Foil, plastic wraps or bags or airtight containers are the best choices for storing most foods in the refrigerator. Open dishes may result in refrigerator odors, dried-out foods, loss of nutrients and mold growth.
- Don't stack foods tightly or cover refrigerator shelves with foil or any material that prevents air circulation from quickly and evenly cooling the food.
- Some foods, including milk, meats and leftovers, should be kept colder than others.
- The coldest part of the refrigerator is usually the area nearest the freezer compartment, but a refrigerator thermometer will provide an accurate check for each appliance. ■

INDIA COLD CHAIN SHOW 2014

December 10-12,
Bombay Exhibition
Centre, Mumbai

Third India Cold Chain Show, India's Biggest Event for Cold Chain Technologies will feature participants from across the globe. The India Cold Chain Show scheduled from December 10-12, 2014 at Bombay Exhibition Centre, Goregaon (E), Mumbai will bring together cold storages, temperature controlling, material handling, logistics and cold supply chain solutions all together at one place. Every year, ICCS gathers more than 5,500 industry professionals under one roof. Taking place in concurrence with India Material Handling & Logistics Show and India Cold Chain Summit, ICCS gives you an opportunity for business, education and networking. It offers latest equipments, live product demos and industry trends.

Supported by National Centre for Cold Chain Development (NCCD), the exhibition offers a large variety of products, solutions and technologies and is particularly beneficial for decision makers from Agro & Agriculture, Fisheries, Dairy,

Horticulture, Hotel, Restaurants, Fast Food Chains, Fruits & Vegetables, Food Grains, Retail, Processed & Packaged Foods, Pharmaceutical, Seafood and many other sectors which are regular users of cold storages, temperature controlling techniques, materials handling and cold logistics.

ICCS 2014 Facts

- More than 300 live technologies & solutions representing cold storage infrastructure, cold transport and cold supply chain.
- 120+ exhibitors, 250+ representative brands from more than 15 countries.
- Connect with industry colleagues & meet industry thought leaders from over 30 visiting countries at India Cold Chain Summit.
- Learn industry best practices, latest trends and meet potential recruiters.
- Explore innovative technologies at Cold Supply Chain Zone, US Pavilion, UK Pavilion and Reverse Logistics Association Pavilion.
- Annual General Meeting of Federation of Cold Storage Associations of India (FCAOI).

The event has garnered support from Kelvin Cold Chain Logistics Pvt Ltd as platinum partner, Pluss Polymers Pvt Ltd as technology partner, BASF India as conference partner, Officins Mario Dorin SPA as cocktail partner, Kirloskar Pneumatic Co. Ltd. as AGM partner and Fresh Food Technology India Pvt. Ltd. & Van Amerongen CA Technology as delegate kit partners. ICCS is officially supported by US Commercial Services and will have a US Pavilion during the show. National Small Industries Corporation (NSIC) and Cold Storage Association Uttar Pradesh are also supporting.

Further there will be India Cold Chain Summit, a two day conference taking place on December 10-11 co-located with India Cold Chain Show at Bombay Exhibition Centre. The conference discussions and sessions theme will be based on 'Exploring new strategies and avenues to expand cold chain business in India'.



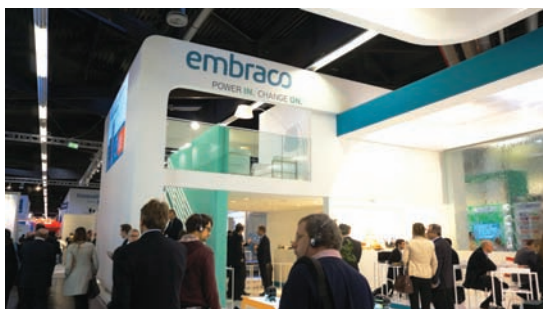
CHILLVENTA 2014

the new records



Cooling India the only one magazine from Asia was invited to cover the event during October 2014 held at the Exhibition Centre Nuremberg in Germany. Chillventa event provides a platform where the industry can discuss and exchange ideas on innovations and markets.

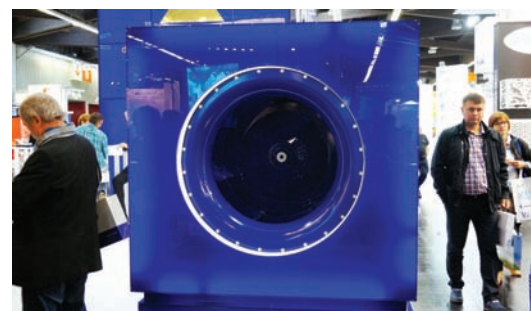
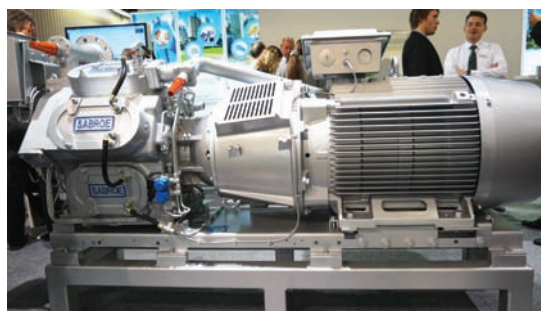
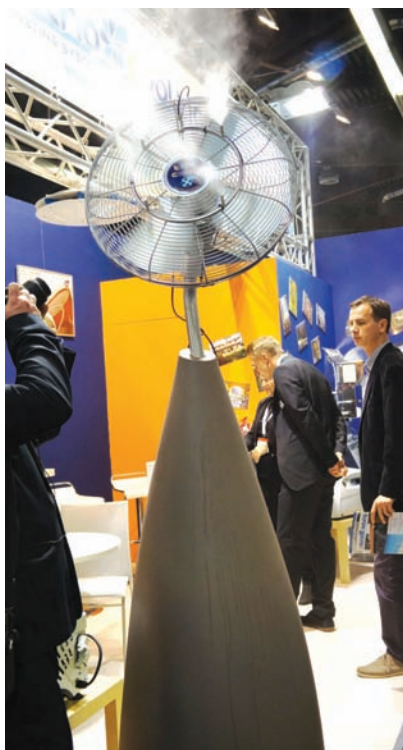
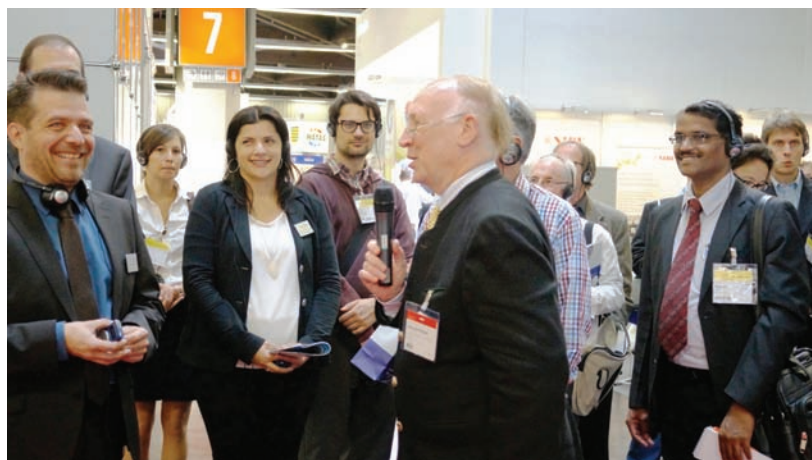
Chillventa continues to set records and has improved all its exhibition parameters. "For the first time Chillventa has topped 30,000 trade visitors, an increase of 7 % compared with the exhibition in 2012, and attracted 984 exhibitors – 70 more than two years ago. These figures show the great commitment and confidence of Chillventa's visitors and exhibitors. It is the key gathering of the national and international market

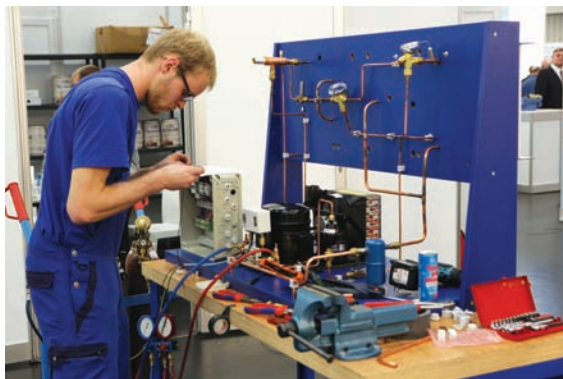
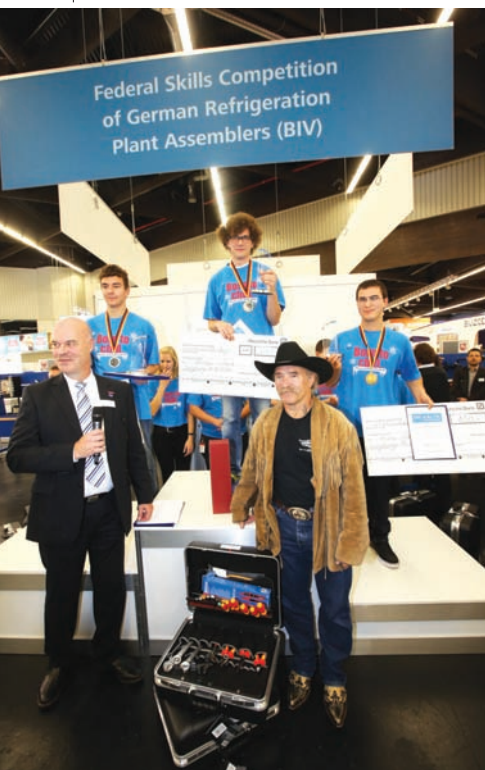


players in the refrigeration, air conditioning, ventilation and heat pump segments,” says Richard Krowoza, Member of the Management Board at NürnbergMesse.

The large international involvement at Chillventa was again particularly impressive. 56 % of the visitors and 67 % of the exhibitors come from abroad. More than 30,000 visitors represent over 110 countries throughout the world.

“Chillventa achieved these records despite the rail strike by the Gewerkschaft der Lokführer (GDL – Locomotive Drivers Trade Union) on the second day and the attendance from Germany also grew appreciably. However, just as important as the quantitative data is the quality of the visiting professionals. The exhibiting companies expressed their appreciation of the professional concentration and the high degree of decision-





making authority," says Alexander Stein, Director Exhibitions Chillventa at NürnbergMesse.

Chillventa's basic theme of "Chillventa Connecting Experts" was not only actively presented at the exhibition, but also in the supporting programme. The successful Chillventa Congressing took place the day before the exhibition under the direction of the expert, Dr. Rainer Jakobs. The 250 international participants were offered a top-class programme. Guided tours for specific target groups, tours

and several special presentations provided comprehensive and targeted information for many visitors.

A special highlight on the last day of the exhibition was the visit by Konny Reimann, TV emigrant and refrigeration and air conditioning fitter. Visitors and companies could get to know the pleasant new Texan and test his specialist knowledge at a talk show and autograph session. Reference for most of the photos is NürnbergMesse. The next Chillventa takes place in the Exhibition Centre Nuremberg from October 11–13, 2016. ■

INDIA COLD CHAIN SHOW 2014

**10-11-12
DECEMBER 2014**

**BOMBAY EXHIBITION CENTRE
GOREGAON (E), MUMBAI**

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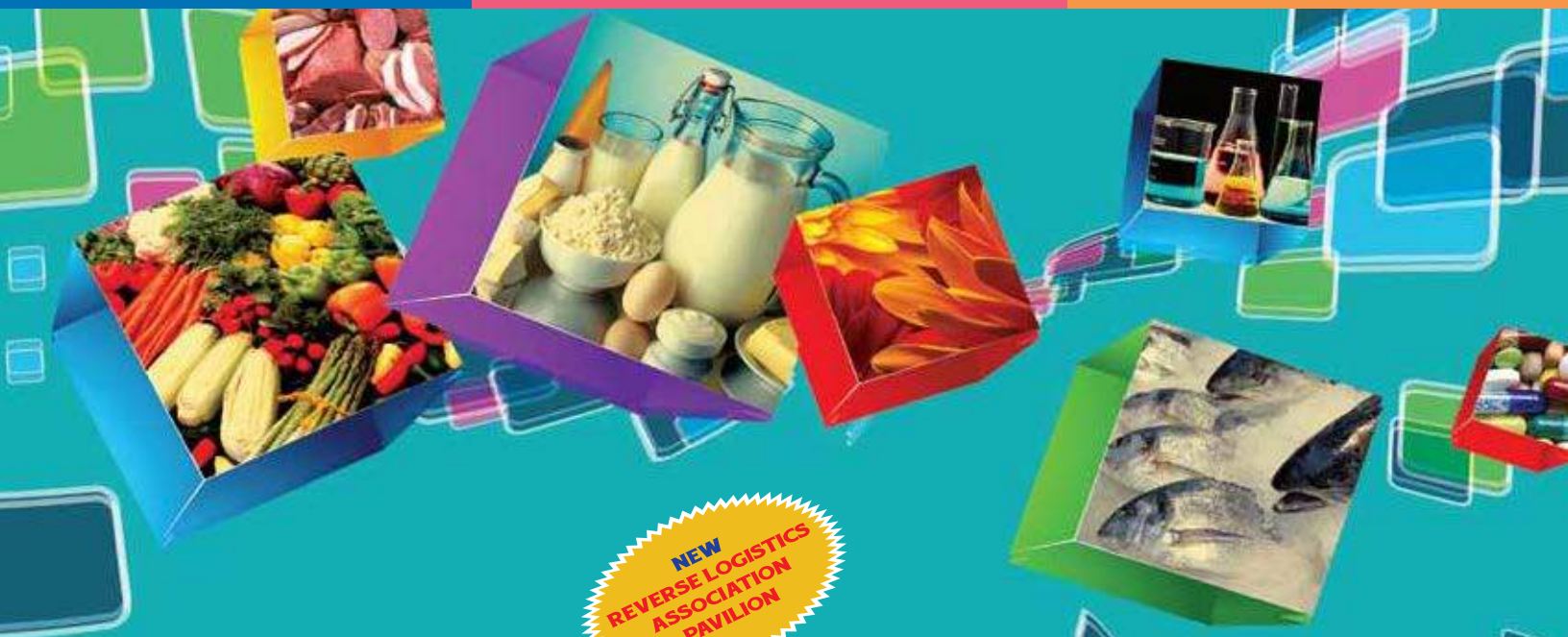
**COLD
STORAGE**



**COLD
TRANSPORT**



**COLD
SUPPLY CHAIN**



**NEW
REVERSE LOGISTICS
ASSOCIATION
PAVILION**

India Cold Chain Show

10-11-12 December 2014 at Bombay Exhibition Centre,
Goregaon (E), Mumbai, Maharashtra.

3rd India Cold Chain Show, India's biggest marketplace for cold logistics, temperature controlling, cold storages & cold supply chain.

India Cold Chain Summit

10-11 December 2014 at Bombay Exhibition Centre,
Goregaon (E), Mumbai, Maharashtra.

"Exploring new strategies and avenues to expand cold chain business in India."

Exhibition Highlights:

- Over 300+ products & solutions.
- Annual General Meeting of The Federation of Cold Storages Associations of India.
- UK Pavilion showcasing latest technologies from the west.
- Materials Handling Solutions for cold storages.
- Cold Supply Chain Zone.

Conference Highlights:

- Importance of efficient cold distribution.
- Cost optimization in running cold storage business.
- Automation: The need for flexibility at cold storages.
- Supply chain integrity and secure cold chain management.
- Raising capital investment in cold chain sector.

Technology Partner



Delegate Kit Partners



Fresh Food
Technology



Conference Partner



Cocktail Partner



AGM Partner



Certified By



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Chamber of
Cold Storages Industry
Telangana



Organised By



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Automatic Industrial Overhead doors from Gandhi Automations

Gandhi Automations offers Automatic Industrial Overhead doors, the ideal solution for all industrial needs. Gandhi Industrial Overhead Doors ensure a better use of inside space as the side guides vertically move the door along the wall and parallel to the ceiling. The doors are installed above the opening, thus ensuring a better use of the transit opening.



Easy and practical to open and operate - As these doors slide vertically, stopping in the proximity of the ceiling, they blend in with the architectural features of the building. Their compact size ensures more available space both inside and outside of the premises.

More environmental control - Heat insulation and soundproofing ensured by heat-insulated panels improve working conditions on the premises and ensure energy savings.

Light and aesthetically pleasing environments - The panels can also be manufactured with the addition of practical portholes or full aluminium sections featuring polycarbonate or unbreakable glass panels, wire meshing or air grilles.

They add value to the premises and meet all requirements - the design and different solutions offered ensure the door to be perfectly suited in any architectural environment from modern

to fine commercial buildings. The doors can meet any industrial and commercial requirement and add value to the building they are installed on. These doors are built to ensure the highest ease and flexibility of use which, in turn ensures a quick, hassle free and accurate replacement of old doors. Reliability - all products are affixed with a CE mark. ■

Website:
www.geapl.co.in

Silver-Copper-Zinc Brazing Alloys by Jinhua Shuanghuan Brazing Alloys Co Ltd



Silver-copper-zinc brazing alloys can provide perfect performance with low melting point, extensive flow properties and creating strong, ductile, rust-resistant joints of excellent conductivity. Suitable for joining all non-ferrous metals and ferrous metals except Aluminum and Magnesium. Flux is needed for brazing of Zine / Tin can help as temperature depressant and reduce cost of filler metal. Nickel can improve the heat-resisting, rust-resisting and wetting properties of the alloy. ■

Website:
www.shqianliao.com

HMX sets up test lab

Providing cooling without the usual guzzling of energy is one of the most positive developments in the field of HVAC. HMX, a Business Unit of A.T.E., is a pioneer in providing energy-efficient cooling solutions for processes, comfort for both the industrial and commercial sectors.



After its award-winning and highly successful HMX-Ambiator, HMX recently launched a range of pre-cooled fresh air units – the HMX-PCU-F and the HMX-PCU-R. The core of all HMX products is DAMA (Dry Air Moist Air) an innovative heat exchanger technology for indirect evaporative cooling, patented. The success of HMX can be gauged from its rapidly growing installation base, which has already crossed 19,500,000 CFM all over India. To make its cooling technology even more efficient, HMX has set up a test laboratory in Peenya. The test lab will be equipped with facilities for accurate measurement capabilities generation of conditioned air at desired parameters, testing of DAMA with different secondary air wet bulb temperature combinations, heat exchanger performance at different ambient conditions, etc. ■



Website:
www.hmx.co.in

S47 series high speed refrigerant charging machine by Shaoxing Cacl Digital Control Co Ltd

Feature

It has Digital control technology with accurate data processing ability. High hydrocarbon-charging refrigerants, improve production beats. Color touch screen in both Chinese and English versions, operation more easy. Rechargeable note R22, R407C and various types of air conditioning refrigerants such as R410A. On the strict vacuity detection, leak detection function. High-speed CA -back guide plunger H5AG hydrocarbon-charging gun. Using RHEONIK mass flowmeter metering. Use CACL E09 edition software, perfect A6 the control technology. Enhance hydrocarbon-charging quality and production efficiency.



Main Configuration

ULVAC VDN301 vacuum pump or lodz pump units, pneumatic vacuum diaphragm valve. CACL pure pneumatic efficient booster pump (CM2). ■

Website:

www.china-cacl.com

Seamless Copper Tube for Natural Gas and Liquefied Petroleum Gas Fuel Distribution Systems ASTM B 837 by Soldia Corporation

Sampo Industrial manufactures a range of seamless copper tubes supplied for use in above ground and indoor Natural Gas and Liquefied Petroleum (LP) Gas Fuel distribution systems installed in Conformance with the requirements of National Fire Protection Association (NFPA) 54, National Fuel Gas Code and Various state systems and regional codes that recognize and list this standard. These systems are commonly assembled with flare fitting or blazed fitting and special marked as type GAS.



Some advantages of using copper in fuel gas piping include flexibility, ease of jointing, ease of bending, compact sizing. ■

Website:

www.soldia.com.cn

Water Cooled Water Chillers from Ahata

Ahata India is renowned manufacturer and service provider of water cooled water chiller, their designed water cooled chillers are made up premium material that make them highly durable and earn higher demand in refrigeration industries. They also provide customized design for these units in accordance with specific requirements of clients. These chillers are easier to operate and require minimum maintenance that makes them widely preferred among customers. They find their usage in the following industries, Chemical Industries: mould cooling, milk plants, food industries and many others.



Features

Compact size, less power consumption, easy operation & less maintenance, corrosion resistant. ■

Website:

www.ahataindia.com

Regal office mobile shelving systems by SSI SCHAEFER

More and more companies are demanding efficient methods to store and retrieve information while making the best use of the office space. Even with the technological breakthroughs they have organizations that still need to store hard copies of documents and must be readily accessible. SSI SCHAEFER regal office mobile shelving system offers user-friendly accessories which simplify the task of the filing personnel, while creating efficient and well organized storage space.



Features

Increase storage capacity by up to 60%; runs on high quality steel tracks that can be installed on carpet, Swiss-engineered gears allow mobile units to move effortlessly with the turn of the hand wheels; can be locked either individually or unblock; also available with user-friendly accessories that create efficient & well organized filing & storage.

Application

It is applicable for offices, archive libraries. Light to medium weight small items such as files, small boxes, brochures etc. ■

Website:

www.ssi-schaefer.in

ABS Starting Capacitors Motors Start Capacitors from Zhejiang Huizhong Industry Co Ltd

C D60 start capacitor is developed and researched according to standard of American Electronics Association (ANSI/EIA-463). The external case of the capacitors is made of ABS plasticized which character is not only good insulating resistance, strong resistance damaged but also protecting electro liquid as good sealed feature. It is popular used for the super AC application as good life, higher degree of reliability and stability.



Features

ABS case. Voltage from 110V AC to 330V AC. UL recognized capacitors.

General Specification

Operating Temperature: -25~+650C;

Voltage Range: 110~330V AC;

Performance Specification: Meets Requirements of EIA-463-A.

Application

It is applicable to start and run of single phase motor in alternating current usage and it suit for single A.C. motors with frequency of 50Hz-60Hz. ■

Website:

www.hui-zhong.net

Filter Drier for Car A/C by Nantong OEM Refrigeration Equipment Co., Ltd

The refrigerant must be clean and dry before entering into expansion valve, otherwise the expansion valve will be blocked by impurities or ice. To avoid these, one need to install a filter drier before the refrigerants enters into the expansion valve. It filtrate the scrap iron and welding slag, absorbs the water into system, special design on connections can eliminate vibration exists during driving.



Features

Shock resistant steel shell construction finer. 25µm final outlet pad keep maximum filtration with minimal pressure drop. Can be used in all environments, including marine applications. ■

Website:

www.filterdrier.cn

Modularly extended fan system by Ziehl-Abegg

Z Aplus is an axial fan within a compact unit made of high-strength composite material, in which the motor and control system are integrated. Apart from the finely tuned combination of efficient individual elements, the composite material has enabled the creation of new shapes that can positively and selectively affect the air flow. Optionally a diffusor can be fitted for the lower pressure ranges. "We were already well ahead of all EU directives for energy saving in 2012," says CEO Fenkl. The fan system meets the ErP specifications 2015 both with the energy-saving EClblue motors and the traditional AC motors. Even high-pole (slow rotating) AC motors are suitable for the ErP 2015 in a Z Aplus system. The higher purchasing price is amortised within twelve months, then supermarket or hotel owners, for example, can save electricity costs every day by lower consumption. The experts from Ziehl-Abegg estimate an annual saving of



An orange heating band protects the compact, energy-saving Z Aplus fan system against freezing when using in evaporators and heat pumps displayed at Chillventa.

more than 150 Euros per year with a 6-pole fan with and axial fan of the FE2owlet series at an average daily operating time of 16 hours (6,000 hrs./year). These calculations are based on an electricity price of 13 cents per kilowatt hour and an average of 80 percent of nominal speed. "This can bring an annual saving of well over 200 Euros depending on the application," Product Manager Chris Besler underlines. Those who consume less electricity also help to protect the environment by lower

CO₂ emissions. The new development is also quieter or enables a considerable air reserve. As Ziehl-Abegg likes to use innovative, high-strength and light materials in its designs, the Z Aplus system weighs at least eight kilograms less than other systems available on the market. Plus the ideally adapted combination of bionic fan, motor and control technology from one mould. Advantages: More safety and simple installation

The new system design brings added advantages for device manufacturers and customer: The sophisticated system minimises the risk of a thermal short-circuit. For device manufacturers wishing to install sound suppressors or textile hoses, there are standardised ports on both sides of the Z Aplus (Eurovent flange). Moreover, a closed cable duct protects electrical leads. ■

Website:

www.ziehl-abegg.de

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Pedal-powered Centrifuge allows Off-grid Blood testing in rural areas

Designer Jack Albert Trew's Spokefuge harnesses the power of the pedal to help doctors in remote areas test blood without electric medical equipment. Trew's simple design uses a bike wheel to power a centrifuge, which enables medical professionals to test for issues like anemia, bone marrow failure and leukaemia. The lowtech device was developed to help people living in rural regions across Africa. Trew's Spokefuge was inspired by the very regions it was designed for. During his research, the young designer found that the bicycle was the favored method of transportation in rural African areas, so he decided to put the already present wheels in these communities to a different use. Blood samples are taken and put into capillary tubes, which are then inserted into a simple rubber casing that fits onto the centrifugal arm that connects to the tire, all of which Trew made using a 3D printer. Once enough capillary tubes are filled to attach to balance out the rear tire, the user pedals the bicycle in a fixed position for 10 minutes. The force created by the spinning wheel will separate the blood samples so they can be tested. The results are comparable



to expensive electric centrifuge devices, and can be carried out anywhere off the grid. Trew's Spokefuge is not only effective, but also costs next to nothing, only requiring the use of an old bicycle to provide modern medical testing. ■

eCool Off-grid Cooler makes Cold Beer emerge from ground like Magic

There are few things as enjoyable as cracking open a cold brewski in the great outdoors. Beers usually live in the fridge but what about when you're taking an off-grid detour? You could fuss with bags of ice or lug around a generator (seriously, don't do that). Or just get yourself a Beth Buczynski eCool Off-grid Cooler. This Danish startup founded by four beer-loving guys invented an environment-friendly cooler that keeps beers cool all year round without a single volt of electricity. They let nature do all the work. The concept of the eCool beer cooler is a simple one. In fact, rural cultures have used it for centuries to keep perishables fresh when there's no refrigerator. Remember grandma's root cellar? It used the natural coolness and steady humidity of the subterranean world to keep food from freezing during the winter and spoiling during the summer. The eCool does the same thing but in a modern, convenient way. The eCool (short for "earth cooler") is just over three feet tall, about nine inches in diameter and weighs about 26 pounds. Installation means digging a three foot hole, but the designers say it'll probably be easier if you use a garden drill. Once installed, the eCool can hold an entire case of beer (that's 24 cans) and can stay in the ground year round. And now the part everybody waits for is to take the beer out and drink it. If envisioned the best



buddy elbow deep in a hole in the back yard trying to retrieve the last beer, banish the thought. The guys at eCool have that part all figured out. Just turn the nifty hand crank on the side and the cooler's internal mechanism will haul up the next beer in line and dispense it through an adorable vending flap. The crank also works in the other direction to lower cans into the cooler. ■

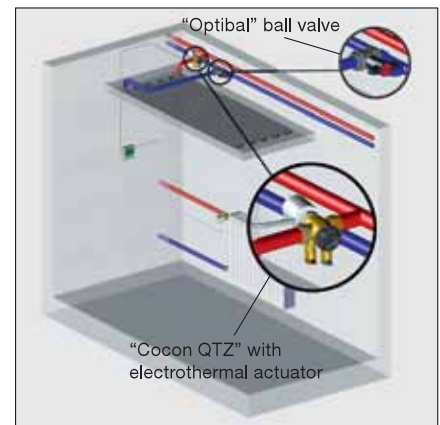
Pressure independent dynamic balancing valve (PID) “Cocon Q” with automatic flow control: multifunctional and economical



“Cocon QTZ” with electromotive actuator/with pressure test points



“Cocon QFC” with electromotive actuator/with pressure test points



Chilled ceiling system

The Oventrop pressure independent dynamic balancing valve “Cocon Q” combines two hydronic functions in one valve.

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