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5th Edition

**DairyTech
India 2015**

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**The IoT technology
adoption**
is growing at a mind-boggling pace

- Cascade systems are often unique and sometimes complex in their designs...
- Lack of refrigeration leads to 28% food waste in developing nations...
- Loss of hot water is a serious issue as it increases humidity in boiler room...



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Publisher's Letter



Publisher's Letter

Making A Robust Cold Chain

With the change in our food habits influenced by the socio-economic change that is coming in our country, we are becoming more and more dependent on the cold chain. Construction of a robust cold chain literally involves a large number of factors, and it is not just a question of setting up a chain, more important is maintaining its consistency through continuous monitoring.

We are making several plans, implementing them, however, we are not yet much careful about the end to end flaw-free functionality of the cold chain. Close monitoring of the chains is very essential. When the products are coming out of the factory, they are up to the standard in most of the cases, however at the end-point always that is not the case.

Especially, in dairy and allied products market, where almost every Indian citizen is a customer, the situation has to change with immediate effect. In India, a special section of people are vegetarians. Most of them consume fruits, milk and dairy products, thus at least in this segment no negligence is tolerable.

In this context, one more challenge is lack of knowledge of handling the goods. Mere cooling is not enough to keep the food items fresh, hygienic and tasty. There are other factors like maintaining a particular temperature range, humidity level and so on. Many of our cold chains or food chains fail to maintain that. Even many of them are not aware of that. So, proper training is very essential in this field.

Although some isolated initiatives are being taken in this direction, so far no organised drive is being seen in this area, which is very essential at this juncture. I hope our private operators come forward with their plans to mitigate this challenge as soon as possible.

Please send your comments at pravita@charypublications.in

Pravita Iyer
Publisher & Director





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OPERATION

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For more information, please contact:
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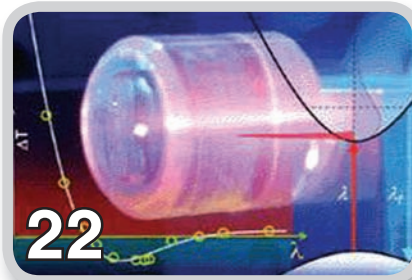
A.T.E. has developed technologies and deployed products in wastewater treatment, eco-friendly cooling solutions, and energy efficiency solutions...



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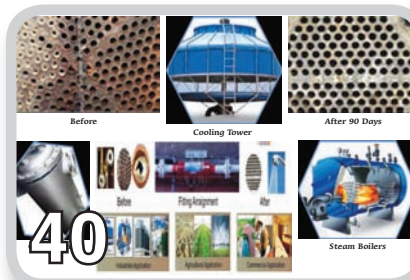
Cascade Systems And Refrigerants



Façades For High Performance Buildings



Parameters To Diagnose Refrigeration System



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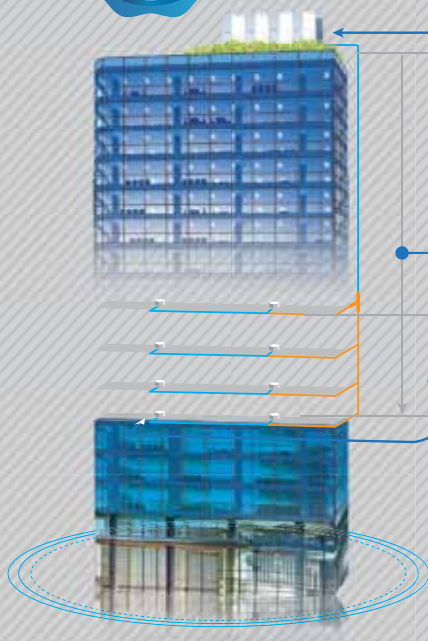
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Editor: P K Chatterjee



Energy Efficiency Is The Tool

Refrigerants have a direct effect on deterioration of our climate. It's not a new thing to the HVAC&R professionals. However, in this global economic circumstances, when the profitability is dwindling, it's truly hard for the business owners to invest in new technologies or retrofits.

The recent devaluation of Chinese currency will also have an effect on the Indian business. To what extent it will affect the Indian industry that we will be able to gauge after a few days. However, the fear is already there. And the business community has already been much more cautious about their investment.

Phasing out of one refrigerant means a big blow on the industry. However, literally, we are crossing two hurdles within a very small time gap. HFCs, which are fluorinated greenhouse gases were introduced in the recent past. Now, it is being found that "If HFC growth continues on the current trajectory, the increase in HFC emissions is projected to offset much of the climate benefit achieved by phasing out ozone-depleting substances." (Montreal Protocol)

So, all the users of cooling machinery have to go for new refrigerants, and get rid of HFC. More than technological challenge, in our developing economy, it is an economic challenge. However, we will have to accept it as there is no alternative.

Then, what can we do to mitigate the economic challenge? Well all fingers point towards energy efficiency. Right at this moment, we need to develop energy efficient cooling machinery. It's a good sign that some of our private HVAC&R and component manufacturers are coming up to address the issue in harmony with the government. I hope in the coming days, the new test facilities that are being set up in the country will help the Indian HVAC&R industry be the best in the world as far as energy efficiency is concerned.

Pl. send your views at pkchatterjee@charypublications.in

P. K. Chatterjee



New test facilities that are being set up in the country will help the Indian HVAC&R industry be the best in the world as far as energy efficiency is concerned...



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A-Gas launches products for safer refrigerant re-use



Graeme Dewerson, Sales Manager, A-Gas

To make a significant contribution for safer refrigerant re-use and system preventative maintenance, A-Gas Australia has announced the launch of new analytical services.

The A-Gas Refrigeration Health Check (RHC) is designed to provide analysis of oil and refrigerant in a currently operating HVAC&R system, it is perfect for system troubleshooting or can be used to target annual maintenance ensuring contamination issues are resolved before the system damage takes place.

"This boxed product contains all equipment needed to take the samples without cross contamination. Also, included is a prepaid TNT consignment note to ensure a prompt response from the A-Gas Laboratory. A full report on the condition of the refrigerant and the oil is provided, together with the steps needed to remediate any problems and extend system working life," said Graeme Dewerson, Sales Manager, Refrigerants, A-Gas.

Full Refrigerant Analysis (FRA) from A-Gas is a new product designed to inform contractors and end users about the quality of reclaimed refrigerant, which has been banked for re-use.

"Full Refrigerant Analysis (FRA) is a key tool for R22 management. It helps determine if end users can re-use reclaimed gas or if it should be professionally recycled. Using recycled R22 backed with enhanced system maintenance – allows operators to remain on R22 – rather than being pushed towards retrofit or early investment in new equipment. It will allow them to evaluate new HFO solutions as they reach the market and means that systems run on the gas they were designed to use rather than on a replacement that may offer reduced performance and lower energy efficiency," added Dewerson. ■

eurammon and EUROVENT join forces



Monika Witt, Chairwoman, eurammon and Christian Herten, outgoing President, EUROVENT

To combine efforts to advocate the use of natural refrigerants in the future, eurammon, the initiative for natural refrigerants, and EUROVENT, the European Association for Refrigeration and Air-conditioning Technology, have decided to intensify their cooperation. Monika Witt, Chairwoman of eurammon, and Christian Herten, outgoing President of EUROVENT, have signed a corresponding MoU for the same.

Since the new statutory regulations have increased the ecological awareness among operators, the market for natural refrigerants is growing significantly. In this context, eurammon and EUROVENT agreed to a strong cooperation. In future, eurammon as the centre of excellence for using natural refrigerants will support the new partner. ■

Frankfurt to host EnEff

For more than 40 years, EnEff – International trade fair and congress for heating, cooling and CHP – has been providing the industry with a biennial platform for district heating and cooling and combined heat and power generation in various locations.

For the first time, it will be held in Hall 4 of the Messe Frankfurt exhibition grounds between 19th to 21st June, 2016. The event is organised by the AGFW, the energy efficiency association for heating, cooling and CHP, and Euroheat & Power, a European association based in Brussels.

"We are pleased to be a partner to AGFW next year. The EnEff trade fair and congress fits very well with Messe Frankfurt's portfolio and areas of expertise and helps us further broaden the range of events and sectors represented in Frankfurt," said Uwe Behm, Member of the Executive Board of Messe Frankfurt GmbH.

With the merger of the German and European events, the EnEff has become particularly international in scope. ■

Bajaj Electricals provides technical solution



Shakti Leekha, Sr. GM and Head Bajaj IBMS during the presentation...

Reinforcing its focus in the Integrated Building Management Systems segment (IBMS), Bajaj Electricals Ltd. presented a comprehensive technical solution on building management system and energy management systems along with their international partner Delta Controls Inc., Canada. This solution offers dependable, open-platform and user friendly Building Management System (BMS) and Energy Management Systems (EMS) to commercial, healthcare, education, leisure buildings along with specialised applications for datacenters with energy management and energy reporting tools for energy efficiency along with building analytical tools.

"Our philosophy at Bajaj Electricals Ltd. is to provide a single ceiling solution for all the various fixtures that go onto the ceiling or on the wall; like smoke detectors, cameras, lights, speakers, thermostats with occupancy and indoor air quality options, wireless sensors and other sensors. We are getting ready to be part of the new revolution of 100 smart cities and are bringing products and smart solutions to enable system integrators and installers to be competent to deliver on this opportunity. Bajaj Electricals has been up skilling system integrators to gain domain expertise in IBMS and help us create an ecosystem for more smart building and cities," said Shakti Leekha, Sr. GM and Head Bajaj IBMS. The software is designed as a unified enterprise platform for building automation, Access Control Solution and Lighting Controls with Multisite management tools. It consists of web-based application that combines the power of enterprise dashboards with easy-to-use facility management tools. ■

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2	Chilled Water Temp in °C (Assumed)	5°C	5°C
3	Supply Temp. from CT / LTMCS	33°C	30°C
4	Approach to WBT	4°C	1°C
5	ΔT for Chiller	28°C	25°C
6	Chilled Water Compressor Motor Kw for 1200 TR	720	643
7	Energy Saved in %	-	10.7%
8	Energy Saved in Kw	-	77 Kw/Hr
9	Total Running Hours per Annum	8640	8640
10	TOTAL POWER SAVED PER ANNUM	-	6,65,280 Kw



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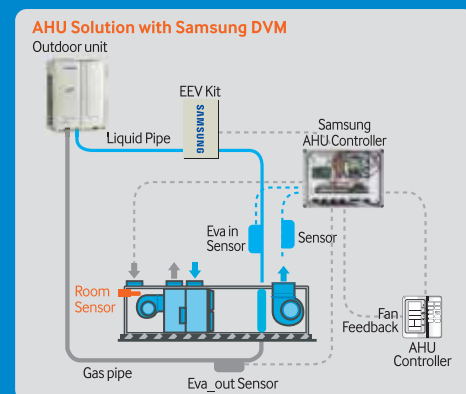


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ACREX India 2016 will cover issues discussed in Symposia



A view of inauguration of Symposia...

Symposia, a seminar with focus on the Pharmaceutical Manufacturing Facilities in India and the role of HVAC&R in the pharma industry, recently held in Mumbai, is a prelude to ACREX India 2016, South Asia's largest exhibition on Air Conditioning, Ventilation, Refrigeration & Building Services, which is scheduled to take place in Mumbai on February 25-27th, 2016. All the issues and trends on the role of HVAC&R systems in the Pharmaceutical Manufacturing Facilities, which were discussed at Symposia will be taken forward on a national level at ACREX India

2016. The seminar focused on good manufacturing practices and environmentally friendly designs that not only ensure quality products, but also the safety and well being of all personnel. The key speakers focused on the need for manufacturing standards, essential for making sure that design, systems and equipment installation are done while eliminating risks.

"The Indian pharmaceutical Industry has grown phenomenally and today has achieved an eminent global position in the pharma sector. Temperature, relative humidity and ventilation should be appropriate and should not adversely affect the quality of pharmaceutical products during their manufacture and storage, or the accurate functioning of equipment. In view of this, we are organising the symposia to spread awareness," said Pankaj Dharkar, President of M/s. Pankaj Dharkar & Associates and National President of Fire and Security Association of India.

"HVAC systems in pharmaceutical facilities must meet global standards of current Good Manufacturing Practices (cGMPs). Pharma regulations require that manufacturers must take proactive steps to ensure that their products are safe, pure and effective. HVAC system plays a critical role in achieving this. This seminar shall focus discussion on understanding the basics of HVAC system from regulatory view point and its validation for the pharma industry. ■

Low carbon heating venture in the UK

A first of its kind low carbon heating venture to merge large scale heat pumps and solar thermal panels with contributions from solar photovoltaic and dedicated heat storage provision in a large scale district heating network is being done in Cranbrook, UK.

Star Renewable Energy will design and build an innovative large scale heat pump system that will work with a solar energy installation to harvest solar energy to supply E.ON's community energy centre in Cranbrook to the east of Exeter, with renewable heating & hot water.

The demonstration project is 1 of 9 schemes sharing a £6 mn funding allocation from DECC. This innovation will drastically lower the environmental impact of warming local homes, businesses and buildings in Cranbrook and the surrounding areas.

As part of the project, Star will install a high temperature 80°C heat pump that will draw heat from approximately 2,000 sqm of ground-mounted solar thermal panels. ■

CTI needs experts to jointly develop a new standard

The Cooling Technology Institute's (CTI's) Engineering Standards and Maintenance (ES&M) Committee is offering all interested parties to participate in the development of a CTI Standard for Parallel Shaft Fan Drives.

The standard will provide the Dry Cooling Industry with design and rating requirements to ensure long service life of parallel shaft gears used with ACCs. In addition, the standard will detail design features and maintenance practices that will minimise unscheduled downtime and reduce maintenance costs.

To become a committee member, or receive current updates, contact Craig Burriss (cburriss@amarillogear.com), Bill Howard (bhoward@ctdinc.com) or the CTI Office.

The Cooling Technology Institute, based in Houston, Texas, is an independent, not-for-profit organisation dedicated to advocating and promoting the use of environmentally responsible Evaporative Heat Transfer Systems for the benefit of the public. ■

Insight into latest air conditioning technology



Toshiba's Plymouth facility...

A tour of Toshiba's European development support centre, which is equipped with R&D and test facilities for new air conditioning technology and controls, was given to leading consultants and engineers – as an insight into the latest developments in air conditioning technology at a recent event hosted by Toshiba at its Plymouth facility.

The event, organised by Wayne Dolley, Toshiba's South West Regional Sales Manager, was attended by representatives from three leading consultants, AECOM, Hoare Lea and BME, all based in Plymouth, and from building services specialist Totus Engineering.

The programme covered how to speed up project design using Toshiba's new web-based equipment selection and technical support tools. These include a SEER / SCOP calculation package, a refrigerant charge app, and fault code identification software.

"Toshiba is doing some pioneering work on the technology front, particularly with its refrigerant management and containment system. They have also identified market requirements - such as over-door heaters for VRF systems - that few manufactures are able to offer. I can see how holding Europe-wide spares in Plymouth is not only great for local contractors, able to collect spares the same day, but nationally with next day delivery also," said Ivor Oatway, Senior Engineer at Building Mechanical Electrical Ltd (BME),

"Overall, it was excellent day, and provided an opportunity not only to see behind the scenes at a leading manufacturer, but update our own skills and knowledge. It is always good to keep abreast of current thinking and developments in the pipeline," added Ivor. ■



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David Weekley Homes honours Uponor North America



Uponor Receiving David Weekley Homes Award...

Uponor North America, an international provider of PEX plumbing, indoor climate and infrastructure systems for the residential and commercial building markets worldwide, was recently honoured with the prestigious Partners of Choice Award for the second year in a row from Houston-based David Weekley Homes. Uponor, who received an A ranking in quality, is one of only 12 companies out of 200 David Weekley Homes' U.S. suppliers to receive the award in both 2014 and 2015.

The award is based on the home builder's supplier evaluation platform, which includes its comprehensive National Trading Partner Survey. The survey is administered to approximately 800 David Weekley Homes team members to evaluate trading partners on the basis of quality and service. Those companies that rank in the top 20 percent each quarter receive the award recognition.

"This year marks our twelfth year managing our evaluation platform and our eleventh year with the award program. Over the past 11 years, only 31 companies have ever won the award two years in a row, so Uponor is part of a very select group of world-class suppliers," said Bill Justus, vice president of Supply Chain Services at David Weekley Homes.

"It is quite humbling to be part of a group of companies to receive the David Weekley Homes Partners of Choice Award two years in a row. Being chosen not just once, but twice, by the team members of David Weekley Homes as a top supplier is a tremendous honor, and we intend to continue our first-class quality and service to all the partners in our value chain," said Carl Hines, national builder sales manager at Uponor. ■

JBS receives Medal of Excellence

The prestigious Bryant Medal of Excellence Award is given to local heating and air conditioning contractors that meet their exceptional standards for customer satisfaction and excellence. California-based HVAC contractor JBS Heating and Air Conditioning has recently been named the recipient of this award for the second consecutive year.

The qualifications for receiving this award of excellence are highly focused on customer care, providing dealer promotions, and reflecting Bryant Heating & Cooling Manufacturer's promise to provide customers with a dependable and worry-free experience during HVAC service, maintenance, repair, and installation requests.

Only 15 dealers in all of North America are named to this top honour every year, and JBS Heating and Air Conditioning is not only proud to be the recipient of this award for 2015, but very proud to accept this honour for the second year in a row. ■

Recognition for DCNE's Cool Calc

A CHR News 2015 Dealer Design Awards was great for Distributor Corporation of New England (DCNE), as they were recognised for excellence in product. An independent panel of contractors acted as judges in the contest that had 107 entries. The company's Cool Calc Manual J was the Gold prize winner in the Contractor Services and Software category. "DCNE is honoured and proud to be recognised for the thousands of hours that have gone into developing this innovative technology," said Nancy Kolligian, President and CEO of DCNE.

Cool Calc is a simple-to-use tool. It utilises advanced geospatial algorithms to process Lidar data and Ortho imagery, allowing it to automatically detect the building footprint, wall-, ceiling-, floor area, and exposures of a home, all from Google Maps. The software uses a home's property tax records and location to automatically select the building materials that were required to meet local building codes for that location when the home was built. ■

UL certification for AirVolution-D



MacroAir AirVolution-D model-780...

The AirVolution-D HVLS fan line by MacroAir has received official Underwriters Laboratories "UL" certification for its 550 and 780 models. To achieve this level of certification, products are rigorously tested and held to the highest standards of safety and quality. This is a testament to MacroAir's continued engineering capabilities.

Not only were the individual components that make up the fans tested, but MacroAir's manufacturing facility was reviewed and inspected on a reoccurring basis in order to ensure that standards were being met under UL's 507 Standard for electric fans.

Obtaining UL Listing takes dedication and a team passionate about perfecting its craft. "To have the AirVolution-D line recognized by Underwriters Laboratories is a great accomplishment, especially since this is the second time we were able to get our fans certified. Our goal has always been to maintain an extremely high level of quality for all our products and demonstrate an expertise within our industry that sets the standards," said Eddie Boyd, president of MacroAir.

The two AirVolution-D models that hold UL Listing certification are:

Model 550 – Extremely effective at controlling temperature and humidity. With blades ranging from 8 to 18 feet, these fans are ideal for medium to large spaces such as auto shops, gyms, and agricultural applications such as dairy farms and equine facilities.

Model 780 – Designed for heavy-duty applications. With blades ranging from 20 to 24 feet, it is perfect for extra-large spaces like warehouses, airports, and stadiums. ■

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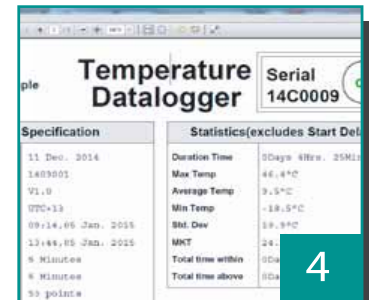
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Tecogen provides sale to Findlay Teller

For installation in the Findlay Teller apartment complex located in the Crotona East section of the Bronx, Tecogen Inc. has announced the sale of two InVerde Ultra, INV-100, Combined Heat And Power (CHP) units. The units will provide a significant portion of the facility’s electricity and heating needs and serve as a backup power source in the event of a Consolidated Edison blackout.

The Tecogen CHP units will supply energy to the facility throughout the year at a much higher efficiency than the utility, resulting in projected annual savings of \$150,000 and a lowering of the building’s carbon footprint. The units will be equipped with Tecogen’s patented low emissions system, Ultra, which will lower criteria emissions from the CHP units, the pollutants related to smog, to near zero levels. These low emissions are well below local air permit requirements and meet the strictest standards, like those in Southern California.

“In completing the renovations, we adhered to the very strict requirements of the Enterprise Green Communities (EGC) Criteria. The EGC Criteria resulted in a property that is very frugal in its energy needs, while the Tecogen system assures us that the modest amount of energy that is consumed is produced by the highly efficient CHP process ,” said Joe Cicciu, president, Findlay Teller Housing Development Fund Corporation.

“It has been a pleasure to work with the Findlay Teller team. They understand energy and its long-term costs and place a high value on sustainability. This project sets a fine example for the many similar buildings in the region,” said Robert Panora, President and COO of Tecogen.

Being well known as a CHP expert, Tecogen provides a full range of expert application support on all of its cogeneration and chiller products, to ensure a successful result for its customers. Some of the company's products cut energy costs & global warming emissions by 40%. ■

CAPS designs The CAPS cooler



CAPS Cooler Tent...

To give workers a place to take a break in order to get cool, stay hydrated, and remain healthy, Custom Air Products & Services, Inc. (CAPS) has recently introduced 'The CAPS Cooler.' A large space converted from a tent, is equipped with a large cooling unit, outfitted with tables, chairs, and microwaves for meal preparation, and kept stocked with continuously replenished bottles of cold water.

“This is the time of year when we focus an incredible amount of time and energy into providing customers with the commercial and industrial cooling units that help them operate efficiently. But we also have an obligation to our own employees; we need to keep them healthy and safe as they provide for our customer’s needs,” pointed out CEO Taylor Norris. ■

DeLClima units installed for high-quality healthcare

To improve the total efficiency of the organisation and to reduce running costs, it is necessary to provide high-quality healthcare to a growing and ageing population. DeLClima, through its subsidiary Climaveneta, has supplied air conditioning units to the American University of Beirut Medical Center.

2 NX-LN-1114T air source chillers and 4 Wizard custom made air handling units with redundant fans, all supplied by Climaveneta, grant perfect comfort and air treatment to the various pressure and temperature sensitive PET /CT rooms and support areas.

Moreover, the cyclotron itself and all related electronic and electrical equipment are located in one data and server room and are being maintained at a constant temperature and humidity year round using 2 AXU15/ BRE22m DeLclima close control units. DeLclima has worked on over 200 healthcare real estate projects around the world gathering over 40 years of experience in improving operational efficiency. ■

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Jukka Koskela
CEO
Flowrox Oy

It is possible for Flowrox to achieve the target of 100 million Euros by 2020...

Flowrox Oy gets a new CEO

Jukka Koskela has joined Flowrox Oy as their new CEO. Koskela brings vast experience of market driven product management to Flowrox. He believes that systematically developed process structure brings beneficial support when a company wants to grow its volume to the next level. Koskela also has a very clear vision about the importance of sales and sales tools. He has come to Flowrox from Outotec, where he had responsibilities as the Vice President of Global Product Management. Settling down at Flowrox has been fairly easy to Koskela, thanks to his Larox background. Flowrox has plenty of Larox history and legacy; however, the most important factor in learning the new company culture has been familiar people

both in Flowrox and in its stakeholder network. "Every company has its own culture. Learning Flowrox business and solving its challenging points requires many discussions and support from the organisation," said Koskela.

Even if the times are currently challenging, Koskela thinks that it is possible for Flowrox to achieve the target of 100 million Euros by 2020. Before that, however, the company has to adjust its fundamentals – so that when the demand increases it can respond to that without problems. "Flowrox has a very good product range, and the basic product profitability is at reasonable level. We have good conditions to reach our strategic goals when demand increases," he added further. ■



Lisa Bate
Board Member
(Director)
World GBC

Bate is a proven leader when it comes to sustainability in architecture and interior design...

WorldGBC elects new director

Lisa Bate has been elected to the board as one of the representatives (Directors) of the 100+ countries – who are part of the WorldGBC. Bate joins new elects from the United Arab Emirates, Peru, the United Kingdom, Jordan, South Africa, and Sweden.

"Our new directors bring with them regional knowledge and expertise that will be valuable in helping WorldGBC increase our impact – as we work through our member GBCs to accelerate sustainability in the built environment around the globe. We are fortunate to have such experienced and passionate individuals on board, as the environmental challenges

our planet faces are daunting and we have a full agenda with some ambitious projects," said Bruce Kerswill, Chairman, the WorldGBC.

Bate is Managing Principal, Shanghai and Executive Vice President. She was also past chair of the Canada Green Building Council, a LEED Accredited Professional in Building Design and Construction, and a past representative to the United Nations Environmental Protection – Sustainable Buildings and Climate Initiative (UNEP-SBCI). Bate is a proven leader when it comes to sustainability in architecture and interior design. ■



Peter Vinge
Customer Service
Manager
MSP Plumbing
Heating Air

"Peter will spearhead all our customer service efforts to ensure the utmost in quality care..." Andy Ryan...

Peter Vinge joins MSP

Peter Vinge has joined Minneapolis Saint Paul Plumbing Heating Air, as their new Customer Service Manager. Vinge will oversee all customer relations and human resource needs as the company continues to expand its team and reach.

"Peter will spearhead all our customer service efforts to ensure the utmost in quality care for every family – because our customers are our lifeline. Twin Cities' homeowners will always be our main focus, but with Peter's help, we can also focus on mentoring and becoming more efficient," said Andy Ryan, General Manager, Minneapolis Saint Paul Plumbing, Heating & Air. Vinge has almost 14 years of customer service experience. He is a graduate of Rasmussen College in Minnesota with a bachelor's degree in

Organisational Leadership and Human Resources. He has also devoted his career to customer service and employee relations. His passion in organisational cohesiveness and quality customer service is evident in his professional successes.

His role as customer service manager entails the whole of the customer and employee experience. Not only will he oversee the customer service department, managing communication procedures, telecommunications and training, but he will also conduct one-on-one coaching and mentoring, evaluations and staffing solutions. Vinge and Ryan will work together to bring about the company's overarching goal – to offer all clients the utmost in quality care for Twin Cities' families. ■

Yet another
innovation
from the leaders in indoor air quality

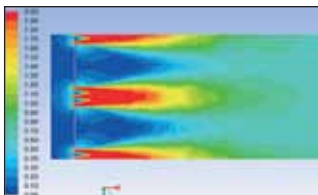


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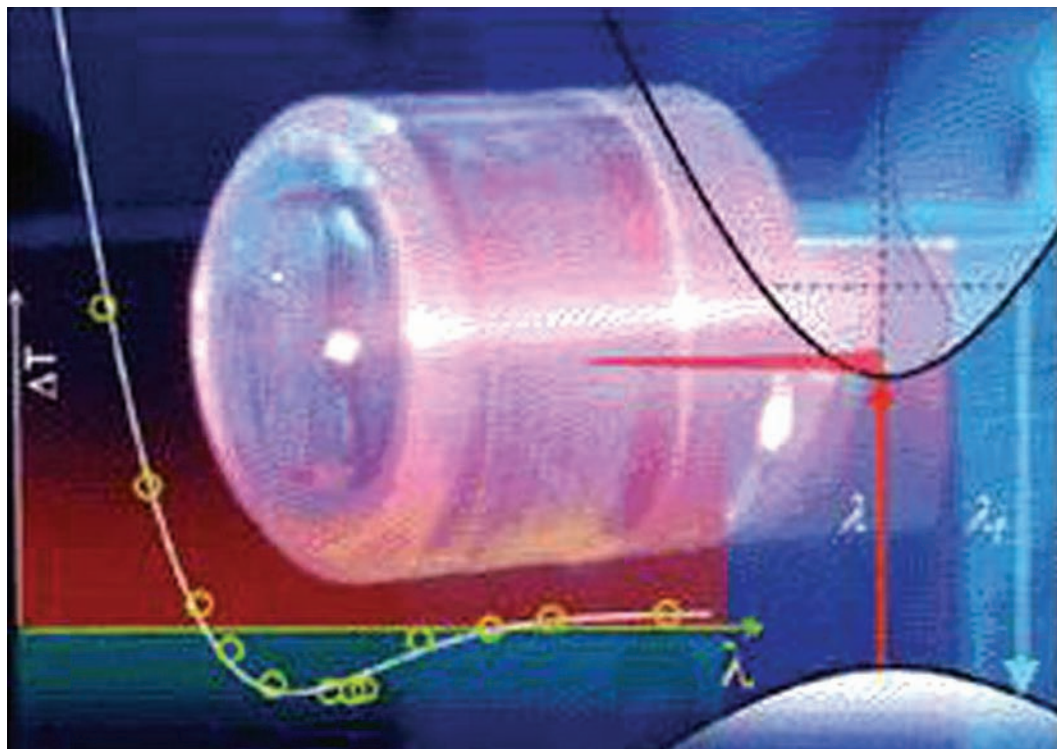
Dilute atomic gases can be cooled to very low temperatures – in fact, down to the nano-Kelvin regime.

At such low temperatures, the quantum ground state is accessible; this has led to the discovery of many exciting phenomena, including Bose-Einstein condensation, quantum manipulation, and entanglement of single atoms...

With the ever growing use of refrigeration in today's civilization at one hand and efficiency, cost and environmental concern with its (refrigeration) existing vapour compression refrigeration model using environmental non-friendly refrigerants on the other hand have always motivated researchers and technologists towards the development of alternative refrigeration technologies e.g., solid state refrigeration, magnetic refrigeration and optical refrigeration etc. Along with different advantages and disadvantages being associated with alternative refrigeration systems, their role in future is inevitable. This article is focused on the science and technology behind optical refrigeration technology. Efforts are being made to bring out the latest developments and future scope of the technology.

Principle of optical refrigeration

Optical refrigeration (also called laser refrigeration or anti-Stokes fluorescent cooling) is a technique for cooling a macroscopic crystal (or a piece of glass) with a laser beam. The idea of cooling a solid-state optical material by simply shining a laser beam onto it may seem counterintuitive, but this is rapidly becoming a promising technology for future cryocoolers. Here, we discuss the evolution of the science of optical refrigeration in rare-earth-doped solids and semiconductors from its origins through to the present day. The crystal must be doped, e.g., with ytterbium or thulium ions, which are excited by the laser beam. The laser wavelength is chosen such that it is longer than the average wavelength of the resulting fluorescence. This



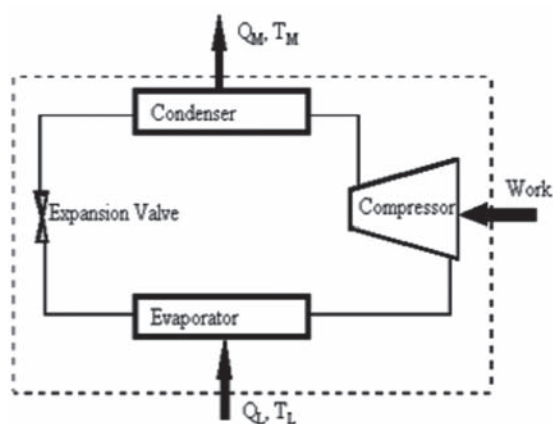


Fig. 1: Vapour compression refrigeration...

means that the energy of the absorbed photons is lower than the average energy of the emitted photons, so that energy is removed from the crystal. Of course, it is essential that the quantum efficiency of the fluorescence is high, and that nearly all fluorescence light can leave the crystal without being absorbed, e.g., by impurities: a single absorbed photon would offset the cooling effect of many other photons.

History of optical refrigeration

Laser cooling of solids is also known as optical refrigeration, proposed in 1929 by the German physicist Peter Pringsheim – nearly 30 years before the laser was invented. In this process, the material to be cooled is irradiated by red-detuned (lower-energy) monochromatic light; as a result, spontaneous emission of higher-energy luminescence (a process called luminescence upconversion or anti-Stokes luminescence) can be excited. Lattice vibrations (or, in the language of quantum mechanics, phonons) provide the necessary energy and momentum to satisfy the conservation laws. As such, the lattice vibrations are annihilated – that is, the heat is converted into light. There was some argument whether an optical refrigerator violates the second law of thermodynamics, until Russian scientist Lev Landau assigned entropy to optical irradiation in 1946.

Based on the second law of thermodynamics, work must be done to reduce the entropy of the system in order to cool it. In optical refrigeration, the pump laser is a monochromatic source of light exhibiting low entropy, while the spontaneous emission has a broadband nature, thus having high entropy. It is the pump laser that does the

work to drive the cooling; therefore, the second law of thermodynamics is obeyed.

This principle proposed by Pringsheim was later used to cool dilute atomic gases based upon the well-known Doppler effect. Dilute atomic gases can be cooled to very low temperatures – in fact, down to the nano-Kelvin regime. At such low temperatures, the quantum ground state is accessible; this has led to the discovery of many exciting phenomena, including Bose-

Einstein condensation, quantum manipulation, and entanglement of single atoms. Laser cooling of solids has a similar physical origin, but with a substantial difference: the atoms in solids have no translational kinetic energy and momentum, as the atoms are locked in a crystalline lattice. However, solids have abundant lattice vibrations that provide the extra energy for upconversion. Thirty years after Pringsheim proposed the concept of laser cooling, French physicist Alfred Kastler suggested that rare-earth-doped solid material may have the potential for laser cooling of solids. Since then, there have been many failed attempts at finding workable laser cooling materials – at least until 1995, when Richard Epstein and his group at Los Alamos National Laboratory (Los Alamos, NM) realised cooling on the order of 0.3 K in a high quality Yb3+-doped glass. Just recently, the Mansoor Sheik-Bahae group at

“ **Thirty years after Pringsheim proposed the concept, Alfred Kastler suggested that rare-earth-doped solid material may have the potential for laser cooling of solids...** ”

the University of New Mexico (Albuquerque, NM) has cooled Yb3+-doped LiYF4 crystals from room temperature through a net temperature drop of 190 K (allowing, for example, indirect cooling of semiconductor 'payloads'). This is the cooling limit for rare-earth-doped materials; below this temperature, similar materials cannot efficiently absorb the pump photon because the atomic resonances follow the Boltzmann distribution and the upper levels of ground state manifold become depopulated.

Methodology involved

Optical cooling of solids, which is also known as optical refrigeration, is based on anti-Stokes fluorescence. Consider a two-multiplet system, such as the ground – and the first excited-state manifolds of a rare-earth ion, in a solid host. The sub-levels within each manifold are coupled by lattice vibrations of the host atoms, or phonons. The cooling cycle is as follows: a coherent, low entropy light source (i.e., a laser) tuned to the red tail of the absorption spectrum will only excite electrons from the top of the

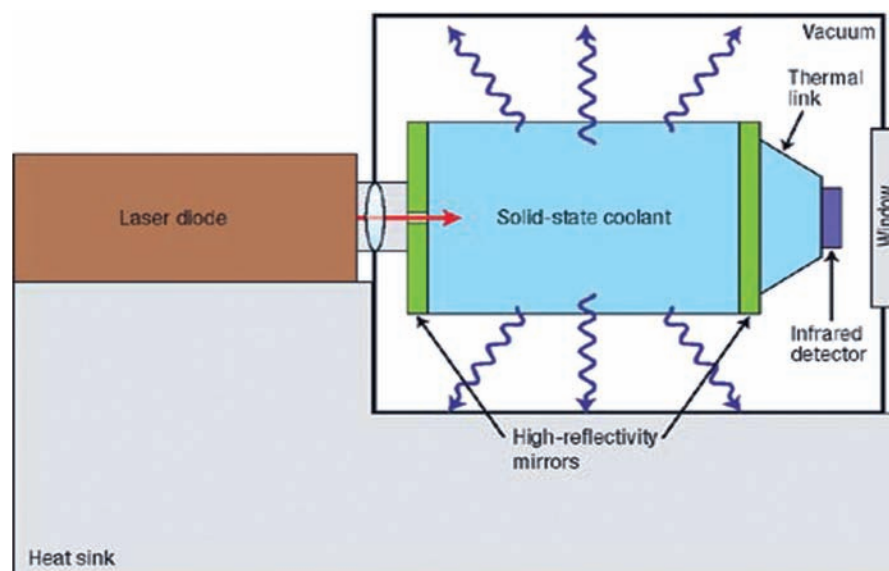


Fig. 2: basics of optical refrigeration...

ground state to the bottom of the excited state. Electrons at the bottom of the excited state manifold will have to gain energy towards establishing a quasi-thermal equilibrium. They draw this extra energy from the phonons, thus cooling the lattice host in the process. A similar process simultaneously occurs during the equilibration of the ground state.

In the final stage of the cooling cycle, the heat is carried away by fluorescence when the ions decay back to the ground state by emitting photons having a mean (fluorescence) energy higher than the absorbed laser photons. This phenomenon is called anti-Stokes fluorescence, and was predicted by Peter Pringsheim in 1929. Pump light is efficiently generated by a semiconductor laser diode and carried to the mirrored cooler element by an optical fibre. The laser enters the cooler through a pinhole in one mirror and is trapped by the mirrors until it is absorbed. Isotropic fluorescence escapes the cooler element and is absorbed by the coated vacuum casing. The load to be cooled, for example an infrared detector, is connected in the shadow region of the second mirror.

Technological developmental status

From daily experience, we know that matter is heated when it absorbs light; in just one example, lasers can be used for industrial machining and cutting. The idea that laser light can cool rather than heating matters is counterintuitive; but in fact, laser light has been used to cool diluted atomic gases and certain rare-earth-element-doped glasses and crystals for the past 30 years. Now, researchers have demonstrated that a red-detuned laser can cool a semiconductor from room temperature down to -20°C . This achievement is a substantial step toward all-solid-state semiconductor optical cryocoolers that are vibrationless, cryogen-free, compact, highly efficient, and possibly even directly integratable into electronic and optoelectronic devices.

Optical refrigeration has reached a new stage in which semiconductors can be substantially cooled by laser light. Cooling a piece of ZBLAN glass in a 'laser fridge' from room temperature down to 208 K has been demonstrated, and 110 K have been achieved with Yb:LiYF₄ (Yb:YLF). In theory, even

“ Currently, most space cryocoolers are mechanical or cryogen-based; in contrast, optical refrigerators have no moving parts or cryogens...”

temperatures of the order of 77 K (liquid nitrogen) should be reachable. Certain ytterbium-doped crystal materials, particularly tungstates such as Yb:KGW = Yb:K₂Gd(WO₄)₂, appear to be suitable for this purpose. However, direct-bandgap semiconductors have a higher cooling efficiency and a lower theoretical cooling limit of about 10 K, because excitonic levels dominate the absorption band and the carriers follow the Fermi-Dirac distribution.

If laser cooling of semiconductors could reach 10 K, it could potentially be used to replace liquid-helium cooling for many applications. Also, semiconductor optical cryocoolers could possibly be integrated with electronic and optoelectronic devices. Although researchers have devoted much theoretical and experimental effort toward laser cooling of semiconductors using group III-V gallium arsenide (GaAs) quantum wells, no net laser cooling has ever been achieved. This is because group III-V semiconductor materials have a weak electron-phonon coupling strength, a high reabsorption effect of luminescence due to the large refractive index, and a large surface-recombination velocity.

A research group has discovered that II-VI group semiconductor cadmium sulfide (CdS) nanoribbons exhibit strong exciton longitudinal optical (LO) phonon coupling, leading to a strong luminescence upconversion facilitated by annihilation of multiple LO phonons. They have further demonstrated the first successful laser cooling in CdS nanoribbons to about 40 K from 290 K – when pumped by a 514 nm green laser. They showed that about 15 K of cooling can be realised even when starting at a low temperature of 100 K when pumped by a 532 nm laser; at the same time, the temperature of the sample is measured by monitoring the Stokes photoluminescence peak shift with an additional laser emitting at 473 nm at a very low power, with its light focused at the same spot as the pump-laser

light. The success of this laser-cooling experiment can be attributed to two factors. The first is a strong electron-phonon coupling, which makes it possible to resonantly annihilate more than one LO phonon during each upconversion cycle – and thus more effectively remove the heat from the CdS nanoribbons. Secondly, the luminescence escape efficiency of the upconverted photons approaches unity because the nanoribbon thickness used in the experiment is less than half the wavelength of the fluorescence photons; this prevents the luminescence reabsorption and recycling that usually generate heat. This work opens the way to a search for other laser-cooling materials with strong electron-phonon coupling strengths, and also implies that other II-VI semiconductors may potentially be laser-cooled experimentally.

Applications of optical refrigeration

This process could become practical for cooling electronics and optoelectronics, possibly leading to athermal lasers. Possible applications of laser refrigeration are the replacement of Stirling coolers and devices like those (avoiding moving parts, vibrations, etc.), but also radiation-balanced lasers, where the internal heat generation is essentially compensated by optical refrigeration. Laser cooling of semiconductors has many potential uses. One possibility is the cooling of high-sensitivity sensors and detectors in space. Currently, most space cryocoolers are mechanical or cryogen-based; in contrast, optical refrigerators have no moving parts or cryogens. Another possible application is on-chip coolers for electronic or optoelectronic devices, including superconductor electronics. In addition, our research results suggest that a radiation-balanced laser (a so-called athermal laser) is possible – if a suitable gain-medium mechanism can be established in the material that is being laser-cooled. Of course, the current challenge is in scaling up laser-cooled devices to a practical size – for instance: to establish laser cooling in a bulk crystal.

Possible applications of laser refrigeration are the replacement of Stirling coolers and devices alike (avoiding moving parts, vibrations, etc.), but also radiation-balanced lasers, where the internal heat generation is

essentially compensated by optical refrigeration. It is instructive to consider entropy changes associated with laser refrigeration. The reduction in thermal entropy of the cooled device is more than compensated by the increase in entropy that arises from the conversion of narrow-band focused laser light into fluorescence light, which has a much higher entropy due to the many spatial modes and different frequencies involved in the emission.

Required conditions

One essential requirement for a material to exhibit net cooling in this process is that it must have a high external quantum efficiency. This simply means a high probability that an excited ion will decay by emitting a photon that escapes the system. In other words, the non-radiative (phonon emitting) decay rate must be few orders of magnitude lower than the radiative rate. Rare-earth ions (such Yb, Tm and Er) are known to satisfy this condition due to their particular atomic orbitals.

However, what prevented scientists from observing net cooling for more than six decades after Pringsheim's prediction was the presence of parasitic impurities. Apart from rare-earth doped glasses and crystals, any other material that may potentially satisfy the purity as well as quantum efficiency conditions should be considered as a candidate for laser cooling.

A prime example is direct-gap semiconductors such as GaAs, as theories predict lower temperatures as well as higher cooling power densities than obtained in rare-earth systems.

Technical challenges

The most demanding technical challenge remains in the area of materials. Researchers have recently reported a new temperature record and achieved the first cryogenic operation by cooling a Yb-doped yttrium lithium fluoride (YLF) crystal to 155 K from room temperature. While it should be possible to achieve cooling down to 120 K in this crystal, cooling to lower temperatures requires crystals with a higher ratio of resonant absorption (Yb concentration) to the parasitic absorption.

Therefore, the main challenge is to grow extremely pure crystals with higher doping concentrations without degrading the quantum efficiency, which is caused by the lifetime quenching phenomena. Similarly, for semiconductors, growing high-purity heterostructures while mitigating the surface recombination velocity to extremely low levels is the paramount challenge.

Future scope

Fundamentally, there appears to be no hard limit on the lowest temperature that can be achieved in optical refrigeration – if the parasitic absorption were to be eliminated. However, like thermoelectric devices, it is ultimately the cooling efficiency, and consequently the overall heat lift that would determine the practicality of such devices. Following simple thermal statistics of phonons and electrons, cooling efficiency as well as the resonant absorption are known to drop with temperature.

Analysis shows that rare-earth doped systems should remain practical for temperatures down to 70 K or perhaps

slightly lower. We and others have chased cooling semiconductors for many years – simply because they can potentially be used to cool to as low as 10 K with much higher cooling power densities than in rare-earth doped materials.

The immediate application of optical refrigeration technology is an all-solid-state cryocooler without any moving parts. This becomes particularly attractive for certain IR imaging applications (e.g., space-based imagers) where microphonic noise due to mechanical vibrations of the cooler lead to image degradation.

Also, in fibre-coupled geometries, the cooling element itself can be very lightweight, thus lending itself to high agility and gimbaled applications. Optical refrigeration has the unique capability to be scaled down to wavelength-size dimensions, thus realising compact or spatially selective micro-coolers. Future advances are also expected to render this technology suitable for cooling superconducting electronics and sensors.

It has also been suggested that using photovoltaic converters, the fluorescence waste can be recycled to enhance the efficiency towards Carnot limit. ■

Dr S S Verma
Department of Physics
S.L.I.E.T., Longowal
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Exposing Students To On-ground Realities

Emerson domain experts will support colleges in their academic and training programmes, providing product displays for the benefit of students – who will now be able to experience latest products from the market, besides organising technology day workshops at the college premises...

For providing increased industry exposure to students, Emerson Climate Technologies, a business segment of Emerson, has initiated a structured engagement programme with engineering colleges in India.

This one of its kind initiative in the heating, ventilation, air-conditioning and refrigeration (HVACR) industry, strives to enhance the students' exposure to on-ground realities of the professional world.



Dr. PH Sawant (Centre) and S Narayanswami (L) during signing of the MoU...



Dr. OG Kakde (Centre-L) and S Narayanswami (Centre-R) during signing...

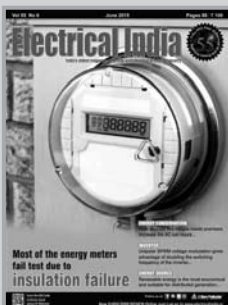
As per the programme, Emerson has signed two independent Memorandum of Understandings (MoUs) with Sardar Patel College of Engineering and Veermata Jijabhai Technological Institute (VJTI). According to the MoUs, Emerson domain experts will support the colleges in their academic and training programmes, providing product displays for the benefit of students – who will now be able to experience latest products from the market, besides organising technology day workshops at the college premises. This initiative will also facilitate factory visits for faculty or students and summer internship projects.

"In a young country like India, where the gap between demand and supply is ever increasing, we need all the talent available getting exposure to real world engineering skills and creative thinking. This will give students an opportunity to join the industry with confidence and achieve their true potential. It will also help Emerson in leveraging the institutes' splendid research and project consulting capabilities for knowledge creation," said, Sridar Narayanswami, Vice President & MD, Emerson Climate Technologies India.

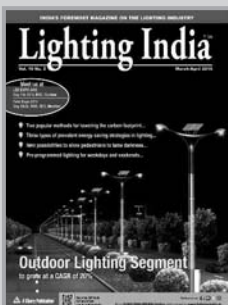
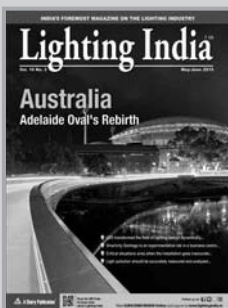
"I am expecting active participation from the VJTI students and faculty to leverage this opportunity and work closely with Emerson experts. Their in depth domain expertise in the HVACR field will be a great source of knowledge to our students and will help them in enhancing their technical skills and knowledge," said Dr. OG.Kakde, director- VJTI.

"We are very happy to be associated with a leading engineering and technology company like Emerson Climate Technologies. We are sure to gain from the company's extensive experience in the HVACR industry and in ensuring our students are industry ready," said Dr. Priyadarshi Sawant, director- SPCE.

Emerson has been supporting academia & industry with the long running ISHRAE Emerson Online University programme – an e-learning platform targeted at various stakeholders of the HVACR industry. It entails participants covering specific modules and taking an online examination. Successful participants are presented with 'Certificate Of Course Completion' at the end of the programme. Emerson is a strong global supporter of the engineering community. As part of its 125 years anniversary celebration this year, it has launched the 'I Love STEM (Science Technology, Engineering, Maths) initiative' in February. ■



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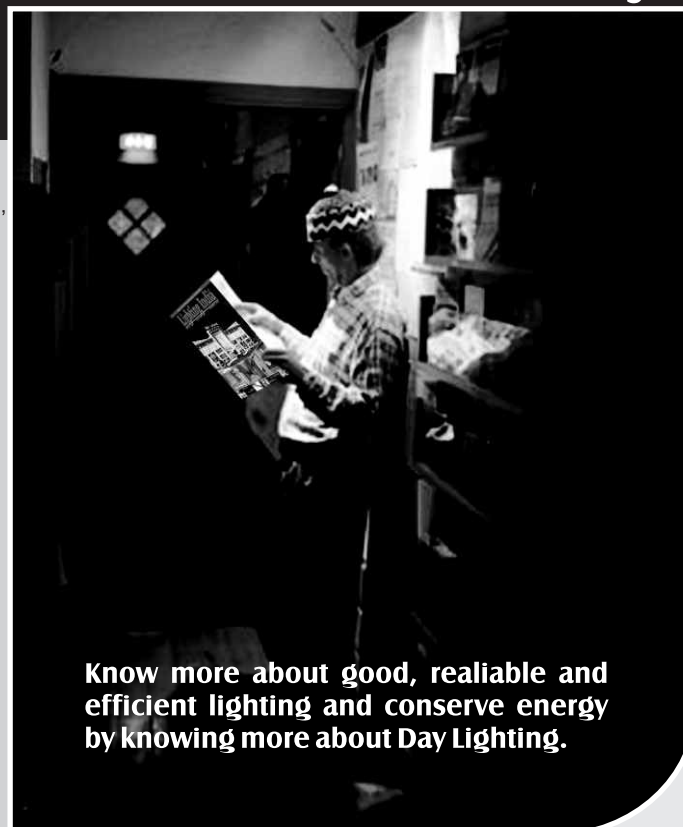
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Cascade Systems And Refrigerants

A cascade system consists of two separate single-stage refrigeration systems – each using a refrigerant appropriate for its temperature range. Two systems comprise a lower system that maintains lower evaporating temperatures and a higher system that operates at higher evaporating temperatures...

.....

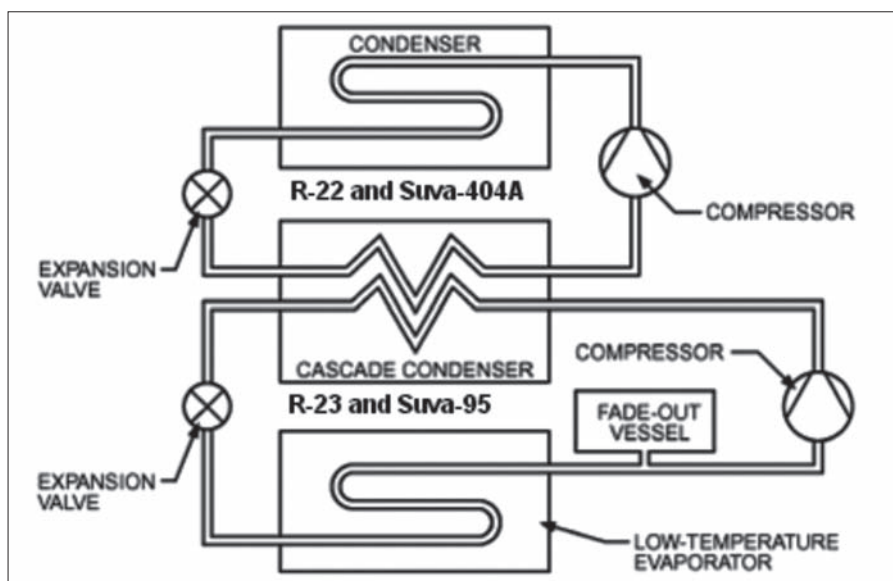


Ultra low-temperature refrigeration systems are typically required in the temperature range from -40°C and -100°C for applications in food, pharmaceutical, biotechnology, chemical, and other industries, e.g., blast freezing, freeze drying and cold storages etc. At such low temperatures, single-stage compression systems with reciprocating compressors are generally not feasible due to high pressure ratios. A high pressure ratio implies high discharge and oil temperatures and low volumetric efficiencies and, hence, low COP values. Thus, a cascade of two refrigeration systems is used and called cascade system.

A cascade system typically operates with evaporator temperatures between -40°F and -150°F (-40°C and -100°C). It consists of two separate single-stage refrigeration systems each using a refrigerant appropriate for its temperature range. Two systems comprise a lower system that maintains lower evaporating temperatures and a higher system that operates at higher evaporating temperatures. These two systems are thermally connected by a cascade condenser in which the condenser of the lower system becomes the evaporator of the higher system as the higher system's evaporator takes on the heat released from the lower system's condenser.

Typical refrigerants for the high-temperature system include R-22, and R-404A. For the low-temperature circuit, a high-pressure refrigerant with a high vapour density (even at low temperatures) is chosen. For many years, R-503, an azeotropic mixture of R-13 and R-23, was a popular choice, but R-503 is no longer available because R-13 is an ozone-depleting chlorofluorocarbon (CFC). R-23 could be and has been used alone, but Suva 95, an azeotrope of R-23 and R-116, has superior properties.

Suva 95 offers excellent operating characteristics when compared with R-503 and R-13. Capacity and efficiency values are nearly equivalent to R-503 and superior to R-13. The



compressor discharge temperature is significantly lower than the discharge temperature of compressors using R-23. Lower discharge temperatures may equate to longer compressor life and better lubricant stability. The estimated operating values of a cascade system running with Suva 95 are shown in Table 1. R-503, R-13, and R-23 performance parameters are shown for comparison.

Suva 95 will maintain a positive suction pressure at lower evaporator temperatures than R-23. Example: at -120°F (-84°C), the suction pressure for R-23 will be 3.9 in Hg vacuum (90 kPa). The pressure for Suva 95 will be 3 psig (122 kPa).

Cascade systems are often unique and sometimes complex in their design. Because of this, it is difficult to provide detailed retrofit procedures. The objective of this

	R-503	R-13	R-23	Suva 95
Capacity	100	71	74	98
Efficiency	100	105	95	103
Discharge Pressure, psi (kPa)	145 (999)	104 (717)	123 (848)	147 (1013)
Suction Pressure, psi (kPa)	18 (124)	12 (83)	13 (90)	18 (124)
Discharge Temperature, $^{\circ}\text{F}$ ($^{\circ}\text{C}$)	225 (107)	198 (92)	280 (138)*	186 (85)

Table 1: Theoretical performance of a cascade system using R-13, R-503, R-23, or Suva 95...

Operating Conditions: -120°F (-84.4°C) evaporator; -31°F (-35°C) condenser; 10°F (5.6°C) subcooling; 0°F (-17.8°C) suction temperature; 70% isentropic compression efficiency; 4% volumetric clearance.

*Field tests have shown that the discharge temperature can be as high as 300°F (149°C) in some hermetic and semihermetic compressor systems.

R-23 conversions to Suva 95

Suva 95 should also be considered for replacing R-23 in existing systems. Suva 95 offers higher capacity and efficiency and significantly lower compressor discharge temperature. In addition,

Original Refrigerant		Suva 95	Static Charge Ratio
Type	Static Charge (psia)	Static Charge* (psia)	
R-13	125	134	1.07
R-503	125	115	0.92
R-23	125	94	0.75
Test Conditions: Evap: -70°F (-57°C); Cond.: -25°F (-32°C)			

Table 2: Typical static charges...

*These are provided as a general guideline; charge optimisation may be required.

This article is providing some general retrofit guidelines, but OEMs and compressor suppliers should always be consulted for their recommendations...

article is to provide general retrofit guidelines and items for consideration when planning a conversion to Suva 95.

Original equipment manufacturers (OEMs) as well as compressor suppliers should always be consulted for their recommendations. Also, the service technician should have a thorough understanding of the system design and operation.

- If a POE lubricant is being used with the R-23, it does NOT have to be replaced when converting to Suva 95.
- The static charge pressure of Suva 95 will be about 25% LESS than that of R-23 (see Table 2).
- The expansion tank will not have to be replaced. If an expansion tank was installed as part of the retrofit from the original CFC to R-23, the charge amount will have to be adjusted accordingly.
- Due to the higher operating pressure of Suva 95, the dump valve setting should be increased to about 290 psig.
- If the system is equipped with liquid injection, the valves will need to be 'throttled back' to reduce the flow.

Because Suva 95 has about 25% higher capacity, the TXV may need to be adjusted or replaced. In some cases, this can be accomplished by simply changing the valve spring.

Note: If the system contains a cap tube that is difficult to access, it may not make economic sense to convert to Suva 95 – if the cap tube has to be adjusted or replaced. ■

Kapil Singhal
Proprietor
B P Refcool



Façades For High Performance Buildings

A thoughtfully designed façade can make a new building work more effectively for its owners, occupants and environment. It can also transform the performance of an existing building...

Exponential growth in population over the last century and rapid urbanisation in developing economies has made a significant impact on climate change. Consequently, nations across the world has identified 'energy efficiency' in built environment as a low hanging fruit that can help in protecting the environment – and the focus is now on lowering energy demand of existing buildings and regulating the consumption of new stock. Indian construction industry is at a critical juncture wherein it has to balance the demand of low cost construction – but simultaneously comply with the stringent environmental and efficiency norms that are becoming order of the day. With majority of building in India expected to be constructed in next three decades, the experts are working towards creating a balance between the technology from western world and old wisdom of Indian buildings that evolved over a period of time in harmony with nature.

Building façades

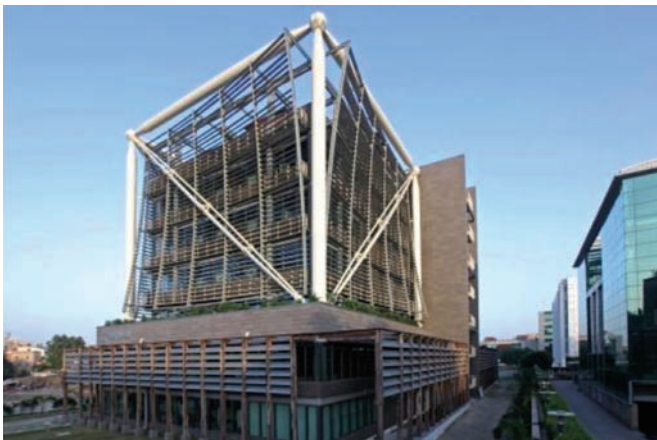
The architectural façade has long been a compelling focus of interest for building physicists and designers combining attributes of both appearance and performance in a holistic manner. Façades form a building envelope form the outer skins of buildings as a project image and creative intent. Increasingly, they are also understood as important environmental moderators. A thoughtfully designed skin can make a new building work more effectively for its owners, occupants and environment. It can also transform the performance of an existing building. The technology has gradually emerged in the recent decade, driven largely by the pursuit of transparency in the building façade among



international building designers. The façade is also the focal point of energy efficiency in a building design – because it works as the first frontier to face the intense heat and a major source of heat ingress into the buildings. As an enclosing building component, it connects or separates the interior and the exterior.

All components of the building façade, therefore, need to work together to regulate the indoor environment, responding to heating, cooling, ventilation, and natural lighting needs. It must balance requirements for ventilation and daylight – while providing thermal protection appropriate to the local climatic conditions. The optimally designed building façade is an important factor – not only for achieving the energy efficiency, but also the human comfort for which the buildings are actually designed.

Further, a building façade can have both positive and negative effects on work performance. Negative effects are associated with discomforts, distractions or health risks that interfere with peoples' ability to do their work – whereas positive impacts are associated with enhancing work performance, psychosocial well-being and health to enhance the overall performance.



Eicher Volvo Corporate Office, Gurgaon (A platinum rated building)...

Façade implications on occupant health and performance

Performance enhancement is more likely to come from a different set of building features and attributes, which affect performance. Lighting, which produces glare or visual discomfort, is more likely to be associated with headaches and eye problems. Glare due to direct solar penetration and due to the lack of luminous uniformity across the space distorts the perception of good indoor daylighting.

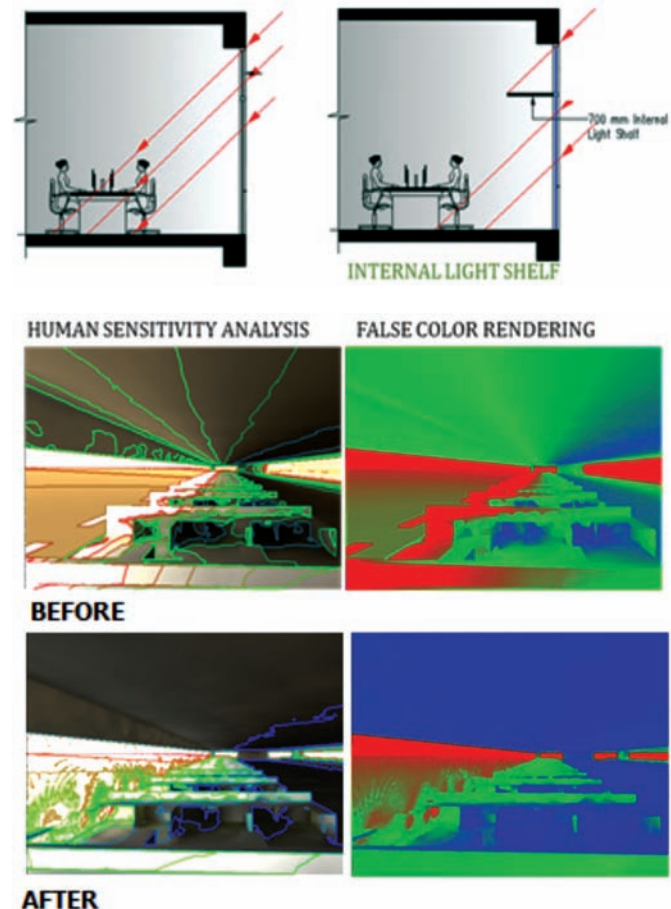
As per a field study of office workers, it is found that workers who had window views of nature felt less frustrated and more patient, and reported more overall life satisfaction – and better health than workers who did not have visual access to the outdoors or whose view consisted of built elements only. The positive effects of nature may also extend to the immune system, thereby directly affecting human physical health.

Thus, one of the perennial challenges in designing facades is to achieve an even distribution of diffused daylight across the building section.

Various computer simulation models like daylight distribution studies; visual comfort and glare analysis help optimise the building design to enhance performance and achieve visual comfort at the

same time. These simulations evaluate building designs to identify potential concerns related to daylight distribution and provide solutions to ensure appropriate illumination of spaces.

Some images have been given below to demonstrate the pattern of direct sun ingress into space and subsequent placement of workstation to achieve glare free daylight in indoor spaces:



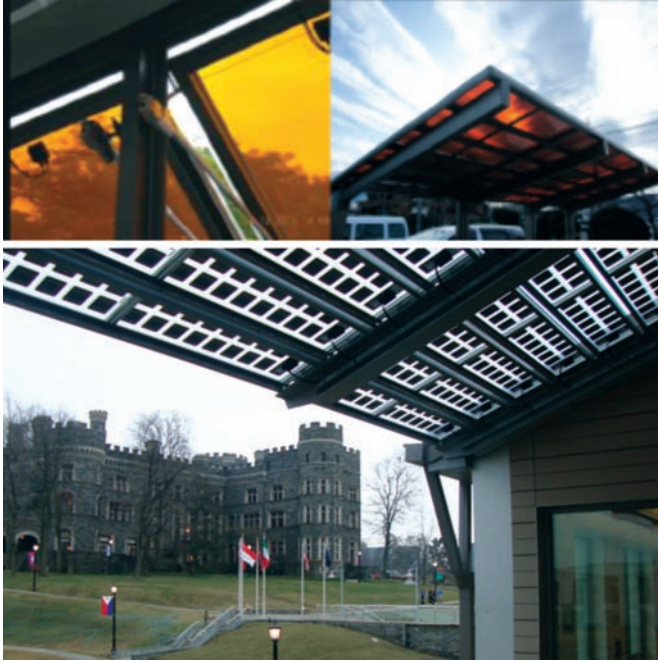
By conducting these simulations at AECOM for our clients, we have experienced that these simulations assist Architects, Engineers and Designers to design spaces with balanced luminance on different interior surfaces – and achieve overall efficiency and visual comfort for the occupants.

Facades of the future... the trendsetter

Catering to the demands of an ever expanding industry and innovative designers, the presentation shifts in its last segment to sensitising on the future technologies in building facades, which will provide better efficiency, aesthetics and commercial value to the developments – addressing a wider spectrum of issues covering following:

- **Facades generating power – Photo voltaic Glass Unit (PGU):** Building integrated photovoltaic's capture the solar radiations and turn it into energy. A high level of energy generation (up to 12% efficiency) can be generated through Photovoltaic Glass unit. The advantage of this technology is that it is allowing the usage of fenestration part of the building as PGUs provide transparency to human eye up to 70%.

- **The energy generation potential:** The electricity produced by Photovoltaic Glass Unit (PGU) system in just 1 sqm of area can vary between 40 to 60 kWh per annum; sufficient energy to supply up to 2000 hours of light from 20 W energy saving light bulbs.



- **Thermally dynamic façades – Phase Change Materials (PCM):** Façade, which responds in accordance with the variations in outdoor conditions. Thermally dynamic façades use phase change material – wherein a layer of salt crystals capture the heat radiated by the sun – and release it back to the environment during non-operational hours. The thickness of conventional materials used in buildings is much more than the equivalent heat capacity of a one-centimetre-thick PCM.
- **Bio mimicry in façades – living buildings:** Just like the surface of a leaf, the 'skin' of future buildings may react to external stimuli, opening, closing and breathing throughout the day through a system of 'cellular' openings that allow light, air and water into the apartments contained within.
- **Facades enhancing outdoor environment – microclimate impact:** Growing vegetation on the façade can potentially create a positive microclimate around the built form. A microclimate is a local atmospheric zone – where the climate differs from the surrounding areas. The studies account that a reduction of approx. 2°C can be achieved by using green vegetation around buildings compared to the surrounding ambient in composite climates like Delhi.

“ **Growing vegetation on the façade can potentially create a positive microclimate around the built form...**

- **Facades enhancing indoor environment – growing fresh air:** Most developing countries have high pollution levels – and as a result the indoor environment can be even more polluted. Drawing ventilation air through a green façade or a greenhouse offers a potential to counter the toxins, VOCs, microbial infections etc., in an air-conditioned building.
- **Façade addressing fuel crises – building powered by algae:** A classic example for this technology is BIQ building algae panels generating power where the algae is grown on façade and burned to provide an alternate energy source.
- **Facades addressing food crises – Hydroponics:** The idea that fruits and vegetables can grow with water, light and nutrients is the basis of hydroponic: one of the innovative systems of making the building self-sustaining. There have been other numerous advantages of this system as well. A reduction is seen in street level concentrations up to 40% for NO₂ and 60% for particulate matters. They potentially contribute to an increase in biodiversity in urban areas by providing a habitat for birds etc. The most important aspect is their 'rejuvenating effect' on the living creatures around as they contribute in softening of the urban landscape and allowing buildings to seem more 'natural' and pleasing for the people.

Conclusion

Energy efficiency is a primary challenge in today's commercial construction industry. How important are energy efficiency gains from a building envelope is a topic that is gaining momentum amongst industry-leading architects and design firms.

In order to address a few paramount issues in the industry, with ever-increasing pressure for the dual objectives of higher performance and improved payback calculation to stakeholders, innovative trends and forces are shaping the future of building skin. They contain the answers to many unfolded domains. ■

Ashish Jain
Associate, Sustainability Solutions Group
Building Engineering
AECOM India Pvt Ltd



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Parameters To Diagnose Refrigeration System

*From the temperature /enthalpy charts it can be seen that,
at any single pressure, the refrigerant can exist as a sub
cooled liquid, a saturated vapour or a superheated gas...*

A doctor always checks the blood pressure and body temperature as well as pulse rate to assess the body system. Similarly, pressure and temperature indicate the healthiness of a refrigeration system. Pressure changes the boiling point of a liquid. The temperature of a vapour or a gas is related to its pressure. Therefore, we always consider the system parameters at constant pressure and temperature.

Majority of refrigerants are found in a gas form below boiling temperature at normal outside temperature – but if we hold them in liquid state by keeping them under pressure such as in a cylinder or receiver, they are at certain nearby boiling temperature.

Status of suction and discharge pressure in a vapour compression system

Looking to the pressure temperature chart of R-12, we read at 0°C (32°F) the pressure is 2.1 Kg/cm² this indicates that liquid R-12 will boil at temperature 0°C (32°F) if pressure on surface is 2.1 Kg/cm² when a refrigeration system is working with a suction pressure of 2.1 Kg/cm². We can decide that the liquid refrigerant is boiling in the evaporator at a temperature 0°C (32°F).

Discharge of temperature

The temperature of the discharge vapour coming out of the compressor, however, is much more than the condensing temperature of 48.90 (12°F). This is because the gas gets super-heated while on its way from the evaporator to the compressor. It also gets superheated in the

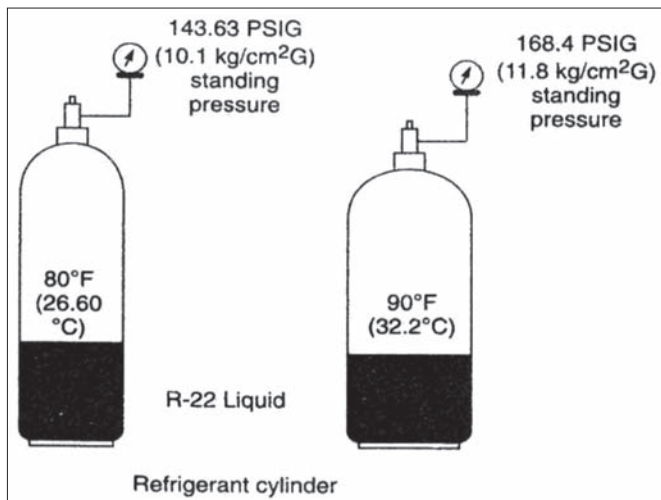


compressor during compression. In the condenser this superheat will have to be removed first before the latent heat from the vapour can be removed to condense the vapour. The first few pipes of the condenser are utilised for desuper-heating the discharge vapour.

Saturated condition

In a closed container, such as a cylinder, if a quantity of refrigerant is available in the liquid form, a pressure gauge connected to the cylinder will show a pressure corresponding to the temperature of the liquid. This temperature will be the same as the temperature of the room in which the cylinder is kept.

For example, a R-22 cylinder with a temperature of a 26.6°C (80°F) will show a pressure of $10.1\text{ kg/cm}^2\text{G}$ (143.63 psig). If the temperature of the room (or the cylinder) goes up, to say 32.2°C (90°F) it will be noticed that the pressure will also go up. The reasons for the increase in pressure is that as the temperature goes up, some of the R-22 liquid in the cylinder is boiled or vaporized because the pressure on the surface before the temperature was raised was only $10.1\text{ kg/cm}^2\text{G}$ (143.63 psig) which corresponds to a boiling temperature of 26.7°C (80°F). The boiling, however, will cease as soon as the pressure reaches $11.8\text{ kg/cm}^2\text{G}$ (168.4 psig) the saturation pressure for R-22 at 32.2°C (90°F).

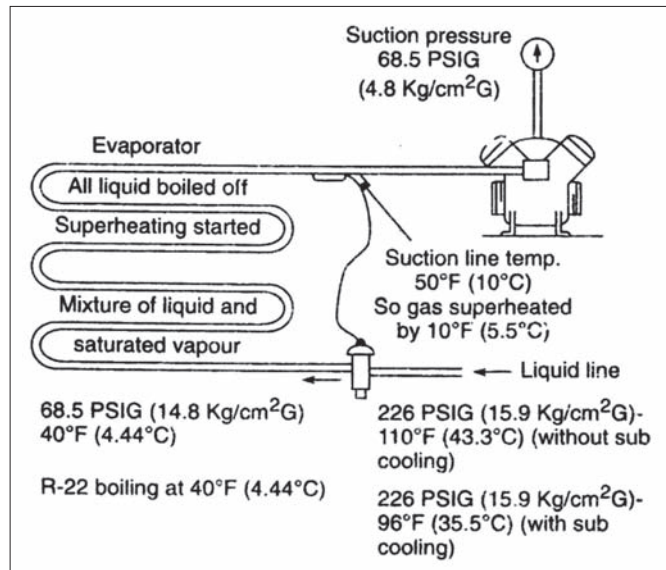


Saturation temperature and pressure of a refrigerant...

The relationship of pressure and temperature of a refrigerant holds good only when some liquid is available in the container. This is called the 'saturated condition'.

Super heat

Let us assume that the cylinder in our example had only a very small quantity of R-22 liquid and that even the last drop of liquid had boiled off just when the temperature touched 32.2°C (90°F). At that time the pressure would have been $11.8\text{ kg/cm}^2\text{G}$ (168.4 psig) – the saturation pressure at 32.2°C (90°F). Any further increase in the temperature of the cylinder above 32.2°C (90°F) will only heat up the vapour inside the cylinder, as there is no liquid left to boil. So the temperature of the vapour will rise above its initial saturation temperature. The vapour is then, said to be 'superheated'. If the temperature of the cylinder rises (so does the temperature of the vapour inside) to say, 37.8°C (100°F), the vapour is superheated by



Superheating of a refrigerant in evaporator...

5.6°C (10°F) from its saturation temperature of 32.2°C (90°F). The superheated vapour will obey the gas law. So there will be an increase in pressure on superheating; but the increase will be very small, compared to the increase, had it been a saturated vapour.

In a refrigeration system we have saturated condition in the evaporator and liquid receiver (or the bottom portion of the condenser) and a superheated condition in the suction and discharge lines.

When we say that an expansion valve is adjusted for a superheat of 5.55°C (10°F), we mean that in the suction line at the place where the expansion valve bulb is mounted, there is no liquid at all, but that the vapour at this place also is superheated by 5.55°C (10°F) above its saturation point. If the refrigerant in the evaporator is boiling at a temperature of 4.4°C (40°F) with the expansion valve adjusted to maintain a superheat of 5.55°C (10°F), it means that all the liquid refrigerant boiled off before reaching the suction outlet of the evaporator and the vapour got heated up by 5.55°C (10°F) from its saturation point of 4.4°C (40°F) by the time the vapour reached the point where the bulb is mounted. The vapour temperature become 10°C (50°F) but the pressure of the vapour remained at $4.85\text{ kg/cm}^2\text{G}$ (68.5 psig) only, since the suction pressure is kept constant by the operation of the compressor.

Therefore, to find out the superheat adjustment of the expansion valve in a system, we have to find the difference between the temperature of the suction line (at the place where the expansion valve bulb is mounted) and the saturation temperature corresponding to the evaporator pressure (or approximately the suction pressure). In our example, the suction pressure is $4.8\text{ kg/cm}^2\text{G}$ (68.5 psig) corresponding to the saturation temperature is 4.4°C (40°F). If the suction line temperature is 10°C (50°F) the superheat is $10 - 4.4 = 5.6^{\circ}\text{C}$ ($50 - 40^{\circ}\text{F} = 10^{\circ}\text{F}$). To measure this superheat fairly accurately, thermo wells are provided in the suction line at the place where the expansion valve bulb is mounted.

Sub-cooling

If the temperature of the refrigerant liquid is less than its saturation temperature, the liquid is said to be in a sub-cooled

condition. If the pressure of a liquid, say R-22, is 13.8 kg/cm²G (195.9 psig), from the tables we can find that its saturation temperature is 37.8°C (100°F). But if the liquid is cooled to 35°C (95°F) without allowing the pressure to drop down below 13.8 kg/cm²G (195.9 psig) by some means, the liquid is said to be sub-cooled by 37.8 – 35 = 2.8°C (100–95 = 5°F). This condition can exist at the bottom portion of a condenser or in the liquid line where a heat exchanger is used.

The pressure is kept constant in the condenser by the compressor. The liquid can get sub-cooled below the saturation temperature in the condenser because the temperature of the water/air at the inlet to the condenser being low. In the liquid suction heat exchanger, the liquid gets sub-cooled below the saturation temperature because of the cooling of the liquid line by the cold suction vapour.

As is obvious, the pre-requisite for the sub-cooling of a liquid and the superheating of a vapour is that the liquid and vapour should not be in contact with each other. Liquid sub-cooling is obtained in water-cooled and air-cooled condensers, which have separation arrangement between liquid and vapour. Also, the liquid can get sub-cooled at the bottom of the condenser as it is away from the point of contact with the vapour. Likewise the suction vapour gets superheated in moving away from the point of contact with the liquid in the evaporator.

Pressure and temperatures

Temperature measures average speed of motion of the molecules and it measures sensible heat. It cannot measure latent heat that causes change of state of a substance.

Since we need to measure total heat (enthalpy), the unit that is used is BTU/hr or cal/hr or watt(J/sec)

BTU measure : (1) Heat Content (2) Heat Transfer (3) Heating and Cooling Capacity (4) Heating & Cooling Load (5) Heat Content of Refrigerant (Enthalpy).

British Thermal Unit is the amount of heat required to raise the temperature of one pound of water through one degree Fahrenheit.

Specific Heat is the amount of heat, measured in BTUs required to raise the temperature of one pound of a substance through one degree Fahrenheit.

“ **Refrigerant normally enters evaporator as sub cooled liquid. As with water this means it is below its saturation temperature of 212°F at sea level...** ”

Specific heat helps us compare how easily various substances are heated. It also allows us to calculate the amount of heat transferred during sensible heating or cooling process.

Each substance has of its own unique specific heat. Substances with low specific heat are easily heated. Mercury has very low specific heat hence it is used in thermometers. Water has very high specific heat compared to other metals.

The same substance in different states has different specific heats. Water has sp.ht. as one whereas ice has sp.ht. 0.5 and steam has sp.ht. as 0.48.

The sensible heat can be calculated by following formula:

$$Q = S \times W \times (\Delta T)$$

The latent heat of vaporisation of water is 970 BTU/lb (540Kcal/kg or 2258K J/kg), 1 Kcal = 3.968 BTU = 4.18KJ

The latent heat of fusion is 144 BTU/lb (80Kcal/kg or 333.5KJ/kg). This is the heat to be added to one pound of ice for changing from 32°F ice into 32°F water.

The total heat or

ENTHALPY= SENSIBLE HEAT + LATENT HEAT

$$1150 \text{ BTU} = 180 \text{ BTU} + 970 \text{ BTU}$$

It is important to be able to graph heat and enthalpy because graphing these helps understand it better. It leads us to plot pressure enthalpy diagrams that are most important for practicing engineers.

These help in:

- Trouble shooting the refrigerant side of a mechanical refrigerating system
- Helps in seeing the functions of each part of the mechanical refrigeration system and how they work together in moving heat.
- Helps in predicting temperatures and pressures one should find at various places within a system.

The BOILING TEMPERATURE is called

SATURATION TEMPERATURE in mechanical refrigeration work.

Normally boiling point for any substance is at atmospheric pressure. Hence it can be stated that every fluid has one boiling point but many saturation temperatures.

The major work in refrigeration is carried out by latent heat. The refrigerant is changed from a liquid into a gas in evaporator, where heat is absorbed from surrounding medium. Likewise; the refrigerant is changed from a gas back into a liquid in the condenser coil, where heat is rejected to outdoor.

The fluid undergoes sensible heating, then latent heating and one saturated then sensible heating known as superheating starts for vapour.

Refrigerant normally enters evaporator as sub cooled liquid. As with water this means it is below its saturation temperature of 212°F (100°C) at sea level, and is therefore sub-cooled. Further even water we drink is sub-cooled in technical terms.

When heat is added to liquid refrigerant in evaporator it EVAPORATES and when heat is removed in condenser it CONDESES.

A refrigerant in almost any condition can be found in a system at any moment of time : Sub-cooled liquid, Saturated liquid, Saturated liquid/vapour mixture, Saturated vapour, or Super-heated gas. All are present at a time at different locations in a system. This happens because the function and pressure in each component is different.

Changing pressure in the system can alter the saturation pressure and temperature. The same system absorbs heat and evaporates liquid refrigerant into a gas at 40°F (5°C) can also reject heat and condense in to liquid at 120°F (45°C) in condenser. That is why evaporator and condenser operate at different pressures in the system.

Pressure

Pressure is defined as force per unit area. Pressure behaves differently for solids and liquids or gases. It tends to exert only in one direction for solids. Fluids on the other hand tend to exert pressure equally in all directions.

We are used to live in the fluid pressure on our bodies by earth's atmosphere. It exerts 14.7 pounds per sq. in (1.033 kg/cm²) or (101.325 kPPa or 1.01325 bar) pressure all over our body at sea level. This pressure is

called atmospheric pressure. This pressure can be measured by barometer and hence it is called barometric pressure.

The depth of atmosphere at sea level is 60 miles and we live at the bottom of it. As we go higher there is less atmosphere over us as compared to sea level. In conventional airliner, the cabin must be pressurized to avoid effects of extreme pressure changes caused by altitude.

The drier air is denser than moist air. The colder air is denser than warm air. The barometric pressure is therefore highest on cold, dry days. In refrigeration systems, pressure exists in 3 ranges, above atmospheric, at, or below atmospheric pressures. Efforts are made to select the refrigerant, which normally would operate above atmospheric pressure for the particular application.

The system for measurement of pressure as absolute and gauge pressures. Absolute pressure is used for weather reporting and forecasting as well as for engineering calculations and for plotting pressure/enthalpy charts. Gauge pressure is used for all services

work. This can be measured with the help of pressure gauge either directly installed on a plant or connected when needed. Gauge pressure equal or below atmospheric pressure is expressed as inches of mercury vacuum. Gauge pressure equal to or above atmospheric pressure is expressed as PSIG.

Gauge pressure + Atmospheric pressure = Absolute Pressure.

Normally a compound gauge is used on suction side as it has markings for above or below atmospheric pressure. The gauges are also marked with corresponding saturation temperatures for common refrigerants for ease of service technicians.

The pressure of a refrigerant and its saturation temperature are closely related, and we need only know one to find out other. Saturation temperature is really a boiling point of refrigerant at that pressure.

As the pressure increases, the boiling point increases and vice versa. Even though refrigeration pressure can be used to find saturation temperature, these facts do not guarantee that the refrigerant is at saturated conditions. From the temperature /enthalpy

charts it can be seen that, at any single pressure, the refrigerant can exist as a sub cooled liquid, a saturated vapour or a superheated gas. If the liquid and gas states of the refrigerant are both present in one place, the refrigerant is at its saturation temperature. If liquid is present, it may be at the saturation temperature or may be below the saturation temperature (sub-cooled liquid). A temperature reading will be needed in addition to determine its condition. The same applies for gas.

In a refrigerant cylinder, if liquid and gas both are present, then cylinder pressure will be corresponding to atmospheric temperature if it has been stored for longer duration for conditions to stabilize. In winter the cylinder pressure will be less and it would be difficult to charge gas in the system. ■

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As a leading manufacturer of components for refrigeration engineering and air conditioning, Güntner provides qualified technical assistance and personal support from the beginning. Different products must be cooled and stored in commercial cooling. This makes high demands on selecting the right air cooler.

Güntner offers a wide range of heat exchangers for all application areas, which are suitable for all current coolants and refrigerants. Our competent employees advise you with professional Güntner know-how by phone and in person on site.

On Line Water Descaling Technology

In addition to the overheating and subsequent failure of the boiler tubes due to scale, efficiency is also decreased in the short-term because of the scale's insulating effect on the heat transfer surfaces...

The most common reason of overheating and failure of all equipment and boiler tubes is the creation of hard scale on the boiler tube shells. This is caused by calcium and magnesium in the boiler water. When untreated, boiler water is heated, this calcium and magnesium will precipitate from the solution to form hard scale on the tube surfaces.

In addition to the overheating and subsequent failure of the boiler tubes due to scale, efficiency is also decreased in the short-term because of the scale's insulating effect on the heat transfer surfaces. A layer of scale just 1/8 inch thick can cause as much as 20-25% loss in efficiency - heat lost up the boiler stack.

Further, as per instruction of the owner/operator, the auditor should inspect the piping systems for leakage, because any leakage is unacceptable, and should be a cause for concern. All water lost from the system must be replaced by the addition of untreated fresh water.

This can produce more problems, because fresh water contains a new supply of those scale-causing minerals. The absorption of minerals in the water is referred as the water hardness.

The utmost reason that the loss of hot boiler water is serious is – it increases the humidity in the boiler room, and will contribute to the malfunction and failure of electrical controls, safety devices and other electrical equipment. In addition, the loss of hot boiler water may contribute to outside corrosion of metal surfaces on which the hot water is dripping. Any leakage discovered should be corrected immediately.

The recommendation to install an Advance E-water descaler in the equipments or boiler's feed water or make-up water system is a good one,



Before



Cooling Tower



After 90 Days



Condensers



Before



Fitting Arrangement



After



Industrials Application



Agricultural Application



Commercial Application



Steam Boilers

even for a boiler not experiencing leakage and scaling. Constant monitoring of water usage may detect otherwise unnoticeable leaking early, so corrective action may be undertaken before any damage occurs.

Another reason to monitor water usage is that high water usage will accelerate scaling when the water has a high mineral concentration (hard water). It's useful to note that the level of water hardness varies throughout the Location and depending on the geographical conditions & chiller, cooling tower and boiler's location, high water usage has been known to result in scaling within a matter of weeks.

Potential applications of Advance E-Water Descaler

Best on line technologies for

- Dairy Industries
- Chemical Industries
- Paper & Pulp Industries
- Power Plants
- Swimming Pools, Hospital Sterilizers and Many Many Sector of Industries for remove Lime scale from Heat Exchangers, Condensers and Boiler and Chillers.

Nowadays, energy-auditors and all organisations focus towards energy efficient, EHS complaint, eco-friendly and chemical free technologies to remove lime scale from boiler, heat exchangers, condensers and chillers and many more applications, Now hope is created by young indian innovators from advance –E-Water Descaler treatment with Advance water conditioner.

In contrast to most severe and dangerous lime scale removers ASWD does not contain dangerous chemicals and most powerful technologies available in the markets.

The consultant or energy auditor is always recommending solutions to Chiller / boiler plant problems discovered during inspections. A common finding is the creation of scale on the waterside heat transfer surfaces of the boiler.

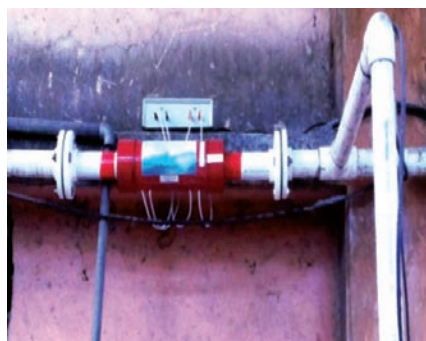
The consultant or energy auditor usually is not a water treatment expert. But certainly recommend a specific treatment to correct the scaling problem as per their Exposer with Latest Technologies, Now a Days Most of energy auditors focus on eco-friendly, Indian and energy efficient Advance E-Water Descaler Technology to monitor the effects of the recommended treatment.

“ Constant monitoring of water usage may detect otherwise unnoticeable leaking early, so corrective action may be undertaken before any damage occurs...”

In this regard, the proper recommendation is that the services of a reputable Indian E-water treatment manufacturing firm be obtained to advise the owner on the proper treatment of the scaling problem.

Basic step involved for: removing lime scale from heat exchangers, condensers & chillers

Advance Water Descaler is Microcontroller Based Process – Working on the principle of Faradays law of Electromagnetic Induction (refer www.indiamart/advancemagnetronics/waterDescaler.pdf) No corrosion, no chemical, non-toxic, eco-friendly methods in rare cases, however, it can cause short circuit and over voltages problems, particularly in voltage fluctuation areas. So, for electrical safety in most desirable conditions, Keep this instrument away from direct water contact, direct sun light and exposure to direct rain.



Detach apparatus only at the time of installation – fit & forget...

Remove or segregate the equipment pipe line to be de-scaled or turn of water valve (if any), only at the time of installation or removal (if required). After installing the device, there is no need to detach cooling tower or condenser or chiller later on – because it is an on line water conditioning method. Thus, it saves your off-production (down time), break down maintenance time and routine maintenance also. Indirectly, it saves lots of down time, manpower cost,

maintenance cost, consumable item costs and no wastage of water.

Circulation through the system

In order to work effectively water must be circulated through the equipment it cannot be stored anywhere in the sump or tank for more effectiveness of vibrating magnetic field. This may be achieved through pumping machinery already connected to the system or through a pump specifically connected for the purposes of scale removal. Ensure that you have more than sufficient space to install this system and circulate through equipment, including any pumps and pipes. Continuously circulate for 8 to 16 hours to remove calcium and scale while monitoring the system during de-scaling check any filters as scale deposits may come free during the process and cause blockages.

Flush and dispose

Put drain rust and hard physical substances directly into sewer or waste water system. Flush entire system with fresh water for effective results.

Green point rating



In this case your organisation also obtains the benefits of 'Green Point Rating' because of No wastage of water or any chemicals used in this system. It improves efficiency and reduces maintenance time. It also saves water. During treatment, we can reuse water for all applications year after year.

Advance Electronics Water Descaler 'Fit & Forget' makes you free from replacing filter and use of salt or any chemicals. Owners of the following businesses can take advantage of these innovations (See table in next page).

Restaurants /Office Homes, Water apps	Coolers & Heat Exchangers	Irrigation Systems	Swimming Pools	Supermarkets
Hospitals & Nursing Homes-steam satirizers	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
Dairy, Apartments	Fabrication & Processing	Canteens	Civil works Town planner	Plumbing & HVAC Contractors

there is significant change in hardness level, that's why it is the best alternative of hazards, heavy running cost of resin, salt, filters, membranes, chemicals and polluted technologies. It is an eco-friendly technology, maintenance free and energy efficient that improves your water quality, decreases heating time as well as cooling time (indirectly), saves energy bill and capital equipment cost. But it will take 30 to 90 Days to removes old scales. ■

Gaurang Sharma

Asst. Professor
Dept. of Electrical Engineering
at Birla Vishvakarma
Mahavidyalaya (B.V.M Engg.
College) Vallabh Vidyanagar



D A Suthar

Working on an Industrial
Project on Water Descaler
Earlier he was Chief Project
Executive at Advance
Magnetronics – an emerging
R & D Institute



Experimental analysis

Water sample taken before the passing through device and following test was carried out as per IS.

Now once again water sample taken after the passing through Advance E-water Descaler

and test was carried out in ISO-9001 Certified Lab the following Parameters was change.

Conclusion

As seen in test report (below) water passing through Advance E-water Descaler,

TEST REPORT						
Report No: ACL/02214/14-15						
Issued to		M/s. Kranti Bio Tech -Ahmedabad				
Sample collected By		Self				
Sample Identity		Water (Before)	Test Report as per	IS : 14543:2000 .IS:3025		
Quantity		1000 ml	Batch No.	----		
Brand Name		----	Date of Mfg.	----		
Date of Receipt 18/04/2015		Date of Start Analysis 20/04/2015	Date of Completion 22/04/2015	Date of Issue 22/04/2015		
Physico-Chemical Requirements						
SR.NO.	TESTS	REFERENCE	UNIT OF MEASUREMENT	DESIRABLE LIMIT*	PERMISSIBLE LIMIT*	RESULTS
1.	pH	IS : 3025 (part-11) - 1983	---	6.5-8.5	No Relaxation	7.2
2.	Total Dissolved Solids (TDS)	IS : 3025 (part-16) - 1984	mg/l	500 Max.	2000 Max.	1,227.00
3.	Colour	IS : 3025 (part-4)	Hazen Units	2 Max.	5 Max.	< 1.0
4.	Odour	IS : 3025 (part-5) - 1983	---	Unobjectionable	---	Unobjectionable
5.	Total Hardness	IS : 10500 : 1991	mg/l	300 Max.	600 Max.	212.00
6.	Permanent Hardness	IS : 10500 : 1991	mg/l	300 Max.	600 Max.	137.04
7.	Temporary Hardness	IS : 10500 : 1991	mg/l	300 Max.	600 Max.	86.21
8.	Calcium	IS:3025 (part-40) - 1991 EDTA Titrimetric method	mg/l	75 Max.	200 Max.	172.34
9.	Chloride	IS : 3025 (Part-32) - 1988 Argentometric method	mg/l	200 Max.	1000 Max.	574.82
10.	Magnesium	(part-46) - 1991 EDTA Titrimetric method	mg/l	30 Max.	---	38.90
11.	Total Alkalinity	IS: 3025 (part-23) - 1986 Indicator method	mg/l	200 Max.	600 Max.	15.00
12.	Iron (as Fe)	IS : 3025 (Part 32) :1981	mg/l	0.3	1.0	0.1
13.	Manganese (as Mn)	IS : 3025 (Part 35) :1964	mg/l	0.1	0.3	< 0.01
14.	Nitrate(as NO3)	IS : 3025 (Part 34) 1988	mg/l	50	No relaxation	0.65
NOTE:						

An ISO 9001 : 2008 Certified Laboratory

TEST REPORT							
Report No: ACL/02215/14-15							
Issued to	M/s. Kranti Bio Tech -Ahmedabad						
Sample collected By	Self						
Sample Identity	Water (After)	Test Report as per	IS : 14543:2000 .IS:3025				
Quantity	1000 ml	Batch No.	----				
Brand Name	----	Date of Mfg.	----				
Date of Receipt	18/04/2015	Date of Start Analysis	20/04/2015	Date of Completion	22/04/2015	Date of Issue	22/04/2015
Physico-Chemical Requirements							
SR.NO.	TESTS	REFERENCE	UNIT OF MEASUREMENT	DESIRABLE LIMIT*	PERMISSIBLE LIMIT*	RESULTS	
1.	pH	IS : 3025 (part-11) - 1983	---	6.5-8.5	No Relaxation	6.9	
2.	Total Dissolved Solids (TDS)	IS : 3025 (part-16) - 1984	mg/l	500 Max.	2000 Max.	1,099.00	
3.	Colour	IS : 3025 (part-4)	Hazen Units	2 Max.	5 Max.	< 1.0	
4.	Odour	IS : 3025 (part-5) - 1983	---	Unobjectionable	---	Unobjectionable	
5.	Total Hardness	IS : 10500 : 1991	mg/l	300 Max.	600 Max.	120.00	
6.	Permanent Hardness	IS : 10500 : 1991	mg/l	300 Max.	600 Max.	64.48	
7.	Temporary Hardness	IS : 10500 : 1991	mg/l	300 Max.	600 Max.	39.56	
8.	Calcium	IS:3025 (part-40) - 1991 EDTA Titrimetric method	mg/l	75 Max.	200 Max.	92.18	
9.	Chloride	IS : 3025 (Part-32) - 1988 Argentometric method	mg/l	200 Max.	1000 Max.	474.82	
10.	Magnesium	(part-46) - 1991 EDTA Titrimetric method	mg/l	30 Max.	---	20.81	
11.	Total Alkalinity	IS: 3025 (part-23) - 1986 Indicator method	mg/l	200 Max.	600 Max.	10.00	
12.	Iron (as Fe)	IS : 3025 (Part 32) :1981	mg/l	0.3	1.0	< 0.1	
13.	Manganese (as Mn)	IS : 3025 (Part 35) :1964	mg/l	0.1	0.3	< 0.01	
14.	Nitrate(as NO3)	IS : 3025 (Part 34) 1988	mg/l	50	No relaxation	0.37	
NOTE:							

Manufactured by: advancemagnetronics@gmail.com

e-Newsletter

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shortly...

INAUGURAL OFFER!!!

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For Details contact: Jigar Padachh - +91 22 2507 3308 or email - advt@coolingindia.in

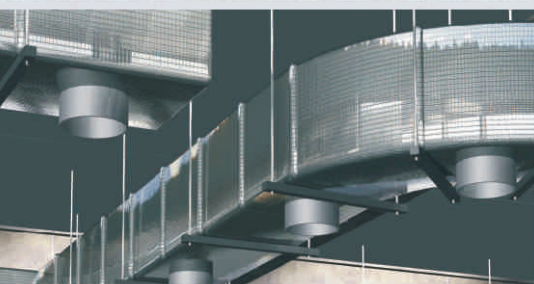
A grim future awaits us.
Unless we act now.
Conserve energy. INSUshield enables.

INSUshield
[Formerly SIL-XL-C]

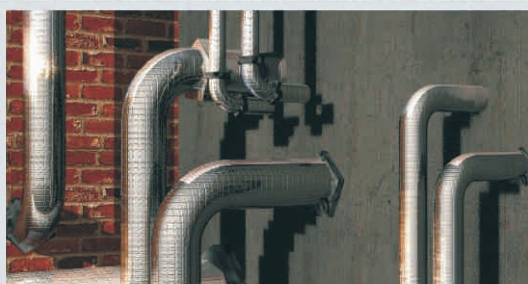
HVAC&R accounts for 50 to 70 percent of the energy consumed in various industries. INSUshield provides unfailing thermal insulation that can help save a considerable amount of energy.

INSUshield is a non-fibrous fire retardant closed cell, tri-dimensional chemically cross-linked polythene foam. An ideal environmental friendly insulation material with a perfect solution for ducts, roofs, pipes, vessels, etc., helping conserve energy.

Features: CFC free and non-carcinogenic | Excellent thermal insulation properties | Wide operating temperature range from -40°C to +115°C | High water vapour resistance | Flexible, easy to install & maintenance free



Ducting Insulation



Piping Insulation



Flooring Insulation

Other products from the INSU range:

INSUboard (Extruded polystyrene Foam): An ideal solution for building insulation with the capacity to resist extreme ambient conditions, thermal shock and mechanical loading.

INSUreflector (Formerly SIL RADIANT SHIELD): A fire retardant polyethylene bubble material encased with aluminium foil on both sides that reflects 95 to 99 percent of radiant heat beneath slated roofs.

INSUsound: A flexible, open cell foam, made from melamine resin, ideal for sound insulation.

Saving Cost Through Chiller Replacement

Cool-Therm installed two Turbomiser TMA 400kW chillers at the North Somerset Council's headquarters at Castlewood earlier this year. What is the result?

High efficiency turbomiser chillers installed at North Somerset Council's headquarters in Clevedon are saving the organisation more than £1000.00 a week in energy costs.

Cool-Therm installed two Turbomiser TMA 400kW chillers at the council's building at Castlewood earlier this year, working closely with the council's M&E and energy management department.

The high efficiency, oil-less chillers, which run on virtually frictionless magnetic levitation bearings, replaced three aging Hitachi machines that were approaching the end of their expected operational life.

The existing chillers, rated at 569kW each, were considered to be oversized for the application following major changes to the building's occupancy and usage, resulting in high maintenance costs, poor control and reliability. Cool-Therm carried out a turn-key project for the client involving the safe removal of the existing chillers, replacing them with new Turbomiser machines. The changeover was successfully completed while maintaining continuity of cooling to the building, so that it could continue to function as normal.

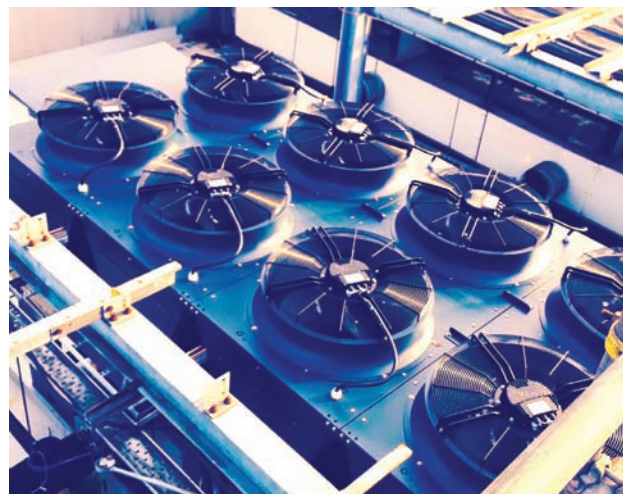
The project took two months to complete, and involved the staged removal of existing units and installation of new chillers with major work completed out of office hours to minimise disruption on site.

Crane lifts posed a particular challenge due to the location of the building near the sea front, with high winds and unpredictable conditions affecting roof-top working.





Before



After

The Cool-Therm team worked closely with Steve Hodges, Principal Mechanical, Electrical and Energy Engineer, North Somerset Council, to ensure the existing chillers were removed safely and the new Turbomiser craned accurately into position.

Accurate placement was important as the new Turbomiser chillers were manufactured with connection positions designed for hook-up to the existing fixed on-site services.

Due to the proximity of the site to the sea, and the risk of metal corrosion from onshore wind and salt-laden air, the heat exchange coils on the chillers were treated with a heavy duty Heresite protective coating designed for use in harsh environments. The chillers, which have an ESEER rating of more than 4.9:1, are equipped with a MODBUS gateway, enabling their performance to be monitored via the internet and any alarms to be interrogated and diagnosed remotely.

Following the installation, the council reports that the chillers are saving in excess of £1000.00 in energy running costs a week.



Steve Hodges said: "The Turbomisers offer a proven high efficiency solution, and the results to date confirm the anticipated savings. We are very pleased with the high quality approach and professionalism of Cool-Therm in delivering the turn-key package, and look forward to the savings that will continue to accrue over the life-time of the plant." ■

(All Images: Cool-Therm)

Ken Strong
Managing Director
Cool-Therm



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Tropicalizing Screw Air Compressor Package Utility

The compressor OEM and the user industry gave priority to cool the discharge air at the package outlet.

But instead of using ambient 30 °C air, they are using hotter inside air to cool the compressor element and heat exchangers, externally...

The industry screw air compressor utility is not tropicalized to suit our Indian conditions, till date. The existing screw air compressor packages in India are more suited to cold climates. The compressor and its sub systems are put to accelerated ageing process due to the localised heat retained inside the hood. Listed below, are the ways to tropicalize the compressor hood.

The HOC i.e., the Heat of Compression liberating from the air compressor element is as such, heating up the compressor element inside and outside in tropical country like India. The heat exchangers fitted horizontally, in the air exhaust path, act as barrier to air flow from hood to the outside from top of hood. For any heat exchanger to function better, it is always preferred to use outside ambient air as cooling media and not the boxed up hotter caged dusty inside air in the hood.

The compressor OEM and the user industry gave priority to cool the discharge air at the package outlet. But instead of using ambient 30 °C air, they are using hotter inside air to cool the compressor element and heat exchangers, externally. This aggravates the compressor inefficiency kW / CFM very early; that is why it takes more kW actually to deliver air at rated pressure, de-rating and early wear & tear, due to dusty harsh ambience inside the hood.

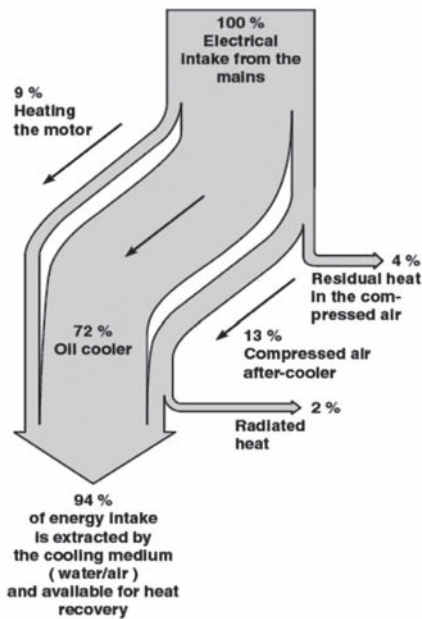
Existing symptoms of inefficiency

- Here, many industries are keeping the all side doors open and forcing air throw by man coolers. Many industries feel that their



Courtesy: BOJE compressor manual/ Compressor hood V type pre-filter reduces ambient dust

The heat balance of a compressor station



Distribution of heat in a screw compressor with oil injection cooling...

compressor runs healthily without hood side walls. So, the OEM needs to give proactive thought to compressor sub systems' comfort cooling for sustainability. Otherwise, the element gets accelerated ageing and early de-rating and failing prematurely.

- When thermal imaging was done inside a running screw compressor package unit, we found the inside temperature around 10 °C more than the ambient temperature surrounding the unit. Having done energy audits in many industries, we observed the trended input power and thermal imaging parameters. We could infer that, if the compressor runs at its rated pressure, its motor overloads always.
- We find that the heat exchanger is choked / restricted by plant dust externally when hot air passes through it. Heat transfer efficiency of the exchangers is reduced due to hotter inlet air from the inside hood to cool the same, instead of the cooler ambient air surrounding the package.
- Here, the compressor motor skin at 60 °C gets forced cooling by its cooling fan, whereas the compressor element boiling at 100 °C is only allowed to cool down itself by the induced hot air from motor to the HX fan.
- This all, leads to 3% kWh as Energy increase due to higher than ambient air intake to compressor directly. Thermal



imaging shows, the air intake mouth reveals choked and hotter temperature.

How to rectify the same at site

Easy Option:

- Give isolated cooling to compressor element. Give fresh air by opening and fixing ½ HP heavy duty fresh air fan at the door near suction mouth on the front side of compressor element, so that ambient air is forced to surround the element. Provide guarded ventilation opening on the panel door at the rear side of element to scatter out, the heat of element easily.
- Next is to provide only ambient air inlet to the heat exchangers. Insert barrier sheet, so that only ambient air comes to HX fins. If the HX are mounted horizontally, then provide slope duct sheet across the heat exchanger width – and extend duct barrier sheet to the side door. Here too, V type filters across the openings of side wall, and at the air intake wall will help to keep compressor hood internals clean.
- Provide magnehelic type draft gauge to monitor compressor air intake suction filter. If the delta P crosses 4 inches WC, this will alert users daily. This, delta P crosses 20 inches WC within a month and not gets noticed. Here the user is losing 3% kWh energy. Condition monitoring daily saves here.

Many OEMs have relocated their HX vertically to the side door to face ambient air inlet to HX in their latest versions...

Permanent Option:

- **Give isolated cooling to compressor element:** Give fresh opening and fix ½ HP fresh air fan at the suction mouth on the front side of compressor and exhaust through guarded ventilation opening.
- **REORIENT the HX:** Many OEMs have relocated their HX vertically to the side door to face ambient air inlet to HX in their latest versions. So in consultation with the OEMs, Re-engineering at Site Service Providers can take up this quick fix job. This can be outsourced. They can re-orient this heat exchanger which is horizontally mounted inside the skid to be mounted vertically on side door and relocate the HX – in such a way that its suction is facing ambient air outside the skid.

Pointers to the industry and compressor OEM

As an industry consumer, it is not enough to give only the natural induced draft to the machine. Once the surrounding air is blocked to the machine, very shortly the machine goes red-hot, and fails sooner. Now the trend here is that to give forced draft of ambient cool dry air to the machine. Then allow the machine to breathe out hot stale exhaust air freely out of compressor house.

The Heat Exchangers, Compressor Element, Motors – where the cool ambient surroundings is there, this indirectly sustains and improves the efficiency of the above systems. Allow the hot sub systems in the compressor hood to breathe in and out, utilising the ambient surroundings. ■

Ashok Sethuraman
A BEE Accredited
Energy Auditor
E-mail: ashok@
energymeasuretosave.com



Cool Ideas To Make A Better India

A.T.E. has developed technologies and deployed products in wastewater treatment, eco-friendly cooling solutions, and energy efficiency solutions...

For 75 years, A.T.E. has been working on achieving social goals through business. And over these 75 years, A.T.E. has grown into a successful, multidimensional engineering group.

The group was founded as a part of India's freedom movement. The idea – to sell high quality German textile machinery in India to challenge the prevailing British monopoly in the field. This endeavour helped in the modernisation and growth of the Indian textile industry, which now holds a strong position in the world. A.T.E. today is recognised as a leader in textile engineering in India, offering end to end solutions across the textile value chain. It is also diversified into the fields of flow technology and print and packaging equipment in the 1970s, thus building-up expertise in diverse fields.

In the 2000s, a new generation of management took over the reins at A.T.E. The strategies going forward was to build on the businesses it had been in, but also go further in achieving social objectives. Well before 'green' became a buzzword, A.T.E. decided to build up environmental businesses. Moreover, the group thought it right to 'invent in India,' and set about creating original and sustainable products and solutions. And so, in 2006, it started developing products based on Machine-to-Machine (M2M) technology. Since then, A.T.E. has also developed technologies and deployed products in wastewater treatment, eco-friendly cooling solutions, and energy efficiency solutions. So, the group encompasses three essential elements of life: Air, water, and Energy.

"I have always been passionate about the environment and wanted to create a positive environmental impact, particularly as I am deeply





Anuj Bhagwati
Head – A.T.E. Group...

concerned that India will be badly hit by climate change. I also wanted to promote a culture of thinking for oneself and crafting original solutions. It's A.T.E. way to work on social goals through business. I believe we will create sustainable stakeholder value and will help society," said Anuj Bhagwati, the head of the A.T.E. group, which succinctly underscores A.T.E.'s commitment to 'invent in India.'

Here is an overview of A.T.E.'s businesses in the environmental space:

Next generation cooling solutions

Fresh air can work wonders. A growing number of studies in the education, healthcare, and manufacturing sectors have shown increased productivity and with healthy fresher air. If fresh air can work wonders, fresh cool air in hot climates is even better. That is precisely what HMX, a part of the A.T.E. group, does with its unique, patented technology. It provides fresh cooled air for the industrial and commercial sectors that not only ensures people comfort and thereby enhances productivity, but also be used to improve process efficiency. And HMX's solutions can do this without the heavy power used by air conditioners, so they're environment friendly with an affordable lifecycle cost!



HMX-Ambiator...

At the heart of all HMX products is the DAMA (Dry Air Moist Air) – a patented heat exchanger (US and Australian patents received). It's a cross flow plate type sensible heat exchanger built out of an engineering polymer, which provides a non-corrosive, non-biodegradable, and anti-bacterial

With more than 20 million CFM spread over 4 million+ square feet in India, HMX has the world's largest installed base of indirect evaporative cooling...

substrate, and has an efficiency of more than 80%. HMX products minimise the use of refrigerants and energy intensive compressors to supply cool air, using the following configurations to supply fresh, clean and cool air for different applications:

- Only Indirect Evaporative Cooling (IEC)
- Combination of Indirect and Direct Evaporative Cooling (IDEC)
- Combination of indirect evaporative cooling and cooling coils (DX or chilled water)



HMX-PCU-F...

HMX products consist of two broad product families – HMX-Ambiator, and pre-cooling fresh air units. All HMX's products improve indoor air quality inside factory sheds, office buildings, and education and healthcare facilities.

HMX has many installations covering the industrial and commercial segments and has a rapidly growing installed base. With more than 20 million CFM spread over 4 million+ square feet in India, HMX has the world's largest installed base of indirect evaporative cooling. More and more large corporates and multinationals from across segments such as automobiles, engineering, food and beverage, etc., are turning to HMX for innovative cooling solutions to increase the satisfaction of their workforce, and for improving the process comfort.

The growing list of satisfied customers of HMX includes progressive companies such as ABB, Bilcare, Bosch, Coca Cola, Dabur, Forbes Marshall, GE, HAL, Himalaya, Honeywell, ICRISAT, ITC, Lupin, NRB, SKF,

Suzlon, Syntel, Taj Hotels, Tata Motors, TVS, Victor Reinz, VW, Wipro, etc.

HMX is thus redefining cooling – uniquely, providing both energy efficiency and fresh air.

World class wastewater treatment

The water situation in India is causing increasing concern, as our growing population, industrialisation and climate change are all exerting increasing pressure on our water resources. Water quality is also a major concern for India. Proper treatment of waste water to enable compromise free recycling or discharge is essential to human health, agricultural productivity, and long term economic growth. A.T.E.'s entry into wastewater treatment is based on its experience that wastewater is the best source of water. Recycling wastewater can go a long way in mitigating the water crisis, if modern treatment technology is optimally leveraged. A science based approach is the cornerstone of A.T.E.'s wastewater treatment venture. A.T.E. Envirotech Private Limited offers comprehensive, innovative and cost-effective wastewater treatment and recycling solutions, including zero liquid discharge.

The company undertakes turnkey projects as well as upgrades existing plants through value added products. With a team of highly experienced professionals and with its own R&D lab, the company has built-up strong capabilities in wastewater management.

As a result of continuous process development, A.T.E. Envirotech has introduced several innovations in the field. The 'AAA' (Air floatation, Anaerobic, Aerobic) technology is a highly successful innovation from the company that enhances biological treatment efficiency and minimises sludge generation. The company has also introduced AVR (Anaerobic Venturi Reactor) based biomethanation plants that can handle difficult to treat effluents. To overcome the challenge faced by the API (Active Pharma Ingredients) industry in treating their wastewater, A.T.E. has also developed a highly successful solution for API wastewater treatment using anaerobic + aerobic biological treatment.

The wastewater treatment project from A.T.E. is also packaged with 'EnviroCola', a customised online assistance system that will provide all the information needed about the ETP, which can be accessed anytime, anywhere.

A.T.E. Envirotech works across industry verticals like textiles, dairy, sugar, pharmaceuticals, petrochemical, chemical, healthcare, food-processing and building segment. The company has already executed over 200 projects in India and other countries that include the USA, Zambia, Philippines, Ethiopia, Malaysia and Indonesia, while many more projects are underway. It has built a strong base of highly satisfied customers, many of which have placed repeat orders. Some of the well-known names in the industry such as Chitale Dairy, Godavari Biorefineries, Renuka Sugar, Torrent Pharma, Cipla, Jeyavishnu Textile Processors, Indo Rama, L&T, VatechWabag, Tata Steel, Voltas, Municipal Corporations (Ahmedabad, Kolkata and Delhi) etc., are customers of A.T.E. Envirotech.

The company also partners with Huber of Germany for special wastewater treatment projects. With over 33,000 installations worldwide and presence across about 60 countries, Huber is a world's leading company in the field of water, wastewater and sludge treatment. Huber's main thrust in India is the municipal segment as well as industrial effluent treatment.



Huber screw press...

Efficient pumping for H₂O management

Efficient water management is integral to water conservation. A.T.E. has over 3 decades of expertise in flow technology. It now offers a wide range of highly efficient pumps that includes well known global brands like ABS, Yamada, Iwaki, along with its own brand of TeraFlow pumps and BoostStar HyP systems.

TeraFlow vertical multi-stage stainless steel centrifugal pumps are designed and engineered to deliver the best possible hydraulic efficiency in diverse applications such as water supply in industrial and commercial establishments, industrial washing plants, water treatment plants etc. The in-line design of the TeraFlow pump makes it compact and easy for installation. TeraFlow pumps are



Tera Flow pumps...



Tera Flow HyP system...

equipped with mechanical shaft seals of detachable cartridge type for easy maintenance. The TFVI and TFVL series of TeraFlow pumps are standardised pumps made of all stainless steel 304/316 construction.

A.T.E. BoostStar Hydropneumatic (HyP) systems are engineered using the most stringent quality and testing standards. At the heart of BoostStar HyP systems are A.T.E.'s TeraFlow centrifugal pumps and instrumentation & control systems made of

the best components. The scalable design of the BoostStar HyP systems enable a variety of configurations, ranging from fixed speed systems to advanced and fully automated variable speed systems. The BoostStar HyP systems are available in a wide-range of configurations of pumps (vertical, horizontal, submersible), and with varying levels of automation and intelligence and are designed for the lowest total cost of ownership. Here again, A.T.E. serves across the industry verticals such as textile, pharmaceutical, chemical, etc., and for a variety of applications. Once again, A.T.E. has built a strong base of satisfied customers with excellent application know-how, high quality products, and excellent after-sales-service support.

Energy efficiency

Energy is the third leg of the A.T.E.'s clean technology platform. Energy efficiency and renewable energy are the key approaches to reduce our demand for such carbon intensive fossil fuels. The company started its exploration of the renewable energy segment in 2008. Building on solid technical fundamentals and through continuous R&D, it has developed a solar concentrator – a proven Concentrated



CST system...



CST system enabled community cooking...

HMX presents next generation
cooling solutions
at



on
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at
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Solar Thermal (CST) system that provides low-cost solar energy for various applications.

A.T.E. has so far supplied solar concentrators to commercial laundries and community cooking applications in Maharashtra and Goa. Both sectors need hot water and steam. After careful study of customer needs and usage pattern, the solar concentrator was integrated with an optimised hot water system. This solution was designed and implemented with a user friendly interface that can be operated by an unskilled person (anybody who can operate an ATM or smart phone can operate this system). Customers are highly happy with the solutions provided with numerous benefits ranging from improvement in profitability, ease of operation, worker comfort, besides huge environmental benefits.

IoT based Machine-to-Machine (M2M) solutions

M2M or remote monitoring based on the IoT (Internet of Things) is now recognised as a potent tool for operations and management effectiveness. This is a natural progression in the connected world, where devices connect to each other, generate and transmit reports. Tracking, measurement, and communication are critical aspects of efficient asset management – efficiency both in terms of product performance and resource consumption. This is an important dimension of any sustainability programme.

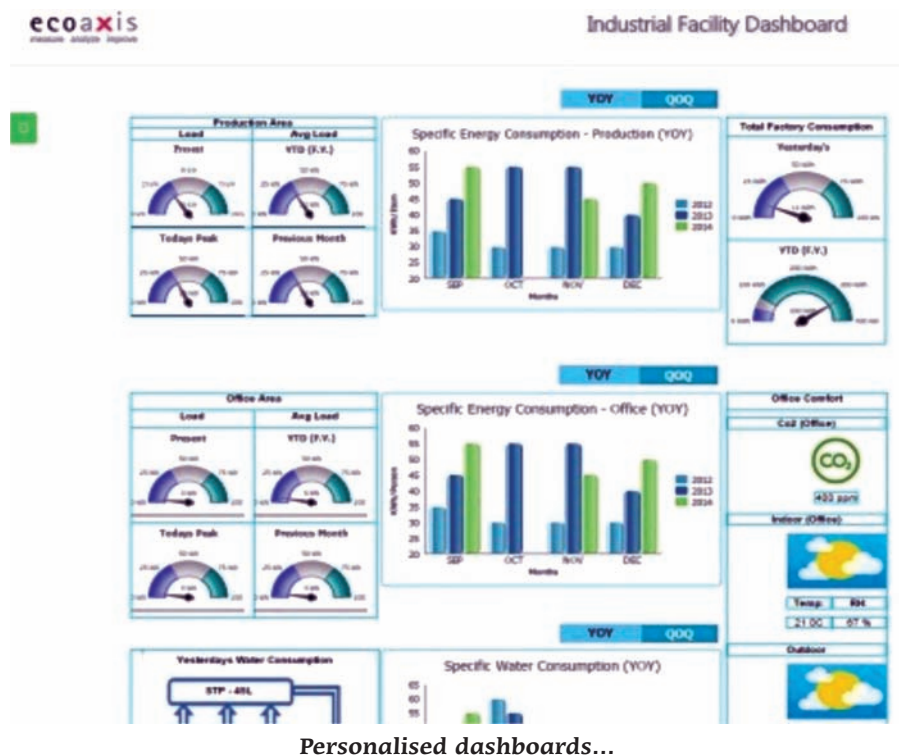
The IoT technology adoption is growing at a mindboggling pace and it is estimated by Gartner that the IoT installed base will grow to 26 billion by 2020.

A.T.E. anticipated this need and the potential many years back – and has been relentlessly building-up its capabilities in this domain. Today EcoAxis, a business unit of A.T.E., provides a unique value proposition to

its customers with its well proven products and solutions. EcoAxis's IoT based M2M technology enables continuous remote monitoring of industrial plant and equipment as well as energy and environmental resources. This system – called SUPERAxis – consists of electronic hardware & software connectors for logging data from machines, instruments and sensors.

OEMs and O&M service providers have packaged EcoAxis' remote monitoring solution to monitor their installed base of equipment for improving service revenue and service processes, reducing warranty costs, and field validation of their product / technology designs.

No wonder, EcoAxis so far analysed over 5 trillion data points, which is growing at a



Personalised dashboards...

Using cloud-based computing, it delivers analytics and alerts in the form of reports, dashboards, emails and SMS - anywhere, anytime and on any device.

EcoAxis has executed a large number of prestigious projects, which includes remote monitoring of Therman absorption chillers, a CEO dashboard for Somaiya Biorefineries, thermal power plant monitoring for KSK Energy Ventures etc. SUPERAxis has been implemented for complete plant monitoring like textile process houses, power plants, printing & packaging units, sugar complexes, etc., as well as for utility equipment like boilers, heaters, chillers, compressors, gasifiers, cooling towers, DG sets, and water, waste water treatment plants, etc. The solution has benefited end users in improving production, productivity, and availability, reducing losses, as well as effectively managing energy & resource utilisation and improving plant maintenance.

1.25 trillion data points every year. Thus, EcoAxis has established itself as a pioneer in the IoT space.

A.T.E. committed to sustainable growth

A.T.E. has taken several steps within the group to promote sustainability and demonstrate its theme of 'Partnering people and the planet.' The group's new facilities in Ahmedabad and Pune encapsulate many environment-friendly features and are built to be LEED compliant. A series of sustainability initiatives have been integrated as a part of the everyday work practices in the A.T.E. group companies.

A.T.E.'s foray into clean technology businesses stems out of understanding of, and commitment to sustainability. With the deep domain knowledge the group has gained over the years, the group believes that its products and solutions will contribute to the sustainable growth of India.

(Source: A.T.E.)



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THE HEART OF FRESHNESS

Farm To Fork Cold Chain In India – Consumer Awareness

While many food manufacturers work a lot on beautifying the body externally, what about nurturing and protecting the product that enables freshness, quality and longer shelf life?

I picked up a top-notch, branded frozen product at a national retail player's outlet and it crushed into paste when it crashed onto the floor. How can frozen food be so soft when it is supposed to be frozen? Yes we are going to unveil our minds to the truth of the so called 'FARM to FORM / PLATE' cold chain in India.

This incident brought a lot of reflection on our nation's retail skills, cold chain skills and more importantly what sort of food safety standards do we ACTUALLY depend on – assuming that we are consuming SAFE food.

We are frequently watching cold chain enthusiasts in India ramping up the number of events, conferences, seminars, trade shows etc about Cold Chain. In such events, there would typically be an extensive discussion about how much the country lacks in terms of infrastructure yet boasting about our food output and bursting consumption growth over the last decade. Ceremony lamps are lit by popular personalities, a long day session on pros & cons about the industry, a few photographs, press releases and period. While such efforts and initiatives are to be much appreciated, how many of such events have actually put consumers in place? How many of such events have ACTUALLY brought a change or improvement in the Indian Cold Chain? How many new technologies have been brought to light that has contributed to national savings on wastage of perishables due to lack of cold chain? We are talking about bringing a revolutionary change, in other words look for a desperate need to save the amount of wastage that could feed the Brazilian population for an ENTIRE year!

FARM TO FORK - Consumer Awareness



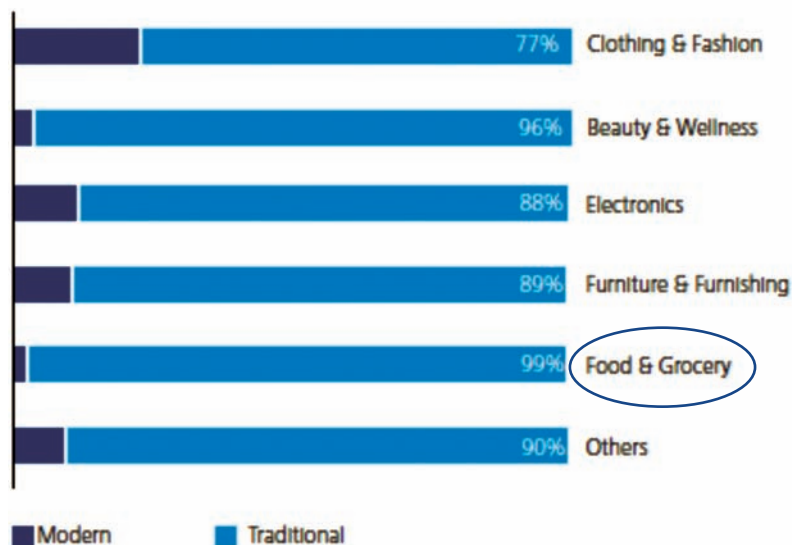
How many food manufacturers in India (be it a national or multinational brand), particularly chilled / frozen/ perishable food actually dedicate x% of sales on improving Holistic Cold Chain? In other words, spend to maintain the quality of food right from the farm/factory to the consumer end. We can only seek hope with a few good food manufacturers who care about cold chain

The only hope to enabling an effective food safety bill is when the government and food manufacturers work hand in hand...

Some interesting facts:

FACT No 1: Only 1% of Food & Grocery purchases are through modern retail.

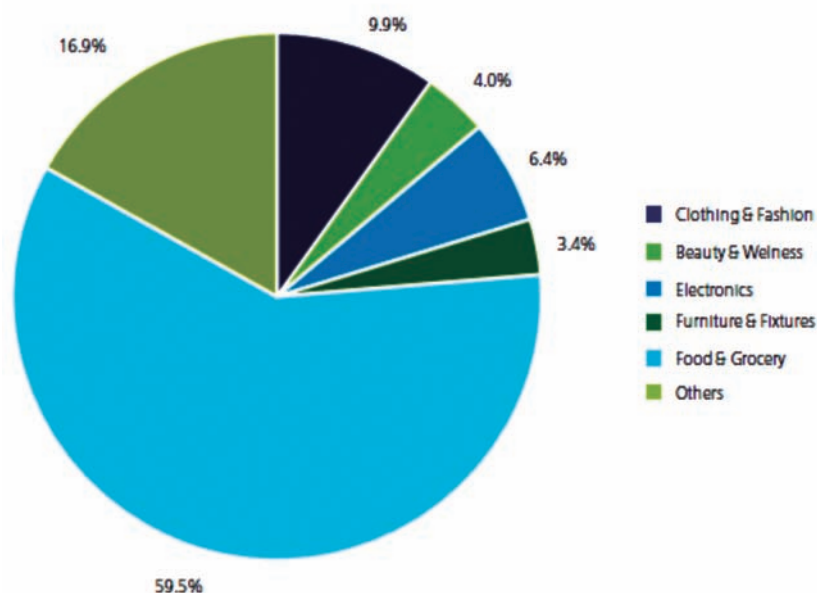
Share of Modern & Traditional retail



Source: India retail report 2009

FACT No 2: More than half of the Indian consumer-spend is dedicated to Food & grocery

India Spends On



while everyone else is after EBITDA and profits.

Cold chain. It sounds very simple, doesn't it? But is it, really? Cold storages, Refrigerated trucks, freezers and coolers, which are the heart and brain of cold chain would be useless without a healthy body to keep alive. While many food manufacturers work a lot on beautifying the body externally, in other words, the product with a variety of flavours, textures, applications carefully targeting various market segments etc. What about nurturing and protecting the product that enables freshness, quality and longer shelf life? Without an integrated Cold Chain in place, i.e., from farm to plate, nothing much can be done than said.

Well, the point to wonder now is that: Coming back to our first point of discussion, If a modern retailer cannot take the necessary initiative to provide optimal cold chain for perishables such as dairy, dairy products, ice cream, frozen food, pastry, meat & poultry, fruits, vegetables etc, how much would a Kirana store or our neighbourhood retailer really care about?

Let us see the Food Safety Standards set for Dairy Products in India: the microbial requirement of food products (1st table next page).

This may look Greek and Latin to a consumer, but the point to note is that there are definitely standards set in our country by FSSAI for health safety, but how much of it is being practised? The real question is: HOW Safe is the food we consume?

How many of us know that some pathogens that can survive in food even at low (negative) temperature include Salmonella spp., Listeria monocytogenes, Campylobacter spp. and Yersinia spp. We are even talking about ice cream and frozen food.

Cold Chain in Milk: Refrigeration is the single most important factor in maintaining the safety of milk. By law, Grade A milk must be maintained at a temperature of 7°C or below. Bacteria in milk will grow minimally below 7°C. However, temperatures well below 4°C are necessary to protect the milk's quality. It is critical that these temperatures be maintained through warehousing, distribution, delivery and storage. The cooler refrigerated milk is kept, the longer it lasts and the safer it is. As the product is allowed to warm, the bacteria grow more rapidly. Infants, pregnant women, the elderly and the chronically ill (such as those undergoing cancer treatments and individuals

S. No	Requirement	Ice Cream/frozen Dessert/Milk Lolly/ Ice Candy/ Dried Ice Cream Mix	Cheese/ Processed	Evaporated Milk	Sweetened Condensed Milk	Butter	Butter Oil/ Butter Fat and Ghee	Yogurt/Dahi
1.	Total Plate Count	Not more than 2,50,000/gm	Not more than 50,000/gm	Not more than 500/gm	Not more than 500/gm	Not more than 500/gm	Not more than 500/gm	Not more than 10,00,000/gm
2.	Coliform Count	Not more than 10/gm	Absent in 0.1 gm	Absent in 0.1 gm	Absent in 0.1 gm	Not more than 5/gm	Absent in 0.1 gm	Not more than 10/gm
3.	E.Coli	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1.0 gm
4.	Salmonella	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm
5.	Shigella	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm	Absent in 25 gm
6.	Staphylococcus aureus	Absent in 1 gm	Absent in 1 gm	Not more than 100/gm	Not more than 100/gm	Absent in 1 gm	Absent in 1 gm	Not more than 100/gm
7.	Yeast and Mould Count	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Not more than 10/gm	Not more than 20/gm	Absent in 1 gm	Not more than 100/gm
8.	Anaerobic Spore Count	Absent in 1 gm	Absent in 1 gm	Not more than 5/gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm
9.	Listeria monocytogenes	Absent in 1 gm	Cheese aother than hard cheese: Absent in 25 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm	Absent in 1 gm

with AIDS, diabetes or kidney disease) are mostly at risk from serious illness due to consuming any unsafe food.

We are not really certain if the milk available in the market is Grade A at par with global food standards or not, but it is definitely evident that the Milk we buy from the retail store has not been transported nor stored at point of sale at 4°C. How so? Most of the Cold Chain experts know that milk dispatched from the factories is transported in insulated containers and not refrigerated ones. Even worse, when it comes to retail, last mile delivery, we can only see closed body containers – not even insulated

ones. The reason? 'Well, it is not all that hot in the morning when milk is distributed to retail stores.' We cannot blame the distributors who are mere transporters who remain as unaware as the consumers when it comes to cold chain.

Do consumers know how much would such lack of cold chain imply in terms of food safety?

According to Food Safety Standards Authority of India (FSSAI), the milk & milk products order (1992) makes it very clear that Milk Manufacturers 'shall endeavour to maintain a cold chain from the place of milk procurement up to the final stage of sale of the milk or milk product to the end consumer and every holder

of the registration certificate shall observe such procedures and practices that may be approved by the Advisory Board for clean milk production, collection, transportation and distribution of milk and milk product.'

Refer the table below for Optimal Storage Temperature for Dairy & Ice Cream Products – which every consumer can be made aware of.

We are not only focusing on critical primary food such as dairy. The plight is pretty much the same for fruits and vegetables, pastry, seafood, meat and poultry and many more.

The only hope to enabling an effective food safety bill is when the government and food manufacturers work hand in hand to deliver fresh, hygienic and safe food through efficient cold chain – that would start right from farm to fork. Until then, perhaps every Indian consumer would continue to compromise by throwing away the bad food and opening a new pouch/ pack instead of demanding the retailer to compensate for the bad quality and health safety breach. ■

Product	(2-4°C)	Freezer (-18°C)
Pasteurized Fresh Whole or Skimmed Milk	1 to 5 days beyond "sell-by" date	3 months. Freezing may result in change in texture. Thaw in refrigerator.
Butter	2 weeks	Butter made from pasteurized cream: 6 to 9 months.
Ice Cream	-	2-3 weeks (Opened) 2 months (Unopened)
Yogurt	7-10 days	Do not freeze.
Cultured Buttermilk	2 weeks	Do not freeze.
Homogenized, Reconstituted Dry Non-fat and Skimmed Milk	1 week	Do not freeze.
Sweet and Regular Cream	1 to 5 days beyond "sell-by" date	Do not freeze. (Change of texture, body appearance. Separation of fat emulsion.)

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(shown here with optional adapter plate)

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Adding Value With Impactful Innovations

The variety of Phase Change Materials (PCMs) available now allows OEMs to manufacture a range of refrigeration equipment to cater to different temperature requirements...

On 13th September 1833, an American ship 'The Clipper Tuscany' landed at Calcutta, carrying about 100 tons of Ice shipped from the frozen lakes of New England, USA. This was to be the first of many voyages from the USA to bring Ice to the Indian subcontinent, which was stored away in Ice houses and either consumed or used in storage of fruits and wine in ships.

The Indian segment would be the most profitable part of a prosperous business called the Ice trade. Ice harvested from the ponds of New England during winter, was sold far and wide including the Caribbean, Europe, India and South East Asia. The person who envisioned and embarked on this venture Frederic Tudor- was made a multi-millionaire within a decade through the sheer audacity of a vision to be a seller of a ubiquitous and universal commodity, but which had also been infeasible enough to readily obtain.

In another sense, the success of this business might also be called a starter to the feast of industrialisation, economic materialism and globalization. A demand for colder and versatile temperatures- for human consumption or storage of temperature sensitive materials was going to be an unwavering reality. Prospering during 1850s, ice trade was to inevitably die out by 1900s. The well known revolutions in refrigeration had happened by then and were replacing natural ice used in most areas.

However, two things from this story from the Victorian era may be of relevance today-

- Demand for colder temperatures for human consumption or cold chain would ultimately be satisfied by mechanical refrigeration systems.



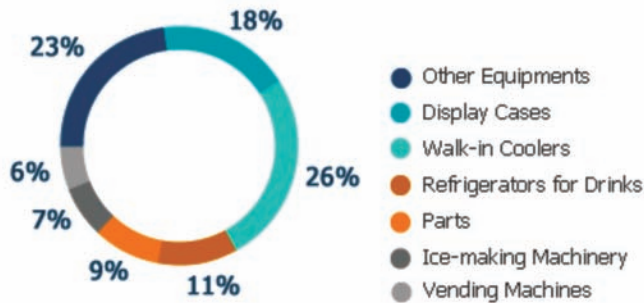
- The then refrigeration plants were also used to freeze water in bulk and ice would continue to have a major influence in cold chain and refrigeration. For ice as a phase change material would fill in the gaps and shortfalls of mechanical refrigeration.

The current refrigeration industry

A refrigerator is a common household appliance that consists of a thermally insulated compartment and a mechanical heat pump that transfers heat from the inside of the fridge to its external environment to cool the inside of the fridge to a temperature below the ambient temperature of the room.

The commercial refrigeration industry comprises a large variety of products, including:

- Cold displays or plug-in commercial refrigerators
- Refrigerating chambers, cold counters and reach-in refrigerated displays
- Refrigerated automatic sales machines
- Ice machines
- Refrigerator parts and other products, such as cryogenic equipment and liquid refrigerators.



Global Market for Commercial Refrigeration per Product (2009) - US\$ 23.1 billion...

Source: Freedonia; Increase in disposable income and eating habits fuel demand for refrigeration equipments

The demand for chilled and frozen food and beverages is being boosted by increases in disposable income, and change in eating habits. Improvements in the standard of living allow more people to eat out. The growing concentration of the developing world's population in major urban centres and an increased participation of women in the work force also contribute to changes in eating habits.

One such change is the higher consumption of frozen foods and refrigerated drinks. The key categories of food and beverage include: (i) non-alcoholic beverages, such as soft drinks, juices and water (ii) alcoholic beverages (iii) ice cream; and (iv) chilled and frozen food.

According to Euromonitor, the ice cream industry in India in 2014-15, valued at about \$31 billion is growing at a rapid pace of 15% annually. The ~\$35 billion worth Indian alcoholic beverage market notes a growth rate of around 7%, while soft drinks valued at ~\$50 billion are also growing at a similar pace.

These positive trends reverberate positively on demand for commercial refrigeration equipment used for the conservation of food and beverage. Simultaneously, there is also a growing ecological concern to minimise dependence on mechanical cooling, and to ensure optimal power consumption by improving efficiency of refrigeration systems.

	2007	2008	2009	2010	2011	CAGR
Ice Cream	56.3	60.7	59.7	63.5	68.9	4.12%
Soft Drinks	648.0	703.6	693.5	739.1	810.4	4.57%
Beer	528.7	569.2	549.5	576.4	615.8	3.10%



Source: Euromonitor, 2010

Template chart...

Source: Euromonitor, 2010

Refrigeration, Cold chain and the role of Phase Change Materials



The Cold chain logistics infrastructure...

Source: Pluss Website

Most stored frozen and chilled foods are sensitive to temperature fluctuations, which are caused by heat penetrating the walls of the freezer. The refrigeration system removes this heat load, but if in case of a power failure, cooling is not provided to the stored product. A Thermal Energy Storage (TES) system, with a high capacity for thermal storage can maintain the required temperature for a longer period in case of a power cut. Traditionally, glycol, coolants and water based gels have been used as TES, but Phase Change Materials (PCMs) can provide a far better thermal backup.

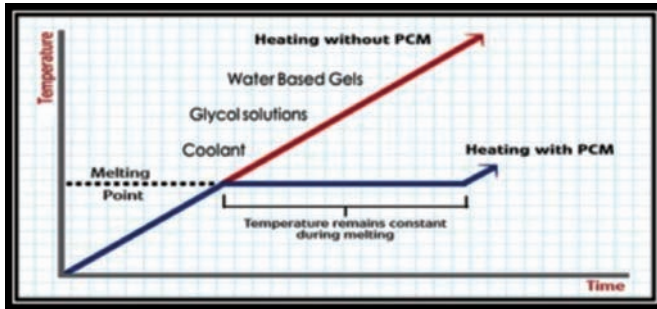
The International Institute of Refrigeration (IIR/IIF) observes that 28% of food produced in developing countries goes to waste due to lack of refrigeration. Less than 4% of India's fresh produce is transported by cold chain, compared to more than 90% in the UK. In an agrarian economy like India, more reliable and efficient cold chains would not only lead to reduction of wastes but also ensure that farmers get a better return for their labour.

Integrating phase change materials in refrigeration

Desirable qualities for a material to be used in refrigeration TES system are:

- High latent heat of fusion per unit volume so that a lesser amount of material stores a given amount of energy.
- A melting point in desired operating temperature range.
- High thermal conductivity so that the temperature difference required for charging can be small and charging is more efficient.
- Non-toxic, non-flammable, non-explosive and non-corrosive

- Reproducible properties over many cycles, to ensure the use of the material as many times for storage and release of heat as required by an application.
- Economically viable to make the system cost effective.

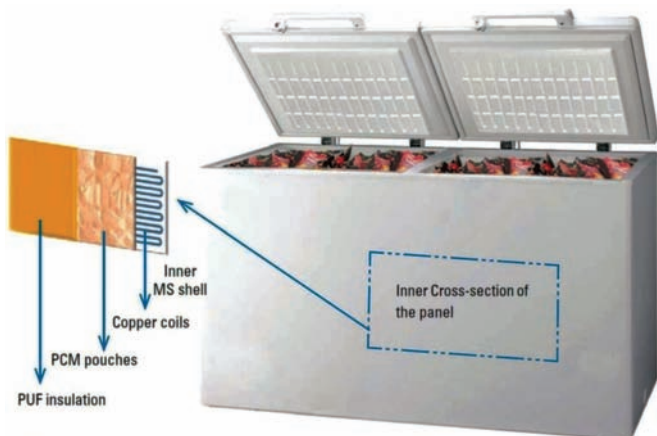


Phase change material can store and release large amounts of heat/energy while maintaining a constant temperature providing a distinct benefit compared to alternative technologies...

The above characteristics are fulfilled by a category of highly specialized materials called Phase Change Materials (PCM). PCMs can release or absorb large amount of heat energy in the form of latent heat while maintaining a constant temperature. Compared to other technologies like ethylene glycol, they not only have better thermal storage capacity but are also non-toxic, non-hazardous, temperature-specific and reusable over a substantial number of cycles (~ 3000 or more). The benefits of the above features are precise temperature control (allowing not more than $\pm 1^\circ\text{C}$ of error); longer duration of retention period (upto 18 hours due to high latent heat), and reduction in the overall weight of the freezer due to high energy storage to weight ratio of the PCMs. Hence PCMs with a suitable melting temperature may be used to provide thermal capacity for maintaining suitable recommended internal temperature during power failure. Integration of PCMs in the evaporator of a domestic refrigerator helps increase its COP by providing better thermal conduction while the compressor is active. PCM may also be used in load shedding applications to shift electricity usage to an optimum time.

Applications with phase change materials

Freezers for ice-creams are designed to maintain a temperature

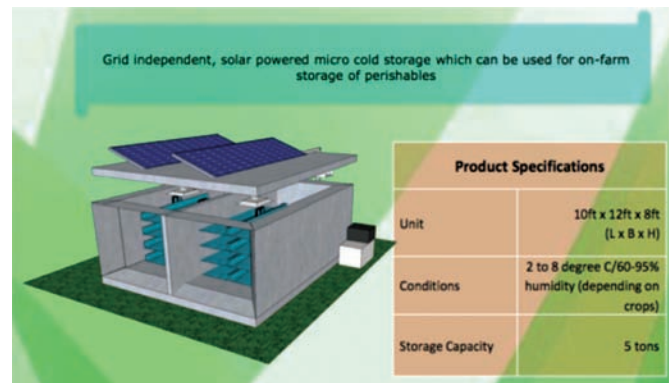


Cross-section of a freezer depicting use of phase change materials (PCMs)...

between -18°C to -23°C while beverages are maintained between 2°C to 8°C in a cooler. The PCM chosen for both of these applications are different due to the different temperature requirements. The selected PCM gets charged passively when the power is available within 9 -10 hours.

The selection of the phase change materials is important as one of the critical factors is the minimum temperature that the refrigeration unit can offer to ensure that the PCM is completely charged. Once fully charged the PCM is in ready state to release the energy in event of a power or equipment failure. This freezer is designed to maintain a temperature of -18°C to -19°C at an ambient of 40°C for a minimum of 16 hours and in spite of several openings and closing of the lid. Innovative products using PCMs strive to provide better off grid cold storage.

Solar based micro cold storage units launched by Ecozen Solutions are helping farmers to store their products in un-electrified areas with poor access to cold storage. Besides reducing crop wastage, the product helps enhance margins by allowing farmers to sell their produce over a period of time as prices increase.



The Micro Cold Storage of Ecozen Solutions is powered by solar panels, but can also draw power from the grid where needed...

Source: Ecozen Solutions Website

In an attempt to make refrigerated trucks more cost efficient, the company, TESSOL relies on frozen PCMs to maintain a chilled temperature. Instead of having a diesel based compressor to run throughout the truck's transport and delivery time, the PCMs can be chilled or 'charged' at the start of the journey using a refrigerant-system based on grid electricity, which is much cheaper than relying upon a diesel based system.



TESSOL's PLUG n CHILL Truck incorporates a refrigeration system which does not rely on diesel to keep the truck cool...

Source: TESSOL Website



Vehicle: TATA ace trucks, Client: Nestle, Delhi...

The field of grocery e-commerce, once held back by expensive logistics, has been making rapid strides, helped by investments made by large companies like Amazon and Google. Integration of phase change materials in e-commerce chains to keep fruits and vegetables cool for a short duration, is ongoing and is expected to increase with time.

There are several refrigeration companies in India and outside which have now introduced deep

freezers and chest coolers incorporated with these phase change materials to cater to the market in low and middle income countries where power availability is an issue.

The variety of PCMs available now allows OEMs to manufacture a range of refrigeration equipment to cater to different temperature requirements. The introduction of these materials have proved to be a boon to the refrigeration industry. ■

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Making More Happen With Less

With a customer-centric approach to designing customised applications, Danfoss' psychrometric lab has been built to provide testing of air conditioners, chillers and other refrigeration equipment for relevant International standards such as IS, ISO 5051, AHRI and AHRI 550/590 among others...

India is a power starved country. Although, the new government has started speeding up the process of commissioning more power generation plants, erecting transmission lines and installing distribution transformers, the country's power demand is also growing very fast. Also, production of energy in the traditional ways increases carbon footprint. So, the best way is to be energy efficient at all places wherever power is used. Not only in India, but also globally today people are thinking of energy efficiency. Under such circumstances, with the national and global thrust on energy efficiency, Danfoss India has set up a one of its kind lab, the Psychrometric (PSR) lab, which tests products for energy efficiency standards and has the potential to redefine manufacturing and designing of energy efficient products in India, thereby meeting global standards of quality and reliability.

Inaugurated by Dr. Ajay Mathur, Director General, Bureau of Energy Efficiency at Danfoss India's Platinum LEED rated Oragadam campus (near Chennai) on the occasion of Danfoss Tech Day, this unique lab is seen as a step towards addressing India's energy security through energy efficiency, by helping stakeholders in performance testing of their air conditioning components that contribute to maximum load on power grids.

"Energy efficiency is at the core of our energy system development and one must understand that it has a direct impact on our GDP. In fact, every organisation across industry should adopt energy efficient technologies to lower their dependence on our already strapped resources. Energy saved today will ultimately serve as the alternate fuel to power both today's unserved homes and tomorrow's

needs. Industries are a key pivot of our GDP – and Danfoss, by investing in the psychrometric lab, has set the direction towards embracing energy efficient technologies to achieve their sustainability goals. This initiative will further support the Air-conditioning and Refrigeration Industry in developing new innovative energy efficient products," said Dr. Mathur (while inaugurating the new lab).

With a customer-centric approach to designing customised applications, the psychrometric lab has been built to provide testing of ACs, chillers and other refrigeration equipment for relevant international standards such as IS, ISO 5051, AHRI and AHRI 550/590 among others. This apart, customers will have the facility to test for the functionality of their applications with Danfoss products, and further customise and improvise solutions to suit their needs, thereby enabling to serve the end customer better.

Speaking on this occasion, Ravichandran Purushothaman, President, Danfoss India, said, "With energy demand on the rise, it is important to view energy efficiency as an alternate fuel. Making more happen with less is a concept that Danfoss has always believed in and mastered globally, we are consistently helping stakeholders put this into practice and the investment in this lab further reinforces our commitment. Danfoss invests 4.3% of our net sales into innovation globally. This ensures focus of our R&D efforts into realising some of the best, new to the world energy solutions that not only address our customer requirements but also help us empower them to contribute positively towards energy security. The investment in the R&D and Psychrometric lab in India will support innovation and help our customers in developing equipment for the existing and new energy efficiency standards."

For some of the existing standards in energy efficiency, it is important that consistent innovation is done to bring down the cost of the products. In fact there are new standards being developed for large air conditioning equipment – which will require necessary test beds for testing and further innovation. In addition to this, the industry needs skilled technicians who can support the energy efficiency market. At Danfoss, consistent efforts are being made to address each of these critical factors in its holistic approach towards addressing today's demand for energy in an efficient manner. ■



Dr. A. Mathur, Director General, BEE (R) at Danfoss India and R. Purushothaman, President, Danfoss India (L) during the official inauguration of the Psychrometric (PSR) lab...



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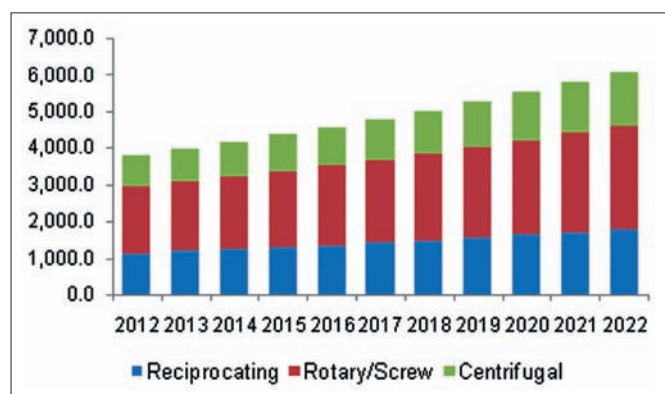
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Air Compressor Market Forecasts Up To 2022

According to a recent report by Garden View Research, Global air compressor market size is expected to exceed USD 37 billion by 2022. Increasing adoption of remote sensing technology to monitor performance expected to contribute to market growth over the forecast period. Strong demand from food & beverage industry, mainly due to mandates on food safety and health requirements is projected to drive growth. Low maintenance, retrofitting of existing systems, efficient operation at lower costs, and rising adoption of variable-speed systems are some of the other factors driving demand across key end-use industries. Single phase and two phase compressed air systems are increasingly accepted in the oil & gas, and home appliances industries.



China air compressor market by technology, 2012 – 2022 (USD Million)...

Additionally, there can be a significant cost saving by eliminating supplementary devices, which balances out the higher investments in these instruments, which is expected to provide immense market opportunities. However, prices of raw material are significantly mounting, which has negatively impacted the air compressor market and this trend is expected to continue over the forecast period. On the basis of application, the air compressor market is segmented into semiconductors & electronics, food & beverage, healthcare, home appliances, energy, oil & gas, manufacturing and others. Other applications mainly include chemical, metal & mining and construction.

Asia Pacific air compressor market is expected to exhibit high growth on account of growing manufacturing facilities and infrastructure spending. Latin America and Middle East & Africa are expected to witness significant growth over the forecast period owing to changing regulatory scenario and growing awareness towards eco-friendly products. North America and Europe air compressor markets are anticipated to decrease owing to end-use industry saturation. Widespread financial crisis and economic slowdown in Europe has adversely impacted the demand in this region.

Atlas Copco, Ingersoll Rand, Chicago Pneumatic, GE Energy, Bauer Group and BelAire dominate global air compressor market share. The industry is expected to remain innovation-led, with frequent acquisitions and strategic alliances. Application development, price competition along with competent distribution channels will be vital for competitive advantage.

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- What were the Challenges that you faced in your Cold Storage/ Food Preservation Plant/ Horticultural Refrigeration Plant and Other Condensing Units in the recent past? Have you Overcome those?
- Have you done any systematic research in your laboratory on increasing efficiency of cold chain?
- If so, your community would like to know how you tackled the challenge, and we are here to offer you the platform for dissemination of your experience...

Please e-mail us your articulated experience (in not more than 1200-1500 words) on those aforesaid areas latest by August 31, 2015.

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Excess flow valves

An updated Excess Flow Valve (EFV) that conforms to the new industry standard (ANSI Z21.93/CSA 6.30) is launched by BrassCraft Manufacturing. This updated product continues to provide an advanced solution to homeowners that helps protect against gas related fires and explosions. The valve is omni-directional (installs in horizontal, vertical up or vertical down) and has no parts that can wear, break or misalign over time.

The EFV activates automatically to restrict gas flow at the appliance in the event of a gas line rupture or disconnect and automatically resets after the gas line is repaired. Plumbers will appreciate the product's easy-to-install design as it installs like a standard gas fitting and can be oriented in any direction.

The new EFV product will be available on July 1, 2015. "We're continually improving our products to meet standards and ensure they perform while offering homeowners the latest safety features," said Krisztina Wilson, Product Manager, BrassCraft Manufacturing. ■

Website: www.brasscraft.com



Electrical rough-in kits

Installation and Maintenance of your thermostat has become easier as WarmlyYours Radiant Heating has developed two Electrical Rough-in Kits that include all necessary items for safely and properly installing a floor-heating thermostat. Both kits feature a 4- by 4-inch dual gang box, which prolongs the life of a thermostat because it allows air to circulate around the control, keeping it from overheating. Thermostats installed in a dual gang box last significantly longer than those installed in a 2- by 3-inch box, according to WarmlyYours experts.

The dual gang box in these kits also makes it easier to wire multiple floor-heating rolls or cables within the same box, as it offers more space for the cold lead connections. It also helps to mitigate the possibility of wires touching each other, which can cause shorts.

"Oftentimes, a single gang box will be mistakenly used to install a floor-heating thermostat. We want to ensure that trade professionals and homeowners alike have the right components to install a floor-heating thermostat in the safest and most effective way. These kits give them everything they need to do that," said WarmlyYours Owner Julia Billen. ■

Website: www.warmlyyours.com



Rooftop Optimisation Kit – Digi-RTU

The Digi-RTU is a heating, ventilation, and air conditioning (HVAC) rooftop control kit that is both a demand management and energy saving device. Through modulating the capacity of a rooftop unit to match the cooling or heating requirements of a space, the Digi-RTU improves the energy efficiency and demand requirements of the unit.

Features

- Variable Refrigerant Flow; Compressor Optimization
- Variable Air Flow; Fan Speed Control
- Integrates with Existing Economizer
- Meets ASHRAE 62.1/ CA-Title 24 Requirements
- Fault Detection & Diagnostics
- Demand Response Functionality; Load Limit Capable
- Remote Monitoring. ■

Website: www.bes-tech.net



Air-cooled scroll chillers



YORK YLAA air-cooled scroll chillers' all-in-one package is a true plug and play system that provides superb efficiency and performance. The chiller is completely self-contained and is designed for outdoor installation.

Chillers include zero-ozone-depletion refrigerant (R-410A), hermetic scroll compressors, a liquid evaporator, air-cooled condenser, and a weather resistant microprocessor control center, all mounted on a formed steel base.

Features

- Reduce your energy costs as much as 40%
- Be more friendly to the environment
- Operate your own way
- Lower your cost of ownership.

Website: www.johnsoncontrols.com

Industrial electric actuators



The Bray Series 70 Electric Actuator provides a rugged, compact industrial actuator solution to a wide range of quarter turn applications including butterfly valves, ball valves, and dampers.

Available in torque outputs from 600 to 18,000 in-lb (68 to 2033 Nm), these actuators mount directly to Bray and other industry standard butterfly valves without the need for brackets and linkages. The manual declutchable override handwheel is standard on all Bray Series 70 actuators, providing end user convenience in installation, commissioning and service.

On/Off and modulating models are available in 24, 110 and 220 VAC. The standard enclosure is NEMA 4x and IP65 rated with an industrial polyester finish, making the Series 70 the ideal choice for cooling tower valves and other outdoor applications.

The advanced Servo Pro modulating control card assures compatibility with virtually any analog control signal used in today's building automation and temperature control systems.

Website: www.bray.com

Automizer automatic flow limiting temperature control



Griswold has combined the equal percentage control of the OPTIMIZER insert with the precision of the Griswold Stainless Steel Flow Cartridge. The Griswold Flow Cartridge limits flow from exceeding coil's specification, while the OPTIMIZER creates a smooth, responsive flow curve.

Most coils have temperature control valve and a balancing or limiting valve. Two valves means two manufacturers and two distributors. This is a single source for both, for fewer hassles and less headaches.

And for an added feature, the Automizer has an integrated isolation ball valve. The entire return side of the coil in one valve.

Website: www.griswoldcontrols.com

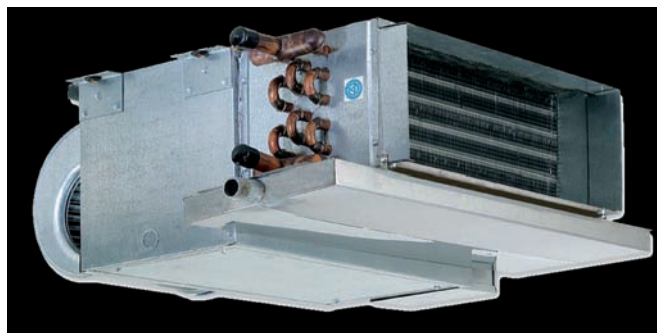
Custom industrial truck-in oven

The Gruenberg Custom Industrial Oven serves as a granulation dryer for dry-dosage pharmaceuticals and was designed for a leading pharmaceutical manufacturer. The high-capacity oven is capable

of handling eight rolling trucks filled with trays of product solution simultaneously and accommodates a total batch load of 4.72 tons.

The pharmaceutical manufacturer purchased two of the 77" wide, by 84" high by 173" deep custom Gruenberg ovens, which feature modular construction in six sections to facilitate easy transport and set up. ■

Website: www.thermalproductsolutions.com

Fan coil – THBC

Factory assembled, horizontal blow-thru ducted THBC fan coils are designed for concealed installations above the ceiling and are suitable for projects such as hotels, motels, condominiums and general commercial applications.

Features and Benefits

- Performance AHRI Certified to Standard 440
- Sound Performance tested as per AHRI Standard 350-2000 (non-ducted equipment)
- ETL-Listed, Constructed in compliance with ANSI/UL 1995 Standard
- High-efficiency motor, Solid State Relays and Electric heat control available for quite operations
- Chilled Water, Hot Water and DX coils with factory mount or field install piping package available
- Double Width Double Inlet (DWDI) direct driven blowers of the whisper quiet type. ■

Website: www.titus-hvac.com

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Riyadh's library gets recognition for architectural excellence

Image Courtesy: Christian Richters
Photographer: Gerber Architekten



One particular challenge for the façade is the enormous temperature differences in Saudi Arabia (in summer up to 80°C and in winter below 0°C). In summer the steel ropes expand, in winter they contract...

This year, the King Fahad National Library of Saudi Arabia, has won the 10th international architectural A+ Award from Architizer in the category Architecture + Material. This project sees Professor Eckhard Gerber and his Gerber Architekten team accomplishing one of the most important urban development and cultural projects in the capital, Riyadh. The symbolic cuboid shape of the new building surrounds the existing building on all sides. The square new building is covered by a filigree textile façade following traditional Middle Eastern architectural patterns and linking them with the state-of-the-art technology. One particular challenge for the façade is the enormous temperature differences in Saudi Arabia. In summer, the steel ropes can heat up to a temperature of 80°C and expand. In winter, the material can shrink because at night times that can experience negative temperatures. These effects had to be calculated to optimise the tension of the steel wires. The façade was combined with a ventilation and cooling system consisting of layered ventilation and floor cooling. In this way, thermal comfort was increased, and energy consumption was significantly reduced by using special methods and technologies for the first time in the Arab world. ■

Fraunhofer's laboratory building: an example of high scale energy efficiency

On July 4, 2013 Fraunhofer ISE officially opened its new laboratory building in Freiburg, Germany. The researchers at Fraunhofer ISE developed the energy efficient building concept, and realised it together with a team of planners, architects and industry partners. Strategies included the heating and cooling concepts through to the building-integrated photovoltaics.

The following energy measures were implemented in the building: The cooling and heating supply is provided with a novel heat pump with turbo-compressor technology – that provides cold and heat at the same time – and uses process waste heat. The heat pump is combined with a stratified storage tank for cold water that supplies processes and air-conditioning with high temperature cold. The cold water storage undertakes a double function in the heating and cooling concept.

In cooling mode, it serves as a cold store as well as a redundant cold supply for the sensitive process technology in the laboratory building. In heating mode it functions as a heat source for the heat pump. Coupled with a 500 m³ hot and cold storage, the entire heating demand can be met by heat recovery, stored as cold and reused phase-deferred. ■

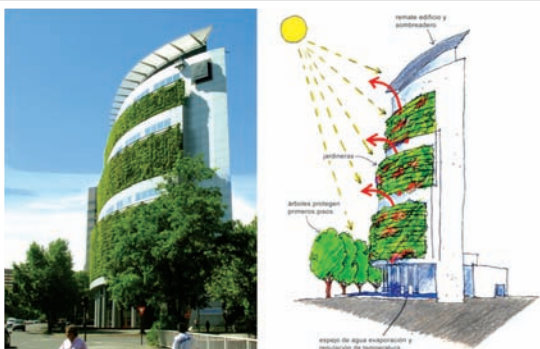


Image Courtesy: Fraunhofer-Institut für Solare Energiesysteme ISE

In the Fraunhofer's energy efficient laboratory building, cooling and heating supply is provided with a novel heat pump with turbo-compressor technology...

A benchmark building that exemplifies sustainable architecture

Image Courtesy: www.sefaira.com



The Consorcio Building, in Santiago, was one of the first projects to be designed with passive strategies in mind...

One of the most sensitive factors in Chile is controlling solar gains, particularly by selecting the building's optimum orientation. Through this process designers also aim to achieve good daylight within the project.

The Consorcio Building, in Santiago, was one of the first projects to be designed with passive strategies in mind.

One of its most remarkable features is a double-skin green façade, which changes through the year. In summer, the green layer filters daylight and minimises glare.

In the winter when the foliage is sparse, it allows sunlight to enter the offices. It was designed by renowned Chilean architects Enrique Browne and Borja Huidobro in 1991 and is 35% more efficient than conventional buildings. (Source: Sefaira) ■

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