Vol. 10 No. 8 A Chary Publication® ₹ 100

Cooling India

March 2015

India's foremost Monthly dedicated to the growth of HVACR Industry

Scan the QR Code to know more about Cooling India Website

Vol. 10 No. 8 | A Chary Publication® | ₹ 100

Cooling India

March 2015

India's foremost Monthly dedicated to the growth of HVACR Industry

Scan the QR Code to know more about Cooling India Website

Analysis & Overview of Industrial Cooling Towers

Articles

News

Publisher's Letter

VRF systems offer design flexibility, energy savings, and cost effective installation

Air conditioning for residential and commercial buildings is the necessity of life due to the large demand for thermal comfort and healthy environment of the living space in modern society. The conception of the air conditioning has gradually developed from one unit for one house to independent units for separate zones in the same house. A writeup 'Variable refrigerant flow (VRF) systems' explains the systems vary the flow of refrigerant to indoor units based on demand. In addition to providing superior comfort, VRF systems offer design flexibility, energy savings, and cost effective installation.

While creating awareness among the working professionals in HVAC&R sector, the article, 'A Redefined Engineering Analysis of HVAC&R Industry' comprises mainly of the culture that has been put into practice in HVAC&R industry by the working class and reviews the work culture in this industry. It highlights HVAC&R professional should never be limited up to making the equipment operational. The aim should be stretched further to make the whole HVAC&R system perfectly functional without any technical compromise.

Investment in a building project entails significant capital investment and associated costs over the economic life of the project. It is a mistaken notion that the buildings costs have to be expensed once. A write up 'A Guide to HVAC System Design' mentions the buildings like any other industry have running expenses in a way that they consume lot of energy and require water & disposal facilities that accounts for significant recurring costs. The HVAC systems often are very large and are responsible for a large portion of a building's first cost and operating cost.

The issue has report ACREX 2015 held in Bangalore.

Please send your comments at pravita@charypublications.in

Pravita Iyer
Publisher & Director

the microgroove™ advantage

IT'S A GAME CHANGER

MicroGroove™ technology is changing the game of air conditioning and refrigeration (ACR) OEM product design.

OEMs are going back to their drawing boards. They are designing ACR products with high energy-efficiency, while minimizing materials usage and reducing refrigerant volume.

The resulting ACR products are smaller and lighter yet can be produced using familiar manufacturing methods.

It's a whole new game!

Interested manufacturers and suppliers of 'smaller diameter inner grooved copper tubes heat exchanger' can get in touch with us.

For more information, write to:
avinash.khemka@copperalliance.asia
shankar.sapaliga@copperalliance.asia

Cu

International Copper Association India
Copper Alliance

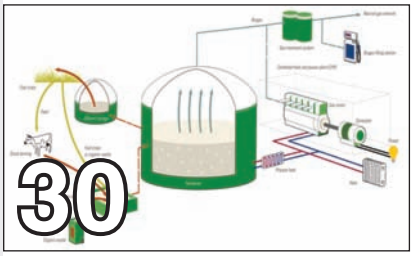
Head Office: 302, Alpha, Hiranandani Business Park, Powai, Mumbai - 400 076 India | Tel: 91-22-61147300
www.copperalliance.org

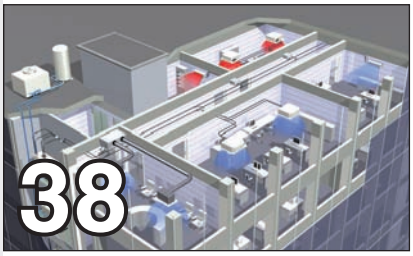
For more information, or to join a free webinar, visit www.microgroove.net

Contents

Vol. 10 No. 8, March 2015

Articles





V5 X Series

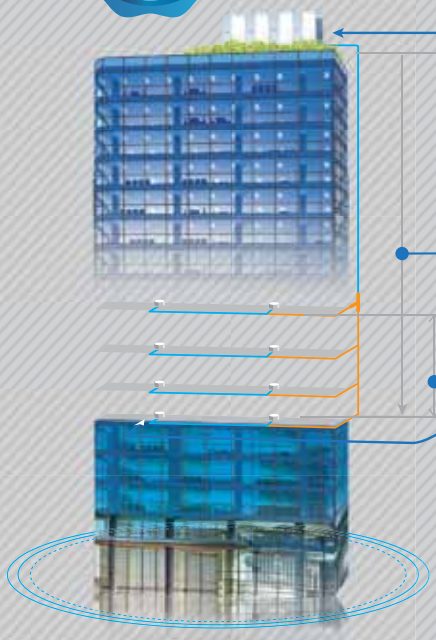
ALL DC INVERTER VRF

88HP

R410A

Diamond Shaped Design

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



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

175m
Max.175m actual piping length

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

Carrier Midea India Pvt. Ltd.,
1st Floor, Pearl Tower,
Plot No. 51, Institutional Area,
Sector 32, Gurgaon - 122001,
Haryana. Ph: - 0124 6144300

www.carriermideaindia.com

Service Helpline
1800 3000 00 11

www.facebook.com/mideaindia | Linkedin: Carrier Midea India

mideacare@carriermidea.com

Contents

Vol. 10 No. 8, March 2015

Focus

Chillers, Plant Design,
Water Treatment and Distribution

Department

Emerson Climate Cold Chain Center Of Excellence

Semi-Hermetic Service & Spares

India's Most Comprehensive Servicing Facility

Global Expertise With State-Of-The-Art Testing Facilities

Built on global standards, Emerson Semi-Hermetic Service center provides best-in-class processes and testing facilities, ensuring quality and reliability in Semi-Hermetic compressor servicing. Customers benefit from in-depth equipment testing, complete overhaul of electrical & mechanical components, as well as functional testing.

With this facility, Emerson takes servicing solutions in India to the next level.

ClimateIndia@Emerson.com or 1800 209 1700

EMERSON
Climate Technologies

EMERSON. CONSIDER IT SOLVED.

Editorial

Paris Climate Conference 2015

United Nations Climate Change Conference, COP21 or CMP11 will be held in Paris, France in 2015, where an agreement in international negotiations on global warming should be reached. Also, the international climate conference will be held at the Le Bourget site from 30 November to 11 December 2015. This will be the 21st yearly session of the Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change and the 11th session of the Meeting of the Parties (CMP 11) to the 1997 Kyoto Protocol. It aims at reaffirming commitment to greenhouse gas emission reductions.

The engagement from industry related associations, notably in favour of HFCs emission reduction, continues to grow. Moreover, the majority of parties are in for a high-green house effect HFC mitigation, so a binding or nonbinding agreement should be achieved whatever the case. The IIR took part in the international Montreal Protocol meeting held in Paris in July which exclusively addressed this issue. It also took part in the next Meeting of the Parties (MoP) on the Protocol in November 2014 and in the UN Climate Change Conference in December 2014. On these occasions, joint documents with the UN Environment Programme (UNEP) focused in order to promote different methods of reducing increase of HFC emissions and to achieve this safely. European Commission has set out the EU's vision for a new agreement, based on scientific evidence; put the world on track to reduce global emissions by at least 60% below 2010 levels by 2050. Inside the UN system the Climate Summit provided a platform for significant announcements; such as by China on cutting it's carbon intensity by 40-45% by 2020 from a 2005 baseline; and France announcing $1 billion for the Global Climate Fund.

Climate conferences in Warsaw and Lima agreed that all countries are to put forward their proposed emissions reduction targets for the 2015 well in advance of the Paris conference. The contributions will be prepared at national level by each Party, and submitted to the UNFCCC, and by November 2015, it will prepare, a synthesis report based on contributions to assess whether they put us on track to keep global warming below 2°C. A negotiating text for the 2015 agreement was agreed in Geneva in February 2015. And, yes before the Paris conference, negotiations will continue at UN meetings in June, September and October in Bonn, Germany.

Gopal Krishna Anand

Directors/Publisher
Mahadevan Iyer
Pravita Iyer

Editor
Gopal Krishna Anand
edit@charypublications.in

Sub-Editor
Kshitija Kolhapure

Editorial Coordinator
Nafisa Kaisar
nafisa@charypublications.in

Advertising Department
Jigar Padachh
advt@coolingindia.in

Design
Rakesh Sutar
Sandeep Amte

Subscription Department
Hemant Yelave
Nafisa Khan
sub@charypublications.in

Accounts
Dattakumar Barge
Bharti Solanki

Our New Address

Editorial, Subscription & Advt. Office:
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Tel.: (022) 2507 3300 / 01

Rs. 100/- Per Copy
Rs. 1000/- Annual Subscription

Printed by Pravita Iyer and Published by Pravita Iyer on behalf of Chary Publications Pvt Ltd., and Printed at PRINT TECH, C-18, Royal Indl Estate, Naigaum Cross Road, Wadala, Mumbai 400 031 and Published at 311, Raikar Chambers, Govandi (East), Mumbai 400 088.

Editor: Gopal Krishna Anand

Climatix IC-Remote Servicing System

Siemens is greatly simplifying the remote maintenance of heating, ventilation, and air conditioning (HVAC) systems. The HVAC regulators from the Climatix product family can be directly connected to the Internet and accessed via a service provided in the cloud. Remote maintenance saves time and money, because a technician does not have to be physically present to carry out many processes, such as the installation of updates. Manufacturers of HVAC systems use remote maintenance to support commissioning from distant locations, make diagnoses, and repair faults. This was already possible via modem or Web server if one had the necessary know-how, but other tasks such as continuous monitoring were possible only with great difficulty. Because tablets and similar smart devices are now becoming increasingly common in the service sector, Siemens has developed a device-independent, Web-based solution. The Internet-enabled regulators from Siemens can simply be registered in the Climatix IC cloud, and from then on they are accessible from anywhere at any time. Climatix IC provides a wide range of services, such as monitoring, diagnosis, an alarm service, and updates. Thanks to the cloud, it's easy to set up comprehensive remote maintenance for HVAC systems ranging from devices in private homes to complex installations in shopping malls. Internet-enabled Climatix regulators automatically connect with the cloud as soon as they are commissioned. All of the important operating data are gathered and stored there. Service personnel and building operators can monitor the equipment, diagnose malfunctions, and repair faults without having to install any additional software. The Web-based service can be accessed from every Internet-enabled device, including a tablet. In addition, Climatix IC can support the installers when they commission the devices. When dealing with data from the cloud, Siemens complies with the most stringent IT security standards. Siemens is increasingly offering its own services via the cloud. Cloud computing or Web-based services are being offered by various business units. ■

Liverpool refrigeration gas specialist secures a cool £750,000 investment

The Montreal Protocol, is now controlling the phase-out of the less damaging HCFCs

A Liverpool company which has developed a more environmentally-friendly range of refrigerant gases has received a £750,000 investment to boost its growth from The North West Fund for Mezzanine.Refrigerant Solutions (RefSols), which is based in Liverpool, provides replacements for the ozone-depleting gases which are used in refrigeration and air conditioning systems.The funding will allow the company to take advantage of the global demand for replacements as the current refrigerants are phased out and allow it to create a number of senior technical and sales jobs.The Montreal Protocol, an international agreement introduced in 1987 to protect the ozone layer, banned the use of ozone-depleting CFCs worldwide and is now controlling the phase-out of the less damaging HCFCs.In many cases these have been replaced by HFCs, which do not deplete the ozone layer This investment will help RefSols to take advantage of this demand and boost its export sales." ■

New Headquarters of Navi Mumbai Municipal Corp. receives LEED Gold Certification

NMMC Headquarters in Navi Mumbai -- A LEED Certified Green Building

The new Head office building of Navi Mumbai Municipal Corporation has been awarded the prestigious GOLD certification under LEED INDIA New Construction rating system by Indian Green Building Council for its commitment to sustainable development. Green Building Consultancy Services, one of the lines of businesses of Electricals & Electronics Division at Godrej & Boyce Mfg. Co. Ltd. was the Green Building consultant and Hiten Sethi Associates was the Architectural Consultant on onboard for the project. The Head Office building of NMMC is located at Belapur, Navi Mumbai, has a total built up area of 33,258 square meters and houses various Administrative, Engineering departments, Political Head offices and General Body hall under one roof. Project was visualized as imposing and expressive, an identity of the corporation which has proved itself successfully in a very short time span. Uniqueness of this project can be defined through various aspects right from Location and Site Character to Planning concept, Structural system, Use of materials, sustainable technologies for essential services and aesthetic approach.The project was completed in 2014 and symbolizes the NMMC's move towards an environment friendly future. Speaking on the achievement, George Menezes, COO & Business Head – Godrej Electricals & Electronics Division said, "It's a matter of great pride for our Green Building vertical, which played a pivotal role in getting the GOLD certification for this iconic building, a first of its kind in the municipal corporations, where on such a large scale all tenets of sustainability have been so nicely woven into the building's design, construction and operations". H N Daruwalla, Exec. VP – Godrej Electricals & Electronics Division commented, It is indeed creditable that NMMC has taken a lead in promoting green building concept. ■

set temperature in style

Honeywell thermostat series

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

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

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

Honeywell

Honeywell Environmental and Combustion Controls, Honeywell Automation India Limited, 56 & 57, Hadapsar Industrial Estate, Pune 411013. (India)
Tel: 91-20-66039400, Fax: 91-20-66039979, ECC Helpline: 1800 103 3848, eccteamindia@honeywell.com, ProductsBU@honeywell.com

DuPont achieves top sustainability certification

DuPont Knowledge Center in Hyderabad Receives Leed Certification for Sustainable and Environmental Building Strategies

DuPont, the world's leading Science Company was awarded the prestigious LEED Certification in Gold Category for the DuPont Knowledge Center (DKC) in Hyderabad, India. DKC is an integrated science and technology center that does global R&D and Application Development in agricultural, nutrition & health, bio-based industrials and advanced material sciences for India & ASEAN. The award has been granted by the United States Green Building Council (USGBC) for Existing Buildings Operations and Maintenance (EBOM). Ranjan Patnaik, Director, DuPont Knowledge Centre (DKC) said, "This certification stands testimony to our respect for environment. The energy-efficient design and eco-friendly maintenance features used in the center aim to 'conserve and preserve' rather than 'waste and exploit' the natural resources, offering a healthier and cleaner environment. We feel honoured to have been recognised for our environmental achievements."In the past year, the team at DuPont Knowledge Centre hasconsciously employed sustainable practices in its buildings and focused on resource conservation and preservation tactics. This outstanding achievementcan also be attributed toDKC's constant and innovative efforts in improving indoor air quality, using better building materials, conserving energy and reducing water consumption. Few examples of the savings include water reuse through the sewage treatment plant, solar powered lights, LED lights, motion sensors for lighting, exhaust systems and rest rooms, CFC free refrigerant, paper waste recycling and vermin compost and usage of green sealed certified chemicals for house-keeping. ■

LG Recognized by UN for Emission Reduction Efforts

LG Electronics (LG) has become the world's first to receive Certified Emission Reduction (CER) credits in appliance industry, from the Clean Development Mechanism (CDM) project encouraged by the United Nations Framework Convention on Climate Change. Established at the Kyoto Protocol, the CDM awards emission-reduction projects in developing countries with CER credits, with each credit equivalent to one ton of CO_2. This cooperative mechanism allows the country or the private sector to meet their Kyoto Protocol targets while contributing to the sustainable development of developing counties through environmentally-friendly investments.In the Indian market, LG acquired CER credits for its enhanced energy efficient refrigerators. The refrigerator project was awarded CER credits equivalent to the amount of reduced energy consumption. LG, which earned approximately seven-thousand tons in CER credit earlier this month, expects to eliminate 5.8 million tons of CO_2 for the refrigerator project over the next 10 years. Credits earned through this effort are expected to create as much as EUR 3.1 million (USD 3.4 million) in additional revenue, of which a portion will be donated to assist impoverished women and children in India. ■

Trane's Commercial Building Solutions that Advance Energy Efficiency, Management and Conservation

Trane, a leading global provider of indoor comfort systems and services and a brand of Ingersoll Rand, will showcased its new products and services at the AHR Expo in Chicago during January, that help increase energy efficiency, lower operating costs and address the sustainability needs of building owners and operators."Our theme for 2015 is around putting intelligence to work in buildings," said Dave Regnery, president of Trane Commercial for North America, Europe, the Middle East and Africa. "We are introducing new products, robust controls and services that, combined with Trane knowledge, make buildings run more efficiently."At the Trane AHR Expo in Chicago, Trane leaders will offer short technology-based in-booth presentations on creating intelligent systems, intelligent buildings and design, and a refrigerant update. Trane leaders are available for interviews upon request and by appointment. Trane leaders will also demonstrate and discuss the following new innovations: Trane Sintesis™ air-cooled chiller that is energy efficient and quiet, and offers customers the choice of operating with a next generation, lower global warming potential refrigerant -- DuPont™ Opteon® XP10 (R-513A) or with R-134a. Product will be available in North America and Latin America with next generation refrigerant option in June 2015.Sintesis is one of the first products in the new Ingersoll Rand EcoWise™ portfolio of productsthat are designed to lower environmental impact with next generation, low global warming potential refrigerants and high efficiency operation.Trane® Tracer™ Concierge™ is a new control system that provides an easy and affordable way for building owners to gain simplified HVAC and lighting control, resulting in improved comfort and performance, with reduced operating costs. Concierge goes beyond managing individual rooms by running heating, ventilation and air conditioning (HVAC) and lighting systems simply and smartly, offering an easy-to-use interface and delivering high energy efficiency, lower maintenance and advanced capabilities. ■

Satisfying all your refrigeration & air-conditioning control requirements

CONTROLLERS

sub-Zero®

Cold Room

Ripening

HACCP

Telecom Shelter

Datalogger

Chiller

Temp. Indicator

Freezer

SPPR (LVM)

Wall Mount Controller

Humidity

Cold Room Control Panel

VALVES

CASTLE™

Ball Valve

Shut Off Valve

Liquid Level Switch

Solenoid Valve

Liquid Level Controller

Globe valve

HSV

Pilot Solenoid Valve

Water Flow Switch

Door Latch and Hinges

Angle Valve

www.ascontrols.com

A. S. CONTROLS PVT. LTD.

A-160, TTC Ind Area, Khairne MIDC, Thane-Belapur Road, New Bombay - 400 705, India.
Phone: +91-22-2778 2005 | Fax: +91-22-2778 2008 | E-mail: sales@ascontrols.com
Mr. Deshpande : +919867006105

DISTRIBUTORS: Mumbai(022): Air Cool(I): 09821038796 / 28224631/4666 | Amocon Enterpirses: 26864648 / 49 | Cool World: 24174444 | Filko Engineering: 22676773| Hari Om: 22701183 | International Trade Impex:22677372 / 22672306 | Om Sai: 09324097269 / 09323195925 **Thane(022):** Bosh Controls: 25470326 **Pune(020):** Freeze Cold Enterprises: 09225600696 | Joshi & Co. 24473035 | Megatech: 24479078 | Silver Star: 24473660 **Aurangabad:(0240):** Ajanta Electsricals: 2350283 **Ahmedabad(079):** Shruti Sales: 26577756 / 78077 **Baroda(0265):** Canon Refrigeration: 09825028355 **Surat(0261):** Capri Refrigeration: 2632755 **Delhi(011):** HRS: 23259650 | Himgiri Refrigeration:23241111 / 232051500 **Agra(0562):** Tewari Commericial Corporation: 2520334 **Kolkata(033):** Reliance Refrigeration: 22373964 | Sethia Trading Corporation: 09830048658 **Hyderabad(040):** Superfreeze(I): 09848010182 **Secunderabad(040):** Andhra E. & R. Co.:07715025 | Usha E. & Corp.: 27715568 **Bangalore(080):** Aircon Refrigeration: 22866082 | Hi-Tech Refrigeration: 41130995 / 09341264630 **Madurai(0452):** Usha Sales Agency: 09843157177 **Chennai(044):** Ref & Al Tr.: 42157733 | Rishabh Enterprises: 28158279 **Coimbatore(0422):** Aircool Centre & Co.: 2523510 / 3510

STRATIFIED CHILLED WATER THERMAL STORAGE SYSTEM

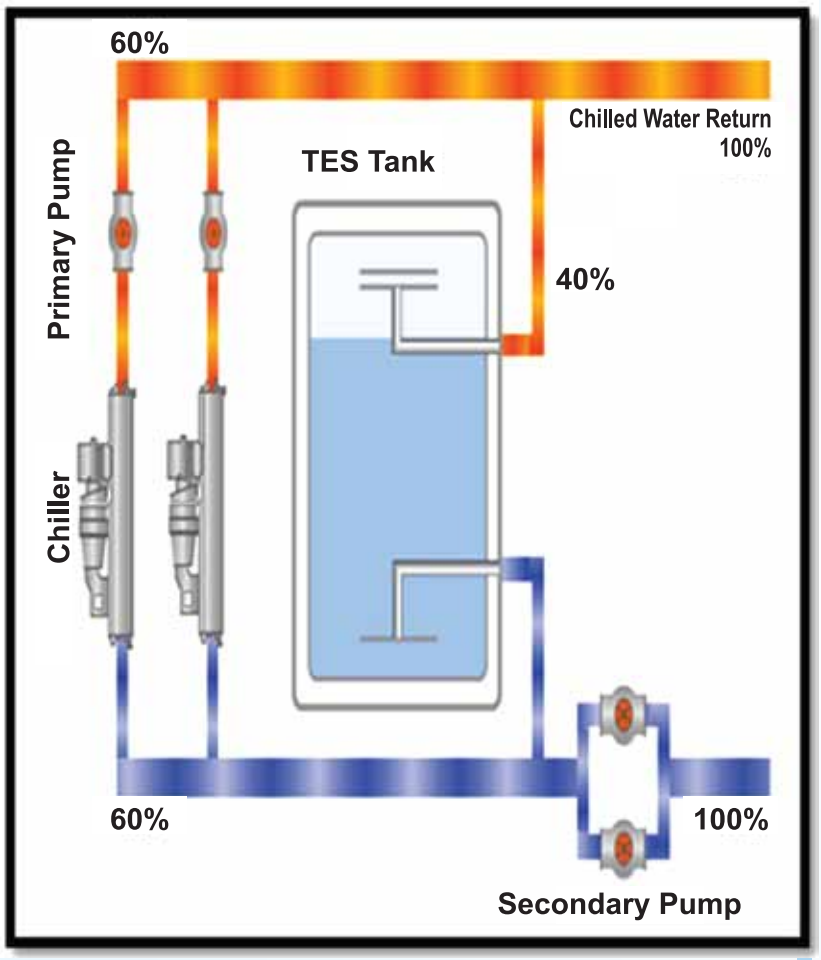
As per ASHRAE's design guideline

Save You Money by:

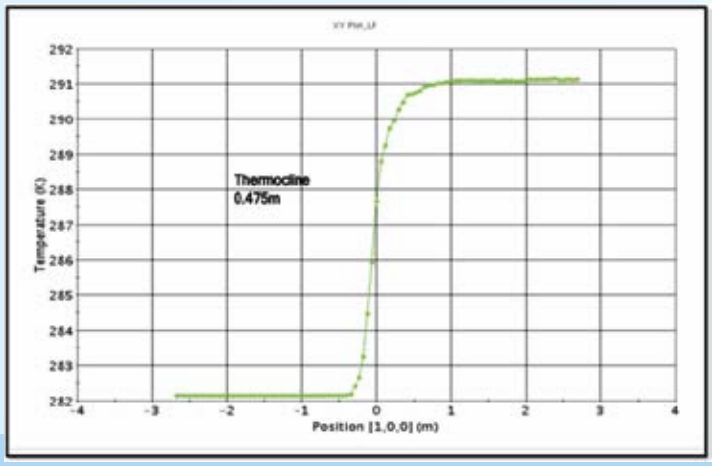
- Reducing annual energy and operational costs
- Deferring capital expenditures on equipment replacement of expansion projects
- Preventing downtime of mission critical operations
- Improving the efficiency and power output of natural gas electrical power generators
- Acting as a negotiating tool in deregulated markets

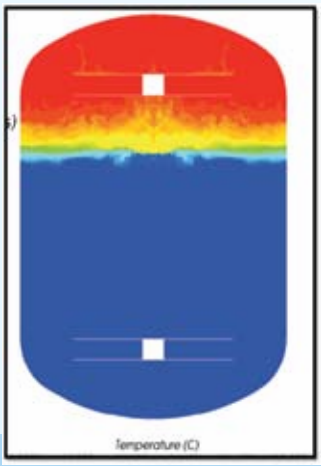
Key Features

- Lowest initial investment cost
- 30% energy saving by utilizing conventional chillers
- Simple System with easy control
- No additional heat exchagers and pumps
- Easy to convert conventional system into CWTES
- Convertible to heating purposes.
- Environmentally friendly system free from brine.
- Storage water utilisation for fire fighting in emergency



Thermocline Thickness & Temperature distribution Analysis through CFD





The key Technology of CHW Storage system is the diffuser design which ensures thermal stratification of chilled water and warm water by density difference. Ensavior, in association with FTENE, Korea, A global leader in TES Technology, provides state of the art technology, which is recommended at ASHRAE's design guideline

World's Most Smart and Innovative Pressure Independent Dynamic Balancing Valve :

- Dual Max Flow rate Settings (summer/winter)
- Removable Display Unit
- Illuminating Display to know health status
- Communication with BMS thru RS-485
- True BTU metering
- Linear Control Characteristics
- 100% valve Authority

Acoustic, Noise & Vibration Control

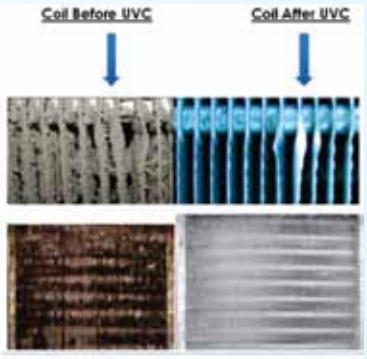
Customized Solution for any of Architectural, Environmental, Industrial or Commercial acoustic issue :

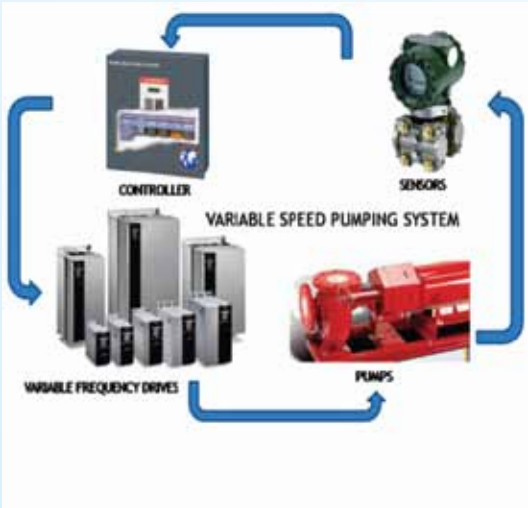
- Acoustic Barrier, Wall, Ceiling, Door, louvers, Absorber
- Sound attenuators
- Floating floors
- Inertia Bases

Ultraviolet Germicidal Irradiation (UVGI) System

An Effective tool for energy conservation and improved Air quality and ideal solution for:

- Reduce allergy symptoms, Sick Building Syndrome and indoor air related sickness
- Elimination of Mould, Fungi, and Microbes on Cooling Coil and Drain Pan.
- Clean and new looking Cooling Coil
- Reduce HVAC maintenance cost
- Earning LEED and GBC Merit Points
- Improvement in energy efficiencies





Pump and Pumping System for HVAC, Plumbing & Fire Fighting

A complete range of energy efficient pumps suitable for district cooling, chilled water, booster and transfer water, fire fighting and submersible pumps manufactured by Xylem Inc, the world's leading pump manufacturer.

- Centrifugal pumps and Pumping system for HVAC on Variable and constant speed
- Hydro-pneumatic pumping system on variable and constant speed.
- Water & Waste water pumps, Submersible Pumps, Drainage Pumps
- Fire fighting skids

Ensavior Technologies Pvt. Ltd.
t: +91 11 47350382, +91 9711154372
e: info@ensavior.com w: www.ensavior.com

Enhanced performance and increased efficiency in compact design

Chairman of the Board Peter Fenkl presenting the new ZAvblue centrifugal fan

Ziehl-Abegg, the specialist in fan manufacture, presents a new centrifugal fan that sets new records in air flow and compact design. The new ZAvblue impelleris up to 20 percent more efficient than other standard products in the market. In this context, the bionic design of the new development from Ziehl-Abegg requires significantly less space in the customer device. Equipment designers can now generate the current airflow with impellers that are one size smaller. The ZAvblue can be used for ventilation and exhaust (duct, tube and rooffans) for close control air handling units (cooling of data centres) as well as in clean rooms, heat pumps or compact air-conditioning units. The ZAvblue has been specially optimized to provide very high efficiency for high air flow even in the most confined spaces. Chairman of the Board Peter Fenkl promises "lower energy consumption due to the bionic lightweight construction and at the same time a significant reduction of the costly space required for the fan unit". A bionic lightweight construction saves on the installation space required whilst simultaneously maintaining the strength. A patent application has been filed for the new development. Since the new fan has standard connection sizes (but an improved airflow) customers can upgrade very quickly from the current products to the more efficient ZAvblue."The new fan design allows the same minimum construction height both with AC as well as EC motors", emphasises Fenkl. This is possible because the ZAvblue can be fitted with both AC and EC motor technology using customized adapters, without having to make significant modifications to the equipment. "The impeller meets the latest EU energy saving requirements both with AC as well as ECblue motors", adds the Ziehl-Abegg Board Chairman. The engineers at Ziehl-Abegg drew inspiration from Professor Claus Mattheck. ■

EPA approves climate-friendly Low-GWP Refrigerants

As part of President Obama's Climate Action Plan, U.S. Environmental Protection Agency (EPA) is increasing options for refrigerants used in various types of refrigeration and air conditioning equipment in the United States to offer alternatives with low global warming potential (GWP). This final rule addresses refrigerants under the EPA's Significant New Alternatives Policy (SNAP) program to identify and approve additional "climate-friendly" refrigerants. Under the authority of the Clean Air Act, EPA's SNAP program evaluates substitute chemicals and technologies that are safe for the ozone layer. This final rule expands the list of SNAP-approved substitutes to include more low-GWP alternatives that can replace both ozone-depleting substances and high-GWP hydrofluorocarbons (HFCs). The approved substitutes have GWPs that range from 3 to 675 and can replace older compounds with GWPs between 1,400 to 4,000. The EPA said that, after receiving input from industry, environmental groups, and others, it is approving additional low-GWP refrigerants, subject to use conditions, in the following refrigeration and air conditioning applications: The agency noted that these alternative refrigerants are already in use in many of these applications in Europe and Asia. ■

India's first Advanced Drives Lab to boost innovation on energy efficient solutions set up at VIT, Vellore

Advanced Drives Laboratory by Danfoss at Vellore Institute of Technology

Danfoss India, a leading provider of climate and energy solutions inaugurated its First Advanced Drives Laboratory set up at the premier Vellore Institute of Technology (VIT) as a part of its Industry Academia initiative to boost skilling in the manufacturing sector. This is the first lab in India, to house the latest global innovations in the field of electric drives within anacademic framework giving VIT students an edge over other premier engineering institutes in the Country. This collaboration further strengthens Danfoss' commitment to promote sector specific skill and competency development through industry academia tie-ups. "Make in India is the new mantra being chanted by all in the industry as well the government. Knowledge, skills and competencies are integral to industrial growth and if India has to strengthen its position as a global manufacturing hub, niche talent creation has to be a pre-requisite. However, the envisaged growth could affect the country's energy intensity and we need to find an efficient yet effective solution to address this. Drives are an essential part of modern industrial,HVAC and Aqua applications and help in conserving energy input. So while companies are yearning to grow in a sustainable manner, the challenges faced by them on competencies and domain expertise can be addressed only through skilling, and this is what we aim to achieve through this collaboration," remarked Ravichandran Purushothaman, President, Danfoss India. He said, the Advanced Drives Laboratory will house the latest electric drives such as induction motor, permanent magnet synchronous motor (PMSM) and synchronous reluctance motor drives- all indispensible innovations. ■

Johnson Controls introduces Quantech Air-Cooled Chillers

Johnson Controls introduces Quantech Air-Cooled Chillers, are now available through an independent sales network. Quantech chillers ship virtually immediately from inventory, making replacement available in as little as two days to minimize downtime and restore comfort quickly. Quantech chillers offer up to 50 percent annual energy cost savings compared with the replaced chillers, have a low lifecycle cost, meet or exceed ASHRAE standards, and help earn LEED credit with a low refrigerant charge."When an HVAC system goes down, occupants want relief and mechanical contractors want to provide a solution as quickly as possible," said Harvey Elder, vice president and general manager, North America Applied Systems, Johnson Controls. "We can deliver these chillers in days, not weeks or months, with the added benefits of high efficiency and a low lifecycle cost."Three models make up the Quantech chiller line: www.Quantech-hvac.com/Product-qtc2.html. The Quantech line includes theQuantech QTC2 and QTC3 15 to 175 ton air-cooled scroll chillers, as well as the Quantech QTC4 160 to 210 ton air-cooled screw chillers with variable speed drives, which are built to order. ■

Copeland Large Commercial Scroll wins 'Green Product' Award at Acrex 2015

Emerson Climate Technologies, a business segment of Emerson, recently won the 'Green Product' Award at ACREX India 2015 held at Bengaluru, for its Copeland® R410A Large Commercial Scroll Compressors. Emerson's Copeland Scroll™ Residential Variable Speed Compressor was also recognized at the awards in the 'Energy Savings' category for its outstanding performance. The awards were selected by an eminent & experienced jury from the HVAC industry and were presented at a grand ceremony with a huge audience of HVACR professionals. The all new Copeland R410A Larger Commercial Scroll compressor opens the door to widespread use of R410A for air-cooled as well as water-cooled chiller systems. This large commercial scroll compressor can be assembled in a wide range of Copeland qualified combinations, which is ideal for manufacturers who gain from increased flexibility in system design as well as inventory optimization. The other award winner, Copeland Scroll™ variable speed compressors are designed to deliver maximum energy efficiency and quiet operation for consistent comfort. It builds upon the reliability and proven performance developed over 25 years of Emerson scroll experience and more than 100 million installations around the world."At Emerson Climate Technologies, we are always looking for ways to make our customers' lives easier and more efficient," noted Sridar Narayanswami – Vice President & Managing Director, Emerson Climate Technologies, India. "Copeland Scroll™ compressors are known for their unmatched performance in the air-conditioning&refrigeration, and we are continually making an effort to enhance their efficiency a notch higher. Being recognized by bodies like ACREX is highly motivating for Emerson." ACREX India is one of the largest exhibitions in the HVACR Industry. ISHRAE (Indian Society of Heating, Refrigeration, Air Conditioning Engineers) had simultaneously held the ACREX Awards during the three day expo. They had a total of four award categories, out of which Emerson Climate Technologies was recognized in two of them, namely Green Product and Energy Saving. ■

Paper Deadline approaching for ASHRAE's 2016 Winter Conference

ASHRAE has announced a call for papers for its 2016 Winter Conference in Orlando, Fla., Jan. 23-27. The call for papers includes a recognition for the best paper written by a graduate student. Papers are being accepted on the following topics: Design Build project delivery, which explores the challenges and benefits, highlights successful projects and addresses several topics, including contracts and alternative design and construction processes. Modern Residential Systems for energy efficient solutions and the latest advances ranging from glazing to water heating to lighting for the residential market. Cutting Edge Technologies, which explores efforts to achieve net zero energy buildings. In addition, the 2016 ASHRAE Winter Conference also seeks papers addressing advances and practices across HVAC&R systems, equipment, fundamentals and applications, especially for the International Design Track. ASHRAE offers two types of paper submissions:

Conference Paper Abstracts due March 23, 2015. Upon acceptance, papers will be due July 6, 2015. These "final" papers undergo a single-blind review, are submitted as a PDF and have eight single-spaced page maximum length.

Full Technical Papers due April 20, 2015. Papers submitted for review must be both technically accurate and clearly written. These papers undergo a double-blind review and can be a maximum of 30 double-spaced pages.

Graduate students who submit a Conference Paper are eligible to participate in a recognition program titled "Best Graduate Student Paper." The recognition program is an ASHRAE effort to expose a deserving graduate student to the international community of researchers in the field by helping to fund their travel to the 12th CLIMA World Congress to be held May 22-25, 2016, in Aalborg, Denmark. ASHRAE will conduct a review of graduate student papers accepted for the January 2016 ASHRAE Winter Conference to make the selection. The graduate student author chosen will receive funding up to $2500 to offset expenses of attending the CLIMA 2016 Congress. Conditions of the award are that the paper must be based on the student's thesis, that the paper be a Conference Paper (not a Technical Paper), that the student be the first author listed and that the submitter be a graduate student at the time of the abstract submission. ■

Towards a Water Positive Future

Water Management at Godrej

Water is a paradoxical commodity: It seems free and plentiful, yet its supply is under tremendous strain. The planet is thirsty. Some experts even see international conflict emerging over access to dwindling supplies.

Use of potable water has more than doubled over the past 50 years, and many fear that we are coming close to a frightening breaking point, a world where chronic water shortages for farmers, businesses and people is the norm. Access to clean water has emerged as a critical issue affecting economic activity, development, and business around the world. Increasing regulatory pressures, climate change, aging and failing infrastructure, growing focus on social responsibility, and concern for environmental are forcing organizations to reassess the impact of water management on their economic wellbeing. Not just for a drop to drink, but for having the know how to manage it smarter in the first place.

Every time we interact with water, we change it, redirect it or otherwise alter its state. As a result, the nature of the water we get and have is continually changing - from rainfall to ocean. The chemical composition of water around us is fluctuating and these risky changes are forcing us to ask some thought provoking questions about how we use and abuse it.

Recognizing these concerns, organizations are undertaking major programs to realign their water use with the larger humanitarian interests. But while objectives like being "water neutral" and mapping of "footprint" —

Tejashree Joshi BE in Environmental trade and Master's diploma in Business Management is heading the Environmental Engineering Services department of Godrej & Boyce Mfg. Co. Ltd. Mumbai. She has worked in Godrej & Boyce Mfg.Co. Ltd. Mumbai for 12 years, with her most recent focus being management of water and waste as a resource for present and future.

Rumi Engineer leads Green Building Consultancy Services & Energy Conservation Dept. at Godrej and Boyce Mfg. Co. Ltd (G&B). Throughout his association with G&B, for more than 30 years, he had versatile roles. He is a LEED Accredited Professional, certified by USGBC, and a BEE certified Energy Manager. He has also been certified as a Sustainability Assurance Practitioner by CII-ITC Centre of Excellence for Sustainable Development and is also a GRIHA Trainer & Evaluator.

tracking the use of water throughout the supply chain — are ambitious, what is being done to achieve them? And its exactly in this context that Godrej and its initiatives with respect to water, comes into the picture.

Water Management at Godrej

As commitment towards environmental sustainability, Jamshyd Godrej, CMD Godrej & Boyce is one of the signatories to 'CII – Mission on Sustainable Growth' (MSG) program across the Industry. It is a purely voluntary initiative launched in 2009 which addresses 10 commandments like specific reduction in Energy, Water, Waste, Carbon emissions etc.

An ambitious target has been set for reduction in specific water consumption by 40% (over the base year of 2010) and we aim to be a 'Water Positive' company by 2020.

Even though the MSG program was started in 2009, the water management program in Godrej started off two decades earlier in 1986. A brief history is provided below:

1986: First Common ETP (Effluent Treatment Plant) of capacity 70 M^3/day commissioned for treating and recycling wastewater generated from various manufacturing activities at the Vikhroli campus.

1989: First STP (Sewage Treatment Plant) of capacity 300 M^3/day commissioned for recycling sewage water from industrial premises to reduce the sewage load and dependence on Municipal water supply and make available treated wastewater for use in landscaping for the industrial premise.

Both the above mentioned initiatives at that point of time were purely voluntary.

1996 again, owing to success of the implementation and the visual gains of the first STP a second STP of similar capacity was commissioned for recycling sewage water from the township which was further augmented to 750 M^3/day in 2010 as the demand for recycled water rose.

2010: We achieved 'Water Neutrality' i.e. the quantity of water recycled and harvested is equal to the quantity of fresh water consumed.

2014: We became 'Water Positive' i.e. the quantity of water recycled and harvested is greater than the quantity of fresh water consumed.

Sewage Treatment and Recycling Plant (750m^3/day): Industrial area

Industrial Effluent Treatment and Recycling Plant (750m^3/day)

A structured Water Management Programme was initiated in 2010, addressing the challenges of water usage efficiency, ageing infrastructure and proactive water-related risk management by leveraging the available resources' and generating newer ones. Today, we measure, monitor and analyze entire water supply systems - from reservoirs to our industrial and residential premises. But that's just the first step. The umbrella initiative of Water Management has around 45 large, medium and small projects in its scope.

- Recycling of treated industrial effluents to achieve 'zero discharge'
- Using of recycled and ground water for cooling applications instead of using potable water
- Using of cooling tower drain water for gardens
- Using recycle water for ready mix concrete production
- Enhancing efficiency of well water pumping system
- Augmenting old and available water resources for larger supply of water
- Sewage treatment and recycling plant with exclusive distribution network for use of treated water for flushing of toilets in residential colonies
- Harvesting of rainwater comprehensively to augment ground water resource.

Considering the humongous setup in Vikhroli and other commercial and industrial setups across the country the total water footprint is approximately 45 lakh litres/ day. Around 50% of this total requirement is sufficed through recycled water in Vikhroli whereas the same is above 45% combined across all manufacturing locations in the country. The past 3 years trend shows a clear increase in the contribution of recycled water in the overall water footprint.

2010: We achieved 'Zero Discharge', for industrial activities in Vikhroli by effectively treating and recycling of industrial effluent generated through various activities.

Recycled Water Usage: Mfg. processes, Landscaping, Flushing etc. : 20 lakh ltrs/ day

Cooling Tower applications: 3 lakh ltrs/ day

RMC production: 3 lakh ltrs/day.

We take pride in acknowledging that not only have we taken various initiatives in our manufacturing and commercial operations and units, but also in our residential colonies in Vikhroli. One

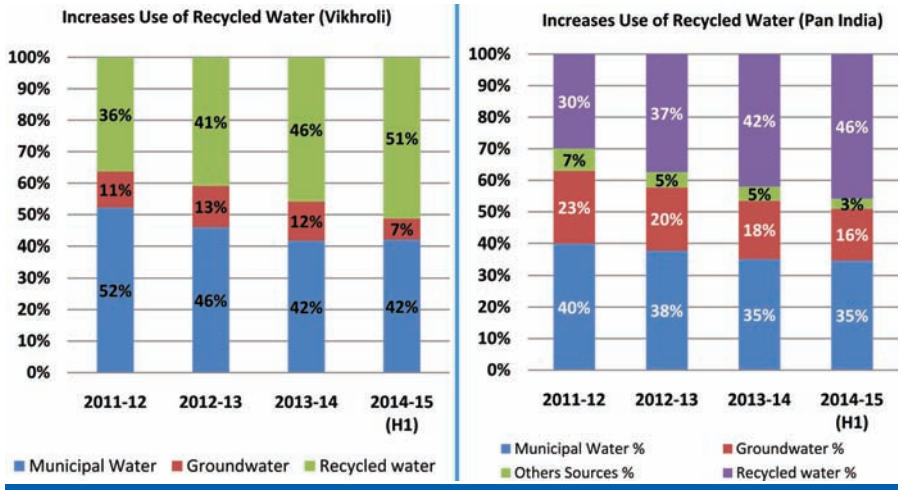


Fig. 1: Water Sourcesand Water Consumption Trend for G&B

Sewage Treatment and Recycling Plant (900 m³/day): Residential area

Fig. 2: Rainwater harvesting in G&B

Replenish: Rain Water Harvesting by Ground water recharge

among the many is the construction of sewage and recycling plant with a distribution network for using it for flushing of toilets in our residential colonies, which reduces about 5 lakh litres/ day of good potable water use. Other very significant initiative which has been taken is the Rainwater Harvesting.

Rainwater harvesting by recharging the ground water aquifers has been taken up at various locations within the Industrial Garden township of Pirojshanagar in Vikhroli resulting in a net recharging of more than 30% of the annual fresh water consumption of the setup.

Achievements & Future Plans

All the above great efforts put in by the organization has resulted in the Godrej & Boyce achieving 'Water Positive' status ending 2014. Achievement of 100% offsetting by recycling and replenishing since 2011 has been a great motivating factor for our team. However, the real challenge lies in maintaining & continuously improving our performance to ensure that we remain a 'Water Positive' company.

Conclusion

The need of the hour is not only to recognize the water problems as already being apparent, instead of a potential threat in the future, but also to act upon that recognition. Unless solutions are found at the micro and macro levels simultaneously, in a country the size of India, it is unlikely that this serious and looming threat will be resolved. We at Godrej have turned this threat into an opportunity for discovering and implementing innovative ideas for management of this most critical resource in the most efficient manner. With our in-house experience and expertise, we are positioned to offer the benefit of this knowledge to all the future developments that embark on this journey of water efficiency. Finally it would be apt to conclude with a beautiful message from Ban Ki-Moon, Secretary General, United Nations, from his speech at The World Economic Forum in 2008, "As the global economy grows, so will its thirst. This is not an issue of rich or poor, north or south. All regions are experiencing the problem of water stress. There is still enough water for all of us but only so long as we keep it clean, use it more wisely and share it fairly." ■

HEAT

An Ultimate Transit Energy

Heat is an universal energy mostly used in the world. It flows easily without application of work. It is considered as low-grade energy cannot be stored or not completely insulated. It is always in transit form.

Heat is defined as a form of energy in transition which flows under the driving influence of a temperature difference. Once the transfer of heat energy is complete, it is stored in one or more forms of stored potential, kinetic, in general as internal energy. It is worth noting that the heat as energy in transition is never measured as such but is determined in term of observed changes in other forms of energy and the relevant physical properties. Strictly speaking the heat transfer anywhere else in a system is merely redistribution of internal energy within the system. There are three basic mechanisms of heat transfer – conduction, convection, and radiation. In engineering applications they may occur separately, or simultaneously.

Modes of Heat Transfer: Heat is transferred by conduction, convection, and radiation.

Conduction is recognized as the transfer of heat within a substance from high temperature regions to low temperature regions. Conduction in solids other than metals is due to longitudinal oscillations in metals due to diffusion of free electrons and in gases due to elastic impacts of molecules. As kinetic energy of motion is proportional to the absolute temperature, it is logical to imagine conduction as occurring by collisions of faster with slower moving molecules. This idea seems to be quite correct. In the case of gases, molecular interaction is responsible for energy transfer; however, in metals an electron gas rather than the molecules is the primary medium of energy transfer.

Convection involves the gross motion of the fluid (liquid and gas) itself with the result that fresh fluid is continually available for energy transfer. The physical movement of fluid generally involves smaller eddies which help in distributing heat energy. The state and nature of fluid flow is of great importance in convective heat transfer. The fluid is set in bodily motion either due to-

- Difference in density due to heating, i.e. buoyancy forces, this is the case of a free convection, or
- External force such as fans, blowers, pumps, etc. giving rise to forced convection.

Prof. Dilip M Patel, MTech (Mech.), Principal, Shree V & K Patel Institute of Engineering, Mehsana, Gujarat

Convection is not actually a separate process, as conduction to or from the fluid is really what constitutes the heat transfer, and the movement of the fluid carries heat transferred to another location. A household water heating system is a good example of the type of heat transfer.

Radiation is transfer of heat energy by temperature excited electromagnetic waves emitted by vibrating electrons in the molecules of material at the surface of a body. The quantity of heat radiated depends on the absolute temperature of the body.

All bodies at temperatures above absolute zero emit electromagnetic waves of different wave lengths. Radiation differs from conduction and convection in this respect and is distinguished by double transformation of energy thermal is converted into radiant energy by an emitter and radiant energy into thermal energy by an absorber.

An interesting example of combined processes of heat transfer is a steam boiler. Here, heat is transferred from the flue gases to the outer surface of the water tubes through all the three modes of the transfer conduction, convection and radiation. From the outer surface of a water tube to its inner surface, heat is transferred only by conduction through a layer of soot, metal wall and a layer of deposited scale. Finally, from the inner surface of the tube to the water, heat is transferred only by convection. Individual modes of heat transfer are, therefore, met within various combinations in the course of heat flow, and it is very difficult to separate them. In practical calculation, it is sometimes, desirable to consider such complex processes as a whole.

Irreversibility in Heat Transfer: It may be noted that transfer of heat is on account of temperature gradient existing between two bodies, which makes the process irreversible, i.e. flow of heat cannot be reversed of its own. Thus, heat transfer in the direction of temperature gradient is a natural and spontaneous process. As it happens in all natural process, entropy increases in the system of bodies among which heat transfer takes place. Let there be two bodies A and B at temperature T_1 and T_2. $T_1 > T_2$ as shown in Fig. 1-1. If dQ is the quantity of heat lost by A and that gained by B, entropy lost by A is dQ/T_1 & that gained by B is dQ/T_2. Thus, in the system of two bodies due to heat transfer there is net increase of entropy dQ/T_2-dQ/T_1. The gain in entropy during heat transfer in dicates fall in quality of heat energy. It is desirable to minimize irreversibility and also gain in entropy in any process in

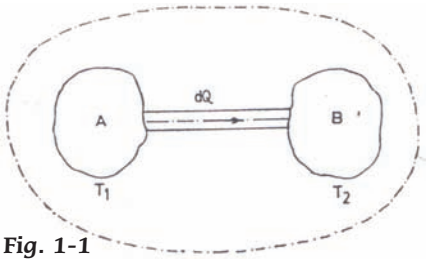
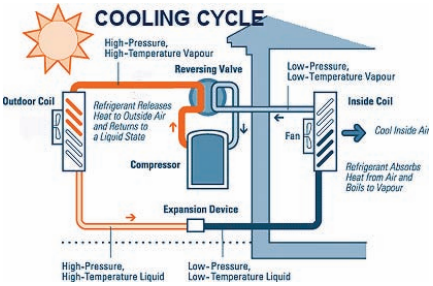
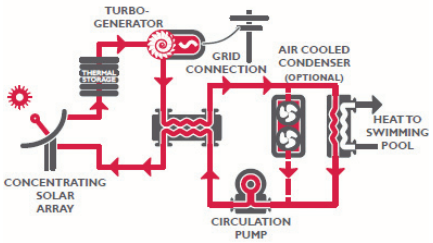


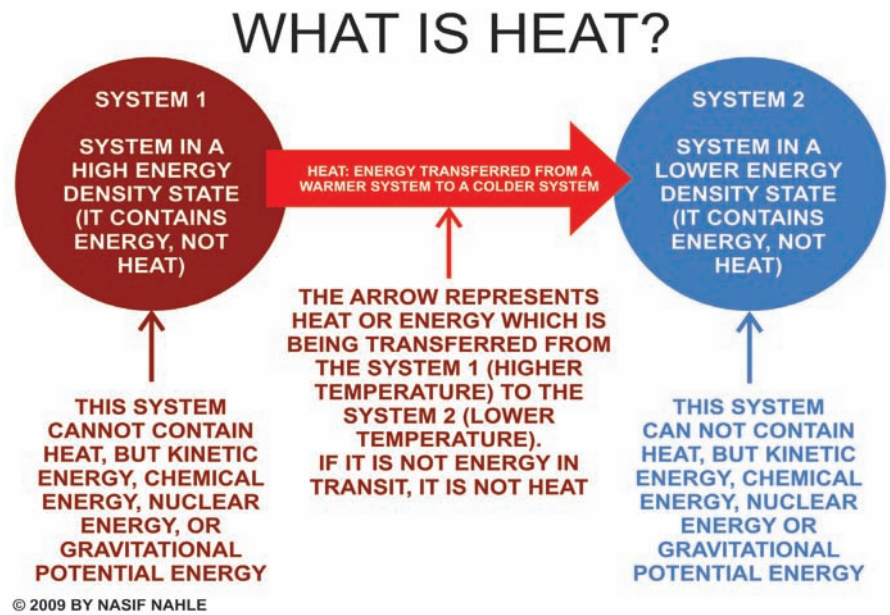
Fig. 1-1





thermodynamics as it renders the process inefficient. This is accomplished by limiting temperature difference (T_1-T_2) in the process of heat transfer. However, with the decrease of temperature equalization is attained. Further, with the system of bodies at different temperatures, on attainment of equalization the plot of increase in entropy of the system is plotted with time, it indicates decreasing rate of increase in entropy. On equalization, entropy of the system becomes maximum and no further increase in entropy of the system is feasible.

Fields of Applications: The importance of heat transfer analysis lies in a very wide range of applications connected with power plant engineering, chemical and process engineering, manufacturing and metallurgical industries, refrigeration and air conditioning practices, cooling problems associated with electrical and electronic equipments, space technology, low temperature technology & many other applications. Condensers, evaporators, coolers, heat dissipating surfaces such as fins, prevention of heat losses through insulating materials, controlled release of heat energy from



fossil and nuclear fuels aerodynamic heating, combustion processes, thermally operated controls, etc. are some of the specific examples of heat transfer applications.

In the design of a plant which incorporates heat exchange with the surroundings, the size of the heat transfer equipments, the material of construction connected with them, and the auxiliary equipment required for their utilization, are basic considerations being faced by a designer. The equipment should fulfill its required objectives and at the same time should be economical to purchase and operate. This requires through understanding of the basic mechanisms of heat transfer and analysis so as to be able to evaluate quantitatively heat transfer rates and other related quantities. Unfortunately, the analysis of heat transfer involves many variables and it is impossible to separate them and treat one at a time e.g. the flow of heat through a condenser involves nine variables. This clearly requires detailed knowledge of the principles governing heat transfer.

Heat exchanges are very important parts of many thermal systems. Their first cost and the cost of their operation and maintenance are of great impertinence for efficient plant installation. As stated earlier heat transfer is an irreversible process, hence it is desirable to reduce the irreversibility that always accompanies heat transfer by reducing temperature difference between the bodies that exchange heat. With the reduction of temperature difference, the rate of heat transfer decreases and in order to maintain the given rate of heat transfer, area of heat transfer is to be increased. Thus, cost of heat exchanger increases rapidly with the reduction in temperature difference employed for heat transfer. Thus, designs should make a decision regarding economic limit to which temperature difference can be reduced.

The popular examples of heat exchanges are :

- Surface condenser of a steam plant,
- Air preheater and economizer for a boiler,
- Intercooler for air compressor,
- Heat exchanger for gas turbine plant,
- Condenser and evaporator for refrigeration unit
- Heat exchange for chemical plant, etc.

In these classes of heat exchanger, the fluids are kept separate and heat transfer take place through the intervening walls. This is often the only possible type as the fluids differ in their chemical composition and at least one is to be recirculated through the plant cycle so that they can not be allowed to mix. Thus, in such case the rate of heat transfer between fluids is limited to the capacity of the separating wall to transfer heat. This capacity of heat transfer is the basis of the design for this type of heat exchanger.

Thermal Conduction

Heat transfer between a hot and a cold body by conduction may take place through material substance such as metal wall, but conduction may take place also through fluids (either gases or liquids). In process of conduction, there is no physical movement of molecules. At the hot end of the material, random movements (activities) of the molecules is increased. As a result of this increased activity of the molecules, collisions with adjacent molecules along the material take place imparting increased momentum to these adjacent molecules, resulting in increased temperature. This is transfer of heat by conduction. In gases, heat conduction occurs by molecules, and atomic interaction. In metals, the flow of energy is due mainly to the diffusion of free electrons. Here, crystal lattice vibrations are of secondary importance.

Basic Equation: The basic equation for rate of heat transfer by conduction for an elementary thickness dx of the plate is

$$H = -KA\frac{dT}{dx} \qquad (1.1)$$

Where, H – rate of heat transferred,

A - area of heat flow normal to the direction of heat flow,

K - coefficient of thermal conductivity,

dT/dx- temperature gradient.

For positive value of x in the direction of heat flow, temperature decreases, making dT/dx negative. Thus, additional negative sign is employed in eqn. (1.1) so that heat quantity is positive. Thus basic equation although introduced by Biot in 1804, is usually attributed to Foerier because of his outstanding contribution to the field. This law was formulated from the study of experimental observations.

Thermal Conductivity: The thermal conductivity of the material, K is the quantity of heat passing between opposite faces of a unit cube in unit time when unit temperature difference is maintained across the faces. Thermal conductivity is a physical property of a substance and characteristics the ability of the substance to conduct heat.

The thermal conductivity when expressed in S.I. Units, is

$$K = \frac{H/A}{dT/dx}\left[\frac{Watts}{m^{o}C}\right] or \left[\frac{Joules}{sm^{o}C}\right]$$

This is the system of units which will be used throughout this chapter. In many cases (particularly for insulating materials) the temperature gradient is expressed $^{O}C/cm$, so that the unit of K becomes watts $cm/m^2\ ^{O}C$. In MKS system of units, K may be expressed in kcal/hr m ^{O}C.

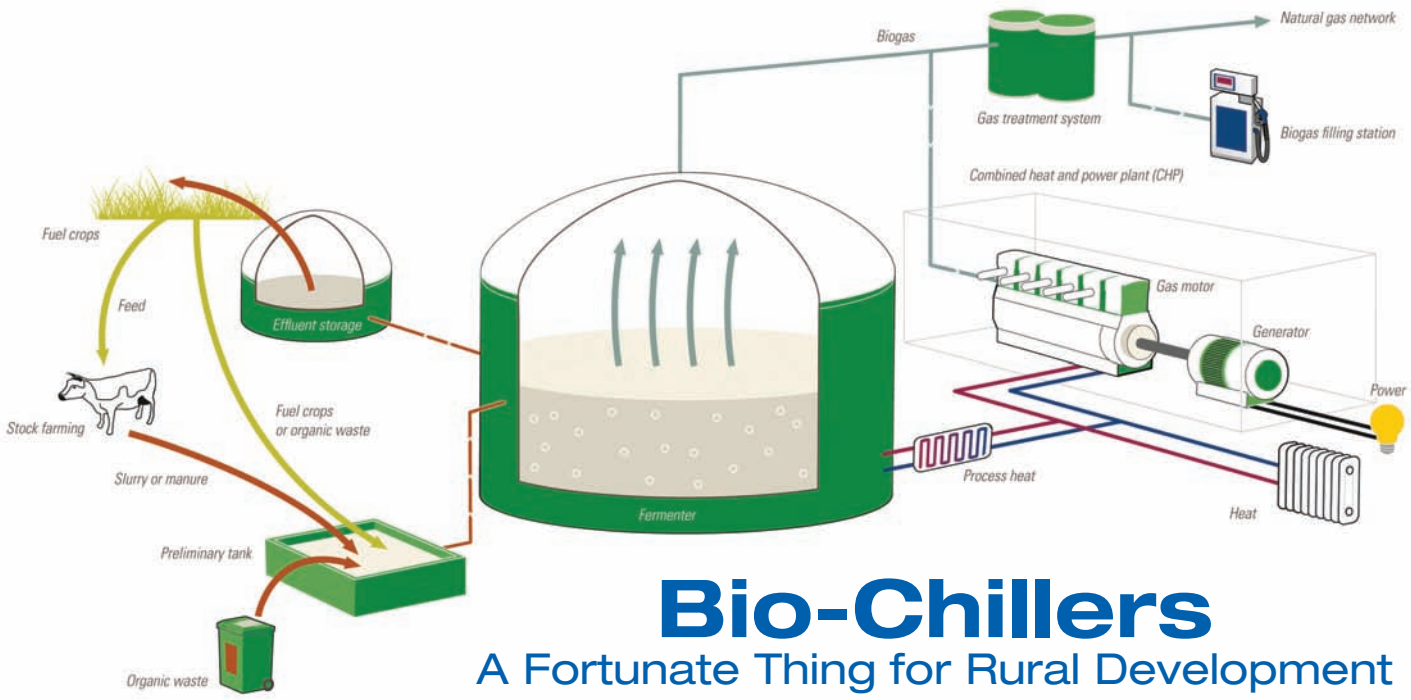
Substance	Thermal Conductivity K (watts/m ^{O}C)	Substance	Thermal Conductivity K (watts/m ^{O}C)
Air	0.02 – 0.022	Glass	0.75 – 0.90
Alcohol	0.14 – 0.16	Hair felt	0.3 – 0.45
Aluminium	170 – 196	Hydrogen	0.1 – 0.15
Asbestos	0.2 – 0.22	Iron	30 – 60
Asphalt	0.6 – 0.65	Lime Stone	0.6 – 0.9
Brass (70% Cu. 30% Zn)	90 – 120	Lead	28.5 – 31.5
Brick	155 – 165	Magnesite Brick	3 – 5.25
Bonded Silicon carbide	12 – 15	Mercury	7 – 8
Carbon dioxide	0.01 – 0.012	Mica	0.6 – 0.65
Chrome Brick	0.9 – 1.9	Monel	27 – 30
Corrugated asbestos	0.045 – 0.075	Nickel	45 – 67.5
Concrete dry	0.9 – 1.0	Oxygen	0.02 – 0.025
Copper	300 – 330	Platinum	60 – 75
Chromium Steel	20 – 24	Plaster	0.75 – 0.90
Chromium Nickel Steel	13.5 – 19.5	Rubber	0.15 – 0.30
Ebonite	0.15 – 0.18	Silver	320 – 365
Glass Wool	0.025 – 0.045	Silica Brick	0.09 – 1.9
Water	0.4 – 0.5	Wrought Iron	30 – 52.5
Zinc	82.5 – 97.5		

The thermal conductivity varies with temperature. Experiments show that for most materials, this dependence is linear, i.e.

$$K = K_o(1 + \alpha T)$$

where $\propto$ is a constant and K^{O} is the value of thermal conductivity at $0^{O}C$. The constant "$\propto$" is positive for insulating materials and negative for metallic conductors. Magnesite, brass and aluminium are exceptions to this rule.

From values of the thermal conductivities of a few substances solids, liquids and gases given in Table 1, it is seen that silver is the best conductor of heat. Mercury, though placed among liquids, should be classified with metals on account of its comparatively high value. Hydrogen appears to be the best conductor among gases; but helium has a slightly higher value. ■



Bio-Chillers

A Fortunate Thing for Rural Development

This article justifies the application scope of biogas as a fuel for traditional vapour absorption refrigeration systems. Both environment and economics benefits can be achieved when biogas is used as a source of energy for refrigerating.

In the current situation the energy demand is increasing with increasing in the population. Energy is the crucial input to the development of any country. The International Institute of Refrigeration in Paris (IIF/IIR) has estimated that approximately 15% of all the electricity produced in the whole world is employed for refrigeration and air-conditioning processes.

In a tropical country, like India, refrigeration is most widely used and generally the most energy consuming process. In general, refrigeration is defined as any process of heat removal from a place for preserving foods and medicines by enhancing their shelf life.

Farmers mostly dairy farmers who sell their products to export markets, refrigeration could play an important role to increase their annual income. Without cooling capabilities the dairy products have to be sold immediately after taking form animals. This reduces the chance of negotiating good prices, because the buyer is in a better bargaining position. Particularly in these sectors, farmers have the potential to produce a lot of biogas through available cattle dung. Biogas based refrigeration technology would be a good opportunity for such farmers to take maximum benefits.

Bio-Chilling system

Cooling effect is produced by the evaporation of a refrigerant. Heat is used in different ways to operate a refrigerator system for evaporating the refrigerant in the cycle. Biomass energy is a good source especially for agro based rural areas where a lot of organic materials are being wasted. Extraction of bio energy with carbon neutral process is possible. As regular hike in the conventional fuel prices like LPG and CNG, biogas serves a good source of fuel for refrigerators. Bio-chilling denotes that heat is produced through any conversion process of biomass such as biogas, producer gas etc to operate a refrigeration cycle. Biogas refrigeration technology can be classified into mainly two categories: electrical refrigeration and thermal refrigeration.

Kim et. al. (8)(2008) & Hwang et. al. (2011) have provided with a broad overview of the various technologies available to use non-conventional energy for refrigeration purposes which includes electric, thermo-mechanical, sorption and some newly emerging technologies. They have also compared the potential of these different technologies in delivering competitive sustainable solutions.

A bio-electric refrigeration system consists mainly of electric generator and a compressor based refrigeration unit. Biogas is used to as fuel to generate electricity. The biggest advantage of using bio-generator for refrigeration is the ease operation and high overall efficiency when combined with a conventional vapour compression system. Winrock International, Pakistan installed a biogas based vapour compressor milk chilling unit during the year 2012-13. They installed 4 biogas plants: two plants of 50m^3 and two plants of 100m^3. The milk chillers run on electricity with capacity of 500 litres and 1000 litres for eight hour. But high initial investment is the major issue for the development of this technology.

Bio-thermal refrigeration system uses heat produced from burning of biogas. Based on sorption principle, this type of system uses physical or chemical attraction between a pair of substances to produce refrigeration effect. A sorption system has a unique capability of transforming thermal energy directly into cooling power. Among the pair of substances, the substance with lower boiling temperature is called sorbate and the other is called sorbent. The sorbate plays the role of

refrigerant. This category is further classified into two streams as absorption systems & adsorption systems.

Prof. Deepak Sharma, Ph.D., FIE is presently working as Professor and Head in the Department of Renewable Energy Engineering, College of Technology & Engineering, Udaipur. He is presently also working as Coordinator of Regional Biogas Development & Training Centre sponsored by Ministry of New & Renewable Energy, Govt. of India and R&D Project on Improved biomass Cook-stove Project of MNRE.

Er. Kapil K. Samar is working as Research Engineer cum Programme Manager, Biogas Development and Training Centre (BDTC), CTAE, Udaipur. He obtained Master of Engineering with specialization in Renewable Energy from M.P.U.A.T., Udaipur.

Room for the research

A few designs of absorption refrigeration system are commercially available which operates on conventional fuels. However, there appear to be a lack of products specifically designed to operate on biogas. There is a simple way of using biogas for refrigeration is by adapting commercial absorption refrigerators. In this situation, the burner in the refrigerator needs to be modified in order to deal with the safe and controlled combustion of biogas with its impurities and the varying levels of methane content. Without modification, chances of components failure are more. Remote ignition via a piezoelectric element substantially increases the ease of operation (2).

Apart from the physical modification, energy analysis will also play an important role in the further modification towards energetic optimization. In this regard, an evaluation based on first law and second law of thermodynamic gives result in point energy loss and identify the reversibility that lead to energy destruction. The second law analysis recognises that heat energy has a lower availability than work energy.

Biogas based Absorption refrigeration system

Vapour Absorption Refrigeration Systems belongs to the class of vapour cycles. The absorption refrigeration cycle consist of a generator, condenser, evaporator, absorber, expansion valve and pump as shown in Fig 1. During one cycle the refrigerant passes through four main stages:

- In the evaporator, the fluid refrigerant evaporates by extracting heat from the product or room being refrigerated.
- The evaporated refrigerant flows into the absorber where it mixes with the secondary fluid.
- The resulting solution is then driven into the generator, where it is heated. This heat causes the refrigerant to vaporise.
- The resulting vapour passes into the condenser, where it returns to liquid state and is ready to start a new cycle.

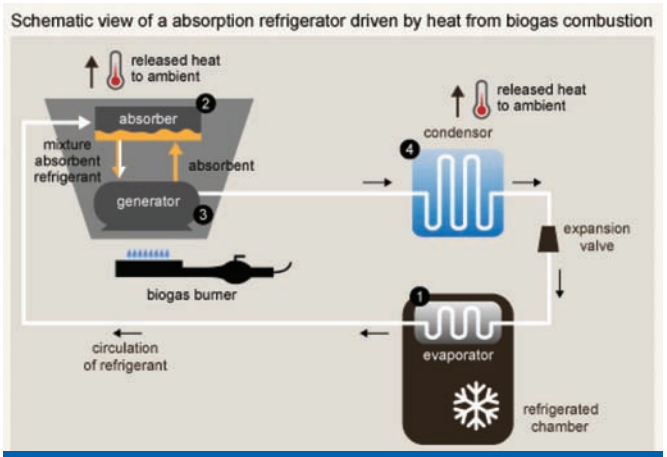


Fig.1: Schematic view of biogas based absorption refrigeration system
(http://www.wisions.net/technologyradar/technology/biogas-refrigeration)

Srikhirin et. al. discussed various designs of vapour absorption refrigeration system. Rao et.al. (10) studied the thermodynamic simulation and analysis the biogas operated double effect ammonia water based GAX absorption refrigeration system. A computer code was developed for computing the effect of temperature and pressure of the high temperature generator and the pressure of the evaporator over the COP for a constant condenser and absorber temperature. It was suggested that biogas can be used to operate the absorption cycle.

It is estimated that one kerosene refrigerator emits between 900 kg CO_2 per year. Biogas based refrigeration can replace conventional refrigerators and offers a sustainable solution for cooling using renewable energy.

Conclusion

There are some commercial products are available based on heat driven refrigeration processes. The basic principles of heat driven refrigeration have long been known but the market for heat driven cooling is still small. Technologies for generating cold from biogas seem to be an innovation field with significant potential. Harnessing this potential would require serious effort in terms of research, development and bringing the technology to market. Key areas to focus in order to improve the overall performance of heat driven refrigerators are efficiency improvements of the different systems and the possibility of the joint operation of various refrigeration cycles. Modification ensures user-friendly operation and maintenance. In the case of users who can produce their own biogas, switching to biogas can result in economic benefits in the medium term, due to the savings made in fuel costs. However, there are currently too few biogas refrigerators in use to provide concrete figures.

The gas demand for refrigeration varies depending on the outside temperature. A 100 litres volume refrigeration system needs about 2000 litres of biogas per day to down the temperature from ambient to five degree Celsius. A large household refrigerator consumes about 3000 litres of biogas per day. ■

A Redefined Engineering Analysis of HVAC&R Industry

Part-2

In continuation of the series 'A Redefined Engineering Analysis of HVAC&R Industry' 'PART-1' published in 'Cooling India', February issue, this article has been framed to create awareness among the working professionals in HVAC&R sector.

There was a time when HVAC&R industry in India was nursing to very limited people but in a stupendous comportment. People carried out the jobs at a slower pace but in a very précised fashion all through those days. The demand for HVAC&R projects was very much limited and the scope of career for workmen was very much alluring. For service oriented firms in HVAC&R field, the scope of generating revenue was also very much limited up to repairing of equipment. There were only a few HVAC&R establishments which were considered to be the market players. As such the competition in the market was not that much tough.

With the advancement in time, scenario has changed completely and the HVAC&R market has expanded beyond imagination. The emerging engineers and professionals of present time are abundantly opting for HVAC&R sector as their career option even at a very minimal pay in comparison to the prevailing market standard pays. HVAC&R projects are getting prominence for high rise buildings and the demand for scheduled projects is high-flying. The scope of generating revenue for service oriented firms has also stretched remarkably and opened the doors for Annual maintenance contracts, Retrofits/Revamp projects, Repair jobs and Sale of spare parts. As of now, numerous indigenous as well as foreign establishments have spread their wings in Indian HVAC&R market. The indigenous establishments include mostly the raw petty contractors and a few gigantic well-pioneered companies.

In lieu of the present prevailing situation in India, undoubtedly it is very easy to visualise the tough competition in the market. Despite of being competent enough, peerless companies are also forced to cut down the profit margins for grabbing high value business. This situation has engendered a new concept of recompensing low profitability with high volume of business achievements and by targeting the completion of scheduled assignments within stipulated time. Appointment of ineffective manpower in surplus number at a very reasonable pay has also been added in the concept. The concept of recompensing low profitability with high volume of business targets has slain the remuneration for the employees and curtailed the employment of technically efficient manpower in all the contracting firms. Considering time to be the essence for every project and service calls, all contracting and sub-contracting companies participated in the race for fastest completion of jobs. In reality, the urge for fast completion of any project or service call has created a chaos. Every individual whoever is unified with the HVAC&R industry is in the fast move for sustenance and survival. In the recent years it is observed that there had been a higher rate of reiteration in the employment with a desire to rise up in the career. Most of the

Y S Rao, a Mechanical Engineer and a Certified Energy Manager by Bureau of Energy Efficiency, enriched with an overall working experience of 16 years in HVAC&R industry in India & in abroad (Bahrain). Presently, working with one of the India's leading MEP contracting company. He is accredited with the Certificate of Completion for "Refrigerant Usage Certification Prep under EPA Section 608" and also a member of ISHRAE Nagpur Chapter.

working folks in HVAC&R field started an individual set up and activated a business of their own. The arbitrary pathways adapted by the folk & their ideologies have slaughtered HVAC&R industry brutally. The final outcome is disastrous and the level of disaster that occurred is un-computable. The catastrophic symptoms appeared in the form of acclimatization of unethical practices & non compliance to standard engineering procedures. The synopsis of this article comprise mainly of such haphazard culture that has been put into practice in HVAC&R industry by the working class. After carrying out thorough surveillances at various sites, all the examination reports and their reviews are compiled together to structure this article. Efforts have been taken to expose the present predominating work culture in HVAC&R industry. Hopefully after reading this article, it will be apparent to the readers how the HVAC&R industry is crippling for its existence and survival.

Un-legislative Method of Installation at a Legendary School Project

This section emits light to expose the blunders at a legendary school project and express the competency level of the present generation engineers working in HVAC&R sector.

Observation - 1

The purpose of ventilation fans is to bring-in the fresh air and take-out unwanted air. There has always been a wrong apprehension carried by most of the site engineers while taking up the installation of ventilation fan units. Untrained engineers when get exposed to sites don't realise the technical aspects of the subject project and perform untidy installation works.

Fig. 1: Untidy Instalation of a Ventilation Fan Unit

Fig. 1 shows an illicit installation of an exhaust air ventilation fan unit. This figure also uncovers the lethargic approach shown by the site execution team while carrying out installation work. The blunders of this installation are listed as under:

- Rubber pads are not provided at all the corners of the ventilation fan unit.
- GI Plenum box is rested on an oil container instead of placing it on metallic frame support.
- GI ducts are not provided with metallic frame/bracket supports and are rested on concrete bricks.
- One of the sheet metal GI duct is rested on other sheet metal GI duct.
- Cowl shaped /Semi arch duct piece is not provided at the exit point of the fan unit.
- Power cables are laid down randomly without proper dressing.

The above list of blunders is sufficient enough to distort the image of the HVAC&R industry as well as adequate enough to degrade the icon of all the professionals who work dedicatedly in this field.

Observation - 2

For comfort cooling application, return air is usually mixed with a small amount of fresh air (say 10%) and is re-circulated through the cooling coil of an air handling unit. The amount of fresh air to be added shall be calculated sanely as per AHRAE (American Heating Refrigeration Air-Conditioning Engineers) guidelines. The amount of fresh air to be added differs from application to application. Say for example, in critical areas of a hospital like operation theatres or bio labs etc. wherein 100% treated fresh air is mostly recommended. But for comfort cooling, it would be an idiotic act if the 100% fresh air is utilised without reusing the return air.

Fig. 2 shows a true picture of a scene that was seen at a school project wherein a ceiling suspended air handling unit was installed with a purpose to cater conditioned air to a class room. The installation was carried out with a messy approach such that the air handling unit was getting 100% fresh air and due to which the air handling unit was unable to suffice the cooling load required in the class room. This chaotic situation could have been corrected at a very initial stage of installation by providing air tight partition around the air handling unit and the return air could have been guided

Fig. 2: No Return Air Provision for an Air Handling Unit

by providing civil opening of appropriate size within the periphery of air tight partition.

Observation - 3

While installing any equipment, special attention and care must be taken by the site engineers and site supervisors for providing ample clearance between them from maintenance point of view. There should always be ample space between two equipment for service accessibility.

Fig. 3(a): Poor Service Accessibility Between Two Ventilation Fan Units

Fig. 3(b): Insufficient Service Clearance Between Two Ventilation Fan Units

Fig. 3a and 3b portrays two different views of ventilation fan units with poor service accessibility and insufficient service clearance. Usually it is experienced that the projects team always put their efforts with an approach to complete the project as soon as possible by adapting unfair or foul means and the service team faces the forthcoming problems while carrying out maintenance because of the poor vision of the projects team. An ideal project team must always carry a future realistic vision.

Observation - 4

Most of the air leakages occur generally through gap between duct collars/droppers and diffusers. Mismatch between these two mechanisms are commonly found everywhere at most of the sites. This mismatch is only because of the following reasons:

- Poor workmanship
- Uncertainty in the false ceiling level
- Vagueness in the plan of reflected false ceiling.

First reason is because of the deployment of unskilled workmen at site by the contractor/sub-contractor. The second reason is because of poor coordination at site and the third reason is due the lacking ability to understand the proposed engineering drawings by the whole project team.

Fig. 4: Mismatched Allignment Between Duct Dropper & Diffuser

Fig. 4 manifests a chaotic installation of duct dropper which is raised far above false ceiling. The duct dropper is neither in contact with the false ceiling nor aligned in line with the diffuser. Such landscapes are very commonly visible in almost all projects.

Observation - 5

Fig. 5(a): Complicated AHU Installation

Mostly it is found that HVAC&R projects are executed without any vision for the future by the site execution team. Most of the present age engineers lack the maturity level to understand the complexity of an installation. The ultimate end result of such intricate situation is the convoluted incomplete state of a project. Different portions of such complicated installations are shown here which will astonish professional engineers.

Fig. 5a describes an illegitimate installation of an air handling unit. This image displayed in Fig. 5a speaks lot many issues related with the installation of air handling unit. A list of all the howlers found in the installation of air handling unit is listed as follows:

- Vibration isolators are not provided for the ceiling suspended air handling unit. In such condition the vibrations generated during the operation of ceiling suspended air handling unit may get transmitted into the civil structure of the building and may affect the structure over a period of time.
- The distance between the air handling unit on the filter section side and the civil beam is very nominal. This may aggravate the situation during the course of testing and commissioning, preventive maintenance and breakdown service calls.
- Connectivity is found to be missing for the actuators provided to regulate the operation of two way valve. This makes the two way valve and the actuator quite immaterial.
- Chilled water pipe lines connected to the air handling unit is tapped from the top side of main header pipe lines. This may restrict the circulation of chilled water through air handling unit during the air lock phase.
- Accessibility to the service door is blocked due to chilled water pipe lines. This may obstruct the smooth maintenance of ceiling suspended air handling unit.
- Provision for return air path is missing. In such a case the air handling unit will draw 100% fresh air and the heat load on the unit will be drastic.

The above list of issues related with the installation of ceiling suspended air handling unit develops a thought about the lack of knowledge of the entire team working on the project collectively with the client/customer, consultant, sub-contractor, engineers, supervisors and workmen.

Fig. 5(b): Complex AHU Installation

Fig. 5b presents a view of intricate installation of a

ceiling suspended air handling unit. Even though sufficient space is provided for the free movement of the service personnel in the region of the equipment, yet there is a question mark on the accessibility to the filter section of equipment. The chilled water pipelines and the condensate drain water pipeline both obstruct the free accessibility to air filters.

Only a few of the landscapes in the referred school project are taken into consideration for framing up this article. Yet there are many other findings during the investigation on this project which are not covered in this article.

Unreasonable Installation methods at a Residential Tower : There are several cases of installation activities that were taken up in an unscientific way by Indian engineers and contractors in abroad also. Indian engineers and professionals as such are mostly preferred in middle-east countries to carryout HVAC&R works. The reason for the demand of Indian engineers and professionals can be estimated in two ways: (a) either the middle-east countries don't possess skilled manpower of their own, (b) or else they have the trust on the capability of Indian professionals and workmanship of our workmen. Instead of upholding the level of faith and the level of confidence these foreign countries do have on us, Indian engineers and workmen have performed in a most perturbed manner. This article unveils the iniquity act performed by Indian contractors & engineers at a residential tower project in abroad. Various observations are presented in a sequential manner in this article to expose the performance of Indian engineers and contractors in abroad.

Observation - 6

As a standard engineering practice, Outdoor AC units are always advised to be installed at location where free flow of air can take place. Any restriction in the pathways of air may cause short cycling of air thereby increasing the ambient temperature of the surroundings. At high ambient temperature, the AC unit starts ailing by screening the following behaviour:

- Frequent tripping of the AC unit due to high discharge pressure
- Coefficient of Performance of an AC unit declines at high ambient temperature & its cooling capacity gets de-rated.
- Refrigerant oil loses its viscosity at high operating temperature & its lubricating property gets diminished. This condition may lead to wearing of compressor parts.

Fig. 6: Restricted Air Flow of Outdoor Split Ac Units

Fig. 6 shows a series of outdoor split AC units installed in an un-engineered and congested pattern. The former part of Fig. 6 shows a series of outdoor split AC units installed closer to each other and facing each other, while the later part of Fig. 6 shows a series of outdoor split AC units installed facing & closer to terrace parapet wall. The consequences in both these cases are symptomatic as the hot air dissipated to the surroundings will get accumulated there itself. This condition will develop a hot pocket zone nearby outdoor split AC units and finally the end result will be system failure.

Observation - 7

Indian engineers, supervisors & workmen are unmatchable in their lethargic work culture as compared to any other professionals across the globe. This can be proved from the fact that they follow the same casual approach while working in abroad. A few instances are presented below in the pictures taken in Bahrain. Fig. 7 displays a pathetic site condition where refrigerant carrying copper pipes connecting Outdoor split AC units to Indoor split AC units are laid down on the roof top without providing any proper supports. A few of the copper pipes are randomly rested on concrete bricks and others are just scattered like crawling snakes.

Fig. 7: Unsystematic Laying of Refrigerant Copper Pipes

Such grubby installation of refrigerant copper pipes develops leakage in the refrigerant circuits very easily as they don't have any sturdy support to hold them. An ethical engineering practice prescribes for the installation of refrigerant pipes on a tray or a trench.

Injudicious Installations

Uncountable faults do crop up in every phase of HVAC&R projects. As such there is nothing that can be hidden because the tendency of all the contracting and sub-contracting companies in the present Indian market have established a mindset of committing errors and justify themselves by exposing the mistakes of other competitors. Even the representatives from the client/customer's side don't bother about the technical aspects and the commercial impact on the whole project. In today's set-up, HVAC&R projects are nevertheless always incomplete due to uncared snags. Although, the left over snags by the project team may be minor but sometimes lays a severe impact on the project. A few of the disorders that are commonly prevalent at almost all the HVAC&R projects is listed herewith.

Observation - 8

Flexible connectors are provided at the outlet of Air handler units or Ducted Indoor Split AC units. The purpose of providing flexible connectors is to curb the jerk at the start up of these units. The installation of flexible connector becomes worthless if it is put in a wrong manner as shown in Fig. 8.

Most of the times, duct installation, pipe installation and equipment installation doesn't go simultaneously and hence there is always an opening for the other activity to correct and rectify the flaw in whole installation. In Fig. 8, the duct installation and the Air handler unit installation was not synchronised in single line & hence the flexible connector was stretched towards one corner. This could have been corrected

Fig. 8: Incorrect Installation of Flexible Connector at Mouth of AHU

by slightly shifting the Air handler unit prior to the pipe installation & connection which has never happened because of the hasty decision taken by the site engineer/site supervisor.

Observation - 9

The most important building blocks for any of the projects are Standards, Inspection, Measurement, Testing, Quality etc. But all these building blocks are hardly / rarely pursued in HVAC&R projects. In India, quality management procedure is quite inactive and infrequent to be seen in HVAC&R projects. Networking all the quality management procedures and activities result in customer satisfaction.

Fig. 9 shows the level of quality work executed by all the team members working on the project. The threaded rods have been provided arbitrarily to aid support for the ducts. Instead of using threaded rods of required size, lengthy threaded rods are used and are left uncut & bent. These threaded rods are installed in an uneven manner and in a tilted position.

Fig. 9: Awful Duct Installation Using Uncut Threaded Rods

Observation - 10

Flow switches/flow sensors are most essential accessories of a Chiller unit. These components must be installed on chilled water pipe lines as well as on the condenser water pipe lines. There has always been an argument on where to install flow switches/ flow sensors i.e. on the inlet water pipe lines or on the outlet water pipelines. All manufacturers have different opinions on this subject. Experience says, it hardly matters on which pipe line these accessories are installed. What matters is, at which location and in which position these flow switches/flow sensors are installed. Fig. 10 shows the installation of flow switches on condenser water outlet pipe line but the most important point to be noticed is its location i.e. near to an elbow

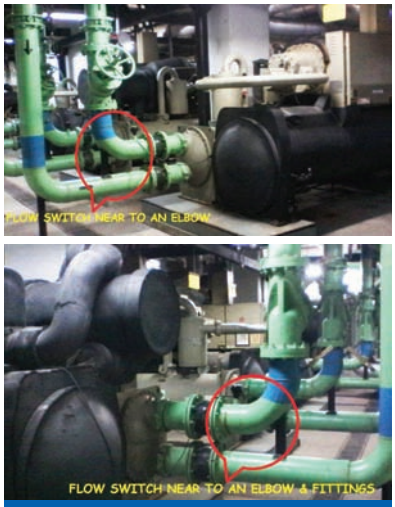


Fig. 10: Flow Switches Installed at A Wrong Location

Engineers commonly fail to understand that, the turbulence of the flowing water is more at or near the elbows and fittings which cause the flow switch/flow sensor to chatter and finally cause frequent tripping of chiller unit. Lay technicians bypass the flow switches to get rid of the nuisance but are unaware of the ill consequences of bypassing the flow switch/flow sensor. The purpose of providing a flow switch/ flow sensor is to stop the operation of chiller unit in case of restricted water flow or insufficient water flow in the hydroponic circuit. Restricted and insufficient water flow on the evaporator side of the chiller unit may sometimes burst the tubes and even evaporator shell also due to frost formation. On the other hand, restricted and insufficient water flow on the condenser side of the chiller unit increases discharge pressure enormously & discharge temperature which in turn may damage the compressor parts.

Observation - 11

While installing chilled water or condenser water pipe lines special care has to be taken especially while tapping distributor pipe lines from the main header pipe lines. While tapping the distributor pipe lines from the main header pipe lines it must be ensured that a shoe piece or semi arc piece has to be provided at the tapping point for proper distribution of water in the hydroponic circuit. The shoe piece or semi arc piece provided at the tapping reduces the turbulence effect and thus reduces the pressure drop effect. Fig. 11 shows both the ways of tapping the distributor pipe lines from the main header pipe lines. The former part shows the outlaw tapping technique and on contrary to the former, the later shows highly recommended practice of tapping.

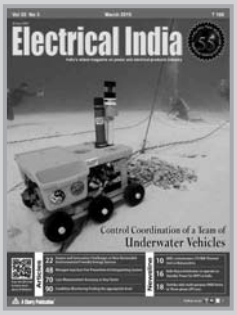
Fig. 11: Tapping of Distributor Pipe Line From the Main Header Pipe Line

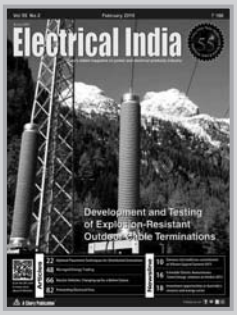
Orientation of the shoe piece/semi arc piece is very tricky and this can be judged correctly only by an experienced and prudent engineer who executes the project with full involvement and dedication. Any wrong alignment/orientation of the shoe piece/semi arc piece may cause fatal failure of the system since it will hamper the appropriate flow of water in the hydroponic circuit.

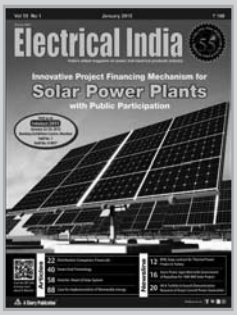
Overlooking of Key Engineering Practices

One of the most important procedures involved in commissioning of refrigerating equipment is its pressure testing to check the leakages followed by vacuumizing and gas charging. Failing to follow these steps may cause disaster to the system. Prior to charging of refrigerant gas into the refrigerating equipment pressure testing has to be carried out positively for 24 hours using dry nitrogen at a pressure slightly less than the safety pressure. The pressure test using dry nitrogen confirms that the system is leak proof.

Many a times, it is very obvious to find technicians in a







Since 1961

The Subscription In-charge
Electrical India
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. EI/SUB/ ☐

Now SUBSCRIBE/RENEW Online Just Log on to www.electricalindia.in

Yes, I would like to subscribe **Electrical India** for.....years
at Rs..... (US $.....overseas subscribers)

Payment details :
Cheque / DD No.....Dated.....
Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

Name.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

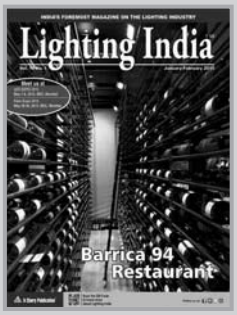
Email.....

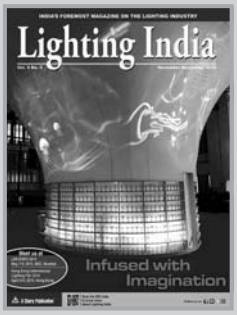
Signature.....

No. of Years	Amount	US $	Tick ✓
❑ 1 (12 Issues)	1000	200	
❑ 2 (24 Issues)	1750	350	
❑ 3 (36 Issues)	2500	625	
❑ 5 (60 Issues)	4000	900	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

CI \ March 2015





Lighting India
formerly The Luminaires
Bi Monthly

The Subscription In-charge
Lighting India
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. LI/SUB/ ☐

Now SUBSCRIBE/RENEW Online Just Log on to www.lightingindia.in

Yes, I would like to subscribe **Lighting India** for.....years
at Rs..... (US $.....overseas subscribers)

Payment details :
Cheque / DD No.....Dated.....
Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

Name.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

Email.....

Signature.....

No. of Years	Amount	US $	Tick ✓
❑ 1 (6 Issues)	750	150	
❑ 2 (12 Issues)	1350	275	
❑ 3 (18 Issues)	2000	500	
❑ 5 (30 Issues)	3000	700	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

CI \ March 2015

confused state and act unwisely in a dilemma while taking up nitrogen pressure testing activity. Generally uneducated technicians charge the system with nitrogen up to a certain pressure level, check for leakages and leave the system for 24 hrs. or 12 hrs. and cross check the pressure to ascertain a leak proof system. This methodology is totally unacceptable. While carrying out nitrogen pressure testing, following activities must be ensured:

- Whether the system is free from gases i.e. the existing refrigerant gas has been removed or recovered.
- Usage of dry nitrogen is highly recommended for pressure testing.
- The nitrogen shall be charged in the system to maintain a maximum pressure of at least 50 psig less than the test pressure as specified by the manufacturer. Or else nitrogen shall be charged in the system to maintain a maximum pressure of at least 20 psig less than the safety valve pressure as specified by the manufacturer. Or else nitrogen shall be charged in the system to maintain a maximum pressure of at least 1.5 times the operating pressure of the refrigerant gas that shall be used in the system.
- The ambient temperature must be recorded followed by date and time at which the initial pressure is recorded.
- The system must be kept pressurised with dry nitrogen for minimum 24 Hours.
- The ambient temperature must be recorded followed by the date and the time at which the final pressure is recorded.
- There may be quite little difference between the initial reading and final reading but not exceeding 5%. This difference may be due to variation in the ambient temperature or else due to fine settlement of nitrogen in the system.

Once the pressure test is finished, and the results are found to be favourable then vacuumization of the refrigerating equipment has to be followed without fail. Vacuumization is a process by which the moisture & foreign particles present in the refrigerant circuit gets removed. Vacuumization has to be done very precisely. The consequences of improper vacuumization may leave traces of moisture in the refrigerant circuit & may cause following ill effects.

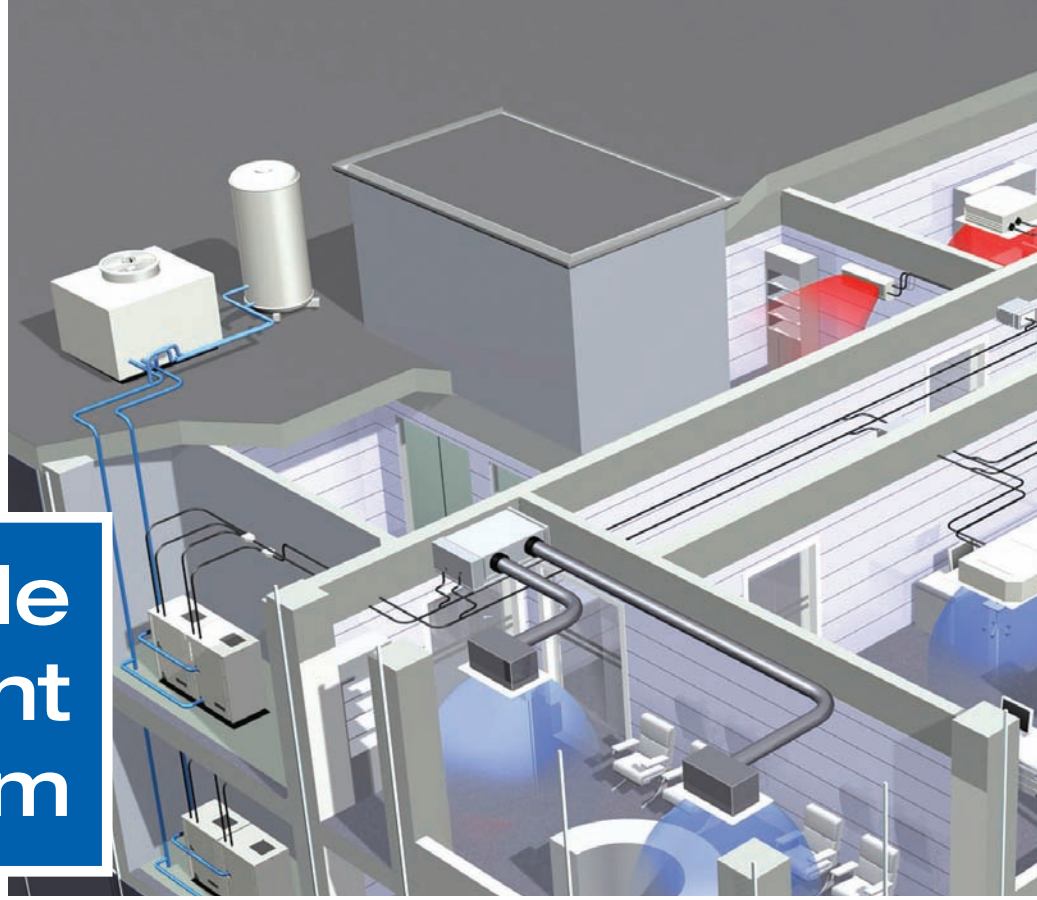
- The left over moisture present in the refrigerant circuit gets trapped in the expansion valves and restricts the flow of refrigerant in the circuit due to ice formation. This situation hampers refrigeration effect.
- A very small amount of moisture if remained in the refrigerant circuit when mixes up with the refrigerant gas & refrigerant oil, starts circulating in the system. These small traces of moisture cause oxidization on metallic surface of copper and mild steel. The oxidation of metal surfaces cause corrosion and forms sludge at high temperature in the refrigerant circuit. The sludge causes several ill effects on the functioning of refrigeration system. The sludge may even jam up the moving parts of the compressor and may even lead to burn out of compressor motors.

Considering all the above ill effects of moisture, it is highly recommended to carry out a thorough vacuumization. The scale for measuring the level of vacuum created/achieved is recorded either in microns or in pascals or in m-bars. Ideally 500 microns is minimum level of vacuum required to be achieved to affirm for the perfect functioning of a refrigeration system. Once the required level of vacuum is achieved the refrigerant circuit is charged with sufficient amount of refrigerant gas. There are a few scales to ensure the correct amount of refrigerant charge in the system. Superheat and sub-cooling temperatures are the best scales to ensure for optimum amount of refrigerant gas charge and establish the ideal performance of a perfect refrigeration system. Unfortunately in India, neither the technicians nor the engineers are conversant with precise vacuumization technique, proper nitrogen testing, exact calculation of superheat & sub-cooling temperature.

Any malicious act of the project team during execution stage calls for frequent maintenance. The present trend pursued in HVAC&R projects is that the residues of project activities are taken care by service/maintenance team by default. The client/customer is also assured for the maintenance and service calls which will be taken care of, during the defects liability period by the contractor and hence accepts the handing over of the project. The ultimate sufferer is always service delivery team who has to attend all the breakdown calls and preventive maintenance services as well.

In India, a non government organization is established so called ISHRAE (Indian Society of Heating, Refrigerating and Air Conditioning Engineers), was founded in 1981 at New Delhi by a group of eminent HVAC&R professionals. ISHRAE is an International Associate of ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers). The primary objective of ISHRAE is the advancement of the art and sciences of Heating, Ventilation, Air Conditioning, Refrigeration Engineering & other related Building Services. ISHRAE conducts conferences, seminars, workshops, and catalogue shows throughout the country with both national and international participation on the latest in terms of technologies, systems and services. The most agonizing part is that, most of the principle contractors, sub-contractors, consultants and even the clients in HVAC&R fraternity are the members of ISHRAE who contributed their share in exploiting this industry religiously and as such ISHRAE don't hold any authority to put a restriction on such shameful act of its members.

Illiterate and untaught technicians always have a tendency to prove their smartness in making the system operational by passing all the safety procedures. It is the moral duty of engineers to guide and impart training to technicians and workmen about engineering aspects. The aim of a HVAC&R professional should never be limited up to making the equipment operational. The aim should be stretched further to make the whole HVAC&R system perfectly functional without any technical compromise. Engineers shouldn't restrict themselves up to commercial part and must emphasis basically on technical part. No sooner a day will come when this HVAC&R industry will be only limited up to road side repairers and will be taken care by petty vendors if it is not esteemed. Now it's the peak time for every HVAC&R professionals to act judiciously and protect this industry from getting endangered. If not today, then never. ■



Variable Refrigerant Flow System

Air conditioning for residential and commercial buildings is the necessities of life due to the large demand for thermal comfort and healthy environment of the living space in modern society.

The conception of the air conditioning has gradually developed from one unit for one house to independent units for separate zones in the same house. Variable refrigerant flow (VRF) systems vary the flow of refrigerant to indoor units based on demand. This ability to control the amount of refrigerant that is provided to fan coil units located throughout a building makes the VRF technology ideal for applications with varying loads or where zoning is required. VRF system works on the principle of simple vapour compression cycle but it has the flexibility to continuously change the flow of refrigerant to different internal units depending on the heating and the cooling load required. VRF systems are available either as heat pump systems or as heat recovery systems for those applications where simultaneous heating and cooling is required. In addition to providing superior comfort, VRF systems offer design flexibility, energy savings, and cost effective installation.

VRF Technology

In a VRF system, multiple indoor fan coil units may be connected to one outdoor unit. The outdoor unit has one or more compressors that are inverter driven, so their speed can be varied by changing the frequency of the power supply to the compressor. As the compressor speed changes, so does the amount of refrigerant delivered by the compressor System.

Each indoor fan coil unit has its own metering device that is controlled by the

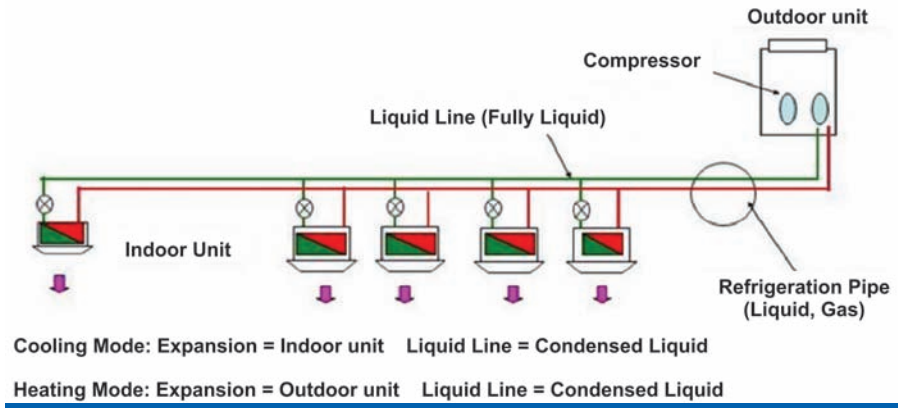
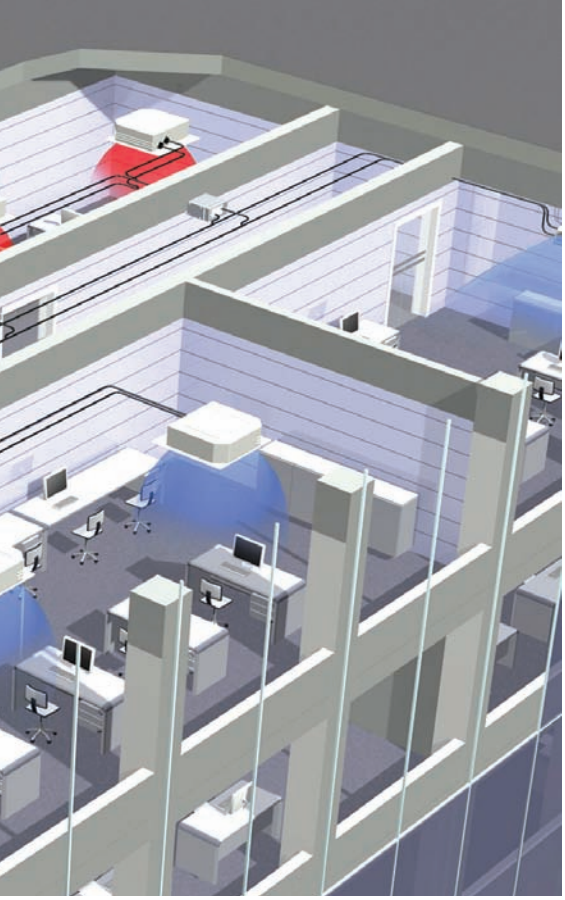


Fig. 1: Typical VRF Heat Pump



Dr Bijan Kumar Mandal, BTech (Hons.) and MTech in Mechanical Engineering from IIT Kharagpur, is PhD in Engg from Jadavpur University. Currently, he is Professor at the Indian Institute of Engineering Science Technology, Shibpur. He has published more than sixty research papers in international journals and conference proceedings. He is life member of Institution of Engineers (India), ISTE and SESI.

indoor unit itself, or by the outdoor unit. As each indoor unit sends a demand to the outdoor unit, the outdoor unit delivers the amount of refrigerant needed to meet the individual requirements of each indoor unit (Fig. 1). These features make the VRF system ideally suited for all applications that have part load requirements based on usage or building orientation, as well as applications that require zoning.

History & Development in VRF Systems

Variable refrigerant flow (VRF) systems, which was introduced in Japan more than 20 years ago, have become popular in many countries, yet they are relatively unknown in the United States. The technology has gradually expanded its market presence, reaching European markets in 1987, and steadily gaining market share throughout the world. In Japan, VRF systems are used in approximately 50% of medium-sized commercial buildings (up to 70,000 ft^2 (6500 m^2)) and one-third of large commercial buildings (more than 70,000 ft^2 (6500 m^2)).

Although vigorous marketing of VRF systems in the U.S. began only two to three years ago, several thousand systems are likely to be sold in the U.S. this year, amounting to tens of thousands of tons of capacity. Of course, the market is still very small compared to the chiller market, but VRF systems are marketed in the U.S. by at least five manufacturers.

The success of the VRF in other countries, and its historically limited market presence in the U.S., has several sources, including:

- Differences in construction practices;
- The long history and large installed base of ducted direct exchange (DX) systems and chillers in the U.S. compared, for example, to Europe, where many buildings did not have air conditioning until recent decades;
- Differences in regulatory environment (e.g., regulations that discourage electric chiller installations in Japan); and
- VRF technology has been developed and promoted by Asian companies, which had limited market presence

Components of VRF Systems

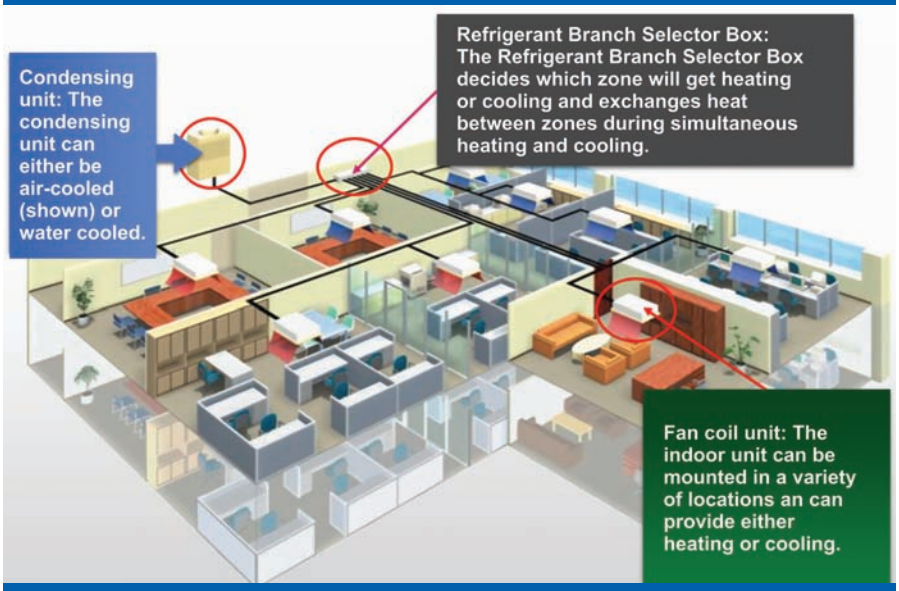


Fig 2: Components of VRF System

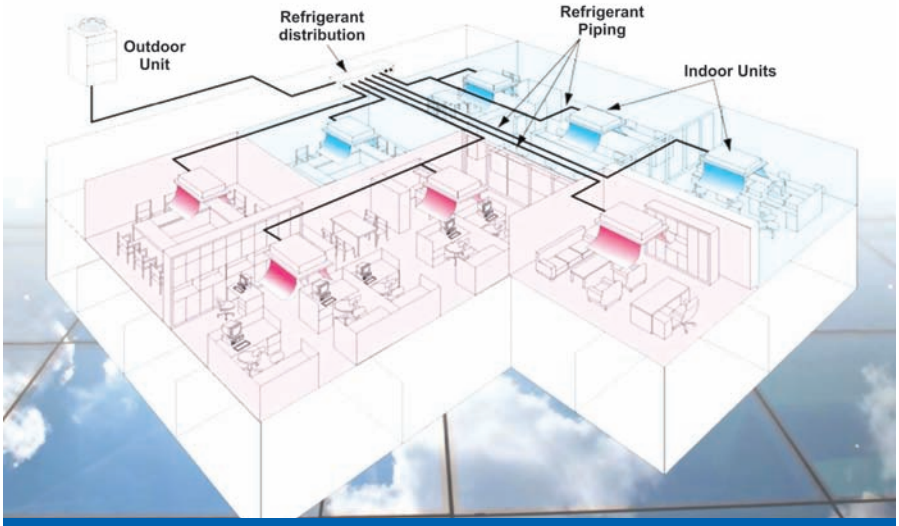


Fig. 3: Simultaneous Heating and Cooling

in the U.S. until recently. Also, building owners are wary of HVAC suppliers whose parts availability, service and technical support infrastructure is uncertain.

Typical Range of Available VRF Systems

Air Cooled

6 – 24 Ton (Simultaneous)
6 – 30 Ton (Change Over)
208/230, 460 Volt – 3 Phase
62 dB(A) Operating Sound Level

Water Cooled

6 – 20 Ton (Simultaneous)
6 – 30 Ton (Change Over)
208/230, 460 Volt – 3 Phase

Single Phase

3, 4 Ton (Change Over)
208/230, 1 - Phase

Features of VRF System

- Zoning System: The main advantage of the VRF system is its ability to respond individually to fluctuations in space load conditions. The user can set the temperature of his/her room according to the requirement.
- Simultaneous Cooling & Heating: VRF systems are capable of simultaneous cooling and heating (Fig. 3).Each individual indoor unit can be handled separately by the user using a programmable thermostat. Most VRF manufacturers offer a centralized control option, which enables the user to monitor and control the entire system from a single location.
- Variable Speed Compressor: VRF systems use variable speed compressors (inverter technology) with 10 to 100% capacity range that provides unmatched flexibility for zoning to save energy. Use of inverter technology can maintain precise temperature control, generally within $\pm 1^{O}$F.

Simultaneous System Components

The system components are:

- An outdoor temperature

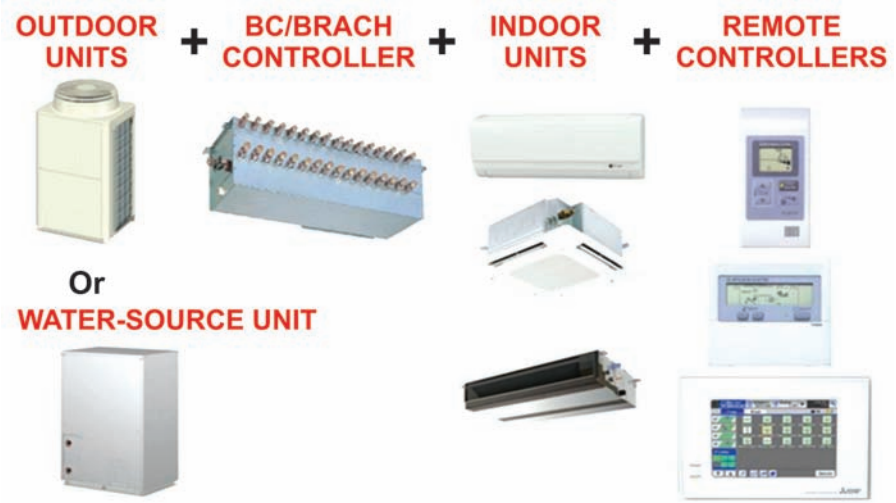


Fig. 4 System Components

- Indoor units
- Branch controller (may be used sometimes)
- Integrated controls

VRF for commercial buildings

- Up to 50 indoor units per outdoor
- 72,000 – 360,000 BTUH
- Simultaneous heating and cooling
- Energy reclaim
- IEER up to 23.9
- COP up to 4.87

Fig. 5 VRF System in Commercial Buildings

Improvements in VRF System

Over the past 21 years the technology has advanced in a number of areas:

- Standard compressors to variable speed and capacity modulated scroll compressors
- Direct driven outdoor fans to variable frequency drive, inverter-driven fans
- Direct driven indoor coil motors to direct current or ECM-type motors
- Variable capacity indoor units
- Better heat exchanger surfaces with multi-segmented coils
- Improved controls and diagnostics
- R-22 to R-410A
- Better refrigerant charge and oil management.

Recent market Sales of VRF system

With the growing increase in the technology the VRF air conditioning market is growing at a fast pace. VRF system with scroll compressor have gained wide acceptance in India. The popular applications for VRF systems have been corporate offices, hotels, IT offices, high-end residential apartments and villas, retail stores, supermarkets and hospitals. AHRI now has a standard for VRF product performance (ANSI/AHRI 2011) and a Product Directory of certified equipment (AHRI 2012).

Part Load Efficiency of VRF (VRV) and Water-Cooled Chiller and Air-Handler System

The system part load efficiency is shown in the figure. The efficiency decreases with the increase in load and reaches a minimum value at 50 percent and it almost remain constant and then again increases. Variable speed operation of the VRF system also contributes to energy savings by reducing cycling losses at part-load operation.

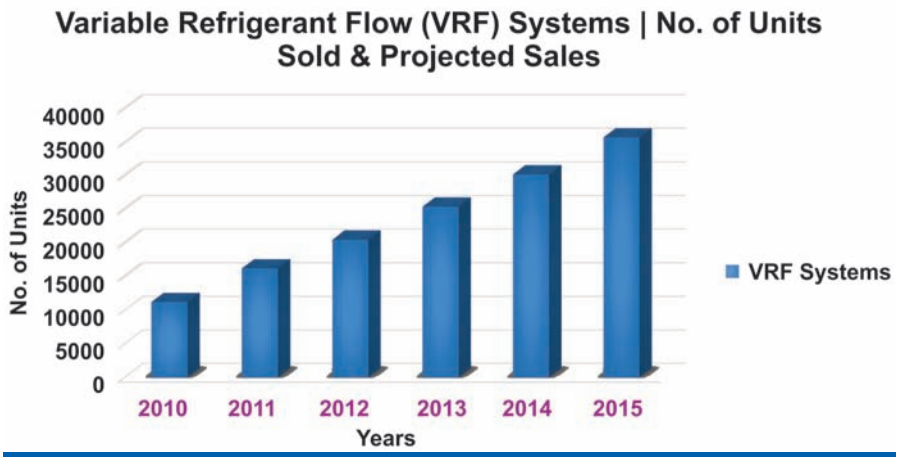


Fig. 6: Source: BSRIA – A multi-client study – India. November 2012

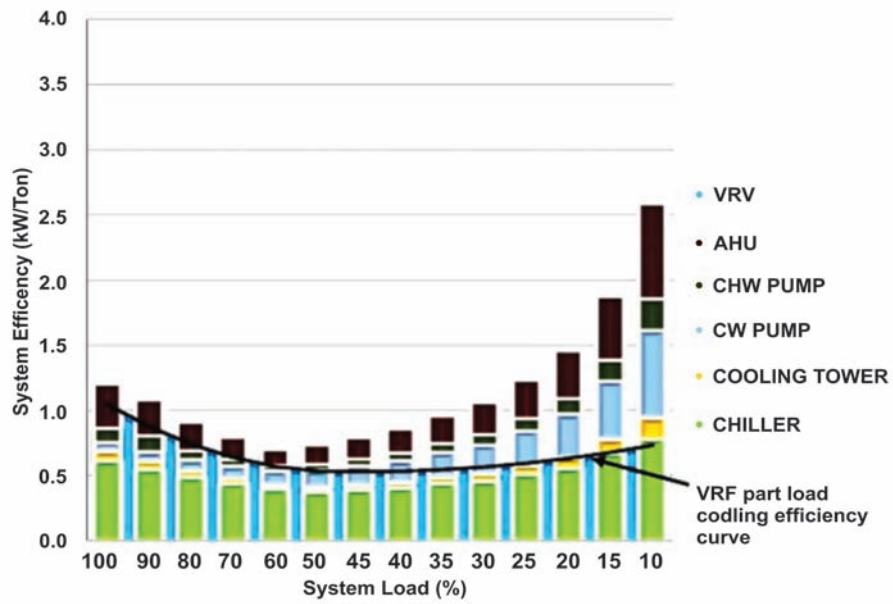


Fig. 7: Variation of System Efficiency with System Load

VRF system: Life cycle cost

The initial installation cost of the VRF system is 5 to 20% higher than that of the air or water cooled chilled water system. This is mainly due to the long pipelines which are used for the refrigerant to flow & multiple evaporator heat exchangers with associated controls. Building owners often have no incentive to accept the initial high cost even of the claimed payback period is short, as the energy savings are quite high in the long run.

Challenges faced by the VRF industry

VRF system are not suitable for all commercial buildings.

- Refrigerant Piping: Long pipelines are used depending on the compressor's ability to maintain pressure drop. All split systems therefore have a maximum allowable vertical & total refrigeration pipework length. 135 feet is the length of the longest pipeline that can be used.

	Fixed Speed System (Only Cooling)	Inverter Based System (Cooling & Heating)
Installed Price	7.0 (Twice Installation)	7.0
Maintenance Cost	3.0	3.6
Running Cost	7.4	3.2
Life Cycle Cost	17.4	13.8

Table 1: 12 HP System – 12 Year Life Cycle Cost (Prices In Rupee Lac)

- Compliance with ANSI/ASHRAE Standard 15-2001: VRF systems must comply with ASHRAE Standard 15-2011 - Safety Standard for Refrigeration Systems (ANSI approved). VRF system increase the chances of refrigerant leakage which are difficult to find and repair. The refrigerant leak, especially if the system serves small rooms, can cause oxygen depletion.
- Fresh air requirements (Compliance to ANSI/ASHRAE Standard 62.1): Ventilation is required to maintain the indoor air quality and building codes which recommends Typically 15 to 20 CFM of fresh air per person. Like all other split system, VRF system also requires a separate ventilation.
- Environmental Concerns: Ozone depletion issue have become a global concern and long refrigerant lines is a strong negative for the system which requires more refrigerant. HFC refrigerants, typically R-410-A and R-407-C are commonly used.
- Particulate Matter Removal: ASHRAE Standard 62.1-2004 specifically discusses the particulate matter removal issues and how VRF indoor units can or cannot uphold the requirements. High MERV (Minimum Efficiency Reporting Value) filters can be used but it has a high cost and high pressure drop and are often suitable for some ductless units.

Conclusion

VRF system are gaining popularity in the American HVAC market due to its flexibility in operation and high efficiency over a wide range of part load operation. In India its market is increasing, but at a slower rate due to the lack of knowledge and unskilled labour in this sector. Although suppliers claim that VRF system are quite reliable but VRF system with a large no. of compressor is less reliable than a chiller system which has a lesser no. of compressors. The system capabilities and limitations must be fully understood and evaluated carefully to determine its suitability. ■

Green-Technology Powered

Global warming is an environmental threat our planet faces today. The global warming is 100% a manmade problem due to mismanagement of nature-gifted natural resources. It is predicted that the Earths average temperature shall increase by 6.5^{O}F by the year 2025 & the earth will be a much different place than we know it today.

What is the solution to this burning problem?

Generate your own power with Renewable Energy like Solar & Wind. The Technology is much in common-man's reach. The commercial- tariff areas are affected most due to steep rise in tariff. Imagine tariff at Rs. 20/ unit in next couple of years. A typical 1.5T Air conditioner along with office fans & lights shall consume approx 40 units per day i.e. approx 1000 units/ month. Hence the expenditure shall be Rs.25000/ month inclusive of maintenance cost. Again the Electricity may not be available round the clock. That means you have to spend additional for generator & cost of fuel. The total expenses shall touch Rs.40000/month for a small office.

Go Green for Cooling Technology

- Absorption chilling technology
- Air-conditioner (only cooling)
- Fridge/bottle coolers.
- Room- coolers (water filled)
- Cold storages.

Main features of this technology are

- Solar-Panel life is 25 years.
- Latest Solar Torr tubular battery life is 10 years.
- Solar energy is available almost for full year.
- Conventional Electric-supply can be used as a standby.
- Breakevenpoint is approx 2 years or even earlier.
- You are helping to reduce Global warming.

Absorption Chilling Technology

The absorption chiller, in the most simplistic sense, allows a building to use thermal collectors to power its air-conditioning. The water heated by solar energy in these collectors is used to initiate a thermal dynamic process involving low-pressure chambers that chills water to around 44°F. The chilled water is then brought to a series of copper pipes that efficiently cool air blown through the pipes and into the home. Except for a few pumps, the system is entirely passive, has no moving parts and requires no electrical input.

Most other prototype models in development are natural gas-fired or use hydro fluorocarbon refrigerants that are known to have a significant impact on earth's ozone.

Solar absorption chillers are one of the most effective and efficient ways to heat and cool buildings using only the power of the sun. These chillers are powered by heat (hot water) which is supplied through evacuated tube collectors. The solar collectors collect thermal energy from the sun and transfer it using a glycol-water solution, along with a system of pipes, pumps and controllers.

Solar Electronics is a systems designer, integrator and supplier for solar air conditioners that use solar powered chillers. By providing the site survey, project management, design and engineering, Solar Electronics will guide you from start to finish on your solar air conditioning projects.

SLR/Cool/DC24V/016
(Make Solar Electronics, India)

SLR/Cool/DC224V/026
(Make Solar Electronics, India)

100% Solar –Powered Air- Conditioner (Only Cooling)

The heart of Air-Conditioner is the compressor. The above mentioned Air- Conditioner (From Solar Electronics, India) uses 48V DC Compressor powered by BLDC motor. The indoor &

Model No- SLR/100/BLDC/DC48
(Make Solar Electronics, India)

outdoor unit fan motors are also 48V DC powered @ 1000 to 1500 rpm. The total wattage consumed by the above model is max. 800W at 48V DC for a typical 9000BTU Air- Conditioner (Only Cooling). Hence 48V/1200W solar panel is enough to drive the Air- Conditioner for full day during office hours. Using 48V/1500W panel with additional 48V/100AH battery shall prolong the backup in the evening & shall also help to store the solar energy during weekly off. This helps you to power your office on your own, thereby keeping conventional electric supply as standby. Approx.200 to 300 sq.ft. area is enough for solar panels mounting preferably on rooftop.

100% Solar Powered Fridge/ Bottel Cooler

Model no-SLR/fridge/100
(Make Solar Electronics, India)

100% Solar- Powered Fridge

Fridge plays a vital role in our daily Urban OR Rural life. Solar fridge model SLR/fridge/100 form Solar Electronics, India is designed to work at 24V DC at 150W power. The compressor used in this fridge (from 100 ltrs to 165 ltr.) typically uses 24V DC 150W to 240W DC compressor which is directly compatible to solar panel Input (of 24V/300W) or battery input. Other sections of the fridge are practically same as conventional fridge. This 100% solar powered fridge from Solar Electronics, India is very ideal for Indian market.

Suresh D Bandal, E&T/C Graduate Engineer from COEP, Pune. has passion for Solar Energy, hence Started his own Company way back in 1989 under the name 'Solar Electronics'. He travels across the cross-section of the world, searching for latest Technology, to apply the same for third-world countries. He is actively engaged in Parabolic Dish Based Stirling Engine, Research & Development.

100% Solar powered water purifier/cooler

Model No- SLR/puri/050
(Make Solar Electronics, India)

Model No-SLR/cool/DC24V/016
(Make Solar Electronics, India)

100% Solar Powered Room Coolers (Water filled)

Solar Coolers from Solar Electronics, India uses BLDC motor which is 12V DC or 24V DC operated for fan - motor & water – pump motor, which is directly compatible to Solar input or Battery input. These coolers also can be powered by conventional electricity. Very ideal for Rural & Urban Indian market. A typical solar cooler model SLR/cool/DC24/016 shall consume total 50W of power & is ideal for 160 sq.ft. room. 24V/100W Solar panel is enough to run the cooler for the full day & also shall charge battery for additional 4 hrs. backup.

Model No- COLDSOLAR/100
(Make Solar Electronics, India)

100% Solar Powered Cold Storage

Cold storage is vital for preserving perishable products like Grapes, milk etc etc & consumes lot of power. However continuous failure-free Electric power supply is very crucial during summer & through out the year. Model. COLDSOLAR/100 is a typical model from Solar Electronics, India, which is 100% powered by solar input of 100 sq.ft. area. The model consists cold storage roof top of Solar panel, Cold- Storage walls made up of sandwiched panels & solar powered Compressor systems. The model varies from 100 sq.ft to 1000 sq.ft. with cascading effect. ■

Cooling Load from Vapour Compression Air Conditioning Systems for India

This article explores the contribution of cooling load from air conditioners (ACs) using vapour compression cycle. The two most important segments of ACs are the split air conditioners (classified among room air conditioners) and screw compressor based chillers (classified among central air conditioners).

The predominant sectors the domestic & commercial sectors.

The air conditioners (ACs) based on vapor compression cycle can be classified into:

- Room air conditioners: split and unitary air conditioners (1-3 TR)
- Duct and package air conditioners: 3-15 TR
- Central air conditioners: > 15 TR.

The majority of the air conditioners are split air conditioners (1-3 TR) and in the central segment the chillers sizes are 100-200 TR for commercial buildings and 900-1500 TR (for industrial AC applications). Most of the central machines in the large capacities are based on screw compressors.

The commonly used refrigerants for the air conditioners are:

- R134A (CH_2FCF_3)
- R410A (CH_2F_2/CHF_2CF_3) (50%/50%)
- R290 (propane).

While the smaller units use R 134A the larger units use R 410A.

The sectors which use the air conditioners are the domestic sector where unitary (window) and split systems are used; and the commercial sector where both split as well as the central systems are in use.

The annual sale of ACs is around 3-4 million units/year and annual sales is around Rs 30,000 crores.

The annual physical growth of the AC sector is 14%. Energy efficiency

M Siddhartha Bhatt is Additional Director & Divisional Head of the Energy Efficiency & Renewable Energy Division of CPRI, Bangalore. He is an energy expert & has a professional experience of 33 years at CPRI and has extensively contributed in the areas of energy analysis, energy efficiency, renewable energy and safety with specialization in the generation sector.

improvement is growing at the rate of 3% which implies that the power growth is around 11%.

Cooling load and the market scenario

The two major segments or compression air conditioners are room air conditioners (1-3 TR) and central ACs. The installed capacity of air conditioners in India are nearly 22 million TR with the domestic sector accounting for nearly 15 million TR and the commercial 7 million TR. Table 1 gives the national scenario of the contribution from air conditioning segment.

It can be seen from Table 1 that the major dominance of the AC power is from the domestic sector which accounts for nearly 22% of the national power. The AC power in the commercial sector account for 9% which gives a total of 31% of the national share of the power. However, when it comes to energy the contribution from ACs is quite low (hardly 10%) because of the low load factor of the ACs. While the power ratings of ACs are high their load factors are low due to seasonal usage, weather conditions and non continuous use only during certain hours of the day.

In the domestic sector 70% of the ACs are unitary (window) & the balance of split. In the commercial sector the break up of unitary & split are 50% each (See Figures 1 & 2).

The break up of the room and central ACs in commercial sector are given in Fig. 3. Among the central air conditioners nearly 28% are in the range of 100-200 TR and used for commercial building load and nearly 26% are of 900-1500 TR and used for industrial air conditioning applications. The balance air conditioners come in varying sizes from 50 TR to 2000 TR.

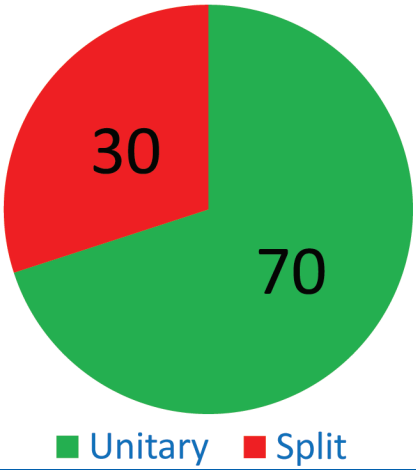


Fig. 1: Domestic sector

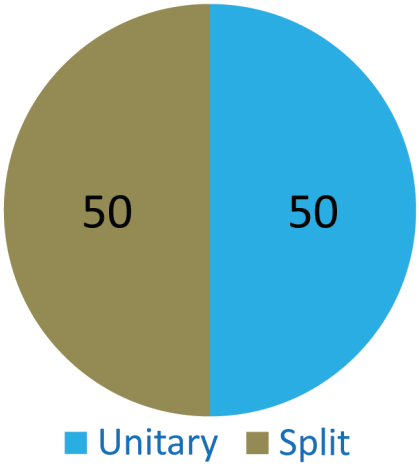


Fig. 2: Commercial sector

Sl. No.	Particulars	Units	Domestic sector	Commercial sector	Total
01	Percentage of total national power shared by building sectors (domestic and commercial sectors) as a whole (all loads including AC loads)	%	22	9	31
02	Total national power shared by building sectors (domestic and commercial sectors) as a whole (all loads including AC loads)	GW	58.30	23.85	82.15
03	Percentage share of AC loads in the total loads of the domestic and commercial sectors	%	50	60	NA
04	Percentage of total national power shared by AC loads alone in domestic and commercial sectors	%	11	5.4	16.4
05	Actual national power shared by AC loads in domestic and commercial sectors	GW	29.15	14.31	43.36
06	Percentage share of domestic and commercial AC loads in the national power scene	%	67	33	100
07	Energy share of AC loads in the national energy scene	TWh	96	64	160
08	Energy share in AC loads from the domestic and commercial sectors in the national energy scene	%	5.88	3.92	9.80
09	Peak load occurrence in AC loads in domestic and commercial sectors		night	After noon	NA
10	Installed capacity of AC in India on a national level	TR	≈15	≈7	≈22

Table 1: National scenario of the contribution from air conditioning segment

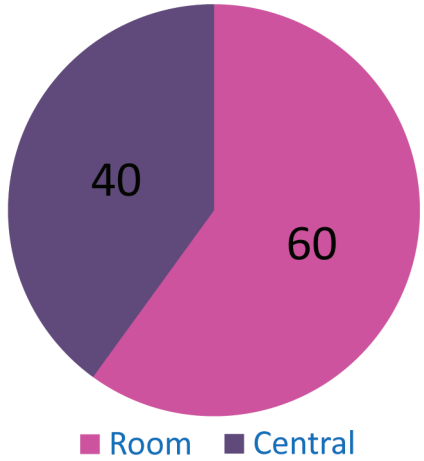


Fig. 3: Commercial sector

Fig. 4 shows the load variation with months for a commercial building in Delhi. It is clear that the variation is from 60% in winter to almost 160% of the average value during summer months. This can be attributed to AC loads.

However, on the overall load scenario of the various regional grids, the winter and summer loads do not show any perceivable differences. This means that the AC loads do not impact the national grid significantly in terms of additional loads or load peaks. Figures 5-9 show the average load during summer and winter for the various national regions of the grid. Except in the Eastern and Southern regions, the peak due to AC load does not get reflected in either the peak load or average load for the various regions. In the eastern region and in 2014 in the southern region, the average load is higher in summer indicating increased use of AC.

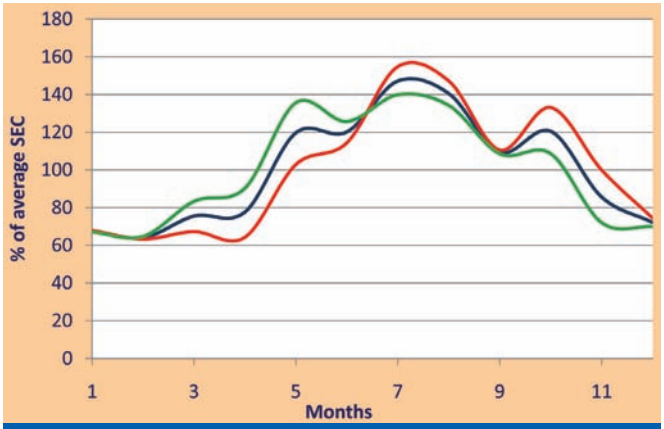


Fig. 4: Building load variation, Location: Delhi
Average SEC=106.676 kWh/m^2/year

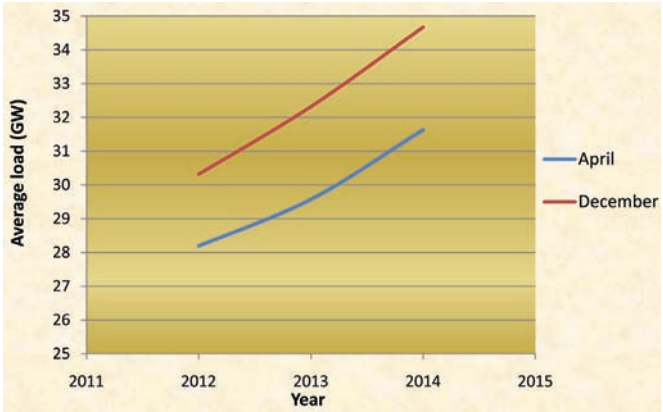


Fig. 5: NRLDC

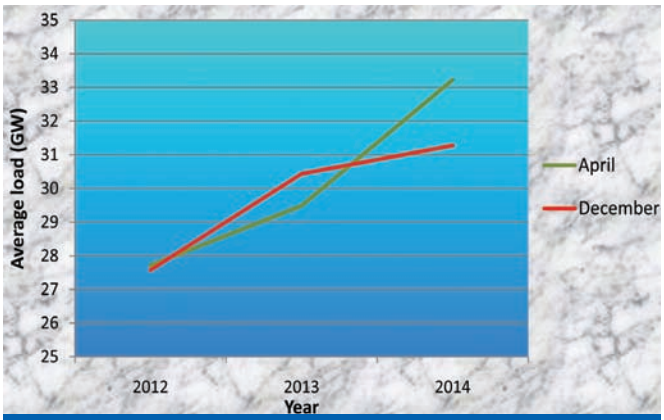


Fig. 6: SRLDC

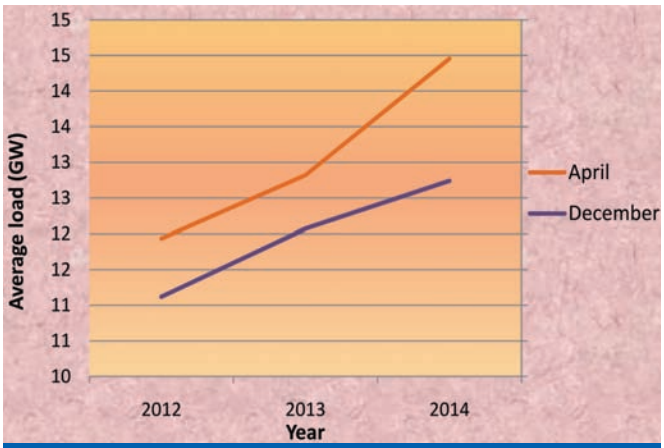


Fig. 7: ERLDC

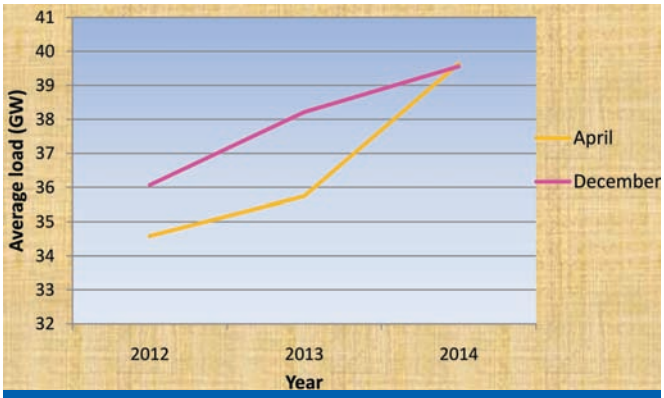


Fig. 8: WRLDC

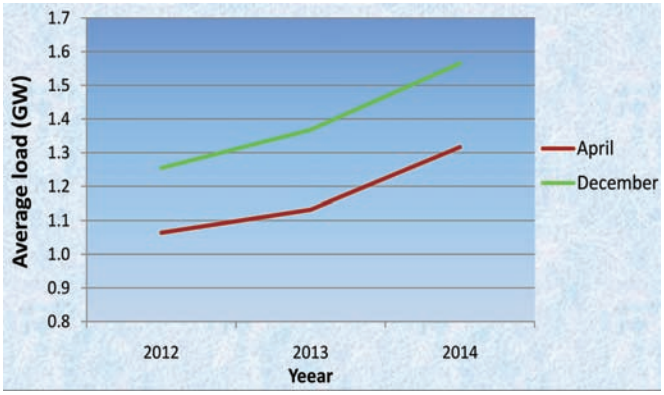


Fig. 9: NERLDC

Solar photovoltaic (SPV) powered AC plants integral with cold thermal energy storage (AC-CTES) using ice build and melt processes

In tropical countries like India, the SPV power generating period can be classified into three distinct phases:

- Summer season with low stochastic losses, high, regular and reliable incident solar radiation.
- Winter season with medium level of regular and reliable incident radiation.
- Rainy season characterized by high stochastic losses (due to cloudy and rainy weather) and low reliability.

Solar photovoltaic systems can provide the power for central AC plants as fossil fuel substitution options. One of the advantages of SPV power is it coincides with the commercial AC loads implying that very less electric storage is required for off grid operation. In a typical PSV plant in India the power output is 0.068 kW/m^2 of SPV panel area. The daily energy generation is 0.885 kWh/m^2. Approximately 6 m^2 of panels are required for providing 1 kW peak power. For providing 1 kW of average power over 12 hours, then nearly 15 m^2 of panels are required. Figures 10 & 11 give the curves for a typical 100 kW AC plant. The SPV peak capacity is around 160 kW. This includes not only the compressor power but also the balance of plant such as pumps, cooling tower fans, AHU fans, etc.

For a typical 100 kW system the capital cost of SPV (combination of crystalline silicon and thin film to handle the Indian weather conditions) power plant (together with the inverter, batteries, etc.) is around Rs 73 lakhs and the saving in energy is around Rs 8,760/day which gives a pay back period of 5.5 years considering an energy charge of Rs 12/kWh. Presently, many SPV systems get paid as much as Rs. 8-10/kWh in the grid tied mode due to the renewable energy obligation. For smart grid configurations SPV lends itself an ideal candidate energy source because AC with cold thermal energy storage CTES referred to as AC-CTES is a means of balancing the mismatch between the load curve and the solar generation curve. The peak power input is critical in SPV powered plants where the plant capacity directly determines the maximum power and energy generation.

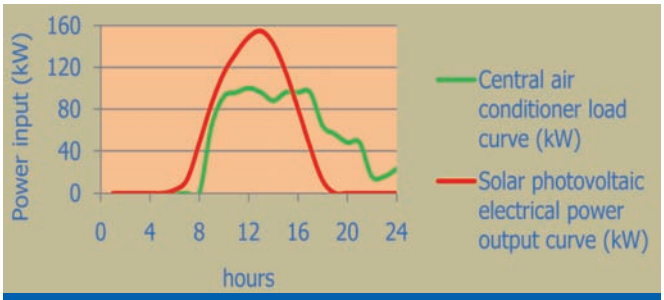


Fig. 10: Air conditioning commercial load curve

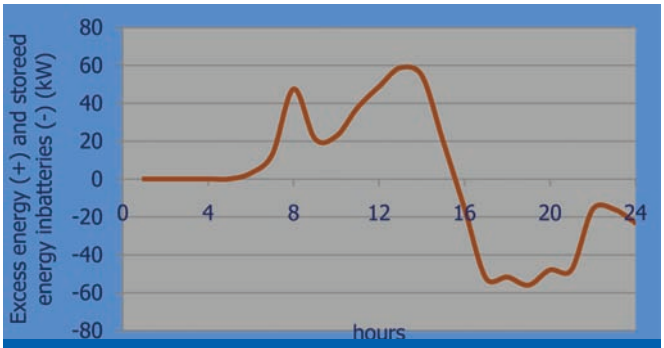


Fig. 11: Solar PV energy- excess (+)and deficient (-)

In the operation of AC-CTES with SPV the power input is reduced and also the energy consumption is lower as compared to conventional AC operation. In grid power operation, the non-peak period can be used for ice free processes.

SPV power is available as a parabolic output and only for 12 hours in a day. For providing electrical power in the non-sunshine period, electrical energy storage is required in the form of battery banks. The energy efficiency of electrical energy storage is 80% which calls for 20% additional generation to meet the load. If the AC-CTES system is available, the storage of electrical energy in battery banks is totally avoided. Further during the sunshine period, the excess energy can be used for the ice freeze process. During the non-sunshine period the ice melt process will provide the cooling effect. With AC-CTES systems, the chilling (cooling effect generation) and the cooling effect utilization are de-coupled. As a result only those equipment associated with chilling are used during the ice freeze process and equipment with AHU operation will be used in the ice melt process. Thus the total power at any time of operation is much lower than the simultaneous chilling and AHU operation of conventional ACs. Also, the CTES can be modulated as per solar incident radiation. Table 3 gives a comparison of AC-CTES with the conventional systems.

The design criterion are:

- Avoiding battery storage of SPV power altogether.
- Total use of SPV power during the sunshine period for providing cooling to the extent required and the storage of the balance through the ice storage system for use during the non-solar period.

AC-CTES based on SPV can be operated through summer & winter (depending on the need) & with limited applicability during the rainy season.

New commercial and domestic buildings can go in for SPV based AC-CTES.

Conclusions

The conclusion of the study are as follows:

- AC loads account for nearly 16.5% of the total national power. Energy wise, AC loads account for 9.8% of the total energy.
- The growth rate of AC power is 14% /year but considering the 3%/year decrease in power due to energy efficiency, the annual growth in power will be only 11%.
- Switchover to solar photovoltaic based AC systems is called for in green building concepts. The parabolic nature of solar energy requires cold thermal energy storage which can be in the form of ice build and melt systems. ■

Analysis & Overview of Industrial Cooling Towers

Cooling towers (CT) are heat exchangers used to transfer process waste heat to the atmosphere though cooling of water to a lower temperature.

Water CT mainly consists of a casing, heat and mass transfer fill matrix and water and air circulation system. Hot water flows in counter flow with ambient air, transferring heat and mass to the ambient air through a fill matrix and the resultant cold water is collected at the bottom. Small CTs are generally single integral and skid mounted. The cooling towers are specified by the TR or MW_t of heat handled, approach to the wet bulb temperature, cooling range and quantity of water handled (m^3/h). Water CTs are generally built from 5 TR to any capacity (say 220 kilo TR).

The type of heat rejection in a cooling tower is termed evaporative in that it allows a small portion of the water being cooled to evaporate into a moving air stream to provide significant cooling to the rest of that water stream. The heat from the water stream transferred to the air stream raises the temperature of air and its relative humidity and this air is discharged to the atmosphere. Evaporative heat rejection devices such as cooling towers are commonly used to provide significantly lower water temperatures than achievable with air cooled or dryheat rejection devices, like the radiator in a car, thereby achieving more cost-effective and energy efficient operation of systems in need of cooling.

If cooled water is returned from the cooling tower to be reused, some water must be added to replace or make-up the portion of the water that evaporates. Because evaporation consists of pure water, the concentration of dissolved minerals and other solids in circulating water will tend to increase unless some means of dissolved-solids control, such as blow-down, is provided. Some water is also lost by droplets being carried out with the exhaust air (drift), but this is typically reduced to a very small amount by installing baffle-like devices, called drift eliminators, to collect the droplets. The make-up amount must equal the total of the evaporation, blow-down, drift, and other water losses such as wind blowout & leakage, to maintain a steady water level.

Historical Development of Cooling towers

With the invention of steam engine, heat energy was used to generate power and cooling tower became a necessity. James Watt's patent for condenser, discovery of combustion, followed by mechanical refrigeration, internal combustion and finally electric power generation resulted in rapid development of industries. All of these generate waste heat that must be removed and dissipated to ambient, which necessitated the development of cooling towers.

The technique of evaporative cooling can be traced back to ancient times when rivers, seas, lakes, ponds, etc. were utilized as a medium of supply of cooling water. With the limited industrial activity of the past ages and plentiful resources, cold water was used in once through mode, discharged back and forgotten. Later, considering the thermal pollution, directly discharging the hot water back to its source was environmentally unacceptable. Hence hot process water was either to be

S Jothibasu has completed BTech in Mech. Engg. & MTech in Thermal Engg. and working as Engineering Officer in Central Power Research Institute. He has served in CPRI's Trivandrum Unit for 11 years and presently serving at Bangalore Unit for last 9 years. He is a consultant, providing Energy Audit service to process industries, Buildings, Hydro, Gas, DG and thermal power stations. He has 30 technical papers to his credit. He is a certified Energy Auditor and Manager of BEE, New Delhi and is a Life Member of SEEM.

Sl. No	Particulars	Unit	Design	CT #1	CT #2	CT #3
1	CT type		Induced draft counter flow type			
2	Hot water inlet	^{O}C	29.0	35.0	35.0	27.0
3	Cold water outlet	^{O}C	25.0	31.2	33.0	25.5
4	Ambient: Dry bulb	^{O}C	--		24.7	
5	Relative Humidity	%	--		53.1	
6	Wet bulb	^{O}C	20.0		18.1	
7	Range	^{O}C	4.0	3.8	2.0	1.5
8	Approach	^{O}C	5.0	13.1	14.9	7.4
9	Water flow rate	m^3/h	80.0	83.0	76.0	74.0
10	Effectiveness	%	**44.4**	**22.5**	**11.8**	**16.9**

Table 1: Energy performance parameters of Cooling Towers

cooled before the discharge or cooled and recycled. When topographical considerations were taken into account in power plant site selection, large ponds or canals were employed to hold, cool, recirculate or discharge process water, which required large area. To reduce the area required, spray systems were introduced to aerate the water in holding plants and to promote faster cooling by generating more water surface.

The next logical development came when it was discovered that spraying downwards in a box, instead of upwards, lower temperature could be achieved. Shortly after this, instead of relying on prevailing winds for air movement, aerodynamically designed fans were incorporated. As mechanics and hydrodynamics of water cooling became better understood, fill or packing material was included in designs to slow the vertical fall of water and provided greater air / water interfacial contact for more cooling. Through the development of the mechanical draft cooling tower, the land area required were brought down up to 1000 times compared to a cooling pond or lake.

Energy Performance Analysis

The Energy performance parameters of few industrial cooling towers, which were used for air conditioning applications, were measured and presented in Table 1. Digital relative humidity meter, temperature indicator and Ultrasonic water flow meters were used for measurement. The approach, range and effectiveness of cooling towers were computed. The observations and suggestions are given below.

- The CT fills are fully chocked with algae & scales and need to be replaced. The nozzles need to be cleaned to remove the scales. The water distribution across the cooling tower should be uniform. It is suggested to ensure that the approach of CT is 4-5°C. Presently, it is 7.4-14.9^{O}C.
- Presently, three CTs are run for one chiller. It is suggested to run only 2 CTs for one chiller, as per design. The water flow to idle CT needs to be closed.
- Raw water is added as make up in Cooling tower (CT) and no water treatment is in place. Scaling is observed on condenser, CT fills and piping. Use of herbal liquid is recommended to avoid the deposit of scales and to dissolve the existing scales in cooling water (CW) line and condenser. Alternatively chemical de-scaling can be carried out once in an year.

Conclusions

- The operating principle & historical development of cooling towers are discussed in this article.
- Timely maintenance of cooling towers and ensuring an approach of 4-5°C will lead to substantial energy saving in cooling applications.
- Treatment of cooling water is essential in order to ensure continued performance of cooling towers. ■

Demand Control Ventilation

The biggest challenge that today our HVAC designers are facing is providing the correct level of heating/cooling/ lighting for the actual occupancy. In many countries a constant ventilation rate is required in the building regulations e.g. in Denmark the minimum ventilation rate is 0.35 l/s per m² floor area .

Demand controlled ventilation (DCV) where the ventilation rate is controlled to maintain a certain air quality is today common in offices, schools and other building where the number of people using the building varies. Moreover, a DCV system based on room temperature control also eliminates the need of additional heating in rooms when the cooling capacity of the supply air exceeds the cooling capacity needed, e.g. when the room is unoccupied or when the solar heat load is low. Figure 1 illustrates this situation. This advantage in terms of energy savings is often

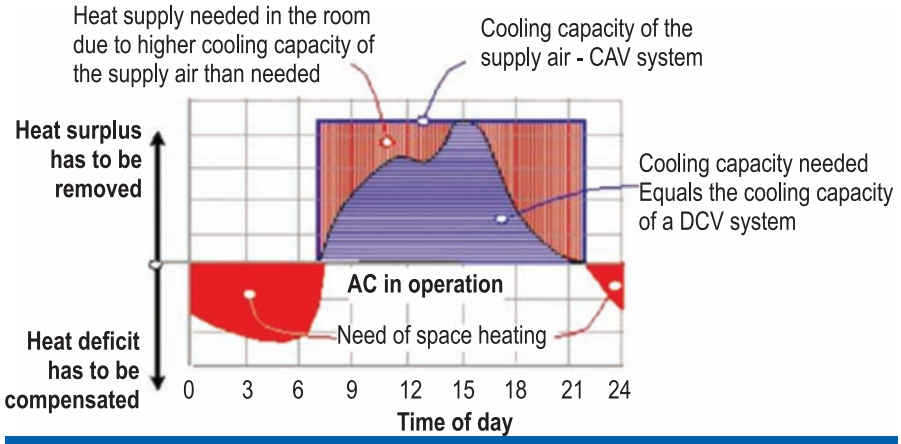


Fig. 1: Comparison of DCV system with CAV system in the application of thermal comfort control (air-based cooling).

overlooked. The fundamental requirement on a DCV system is to assure good indoor climate with reference to indoor air quality, thermal comfort and acoustic environment. In addition, this goal should be achieved cost-effectively and with a minimum of purchased energy.

Principle and concept of Demand Control Ventilation

The concept of DCV has been known for over 20 years. The sensors of the first generation did not provide the required reliability, and the cost of the sensors was high. In recent years, the advances in sensor technologies have made demand controlled ventilation both reliable and cost-effective. The ASHRAE Standard 62.1-2004 indicate that the demand controlled ventilation is acceptable when correctly designed and installed.

CO_2-based demand controlled ventilation is a combination of two technologies

CO_2 sensors continually monitor air in a conditioned space. Since people exhale carbon dioxide, the difference between the CO_2 concentration in the interior of the building and the level in the exterior of the building indicates the occupancy and activity level in a space and, thus, its ventilation requirements. The sensors send carbon dioxide data to the ventilation controllers, which automatically increase ventilation when carbon dioxide concentrations exceed a certain level in a space. Ventilation rates can be measured and controlled based on real occupancy. This contradicts the conventional method of ventilating at a fixed rate independent of occupancy. This results in much larger air flow rates coming into buildings than necessary. That quantity of air must be taken into account, because it increases energy consumption and costs. In humid climates, the excess ventilation also can result in uncomfortable humidity and mould growth, making the indoor air quality quite inappropriate. Furthermore, the lack of fresh air can make building occupants drowsy. To avoid the problems of excessive and insufficient fresh air, people can apply demand controlled ventilation.

Demand-controlled ventilation is created by adding an IAQ control loop to an existing thermal comfort control system (Fig. 2). An IAQ sensor continuously assesses the air renewal requirement and converts this into an outside air demand signal. The IAQ sensor assesses the quality of the indoor air as it would be perceived by a person on first entering the space.

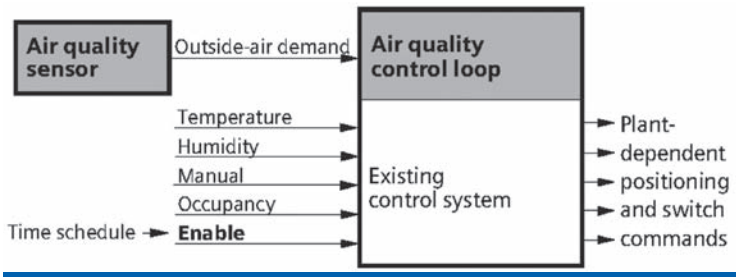


Fig. 2: Principle of demand control ventilation

Ms. Sadaf Alam, Research Scientist in Finland is IGBC AP certified professional, worked as a senior Energy Analyst consultant and has experience in Building Energy simulation and analysis. She has worked on projects with activities ranging from Energy Efficient building design, LEED certification, whole building energy simulation & day lighting simulation & analysis.

Today's sensors are CO_2 sensors and/or VOC sensors (VOC: Volatile Organic Compounds). For definitions, specifications and test data refer to VDMA Standard 24 772: "Sensors for the measurement of indoor air quality". However, simply adding an IAQ control loop does not make demand-controlled ventilation. As shown in the figure 3, Another highly significant feature is that control via a time schedule is replaced by a number of demand switches responsible for enabling the system.

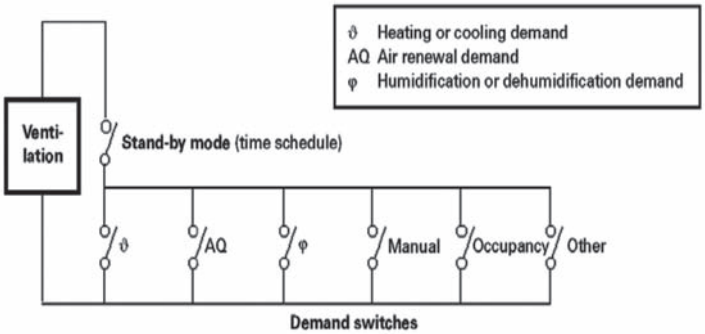


Fig. 3: Enabling the system on the basis of demand signals during standby periods

Control strategy

When implementing demand-controlled ventilation, there are three different categories to consider, based on:

Type of fan control

- On/Off
- Step control (e.g. 0 / 1 / 2)
- Variable speed control.

Method of heat recovery

- Plate heat exchanger
- Mixing dampers for re-circulated airs
- Thermal wheel.

The principle for the control of a demand-controlled partial air conditioning system for heating/cooling and heat recovery with a plate heat exchanger is illustrated below figure 4: IAQ is controlled by adjusting the fan speed (on/off, multistage or variable speed (control). Control of IAQ operates in a similar fashion in systems where a thermal wheel is used for heat recovery.

Benefits of Demand Control Ventilation

Following are the benefits of Demand control ventilation:

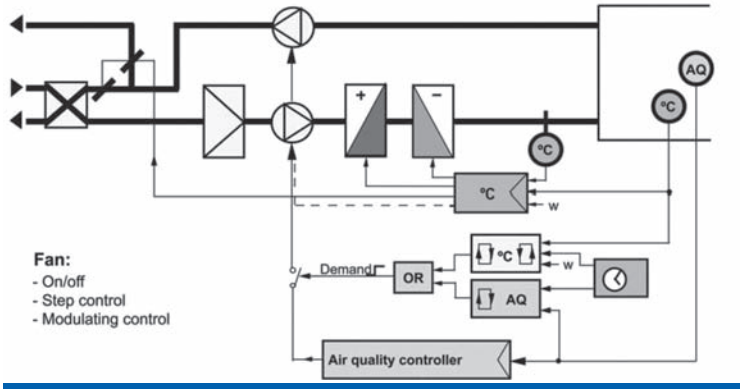


Fig. 4: Implementation of demand-controlled ventilation based on the example of a partial air conditioning system with heating/cooling & heat recovery with a plate heat exchanger.

- Automatic provision of optimum ventilation
- An increased sense of well-being and higher productivity
- Energy cost savings of 20 to 70% and, hence, less damage to the environment
- Good IAQ, supported by documentary evidence
- Demand controlled ventilation saves energy by avoiding the heating, cooling, and dehumidification of more ventilation air than it is needed. According to the observations, the savings range from 5 to 80 percent in contrast to the conventional ventilation system.

The payback can vary from several months to two years and can often be significant enough to facilitate to pay for other building systems.

The payback from CO_2-based DCV will be greatest in higher density spaces, where occupancy constantly changes (e.g. schools, theatres, retail establishments, and meeting and conference areas). In spaces with more static occupancies (e.g. offices) DCV can provide control and verification that adequate ventilation provided to all spaces. For example, a building operator may arbitrarily and accidentally establish a fixed air intake damper position that results in over- or under ventilation of all or some parts of space. A CO_2 control strategy can ensure the position of the intake air dampers is appropriate for the ventilation needs and occupancy of the space at all times. Active control of ventilation system can provide the opportunity to control indoor air quality. Demand controlled ventilation creates improved IAQ by increasing ventilation if CO_2 level rise to an unacceptable level.

Design considerations for DCV

CO_2-sensing is a rather uncomplicated technology, and installation of CO_2 sensors is a trouble-free procedure. Sensor voltage, power and control of output requirements are similar to those ones commonly used in thermostats. There are two types of sensors: wired and wireless. Data from wireless sensors is delivered with the use of signal communications. Wireless sensors have self-contained power supply. Such sensors are used on-board power controlling to alert a building operator when battery charge is low and needs be changed.

All suppliers of HVAC systems frequently offer systems for located demand controlled ventilation and reading data from sensors. Therefore, putting into operation of CO_2-based DCV is not a complicated process. However, upgrading previous systems with pneumatic controls for operation with DCV may be more challenging. Sensors are typically mounted on walls similar to thermostats. Some manufacturers offer standard sets, which include a thermostat and sensor. The standard sets which can monitor temperature, CO_2 and humidity are also available. They are used in systems that include a drier to control humidity in ventilation air.

Data from CO_2-sensors delivered to HVAC control system in a building or to an actuator that controls the amount of ventilation air. For reconstruction of HVAC system it may become necessary to repair or upgrade dampers. Good operating of dampers that can be automatically controlled is of great importance. Pneumatic controls will need to be replaced with electronic control or Direct Digital Control (DDC). Actuators which do not have input points for the sensors will need to include these points. But it is not simple to upgrade and calculate HVAC systems for more complex systems, such as variable-air-volume systems, as it may seem. One needs a more complex algorithm. CO_2-sensors can be mounted in the interior of the building or by integration into an air handling system. The data from sensors to regulate the amount of supply outdoor ventilation air are applied in them. The illustration of this is provided in Figure 6.

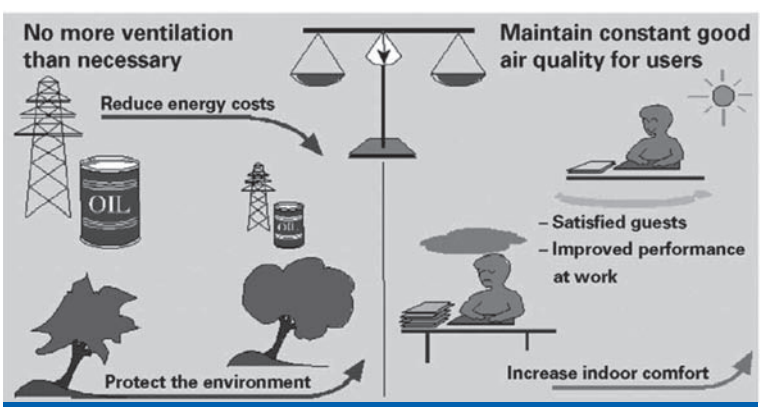


Fig. 5: Benefits of demand-controlled ventilation

Energy saving potential

If demand controlled ventilation lowers excessive supply outdoor air in a building during heating and cooling seasons, then annual energy expenses for heating and cooling the outdoor air reduce correspondingly. In addition, lower outdoor air requirements decrease the fan energy expenses to supply or extract air from a building. Actual occupancy levels in buildings are generally significantly lower than the design occupancy levels. The experience indicates that actual occupancy levels may be 25-30% and 60-75% lower in some buildings than the design levels. The first and last, saving energy potential using demand controlled ventilation may vary depending

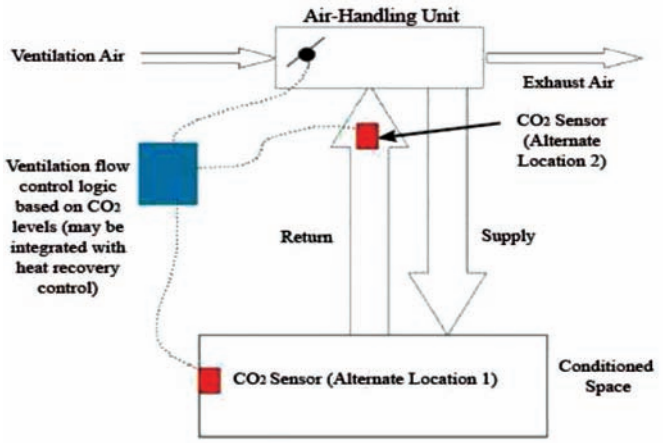


Fig. 6: Generalized DCV integration into HVAC system.

on climate, type of a building, Type of HVAC system and occupancy in the space in which DCV is implemented and other operating conditions. The capability of authorized staff to maintain and operate equipment properly may also positively affect savings. Available data suggest that demand controlled ventilation reduces ventilation, heating and cooling loads by 10% to 30%. Buildings with large fluctuation of occupancy, such as office buildings, shopping malls, cinemas, auditoriums, schools, nightclubs etc., realize the largest saving energy. Demand controlled ventilation reduces electricity requirements when actual occupancy level is below than design occupancy level during the demand periods. Lower amount of supply of outdoor air reduces cooling and ventilation loads and thus, air-conditioning power reduces. Generally speaking, energy saving potential varies from building to building. It depends on its occupancy.

Figure 7 shows an example of graphical representation of energy saving potential.

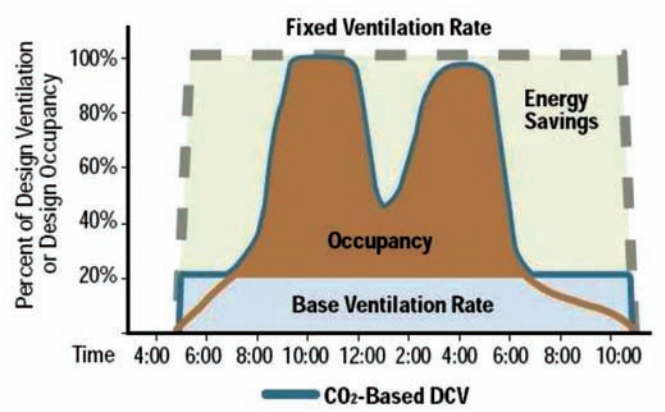


Fig. 7: A graphic representation of energy saving potential.

Market factors

The quick pay-off period of CO_2 sensors can be expected in spaces, in which occupancy is variable and unpredictable (auditoriums, some school buildings, shops etc.), as well as in the areas with high heating and/or cooling demand and high utility rates. On the average demand controlled ventilation has a payback period of two to three years that can be cost-attractive for many customers. But many buildings do not use DCV that is due to some disadvantages, namely that CO_2-sensors of DCV system do not respond to other indoor pollutants and expensiveness of operational personnel. DCV is a new concept for standards and local building codes, which one should not hurry to apply. Contractors and designers have questions and doubts about liability of systems, if they can meet indoor air quality standards. Because of that it may be due to incorrect installation of CO_2-sensors and presence of large amount of non-human pollutants exceeding the acceptable level. On the other hand, DCV requires installation and operational personnel, which are more expensive and difficult to find. But the energy saving can compensate these disadvantages.

Discussion and Conclusions

DCV system controls the amount of outdoor fresh air supply, depending on the number of people in a building and their activity. DCV makes it possible to maintain the needed ventilation and improve indoor air quality while saving energy. Such systems benefit both building operators and building occupants. DCV reduces electricity requirements when an actual occupancy level is below than the design occupancy level during the demanded periods. The lower amount of supplied outdoor air reduces cooling and ventilation loads and, therefore, air conditioning power reduces. Maximum saving energy using DCV is provided in buildings, where the number of people continuously changed, is unpredictable and attains a high level, for example, office buildings, shopping malls, cinemas, auditoriums, schools, nightclubs etc. In buildings with a more stable occupancy level, DCV provides enough amount of fresh air supply per person all the time. But it could be uneconomical, because DCV reduces energy costs less in the areas with a high utility level. Saving energy potential can change as well, depending on climate, the type of a building, the type of a HVAC system with which DCV is implemented and other operating conditions. Demand controlled ventilation creates improved indoor air quality by increasing ventilation, when CO_2 level rises to an unacceptable level. One of the most important aspects of designing DCV is correct control strategy selection.

In such a manner the set-point control strategy can be designed for spaces with high occupant densities, which reach full or nearly full occupancy rapidly once occupancy commences. While the proportional control strategy is applicable to a wide range of occupant densities and patterns. A proportional control approach starts to open a damper or increase the introduction of outdoor air when indoor CO_2 levels are a certain amount above outdoor levels. This lower control set point in the control range is 100 to 200 ppm above outdoor levels. As CO_2 levels in the occupied zone rise, the damper opens wider. Two important criteria for any CO_2 control strategy are that the target per-person ventilation rate is met at all times and that during periods of changing occupancy the lag times as prescribed in ASHRAE standard 62.1-2004 are met. It is possible to determine the number of sensors & to select types of sensors, when a control strategy is chosen correctly. ■

New record pipe run set by air conditioning chiller system at Swansea Civic Centre

A new Turbomiser chiller installation at Swansea Civic Centre in the UK is believed to have the longest pipe work run ever used on a Turbocor-based air conditioning project.

Designed and project-managed by the council's in-house mechanical and electrical design and maintenance section, the project uses two 420kW "split" Turbomisers, installed by Cool-Therm's Wales branch in the building's plant room.

They are connected to two air-cooled condensers some 70m away on the rooftop. The Turbomisers replaced a pair of conventional, aging Carrier chillers based on R22. To avoid disruption, it was essential to use some of the existing refrigeration pipe work.

Dave Blackmore, Cool-Therm director, explains: "The internal building pipe work runs through library archives, risers and ceilings, and into office spaces. Replacing it would have been complex and expensive, and would have caused considerable upheaval for the building.

"The project manager was understandably keen to retain it and replace the outdoor condensers and chillers in the plant room, resulting in minimal disturbance to the operation of the building."

This posed a number of design and installation challenges. The original chillers were based on different pipe sizes to those on the Turbomisers. Integrating the two required careful design and installation onsite.

In addition, the original dual-circuit Carrier system had four pipes running through the building per chiller, two liquid and two discharge pipes, compared with Turbomiser's single

Ken Strong, is managing director of UK-based cooling specialist Cool-Therm. He has many years' experience in chillers and air conditioning, and is one of the pioneers behind the development of the award-winning Turbomiser ultra-efficient chiller, based on Turbocor oil-less compressors.

circuit. To overcome this, Cool-Therm designed and manufactured its own bespoke Refnet Y-joint pipe connecting system. The design for the new chiller system itself posed a particular challenge due to the complex configuration. It required intensive planning as well as detailed flow calculations to ensure it would perform efficiently and as intended.

Dave Blackmore says, "We needed to make sure there was no excessive pressure drop across any specific component or pipe length, in order to deliver the correct cooling capacity at the flooded evaporator - rather than in the pipework.

"This entailed a forensic focus on pipe sizing, vertical and horizontal pipe lengths. The evaluation had to be right first time, there was no margin for error. Calculations had to take account of all system pressure drops, factoring in bends and 45 degree angles, all components and the properties and behaviour of refrigerant via psychrometric charts."

A further issue arose due to the oil-free nature of the Turbomiser chillers, which run on magnetic bearings. The previous chillers, based on reciprocating compressors, used conventional lubricant and therefore pipe work incorporated oil traps. This meant that all oil residues in existing pipe work had to be flushed out and thoroughly cleaned prior to installation.

"We couldn't allow any oil to remain in the system. This required removing all the oil traps and blowing the pipes out with oxygen-free nitrogen (OFN). As a back-up, we also ran a separate recovery rig with an oil accumulator in series with the chiller to catch any residual oil that remained after treatment with OFN."

The existing chillers were disconnected and dismantled in situ, and taken out in manageable sections through public access areas in the civic centre. The Turbomisers were transported to the plant room in the same way.

Dave says: "Fortunately, Turbomiser chillers are fully modular so we were able to break them down, bring them in into the building in 'kit form' and rebuild them in situ in the plant room, reducing disruption to the customer as well as saving a great deal of time and effort on-site."

Cool-Therm fitted new refrigerant leak detection and emergency extract ventilation in the plant room to comply with current F-Gas regulations. The plant room also features a fully integrated compressor input/output board with an RS232 connection to a laptop or building management system. All the controls can be integrated with the Turbocor compressors.

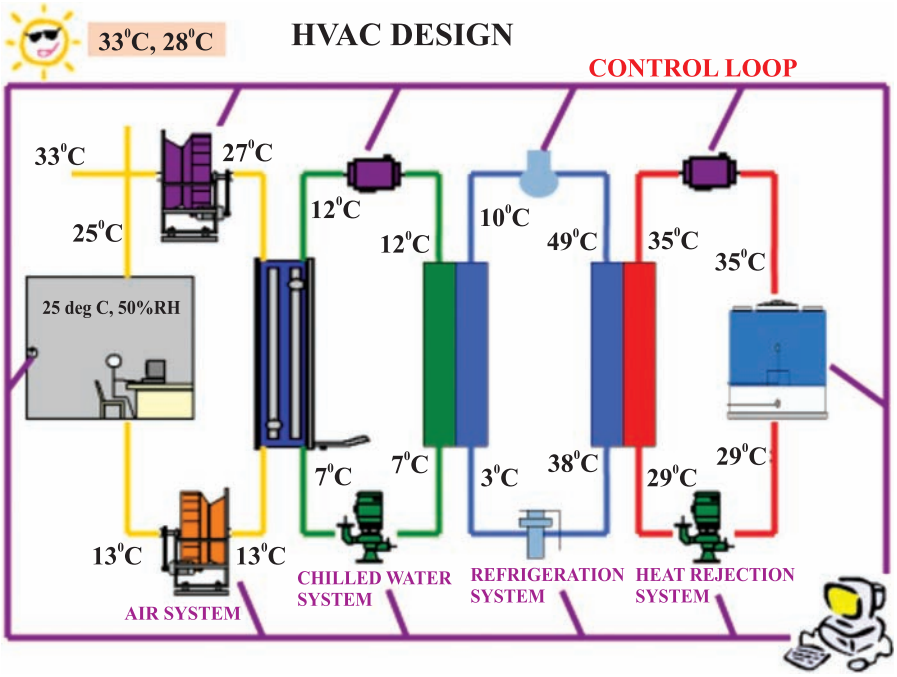
Given the coastal location, the specification of the aluminium condensers required special attention in order to safeguard them against maritime conditions and potential corrosion. The micro-channel condensers are designed to reduce refrigerant charge while, at the same time, increasing the effectiveness heat exchange. However, Swansea Civic Centre is located just 20m from the seafront and is constantly exposed to salt and sand and corrosive sea breezes. To protect against this, the micro-channel condensers were treated with an anti-corrosion coating to protect them from the elements.

"The client wanted an extended warranty on the system. To achieve this given the location, we ensured that condensers were galvanised and then epoxy coated and that copper pipe work was PIB (pipe insulation billet), covered with galvanised wrapping on top of that. This ultra-corrosion resistant treatment enables the equipment to withstand the effect of the sea air and coastal weather conditions."

Turbomiser chillers are based on the Turbocor oil-free compressor, which uses virtually frictionless magnetic bearings to produce the most energy efficient product of its type on the market. Turbomiser chillers reduce energy costs by up to 50 per cent compared with traditional chillers based on screw or reciprocating compressors.

Apart from offering dramatically lower energy consumption, the main benefits of Turbomiser chillers are reduced refrigerant leakage; less maintenance due to the oil-free design and limited number of moving parts; light weight (the unit's compressor weighs just 125 kg compared with 600kg for traditional compressors); excellent part load efficiency; quiet operation, and an exceptionally low start-up current (5 Amps compared with up to 600 Amps for conventional chillers). ■

A guide to HVAC System Design



Heating, Ventilating, and Air Conditioning (HVAC) systems play a vital role in the successful operation of a facility. They are responsible for maintaining comfort conditions day in and day out.

HVAC systems are of great importance to architectural design efforts for four main reasons.

- First, these systems often require substantial floor space and/or building volume for Equipment and distribution elements that must be accommodated during the design process.
- Second, HVAC systems constitute a major budget item for numerous common building types.
- Third, the success or failure of thermal comfort efforts is usually directly related to the success or failure of a building's HVAC systems.
- Last, maintaining appropriate thermal conditions through HVAC system operation is a major driver of building energy consumption.

HVAC System Evolution

The first step in selecting a HVAC system is to determine and document constraints dictated by performance, capacity, available space, budgets and any other factors important to the project. This usually starts with a formal meeting with an architect/owner and understanding his or her requirements.

Owner's Needs

If the architect is a creator, the customer is a king and his needs and requirements must be met.

Depending on the customer goals, the building and its HVAC requirements have to be designed accordingly. For example take an example of multi-storey office building. The complete building may have either a single owner or multiple owners. A single owner normally has a preference for a central plant, as the quality of air conditioning is far superior and life expectancy is higher. The operation and maintenance costs are also lower than a floor-by-floor system. In addition the owners can opt for an

intelligent building by incorporating a building management system (BMS).

This will enable the owner to derive benefits of optimal utilization of the air conditioning plant. A multiple owner facility requires a system, which provides individual ownership and energy billing for which a floor-by-floor air conditioning system using packaged units or split units is most suited subject to economics of space and aesthetics.

Another important requirement is the normal working hours of the user/users. Some users may have different working hours or different timings. Some areas such as computer rooms may need 24-hour air conditioning. Other areas may have special design requirements. Due to such multiple requirements many engineers prefer a "hybrid system" which is a combination of a central plant and packaged units/split units. For example, a hotel may use packaged unitary air conditioners (or fan coil units served with air-water central system) for the individual guest rooms, roof top units for meeting rooms/restaurants, and a central plant system for the lobby, corridors and other common spaces. Such systems offer high flexibility in meeting the requirement of different working hours and special design conditions.

While HVAC engineer manages the system design the architect retains control of the complete building product. The type of system selected is determined by HVAC designer's knowledge of systems. Architect must also understand the basics, system objectives, the role of key system components, the type of systems that are available and what such systems can and cannot accomplish. Most customers may not understand HVAC design aspects; their benefits and limitations and it is the architect's/HVAC engineer's responsibility to guide and advise the best option. For HVAC engineer the customer may be an architect whose customer may be the building owner.

What Influences HVAC design?

Investment in a building project entails significant capital investment and associated costs over the economic life of the project. It is a mistaken notion that the buildings costs have to be expensed once. The buildings like any other industry have running expenses in a way that they consume lot of energy and require water & disposal facilities that accounts for significant recurring costs. The HVAC systems often are very large and are responsible for a large portion of a building's first cost and operating cost.

Every building is unique. For instance residential apartments, shopping complex, office complex, hospital, hotel, airport or industry; all have different functional requirements, occupancy pattern and usage criteria. The geographical location of the building, ambient conditions, indoor requirements, building materials, dimensional parameters, aesthetic requirements, noise and environment issues need careful evaluation. The HVAC design and selection must be customized to meet all these requirements.

Each solution begins with an assessment of the owner's business needs for HVAC, architect's vision, requirements of the facilities manager, combined with a review of the HVAC system itself, be it existing or planned.

Design aspects for HVAC System

HVAC systems is an important part of the building construction budget, account for a major portion of a building's annual energy consumption, often require substantial space allocations and contribute to interior environment that is critically evaluated by the building occupants and the users. Everyone cares about cost! But the wise customer lays down a list of minimum requirements and then negotiates. Mostly customer goes for price only and skips on right equipment and design specifications. The selection process could be chilled water system or direct expansion system, the design of HVAC systems is mainly related to various parameters, including but not limited to the factors listed below.

Details of architecture

- Structure, orientation, geographical location, altitude, shape, modules-size & height
- Purpose of the building, area classification, occupancy and usage patterns
- Ratio of internal to external zones, glazing, plant room sitting, space for service distribution
- Climate and shading, thermal insulation, passive climate control, relationship with adjacent buildings
- New or existing building, renovation or extension project, retrofitting or new equipment
- Plant and system design to match the characteristic of the building and the need to meet the needs (known and unknown) of the ultimate occupants.

Details of Space allocation

- Floor space and clear heights to accommodate HVAC plant, equipment, distribution and room elements
- Shaft spaces available for routing ducts/pipes
- Location and size of structural columns and beams, clearance through steelwork, position of reinforcing rods
- Ceiling height, clearance between suspended ceilings and beams
- Foundation and supports requirement, permissible loadings
- Location of obstructions that may be in the route of air-conditioning services, particularly ductwork.

R Muralidharan Iyengar, BE Mechanical, presently working as air conditioning consultant and principal faculty for AC training in Chennai, Ishrae past president & member with Ishrae, Ashrae and has forty years of field experience in various disciplines with Bluestar, Munters, Nova magnetic, Philips, Pfizer, Aegis chemicals, Capsulation services and BARC.

Details of building construction

- Materials and thickness of walls, roof, ceilings, floors and partitions and their relative positions in the structure, thermal and vapor transmittance coefficients, areas and types of glazing, external building finishes and colour as they affect solar radiation, shading devices at windows, overhangs, etc., as they reduce solar radiation and light transmission, building mass, particularly as it affects thermal capacity
- Sound and vibration control requirement, relation of air-conditioning equipment to critical areas
- Co-ordination with other services (e.g. electrical and plumbing work), use of service shafts, ducts and equipment rooms to best mutual advantage.

Building regulations

- Government and local regulation on occupancy & safety classification
- Regulations of Public utilities on electrical wiring, power usage, water supply and drainage
- Health and Safety regulations on indoor air quality, ventilation air quantities, noise control, electrical, fuel, insulation and other hazardous materials
- Local fire authority regulations and smoke removal systems
- Insurance company regulations.

Miscellaneous Requirements

- Accessibility for installation of equipment, space for maintenance;
- Location of fresh air intakes and exhausts (to avoid short-circuiting and contamination);
- Location of fire zones and fire walls (position of fire dampers);
- Acceptable noise level: space available to house equipment and its location relative to the conditioned space
- Indoor & outdoor equipment preferences
- Acceptability of components obtruding into the conditioned space.

Building Aesthetics

- Architectural characteristics of space,
- Reflected ceiling plans: Integration of air distribution devices in ceiling to harmonize with lighting layout, fire sprinklers, detectors, communication systems and ceiling design
- Size and appearance of terminal devices.

System considerations

- Thermal influence – Solar gain, ambient conditions (dry bulb/wet bulb temperatures), indoor condition (dry bulb/relative humidity) requirements, heat gain from people, artificial lighting, equipment and machinery, ventilation air load
- System behaviour – Thermal comfort, indoor air quality, cooling /heating peak loads, partial loads, average load conditions and pattern of variation, capacity of the system
- Load behaviour – Sensible/latent heat balance, Load diversity, and system response related to thermal capacity storage effects
- Psychrometric processes – engineer prefer to carry out their calculations on a psychrometric chart of the aspects include actual vapor pressure; relative humidity; moisture content; specific enthalpy; specific volume (or humid volume) and dew point.
- Operation Philosophy- Hours of system operation;
- Control Systems- Zone or individual control, system response and lags, permissible tolerances and time system, direct digital controls, sequence of operations and control logic
- Energy Efficiency-Energy availability, level & pattern of energy use, type of system, peak load and part load energy performance, Variable speed drive, energy efficient equipment, building management systems, economizer controls, zoning requirements
- Control and operational requirements – supervision, records, type of adjustment and regulation, hours of operation, summer/winter changeover, day/night and weekend operation, high/low limit protection, frost protection, fire protection, special control areas (e.g. computer rooms, executive offices);
- Redundancy- Spare & standby requirements, equipment configuration
- Technology features – Humidification/dehumidification requirements, Air purity, Special acoustic treatment, fire protection & smoke management; Water service – capacity, pressure, maximum temperature, chemical analysis (choice of materials), water treatment;
- Commissioning and testing of the completed plant and the adjustment to ensure that it operate as designed in all respect. It is a matter of increasing importance, as components become more sophisticated, more packaged and thus less susceptible to any level of repair.

Financial Consideration

- Capital cost
- Operating cost (fuel, power & water)
- Maintenance & consumables cost
- Replacement costs
- Upgrading costs
- Equipment failure costs
- Labour costs
- Insurance costs
- Interest on capital and depreciation
- Return of investment (ROI)
- Life cycle analysis.

Conclusion

Costs can often be influenced by the owner's/company's insurers and risk managers. Successful HVAC systems are the key to successful buildings. Proper selection of air-conditioning services and choice of the most effective system is the foremost application consideration. This includes primary influence from the architect. It is important to understand the characteristics of the building envelope, functional requirements and desired environmental conditions. Each solution begins with an assessment of the owner's business needs, architect's vision and the requirements of the end user, combined with a review of the HVAC system itself, be it existing or planned. ■

Klima-Therm secures UK distribution agreement with GREE for centrifugal chillers

Klima-Therm, the expanding chiller and air conditioning specialist, has been appointed UK distributor for Chinese manufacturer Gree's range of centrifugal chillers. The announcement follows the company's recent appointment as UK distributor for World Energy absorption chillers. The additions, together with its existing ranges of screw and Turbomiser chillers, mean that Klima-Therm now offers a complete range of chiller technologies, on proven platforms from leading manufacturers, reinforcing the company's place in the premier league of UK chiller suppliers.

Roberto Mallozzi, MD, Klima-Therm and Sam Chen, Gree

The agreement enables Klima-Therm to offer high efficiency, cost-competitive centrifugal chiller solutions for the largest buildings and estates, requiring several megawatts of cooling capacity.

Star products in the Gree range are its variable speed centrifugal chiller and photovoltaic (PV) powered inverter chiller. In addition to producing renewable electricity to drive the cooling system, the PV chiller can feed power directly into the grid, enabling the end user to benefit from electricity feed-in tariff.

Roberto Mallozzi, managing director of Klima-Therm, said: "We are delighted to have secured the distribution agreement with Gree. Having visited a number of their factories and headquarters in China, the quality and scale of the company is beyond impressive, it is breath-taking. After two decades of rapid growth, one in three residential air conditioning units in the world is now manufactured by Gree, an astonishing feat. Our goal is to make them as famous in the UK's commercial sector."

He added: "Although the Gree name is only just becoming established in the UK, the company acts as OEM for some of the world's best known air conditioning brands. Visiting their vast production plants is like walking through a Hall of Fame, as branded equipment bearing the industry's top names rolls off the production lines alongside Gree's own systems.

"They have total confidence in Gree to produce outstanding quality products and, having seen their meticulous approach, R&D and manufacturing facilities, so do we." Klima-Therm is backing the launch of Gree centrifugal chillers with a five-year warranty, believed to be an industry first in UK chiller market.

Tim Mitchell, Klima-Therm's sales director, said: "It demonstrates our confidence in Gree technology, and provides a compelling additional benefit for consultants and end users. "With the acquisition of centrifugal and absorption chillers, we are now in the enviable position of being able to offer a range of fully referenced chiller alternatives for a project, enabling clients to decide on the most appropriate technical and commercial solution. Very few companies have the capability to do this."

Klima-Therm's strategy ideally positions the Wimbledon-based company to take advantage of the wave of major building projects taking place across London over the next five years. Upwards of 250 major projects are either under construction or in the pipeline, most of which will require large scale chiller-based cooling.

Gree has nine manufacturing plants, seven in China plus facilities in Brazil and Pakistan. It produces some 55m residential air conditioners and 4.5m commercial systems a year, and manufactures all key components such as compressors and motors.

A core philosophy of Gree is the move from "Made in China" to "Created in China". As such, Gree manufactures all key components such as compressors and motors and operates five Research Institutes, 41 Research Centres, 530 laboratories, employing 7,000 engineers, and holds more than 12,000 technology patents. Gree spent over US$630 million on research and development in 2013 alone, and holds CE, UL and TUV certification. ■

Applications in Industrial Refrigeration

Refrigeration systems have application in all type of industries like Chemical, Pharma, Food and Beverages, cold storages, dyes and dyestuff manufacturing and for HVAC applications, commercial buildings.

Individual components of the systems remain same but the system adapts to the application's requirements. In order to understand systems better, it is necessary to understand their classification and how individual components affect system performance.

Refrigeration systems are classified based on their Evaporator and Condensers as:

CONDENSER SIDE		EVAPORATOR SIDE	
Air cooled	Water cooled	Direct refrigerant to process (Dx Type)	Refrigerant to medium (Chilled water / Brine)

Comparison of performance of condensers

Condenser controls pressure and therefore capacity of the compressors. Final heat rejection to atmosphere is in the condensers and as can be seen above, it could be in the form of air or cooling water.

In case of very low temperatures, cascade systems are used where the intermediate condenser could be a refrigerant liquid fill tank. When the refrigerant gas coming out of Low Stage compressor is mixed into the refrigerant liquid, the liquid evaporates and cools the gaseous refrigerant. This liquid is then taken to the suction of high stage compressor and finally the heat is rejected to atmosphere through its condenser, which would be of one of the three types mentioned in next page.

Application of Dx type of systems in Industry

Dx systems are used in various applications as mentioned herein -

Rajesh Deshpande,
Managing Director of Energetic Consulting Pvt Ltd (ECPL), is BTech Chemical Engineering.

- Chemical processes where refrigerant is directly expanded in the heat exchangers or reactors (Fertilizer plants).
- Tank farms for storage of LPG or Propane where the fluid cooled is the fluid compressed
- Ice cream tunnels or milk chillers
- Cold rooms and blast coolers
- Cryogenic applications

Industrial HVAC systems.

Advantages of Dx over systems using heat transfer mediums like chilled water / brine are as follows

- Lesser heat transfer area is required-
  - Evaporating liquid has better heat transfer coefficients
  - For the same energy, temperature of refrigerant is lower than that of chilled water/ brine
- Rate of cooling is very fast
- Thermal storage in the refrigerant is higher compared to same volume of water
- No chilled water pumping.

Disadvantages of Dx systems are as follows

- Pressure drop in the liquid refrigerant lines is large if the distance of user equipment is high. In order to overcome it, a separate pump is required, resulting in energy loss
- Over the liquid and gaseous pipe lines, refrigerant picks up heat resulting in superheating again causing energy loss
- Possibility of refrigerant leakages cause loss of refrigerant
- Variation in user load pattern forces the equipment to part load without ON/OFF control.

Application of Medium type of systems in Industry

These are most commonly used systems in the industry as they offer tremendous flexibility in catering to multiple requirements at different locations. Since there is a medium involved in it, handling of the medium (chilled water /brine) is equally important as that of refrigeration system. Power consumption of the pumps required for

Condenser Type	Energy Consumption	Advantages	Disadvantages
Air Cooled	Fan Power, Higher Compressor power input for a given refrigerant load.	1) No water consumption. 2) No Pumping. 3) No spray/drift. 4) Appropriate in Humid environment.	Higher Head pressure lead to lower COP.
Water Cooled	Circulating Pumps, and Cooling tower components.	1) More Efficient. 2) Lower Condensing Pressure (High COP). 3) Higher Summer Capacity.	1) Water Pumping and maintenance. 2) Water Consumption. 3) Higher maintenance Cost. 4) Legislative Compliance on bacteria.
Evaporative	Fan and Pump Power.	1) More efficient in dry environment. 2) Highest efficiency due to lowest head pressure.	1) Water Consumption. 2) Water Pumping and maintenance. 3) Legislative compliance on bacteria. 4) More refrigerant required.

Comparison of performances of refrigeration systems based on condenser type

circulation of the medium are additional and particularly in case of low load on the system, pumping power becomes significant.

Chilled water systems are further sub-divided into

Closed loop systems

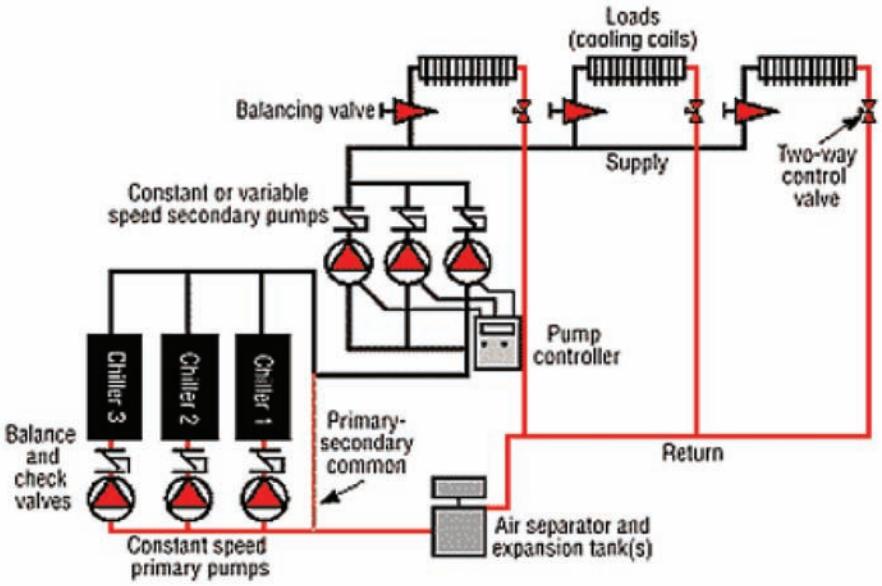
Closed loop system is when the chilled water is circulated through the system and chiller by a single (circulation) pump. In this kind of system, pumping is most optimized and the minimum (and maximum) flow in the system is equal to minimum (and maximum) flow handled by the refrigeration system.

Closed loop system is effective in following cases:

- Similar temperature need (like HVAC system)
- Flow variations are not large
- Thermal shock to the system is not large
- Demand is continuous and at an average load.

Hot Well – Cold Well system

These systems are used in cases where the closed loop systems are not effective or technically challenged. They are preferred by users as operating variations do not affect the basic refrigeration system. However, it is an energy inefficient system and power consumption of pumping is generally higher than closed loop system.



Conclusion

Refrigeration systems are used in various applications in Industrial environment. Though not entirely different, applications decide arrangement of the components and their inter connectivity.

Performance of the system is at its best when the application matches equipment design and therefore it is equally important to do proper application engineering as it is to select right equipment. ■

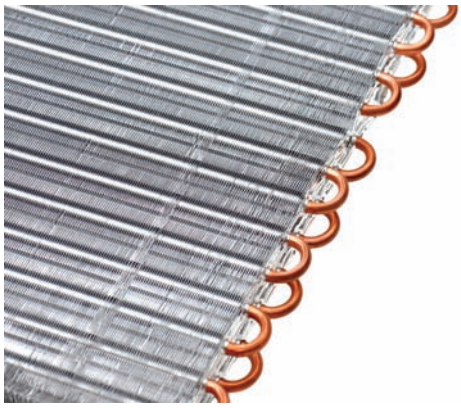
HFC-32 Refrigerant receives EPA Approval via SNAP Program

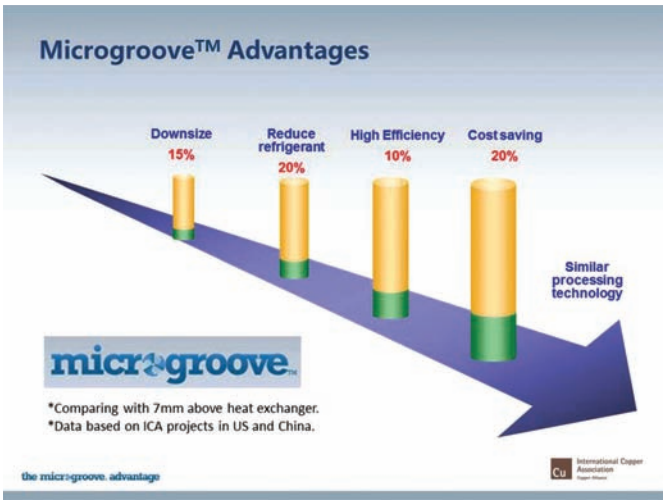
Environmental Protection Agency (EPA) announced the coming final approval of HFC-32 (R-32) refrigerant for use in certain refrigeration and air conditioning applications. This final action addresses President Obama's Climate Action Plan that calls on EPA's Significant New Alternative Policy (SNAP) Program to identify and approve additional climate-friendly chemicals as determined by the EPA. "This acceptance of R-32 is a great achievement for the Daikin organization. Not only did Daikin representatives submit the application to the EPA," states Takeshi Ebisu, President and CEO, "but this action represents the EPA's first SNAP approval of a lower Global Warming Potential refrigerant for any household comfort cooling HVAC application in the United States." Ebisu added: "A critical part of the SNAP review and approval process is EPA's consideration of whether an alternative is safe in its proposed use. EPA's SNAP approval is based on EPA's conclusion that R-32 can be safely managed in these applications." HFC-32 (R-32), a chlorine-free, single-component refrigerant, will now become an EPA approved refrigerant for use in home air conditioning. It offers a global warming potential of about one-third compared to currently used R-410A refrigerant. When used in approved refrigeration and air conditioning products, up to 30% less refrigerant is needed for proper charge levels compared to R-410A refrigerant, further reducing potential climate impact. Successfully used across Asia, it is estimated that HFC-32 (R-32) refrigerant is contained in approximately 8 million total units in Japan and in approximately 5 million units manufactured by Daikin Industries, Ltd. HFC-32 (R-32) will be approved for use in equipment meeting the requirements of UL Standard 484 and the use conditions of the EPA SNAP approval. Such equipment includes package terminal air conditioners, window room ACs and portable air conditioners. ■

Building Better Appliances with Smaller-Diameter Copper Tubes

The "less is more" principle popularized by American inventor R. Buckminster Fuller is especially apt with respect to coil designs for air-conditioning and refrigeration appliances. Demands to increase energy efficiency and lower material costs forces manufacturers to reconsider their coil designs. Also, concerns about the atmosphere are driving manufacturers to reduce refrigerant volumes and minimize the ozone depletion potential (ODP) and global warming potential (GWP) of refrigerants. Microgroove Copper condensers helps reduce cost, create higher energy efficiency, less refrigerant, comes with higher durability and demands low investments. Coils made with smaller diameter and inner grooved copper tubes enable efficiently removing heat from the refrigerant in case of the condenser coil or evaporator coil. This higher heat transfer efficiency increases the overall energy efficiency of the system. The use of smaller tubes also improves the air-flow outside the tubes because of the reduced form factor.

Use of 5 mm Microgroove Copper condensers helps reduce cost, create higher energy efficiency, less refrigerant, comes with higher durability and demands low investments. Coils made with smaller diameter and inner grooved copper tubes enable efficiently removing heat from the refrigerant in case of the condenser coil or evaporator coil. This higher heat transfer efficiency increases the overall energy efficiency of the system. The use of smaller tubes also improves the air-flow outside the tubes because of the reduced form factor.





Conclusion

Improving energy efficiency contributes significantly to the reduction of greenhouse gas emissions arising from fossil-fuel generated electricity. The economic, social and environmental aspects of sustainable development rely on the complex optimization of many factors, including resource conservation, waste minimization, energy efficiency, climate change mitigation, longer product life cycles, and effective recycling. Copper, the "green" material, plays an important role in all of these solutions. ■

Courtesy: Avinash Khemka, Chief Manager HVAC
International Copper Association India

Gubba Cold Storage uses Thermal Imaging to Guarantee Best Cold Storage Conditions

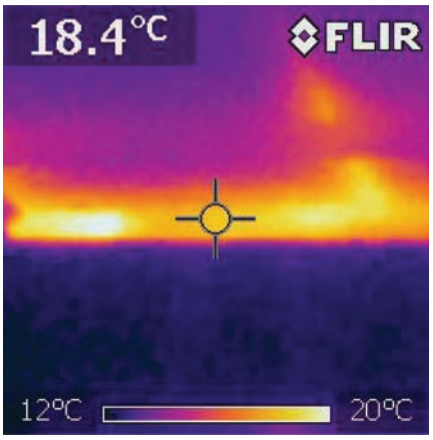
Gubba Cold Storage offers its customers high-quality cold storage services for a wide range of products. In order to guarantee the best conditions for the stored goods, Gubba Cold Storage makes sure that its infrastructure is in an impeccable state. That is why the company recently invested in thermal imaging technology from FLIR. Thanks to FLIR, no insulation leakage or bad electrical wiring goes unnoticed.

Since 1987, Gubba Group Ltd has been offering cold storage services out of Hyderabad, Telangana, India. Gubba Cold Storage's eleven cold storage units are operational on a 24/7 basis and offer infrastructure for stocking seeds, pharmaceuticals products as well as agricultural products. Every stored product in the cold storage facilities has its own set of prescribed temperature settings. Understandably, with the continuous operation of Gubba Cold Storage's facilities lead to high energy consumption.

"At Gubba, we provide a host of value added services to our customers that helps build their trust," says Gubba Prashant, director at Gubba Group Ltd. "As customer satisfaction is our main priority, we will do everything in our capacity to ensure that our customers' stocks are preserved perfectly."

Insulation Leaks & Humidity

To preserve the temperature in the cold storage units, the quality of insulation is of course of utmost importance. Leaks in the insulation



Leaks in the insulation material covering the cold storage unit can be a threat to the temperature uniformity inside the unit

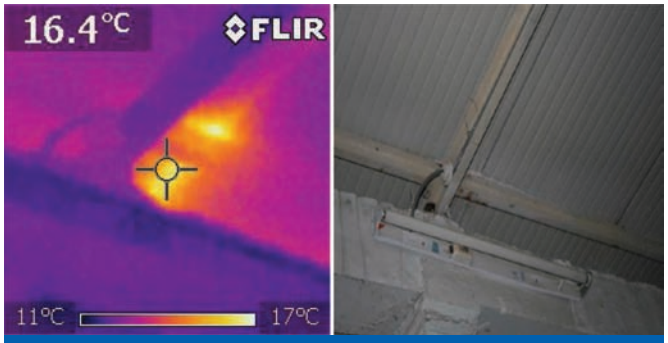
FLIR i3 is the smallest, lightest & most affordable thermal imaging camera on the market

material covering the cold storage unit can be a threat to the temperature uniformity inside the unit. However, insulation leaks used to be discovered in a rather random fashion and repaired on the fly. What's more, insulation leaks can also allow moisture to enter the unit, which can also disturb the required relative humidity. The moisture that enters the building will condense and freeze. Eventually, the build-up of ice can also affect the insulation properties of the cold store wall and weaken the structure of the wall or building. "I did not know about the power of thermal imaging, until I saw one of these cameras at work at a FLIR exhibition booth in India," says Gubba Prashant. "There, I discovered that you can quickly scan large areas to look for insulation problems, find moisture beneath the insulation surface and much more. We decided to invest in one of FLIR's handheld thermal imaging cameras and we haven't regretted it ever since."

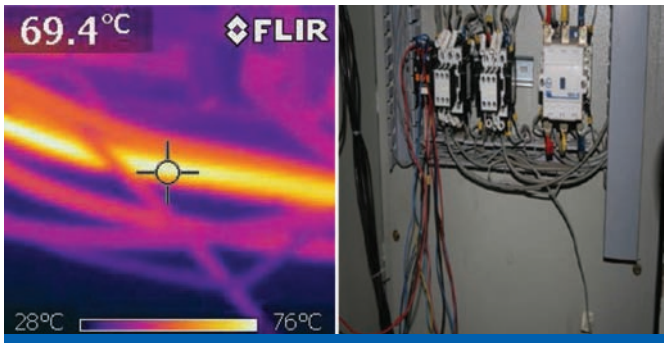
Easy and Timely Detection

At Gubba Cold Storage , Gubba Prashant is now frequently using a FLIR i3 point and –shoot camera to monitor the cold storage units and to detect possible leakages. One of the many advantages of this new approach is that inspections can now be scheduled in advance and on a regular basis. Small leakages can easily be detected before it escalates into something worse. And more importantly, by blocking these leakages in time, uniformity in temperature and relative humidity is maintained in the unit. This helps Gubba Cold Storage to save its customers' stocks from perishing.

The FLIR i3 is the smallest, lightest and most affordable thermal imaging camera on the market from FLIR. It is incredibly easy to use and requires no former experience. It really is a matter of "point shoot-detect" to obtain high-quality thermal images that will immediately give you the thermal information you need. It only weighs 365 g & is easy to store in a belt pouch.



Small insulation leakages can easily be detected before they escalate into something worse



Gubba Group uses the FLIR i3 camera extensively for safety checks in electrical panels & chiller rooms across its various cold storage buildings

Soft and Hard Benefits

"Again, next to safeguarding our facilities, doing regular inspections with our FLIR thermal imaging camera and sharing these thermal images with our customers also allows us to build trust," says Gubba Prashant. "After performing a thermal audit with our FLIR i3 camera, we provide our customers with a report that certifies perfection in temperature and relative humidity maintenance." "But next to these intangible benefits, there are also hard benefits, such as enormous power savings and reduced energy bills, as a result of repairs we were able to do based on information from our thermal imaging camera."

Nagesh, "After performing a thermal audit with our FLIR i3 camera, we provide our customers with a report that certifies perfection in temperature and relative humidity maintenance."

Electrical Inspections

Aside from detecting heat and energy loss in cold unit storage structures, FLIR's thermal imaging camera has proved to be an accurate & effective tool in Gubba Cold Storage's facilities predictive maintenance programs. In electrical installations, hot spots in the thermal image usually point to emerging problems. With the FLIR i3 camera, Gubba Prashant's team can now scan electrical cabinets and components & survey multiple wires and connections to get an instant picture of potential trouble.

"We use the FLIR i3 camera extensively for safety checks in electrical panels and chiller rooms across our various cold storage buildings," says Gubba Prashant. "When the thermal imaging camera clearly shows you an electrical cable that is much hotter than its environment, you know you have to intervene. This is how we can prevent bigger problems from happening." ■

Courtesy: FLIR Systems India Pvt Ltd.

Water Treatment & Distribution Program

Water treatment can be a mystery, as the old adage goes, "Out of sight, out of mind," is too often the philosophy of many building owners.

This attitude arises in part because the inside of the equipment and piping infrastructure cannot be easily seen or inspected because of the problems associated in HVAC Water Systems are Closed Loop and open Air Raw or filtered makeup water contains dissolved minerals and insoluble matter that pose a serious threat to efficient cooling. Microbiological organisms, dirt or silt, dissolved minerals and gases, if left untreated, can concentrate and cause serious reductions in heat transfer efficiency, increased maintenance problems, or even a total system failure. By their very design, open re-circulating cooling systems are prime candidates for contamination problems. As the cooling water evaporates, contaminants are allowed to concentrate in the system. Contaminants enter the system either through the makeup water or from the air via the cooling tower. If left untreated, high concentrations of impurities in open re-circulating systems can lead to a number of serious problems including: Scale Fouling Microbiological growth and Corrosion.

In the recent past, due to the increased focus on environmental and energy issues, the water treatment industry has been searching for new technologies to improve equipment efficiency and pollution problems. Currently, most HVAC systems require the use of corrosive biocides, scale removers, anti-corrosion chemicals and water softeners to maintain safe, balanced operating conditions.

There are several examples of less-than-scrupulous water-treatment companies selling expensive or ineffective water-treatment chemicals & equipment, which also might discourage maintenance and engineering managers from developing an effective water-treatment program.

Chemical products are produced by many manufacturers in formulations that claim similar results for each of their targeted treatment issues. The partnership believes the product and system can be proven unique in that it will consolidate the water treatment abilities of several chemicals into to a

Norman Dsouza, Sales and marketing director, actively involved in propagating integral approach to design in construction and maintenance of buildings, having direct impact on environment and natural resources.

single chemical that is more efficient, safe to handle, environmentally friendly and economical to use.

The market for water treatment chemicals is vast and the distribution system for these products fragmented. It's likely that each city will have several small distributors and they will represent products from many manufacturers. It's also likely that each distributor will supply many building maintenance contractors that will manage HVAC systems for building owners and management companies. It is believed that much of the power to direct chemical purchases comes from building management companies. The partnership therefore plans to focus its marketing efforts toward developing a close relationship with significant management companies serving this industry. It is believed this strategy will broaden initial market penetration on a greatly accelerated basis.

Water treatment is the best insurance for protecting major investments in a building's heating and cooling infrastructure. Left untreated, water systems can quickly cause untold damage.

A successful water-treatment program for HVAC and potable-water systems is mandatory to maintain the energy efficiency of equipment in like-new condition, guard the equipment from scale and corrosion, and protect building occupants.

The water-treatment industry has changed significantly in the last 25 odd years as companies have sought immediate profit gains through mergers and acquisitions.

Environmental regulations also have changed the technology used in the water-treatment industry. Cooling-tower systems now use phosphates and molbydates versus chromate-based inhibitors, which were popular in the past for scale and corrosion control.

Recent outbreaks of Legionella also have raised the level of scrutiny of water-treatment solutions for potable-water systems, spas, whirlpools, cooling towers, storage tanks and other parts of systems susceptible to growing and breeding the bacteria.

Many institutional and commercial facilities have realized that developing a relationship with a water-treatment company is just as important as the water-treatment technology itself. Selecting a reputable and reliable water-treatment company is crucial.

Maintenance and engineering managers should view the relationship as a partnership, where they can openly discuss and review new water-treatment technologies to decide which is appropriate for their facilities. Managers view some new water-treatment technologies in the same light as snake oil, but with a true partnership, they can avoid potential disasters from the latest and greatest ideas.

After selecting a water-treatment company, the next step is a raw water analysis. This step is necessary to design the chemical program appropriate for each building requirements.

By conducting the raw-water analysis and determining a system's operating hours, load factor and operating temperature, a water-treatment specialist can determine the equipment, chemicals and monitoring required for a successful water-treatment program. It is not a good idea to base a building's chemical treatment on a neighboring facility's program, since local water sources can vary, operating hours are different, and equipment is designed specifically for each building.

The major systems in buildings that require water treatment are cooling towers, condenser-water systems, steam systems, closed systems for chilled water & hot water, and potable-water systems. Managers must design a water-treatment program for each system.

The major components in a condenser-water system are cooling towers, water chillers, pumps and piping. The system rejects heat from the system via the cooling tower. Circulating water across the cooling tower cools it by evaporation, & it returns it to the chiller.

Condenser-water systems are open, and as water cools, impurities in the water concentrate. This process leads to potential scale and corrosion of the metals in chillers and cooling towers.

Controlling scale and corrosion is a major treatment required so that all condensing-water systems can maintain chiller efficiency and prolong equipment life. Traditional equipment needed to control scale and corrosion in a cooling tower system includes a conductivity controller, a chemical-feed pump and controller, a water meter on

cooling tower make-up, a blow-down solenoid valve, and a corrosion coupon rack.

In cooling-tower systems, four primary factors - pH, temperature, hardness and alkalinity - determine the appropriate amount of chemicals to use and the amount of water to bleed from the system. By verifying these factors, managers can establish the proper water-treatment program to protect the equipment and maintain efficiency.

Setting up the proper program significantly reduces treatment and makeup water costs. Makeup water for a cooling-tower system is usually 2-3 % of the system's circulation rate. For a 1,000-ton system, the makeup rate is 60-90 gallons per minute of makeup water. If the makeup is metered, most water departments allow a credit for sewer charges. This is a significant operating cost, so it is worth the effort to set up a treatment program properly.

Another major source of contamination in a condenser-water system is growth of biological organisms. Two methods can help control biological growth in condenser-water systems - biocides and ozone.

Using biocides is the more traditional approach and usually involves two or more chemicals alternately injected into the system. This process requires feed equipment to introduce the biocides automatically.

Ozone generation in cooling-tower systems continues to surface as a viable treatment option to replace chemicals for biological and scale control and reduce water makeup. Ozone is an excellent biocide, but there are many examples of misapplied ozone systems on cooling towers, resulting in expensive repairs to chillers and cooling towers.

For certain applications, ozone generation might be successful when administered properly. Maintenance managers should thoroughly research this option before implementation or discuss it with their water-treatment specialist.

Managers can expect treatment costs for a 1,000-ton cooling-water system to be Rs 945 per ton per year. Condenser-tube fouling can significantly increase energy cost. A film thickness of 0.0005 inch will increase energy use by 4%, while a film thickness of 0.003 inch increases energy use by more than 22%. Clearly, spending Rs 315,000 per year on treatment is a smart purchase.

Steam systems consist of boilers, steam piping, condensate piping and boiler-feed equipment. Major factors in establishing a treatment program include raw-water analysis, operating pressure, load factor, and percentage of returned condensate. Treatment includes steam-line treatment, scale and corrosion inhibitors, and an oxygen scavenger.

In recent years, concern has risen over using direct-steam humidification in concert with amines for steam-line treatment. Once amines are dispersed into the air, they can cause problems for building occupants susceptible to respiratory problems.

The current practice is to use steam-to-steam heat exchangers or other humidification methods to avoid direct-steam humidification. Managers should review this issue with a water-treatment specialist and other consultants to determine the optimum solution that ensures occupant safety. Typical costs for water treatment of a steam boiler system is Rs 1200 per year per boiler horsepower or Rs 300,000 per year for a 500 bhp boiler plant. Boiler energy costs can increase 25% per month if the tubes are scaled, even by a small amount.

Legionella - legionella pneumphila - is a bacteria that was discovered in 1976 at an American Legion convention in Philadelphia. Investigators originally believed that an abandoned cooling tower was its source, but recent research indicates that the Legionella might have been introduced through a potable-water system.

While Legionella are relatively resistant to standard water-disinfection procedures, research has produced very effective means to control and prevent it in potable-water systems.

Control methods designed to disinfect an entire water distribution system include: thermal flush at a minimum of 1,400 degrees, copper-sliver, ionization, hyperchlorination.

Control methods that are designed to disinfect only a specific portion of a water-distribution system include: ultraviolet-light sterilization, ozonation, instant steam heating.

Selecting one or a combination of these two types of control methods is best for eradicating Legionella colonies and preventing re-colonization of the water-distribution system.

Managers seeking to improve water quality might consider making such responsibilities part of a more comprehensive system of specialized inspections and checks. Some departments assign certain pieces of equipment to an area maintenance inspector who is familiar with that system and equipment or a trained and experienced inspector might be assigned to inspect and treat a facility's cooling-water system by using a checklist, taking water samples, and recording equipment conditions and variables.

The inspector can note and correct deficiencies in equipment condition when they are minor. The inspector also can adjust water quality on the run - that is, make a second round at the end of the shift to perform water treatment as prescribed in order to adjust the chemical makeup.

This specialized approach can prevent problems, such as scale buildup in cooling-system piping and in operating equipment. It also can prevent slime and algae formation in cooling towers.

A water-treatment vendor can provide the appropriate chemical composition and treatment routine for boiler feedwater, steam and steam condensate, and waste water. The vendor's representative can visit the facility, take samples and have them analyzed at a laboratory. The vendor also can furnish a report, provide an analysis of the water and recommend treatment and using their chemicals.

An alternate approach is to send the water samples to an independent testing laboratory for analysis and treatment recommendations. Of course, there is a fee for this service. While the vendor service is free, the cost of the analysis is included in the cost of the chemicals purchased from the company. ■

Cooling India

Monthly

The Subscription In-charge
Cooling India
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. CI/SUB/ ☐

Now SUBSCRIBE/RENEW Online Just Log on to www.coolingindia.in

Yes, I would like to subscribe **Cooling India** for.....years

at Rs..... (US $.....overseas subscribers)

Payment details :
Cheque / DD No.....Dated.....

Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

CI \ March 2015

Name.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

Email.....

Signature.....

No. of Years	Amount	US $	Tick ✓
❑ 1 (12 Issues)	1000	200	
❑ 2 (24 Issues)	1750	350	
❑ 3 (36 Issues)	2500	625	
❑ 5 (60 Issues)	4000	900	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

Medical Equipment & Automation

India's Premium magazine on diagnostic, medical equipment and technology

Bi Monthly

The Subscription In-charge
Medical Equipment & Automation
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. MEA/SUB/ ☐

Now SUBSCRIBE/RENEW Online Just Log on to www.medicalmagazine.in

Yes, I would like to subscribe **Medical Equipment & Automation**
for.....years at Rs..... (US $.....overseas subscribers)

Payment details :
Cheque / DD No.....Dated.....

Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

CI \ March 2015

Name.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

Email.....

Signature.....

No. of Years	Amount	US $	Tick ✓
❑ 1 (6 Issues)	750	150	
❑ 3 (18 Issues)	2000	500	
❑ 5 (30 Issues)	3000	700	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

An exclusive HVAC Mall at your fingertips!

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

A few of the advantages

Save precious time and energy: If you already know the specific things you wish to buy, for eg. A specific product/brand then online shopping is a convenient choice. Save time & energy for other tasks.

Save money: Get the best offers online as well as compare prices across sites in just a few clicks. Also save the cost of travelling to a store to buy items.

Secure Payment Systems: Online purchase has become safer and secure due to progress in technology.

At your Convenient Time: Online stores are available 24/7 so one can shop at his own convenient time.

Compare prices and features: It is very simple to compare products for features and prices across various sites with a few clicks.

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

Over the years, Infinity has developed a reputation for dealing in great products at honest prices. www.hvacmall.in is an extension of the same. Here they are enabling the customer to purchase online from the comfort of their home globally tested products of reputed brands.

Online shopping experience at www.hvacmall.in is easy, enjoyable and secure. It has a wide range of products from thermometers, vacuum gauges, vacuum pumps, data loggers, measuring instruments, manifolds, hand tools, water pressure pumps, etc.

A few of its benefits

- Their best prices – Infinity offers best prices at www.hvacmall.in
- Free Shipping – Get free shipping and that saves more money
- Cash on delivery- COD option is available within the city limits of Mumbai, Thane, Pune & Nashik
- Secure Payments – HVAC Mall is tied up with Infibeam, one of the largest online retailer and a premier technology provider in India
- Company backing – The online portal is run by the reliable and trusted Infinity HVAC Tools, so one has the backing and after sales support
- Top brands – All the best brands - Supco, Sievert, Refco, Mighty Mounts, Rex, Kyowa, Bacharach, well known in the industry for years
- Way to the future – The online retail industry is the way of the future, so step in & reap the benefits.

For further details contact:
www.hvacmall.in ■

budget

Post Budget Reaction of Ravichandran Purushothaman, President, Danfoss India and Chairman, CII National Taskforce on Cold Chain Development

This is a very comprehensive budget as it seeks to find a fine balance between inclusiveness and sustainable growth. It emphasizes on the bottom of the pyramid and increasing focus on savings in middle class. A pragmatic approach has been used which will steady our economy and keep inflation under check. While there is emphasis on Make in India, the measures for improving the skilled workforce in India like the setting up of a National Skills Mission for skill development and entrepreneurship at a cost of Rs. 1,500 crore and setting up of new Institutes will truly enable us to be skill-ready to become a global manufacturing hub.

On the agriculture front, the increased NABARD funding will fuel more rural growth and create more job creation in rural. Micro irrigation and " more crop per drop of water " including organic farming can fuel more investments. This creates foundation for setting up of more producer company (small farmers aggregation), eliminate middle men and build a full supply chain to deliver directly to end customer. The proposal to set up a National unified market for farm produce will encourage better farm to fork movement and fast track growth of the agricultural sector. Tax exemption for transportation of food grains and for certain pre-cold storage services will encourage more movement and value addition in the farm to fork sector. The renewed PPP Model where the Government will absorb majority risk will encourage private investors in the cold chain sector. With regard to GST reforms which is touted to be in place by April 2016, it will provide a major boost for the economy. The additional push of Rs. 70,000 crore towards infrastructure will be instrumental in matching our global ambitions. ■

Ravichandran Purushothaman, President, Danfoss Industries Pvt Ltd

Güntner offers ECOSS Stainless Steel Evaporative Condensers

ECOSS Stainless Steel Evaporative Condenser

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

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

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

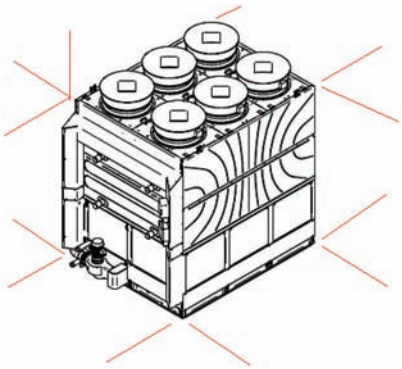
Traditional systems in the world today include a galvanized steel unit with a serpentine coil in the case of a condenser and a mesh in the case of a cooling tower. The use of galvanized steel has been around since the 1950s and owing to the material's large presence and lower price, is a very widely preferred base material for the manufacturing of an evaporative condenser. Some of the issues faced are:

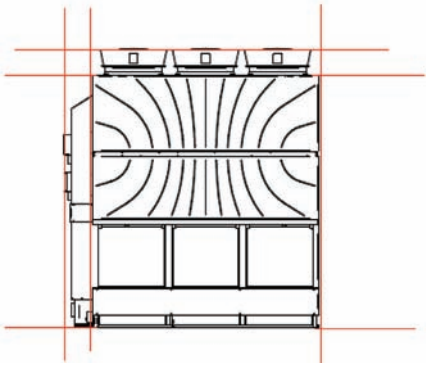
- More water usage is an expensive & environmentally harmful endeavour

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

Güntner Development

- Use Stainless Steel
- Make a more efficient system which uses less water and can run at higher cycles of concentration





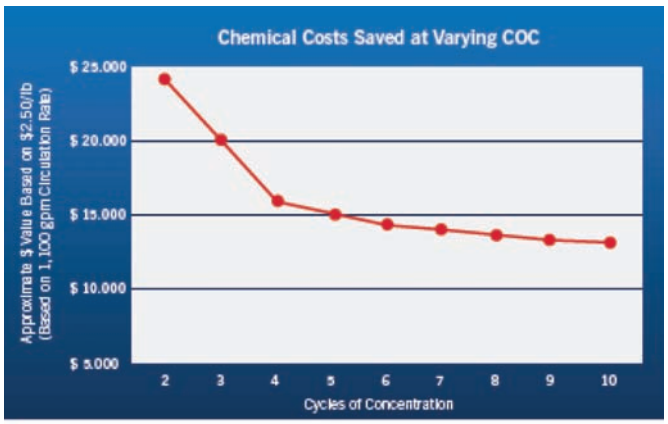
- Superior material which is self passivating, can work with less treated water and eliminates usage of chemicals
- Stainless Steel 304 has a low propensity to scale so water treatment and maintenance costs are significantly reduced
- Onsite installation is very easy (eliminates a lot of equipment and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

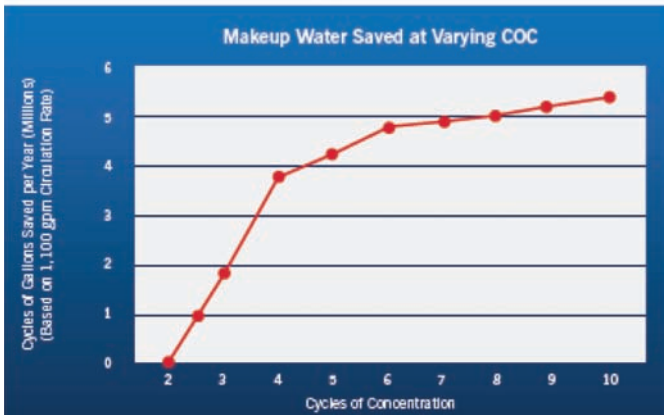
The Güntner ECOSS stainless steel evaporative condensers are a proof of our ecological commitment to environmental and industrial concerns.

Galvanized coatings incur the requirement of a lot of chemicals in the water treatment programs and new laws and more stringent regulations regarding the discharge of chemical waste means that the maintenance of the evaporative condensers has become difficult and expensive. Owners of the units have to keep all the above costs and regulations in mind while planning their facility and the decisions are made easier with the ECOSS.

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

The star of the unit's design is in the 304L stainless steel coil and casing which nullify any zinc or lead in the blow-down.



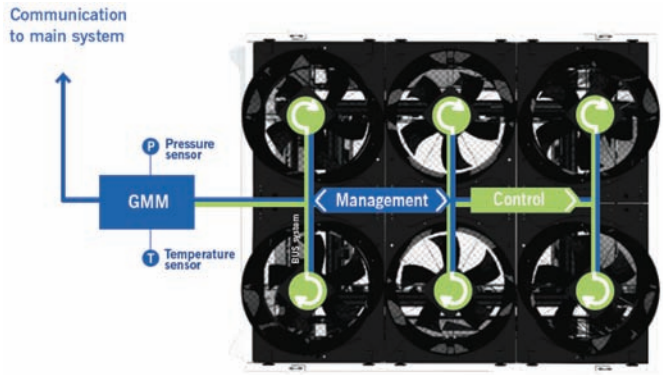


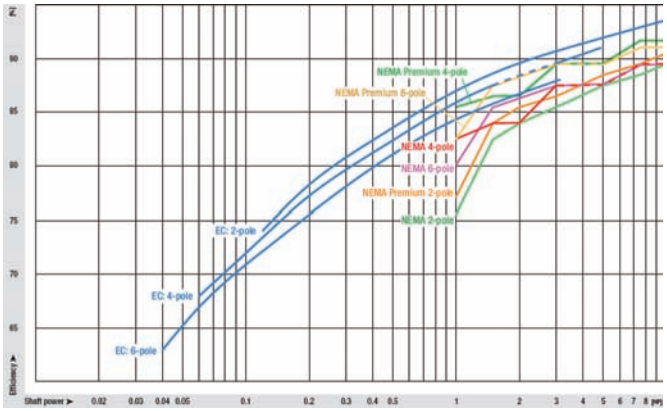
There is no white or red rust and thereby a major reduction in chemical cleaning agents usage.

The fans of the unit are single axis, direct drive fans. The motors being mounted directly on the impellars means taking out the transmission losses and degenerative losses incurred with a dual axis belt driven fan. Belt tightening, replacement and bearing and greasing of the motors are a thing of the past as the direct drive motors are self-lubricating with high efficiency bearings. The motors are available in both AC and EC technology and have a very good acoustic characteristic. The multiple fan motors provide increased redundancy and the open-able fan decks are extremely ergonomic for maintenance and checks.

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

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





EC motors are equipped with optimized power electronics, especially designed and developed for these motors. Compared to an AC motor, the motor of the EC fans have no windings in the rotor but instead have a permanent magnet. Due to this, there are no induction and slip losses in the rotor. Especially for speed controlled applications, the EC technology offers a larger variety of benefits like low capacity motor management, automatic parameterization, function and selective fan shut down. The flexibility of this on the ECOSS can be set by the factory itself so that the unit you get is a plug and play. Taking developments into consideration, the Güntner ECOSS advantage can be seen to be almost 70% more economically viable than the competition. ■

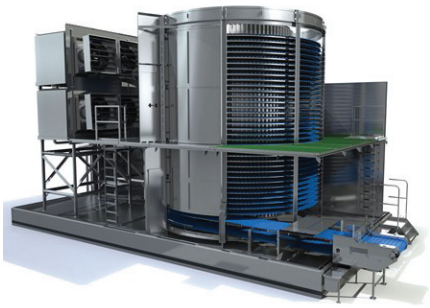
	10x12'	12x12'	10x18	12X18'
Power Spectrum in TR	212 - 328	304 - 414	288 - 475	456 - 633
Refrigerant	R717, R22 R134a, R507, R404a	R717, R22 R134a, R507, R404a	R717, R22 R134a, R507, R404a	R717, R22 R134a, R507, R404a
Range of Condensing Temp.	60°F - 110°F	6O^{O}F-110°F	60°F-110°F	60°F-110°F
Range of Wet Bulb Temp.	50°F- 86°F	50°F-86°F	50°F-86°F	50°F-86°F
Rows (no.)	6, 8, 10, 12	8, 10, 12	6, 8, 10, 12	8, 10, 12
Tube diameter	¾"	¾"	¾"	¾"
Coil Material (Tubes, bends, headers, connection)	304L Stainless Steel	304 L Stainless Steel	304L Stainless Steel	304 L Stairless Steel
Applicable Standards	ASME B31.5, CRN, ISO 9001	ASME B31.5, CRN, ISO 9001	ASME B31.5, CRN, ISO 9001	ASME B31.5, CRN, ISO 9001
Base Footprint (L x W x H (Ft.))	11'11-¾" x 9"9-¾" x 13"10-¾"	11'11-¾" x 11"10 x 13"10-¾"	18'4" x 9"9-¾" x 14"10-¾"	18'4" x 11'10" x 14"10-¾"
Shipping Weight (lbs.)	7751-9615	9924-11152	12195-160610	15481-18411

GEA Refrigeration Technologies at Anuga FoodTec in Cologne, from March 24-27 2015

On the occasion of Anuga FoodTec 2015 in Cologne, the international trade fair for the food and beverage industry, GEA Refrigeration Technologies will present selected solutions from its product portfolio. One highlight shown at the GEA fair stand will be the GEA Geneglace G100 ice generator, equipped with stainless steel components and offering a daily capacity of up to 2,500 kg of hygienic flake ice. A prime example of how mechanical engineering and control technology can effectively complement each other – when it comes to efficiency, reliability, and low total cost of ownership – is the combination of the GEA Grasso M screw compressor package with the new GEA Omni™ control system. The GEA Grasso M screw compressor package offers maximum cooling duty of 860 kW (at 4,500 rpm). Its compressor is efficient, rugged, and yet modest when it comes to maintenance requirements. The GEA Omni™ control system contributes additionally to low total cost of ownership and high levels of availability - not least by promoting modest power requirements and stable plant operations. A key feature of the GEA Omni™ is its high-definition touch screen (color display with 1366 x 768 pixels), which is intuitively operated with single-finger and multitouch actions. The GEA Omni™ control system can likewise control other compressors – and even complete refrigeration facilities – and is also able to integrate components from other manufacturers. In addition, GEA Refrigeration Technologies introduce the new S-Tec range of spiral freezers and coolers. S-Tec spirals are available as single and twin drum versions in a wide range of infeed and exit configurations. ■

Lean and thrifty: the GEA Grasso M screw compressor package.

Simplifies efficient and safe operation of refrigeration systems: the GEA Omni™ control System.



Visualization of a single-drum type of the new S-Tec freezer / cooler

Mitsubishi Electric US Cooling & Heating Division Promotes John Gabilondo to Vice President of Operations

Mitsubishi Electric US Cooling & Heating Division (Mitsubishi Electric), America's selling brand of ductless cooling and heating systems, announced the appointment of John Gabilondo as vice president of operations.

In this role, Gabilondo directs the division's efforts to exceed business goals throughout all levels of customer support and service, inventory planning, warehouse operations and both the domestic and overseas supply chain. He is responsible for the strategic planning and implementation of enhanced operational practices, in addition to serving as a liaison to other functions within the organization. "We're pleased to have someone with John's dedication and expertise leading our operations team," says Allan Dziwoki, senior vice president, sales, marketing and operations, Mitsubishi Electric US Cooling & Heating Division. "John's leadership, experience and proven track record within our organization will serve to benefit us as we continue to strengthen and expand our efforts."

Throughout his 19-year tenure with the Cooling & Heating Division, Gabilondo has developed and led strategic initiatives for the division's infrastructure, operations and logistics and supply chain. He has played a central role in the implementation of improved management systems, accountability programs and financial growth across all facets of the organization. Before joining Mitsubishi Electric in 1995, Gabilondo oversaw operations and customer relations at Graco, Inc., Los Angeles, Parker & Sons Publishing, Los Angeles and Zale Corporation, Dallas.

John Gabilondo

"I'm honored to accept this position and continue my career within a company that is dedicated to providing its customers with superior HVAC solutions," says Gabilondo. "I look forward to building on and developing the division's operational infrastructure to further support our planned growth."

Gabilondo holds a Master of Business Administration from the University of Phoenix, and a Bachelor of Science from Louisiana State University, Baton Rouge, La. ■

Hitachi appoints Ichiro Iino New Chief Executive for Asia Pacific

Hitachi, Ltd, announced the appointment of Ichiro Iino as Chief Executive for Asia Pacific who will be responsible to grow Hitachi's "Social Innovation Business" in ASEAN, India, Korea and Oceania.

Iino will succeed Kiyoaki Iigaya, who is returning to Japan to assume the post of President of Hitachi Document Solutions Co., Ltd. He will also take over the role as new Chairman of Hitachi Asia Ltd, and Hitachi India Pvt. Ltd, from Iigaya. Both appointments will be effective April 1, 2015.

Under the 2015 Mid-term Management Plan, Hitachi aims to achieve an overseas sales ratio of more than 50%, while expanding business in the global market for its Social Innovation Business. In addition to having overall responsibility for regional profitability, Iino will have the authority to make investments in new business areas where growth is expected and will be accountable for achieving positive returns on these investments. This is part of Hitachi's transition to an "autonomous decentralized global management" structure in which each region is able to lead its business autonomously. Iino most recently served as Managing Director of Hitachi India Pvt. Ltd, and has been proactively expanding business opportunities in India for the past four years as the first Managing Director. In this short period of time, he has successfully transformed Hitachi India into a full-fledge regional headquarter by restructuring the organization to generate new businesses addressing regional needs. He also led Hitachi group companies in the South Asia region under the "One Hitachi" initiative, to provide customers with the full value chain of services as one entity.

Ichiro Iino

In his new role, Iino will be responsible for business development in four key areas: healthcare solutions, collaborative solutions with developers and conglomerates, and home appliance business targeting the B2B market, and financial solutions. ■

Emerson Climate Technologies, India launched a Slew of New Products at Acrex 2015

Emerson Climate Technologies, a business segment of Emerson, recently launched three products for the India market. The Residential Variable Speed Compressor & Drives, Multi Compressor Pack and Semi-hermetic Water Cooled Condensing units were unveiled at the prestigious ACREX India 2015 in Bengaluru.

Sridar Narayanswami – Vice President & Managing Director, Emerson Climate Technologies, India said, "As expectations for quality of life continue to rise, there is a growing need for reliable and efficient refrigeration technology to keep food safe during production, processing, transportation, and storage, leading to improved food quality and human health." He added, "We are now introducing locally built, large refrigeration systems like Multi compressor Pack, Semi-Hermetic, Scroll & Reciprocating Condensing Units that are energy efficient and can reliably meet the growing needs of large cold storages in India."

Refrigeration Solutions

The Emerson Multi Compressor Pack (EMP) Refrigeration systems in 2, 3 & 4 compressor configuration comes assembled with a choice of compressor technology – Copeland Scroll™& Semi–Hermetic compressors. EMP also comes equipped with factory installed components that include HP/LP cutout switches, Complete Oil Management Systems and Controls to ensure safe management of the systems.

Emerson also launched the new Copeland™ Semi-Hermetic Water Cooled condensing unit with its range extending from 0.7 to 50 HP for low, medium and high temperature applications. These condensing units have been designed by employing the highly efficient shell and tube heat exchangers along with Emerson's proven range of high efficiency Copeland Semi Hermetic compressors. These can be adopted as an option to air cooled units where its compact size allows for use in applications where space is a constraint.

Also, on display were the Semi-Hermetic Condensing Units manufactured in the range of 5 to 40 HP at the Emerson Cold Chain & Distribution Center, Chakan, Pune. These condensing units come equipped with dedicated medium or low temperature compressors which make them suitable for all general refrigeration applications, such as supermarkets & hypermarkets, hotels, restaurants & food service and cold rooms, storages and pre – cooling.

Emerson Condensing Units have been well received in the Indian market by virtue of their robust and reliable design. Long-term engineering and manufacturing experience has led to this complete range of condensing units featuring Semi-Hermetic reciprocating compressor technology. With these products, Emerson now offers the widest range of locally built Semi -Hermetic condensing units for commercial and industrial refrigeration applications in India.

Air Conditioning Solutions

In the air -conditioning segment, the residential variable speed compressor was launched. These compressors offer customers environmentally responsible refrigerants. The Variable Speed compressor highlights were -

- Expansive 900-7200 RPM speed range for enhanced light load efficiency and dehumidification.
- Highest part load efficiency in its class enabling significant energy saving and future India inverter standards compliance.
- Patented 6 pole/9 slot concentrated brush-less permanent magnet motor enhances the energy efficiency
- Use of variable volume ratio (VVR) Scroll sets boosts the system COP at both high and low pressures.

Emerson Climate Technologies displayed its range of Dixell electronic controls and flow control products as well at the ACREX Expo, showcasing its integrated range of solutions for the AC, heating and refrigeration sectors.

ECT & ISHRAE Renew Online University Program

At ACREX 2015, ISHRAE Emerson Online University program MoU was renewed between Emerson Climate Technologies India & ISHRAE for 2 more years. The agreement was signed by ISHRAE National President – Nirmal Ram & Sridar Narayanswami. The agreement envisages Online University as a free e-learning platform targeted at dealers,

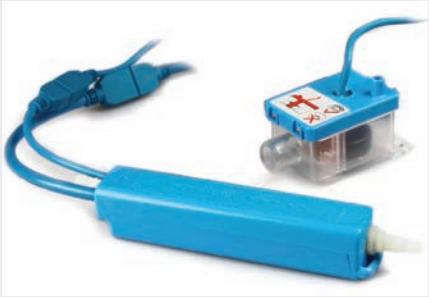
contractors, technicians and other HVACR professionals. It entails participants covering specific modules and taking the online examination. Successful participants represented with 'Certificate Of Course Completion' at the end of the program. ■

Tapping a valuable resource

As water becomes an increasingly precious resource, using it in a sustainable way that minimises waste has become critical. Grey Water is the most commonly used type of water in the world, and it is also the most wasted on a daily basis. It is defined as water that is created through wastewater in the home, excluding toilet water (or black water.) We unknowingly generate up to 140 gallons of it every day when we have a shower or bath, or use the washing machine or dishwasher. It is a common misconception that grey water cannot be recycled, when in fact in can be used to wash clothes, water the garden, keep our cars cool or water a constructed wetland. Commercial and domestic air conditioning is becoming more and more commonplace. Wastewater or condensate water is generated as warm air is cooled by the air conditioning system and humidity in the air forms condensation. This condensate is then collected in the unit and traditionally is then pumped outside into a drain where other wastewater is sent, or drained straight out of the building using gravity. A standard air conditioning unit will produce on average 5475 gallons of grey water a year; that's enough to fill 110 bathtubs, wash a car 547 times, do 138 loads of washing, or could flush a toilet 2737 times per year!

In the past, removing condensate water from an air conditioning unit was a challenge and was often not viewed as being economically viable. However, as the search to discover innovative ways to recycle water gathers pace, and with more people looking to air conditioning systems to keep their homes cool, the theory of recycling the grey water generated from air conditioning units has become a reality. With the right drainage systems and correct pumping methods, it is entirely possible to have sufficient recycled grey water to significantly reduce water bills and help sustainability.

Aspen Pumps is a company which is at the forefront of innovating AC grey water recycling and has been providing water condensate removal solutions to the industry for over 20 years. Being able to reuse grey water is imperative to ensuring that Aspen, and other companies involved in this area, work in a way that protects the environment. With water becoming scarcer in many regions across the globe it is critical that people are offered the tools to reuse their grey water. Aspen offers a range of pumps that will lift the water up and into storage tanks, outside water butts, and other water drainage systems, which means that the water can then be reused and recycled as appropriate.



Traditionally, gravity drain systems have been used to recycle water through drainage into storage tanks where it can then be recycled. However, gravity drain systems can only work if there is sufficient space when installing an air conditioning unit, or attempting to drain the water into a water recycling unit. Draining the excess water into a bucket or straight out the window onto the exterior wall was common installation practice, simply because there wasn't a better way available. Since then, the development of efficient pumps in this market has allowed installers to fit a pump either in, on or above the air conditioning unit allowing the water to be pumped up and away from the unit without the need for gravity. Ultimate flexibility is guaranteed, as AC units can now be placed as desired by the home owner/builder, instead of placing the unit close to an outside wall which is a requirement for gravity drainage.

In buildings where space is an issue and water recycling is more difficult, air conditioning systems connected to a water recycling tank with a pump means that an average tower block with 150 flats could recycle up to 22,500 gallons of water per month. That's enough water to fill a 21ft swimming pool! With over 80 million air conditioning units being sold in America and 50 million in China annually, if every one of those people who bought a unit used a condensate water pump to save water, there would be a saving of over 700 trillion gallons of grey water per year.

The newest pumps, such as Aspen's, have the ability to pump grey water up to a height of 20 metres, meaning that the water can be pumped into a roof top storage tank and reused for washing clothes, washing cars and watering gardens. This creates fantastic sustainability opportunities. Aspen Pumps Hi-Lift 2 litre Tank pump can pump up to 12 metres of head and has a flow rate of 11 litres an hour. This would be more than enough to transport water from an air conditioning unit to a water storage tank ready for recycling.

Whatever the country or environment, if there is an air conditioning unit then there is an opportunity to tap a valuable source of recyclable grey water. The average person uses 140 litres of water per day with only approximately 5-10 litres of this is used for drinking and cooking. With this in mind, with the right pump, trunking and accessories the average household will reap huge benefits from water sustainability opportunities and economic savings. ■

For more information contact:
sales@aspenpumps.com
www.aspenpumps.com

Refrigerant Recovery Unit

Recover all commonly used refrigerants (CFC,HCFC,HFC),includind R410A.
1/2 HP&1HP,oil-less compressor recovers both vapor and liquid refrigerant quickly.
Heavy duty industrial grade condenser and cooling fan.
Oil separator device for recyling refrigerant.
High pressure safety Shut-off switch.
Fiter/Drier removes both moisture and acid from the refrigerant.
Ergonomic and compact design makes it easy to carry and use.
Design fo residential,commercial and automotive A/C system.
Optional 80% capacity shut off kit to prevent from overfilling the storage tank.
Suitable for all the main voltage standard in the world. ■

Website:www.aitcoolinc.com

Vacuum pump

Designed specially for HVAC/R service.
Ultimate deep vacuum:single stage is 2Pa,while dual voltage is 2×10 ⁻¹Pa.
Compact design with aluminum housing and easy to carry.
Thermal protector in the motor guarantee the pump to run steadily.
Both 1/4" and 3/8" SAE flare inlet connections allow for flexibility of connections.
Vacuum pump oil included.
Individual design for special customers.
Suitable for all the main voltage standard in the world. ■

Wenling AITCOOL Equipment Co.,Ltd
Xiazaiwu Industry Zone,Shiqiaotou Town,Wenling City,Zhejiang,317500,China
Tel: 0086-576-81622550 Fax: 0086-576-81622660
E-mail:sales@aitcool.com
Website:www.aitcoolinc.com

Refrigerant Recovery System

Recovery/recycle/vacuum/charge
Electron balance protection system for impact absorption
Large size dual condenser installation
Large size graphic lcd(240×128)
Work progress red wheel basis installation
Operating method is easy progressive form display screen and membrane keyboard
Fine digital electron balance(10g/50kg)
Core type large size dry filter
High temperature/high pressure compressor for only refrigerant
Station vacuum pump full automatic injection function
Automatic discharge function for waste oil
Automatic air purge/tank safety valve system
Automatic refrigerant transfer and tank receipt
Overpressure power prevention and inside protection system
Refrigerant injection amount memory function for all models of car
Multilanguages support
3"1/2 inch large size gauge only for refrigerant (made in china)
16kg recovery tank 3000mm high pressure hose only for refrigerant
SD card to enter the vehicle with infinity,and other infrormation refrigerant(Easy upgrade) ■

Website:www.aitcoolinc.com

AITCOOL

Aitcool inc.,founded in 2007, is a professional national High-Tech enterprise,specializing in researching, developing and manufacturing refrigeration tools for HVAC/R,with an annual capacity of 30,000 refrigerant recovery machines and 200,000 rotary-vane vacuum pumps at present.AITCOOL has the most professional mechanical, electrical, refrigerating senior engineers.

In March 2008, AITCOOL achieved the invention patent of refrigerant recovery machine;

In October 2008, our refrigerant recovery machine project was approved by Ministry of national science and technique.

In October 2010, AITCOOL was honored as national High-Tech enterprise;

In September 2011, Our automatic refrigerant recovery machine project was approved by National Economic Commission.

With the high quality and advanced technology, the joint efforts of all our colleagues, which guarantee AITCOOL healthy development over a long period,All products have obtained china patents and got theEuropean CE,American UL certificate,CSAcertificate,etc.,and also achieved ISO9001 certificate, exported to more than forty countries,including USA, South America, EU, Australia, Southeast Asia, Middle East, Japan,etc.. our products with high quality and competitive price is no doubt your best choice. ■

Website:www.aitcoolinc.com

Datacenters – evaporative humidification and cooling from Carel Industries S.r.l.

The need to humidify datacenters is due to the possibility that the accumulation of static electricity can damage the electronic components in the computers when discharged. The risk is much greater when the air is "dry", that is low humidity. The physical explanation of the phenomena is that levels of humidity exceeding 40% produce a very fine film of liquid on surfaces, which discharges any electrostatic charges produced to earth and thus prevents the accumulation of the electrostatic charges, which can be dangerous. Moreover, the liquid film reduces friction due to rubbing and therefore the generation of electrostatic charges. Low humidity levels are frequent in datacenters due to the generation of heat by the electronic equipment, which have several kW power per square metre of floor plan. By heating the air the relative humidity decreases, thus increasing the generation of static electricity. Datacenters are also appearing that make maximum use of the potential for free cooling, where necessary enhanced by a direct and indirect evaporative pre-cooling unit. ■

For further details contact:
www.carel.com

Jupiter Electronics brings Low Cost OEM Pressure Transmitter

The M5100 series from Measurement Specialties sets the price/performance standard for transducers used in demanding environments. The pressure port is machined from a solid piece of 17-4PH stainless steel (3 16L optional). There are no O-rings, organic or weld exposed to the pressure media. This allows for a leak proof, all-metal sealed pressure system which withstand more than 10 millions pressure cycles without failure.

Features
It is Heavy Industrial–High EMI Rated and Heavy Industrial CE Approval; it has Extended Temperature Range and -40°C to +125°C Operating Temperature Range. ■

Website:
www.jupiterelectronics.com

Stainless Steel Road Milk Tankers from Surakhsha Transport

Stainless Steel Road Milk Tankers are offered by Surakhsha Transport Systems India Pvt Ltd, are of double wall construction with 100mm PUF Insulation between the inner tank and the outer tank. The inner tank will have high degree of polish finish for Milk storage and transportation. PUF insulated tank is capable of transporting chilled milk at 3°C to 4°C and the average temperature drop of milk in a fully filled tank in a day will be less than 2°C. CIP cleaning arrangement will be provided for regular water cleaning and maintenance of the tank. Road Milk tanker can be supplied with single/double/ triple compartments and capacity in the range of 4000L to 21000L based on the chassis selected. ■

Website:
www.surakhsha.in

Sea-Bird Refrigeration offers Air Cooled Condensing units

Air cooled condensing units with Semi-Hermetic Reciprocating Compressors by Sea-Bird Refrigeration Pvt Ltd.
Compressor for three phase current.
Compressor for single phase 230 V/1/50Hz with fitted starting device and run capacitor.
Condenser with grooved copper tubes and Aluminium Fins.
High and Low pressure cut-out including mounting brackets, wired to terminal strip, Electrical wiring to the connection box IP65.
High cooling capacity with reduced power consumption.
Full exploitation of the finned package due to careful matching of the high capacity external rotor fans.
Fans with especially efficient low noise external rotor Motor single phase.
Designed for extremely high ambient condition up to 65^{0}C/75^{0}C.

Options
Oil Separators, non-return valve, safety valve, crankcase heater.
Pressure gauges, filter drier, solenoids valve, suction accumulator.
Moisture Indicator, Fan Speed Controller and 3 Phase Fan. ■

Website:
www.amoking.com

INSUshield (Formerly SIL-XL-C) from Supreme

INSUshield is a non-fibrous, fire retardant, closed cell, tri-dimensional chemically cross linked polyethylene foam. Conforms to 'Class O' for Fire Propagation and 'Class 1' for Surface of Flame. It is an ideal environment friendly material, with a perfect solution for all the thermal insulation needs.

Features and Benefits

Class O in fire propagations and Class 1 in surface spread of flame;
More than 90% closed cell-Negligible water/moisture absorption;
Wide operating temperature range from-40^{0}C to +115^{0}C;
Low and stable 'K' value; chemically inert; Resistant to growth of fungi and vermin; Non-fibrous and non-toxic – non – irritant. No risk of airborne fibers contaminating indoor air quality; non-carcinogenic with environmental and user friendly; weather resistant and shock proof;
Ease of use and maintenance free; emits non-toxic smoke.
Applications: AC/Humidification Duct insulation; Under deck insulation; Pipelines; Acoustic flooring etc. ■

Website:
www.supreme.co.in

Seungil Electronics offers Stand Alone Type

AH series products are stand-alone electrode type humidifiers that are designed as the control box integrated structure for user convenience. The products consist of the standard type products with the capacity of 2.0kg/h and non-standard products with the capacity of 91kg/h -360kg/h. They can be easily installed on AC units in places where humidifiers are needed. The humidity sensor attached to unit allows automatic operation and proportional operation by utilizing the external relative signal or humidity value.

Features

Precise Control / Auto draining; Repulsion start type Pump; Various capacity; ON/OFF, proportional control; Safety / Reliability. ■

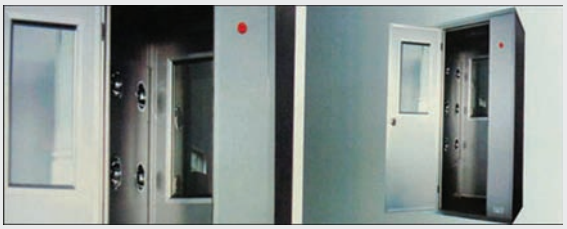
Website:
www.si-tec.co.kr

X3 Series air coolers

Xtreme Cooler™ is ideal choice for applications where extreme heat is encountered and in large facilities where refrigerated air is considered to be expensive. Designed to cope with the harshest conditions, Xtreme Cooler has a range of benefits, like Suitable for upto 2000 sq ft area. It has streamline design, durable and elegant appearance with swirl designed outlet, easy to let off waste.
Integrated triangle water distribution structure to make the water distribution evenly.
Damper to prevent warm air-leakage in winter and intelligent LCD control.
UV-proof, anti-corrosion, anti-aging & resistance to deformation high strength polymer body.
Specially designed axial fan with large airflow, low noise and energy-saving design. High quality aluminum housing waterproof motor. High performance Greenkol cooling pads. ■

Website:
www.xtremecooler.com

Air Shower by Integrated Clean room Technologies Ltd



Air Shower is a self-contained air chamber installed at the entrance to cleanrooms in order to minimize the amount of particulate contaminants entering the cleanroom. Personnel move through the air shower while particulate contaminants are washed off with high velocity HEPA-filtered air jets. The high air velocity of 6000 FPM ensures efficient scrubbing action necessary to remove particulate matter. Contaminated air is then taken in through the base of the unit, filtered, anad re-ciculated into the chamber.

Two stage filtration: EU6 and EU 14.
SS 304 doors with double walled flush glass view panels and door closer.
Air Cleanliness: ISO Class 5 (ISO 14644 – 1 : 1999 (E).
Air Velocities: 6000 fpm.
Vibration Level – minimum.
Noise Level: Less than 70 dB. ■

Website:
www.icleantech.com

Flash Defrost Technology: latest developments by Frigesco at CleanEquity Monaco 2015

CLEANEQUITY MONACO2015

FRIGESCO™ DEFROST TECHNOLOGY

Frigesco was invited to present the latest developments in its transformational flash defrost technology at CleanEquity Monaco 2015 event, which takes place on March 5-6. Frigesco's system works by harnessing waste heat from refrigeration systems to carry out very low energy defrosts, in the process reducing supermarket cooling energy costs by up to 20 percent. The technology won a string of awards and is currently undergoing field trials in working supermarkets in the UK, South Africa and the US.

According to Frigesco, the system has wider application, and it has recently secured UK government support in the form a Department of Energy and Climate Change (DECC) grant to develop system for use in air source heat pumps (ASHPs).It will be used to fund joint research by Frigesco and heat pump specialist Glen Dimplex to develop flash defrost technology for application in ASHPs, themselves a clean-tech for sustainable heating and cooling, with major growth potential due to their exceptional efficiency.

Clean Equity Monaco's expert panel has identified Frigesco as one of the world's most innovative clean-tech companies, and selected it to present its technology to senior financial and strategic clean-tech investors, policy makers, legislators and end users.

David Walter, Managing Director of Frigesco, said, "It is another important step in our journey to develop and communicate the benefits of flash defrost. The results from the first field trials are now beginning to come back, and as anticipated prove the outstanding efficiency of the system.

He added, "We are now talking to some of the world's largest retailers and manufacturers about the next steps in implementing flash defrost. After four years of research and development and proving trials, we believe 2015 will be an important year for us and provide the springboard for commercial take off."

Frigesco Directors: Robin Campbell, Richard Willmott, Tom Davies, David Walter and Bob Arthur

Event was hosted by London-based investment bank Innovator Capital. The high profile supporters and sponsors include Cranfield University, Prince Albert II of Monaco's Foundation, Covington & Burling, Porto Novelli, PR Newswire, and Monaco Chamber of Economic Development. The annual gathering gathered innovators, policy makers and investors from across the world to discuss the most promising new clean technologies. ■

ACREX India 2015

Less Energy = More Life for a Greener Tomorrow

Acrex India 2015 initiated with the theme Less Energy = More Life which had 360 degree approach for having a greener tomorrow and to reduce the use of energy. The event is growing phenomenally every year and has marked itself as launch platform for the HVAC & R industry and many International Organizers such as UNEP, CIBSE, REHVA, EBTC, AMCHAM, US Commercial Services, VDMA Germany, KRAIA Korea and CAR China to network with the Indian Industry. ACREX India 2015 created new benchmarks by developing on these industry associations. The expo also got support from the prestigious Indian associations like IGBC and BEE. Organized by the Indian Society of Heating, Refrigeration and Air Conditioning Engineers (ISHRAE) and produced by NuernbergMesse India Pvt. Ltd, was held from 26–28 February 2015 at Bangalore International Exhibition and Centre (BIEC), the LEED Certified Green Exhibition Centre, with over 40,000 sq mt spaces.

At the inauguration of Acrex 2015

The inauguration started with lighting of lamp by Thomas H Phoenix, President ASHRAE, P.E, Fellow ASHRAE, ASHRAE-Certified Building Energy Assessment and Building Energy Modeling Professional; Pawanexh Kohli, Chief Advisor, NCCD; Arvind Surange; Anand Joshi, AAR at Strategy Conference Room, Vivanta By Taj, Yeshwantpur, Bangalore.

Nirmal Ram, President, ISHRAE, highlights "Bangalore is a home to 39 green buildings out of a total of 41 in the state of Karnataka. Besides, in 2013, Bangalore's construction industry saw a growth trend as compared to other metros with many new launches, good demand and resilient prices. With increasing need for energy efficient HVAC & R solutions, it is just the right time for ACREX India 2015 to come to Bangalore."

The event brought huge opportunities to the Indian entrepreneurs with 400 exhibitors and nearly 30,000 visitors participating from over 25 countries from Canada, China, Czech Republic, France, Germany, Hong Kong, Italy, Japan, Korea, Netherlands, South Korea, Taiwan, Thailand, Turkey, Ukraine, UAE, United Kingdom, and USA. The event covered broad spectrum of products and state – of- the – art cutting edge technology with the latest trends and know-how which was accompanied by technical workshops, educative seminars presentations and conferences by elites of the industry on Refrigeration and Cold Chain made an educative efforts to enhance the event.

The topics covered during the workshops such as Acoustic Considerations in HVAC Systems by Dr.S Rajagopalan; Designing High Performance Healthcare HVAC Systems by Walter N. Vernon & Dick Moeller; Open Communication Protocols for Optimizing Building Operations by Dennis D. Kelsey. A key note address was given by Pawanexh Kohli on Cold Chain Scenario in India during the Cold Chain Seminar followed by the inauguration; a seminar on Transport Refrigeration - For Primary & Secondary Distribution by Srinivasan G K; Emerging prospects in Banana Value Chain through Ripening by Srinivas Reddy M; Net Zero Energy Cold Storage by Arvind Surange etc. It also gave the professional visitors an in-depth knowledge about the technical and scientific subjects with exchange of knowledge and ideas at global standards.

Microgroove: Changing the game of ACR OEM product design

Thermobreak Acoustiplus at Display at Sekisui booth

Keenly watching the products at Carel booth

Visitors at Greenheck Stall

An exterior view of Guntner booth

Hitachi: Inspiring the next

The visitors profile included Architects, Interior Designers, Builders, Contractors, Project & Facility Managers, MEP Consultants, Developers, Manufacturers, Distributors and end users from Private and Public sectors, HVAC&R Consultants Contractor, Service Personnel and the seminar ended with a panel discussion on Challenges Faced in COLD Chain- a Sunrise Sector in India. "ACREX India is currently South Asia's biggest exhibition for air conditioning systems, cooling systems and building services. It has become an all-embracing, high-quality and professional exhibition. Together with Bangalore's rapidly developing building industry, ACREX India is the ideal platform for industry and business to get to know the sector's latest technologies," said Madhava Rao, Chairman of ACREX India 2015.

Energy efficient solutions from Danfoss

Danfoss India showcased energy efficient solutions for the dairy and cold room industry at ACREX 2015. A key enabler in the farm-to-fork processes such as packaging, processing and transport, Danfoss manufactures sustainable technologies which help save energy and costs in various industries including dairy and cold rooms. Through its key distributors (Hindustan Refrigeration stores, Alpine Refrigeration and Shravan Engineering) the company exhibited latest energy efficient solutions such as Optima Slim Pack condensing unit, MLZ ,LLZ compressors, Electronic Controllers, Industrial Refrigeration Valves and line components, Micro Plate Heat exchangers, Freon controls and Valves.

"We are pleased to be part of ACREX 2015 expo as this is one of the biggest platforms to increase awareness and the importance of energy efficiency among stakeholders in the industry thereby enabling and building a sustainable future for India. Our technological prowess in the field of energy efficiency has helped us in our endeavour to combat climate change by engineering eco-friendly products for a better tomorrow," said Ambat Rajesh Premchandran, Vice President, Refrigeration & Air Conditioning, Danfoss Industries Pvt. Ltd.

German Pavilion

German Pavilion which was officially supported by Ministry for Economy. The Federal Ministry for Economy and Energy (BMWi) in cooperation with the Association of the German Trade Fair Industry (AUMA) are supporting a German group participation, giving 10 companies the platform to present their excellent products and extended a warm welcome to all visitors of the German Pavilion in Hall 2A Lower Level, Stand No. 160. Exhibitors from German Pavilion were Güntner GmbH & Co. KG which showcased Air Cooler Cubic Vario AGHN, Air Cooler Cubic Compact GACC and Air Cooler Compact Slim GDF. HERMETIC-Pumpen GmbH offered Canned Motor Pump Type CNF, CAM and CAMR. LEITENBERGER Mess- u. Regeltechnik GmbH introduced Thermometer, Pressure Gauges and Manifolds etc and thermofin GmbH displayed Hybrid Dry Coolers THDD, Insulated Coolers and Penthouse Coolers TIx.

SMART Home

For the emancipation of industry and the participation of Smart Home Companies the organizers created a special "Smart Homes Pavilion. Smart Home is a residence equipped with computing and information technology devices that anticipate and respond to the needs of the residents; thus, working towards enhancing their comfort, convenience, security, and entertainment through the upgradation of technology within the home. According to market observers, the home automation market in India is growing at a compound annual growth rate (CAGR) of 30 percent with applications such as security, lighting and energy management likely to play an important role in achieving this significant growth rate. Automation and control systems form a very important product segment of ACREX India.

Prana

Prana is a permanent exhibit installed at BIEC and was executed by ISHRAE in 2012. It illustrated how home and office spaces can be made itself a sustainable. It has air-conditioning using geo thermal energy (earth air tunnel system), radiant flooring, efficient water & lighting fixtures, use local & recyclable materials which sensitizes visitors on their ideal future sustainable lifestyles without compromising modern day comfort.

With such a successful execution of ACREX India 2015, they are all set and ready to conducted ACREX INDIA 16 at the Bombay Convention and Exhibition Centre (BCEC), Mumbai, India with the new focus on diverse Building Engineering Services that include Fire & Safety, Electrical & Plumbing Services Building Automation and the ever growing Cold Chain Industry. ■

Toshiba wins top accolade for pioneering leak protection system at National ACR Awards 2015

Toshiba Air Conditioning, a division of Toshiba Carrier UK Limited, achieved a double triumph in the National ACR Awards 2015. The company won the prestigious Air Conditioning Product of the Year Award for its pioneering refrigerant leak detection and isolation system. It was also highly commended for its high profile marketing campaign in the Marketing Initiative of the Year category.

Toshiba's total refrigerant management and containment system provides complete assurance for end users, building occupiers & the environment. In the event of a refrigerant leak, it isolates the section of pipework containing the leak, enabling the rest of the system to continue functioning as normal.

Jill Kay, national accounts manager at Toshiba Air Conditioning, receives the Highly Commended award for Marketing Initiative of the Year

Conventional approaches shut down the entire system in the event of a leak, impacting air conditioning service throughout a building until the source of the leak can be identified and repaired. The new technology means that only the immediate area served by the compromised circuit suffers loss of service. David Dunn, General Manager of Toshiba, says, "I am delighted that the judges recognised the technology as a major step forward, both for the industry and end users. The benefits are compelling, from a commercial, occupant and environmental point of view."

The system is particularly valuable for use in applications such as hotels and multi-tenanted buildings, where in the event of a leak it enables unaffected areas to continue functioning as normal. A number of national hotel chains are now specifying the system as standard for new and refurbished projects. The technology uses a number of "isolation cells" throughout a building, and constantly monitors refrigerant content within the air conditioning system. In the event of a major leak, it automatically initiates a full pump down of refrigerant, delivering the ultimate fail-safe condition.

David Dunn (centre), Toshiba Air Conditioning's general manager, receives the award for Air Conditioning Product of the Year at the National ACR Awards 2015

Toshiba's received the marketing accolade in recognition of its multi-channel campaign over the past two years to raise its profile across the industry. This has involved a high profile public relations campaign, creation of a suite of smart phone apps, a library of instructional videos, new system design and calculation software, BIM icons for use in system design, successful entries for industry awards, & targeted newsletters aimed at contractors & consultants. ■

J and E Hall Gold Medal

Nominations for 2015 are now open. Deadline for nominations is 15th October 2015 This internationally respected award recognises the most noteworthy practical contribution to the field of refrigeration. The award, which has been sponsored by J&E Hall consistently for 38 years with a prize award of £5,000, is open to individuals or teams with recent outstanding achievements in one or more of the following areas:

- Practical applications of innovative designs
- Projects which have made an original contribution to the field
- Systems which demonstrate substantial potential and evidence that they will be completed successfully
- Outstanding & significant work in a new or unusual area. ■

Index to **Advertisers**

Declaration FORM IV

Statement about ownership and other particulars of the newspaper entitled COOLING INDIA

1. Place of Publication : 311, Raikar Chambers, Govandi (East), Mumbai - 400 088.
2. Periodicity of Publications : Monthly
3. Publisher's Name : Pravita Iyer
   Nationality : Indian
   Address : As above
4. Printer's Name : Pravita Iyer
   Nationality : Indian
   Address : As above
5. Editor's Name : Gopal Krishna Anand
   Nationality : Indian
   Address : As above
6. Name and addresses of individuals who own the newspaper and partners or shareholders holding more than one percent of the total paid up capital
   - Mahadevan Iyer, 311, Raikar Chambers, Govandi (E), Mumbai - 400 088.
   - Pravita Iyer, 311, Raikar Chambers, Govandi (E), Mumbai - 400 088.
7. I, Pravita Iyer, hereby declare that the particulars given above are true to the best of my, knowledge and belief.

Mumbai
15th March, 2015

Sd/-
Pravita Iyer
Sign of Publisher

Is this the ultra-efficient refrigerator of the future?

The classic refrigerator is one of the most power-hungry appliances in the home. Phononic is hoping to change that with a new solid-state refrigerator that is more reliable, greener and quieter than most modern refrigerators. It could just be the future of refrigeration. Many computers and accessories have stared using solid state drives because they are less susceptible to shock in addition to being faster, smaller and quieter than standard hard drives. So Phononic decided to apply that same technology to appliances – most notably, refrigeration. Most refrigerators rely on compressors to release refrigerant into the guts of the fridge to keep everything cool inside. Besides the fact that refrigerant is toxic, it's not super efficient. So Phononic replaced that bulky compressor with a compact thermoelectric semiconductor, taking advantage of the efficiency, size and quietness of solid state technology. ■

Awesome Clay Refrigerator Requires Zero Energy to Keep Food Cool

An Indian entrepreneur has created a refrigerator made entirely from clay that keeps food cool without using any electricity. Mansukhbhai Raghavbhai Prajapati, a Gujarat-based potter, makes his natural MittiCool refrigerator to provide an alternative for people in rural areas who can't afford conventional refrigerators. The MittiCool fridge uses the natural cooling effect of water evaporation to keep vegetables fresh for up to a week and store milk for three days before it spoils. Water from the upper chambers drips down the side of the clay fridge and takes away heat as it evaporates, leaving the chambers cool. The water is stored in the upper chamber and can be used for drinking via a small faucet tap on the front lower end of the chamber. Two shelves in the lower chamber are used for storing food- the first is used for vegetables and fruits, while the second shelf can be used for storing milk. ■

Edmonton locals could ice skate to work using the new Freezeway

Landscape architecture student Matthew Gibbs wants to make getting around the chilly Canadian city of Edmonton easier - and a lot more fun. For his thesis project, Gibbs envisioned a seven-mile trail in the city that fuses commuting with winter activities. Rather than trudging through snow, the so-called Freezeway would invite locals to zip around Edmonton on ice skates or a toboggan! In 2013, Gibbs came up with the Freezeway, which nabbed the first prize of a design competition. Rather than battling Edmonton's long winter, the Freezeway would embrace it by transforming two existing greenways in the city into an icy trail. The plan would bring together the now separate greenways, connecting them into a seven mile long skating trail. For chilly months out of the year, Edmontonians would be encouraged to get outside, using the ice trail for fun, to get to work, or visit the shops and cafes it passes through. The frozen trail would also encourage locals to exercise and engage with neighbours and friends, rather than be cooped up inside during sub-zero temperatures. When intersected with pedestrians or cars, the trail would be outfitted with rubber crossing points to ensure safety. ■

RNI Reg. No.: MAHENG/2005/18432