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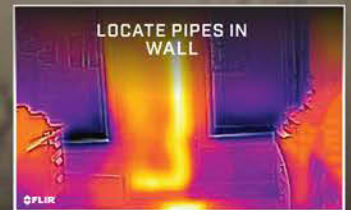
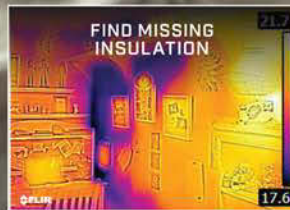
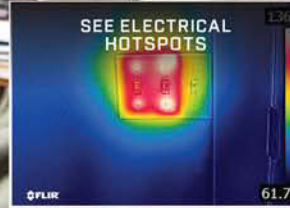
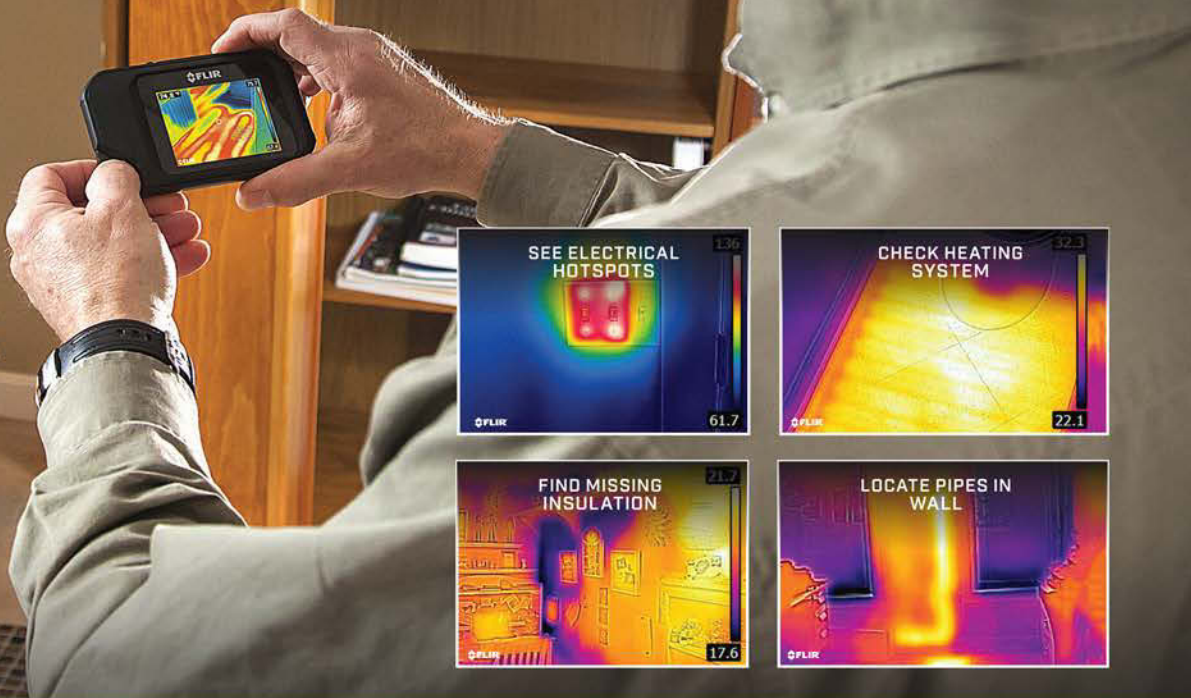


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# Publisher's Letter



## Publisher's Letter

### Better Late Than Never

It is quite an unfortunate situation owing to what we were supposed to do years back, we are proposing now. In any case, it sounds good that members of the Climate and Clean Air Coalition (CCAC) have committed to accelerate ambitious actions to reduce Short-Lived Climate Pollutants (SLCPs) within the next five years. The CCAC Paris Communiqué, endorsed by 49 Ministers, 16 intergovernmental organisations and 44 NGOs, resolves to prioritise, develop and implement measures that lead to the delivery of SLCP reductions at scale in the near- to medium-term, aiming to achieve significant climate, health and numerous other benefits. The credibility of the proposal has been further asserted by the matched financial support proposal with countries committing a total of \$12 million to the Coalition's trust fund and 100's of millions of dollars to reduce SLCPs worldwide.

In a message delivered to COP21 delegates in Paris, the United Nations Secretary General, Ban Ki Moon has said, "The Climate and Clean Air Coalition is an impressive example of a partnership that can deliver results. We must act urgently to limit carbon dioxide emissions to keep global temperature rise below two degrees Celsius. In addition we need immediate action to control short-lived climate pollutants, not only to mitigate warming, but to reduce air pollution and improve public health."

The CCAC has also launched its Five Year Strategic Plan at the COP 21 assembly. On the occasion, Achim Steiner, Executive Director, UN Environment Programme (UNEP) has drawn attention on the immediate benefits of SLCPs' reduction for the climate and livelihoods.

In the words of Margaret Chan, Director-General, World Health Organization, "There is a double benefit to actions, they are good for climate change in the longer term – and in the immediate short term, very good for reducing air pollution. The payback of this coalition's actions is measured in reduced air pollution, improved food security, improved energy access and better health. A healthy planet is good for the health of the people of our world." I feel this is the best description of the benefits that we are going to enjoy in the next five years.

Please send your comments at [pravita@charypublications.in](mailto:pravita@charypublications.in)

**Pravita Iyer**  
Publisher & Director





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# Contents

Vol. 11 No. 5, December 2015

## Articles



30

Getting The Most Out Of Your Heat Exchangers



34

Key Challenges Of Compressor Users In India



36

Historic Spanish Hospital Upgraded



40

Science Of Cold Welding



48

Tri Generation - Way Of Sustainability



51

Augmenting Solar Power Through Phase Change Materials

## Departments

Publisher's letter.....	04	Research & Development.....	39
Editorial.....	08	Awards.....	47
Newsline.....	10	India Cold Chain Show 2015 (Pre-event Info).....	56
Market Potential.....	11	CeMAT Hannover (Pre-event Info).....	57
Appointments.....	20	Vacuum Management.....	58
Carbon Economics.....	22	Software.....	62
Initiative.....	24	Product Profile.....	66
Finance.....	29	Index to Advertisers.....	69
Refrigerant.....	33	Cooling Museum.....	70

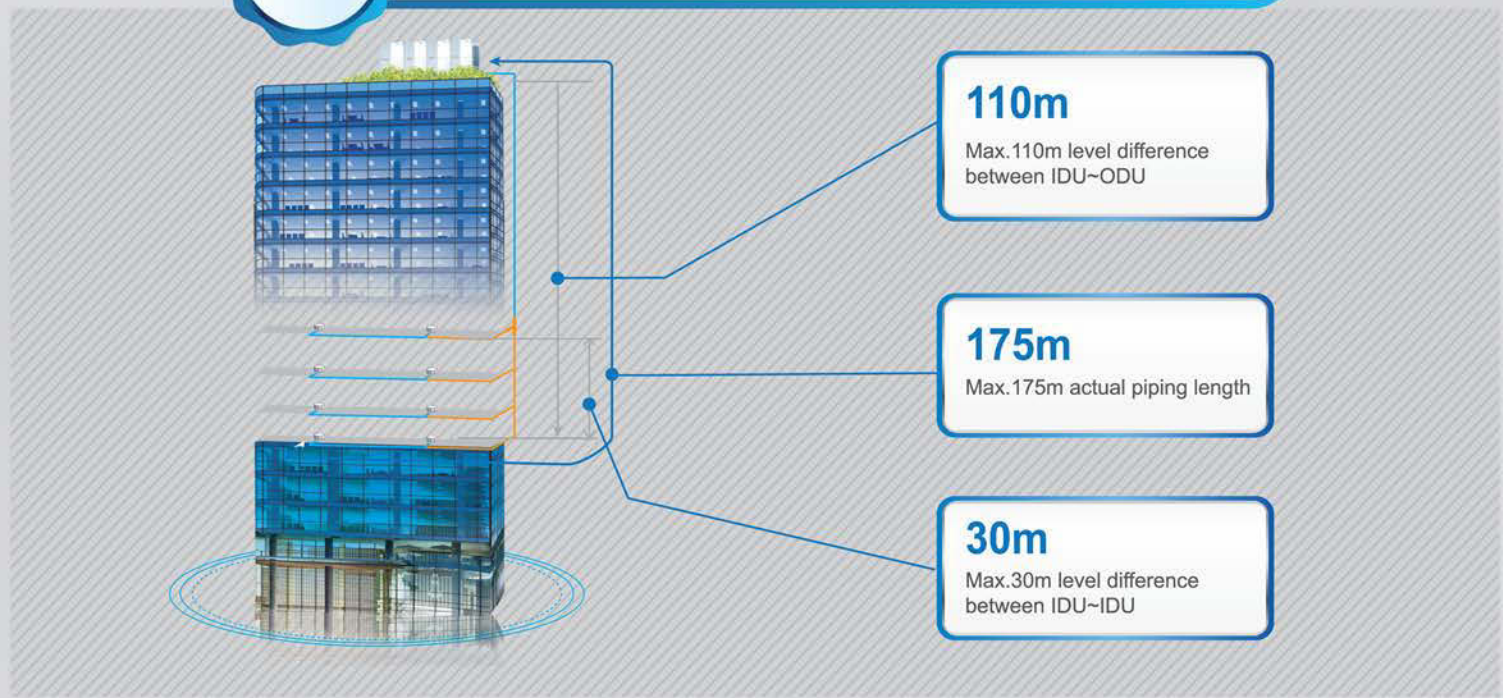
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# FROM THE EDITOR



## Mitigating Climate Risk

While on one side almost the entire world is under threat of sudden terrorist attacks, global political leaders, scientists and intellectuals just assembled at COP 21 in Paris to plan the future course of action for mitigating climate deterioration. The bitter truth is that the process of climate deterioration started from (so called) today's developed countries, and now the developing countries are under pressure to slow down the damaging pressure. In this context, I appreciate respected Narendra Modi's (the Prime Minister of India) view: "We need research and innovation to make renewable energy much cheaper; more reliable; and, easier to connect to transmission grids." That is the only way to prevent further deterioration of global climate.

It goes without saying that the way the demand of the civilized society is growing, it is not an easy task to control emissions, and change the situation overnight. This is completely depending on every individual's will. Lots of opinions, comments and views are hovering around centering the proposed final COP21 agreement. However, I agree with the view of the World Wildlife Fund (WWF) Vice President of Climate Change, Lou Leonard.

He says, "The draft final text offered by the French Presidency contains strong signals that would commit the world to a temperature goal that's in line with science. The key to making that meaningful is how countries agree to strengthen commitments on an accelerated timeframe that keeps the temperature goal in sight. Most importantly, 'parties' are called back to the table in 2018 to take stock of progress and submit stronger commitments. To make this 2018 political moment effective, both the finance and emissions reductions pledges must be scaled up before 2020 to provide any chance of limiting warming to well below 2°C or 1.5°C. Our biggest concern at this point is that there's currently no guarantee of assistance for those who will suffer the most from the impacts of climate change."

**Pl. send your views at [pkchatterjee@charypublications.in](mailto:pkchatterjee@charypublications.in)**

*P. K. Chatterjee*

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*There's currently no guarantee of assistance for those who will suffer the most from the impacts of climate change...*

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## LG Electronics opens its new headquarters in Alpharetta

Photo by John Amis/AP Images for LG Electronics USA



President and CEO LG Air Conditioning & Energy Solutions Hwan-Yong Nho with LG Electronics USA President and CEO William Cho and Senior Vice Presidents Kevin McNamara & Ellen Kim perform the official ribbon cutting at the grand opening of LG Electronics USA Air Conditioning Systems headquarters...

LG Electronics U.S.A. recently celebrated the opening of its new Atlanta LG Air Conditioning Systems Headquarters. At 40,000 square feet, this state-of-the-art facility is poised to support LG's fast-growing air conditioning systems business and educate engineers, contractors and technicians about LG's industry-leading Heating, Ventilation and Air Conditioning (HVAC) technologies.

The city of Alpharetta has been home to the LG air conditioning business since 2006 making it a natural choice for this year's headquarters expansion. As the LG customer base continues to grow, a well-equipped location for training, operations and engineering became necessary in order to streamline all parts of

the business and further develop and showcase LG's innovative HVAC technology.

"The new LG headquarters in Alpharetta is a symbol of our commitment to forward-thinking B2B technology, continuous innovation and elevated education in our air conditioning business and beyond. Today's opening is another important milestone, and we look forward to remaining part of the ever-expanding Alpharetta business community," said William Cho, President and CEO, LG Electronics USA.

The building features the LG Innovation Center, a brand-new Learning Academy and an Engineering Control Lab, all aimed at bringing together engineers, contractors and technicians under one roof. The Technology Innovation Center, a global showcase for LG commercial solutions, offers a central location for customers to interact with LG's B2B products, including its flagship VH7B series, considered to be the pinnacle of video wall digital signage solutions. ■

## HVAC market in India to grow

A recent report by Research and Markets titled 'HVAC Market in India 2015-2019' states that rising urbanisation and economic growth have led to the construction of malls, hospitals, commercial buildings and manufacturing facilities in India. The expansion of commercial space, addition of new office and floor spaces, corporate hubs and SEZs, and the proliferation of organised retail outlets are all driving the demand for HVAC systems across the country. Smart buildings use communications and automation technologies to integrate subsystems like HVAC, lighting, smart meters etc. These systems share information to optimise the performance of the buildings. Smart buildings are typically designed to synchronise with smart grids to optimise energy requirements.

The HVAC market in India to grow at a CAGR of 10.61% over the period 2014-2019, predicts the report. Further, it indicates that a demand-supply imbalance in power is a major constraint that restricts the deployment of HVAC systems for both residential and commercial use. ■

## Global ventilation fans' market to grow further

According to a recent research report by Transparency Market Research (TMR), the global ventilation fans market was worth US\$1.6 bn in 2015, and is expected to reach US\$2.4 bn by 2023, expanding at a CAGR of 4.9% from 2015 to 2023.

Ventilation is defined as the procedure that replaces or changes air in a space to control temperature or remove smoke, carbon dioxide, moisture, heat, odours, airborne bacteria, dust, and replenishes oxygen. This comprises exchange of air to the outside and air circulation within the premises. Proper installation and operation of ventilation fans provide a path for contaminated air or H<sub>2</sub>O vapour to exit a house.

Significant growth in construction industry in BRICS economies, major infrastructure development projects in MENA, the recovering construction sector in developed regions, rising awareness of the importance of Indoor Air Quality (IAQ), and govt regulations on the ventilation prove to be the key driving factors for the growth of the ventilation fans' market. ■

## A-Gas to display its innovations at AHR EXPO 2016

A-Gas Americas will be showcasing innovative new services and products at the 2016 AHR Expo in Orlando (Jan. 25<sup>th</sup> to 27<sup>th</sup>). The spotlight will fall on the over-the-counter cylinder exchange business Refri-Claim, which makes refrigerant reclamation easy, sustainable and profitable for wholesalers and their customers. Refri-Claim, part of A-Gas America's Total Solutions offering to partners in the wholesale market, provides back-up refrigerant cylinders, helps with repairs and handles the paperwork associated with recertification.



The new Gas-Trak Online (GTO) app from A-Gas will be a topic for discussion at the A-Gas booth. GTO is a refrigerant management reporting and advanced cylinder-racking tool developed by A-Gas UK. It is a fast and simple way for wholesalers and contractors to manage refrigerant use on their mobile phones and tablets. A-Gas Americas is currently working on modifications to GTO targeted specifically at the US market.

In addition, Refrig Health Check from A-Gas, the new oil and refrigerant analysis service for HVAC&R systems, will also be a talking point. As per A-Gas, RHC is perfect for system troubleshooting and can be used during annual maintenance to ensure contamination issues are resolved before system damage happens. Refrig Health Check is a complete oil and refrigerant analysis solution in one box available to contractors directly from A-Gas wholesalers. ■

# Automotive Antifreeze Market To Witness Growth

**The global automotive antifreeze market is projected to grow at a CAGR of 6.19% from 2015 to 2020 to reach US\$ 720.0 Million by 2020...**

Heat exchange between the engine and its surroundings is one of the major concerns in performance and efficiency of an internal combustion engine. Water-cooled engines use heat transfer fluid or coolant to remove the excess heat from the engine and prevent it from overheating. The engine coolant is basically the combination of water, antifreeze and other additives blended together. Ethylene glycol is most preferred base for automotive engine coolants. However, other coolant base fluids such as propylene glycol and glycerin also exist in the market providing less toxic and environmental benefits.

The antifreeze lowers the freezing point as well as increases boiling point of the coolant to

provide extra protection against freezing of the coolant or overheating of the engine. Several other corrosion inhibitors are added to the antifreeze or coolant, to improve performance and efficiency. These additives can be inorganic salts, organic acids, or combination of both.

The automotive antifreeze has growth potential in the global market with the rising demand for automobiles across the world.

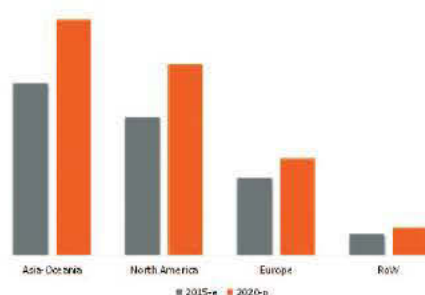
The aftermarket is the largest market of engine coolants. The aftermarket demand for engine coolant largely depends on the average service life of the coolant, vehicle parc, and miles driven per year.

According to a recent publication by the OICA, the global vehicle parc reached 1,183.2 Million units in 2013 and is projected to grow in the near future, fueling the demand for engine coolant.

The global automotive antifreeze market is projected to grow at the CAGR of 6.19% from 2015 to 2020 to reach USD 720.0 Million by 2020.

Asia-Oceania is projected to dominate the engine coolant market from 2015 to 2020, as it has the highest vehicle production as well as vehicle parc. Growing middle class, rising disposable income, and developing road transport infrastructure are other factors fueling the demand for automotive engine coolant in Asia-Oceania region. ■

**Global Antifreeze Market Size for Automotive, by Region, 2015-2020 (USE Million)**



Source: Markets and Markets Analysis

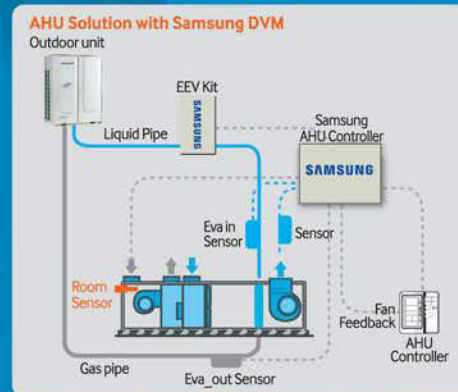


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# SAMSUNG

## Airedale's new product receives many enquiries at DCD Converged



The new Smart Cool i-drive precision air conditioning system (5-83kW) proved a big draw to the Airedale International stand at this year's DCD Converged (18 & 19 November 2015). Of particular interest to visitors was the SmartCool's split evaporator coil, which helps manage air distribution and prevent hot spots by providing a high level of control over dehumidification and cooling capacity when operating under constant pressure control and removing the need for reheat.

Airedale's focus on the design of high performance, high resilience cooling systems has again resulted in a system, which delivers class-leading energy efficiencies. Smart Cool i-drive typically outperforms the nearest rival system by delivering up to 21% more cooling kW/m<sup>2</sup>.

The single-circuit SmartCool i-drive PAC delivers very precise supply air temperature up to 26°C under variable heat loads and wide outside ambient conditions of between -20°C and +50°C. Designed for use in high density applications using elevated return air temperatures, hot and cold aisle containment as well as perimeter cooling environments, the SmartCool i-drive range is available with the option of high capacity compressors for extreme temperature applications. With a choice of single, inverter-driven compressor or tandem compressor set with optional fixed-speed compressor, the SmartCool i-drive delivers excellent part-load efficiencies, very precise control and lower capacity turndown, providing a highly versatile, resilient cooling solution that can adapt to load requirements. Another major benefit, the range is designed for pipe lengths of up to 100 metres delivering a great deal of flexibility for data centre architects in siting outdoor condensers, without compromising efficiency and performance. The new range is an air-cooled, mechanical Direct Expansion (DX) inverter-driven variant of the award-winning SmartCool Chilled Water PAC, which picked up two industry awards in 2014. ■

## Greenheck modifies its fire smoke dampers

Greenheck has expanded its collection of the largest non-actuated fire dampers in the marketplace. Now available in widths as great as 144" and heights up to 100", Model DFDAF-310 represents a 20% dimensional increase over dampers previously available for a 1.5-hour dynamically-rated fire damper with robust airfoil blade construction.



The electronically actuated 1.5-hour fire resistance rated airfoil blade combination fire-smoke damper product line has also grown. Models FSD-311 and FSD-312 have increased available sizes in their product classes by 20%, now offering widths as great as 144" and heights up to 100".

Greenheck, the globally known company in manufacturing and distribution of air movement, conditioning and control equipment, offer UL certified dampers and AMCA licensed dampers in the industry. ■

## USGBC commits to scale up LEED Green Buildings

The U.S. Green Building Council (USGBC) will commit to scaling green buildings to more than 5 billion square feet (478 million square meters) over the next five years through the LEED and EDGE green building rating systems. USGBC's commitment was made at Buildings Day, an official event at the United Nations climate negotiations conference known as COP21.

"As we gather around the imperatives to address climate change at COP21, we know that buildings must continue to be a key focus area for countries to reach carbon emissions reduction goals," said Roger Platt, President, USGBC.

"By encouraging the use of green building rating systems like LEED and EDGE in both the public and private sectors, countries can log immediate and measurable reductions of these emissions – as their building stock uses less energy and water, creates less waste, saves money and creates a healthier environment for everyone," he added. ■

## Carel Group's new production lines start at Croatia



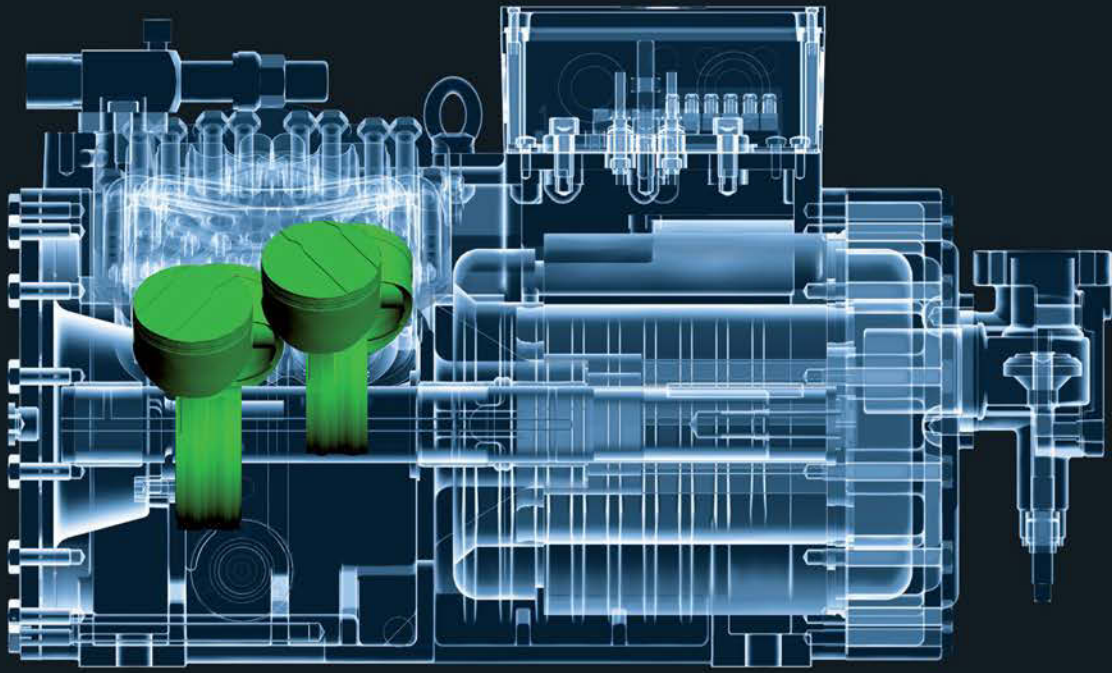
The Carel Group is a multinational that designs, manufactures and markets control solutions for air-conditioning, refrigeration and air humidification. The group, a specialist in air-conditioning, refrigeration and air humidification control solutions, has commenced production at its new plant in Labin, situated on the south-eastern coast of Istria in Croatia.

The new production plant, built over three years for a total investment of five million Euros, will allow the Carel Group to increase its production capacity in Europe – and make product distribution even more efficient.

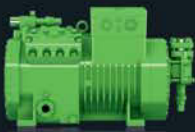
The Labin plant covers a total area of around 90,000 m<sup>2</sup>, 7,000 m<sup>2</sup> of which indoors, and currently employs 50 local workers, a number that will increase to 110 when the plant is fully operational. The Croatian plant is the group's fourth site abroad, following those opened in Brazil, China and the United States, bringing the total to seven production sites (the other three are in Italy, specifically at the Group's headquarters in Brugine, Padova province), in addition to 19 fully-owned subsidiaries worldwide.

In 2014, the Carel Group recorded sales of 181 million Euros, an increase of 7.6% over 2013, with exports accounting for 80% of sales. The new plant will help increase the group's volumes in Western Europe, where currently 49% of its sales are generated.

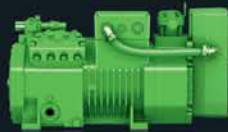
"We are especially proud of the opening of this new plant in Croatia. Together with our Italian sites, this new plant will help support our growth in Europe. We are in fact continuing to develop our strategy that foresees the majority of our products manufactured at multiple sites, so as to guarantee continuity of supplies to customers in any circumstances," commented Francesco Nalini, Carel Group Managing Director. ■



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## Knorr-Bremse offers great solutions for climate protection



Train to paris internet zoom...

In the coach given over to the 'Pro-Rail Alliance,' Knorr-Bremse has presented its trailblazing climate-care solutions that help the already resource-efficient railways to be operated in an even more energy-efficient and thus climate-compatible way.

These include the driver assistance system iCOM Assist that helps drivers operate their trains as energy efficiently as possible. Based on

its knowledge of the track topography, the composition of the train and its scheduling, the driver assistance system computes an energy-optimised run and makes appropriate recommendations to the driver. This enables the absolute energy consumption to be reduced substantially. In this way, the system makes a valuable contribution to improving the environmental balance sheet and helps make rail transport more competitive than ever.

The energy-saving portfolio also includes modern HVAC systems from Merak and Sigma, both subsidiaries of Knorr-Bremse. Thanks to ingenious control engineering, these systems constantly adapt the intake of fresh air to the actual number of passengers. If there are not many passengers on board, the system cuts its fresh-air intake, thereby reducing the volume of air to be heated or cooled. As a result, the energy consumption of the HVAC system is reduced without any loss of comfort for the passengers. Ideal energy distribution within the train is handled by auxiliary power converters from Knorr-Bremse, which owing to the use of innovative materials are highly efficient, light and compact. The energy metering system iCOM Meter registers and records the actual energy consumption of the train in real time. On the one hand this enables the railway operator to check their electricity bills precisely. And on the other hand the operator can use this data to identify further potential for saving energy. ■

## Energys installs Eco3 at Swanlea School in London



S Martin

Smartcool Systems has in partnership with Energys installed its ECO3 technology at Swanlea College. This is a large, vibrant and thriving school in the centre of London. Swanlea students

contribute significantly to the exciting and developing community of Whitechapel.

Steven Martin, EVP of Smartcool, states, "The original design of Swanlea College incorporated technologies to ensure a smaller carbon footprint than pre-fabricated buildings built in 70s and 80s. In keeping with the theme of ongoing energy reduction at the college, Smartcool installed on 10 Sanyo heat pumps using the ECO, and we have already been asked to consider more opportunities on campus."

Energys have been actively marketing the Smartcool technologies to some of their other high profile clients.

Smartcool has completed site surveys and presented proposals for initial installations and expect budget approval shortly. ■

## Adept Technology becomes a consolidated subsidiary of Omron

Omron Corporation, globally known in the field of automation based on its core sensing and control technology, has completed acquisition of Adept Technology, Inc. ('Adept'), a global provider of intelligent robots, autonomous mobile robot solutions and services.

Under the terms of the previously announced transaction, Omron's U.S. subsidiary is acquiring Adept through an all cash tender offer followed by a second-step merger. The tender offer expired at 5:00 p.m. New York City time on October 22, 2015.

Approximately 83.32% of all issued and outstanding shares of Adept common stock were tendered into the offer and accepted for purchase by Omron's United States subsidiary. This subsidiary completed the second-step merger, making Adept a consolidated subsidiary of Omron. The impact of the acquisition on the consolidated financial performance of Omron will be the subject of timely disclosure in Japan. ■

## ABM reduces Southern California Federal Buildings' energy, operating costs

ABM, a well known provider of facility solutions, has signed a contract with the U.S. General Services Administration (GSA) to begin a second phase of extensive energy and facility improvements to federal buildings throughout Southern California, including the Edward R. Roybal Federal Building in Los Angeles; the U.S. Social Security Building in Huntington Park; the 300 North Los Angeles (NLA) Building; the Glenn M. Anderson Federal Building in Long Beach; and the Ronald Reagan Federal Building and U.S. Courthouse in Santa Ana.

In all, ABM's Bundled Energy Solutions program guarantees savings of at least \$48.4 million in energy and operating costs over the next 20 years through its innovative, long-term financing solution, reducing the buildings' energy use by 38%. ABM recently completed the first phase of the multi-million dollar contract for GSA, which centered on retrofitting the central plant's HVAC system and upgrading building automation controls to regulate energy usage. This upgrade is expected to reduce energy consumption by 25. The central plant is shared by the Edward R. Roybal Federal Building and the 300 NLA Building.

ABM's Bundled Energy Solutions (BES) program is designed as a financial solution to meet clients' technical facility needs and sustainability goals. Its goal is to drive costs out of a client's operating budget, allowing savings to be reallocated to fund mission critical facility needs.

This customised solution for GSA includes 54 energy conservation measures across the buildings including: replacing and retro commissioning heating and cooling equipment with state-of-the-art systems, including low load chillers, providing more fresh air to the buildings' occupants; upgrading building automation controls to regulate energy usage; installing state-of-the-art LED lighting and occupancy control devices, reducing wasted lighting energy; transformer upgrades; solar window tinting; and phase change technology that helps save energy by actively absorbing and releasing heat, offsetting heating and cooling loads in the NLA Building. ■

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## Ferguson partners with Fujitsu General to serve VRF customers



Ferguson, an American HVAC&R equipment, parts and supply company, has made a partnership with Fujitsu General to distribute the Airstage Variable Refrigerant Flow (VRF) system in the Northeast. The partnership includes exclusive distribution in the Baltimore, Maryland, Washington, D.C. and Philadelphia, Pennsylvania markets as well as distribution in New York City and New Jersey.

VRF has grown steadily in the U.S. over the last decade, and even experienced market growth

throughout the recession due to its energy savings, space-savings and zoning benefits. The systems offer major energy savings compared to traditional HVAC units. For example, they incorporate variable-speed operation to control refrigerant flow, they have ductless systems that eliminate ductwork energy loss and the refrigerant (used) requires less energy than water or air for heat transfer.

"The cost of utilities in the Northeast are some of the highest in the country (US). The efficiencies of VRF maximise equipment output, and the return on investment can be realized much sooner than traditional HVAC units due to reduction in operating costs," said Matt Coley, Business Development Manager of Ferguson's Northeast VRF Division.

Now that post-recession construction has picked up, the VRF market continues to grow at approximately 25% each year and VRF systems are used in a larger variety of building types and applications. Tall buildings, which are especially prominent in Northeast metropolitan areas, benefit from VRF's design flexibility because of its ductless operation, the ability to use multiple units in one building and extended piping lengths. Fujitsu Airstage™ outdoor units may be combined using twining kits to create up to 24 tons with a group of three outdoor units. ■

### Companies covered in this issue

Company Name	Page No.
ABM	16
AHR EXPO 2016	10
Airedale International	14
Bosch	68
Carel Group	14
Cofely Besix Facility Management	20
Endress+Hauser	20
Extech	69
Flynn Refrigeration	20
Fujitsu	18
Greenheck	14
Hitachi	68
KNOLL	68
Knorr-Bremse	16
LG Electronics	10
Massachusetts Clean Energy Center	18
MECO	67
Omron Corporation	16
RectorSeal Corp.	66
Smartcool Systems	16
Transparency Market Research	10
US Green Building Council	14

## Construction industry to drive the growth of HVAC market

As per the report titled "Global HVAC Market: 2015 Edition" by Konzept Analytics, the demand for HVAC equipment will be driven by, rising demand in the housing market, increasing GDP, construction spending, rising demand of air conditioning and rising urbanization.

Some of the noteworthy developments of this industry include growing demand for variable refrigerant flow systems, technological advancements, increasing demand of smartphone, growing integration of HVAC controls and growth of radiant floor heating.

However, the expansion of global HVAC market is hindered by environmental impact and stringent regulations.

But with an increase in new building construction inherently comes an increase in new HVAC unit installation. In both residential and non-residential, HVAC equipment installation will be on the rise in coming years. Konzept Analytics has also done an in-depth analysis of the global HVAC equipment market along with a detailed study of the US market. ■

## MassCEC approves Mitsubishi Electric HVAC products

The Massachusetts Clean Energy Center (MassCEC) has approved products from Mitsubishi Electric US, Inc. Cooling & Heating Division (Mitsubishi Electric) to be installed as part of the energy-efficient air-source heat pump Clean Heating & Cooling program. As part of a five-year, \$30 million plan, Alicia Barton, CEO, MassCEC, announced that Massachusetts households and businesses will be eligible to receive rebates on energy-efficient HVAC systems. Homeowners must select from a list of prequalified equipment by manufacturers such as Mitsubishi Electric.

The rebate plan, a collaboration between MassCEC and the Massachusetts Department of Energy Resources (DOER), will assist consumers with the initial costs of installing a renewable-energy heating and cooling system. "People today, more than ever, want to be energy efficient," says Tim Gochinski, Owner of Pioneer Heating & Cooling, Florence, Massachusetts. Gochinski believes the rebates are the deciding factor for customers looking to improve their home comfort system and assist in their move toward energy-efficiency compliance. He has already seen the results of this program, attributing nearly 20 to 30% of his company's sales to the program.

Consumers will see the most benefit in their wallets, according to Gochinski, by not only saving on equipment costs, but also lowering their heating and cooling bills with a Mitsubishi Electric system, which is up to 40% more efficient than a traditional system. The patented Hyper-Heating INVERTER technology allows heat pumps to operate at 100% heating capacity at +5 degrees Fahrenheit, giving them the highest performance capabilities in cold climates on the market.

Additionally, in a side-by-side comparison with competitors, at 30.5 SEER, Mitsubishi Electric's MSZ-FH09NA/MUZ-FH09NA system is one of the most energy-efficient ductless zoning systems in the U.S. ■



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**Anthony Varga**  
(next) CEO & GM  
Endress+Hauser  
Canada

"I'm excited to work with the clients and employees of Endress+Hauser, Canada..."

### A Varga to become CEO and GM of Endress+Hauser, Canada

International measurement and automation equipment firm Endress+Hauser has appointed Anthony (Tony) Varga as CEO and General Manager of its Canadian operations. Varga will officially take over the charge in January 2016, coinciding with the retirement of Richard Lewandowski, CEO and General Manager, who successfully led the Canadian business unit through tremendous growth over 20 years as CEO.

Employing more than 150 people in offices across the country, the company has become a leading provider of complete solutions for industrial measuring technology and automation in Canada. The group is the largest independent manufacturer of

instrumentation in the world, with global manufacturing facilities, over 12,000 associates, and net sales of over \$2 billion CAD.

Varga joins Endress+Hauser from Rittal Systems, most recently serving as the President of Rittal Canada and Senior Vice-President of Rittal's North American Sales.

"I'm excited to work with the clients and employees of Endress+Hauser Canada. It is an international leader in its field, and I have already seen how that culture of excellence is reflected in the Canadian team members I have met. We have a great deal to offer the Canadian marketplace," said Varga. ■



**Danielle Dixon**  
Marketing Executive  
Flynn Refrigeration  
United Kingdom

"This is a great time to be joining the team – as we continue to rapidly expand on a global scale..."

### Danielle Dixon joins Flynn Refrigeration as Marketing Executive

Danielle Dixon (Danni), an experienced sales and marketing practitioner, has joined Flynn Refrigeration as Marketing Executive to bolster their client management & sales support team. Flynn Refrigeration is an independent company providing a complete supply package for all aspects of refrigeration and AC systems used within marine and industrial applications. Having previously worked as both a Senior Sales Adviser and a Sales & Marketing professional, Danni will support client relationship management and customer service, as well as drive their marketing & social media campaigns.

Flynn Refrigeration's Managing Director, Alex Flynn says, "Danni's new appointment will prove

invaluable – as we seek to enhance our customer service. Danni has the perfect skill set to assist us in the continued growth of the company. We're experiencing strong growth and we believe next year is going to be pivotal as we aim to hit ambitious targets. I have total confidence in Danni's abilities and the support she will provide to the team, our suppliers and most importantly, our customers."

Danni says, "This is a great time to be joining the team – as we continue to rapidly expand on a global scale. The team is dedicated to providing a world-class service from start to finish, and I'm really looking forward to being part of a dynamic, forward-thinking business, and using my skills to maximum effect." ■



**Richard Castelino**  
BDM, CBFM  
Dubai, UAE

"I'd like to ensure that CBFM strengthens its position even further as the top facility management company in the UAE region..."

### R Castelino takes over as BDM of Cofely Besix Facility Management

Cofely Besix Facility Management (CBFM), Dubai's leading integrated facilities management company has inducted Richard Castelino as Business Development Manager (BDM). Castelino is a qualified MBA Marketing professional, with more than four years' experience working in Sales and Marketing within the Facilities Management industry. Prior to joining CBFM, Castelino worked at Farnek Services as Business Development Executive for four years, and was later promoted to Business Development Manager in 2015.

"Facilities management in the UAE is growing at such a fast rate, and I would like to ensure that

Cofely Besix FM strengthens its position even further as the top Facility Management company in the region," said Castelino.

He is a firm believer in continuous improvement, and he focuses predominantly on service delivery and customer satisfaction when dealing with any new or existing clients.

"We are very pleased to welcome Castelino to Cofely Besix FM. He is young and dynamic, with an excellent track record, and we welcome his fresh approach and ideas that will further assist CBFM in strengthening our position in the UAE FM market," said Ian Harfield, CEO of CBFM. ■



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# Putting A Price On Carbon Is Essential

*In an international panel discussion at COP 21, experts unanimously agreed that there cannot be any alternative but to charge a price for carbon footprint. However, the methodology has to be determined...*

Putting a price on carbon is essential for success in the international response to climate change, said participants in a COP21 side event.

Without a price, recognising and charging for the damaging effects of emitting greenhouse gases, efforts to address climate change will be inefficient and likely too slow to avoid its worst effects.

Pricing carbon is “not the only thing, but a necessary thing. We have to take carbon pollution out of our growth model. That entails energy policy reform, energy subsidy reform and putting a price on carbon,” said Rachel Kyte, Special Envoy for Climate Change, World Bank Group.

China has seven pilot emissions trading systems, and has announced its intention to launch a national system in 2017.

Qimin Chai, a Deputy Director in China’s National Center for Climate Change Strategy and International Cooperation, said it is key to “count the benefits and the costs” of action on climate change, explaining how emissions trading systems can spur development and stimulate economies through recycling of investment, if the price is high enough.

Countries and constituencies need to “make pricing integral, and build on it,”

explained David Heurtel, the Development, Environment and Climate Change Minister in the province of Québec, Canada. Québec launched an emissions cap and trade system in 2013 and linked it with the emissions trading system in California, U.S.A., a year later. The Canadian provinces of Ontario and Manitoba have since announced their intentions to cap



and trade their emissions. One province, British Columbia, has had a carbon tax for several years, and another province, Alberta, is planning one.

Québec started with a low carbon dioxide price per tonne, which has steadily risen. The gradual transition has worked well, avoiding economic dampening. Business has integrated the cost and the province has reinvested the income, explained Heurtel.

Bruno Lafont, Co-Chair of the Lafarge Holcim cement company, said, he was in favour of global carbon pricing, stressing the word global. With some constituencies subject to a price and others not, competition could be uneven. Businesses need “stability and predictability” and any pricing system needs to avoid “distortion of competition,” Lafont opined. ■

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# Glimpses On The Mitigate GHG



**H**ow hot is the environment outside the building? How fast are the glaciers melting? How quickly are the levels of the natural water sources increasing? Yes, these are the challenges arising out of climate change that the entire world is facing today. Several countries are charting their action plans to mitigate further deterioration. Under such circumstances, naturally the question arises what is the plan of the world's most technologically advanced country, the USA?

The US President Barack Obama has taken unprecedented action to address the global threat of climate change and work with companies, NGOs, universities and other governments to reduce emissions, invest in clean energy and build resilience to the impacts of climate change.

To lead by example, his administration has announced new greenhouse gas emissions targets for Federal Agencies to cut emissions by 41.8% from 2008 levels by 2025. These carbon reductions will save taxpayers up to \$18 billion in avoided energy costs, as well as increase the share of electricity the Federal Government consumes from renewable sources to 30%. These emission targets are a key piece of President Obama's Executive Order 13693 on Planning for Federal Sustainability in the Next Decade.

In addition, the Federal agencies are also releasing their new "Strategic Sustainability Performance Plans." The Sustainability Plans provide an overview of how agencies are saving taxpayer dollars, reducing carbon emissions, cutting waste, and saving energy. Building on last year's plans, agencies are

continuing to modernise their programmes and policies to be more climate-resilient, outlining initiatives to reduce the vulnerability of Federal programs and assets.

To recognise the extraordinary achievements in pursuit of the President's Federal sustainability goals, the White House has also announced the winners of the 2015 Green Gov Presidential Awards, honouring those – who have gone above and beyond in reducing carbon emissions and implementing sustainability projects in the government.

## GHG reduction targets for 2016

With a footprint that includes 360,000 buildings, 650,000 fleet vehicles, and \$445 billion spent annually on goods and services, the Federal Government's actions to reduce pollution, support renewable energy, and

# Steps By US To

***With a footprint that includes 360,000 buildings, 650,000 fleet vehicles, and \$445 billion spent annually on goods and services, the Federal Government's actions to reduce pollution, support renewable energy, and operate more efficiently make a significant impact on national emissions and drive progress across the Federal supply chain...***

operate more efficiently make a significant impact on national emissions and drive progress across the Federal supply chain. Federal agencies have developed targeted strategies to cut their GHG emissions by reducing energy use in their buildings, making their vehicles more efficient, using clean energy sources like wind and solar, and employing Energy Savings Performance Contracts (ESPC).

## Some examples

**General Services Administration:** Since 2008, GSA has already reduced its annual emissions by 43% below its baseline of 2.3 million metric tons per year – the equivalent of keeping over 5,000 railcars worth of coal in the ground each year. As the nation's largest owner of office space, GSA's focus to achieve GHG reductions is reducing energy in Federal facilities. It plans to leverage energy savings performance contracts to complete innovative projects that deliver significant energy and cost savings, including a retrofit of a building in New Carrollton, Maryland, which will cut energy use by 60% and deploy one megawatt (MW) of on-site solar power.

GSA also recently awarded a contract for 81 Mega Watt (MW) of off-site solar from two locations on Maryland's Eastern Shore, demonstrating how Federal agencies are helping to transform the energy grid and move the nation toward a clean energy future.

**NASA:** NASA will cut energy use in its facilities and

deploy clean power to help reach its GHG emissions reductions target. For example, at the Johnson Space Center in Houston, Texas, NASA expects to reduce energy consumption by 17% through a new combined heat and power system, which produces electricity using natural gas-powered turbines and uses the excess heat for the facility's heating and cooling. NASA is also investing in renewables to provide clean, cost effective power and reduce its emissions while enhancing energy resilience. The White Sands Test Facility in New Mexico will break ground next May on a 1.6 MW solar plant that will power the facility's water system, provide backup power during outages, and cut GHG emissions by 1,600 metric tons per year.

**Department of Homeland Security:** DHS is using several innovative strategies to meet its GHG reduction goal. The Department's priority strategy is improving energy performance in its facilities, with plans to leverage \$73.2 million in ESPC projects that include installation of solar power at facilities in California and Puerto Rico. Additionally, DHS is

promoting clean energy and sustainability in its daily operations, for example, the Coast Guard has upgraded 4,800 navigational aids to use solar power. DHS also intends to reduce GHG emissions by streamlining its fleet and cutting petroleum use, continuing to build on its recent success of eliminating 1,123 vehicles, replacing 288 vehicles with more efficient models, and reducing gasoline use by 1.5 million gallons.

**Department of Energy:** To help achieve reductions in GHG emissions by 2025, DOE has plans to expand renewable power at two of its National Laboratories, which have led the nation in science and technology innovation for more than 60 years. At the National Renewable Energy Laboratory in Colorado, DOE will install up to 1.6 MW of solar power. Brookhaven National Laboratory in New York will expand its existing solar array with an additional 230 kilowatts, which will not only expand solar research capabilities at the lab but also provide clean electricity to the site.

**Department of Interior:** As part of its efforts to enhance sustainability across operations, the Department will showcase potential for energy and water improvements at its historic headquarters building in Washington, DC.

The project, which leverages ESPC financing, will install a combined heat and power system and upgrade lighting, windows, energy management controls and the cooling system, achieving a 44% reduction in GHG emissions from the building's operations.

**NASA**  
*is also investing in  
renewables to provide clean,  
cost effective power and reduce its  
emissions while  
enhancing energy resilience...*

### Scope 1 & 2 (Direct) GHG Emissions Targets Principal Agencies

	Reduction Target 2025 vs. 2008	2008 Emissions MTCO <sub>2</sub> e	2025 Target MTCO <sub>2</sub> e
Department of Agriculture	43.0%	604,439	344,530
Department of Commerce	25.0%	380,549	285,412
Department of Defense	42.0%	26,855,109	15,575,963
Department of Education	30.0%	219	153
Department of Energy	50.0%	4,695,942	2,347,971
Department of Health and Human Services	38.7%	967,517	593,088
Department of Homeland Security	51.0%	776,297	380,385
Department of Housing and Urban Development	68.3%	17,592	5,577
Department of Justice	35.0%	1,606,794	1,044,416
Department of Labor	50.3%	266,075	132,239
Department of State	38.5%	87,572	53,857
Department of the Interior	36.0%	793,628	507,922
Department of the Treasury	60.0%	293,552	117,421
Department of Transportation	35.0%	920,256	598,166
Department of Veterans Affairs*	24.0%	2,956,351	2,246,827
Environmental Protection Agency	46.0%	142,009	76,685
General Services Administration	54.0%	2,270,645	1,044,497
National Aeronautics and Space Administration	47.0%	1,255,260	665,288
National Archives and Records Administration	40.0%	66,303	39,782
Office of Personnel Management	50.0%	18,654	9,327
Smithsonian Institution	40.0%	138,005	82,803
Social Security Administration	55.0%	131,454	59,154
Tennessee Valley Authority	31.2%	363,544	250,118
U.S. Army Corps of Engineers	20.0%	319,669	255,735
<b>Combined Total</b>	<b>41.8%</b>	<b>6,717,317</b>	<b>45,927,435</b>

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\* Target based on data expected to change as a result of significant increases to mission-related energy consumption

### Scope 1 & 2 (Direct) GHG Emissions Targets Contributing Agencies

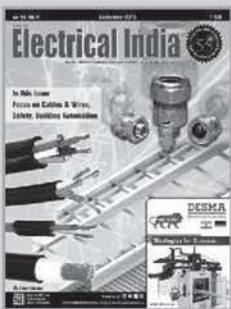
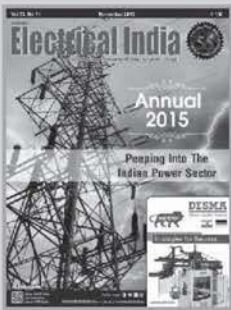
	Reduction Target 2025 vs. 2008	2008 Emissions MTCO <sub>2</sub> e	2025 Target MTCO <sub>2</sub> e
Broadcasting Board of Governors	36.1%	66,912	42,757
Nuclear Regulatory Commission	40.0%	13,800	8,280
U.S. Railroad Retirement Board	40.0%	4,099	2,460
U.S. Small Business Administration	35.0%	539	351
<b>Combined Total</b>	<b>36.9%</b>	<b>85,351</b>	<b>53,847</b>

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Apart from all above, the US government has declared several awards to encourage the promoters and innovators of climate actions. The Federal Government in the USA is determined to achieve its target.

As part of the administration's initiative to reduce energy use, pollution and waste, and save money in Federal operations, Federal

agencies have released updates that show significant progress toward aggressive energy and sustainability goals set by the President in 2009. The annual performance scorecards benchmark agencies' progress; help them target the best opportunities to improve their energy efficiency; and reduce costs and waste in their operations moving forward. ■



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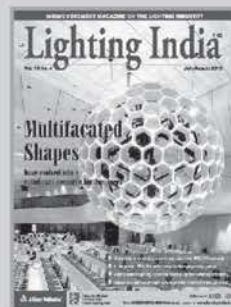
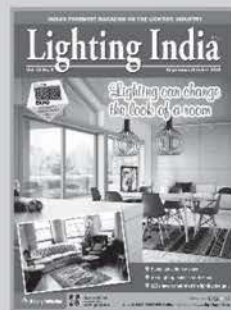
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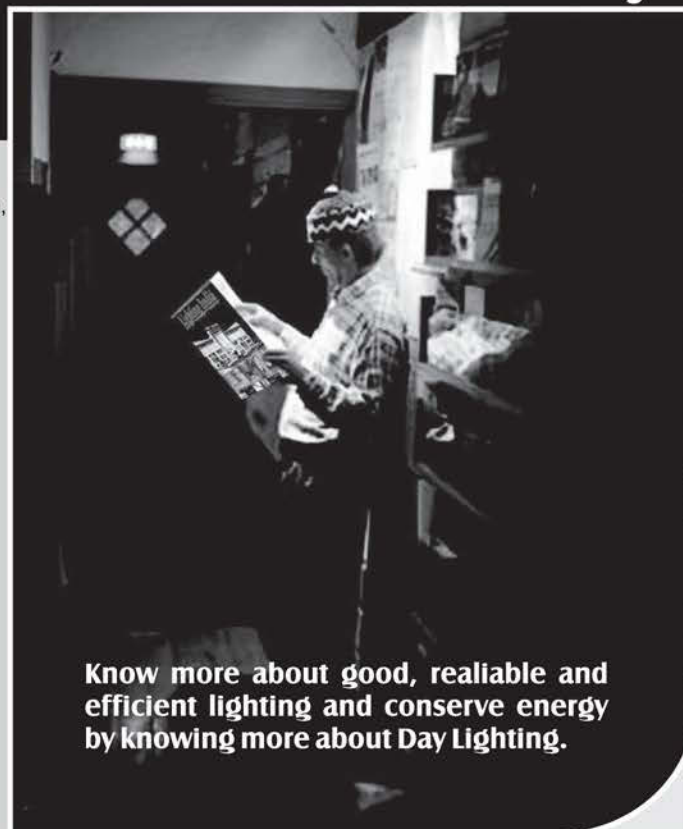


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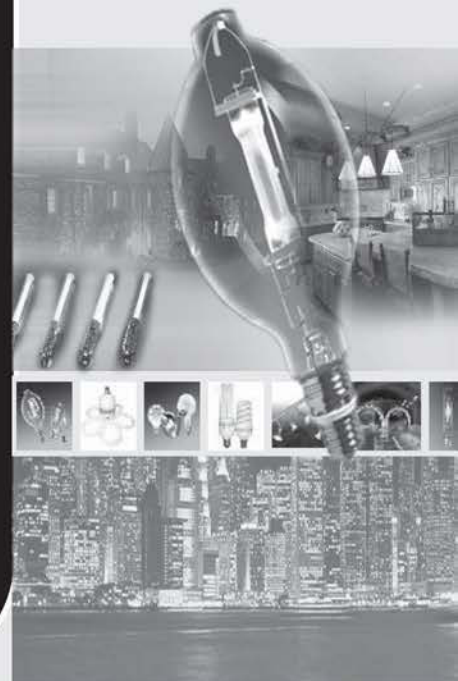
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## Lighting India



# Strategic Financing For **Climate Management**



***As the global awareness on climate control is rapidly growing, financial institutions all over the world are coming ahead to support the cause. On the occasion of COP 21, some financial institutions have declared their commitment to finance projects targeting climate control...***

All together 26 financial institutions from developing and developed countries with combined balance sheets of more than US\$11 trillion signed on to the voluntary Principles to Mainstream Climate Action within Financial Institutions, pledging to integrate climate considerations into their investment and advisory functions.

"As one of the financial institutions adopting these principles, which together account for US\$11 trillion under management, we believe these principles will help us better serve our private and public country clients. Integrating climate risk more fully into decision making, and driving the new clean energy and resilient infrastructure investments are critically needed," said Rachel Kyte, World Bank Group Vice President and Special Envoy for Climate Change.

These principles lay out a clear pathway for financial institutions to integrate climate change into their operations with the aim so they can deliver better, more sustainable, short and long term results, both developmentally and financially.

They lay out five measures for integrating climate action within financial institutions— a commitment to climate strategies; managing climate risks; promotion of climate smart

objectives; improving climate smart performance and accounting for climate action.

These five principles have been developed based on practices implemented by financial institutions worldwide over the last two decades. A related publication on Emerging Practices linked to these principles was also released during the occasion, which illustrates some of the many ways financial institutions currently integrate climate change considerations into their core activities, and provides key lessons of experience, including the usefulness of climate risk screening, and the development of common metrics for mitigation and adaptation finance.

The principles were initially developed by a group of multilateral development banks and several members of the International Development Finance Club (IDFC), a network of national, regional and international development banks. This group was then joined by other public and private financial institutions worldwide.

For its part, the World Bank Group has been mainstreaming climate change into all its operations in its fund for the poorest countries, IDA, the International Development Association. ■

# Getting The Most Out Of Your Heat Exchangers



***Heat exchangers are critical for the efficient operation of the chiller plant. Any deterioration in the condenser heat transfer will directly impact the efficiency of the chiller and lower the cooling capacity...***

**B**uildings require to be cooled in summers and in some cases, heating of the building space is also required (cold climates as experienced in northern regions of India). Transfer of heat from or to a building environment is undertaken by the use of heat exchanger. A Heat Exchanger (HE) is thus essentially a mechanical system to transfer heat from one medium to another. Heat exchangers are thus a critical component of a building HVAC system as their design is fundamental to the operation of the whole plant.

Heat exchangers are simple in theory but complex in design as well as operation. A

minor change in design parameters can alter a HE's operating parameters, and in turn, the plant's performance characteristics. Heat exchanger design is a continuously evolving field, with the main focus being on improvement in HE exchange. The HE is a static device, and hence leads to the assumption that not much maintenance would be needed for such a component of a HVAC system, the truth is, in fact, very different. HE as critical to the efficient operation of the HVAC plant and require as much – if not more – attention in operations as well as maintenance to ensure that the overall plant runs as per design.

## Overview of heat exchangers

There are many types of HEs in the market depending on the type of application and design requirement. Heat exchange typically occurs between two fluids and usually across a medium. The most common classification methods of HEs are as follows:

**Nature of heat transfer:** This classification is based on the mechanism of heat transfer between the two fluids:

**Direct type** – where the two liquids physically mix and heat is transferred. An example of such a heat transfer is between water and air in HVAC system cooling towers.

**Recuperators** – Where the hot and cold fluids flow simultaneously across a separating medium and heat is transferred across this medium. The HE in the HVAC system – condensers and evaporators are of this type.

**Type of flow:** The direction of flow is a commonly used classification approach. Counter flow HE have the hot and cold fluids flowing opposite to each other, while parallel flow HE have fluids moving in the same direction

**Number of passes:** Another common classification method is the number of passes the hot and cold fluids make over the passage of the HE. Single pass systems are not seen these days as HE design has evolved to allow multiple passes to increase heat transfer.

**HE components:** The two HE in an HVAC system are the condenser and evaporator. Both of these are of the Shell and Tube type, where one of the fluids is in the shell and the other passes through the shell through tubes. The tubes are held together by the HE covers at either end and inlet and outlet points are provide for the hot and cold fluids. The other components of a HE are the instruments such as pressure gauges and temperature gauges, as well as any instrumentation that is fitted onto the condenser or evaporator. Figure 1 shows a typical heat exchanger.

**Key HE terminologies:** For the plant operator, detailed knowledge of HE design terminologies such as thermal conductivity of the material, expansion coefficients, etc. are not needed. What is essential is to understand the purpose of the HE, and accordingly observe the parameters so that any deviation are spotted immediately and corrective action can be taken. Thus, for routine operations, the key parameters that the operator and maintainer are required to know are the temperature difference between the fluids entering and leaving the HE and the pressure at different points in the unit.

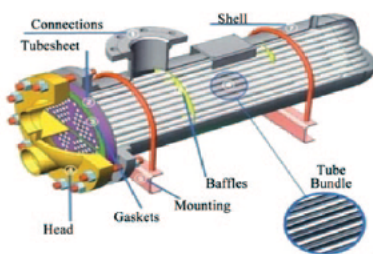


Figure 1: A typical Shell & Tube type heat exchanger...

*For routine operations, the key parameters that the operator and maintainer are required to know are the temperature difference between the fluids entering and leaving the HE and the pressure at different points in the unit...*

**Condensers:** As the name suggests, the function of a condenser is to condense the hot gases coming out from the chiller compressor and reduce the pressure and temperature. In water cooled system, water is circulated across the condenser to condense the refrigerant gas. Water takes away heat from the hot gases, which results in condensing of the gas (lowering of temperature, and hence, pressure). The water is then passed through a cooling tower where it gives up its heat to the atmospheric air in another heat exchange process and again pumped into the condenser for the next cycle of heat removal. In air cooled systems, air is passed over the condenser coils and air takes away the heat from the refrigerant.

**Evaporators:** In the evaporator, the cold refrigerant liquid and water is the medium that gets cooled. Essentially, the cold refrigerant takes away the heat from the water that is circulating in the chilled water lines of a HVAC system. After evaporation, the heated refrigerant flows into the compressor, where it is heated and then condensed to repeat the vapour compression cycle of the HVAC plant.

### Heat exchanger operations:

As mentioned earlier in the article, a HE is designed to operate within a narrow range of system parameters. Thus, it is essential to operate the plant as per the design recommendations to ensure that the correct heat transfer processes occur and the system operates to its best efficiency. In case the cooling water in a condenser fails, the hot gases will damage the condenser tubes.

Similarly, if the flow of water stops in the evaporator, the cold refrigerant will cause the water in the tubes to freeze, resulting in the tubes cracking as ice occupies a larger volume than water.

While most modern HVAC systems have automatic control of the HE system, the operator should know how the control is affected and the implication of an out of design situation. The key parameter that an operator needs to monitor during HE operations is:

**Inlet / outlet temperatures:** The temperature difference between the inlet and outlet temperatures of the hot and cold fluid as well as between the inlet of hot fluid and outlet of cold fluid are the basic parameters that should be observed. Any variation of these from design is an indication of a problem in the HE operation.

**Pressure drop across the HE:** Since the diameter of the tubes is small to allow for multiple passes and a greater amount of fluid, the flow of water encounters resistance from the walls of the tubes. This is seen as pressure drop across the inlet and outlet of the tube headers. An increase in the pressure drop is an indication of a malfunctioning HE.

**Flow rates:** While no instruments are usually installed to measure flow rates on HE in the HVAC systems in buildings, the operator should check that the pumps of the HVAC system feeding the condensers are operating at the correct rpm and pressures. Evaporators are fitted with anti-freeze sensors that trip the plant in case the cold fluid temperature reaches a certain temperature, usually 4-5 degrees Celsius. Modern systems also have flow sensors in the piping of the condensers and evaporators.

### Measuring HE performance:

The performance of a heat exchanger deteriorates over a period of time on account of many factors such a quality of water and operating methods. Water is the most common HE fluid in HVAC systems as it is easily available, cheap and has good heat transfer characteristics. However, water quality is always suspect in the building services environment and these impacts the HE operations. The main problems that are encountered in HE operations are given below.

**Fouling:** This is the build of contaminants on the surface of the tubes leading to a reduction of heat transfer between the hot and



cold fluids. In addition, since the contaminants reduce the pipe flow areas, the pressure drop increases, which leads to higher pumping power and consequently higher energy costs. Fouling is caused by biological contaminants in the water or mineral deposits, which attach themselves to the tube surfaces. Fouled tubes are usually cleared by mechanical means or by caustic cleaning processes.

**Scaling:** This occurs when certain salts in the water precipitate and form a film around the walls of the tube. Since the entire surface of the tube is covered, the heat transfer is adversely affected, impacting HE efficiency. The salts form the film at elevated temperatures and cannot be removed by mechanical means. Scaling is countered by using acidic solutions that dissolve the scales and is a time intensive process.

### Measuring HE performance:

The effect of fouling and scaling is to reduce the heat exchange between the two fluids. There is no direct way to measure the drop in HE efficiency, although a lowering of the temperature difference between the inlet and outlet is an indication of a defective HE. The recommended way to assess the performance of the HE is to carry out a simple heat exchange calculation.

$$U = \frac{Q}{(A \times LMTD)}$$

$$Q = q_s + q_l$$

$$q_s = W \times C_{ph} \times (T_i - T_o)$$

$$q_l = W \times \lambda_h$$

Figure 2: Overall heat transfer coefficient...

The overall heat transfer co-efficient 'U' is used to measure the performance of a HE. The formula used is shown in figure 2

In this equation: U is the overall heat transfer coefficient. Q is the heat duty measured for sensible and latent heat separately. A is the area of heat exchange and LMTD is the Logarithmic Mean Temperature Difference, which is a function of the temperature difference between the fluids. W is the mass of the fluid entering the system.

The steps involved in finding out U are shown in figure 3. From data obtained through the calculations, the performance of the HE

can be assessed by comparing the values obtained with the design values of the HE. The key inferences that can be obtained from the performance test are:

- Pressure drop across the HE: If this is more, it could be an indication of fouling. If it is less, it could be due to increased average bulk temperature of the HE due to lower performance.
- Temperature gradient: This gives an indication of the effectiveness of the heat transfer.
- Heat Transfer Co-efficient: This is the overall parameter, which gives an indication of the condition of the HE. A lower U value is on account of fouling of the HE tubes.

### Heat exchanger maintenance:

As heat exchangers are in continuous operation, and there is usually not standby HE for a particular plant, maintenance of HE should be undertaken as per the OEM guidelines at a minimum. As there are no moving parts, preventive approach to maintenance is sufficient to keep the HE in a good condition. The key maintenance activities that need to be undertaken for the HE in a chiller plant are:

- Use of Anti Fouling/Scaling Additives: Where possible, the water should be dosed with anti-fouling/scaling additives that help in inhibiting the formation of scales.
- Annual tube cleaning: Minor amount of fouling and scaling will occur during operation. This is a progressive activity and if the scale layer is not removed in time, the impact on heat transfers increases substantially. Thus, the condensers should be cleaned at least once a year by shutting down the plant.

### Summary

Heat exchangers are critical for the efficient operation of the chiller plant. Any deterioration in the condenser heat transfer will directly impact the efficiency of the chiller and lower the cooling capacity. A fouling factor of 0.001 (a measure of thickness of scale) can lead to an energy loss of 10 to 111 %. For a 500 TR plant, this translates to an annual increase in operating cost of approx. Rs 6,40,000. Thus, not only is regular HE maintenance a good practice, it also saves energy for the owners. The reality is however different, and HE maintenance is often the last priority in most maintenance activities, either due to ignorance

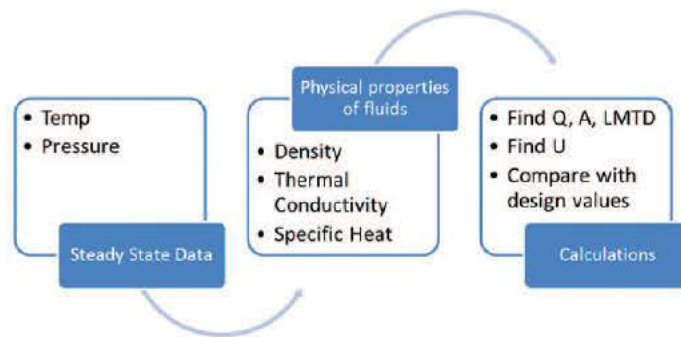


Figure 3: Steps in assessing performance...

- Visual observation: Daily checks on the pressure and temperature parameters will help identify early on if any fouling has started.
- Maintaining water quality: This is a very important maintenance activity as poor quality of water will result in sludge formation, fouling and scaling.
- Avoid water stagnation: In case the HE is not in use for an extended period of time, the water in the system should be circulated at regular intervals to avoid rust formation in the tubes.

or due to lack of priority when the budgets are drawn up for the maintenance activity. The best way to get the maximum out of the heat exchangers in the system is thus to have an effective maintenance program and regular measurement of the performance HE. ■

**Aneesh Kadyan**  
Director - Operations  
CBRE South Asia Pvt Ltd.,  
Asset Services - India



# Boosting Supermarket REFRIGERATION

*While experts and financiers worldwide are busy with chalking the future courses of action to mitigate the global pollution, this year Honeywell has introduced a breakthrough refrigerant that features lower-global-warming impact, addresses climate change concerns and new regulations...*

**G**lobal regulators are increasingly moving to phase out high-global-warming refrigerants and, on July 20, the U.S. Environmental Protection Agency published landmark regulations that will phase out the use of many hydrofluorocarbon (HFC) refrigerants. The new regulation, effective July 2016, will require supermarkets, largest consumers of the HFC refrigerant R-404A in the U.S., to discontinue its use as a retrofit refrigerant. R-404A will also not be permitted for use in new supermarkets beginning January 1, 2017.

Honeywell Performance Materials and Technologies (PMT) is a global leader in developing advanced materials, process technologies and automation solutions. PMT's Advanced Materials businesses manufacture a wide variety of high-performance products, including environmentally friendlier refrigerants and materials used to manufacture end products such as bullet-resistant armor, nylon, computer chips and pharmaceutical packaging.

This year the organisation has received a prestigious award for their product 'Solstice N40 (R-448A)' refrigerant for supermarket refrigeration. Often referred to as the 'Oscars of Invention,' the R&D 100 Awards honour the 100 most innovative technologies and services of the past year.

Evaluated with Oak Ridge National Laboratory, Solstice N40 (R-448A) refrigerant replaces high-global-warming refrigerants in supermarket applications. It is part of a growing line of Solstice products for applications ranging from auto air conditioning



low Global Warming Potential (GWP). Solstice products have been developed and are being commercialised by Honeywell's Fluorine Products business. According to George Koutsaftes, Director, Refrigerants Business, Honeywell Fluorine Products, "In addition to its lower environmental impact, Solstice N40 is highly energy efficient, giving supermarket owners an added benefit."

Solstice N40 refrigerant, also known as R-448A, has a Global Warming Potential (GWP) that is 68% lower than R-404A. In a full-scale supermarket refrigeration evaluation under controlled conditions at Oak Ridge

Solstice N40 demonstrated lower energy consumption and increased refrigeration capacity compared to R-404A. In supermarket trials conducted in the U.S. and Europe, the refrigerant demonstrated at least 3% lower energy consumption in low-temperature applications and 5 to 16% lower energy consumption in medium-temperature refrigeration compared with R-404A.

In R-22 retrofit cases, Solstice N40 gives same performance. Whether replacing R-22 or R-404A, it is a near drop-in replacement for supermarkets. Solstice N40 is nonflammable (ASHRAE A1) and non-ozone-depleting. ■

# KEY CHALLENGES OF Compressor Users IN INDIA



*In the case of reciprocating compressors, poor product quality as a result of design issues is a critical cause of concern for end users...*

Compressors find wide applications across industries such as oil and gas, power, automobile, food and beverages, cement, chemicals etc. There are three basic types of compressors used:

- Reciprocating compressors: These are positive displacement compressors that contain components moving in both linear and rotary directions. They are used in processes that require high pressure delivery of gases.
- Rotary screw compressors: These often have a built-in powerful fan that helps lower the temperature of cooled air making it beneficial for use in certain moisture sensitive operations.
- Centrifugal compressors: Their durable

nature ensures that they can be used in hazardous environments such as oil and gas, power industry etc.

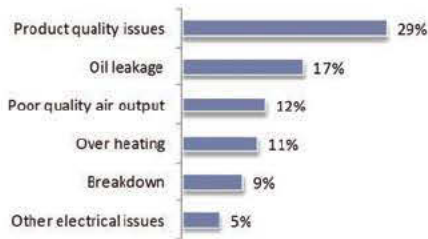
Users of different types of compressors face different issues or problems with them. These issues are usually mechanical, electrical or quality related, and can pose a major challenge to end users. They can result in critical problems such as oil leakages, low head pressure, overheating, increase in noise and vibrations, etc. – ultimately causing a reduction in the efficiency of the compressor.

## **Key concerns for reciprocating compressors**

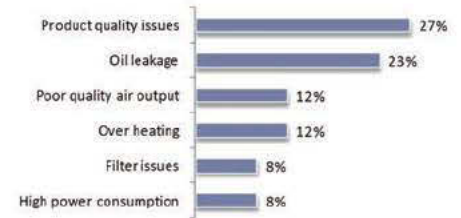
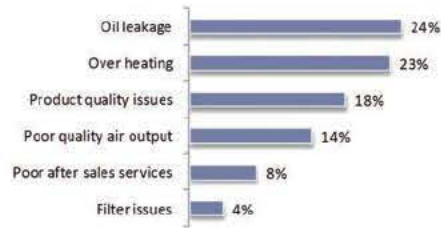
- Valve failure: It is the key reason for critical problems such as oil leakages and low

head pressure. Improper operations and faulty designs are the main causes of valve failures. It is difficult to detect as the system continues to work despite the failure, but with reduced efficiency.

- Failure of the lubrication system: Lack of proper maintenance of the lubrication system can ultimately result in failure of the compressor. Maintenance is critical as reciprocating compressors depend upon lubrication for providing a uniform oil film between closely fitted parts.
- Pulsation issues: Reciprocating compressors produce pulses of air or gas that get compressed when they are discharged into the distribution piping. This resonance in the distribution pipeline



Sources: ValueNotes BrandMeter...



generated by the pulsation can severely damage the components of the compressors.

- Piston related issues: Corrosion of piston rings and the shaft is the major cause of piston failures. Pistons also fail due to an increase in the compression ratio at constant suction pressure.

ValueNotes recently conducted an in-depth B2B customer and trade perception study for various brands and types of industrial compressors in India. ValueNotes BrandMeter is based on interviews with over 300 end-users, distributors, dealers and EPC consultants across India. End-user industries included automobile, cement, chemical, food & beverage, pharmaceuticals, power, steel and textiles. The study revealed the challenges faced by end users of compressors.

In the case of reciprocating compressors, poor product quality as a result of design issues was a critical cause of concern for end users.

## Key concerns for rotary screw compressors

- Overheating of screw compressors: Clogging of the radiator, improper ventilation in the compressor room, stuffed panel filters, blockages in the distribution pipelines, etc. can result in overheating and intermittent tripping of a compressor, which reduces its efficiency. In extreme conditions, overheating can result in an explosion of the compressor.
- Oil problems: Extremely high running temperatures, old / saturated oil separators, high levels of oil, wrong type of oil, malfunctioning of minimum pressure valves, etc. can result in an oil carryover in the air output. Also, the oil should be able to sustain temperatures as high as 99°C; if not, it will start precipitating particulates in the system that block oil filters and oil

separator cartridges.

- Filter related issues: Dust particles in the air can result in the air suction filters getting torn or blocked. Such filters are not able to block oil or dust from reaching the screws of the compressor with dust, causing scratches on the compressor.
- High ampere (power) issues: Higher motor ampere (power) results in higher noise levels. Motor ampere increases as a result of higher temperature of suction air, failed oil cooler, a reduction of the torque of the motor, blocked system filters, etc. Increase in ampere translates into increased power consumption and higher levels of vibrations.
- Breakdown of coupling due to misalignment: Even the slightest misalignment can cause the membrane coupling to break resulting in compressor failure. The initial symptom of this failure is a decrease in torque transmission from motor to coupling.

ValueNotes' BrandMeter corroborated the oil leakage and overheating problems with screw compressors.

## Key concerns for centrifugal compressors

- Breakdown of compressors due to high axial displacement: Frequent breakdown of compressors can occur due to high axial displacement. Failure of the surge protection system results in damage to the thrust bearings and shaft position probes.
- Breakdown due to failure of impellers: Excessive water carryover causes corrosion of control linkage resulting in failure of inlet guide vanes. Poor design of the inter-stage coolers usually causes water carryover.
- Blade detachment due to fatigue cracks: Multiple fatigue cracks, which develop at the root area due to forging defects can result in blade detachment. In extreme cases, blade detachment at a high speed

can damage other rotating and mechanical parts of the compressor.

- Increased vibrations: Increased vibrations are caused by shaft instability.
- Increase in noise: High noise in centrifugal compressors is generated by high speed rotation of vanes or impellers.

ValueNotes BrandMeter also found that compressor breakdowns (product quality) were a key concern among users in India.

ValueNotes BrandMeter found that the user's perception of the quality of a compressor brand is closely related to the quality of the after-sales service provided by the supplier. Even in case of multiple issues with the compressor, prompt after-sales service can result in the user having a more favourable opinion of the brand. In contrast, users with lower instances of compressor breakdowns had a more negative opinion of the brand if slow after-sales service was provided by the supplier. Further, good after-sales service ensures better maintenance of the machine and consequently a significant reduction in user complaints.

Uninterrupted operations of compressors is critical for manufacturing as it is directly associated with productivity. Issues such as excessive power consumption, frequently required maintenance and expensive spare-parts result in additional production cost to the manufacturers. ■



**Adity Ghosh**  
Senior Research Analyst  
ValueNotes Strategic Intelligence

# Historic Spanish Hospital Upgraded



*More and more frequently, grooved solutions are being selected by mechanical contractors faced with time and cost challenges...*

*The Santa Maria Hospital in Lleida was extended whilst services were maintained for the local community...*

W

hen Lleida community in Spain sought to modernise a historic hospital, they had to minimise patients' inconvenience while increasing capacity and improving an aging HVAC system. This article looks at why project managers chose to install a modern grooved mechanical piping system.

**Patients' safety**

In extending Lleida's existing Santa Maria hospital, safety was the paramount concern for everyone involved, as the project did not enjoy the luxury of an empty building, and medical facilities were still required to serve the local community during the upgrade process. This created obvious additional challenges for the HVAC installation.

Exterior and mechanical room piping were carbon steel, with polypropylene piping used in other areas inside the building. If mechanical contractors Climatizacion SAUFER had opted to use hot works on the carbon steel pipe, continuing work in Santa Maria would have been unthinkable with patients still onsite and medical facilities could have suffered lengthy shutdowns.

Welding pipework is potentially hazardous, creates toxic fumes and is a fire risk. Entire systems are required to be drained and dried prior to performing maintenance work since a pipe may burst when flame comes into contact with liquid. For example, if a welder accidentally opened the wrong pipe or if a system was not fully drained, the worker could suffer from molten metal splatter. An area where work is being carried out needs to be evacuated and costly fire-watch is necessary.

Instead of welding, a grooved piping system was used, eliminating many of the risks traditionally associated with joining pipe, and allowing

care to carry on unhampered in surrounding areas of the hospital. Thanks to the use of a Victaulic no-flame system, work was able to continue safely with patients still in beds, and only the need to empty the most nearby wards.

**Faster install**

A whole range of Victaulic grooved products were used throughout the Santa Maria Hospital - from butterfly valves and suction diffusers to rigid and flexible HVAC couplings - including in the mechanical rooms.

More and more frequently, grooved solutions are being selected by mechanical contractors faced with time and cost challenges. In Lleida, this helped the mechanical contractor solve important cost issues, gave them the possibility to do a high speed and high quality job and solve unique safety problems connected with the project.

Some of the major advantages of the Victaulic system are derived from its simplicity - the design of a mechanical pipe joint is inherently easier to work with during maintenance activities. The mechanical joint, or coupling, is comprised of four elements: the pipe groove, the gasket and coupling housings, and the nuts and bolts.

The pipe groove is formed by cold forming or machining a groove into the end of a pipe - using a simple Victaulic grooving tool it is possible to do this onsite, as in Lleida, or offsite in a workshop enabling prefabrication. The key section of the coupling housing engages the groove and the coupling housing fully encloses the gasket, reinforcing it and securing it in position.

Grooved piping systems are dramatically easier and faster to assemble than their welded equivalents. Their smaller footprint, speed of installation and their flame-free assembly help minimise risk, exposure and cost involved on sites. Grooved systems also present advantages for maintaining and rerouting pipes as they require less access space for work than welded systems.



*The flame free assembly of the Victaulic grooved mechanical system allowed patient care to carry on unhampered during installation...*



*The flame free assembly of the Victaulic grooved mechanical system allowed patient care to carry on unhampered during installation...*

### Customer support

In the Santa Maria Hospital, Victaulic systems provided an easy, safe, high quality and economical solution that helped Climatizacion SAUFER to meet their delivery agreements on time and on budget whilst minimising disturbance to patient care. The revamp was completed ahead of schedule.

"Victaulic products were chosen for their high quality and the reduced time and cost of installation with no need to use specialised labour," commented Xavier Ferrer, Climatizacion SAUFER Project Manager.

The range of customer support services provided by Victaulic through its Construction Piping Services (CPS) division helped convince the general contractor, FCC, of the suitability of the system.

CPS services include free estimates and specification updates demonstrating how the Victaulic piping system can save time and money; detailed project-specification drawings and site visits to supervise transition from drawing to implementation; and software solutions to design and specify Victaulic products in a project.

In addition to its comprehensive estimating, pre-planning, project-coordination and software-solutions services, Victaulic is the only mechanical piping systems manufacturer with more than 200 factory-trained piping specialists worldwide to service customer needs in the field.

"This was not our first installation with Victaulic," added Ferrer. "We were sufficiently impressed in Lleida that we would now say that the company would be our first choice for subsequent projects." ■



**Pankaj Soni**  
Manager for India  
with Victaulic



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**Cooling India** invites HVACR professionals and industry experts to write articles on their area of expertise and interest.

# Simplifying Building Renovation



*Model shows the wiring and pipes integrated in the façade of a demonstration building from the 1950s in Frankfurt, Germany. ©Fraunhofer ISE*



*Multi-functional façade element with thermal insulation boards made of polystyrene (EPS) and integrated duct system made of polyethylene (HDPE) ©Fraunhofer ISE*

Reducing energy consumption and boosting energy efficiency are important prerequisites to achieve a climate neutral building stock, the aim of the German federal government by 2050. The political ambitions are high, yet the current renovation rate is very low. Flexible and cost-effective solutions are lacking.

Together with industry partners the experts at Fraunhofer ISE have been working on developments over the past years to combine the renovation of the building envelope with the optimisation of the HVAC systems. Now they present their first prefabricated element developed within the project 'Retrokitt.'

The element consists of multi-functional insulation boards and prefabricated window elements. The construction allows different materials to be combined together. "Depending on the fire safety regulations, insulation materials such as foam or mineral wool can be combined with ventilation ducts made of plastic or metal," explains Fabien Coydon of Fraunhofer ISE. The technical components of

***A prefabricated façade and window elements are the first results stemming from several research projects in which Fraunhofer ISE is involved. It has been shown that the use of these elements increases a building's energy efficiency...***

ventilation, heating, sanitation pipes or electrical and ICT wiring can be integrated in the thermal panels. These façade elements are especially suitable for existing and older buildings.

One of the biggest advantages of these multi-functional façade elements is that they are installed outside on the façade. Therefore, the inhabitants experience less disrupted during renovation. Also, the installation time required is reduced. To install the element, the window elements are first mounted onto the façade and subsequently a first layer of insulation with integrated channels. The ducts or pipes for the building technology services and the sanitation system are then installed using a simple click system. Afterwards a

second layer of insulation is installed and the exterior plaster is applied. Finally the old windows are removed from inside.

"We see here a large potential because the concept and installation procedure enable a fast, cost-effective and high quality renovation. And the need is high, since residential buildings from the post-war era through to the 80s urgently require an energy retrofit to meet today's standards," says Coydon.

The multi-functional façades, the prefabricated window elements and the entire renovation concept developed by Fraunhofer ISE are protected by patents. Product marketing is possible through licensing contracts. ■



# SCIENCE OF COLD WELDING

*Cold welding concepts are used in nano and micro fabrications in high-technology areas. For example, a gold nanowire can be cold welded instantly. The technique is also used in the nuclear field...*

**W**elding of materials for construction is a very important component of any type of industrial infrastructure. There are different types of welding processes with different advantages. A weld can be defined as a coalescence of metals produced

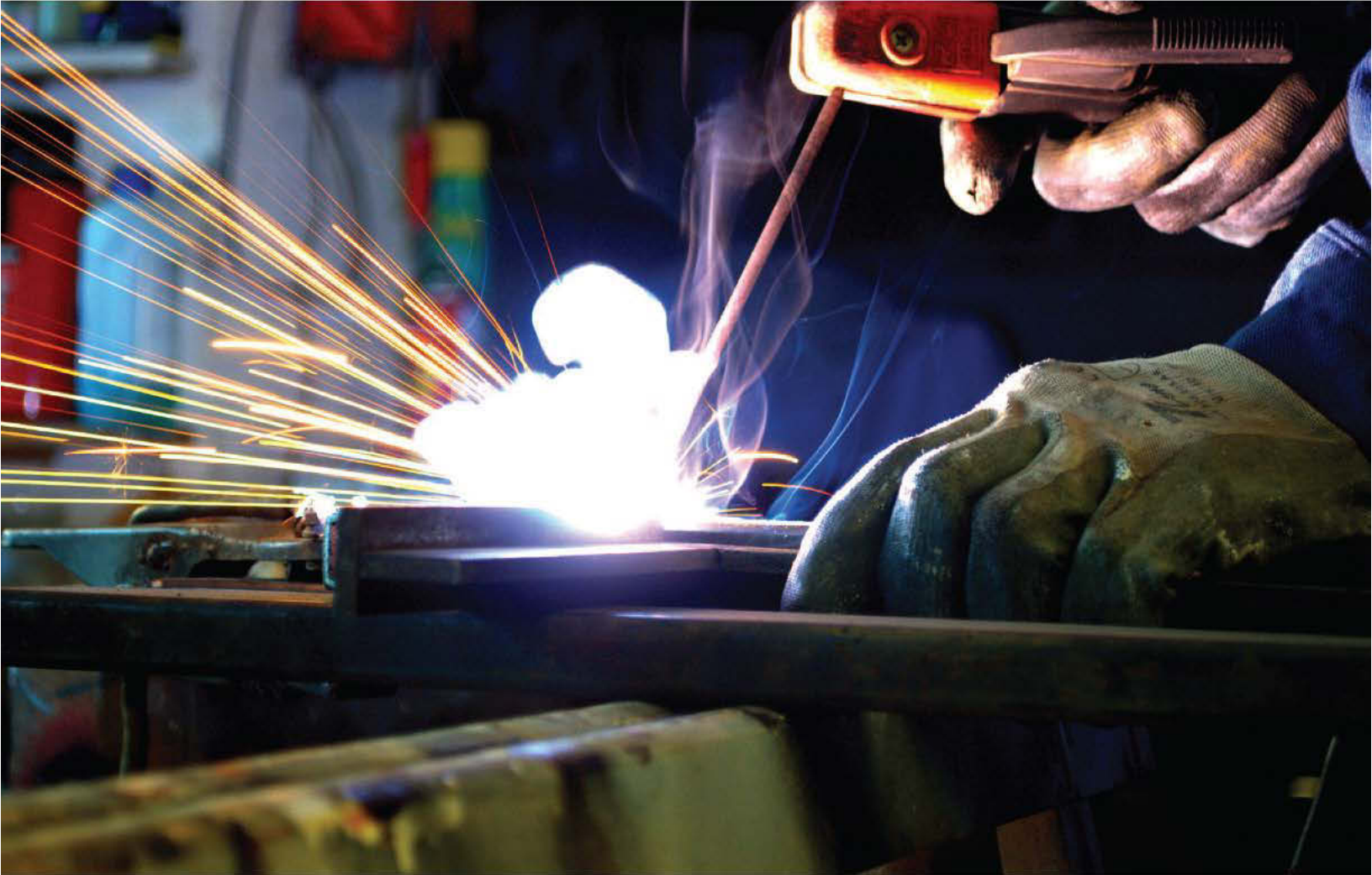
by heating to a suitable temperature with or without the application of pressure, and with or without the use of a filler material. In fusion welding a heat source generates sufficient heat to create and maintain a molten pool of metal of the required size.

The heat may be supplied by electricity or by a gas flame. Electric resistance welding can be considered fusion welding – because some molten metal is formed. Solid-phase processes produce welds without melting the base material and without the addition of a filler metal. Pressure is always employed, and generally some heat is provided. Frictional heat is developed in ultrasonic and friction joining, and furnace heating is usually employed in diffusion bonding. This article presents a brief summary on cold welding, its advantages, developments and characterisation of cold welds.



## Welding history

Welding is a technique used for joining metallic parts usually through the application of heat. This technique was discovered during efforts to manipulate iron into useful shapes. The welding technique—which involved inter-layering relatively soft and tough iron with high-carbon material, followed by hammer forging—produced a strong, tough blade. In modern times the improvement in iron-making techniques, especially the introduction of cast



iron, restricted welding to the blacksmith and the jeweler. Other joining techniques, such as fastening by bolts or rivets, were widely applied to new products, from bridges and railway engines to kitchen utensils. Modern fusion welding processes are an outgrowth of the need to obtain a continuous joint on large steel plates. Riveting had been shown to have disadvantages, especially for an enclosed container such as a boiler. Gas welding, arc welding and resistance welding all appeared at the end of the 19th century. The first real attempt to adopt welding processes on a wide scale was made during World War I. By 1916, the oxyacetylene process was well developed, and the welding techniques employed then are still used. The main improvements since then have been in equipment and safety. Arc welding, using a consumable electrode, was also introduced in this period, but the bare wires initially used produced brittle welds. A solution was found by wrapping the bare wire with asbestos and an entwined aluminium wire. The modern electrode, introduced in 1907, consists of a bare wire with a complex

coating of minerals and metals. Arc welding was not universally used until World War II, when the urgent need for rapid means of construction for shipping, power plants, transportation, and structures spurred the necessary development work. Resistance welding, invented in 1877 by Elihu Thomson, was accepted long before arc welding for spot and seam joining of sheet. Butt welding for chain making and joining bars and rods was developed during the 1920s. In the 1940s, the tungsten-inert gas process, using a non-consumable tungsten electrode to perform fusion welds, was introduced. In 1948 a new gas-shielded process utilized a wire electrode that was consumed in the weld. More recently, electron-beam welding, laser welding, and several solid-phase processes such as diffusion bonding, friction welding, and ultrasonic joining have been developed.

### Welding processes

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing fusion, which is

distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal. In addition to melting the base metal, a filler material is often added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that can be as strong as the base material. Pressure may also be used in conjunction with heat, or by itself, to produce a weld.

**Arc welding:** The electric arc used in welding is a high-current, low-voltage discharge generally in the range 10–2,000 amperes at 10–50 volts. An arc column is complex but, broadly speaking, consists of a cathode that emits electrons, a gas plasma for current conduction, and an anode region that becomes comparatively hotter than the cathode due to electron bombardment. Therefore, the electrode, if consumable, is made positive and, if non-consumable, is made negative. A direct current (DC) arc is usually used, but alternating current (AC) arcs also can be employed. Total energy input in all welding processes exceeds that which is required to produce a joint, because not all the heat generated can be effectively

utilised. Efficiencies vary from 60 to 90 percent, depending on the process; some special processes deviate widely from this figure. Heat is lost by conduction through the base metal and by radiation to the surroundings. Most metals, when heated, react with the atmosphere or other nearby metals. These reactions can be extremely detrimental to the properties of a welded joint. Most metals, for example, rapidly oxidise when molten. A layer of oxide can prevent proper bonding of the metal. Molten-metal droplets coated with oxide become entrapped in the weld and make the joint brittle. Some valuable materials added for specific properties react so quickly on exposure to the air that the metal deposited does not have the same composition as it had initially. These problems have led to the use of fluxes and inert atmospheres. In fusion welding, the flux has a protective role in facilitating a controlled reaction of the metal and then preventing oxidation by forming a blanket over the molten material. Fluxes can be active and help in the process or inactive and simply protect the surfaces during joining. Inert atmospheres play a protective role similar to that of fluxes. In gas-shielded metal-arc and gas-shielded tungsten-arc welding an inert gas—usually argon—flows from an annulus surrounding the torch in a continuous stream, displacing the air from around the arc. The gas does not chemically react with the metal but simply protects it from contact with the oxygen in the air. Some of the best known arc welding methods include:

- **Shielded Metal Arc Welding (SMAW)** - also known as 'stick welding or electric welding', uses an electrode that has flux, the protectant for the puddle, around it. The electrode holder holds the electrode as it slowly melts away. Slag protects the weld puddle from atmospheric contamination.
- **Gas Tungsten Arc Welding (GTAW)** - also known as TIG (tungsten, inert gas), uses a non-consumable tungsten electrode to produce the weld. The weld area is protected from atmospheric contamination by an inert shielding gas such as Argon or Helium.
- **Gas Metal Arc Welding (GMAW)** - commonly termed MIG (Metal, Inert Gas), uses a wire feeding gun that feeds wire at an adjustable speed and flows an argon-based shielding gas or a mix of argon and carbon dioxide (CO<sub>2</sub>) over the weld puddle

to protect it from atmospheric contamination.

- **Flux-Cored Arc Welding (FCAW)** - almost identical to MIG welding except it uses a special tubular wire filled with flux; it can be used with or without shielding gas, depending on the filler.
- **Submerged Arc Welding (SAW)** - uses an automatically fed consumable electrode and a blanket of granular fusible flux. The molten weld and the arc zone are protected from atmospheric contamination by being 'submerged' under the flux blanket.

**Plasma welding:** is an arc process in which hot plasma is the source of heat. It has some similarity to gas-shielded tungsten-arc welding, the main advantages being greater energy concentration, improved arc stability, and easier operator control. Better arc stability means less sensitivity to joint alignment and arc length variation. In most plasma welding equipment, a secondary arc must first be struck to create an ionised gas stream and permit the main arc to be started. This secondary arc may utilise either a high-frequency or a direct contact start. Water cooling is used because of the high energies forced through a small orifice. The process is amenable to mechanization, and rapid production rates are possible.

**Thermochemical processes:** One such process is gas welding. It once ranked as equal in importance to the metal-arc welding processes, but is now confined to a specialised area of sheet fabrication and is probably used as much by artists as in industry. Gas welding is a fusion process with heat supplied by burning acetylene in oxygen to provide an intense, closely controlled flame. Metal is added to the joint in the form of a cold filler wire. A neutral or reducing flame is generally desirable to prevent base-metal oxidation. By deft craftsmanship very good welds can be produced, but welding speeds are very low. Fluxes aid in preventing oxide contamination of the joint. Another thermochemical process is aluminothermic (thermite) joining. It has been successfully used for both ferrous and nonferrous metals but is more frequently used for the former. A mixture of finely divided aluminium and iron oxide is ignited to produce a superheated liquid metal at about 2,800° C (5,000° F). The reaction is completed in 30 seconds to 2 minutes regardless of the size of

the charge. The process is suited to joining sections with large, compact cross sections, such as rectangles and rounds. A mold is used to contain the liquid metal.

**Resistance welding:** Spot, seam and projection welding are resistance welding processes in which the required heat for joining is generated at the interface by the electrical resistance of the joint. Welds are made in a relatively short time (typically 0.2 seconds) using a low-voltage, high-current power source with force applied to the joint through two electrodes, one on each side. Spot welds are made at regular intervals on sheet metal that has an overlap. Joint strength depends on the number and size of the welds. Seam welding is a continuous process wherein the electric current is successively pulsed into the joint to form a series of overlapping spots or a continuous seam. This process is used to weld containers or structures where spot welding is insufficient. A projection weld is formed when one of the parts to be welded in the resistance machine has been dimpled or pressed to form a protuberance that is melted down during the weld cycle. The process allows a number of predetermined spots to be welded at one time. All of these processes are capable of very high rates of production with continuous quality control. The most modern equipment in resistance welding includes complete feedback control systems to self-correct any weld that does not meet the desired specifications. Flash welding is a resistance welding process where parts to be joined are clamped, the ends brought together slowly and then drawn apart to cause an arc or flash. Flashing or arcing is continued until the entire area of the joint is heated; the parts are then forced together and pressure maintained until the joint is formed and cooled. Low- and high-frequency resistance welding is used for the manufacture of tubing. The longitudinal joint in a tube is formed from metal squeezed into shape with edges abutted. Welding heat is governed by the current passing through the work and the speed at which the tube goes through the rolls. Welding speeds of 60 m (200 feet) per minute are possible in this process.

**Electron-beam welding:** In electron-beam welding, the work piece is bombarded with a dense stream of high-velocity electrons. The energy of these electrons is converted to heat upon impact. A beam-focusing device is included, and the work piece is usually placed

in an evacuated chamber to allow uninterrupted electron travel. Heating is so intense that the beam almost instantaneously vaporises a hole through the joint. Extremely narrow deep-penetration welds can be produced using very high voltages – up to 150 kilovolts. Work pieces are positioned accurately by an automatic traverse device; for example, a weld in material 13 mm (0.5 inch) thick would only be 1 mm (0.04 inch) wide. Typical welding speeds are 125 to 250 cm (50 to 100 inches) per minute.

**Friction welding:** In friction welding two work pieces are brought together under load with one part rapidly revolving. Frictional heat is developed at the interface until the material becomes plastic, at which time the rotation is stopped and the load is increased to consolidate the joint. A strong joint result with the plastic deformation and in this sense, the process may be considered a variation of pressure welding. The process is self-regulating, for, as the temperature at the joint rises, the friction coefficient is reduced and overheating cannot occur. The machines are almost like lathes in appearance. Speed, force and time are the main variables. The process has been automated for the production of axle casings in the automotive industry.

**Laser welding:** Laser welding is accomplished when the light energy emitted from a laser source is focused upon a work piece to fuse materials together. The limited availability of lasers of sufficient power for most welding purposes has so far restricted its use in this area. Another difficulty is that the speed and the thickness that can be welded are controlled not so much by power but by the thermal conductivity of the metals and by the avoidance of metal vaporisation at the surface. Particular applications of the process with very thin materials up to 0.5 mm (0.02 inch) have, however, been very successful. The process is useful in the joining of miniaturised electrical circuitry.

**Diffusion bonding:** This type of bonding relies on the effect of applied pressure at an elevated temperature for an appreciable period of time. Generally, the pressure applied must be less than that necessary to cause 5 percent deformation so that the process can be applied to finished machine parts. The process has been used most extensively in the aerospace industries for joining materials and shapes that otherwise could not be made – for example,

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*Diffusion bonding relies on the effect of applied pressure at an elevated temperature for an appreciable period of time. The process has been used most extensively in the aerospace industry for joining materials and shapes that otherwise could not be made...*

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multiple-finned channels and honeycomb construction. Steel can be diffusion bonded at above 1,000° C (1,800° F) in a few minutes.

**Ultrasonic welding:** Ultrasonic joining is achieved by clamping the two pieces to be welded between an anvil and a vibrating probe or sonotrode. The vibration raises the temperature at the interface and produces the weld. The main variables are the clamping force, power input, and welding time. A weld can be made in 0.005 second on thin wires and up to 1 second with material 1.3 mm (0.05 inch) thick. Spot welds and continuous seam welds are made with good reliability. Applications include extensive use on lead bonding to integrated circuitry, transistor canning, and aluminum can bodies.

**Explosive welding:** Explosive welding takes place when two plates are impacted together under an explosive force at high velocity. The lower plate is laid on a firm surface, such as a heavier steel plate. The upper plate is placed carefully at an angle of approximately 5° to the lower plate with a sheet of explosive material on top. The charge is detonated from the hinge of the two plates, and a weld takes place in microseconds by very rapid plastic deformation of the material at the interface. A completed weld has the appearance of waves at the joint caused by a jetting action of metal between the plates.

### Welds characterisation

The philosophy that often guides the fabrication of welded assemblies and structures is 'to assure weld quality.' However, the term 'weld quality' is relative. The application determines what is good or bad. Generally, any weld is of good quality if it meets appearance

requirements and will continue indefinitely to do the job for which it is intended. The appropriate methods of characterisation depend on the weld's function and the particular set of properties required for the application. In some instances, the ability of a weld to function successfully can be addressed by characterising the size or shape of the weld. An example of this is where factors related to the welding procedure, such as inadequate weld size, convexity of the bead, or lack of penetration, may cause a weld to fail. In other cases, it is important to characterise metallurgical factors such as weld metal composition and microstructure. Examples might include welds for which the goal is to avoid failures due to inadequate strength, ductility, toughness, or corrosion resistance. In general, the goals of weld characterisation are to assess the ability of a weld to successfully perform its function, to thoroughly document a weld and welding procedure that have been demonstrated to be adequate, or to determine why a weld failed. In the first part of this article, characterisation of welds will be treated as a sequence of procedures, each more involved than the last and concerned with a finer scale of detail. Initially, non-destructive characterisation procedures will be the focus. The first level of characterisation involves information that may be obtained by direct visual inspection and measurement of the weld. A discussion of nondestructive evaluation follows. This encompasses techniques used to characterise the locations and structure of internal and surface defects, including radiography, ultrasonic testing, and liquid penetrant inspection. The next group of characterisation procedures discussed are destructive, requiring the removal of specimens from the weld. The first of these is macrostructural characterisation of a sectioned weld, including features such as number of passes; weld bead size, shape, and homogeneity; and the orientation of beads in a multipass weld. Macroscopic characterisation is followed by microstructural analysis, including microsegregation, grain size and structure, the phase makeup of the weld, and compositional analysis. The third component of weld characterisation is the measurement of mechanical and corrosion properties. The goal of any weld is to create a structure that can meet all the demands of its service environment. In many cases, the best way of assessing the

performance of a weld is to establish its mechanical properties.

In addition to a number of standard material tests, many mechanical tests are directed specifically at determining a weld's capabilities. Examples of mechanical properties typically characterised for welds include yield and tensile strength, ductility, hardness, and impact or fracture toughness.

Corrosion testing is often employed in situations where a welding operation is performed on a corrosion-resistant material, or in a structure exposed to a hostile environment. Although absolute corrosion performance is important, a major concern is to ensure that a weld and its Heat-Affected Zone (HAZ) are cathodic to the surrounding metal.

Following the discussion of the characterisation procedures, the second part of this article will give examples of how two particular welds were characterised according to these procedures.

**Nondestructive weld examination:** A standard should be established based on the service requirements. Standards designed to impart weld quality may differ from job to job, but the use of appropriate weld techniques can provide assurance that the applicable standards are being met. Whatever be the standard of quality, all welds should be inspected, even if the inspection involves nothing more than the welder looking after his own work after each weld pass.

A good-looking weld surface appearance is many times considered indicative of high weld quality. However, surface appearance alone does not assure good workmanship or internal quality.

Non-Destructive Examination (NDE) methods of inspection make it possible to verify compliance to the standards on an ongoing basis by examining the surface and subsurface of the weld and surrounding base material. Five basic methods are commonly used to examine finished welds: visual, liquid penetrant, magnetic particle, ultra-sonic and radiographic (X-ray). The growing use of computerisation with some methods provides added image enhancement, and allows real-time or near real-time viewing, comparative inspections and archival capabilities.

A review of each method will help in deciding which process or combination of processes to use for a specific job and in performing the examination most effectively.

## Cold welding

Cold welding, the joining of materials without the use of heat, can be accomplished simply by pressing them together. When two surfaces without an interposing oxide layer are brought together, the similar atoms of either side collapse into each other. Unlike the conventional welding process, there is no application of severe heat or melting of the material at the interface. Both the surfaces continue to remain in solid phase throughout this forced adhesion process. The necessary force for the adhesion is applied through mechanical rolls and dies. Cold welding is also known as contact welding. Cold welding was initially discovered by modern societies in the early 1940s and thought of as a new phenomenon, but this process has actually been in existence for thousands of years. It was learned that two pieces of similar metals will bond together inside a vacuum as long as they possess clean, flattened surfaces and a strong initial force can be applied. During the process, deformities occur across 60 to 80% of the bonding surface, and this allows pure, clean metals to come in contact. Permanent bonding then takes place on the atomic level, with welds much stronger than what could be accomplished by other means. Another advantage is that there are absolutely no intermediary materials used as a type of solder, so as long as oxides are not allowed to reform across the metal's surface, it should last for decades. Since the initial discovery period, researchers have shown that cold welding can also be accomplished without excessive force. By applying less pressure over a longer period of time, similar results can be achieved. Another method is to increase the surface temperature of the two materials being bonded for a short period of time to accelerate the molecules.

**Cold welding process:** Surfaces have to be well prepared, and pressure sufficient to produce 35 to 90 percent deformation at the joint is necessary, depending on the material. Lapped joints in sheets and cold-butt welding of wires constitute the major applications of this technique. Pressure can be applied by punch presses, rolling stands, or pneumatic tooling. Pressures of 1,400,000 to 2,800,000 kilopascals (200,000 to 400,000 pounds per square inch) are needed to produce a joint in aluminium; almost all other metals need higher pressures. A general flow of metal takes place

between the die surfaces at room temperatures, stretching the mating surfaces of the metals. A true homogeneous weld is formed with no introduction of a bonding agent. While most ductile metals can be welded into similar or dissimilar metal joints, some of them are more readily joined together. Aluminium, copper, and ferrous metals clad with aluminium or copper flow together with relative ease. Copper or copper clad material must be electro less nickel plated to provide optimum weld ability. The weld zone is not only metallurgically homogeneous, but the metal is work hardened and stronger than the adjacent areas. Parts are joined without contamination from sparks or dusts and vapours. There can be no contamination from fluxes, solders or brazing alloys, which are traditionally used in certain industry sectors. The interior of an enclosure is as free from contamination after welding as it is before. Since no heat is required or generated during welding, the contents of the enclosure are not subjected to temperature cycling.

Cold weld enclosures are truly vacuum tight. While ordinary specifications call for seals with a Helium leak rate of 10-9 cc/sec/atm. Radiflow tests have been made on cold welded enclosures without detecting leaks at the instrument threshold of 10-11 cc/sec/atm. The weld can be made in an optimum environment for a given product, eliminating secondary pump-out operations. Seals may be made in high or low vacuum, dry nitrogen or other desired atmospheres at predetermined pressures.

The cold weld press consists of a 4 post arrangement allowing a stable and repeatable platform for cold welding. A 12 ton press has the capacity for welding most all standard device packages covering crystal and transistor outlines. Larger tonnage presses of either 20 ton or 40 ton are also available to cover multiple package welding, utilising multiple dies, and for the sealing of large diameter SCR devices (some as large as 5" in diameter).

The press system consists of a press base, mounted and sealed within the stainless steel glove box (optionally supplied mounted on a free standing bench assembly). The four posts extend through the top of the glove box and support the press crown assembly. Tonnage is developed by an air-hydraulic booster and operates on 100psi or less. This arrangement of hydraulic cylinders, oil reservoir, tools and boosters allows a low

pressure ram advance for closing the welds tools and a short high pressure stroke for cold welding. Tonnage can be held indefinitely without oil heat up problems. The precision weld tools consist of upper and lower weld dies, which are permanently aligned and mounted on a precision two post die set. This method assures long life and optimum alignment. A floating adapter on the press ram seats in a tee slot atop the weld tool assembly eliminating any miss-guidance. Brass bushings on guide posts minimise lubrication contaminants within the clean atmosphere. The weld tools are designed for particular part configurations, considering material, material thickness, geometric shape, deformation characteristics, feed through requirements, finished dimension needs and reduction requirements in the weld area. Package design should consider requirements and limitations of the cold weld method in early stages of development. Each weld tool is machined from high-carbon-high-chrome tool steel and hardened, ground and polished with tolerances on some dimensions held to plus or minus .00025". The tools are tested for alignment, deformation and weld performance before shipment. Both upper and lower weld dies have a standard 2 1/4" diameter and 2.2" length. Dies have 'O' rings grooves in sides and bottoms for use with vacuum die set chambers. This die size is adequate for most all standard electronic device packages and will withstand the repeated application of 12 ton loads for many hundreds of thousands of welds.

When an evacuated device is required during the weld cycle, stainless steel vacuum chambers can be added to the weld tool. Dual interlocked safety pushbuttons are used to initiate a spring loaded upper and a stationary lower vacuum chamber surround the weld dies. The low pressure down stroke of the press ram is resisted by springs, allowing the vacuum chamber to be sealed for evacuation and backfill (nitrogen/helium) without applying pressure to the parts to be welded. This process cycle is PLC (Programmable Logic Controller) operated and allows adjustable vacuum and backfill gas time delays. The PLC is interlocked with pressure monitoring and automatic vacuum pump operation facilities. Complete evacuation and backfill are assured via ports in the tooling. The upper weld tool cavity retains a part by means of spring-ball plungers. Once the required vacuum level

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within the chamber is achieved the vacuum instrumentation will interface with the PLC to allow the weld follow through of the press at the correct time. The vacuum system provided is based on customers' requirements and Pyramid can provide pumping options covering rotary, turbo drag, turbo molecular and cryogenic vacuum pumps. Vacuum levels to  $2 \times 10^{-6}$  mbar are achievable based on pumping system and time of process. All vacuum systems are supplied with all necessary valving, vacuum instrumentation, interconnections and fittings.

**The science and art of quality weld repairs:** Proper selection and application of weld technologies for the repair of high-temperature components in heat-recovery steam generators and high-energy piping systems is critical to maintaining the high availability and reliability demanded of combined-cycle plants. For better decision-making, industry personnel responsible for weld repair of high-temperature components should come up to speed on (1) typical features of welds, (2) damage that may affect welds in service and the consequent need for repair, (3) the excavation design and geometry of full and partial weld repair, (4) welding processes, (5) welding and Post-Weld Heat Treatment (PWHT) requirements of the construction codes, (6) performance assessment of weld repairs, (7) principles of microstructural control within weldments – among many other things also covered in the report. Cold weld repair where preheat may be applied, but PWHT is excluded. The technique may help users mitigate the financial impact of

lost production by allowing units to return to operation sooner than they would if PWHT were required. Cold-weld repair technology was pioneered in Russia in the 1960s and later advanced in the UK. The US National Board Inspection Code in 1977 allowed weld repairs without PWHT for several materials provided specific buttering techniques were used. In 1995, the NBIC accepted that certain welds were impractical to PWHT and allowed cold-weld repair provided the owner/operator could demonstrate properties equal to those for the original construction. Several controlled weld-metal deposition techniques were developed to enable cold-weld repairs. They use the thermal fields, generated by successive weld beads, to provide both the grain refinement necessary to assure success as well as some local tempering of the structure of the Heat-Affected Zone (HAZ). The so called half-bead, temper-bead, and heat-input control techniques all are based on controlled overlap of the adjacent weld bead segments and the use of several buttered layers.

Cold-weld repairs are not as simple as they might sound. Decisions on excavation configuration, filler-metal specifications, heat input at various stages of the repair, etc. are critical. Plus special training is required for welders performing the work. The ETD report is valuable for its perspective and recommendations on the process to avoid missteps. Keep in mind that toughness of the HAZ and weld strength depends significantly on use of a welding technique that minimises the coarse region from the parent metal. The first layer of weld should consist of small beads, deposited using low heat input to ensure minimum penetration into the parent metal. This can be achieved by using small electrodes, welding in the horizontal position, and adjusting the angle of the electrode to minimise penetration. Great care must be taken to avoid hydrogen cracking and lack-of-fusion defects. A 50/50 bead overlap will reduce the coarse-grained area, but not necessarily remove it altogether. Depositing a bigger weld bead on top of the smaller ones, such that its refined zone overlaps the coarse areas created by the original runs, is the preferred technique. Sometimes, the first beads are ground down slightly to enable the refined zones of the next beads to line up correctly. The final bead of any welding sequence should be deposited in the middle of the cap, away from the parent metal.

One of the takeaways is that cold-weld repairs of thermal fatigue cracks using Inconel-type weld metal normally are considered temporary, possibly providing up to five years of service before another crack is caused by thermal cycling. For a given repair situation, both the operating conditions and type of defect must be considered. Cold welding with nickel-based filler should be suitable for repair of manufacturing defects in castings, such as turbine casings, they said, or for repairs to previous weld repairs made at the manufacturing stage – because they generally experience low stress levels. Subject to periodic inspection, the repairs could be considered permanent. By contrast, in-service defects generally are caused by more severe loadings, so cold-weld repairs with nickel-based filler should be regarded temporary, as noted earlier.

## Advantages of cold welding

As the process is performed at ambient temperature, there are no thermal effects on the parts being joined, and the process is fast, clean, very energy efficient and creates no heat affected zone to change the physical properties of either part.

Additionally, it creates a solid-state weld between either similar or dissimilar metals. Unlike some types of welding, no filler is needed. It is simple and inexpensive to operate once dies have been produced. However, it is highly specialised with respect to joint design and materials to be welded.

## Limitations of cold welding

- The joint can fail in a reactive environment or a high oxygen environment.
- It is suitable for buried pipes and for components deployed in spaces, where there is no risk of oxygen contact.
- For the cold welding to be effective, the surfaces need to be brushed and cleaned effectively.
- If the outer layer of any one of the components has high oxygen content, adhesion is unlikely to occur.
- Another critical factor is the malleability of the metals used. At least one of the two metals to be joined must be malleable.
- Another setback is that since the weld takes place quickly, and is considered permanent, it is very difficult to verify the integrity of the weld, especially in thicker

metals. Whether the result of poor parts fit-up, rapid cooling or a variety of possible contaminants – from the atmosphere, base material or filler metal – weld cracking carries with it significant consequences for any welding operation. Not only does this defect adversely affect the integrity of the finished weldment, but it also requires significant time and money to rectify.

- As the welds are made in the 'solid state' they are difficult to inspect; thus reliance must be placed on process control. With the exception of butt welds, or welds where the contact surfaces are sheared together, the thickness of the parts is reduced significantly at the weld.

## Growing applications of cold welding

Modern uses for cold welding are numerous, but it is still definitely considered a situational process due to the aforementioned limitations. Perhaps the greatest use of cold pressure welding has been for joining of wire, foil to wire, wire to bi-metals, and sealing of heat sensitive containers such as those containing explosives (detonators for example). Rod coils are butt welded to permit continuity in post-weld drawing to smaller diameters. In the electronics industry, cold welding processes are used to seal tin plated steel crystal cans and copper packages for heat sensitive semiconductor devices. Glass packages are also sealed using an indium or tin alloy interlayer. An interesting application of the process is underground wire servicing where joins need to be made in hostile environments, such as in the presence of explosive gases.

- The technique makes it possible, however, to work in many hostile environments that were previously impossible, like welding underground pipelines that carry flammable gasses.
- Cold welding is a hermetic sealing process widely used in the crystal, transistor and high powered solid state electronic switching industries.
- The cold welding process uses a magnetic field to rapidly collapse one component onto another forming a metallurgical bond. The welding cycle is extremely short – typically less than 1 second. A typical magnetic pulse welding system includes a power supply, which contains a bank of capacitors, a high-speed switching system

and a coil. The parts to be joined are inserted into the coil, the capacitor bank is charged and the high-speed switch is activated. As current is applied to the coil, a magnetic field is created, and the outer component is collapsed over the inner component. The technology is well-suited for joining dissimilar metals and cylindrical components, such as air conditioning tubing and tubular space frames. Magnetic pulse welding offers numerous benefits to assemblers, such as no heat input, fast cycle time, ability to join dissimilar materials, and base metal strength in most materials. The weld produced is a true solid-state bond. Magnetic pulse welding is a good alternative to brazing because it offers greater repeatability. Plum says magnetic pulse welding is being used for more and higher volume applications. For example, the technology appeals to auto part manufacturers because of its ability to join dissimilar materials, such as aluminium to steel, within very short cycle time.

- Cold welding concepts are used in nano and micro fabrications in high-technology areas. For example, a gold nanowire can be cold welded instantly. The technique is also used in the nuclear field. The welding of metals at the nanoscale is likely to have an important role in the bottom-up fabrication of electrical and mechanical nanodevices. Existing welding techniques use local heating, requiring precise control of the heating mechanism and introducing the possibility of damage. The welding of metals without heating (or cold welding) has been demonstrated, but only at macroscopic length scales and under large applied pressures. The high quality of the welds is attributed to the nanoscale sample dimensions, oriented-attachment mechanisms and mechanically assisted fast surface-atom diffusion. Welds are also demonstrated between gold and silver, and silver and silver, indicating that the technique may be generally applicable. ■

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# Johns Manville honoured for its contributions to environment

*A potential to reduce end user CO<sub>2</sub> emissions by over 270,000 tons per year...*

**G**lobal building products manufacturer Johns Manville (JM) was recently honoured with the '24-Karat Gold Challenge Award' by the Colorado Department of Public Health and Environment for 'above and beyond' efforts in creating and implementing a program that has made a measurable contribution to the environment, the economy and society. JM was nominated to receive the award by 97 'Gold Leader' peer companies within the Environmental Leadership Program.

The Environmental Leadership Program, administered by the Colorado Department of Public Health and Environment, recognises organisations that go beyond compliance with environmental regulations and strive toward a goal of sustainability. Members work through three levels of partnership: Bronze, Silver and Gold.

Program membership stands at 160 organizations, representing a variety of sectors from manufacturing and agriculture to schools and service providers.

Johns Manville won the award owing to recent activities at the Johns Manville / Industrial Insulation Group manufacturing facility in Fruita, Colo. Staff reinvented, redesigned and reconstructed its manufacturing process, resulting in the elimination of approximately 863 tons of material annually from landfill waste by diverting that material into a new energy-conserving product stream. As a result, the facility eliminated 40 years of reliance on a 3-acre waste impoundment complex. Additionally, the product made from this reclaimed material is conservatively estimated to reduce end user CO<sub>2</sub> emissions by over 270,000 tons of CO<sub>2</sub> per year. ■



*A view of the award ceremony ...*

## AIRAH Awards 2015



**T**he names of the winners of the AIRAH Awards 2015 have been recently announced.

A solar cooling PhD student, an inspiring young engineer, an innovative system of prefabrication, a stunning university campus building, and an effective commercial retrofit were among this year's winners.

"Every year the AIRAH Awards introduce us to people, projects and products that are helping to change the HVAC&R industry – and by extension the built environment, and in fact our lives – for the better," says AIRAH Chief Executive Officer, Phil Wilkinson, F. AIRAH.

**Winners:** **AIRAH Future Leader Award:** Chris King, M. AIRAH, from Bosch; **Student of the Year:** Inga Doemland, Stud. AIRAH; **Award for Excellence in Innovation:** A.G. Coombs / Lendlease prefabrication approach at Barangaroo; **Award for Excellence in Sustainability:** the work by Steensen Varming on the University of Technology Sydney's Thomas Street Building; **Best HVAC&R Retrofit or Upgrade:** Aurecon's air conditioning improvements at 175 Eagle St, Brisbane; **Product of the Year:** Conserve It's PlantPro BMS and **WR Ahern Award:** Stefan Jensen, F. AIRAH; and Paul Bannister, M. AIRAH.

The AIRAH Awards 2015 sponsors were Mitsubishi Electric (event sponsor), A.G. Coombs (Future Leader), NABERS (Excellence in Sustainability), Standards Australia (Excellence in Innovation), Heatcraft (Student of the Year), Actron Air (Dinner Sponsor), LG (Product of the Year and Best HVAC&R Retrofit or Upgrade) and Daikin (after-dinner speaker sponsor). ■



# TRI-GENERATION WAY OF SUSTAINABILITY



*One of the important features of the CCHP is to provide cooling by utilising the rejected heat instead electricity. This solution is realised by the thermally activated technology, which is dominated by the sorption cooling...*

*One of the well known and age-old technology, Combined Heat And Power generation systems (CHP) better known as cogeneration, allows the simultaneous generation of heat and power in a single energy process...*

The population growth and technological advancement exhibited in the last two decades along with the desire for higher life standards and comfort levels have led to an unprecedented increase in the energy consumption worldwide. Energy consumption has increased from 7140.7 Million tons of oil equivalent (Mtoe) in 1980 to about 12875.6 Mtoe in 2010. Asia and Oceania have the largest share in the energy consumed in 2010 with about 37.9% followed by North America with 23.1% and Europe with 16.4%. India's electricity consumption stands at 587 billion kWh in 2006, out of which currently 8% is being used by the commercial sector and 25% in the residential segment. 30% of energy consumed in the commercial sector in India is on account of HVACR. Energy demand is increasing and more than 25% of total electricity consumption is in residential/commercial sector put together. Projected annual increase in energy demand is 5.4 billion kWh in residential and commercial sector in India.

The total world energy consumption exhibits that the oil still the dominant resource with 33.1% of the global energy consumed followed by coal (29.9%) and natural gas (24%). Renewable energy resources contribution to the over all world energy consumption pattern is still less than 9% with 6.6% of hydro-electric power and less than 2% for all other renewables combined. This heavy reliance on conventional fossil fuels has led to an increase in the global energy-related CO<sub>2</sub> emissions by 1.4% to reach 31.6 Gigatonnes in 2012 with a historic peak exceeding 400 ppm in the atmosphere in May 2013. In addition, energy uses in buildings, mainly electric power, heating and cooling/refrigeration, contribute to about 20 – 40% of the over all energy consumption with similar contribution to carbon dioxide emissions. The majority of these buildings depend on large central stations or plants to provide their electricity demands employing oil, natural gas or coal as fuel resources.

However, the operation of these central

stations is usually characterised by high rates of energy losses mainly in the form of waste heat. With additional losses in the electric power transmission through high voltage lines and in the transformers, only 35 – 45% of the over all energy produced by these stations is delivered to the final user. Thus, the high investment cost and high incremental risks of these stations along with their high energy production environmental foot print and complex design favour the switch to more efficient and compact decentralised energy production systems and facilities.

One of the well known and age-old technology, Combined Heat And Power generation systems (CHP) better known as cogeneration, allows the simultaneous generation of heat and power in a single energy process. It is estimated that the installation of 1 million micro-CHP units, with size range of 1–10 kWe, in the UK residential sector would allow an annual cost reduction of about £176 million on the energy production and the mitigation of 2.1 million tons of CO<sub>2</sub>.

Although Combined Heat And Power (CHP), as a proven and reliable technology, mainly used in large scale centralised power plants and industrial applications, provides various technical, economic and environmental advantages compared to the separate production of heat and power in conventional Separation Production (SP) systems, such systems efficiency and capability decrease dramatically in hot climates especially in the summer months where the need for heating is minimal. Thus, a balanced and continuous heat and electricity demand profile all over the year is required to attain high cogeneration system over all efficiency. However, the case is very different in real climatic conditions where many regions exhibit a summer season with an increasing demand for cooling and air conditioning due to larger thermal loads, higher

life standards, new buildings design and architectural characteristics and the desire for high levels of thermal comfort. Combining heat and power system (CHP) with a thermally activated cooling technology by harnessing the discharged waste heat from power generation systems to fulfill heating and cooling needs with power generation known as the Combined Cooling, Heating And Power (CCHP) tri-generation system, an effective way to improve the overall efficiency and reduce the negative environmental impacts Green House Gas (GHG) emissions.

The concept of integrating various units to form a combined heating, cooling and power generation system was first introduced in the early 1980s for municipal cooling and heating. A typical tri-generation system comprises a prime mover, electricity generator, thermally activated technologies, heat recovery unit and a management and control unit. Over the last three decades, tri-generation systems have attracted considerable interest, especially small-scale systems (below 1 MWe), with the development of different options and alternatives for thermally driven cooling technologies and cogeneration units. Potential tri-generation users are small and medium-scale applications ranging from less than 1 kW to more than 10 MW including multi-residential dwellings and communities, office buildings, hotels, hospitals, commercial and shopping malls, universities, restaurants and food industry. Compared to the conventional separate way of energy production (heat by boilers and electric power by central stations) and conventional cogeneration units, tri-generation systems enhance the over all

energy production efficiency with various technical, environmental and socioeconomic benefits on different levels.

Employing CCHP, overall fuel energy utilisation increases dramatically ranging from 70% to more than 90% compared with 30 to 45% of typical centralised power plants. In general, less primary energy is needed to obtain the same amount of electricity and thermal energy. In addition to the saving in primary energy, vast reduction in net fuel costs, transmission and distribution savings achieved. Based on a typical CCHP system, only 100 units of prime energy are needed for 33 units of electricity power, 40 units of cooling power and 15 units of heating power in summer day. The electricity generation efficiency of CCHP system is similar to centralised power plant, because electricity is consumed locally without loss on distribution lines, though small scale prime mover is less efficient than large prime mover in power plant. The keystone of full energy utilisation of CCHP system lies on the recovery of waste heat from prime mover. Further, CCHP systems increase the reliability of the energy supply network. Weather and terrorism are fatal threats to centralised power plants. A smaller more flexible and dispersed system, CCHP might prevent these threats from becoming reality, and controlled repercussions and fast recovery could be achieved if these situations occurred.

One of the important components of the CCHP is the prime movers technology. The technology can be divided into two categories, combustion based technologies such as Stirling engine, gas engine, Rankine cycle and reciprocating engine and electrochemical based technology fuel cells. Among these technologies, Stirling engine, Organic Rankine Cycle (ORC) and fuel cell driven technologies are relatively at development stage.

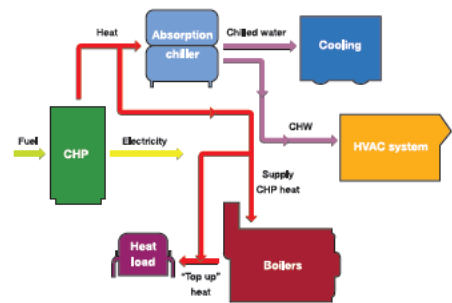
Reciprocating engines of the capacity in the range of 100 – 5000 kW are commonly employed in CCHP. Waste heat can be recovered at different levels, from exhaust gases at 200-400°C and from jacket water cooling and oil cooling at 90-125°C. Generally, reciprocating micro CHP systems have a total efficiency of about 80%. In one of the ICE

integrated tri-generation with biomass gasification where gas produced by the gasification is used in engine to produce electricity and waste heat is recovered to provide heating needs and cooling power through an absorption cooling unit. Gas turbines can also be an attractive prime mover with different sizes and configurations for CCHP. Compared to ICE based systems, gas turbines are more compact and require less maintenance with hot gases released at a temperature of 250°C that could easily drive thermally activated cooling technologies. A tri-generation system using gas turbine with 100 MW power, 70 MW heat and 9 MW cooling capacity was developed. However, micro turbine applications in the residential and building sector are still very limited due to their low electrical efficiency and inflexibility to load profile changes.

One of the important features of the CCHP is to provide cooling by utilizing the rejected heat instead electricity. This solution is realized by the thermally activated technology, which is dominated by the sorption cooling. The difference between the sorption cooling and the conventional refrigeration is that the former one uses the absorption and adsorption processes to generate thermal compression rather than the mechanical compression using the rejected heat from the prime mover along with the electricity generating. This cascade utilisation of heat owes to the thermally activated technology. By introducing thermally activated technologies, the electric load for cooling is shifted to the thermal load, which can be fully or partially achieved by absorbing or adsorbing the discard heat from the prime mover. The main application of the sorption refrigeration is for CCHP systems in residential buildings, hospitals, supermarkets, office buildings and district cooling systems.

Mainly three types of the thermally activated technologies exist i.e., absorption chiller, adsorption chiller and desiccant dehumidifier. Since the temperature of the discard heat from prime movers can lie in different ranges, thermally activated facilities should be chosen to couple with prime movers. For example, if the heat source temperature is around 540°C, then the suitable choice is a double-effect/ triple-effect absorption chiller based on the number of times the heat is utilised within the absorption system.

An economical, efficient and of low



emissions CCHP system should be designed with fully consideration of energy demands in a specific area, prime mover and other facilities' types and capacities, power flow and operation strategy, and the level of GHG emissions. The selection of facility types belongs to the design of the system configuration, which emphasizes on the selection of prime movers according to current available technologies, and on the system scale. The existing CHP/CCHP sites in the market sorted by prime movers, 42% reciprocating engine, 23% steam turbine, 12% combustion turbine, 7% combined cycle and 16% others. With a selected CCHP system configuration, operation strategy is the key to achieve the most efficient way for the CCHP to operate. The operation strategy determines how much electricity or fuel should be input to the system according to the demands; which facility should be shut down to keep the whole system efficient; how the energy carries flow between facilities; and how much is the power one facility should operate at. With a designated configuration and an appropriate operation strategy suitable sizing and optimisation can make the system operate in an optimal way.

Finally it can be concluded that with the dramatic increase in the world primary energy consumption and the corresponding green house gas emissions, combined cooling, heating and power generation presents a promising technology providing multiple energy products accompanied with highly efficient energy production, green- house gas emissions reduction, higher energy supply reliability and lower operational and maintenance costs. ■

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# Augmenting **SOLAR POWER** Through **PHASE CHANGE** Materials

*A solar dryer with thermal storage through PCMs would continuously operate 24/7 thereby eliminating the only drawback of solar drying as compared to fuel based drying while enhancing the advantages...*

Solar energy should have been the most intuitive source of power to fuel the constantly increasing energy demands of a thriving human race. The biological demands for food, heat and light were being met for 3.4 billion years, but only in the past century humans were able to convert solar energy into the most sought after source of energy – ‘electricity’. This development alone should have single-handedly catapulted our race in to the next phase of evolution, where energy becomes abundant and is no longer a constraint in the giant leaps of technology as visualized by so many of us today.

However, the idea of abundant usable energy through solar power had limitations, which were until a decade ago considered insurmountable. But as profusion of human

ingenuity is only matched by that of abundance of sunlight, there are inventors, innovators and dedicated scientist working round the clock, around the world to make solar power usable, cheap and efficient.

Let’s try to understand solar energy from the perspective of its classification, usability and limitations.

**Classification of solar energy can be done under two broad categories:**

- Direct solar energy is the form of energy which is directly utilised by the end source through direct contact and converted into heat or electricity. This includes biological phenomenon of photosynthesis, thermal heating, photovoltaic cells, etc.
- Derived solar energy entails the usage of converted solar energy without direct

contact with the energy source. For example, the food that we eat, fossil fuels, etc.

The current applications of solar energy fall under two categories: photo-electric applications and thermal applications.

**Photo-electric applications:** These applications convert solar radiations into electricity. Solar cells fall into this category, and are the most sought after devices currently for applications ranging from satellites to small calculators.

**Thermal applications:** These applications convert solar energy into thermal energy. Thermal energy has application in electricity generation, water heating, food drying, etc.

Certain limitations are present in all form of energy sources. With solar energy, to a great extent, limitations have stifled commercialisation potential. Some of the persistent ones are as follows:

- As abundant as the sunlight maybe, it's limited by day night cycle, location and season. Sunlight intensity varies, which causes thermal instability in certain heat

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*Solar drying provides much higher quality produce as compared to open sun drying and is cheaper and environment friendly as compared to fuel based drying. This has the potential to alter the landscape of food drying by replacing fuel based drying...*

---

specific applications.

- Generally, applications require specialised construction, special materials and have high manufacturing and maintenance cost.

The primary focus of this article is utilisation of 'direct solar energy' and how through Phase Change Materials (PCM) we have finally surmounted the limitations for different applications.

Phase Change Materials (PCM) technology offers the scope of developing and deploying specific solar energy applications that are

cheap, easy-to-use, efficient, dependable, and offer functionalities previously unimagined. Let's look at this class of materials that offer to change the solar energy paradigm forever. Phase Change Materials (PCMs) are innovative materials which offer the possibility to maintain desired temperatures with precision. They can store and release large amounts of thermal energy at constant temperature. They can be utilised in various solar power applications because of these properties.

**Solar Water Heater:** Solar water heating (SWH) is the conversion of sunlight into renewable energy for water heating using a solar thermal collector. Solar water heating systems comprise various technologies that are used worldwide increasingly. But due to certain limitations such as freezing, overheating, low efficiency and day night cycling, the commercialisation has been slow.

PCM has the potential to solve these limitations through their property of maintaining specific temperature range over a large period of time. For instance, in most households heated water requirements peak



*A sea of mirrors directs a powerful beam of light toward a solar power tower...*

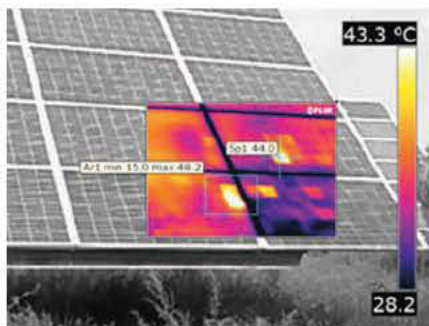
in early morning. Whereas, heated water supply is maximum around the afternoon. This imbalance of demand and supply can be solved by proper application of PCMs as buffer for maintaining temperature around the clock in the water heater.



*Solar water heaters being used in township in Northern China...*

**Food drying:** Drying is an essential process in the preservation of agricultural products. The dried produce also fetches significantly higher prices than fresh produce. Most food products, especially fruits and vegetables require hot air in the temperature range of 40 to 60°C for safe drying. Solar drying provides much higher quality produce as compared to open sun drying and is cheaper and environment friendly as compared to fuel based drying. However, the day time only operation of solar drying has been a limiting factor in wider adoption. A solar dryer with thermal storage through PCMs would continuously operate 24/7 thereby eliminating the only drawback of solar drying as compared to fuel based drying while enhancing the advantages. This has the potential to alter the landscape of food drying by replacing fuel based drying for industrial food processing units and improving the value proposition of solar drying for commercial and domestic drying units.

Advantages of phase change materials



*Temperature profile of a solar cell on a hot summer day...*

based solar dryers over conventional solar dryers:

- Higher system productivity due to 24/7 drying operation and higher collector efficiency leading to reduced capital cost per unit of dried product.
- Shorter drying duration resulting in reduced food wastage enabling higher farm productivity.
- Better quality dried product with higher nutritional value, aroma & taste due to controlled drying with no temperature fluctuations.
- Countering in all the factors we can easily see the potential for lower power consumption and cost reduction.

**'Solar panel temperature is one of the important factors that affect how much electricity your panels will produce. It's ironic – but the more sunshine you get, the hotter the panels get and this in turn counteracts the benefit of the sun. In some cases the heat factor can reduce your output by 10% to 25% depending on your specific location.'**

Let's look at this problem in detail and try to understand how PCMs can solve it.

The solar panel temperature affects the maximum power output directly. As solar panel temperature increases, its output current increases exponentially while the voltage output is reduced linearly.

Since power is equal to voltage times current, this property means that the warmer the solar panel the less power it can produce.

Every solar cell comes with a 'Temperature Coefficient  $P_{max}$ '. For example, the temperature coefficient of monocrystalline solar panel is  $-0.48\%$ . In most practical cases, in countries like India, during summers the temperature of panels

may exceed 45°C for better part of the year.

Due to the constraints of 'Temperature Coefficient  $P_{max}$ ', the efficiency of the solar panels drops 15 to 20% on an average.

Phase change materials due to their ability of maintaining precise temperatures for long durations, can be utilised. For instance, a PCM with operational range of 23 to 25°C can provide a stable temperature for the panels even in extreme weather conditions and thereby maintain the efficiency of the panel. ■

**Anirudh Batra**

Associate- Business Development in PCM Division of Pluss Advanced Technologies



**Vishnu Sasidharan**

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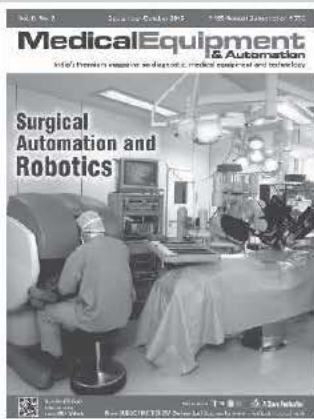


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# India Cold Chain Show 2015



Latest technologies and trends in Cold Storage and Logistics is the watchword of the India Cold Chain Show 2015, scheduled from 16 to 18 December 2015, Bombay Exhibition Centre, Goregaon (E), Mumbai. The three day show is a harbinger to a global platform for industry professionals to acquire knowledge, learn and network. Last edition, India Cold Chain Show 2014 was attended by 5,331 trade visitors from 25 countries and featured 125 exhibitors, the event showcased over 260 live solutions.

This 4th edition is exclusively focused on the temperature control and cold chain industry to take a step in the right direction and get the

*The three-day show is a harbinger to a global platform for industry professionals to acquire knowledge, learn and network...*

complete insights required to expand the business. Temperature control and special handling are rudimental concerns to most perishable & frozen food industry and biopharma industry today. The industry is highly challenged with the issues of wastage of food product and round the year availability of good quality product.

How to traverse the stumbling block in the growth of the supply chain industry and maintaining good quality of Cold Chain Products throughout distribution networks. The exhibition highlights the case studies, best practices and interactive discussions helping advance industry standards and ability to identify the areas to strengthened and enlarged prospects to ensure product integrity.

This December, you will see technologies and solutions classified into 3 broad segments – Cold Storage, Cold Transport and Cold Supply Chain. The focus is now given on bringing larger audience for each category. While each year ICCS is

attended by a variety of industry professionals from all over the country, this focused approach would ensure even wider audience at the event.

The edition is also covering the renewable energy sector to support the sustainable development of Cold Chain Industry and strengthening India Cold Chain with Solar

Power. As per the sources, the investment in Cold Chain India is forecasted as USD 15 billion in next five years.

India Cold Chain Conference: This is a two-day conference that will take place on 16 to 17th December 2015, and be co-located with India Cold Chain Show at Bombay Exhibition Centre, Goregaon (E), Mumbai. The conference discussions and sessions will be based on the theme "Trends And Innovative Solutions In Cold Stores Modernization, Soft Skills Development etc., And Efforts to Make Sea Food Industry more Vibrant".

The event has garnered support from Pluss Polymers Pvt. Ltd. as knowledge partner, Officine Mario Dorin SPA as cocktail partner, Fresh Food Technology India Pvt. Ltd., as delegate kit partners and Crystal Titan Containers as networking dinner partner. ICCS 2015 is officially supported by Holland Pavilion during the show.

**Visitors' Registration:**

The event is free to visit. For visitor registration and more information please visit: [www.IndiaColdChainShow.com](http://www.IndiaColdChainShow.com)

**Contacting Show Team:** For any visiting queries, contact: **Rohan Chopra** +91 - 9873201377 [rohan.chopra@reedmanch.com](mailto:rohan.chopra@reedmanch.com)

# CeMAT Hannover

## The Event You Can't Miss

Once again, Hannover, Germany will be hosting the world's leading trade fair for intralogistics and supply chain management in 2016 – CeMAT Hannover, to be held at Hannover, Germany from 31 May to 3 June 2016.

As an engine for innovation, CeMAT brings together market leaders, small and medium-sized enterprises, top decision-makers and experts in the field. In short, CeMAT provides a unique platform for success that you as an exhibitor will not want to miss.

The lead theme for CeMAT 2016 is Smart Supply Chain Solutions. In other words, the show will highlight the pivotal role of logistics in today's increasingly digitized and integrated industrial value chains. Dr. Andreas Gruchow, a Member of the Managing Board of Deutsche Messe, explains, "Logistics is growing in importance because accuracy and flexibility of supply are fundamental to the growing Industry 4.0 trend. Soon, all parts containers, racks, materials handling and transport systems and even the materials themselves will need to be intelligent so that they can communicate with their surroundings and with machines and robots in downstream and upstream production and assembly processes. And this, precisely, is the focus of the upcoming CeMAT with its



*Glimpses from the past CeMat events...*

lead theme of Smart Supply Chain Solutions. The show will present automation and integrated control solutions for tomorrow's intelligent, digital logistics processes. The scope will extend far beyond mere logistics optimization solutions because the digitization trend is revolutionising entire value chains and creating completely new business models. CeMAT has a vitally important role to play in this revolution – because it is the only trade fair that provides a global perspective on the technology trends involved."

### What will you see in CeMAT 2016?

Automatic guided vehicles that optimise

their own routes. Warehouses that automatically recognise missing inventory and order refills in real time. Systems that develop into complete service providers, thanks to innovative IT. CeMAT 2016 brings all the fascinating trends in intralogistics together at the same time and place. The future belongs to the Smart Factor – but only after perfectly integrated logistics processes create the necessary preconditions. This makes the intelligent control of inventory flows an absolute must.

Manufacturers, dealers, service providers: All of these are on the lookout for new technologies and ideas. And CeMAT is the only place that brings together groundbreaking solutions for the entire supply chain – under the keynote heading of 'Smart Supply Chain Solutions.'

### Integrated worlds

A key focus in 2016 will be on IT, which represents the common connection between all the fields involved in highly automated logistics. As a result, CeMAT is an absolute must for IT specialists as well as for production managers and top executives across the world who want to obtain a complete overview of today's market and discover the building blocks for the factories of tomorrow. ■



*Glimpses from the past CeMat events...*

# Managing Vacuum Supply Centrally

*A clinic in Denmark is efficiently managing its vacuum requirement without much need of maintenance and their system offers the advantage of dry compression...*



*The VCR Viborg central vacuum supply with three Busch Mink MV claw vacuum pumps...*



*VCR centre for spinal injuries in Viborg, Denmark...*

**T**he VCR centre for spinal injuries in Viborg, Denmark is a modern clinic, which has a central vacuum supply powered by dry-running Mink claw vacuum pumps. VCR Viborg is run as an independent centre for patients with spinal injuries, but is a part of the neurology department of Viborg Regional Hospital. When the clinic was built in 2014, the management opted for a Busch central vacuum supply. Viborg regional hospital and other clinics administered by the regional authority of Central Jutland (Region MIDT) also rely on similar Busch vacuum systems.

The central vacuum supply comprises a rack of three Mink MV 0040 Bclaw vacuum pumps, an upstream 500 litre vacuum reservoir, bacteria filters and a controller. The system is installed in a utility room in the basement, and supplies vacuum to 40 connections in patient rooms, treatment areas and operating theatres throughout the hospital.

As the hospital is relatively small, Busch offered VCR Viborg a vacuum system equipped with three of the smallest Mink claw vacuum pumps, each with a pumping speed of 40 m<sup>3</sup>/h. Two of the three Mink MV vacuum pumps maintain a vacuum level of about 250 mbar in the vacuum reservoir.

If devices requiring vacuum are connected anywhere in the hospital network, air flows into the vacuum reservoir. The subsequent rise in pressure causes one of the two vacuum pumps to start automatically, returning the vacuum level to the desired value. All three

Mink MV vacuum pumps have an integrated frequency converter, and are controlled to deliver the minimum output required to maintain 250 mbar in the reservoir. This means the vacuum pumps often run at reduced speed, allowing them to operate extremely efficiently.

The second vacuum pump is activated only when the output of the first is insufficient. The system is dimensioned so this occurs only in extreme cases. The controller starts the vacuum pumps alternately, so the number of operating hours for each unit is approximately equal.

The third Mink MV 0040B serves as a standby and reserve unit, and is controlled redundantly by a pressure sensor in the reservoir. If this sensor detects a sudden rise in reservoir pressure – only possible if the system has a leak, or the other vacuum pumps have stopped – the standby unit is activated. The hospital vacuum supply is thus guaranteed, even if two vacuum pumps fail. The standby unit can also be used when maintenance work is carried out on the other two vacuum pumps. In this way the system is designed in accordance with the European standard EN ISO 7396-1 'Medical gas pipeline systems - Part 1: Pipeline systems for compressed medical gases and vacuum.'

Mink claw vacuum pumps offer the advantage of dry compression. In contrast to the oil-lubricated vacuum pumps often used in the past, no operating fluids are required in the compression chamber. This makes contact-

free claw technology possible: none of the moving parts touch each other, so lubrication and cooling are not required and no component wear takes place. For the operators of Mink vacuum systems, this means almost no maintenance – oil, filters and components do not need replacement.

Mink MV servicing is restricted to a gearbox oil change every 8000 operating hours. Due to the way operating hours accumulate in the VCR Viborg system, this corresponds to a theoretical service interval of several years. However, the two bacteria filters installed between the reservoir and the vacuum pumps require regular inspection. These filters prevent bacterial contamination from the vacuum pumps to the hospital environment. The filters are arranged in parallel, with only one filter in use at a time. A shut-off valve diverts the air flow to the other filter to permit cleaning or replacement without interrupting the vacuum supply.

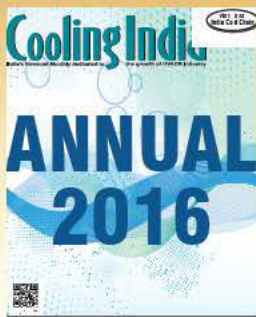
After more than a year of operation, the technical staff at VCR Viborg are extremely satisfied with the central vacuum supply. Maintenance has not been an issue, as the system has performed perfectly and the first service is not due for some time. Also, reassuring is the local support by Busch Denmark, with advice and practical assistance from vacuum specialists available at any time. ■

**Uli Merkle**  
Manager, Marketing Services  
Busch Dienste GmbH, Germany

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# Improving Product Design In Digital Environment

*Exa Corporation has rolled out an innovative software for detection and elimination of unwanted noise through simulation. According to BMW Group, the software FIND enables efficient optimisation of HVAC noise in the earliest stages of vehicle development...*

**E**x Corporation, a global innovator of simulation software for product engineering, has revealed its patent-pending FIND (Flow-Induced Noise Detection) capability within Exa PowerACOUSTICS.

This integrated solution represents a critical advancement for Exa's existing aeroacoustic Computational Fluid Dynamics (CFD) simulations by clearly pinpointing the origins of airflow-induced noise.

Exa PowerFLOW has long been the established leader in aeroacoustic simulations, but engineers have been challenged to unravel the complex turbulent flows in order to understand how to acoustically improve their designs by reducing the noise sources.

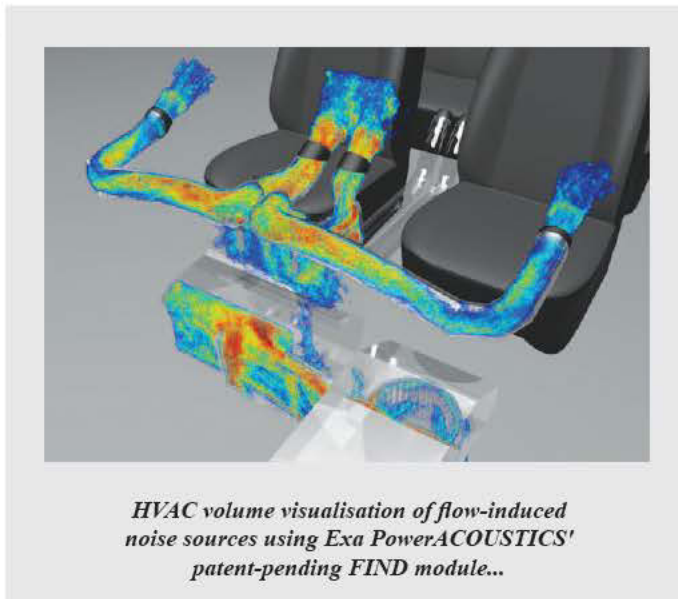
Now the FIND software can analyse the fluid flow of a design and rank the different noise sources in order of importance, providing engineers with the insight they need.

The noise generated can also be listened to before and after design modifications, so that the impact of any proposed improvements can be aurally assessed.

Exa's solutions empower engineers to understand issues early in the development process. Product designs can then be improved in a digital environment, long before costly

physical prototypes that provide no insight have been built.

For the automotive industry, the FIND module within Exa PowerACOUSTICS predicts the flow-induced noise sources for areas such



*HVAC volume visualisation of flow-induced noise sources using Exa PowerACOUSTICS' patent-pending FIND module...*

as greenhouse or underbody wind noise, HVAC and blower noise, or noise from within exhaust systems. Using a patent-pending method, it analyses the airflow simulated with Exa's PowerFLOW, in ground vehicle aeroacoustics and the fastest and most accurate solution available.

As always with PowerFLOW, the simulation reproduces the transient nature of real fluid

flow, resulting in accurate modeling of turbulence. Flow-induced noise sources, even those normally masked by turbulent airflow, are then pinpointed in space by the FIND model and their intensity quantified, enabling a precise

localisation and ranking of noise problems.

Thanks to other Exa products, the results can be visualised in 3D: quickly, clearly and simultaneously with the underlying design geometry. This makes it easy to convey the findings to engineers and managers, and easy to decide how to improve the design.

"Exa PowerFLOW accurately predicts aeroacoustic noise levels and PowerACOUSTICS FIND provides an unprecedented insight to identify noise sources. This allows engineers to make design changes that will reduce the generated noise levels. This capability applies to all aeroacoustics applications across

multiple industries, such as wind noise and HVAC systems noise in automotive, landing-gear noise in aerospace, or applications in the rail industry. FIND provides significant additional value to our clients through these breakthrough capabilities that were not available anywhere, until now," remarked Dr. Franck Péro, Sr. Director of Acoustic Applications for Exa. ■

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# Innovations Needed

## To Make Renewable Energies Cheaper



*The Prime Minister of India, Narendra Modi is addressing at the Innovation Summit of COP 21, in Paris, France. (L2R) The President of USA, Barack Obama, the President of France, Francois Hollande and Bill Gates are also seen...*

**A**ddressing President Hollande, President Obama, Excellencies, Bill Gates and Distinguished Guests, Narendra Modi started his speech. He stressed on the need for innovations to make renewable energies cheaper and providing opportunities to developing nations...

### Verbatim

"Let me begin by saluting President Hollande and the people of France for their courage and resolve; and, to the world for coming together for Paris and France.

The outstanding arrangements reflect the character of this great nation. The world has assembled in Paris to change the course of our planet to a sustainable path.

We must speak about goals and targets on carbon emissions and rise in global temperature. But, it is just as important to focus on the instruments that will make it natural and easy for the world to get there.

A vast section of humanity lives at the edge of poverty and in darkness after the sun sets. They need energy to light up their homes and power their future. And, they are also the most vulnerable to the consequences of an industrial age powered by fossil fuel.

Access to energy and a better life is a universal aspiration. And, so are clean environment and healthy habitats. As the world's majority works its way to prosperity on a planet left with very limited carbon space, we have to do many things.

We have to ensure, in the spirit of climate justice, that the life of a few does not crowd out the opportunities for the many still on the initial steps of the development ladder. The advanced countries must leave enough room for developing countries to grow. And, we must strive for a lighter carbon footprint on our growth path. For that we must come together in a partnership to bring clean energy within the reach of all.

Innovation is vital for combating climate change and ensuring climate justice.

That is what makes this Innovation Summit very special. This unites us behind a common purpose. We need research and innovation to

make renewable energy much cheaper; more reliable; and, easier to connect to transmission grids.

We can make conventional energy cleaner. And, we can develop newer sources of renewable energy. This is a global responsibility to our collective future.

Our innovation initiative should be driven by public purpose, not just market incentives, including on intellectual property. That also means strong public commitment by suppliers to developing countries. That will make clean energy technology available, accessible and affordable for all.

This partnership will combine the responsibility of governments with the innovative capacity of the private sector. We will double our investments in research and innovation; and, deepen collaboration among ourselves. We should have an international network of 30 to 40 universities and labs focusing for next ten years on renewable energy.

Innovation must be backed by means to make it affordable and ensure adoption. We have a very successful model of public-private partnership with many countries present here. India is also building renewable capacity in developing countries, including small island states.

The progress on clean energy technology and costs is impressive. If we raise the level of our efforts, we can transform the world. We will also lay the foundation of a new economy in new low carbon age.

We will restore the balance between ecology and economy, and between our inheritance and obligation to the future. And, live up to Gandhiji's call to care for the world we shall not see.

Thank you." ■

**At the Innovation Summit of COP 21 in Paris, where scientists, politicians, intellectuals, financiers and other international figures assembled to take part in serious discussions on creating a roadmap for reduction of harmful emissions, Indian Prime Minister, Narendra Modi delivered his thought provoking speech. Verbatim...**



*(R2L) The Prime Minister, Narendra Modi and the President of France, Francois Hollande at launch of the International Solar Alliance, during the COP21 Summit, in Paris, France on November 30, 2015...*

### **Airedale presents inverter driven PAC system**

**T**he SmartCool SV DX i-drive (5-83kW) is a single circuit, air-cooled PAC that delivers very precise supply air temperature up to 26°C under variable heat loads and wide outside ambient conditions of between -20°C and +50°C.

A unique feature, an optional segregated evaporator coil allows a high level of control over dehumidification and cooling capacity when operating under constant pressure control, helping to manage air distribution and prevent hot spots.

Designed for use in high density applications using elevated return air temperatures, hot and cold aisle containment as well as perimeter cooling environments, the SmartCool i-drive range is available with the option of high capacity compressors for extreme temperature applications.

**Website:** [www.airedale.com](http://www.airedale.com)



### **Rector Seal presents pre-insulated, linesets for A/C systems**

**R**ectorSeal Corp., a well known manufacturer of quality HVAC&R products, has introduced Paircoil a pre-insulated, malleable linesets designed specifically to expedite installations of ductless mini-split and conventional air-conditioning systems. Paircoil is sold in 65-foot (20-metre) rolls of either 1/4 (6.35-mm) and 3/8-inch-diameter (9.52-mm); or 1/4 and 1/2-inch-diameter (12.7-mm) copper liquid/suction line sizes. As per the company, its durable industrial-grade insulation features a UV light and wear-resistant coating with a non-frictional surface – making it easy to pull.

It also features embossed incremental one-metre inscriptions for hands-free measuring. The competitively-priced Paircoil's white insulation efficiently reflects solar heat, is water-resistant, and features a hardened, but ductile surface.

**Website:** [www.rectorseal.com](http://www.rectorseal.com)



### **Couplet of products combining vacuum and steam**

**S**ous-vide, French for 'under vacuum', is the term given to a method of food preparation in which vacuum-packed food in plastic bags is cooked at low, steadily maintained temperatures over an extended period of time. For this preparation method, a vacuum-sealing drawer and a steam oven from Miele join together to form a formidable team.

The vacuum-sealing drawer conforms to the design of Miele's Generation 6000 built-in appliances and is, from the outside, hard to tell apart from a Miele warmer drawer. With a fascia height of only 14 cm, this product ideally combines with various compact units to fill a classic 60 cm recess. The vacuum chamber only becomes visible when the drawer is opened.

**Website:** [www.miele.de](http://www.miele.de)



## MECO presents single phase multifunction appliance meter

**M**ECO offers a Single Phase Multifunction Appliance Meter – TRMS, Model EM09 (20A, 5A and 1A). It measures 10 parameters on 10 display pages on a large LCD display (20mm). It is equipped with 5 keys to view all the parameters and for programming of the meter. The meter is ideal for HVAC industry.

### Features

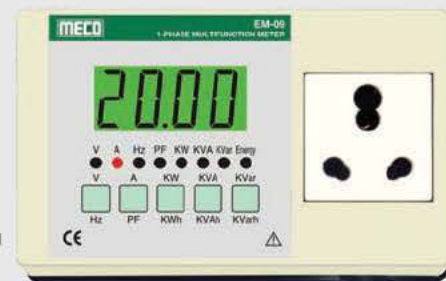
- Measures V, A, PF, Hz, KW, KVA, KVar, KWh, KVAh, KVarh
- TRMS Measurement
- Can be used for Continuous Monitoring
- Auto / Manual Scroll Display (User Selectable)
- State of Art Microcontroller Design
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- LCD Display with Backlight
- RS-485 Port (5kV Isolated) with MODBUS RTU Protocol (Optional)
- POWER MASTER Software for MIS Reports (Optional Applications)
- Appliances Testing (AC, Refrigerator, Washing Machine, Air Cooler, Microwave Oven etc.)

- LED Lights Testing
- Can be given to Field Technicians in their Tool Kit
- Can be used by R&D Dept. in Designing Energy

### Efficient Products

- Energy Audit and Plant Maintenance
- Studying Energy Efficiency of Electrical Equipment
- Building Management Systems
- Power Management
- Product Quality Testing

Website:  
[www.mecoinst.com](http://www.mecoinst.com)



## Refrigeration technology for any application

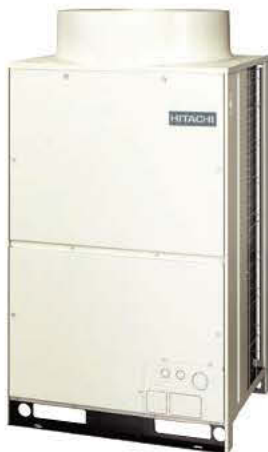


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### ***KNOLL presents MQL system with injector technique***

**K**NOLL ControLube minimal quantity lubrication system is controlled by a microprocessor and makes use of the injector technology familiar from the automobile industry. It unites the advantages of single- and dual-channel solutions – and has even more to offer.

Cooling lubricants and systems perform many tasks during chipping: they reduce the friction, remove chips, discharge heat, and ensure an even temperature of workpiece and tool in order to be able to adhere to tight tolerances. However, the use of cooling lubricants is sometimes associated with high costs for provision, preparation, and disposal, and it pollutes the environment.

For a long while, the operators of chipping machine tools have been searching for alternatives. Minimal quantity lubrication, which represents a middle path between wet and dry processing, is becoming increasingly significant.

Website: [www.knoll-mb.de](http://www.knoll-mb.de)



### ***Hitachi offers highest seasonal efficiency***

**H**itachi offers a 2-pipe heat pump or 3-pipe heat recovery VRF from a single unit. FSXN1E is available from 8HP to 54HP and is fully compatible with the full range of System Free indoors – including the 0.6HP units – allowing a greater number of connectable indoor units than ever before, achieving complete design and installation flexibility.

A compressor with improved performance at low speed and optimised R410a refrigerant cycle contribute to high seasonal efficiency values. Boasting the lowest refrigerant charge on the market, Hitachi's FSXN1E also achieves a lower cost of installation and on-going maintenance, as well as being more suitable for air conditioning smaller rooms.

Website: [www.hitachiaircon.com](http://www.hitachiaircon.com)



### ***Bosch presents ultra modern products***

**B**osch's thermotechnology brands Junkers/Bosch and Buderus present revolutionarily simple and forward looking generations of devices for the top segment. The innovative modular concept and the well-thought-out layout of the components afford excellent access to the individual components inside the device.

In addition, the devices can be expanded retroactively. The new design of the devices is particularly striking, featuring bold glass fronts in black or white. Developers and customers have jointly broken new ground in terms of design and haptics.

Bosch Thermotechnik GmbH represents the Thermotechnology Division of the Bosch Group. Together with its subsidiaries, the company is a leading supplier of heating products and hot water solutions in Europe.

Website: [www.bosch-thermotechnology.com](http://www.bosch-thermotechnology.com)

## Mini Thermo - anemometer series

These are pocket air velocity meters. They display Temperature, Relative Humidity and Dew Point.

### Features:

- Fold up protective housing extends to 9" for better reach
- Large dual display of air velocity and temperature
- Data hold to freeze most recent display
- Auto shutoff 15 minutes after last key is pressed
- Water resistant housing floats and drop tested to 6 feet
- Complete with CR2032 lithium battery and lanyard.

### Windspeed:

- Measures ft/min, MPH, m/s, km/h, Knots and Beaufort Force
- Selectable averaging function of 5, 10 or 13 second intervals
- Replaceable non-corrosive plastic wind vane (impeller).

### Temperature and Windchill:

- Measures from 0 to 122°F (-18 to 50°C)

### Model 45158 Additional Features:

- Relative Humidity and Dew Point
- Dual display of air velocity and relative humidity
- Measures RH from 10 to 95%
- Measure Dew Point from 32 to 122°F.



Website: [www.extech.com](http://www.extech.com)

Measurements	Range	Resolution	Basic Accuracy
ft/min (feet per minute)	100 to 5500 ft/min	20 ft/min	± (3%rdg + 40ft/min)
m/s (meters per second)	0.5 to 28m/s	0.1m/s	± (3%rdg + 0.2m/s)
km/h (kilometers per hour)	1.8 to 100.6 km/h	0.7km/h	± (3%rdg + 1.4km/h)
MPH (Miles per hour)	1.1 to 62.5 MPH	0.2MPH	± (3%rdg + 0.4MPH)
knots (nautical miles per hour)	1.0 to 54.3 knots	0.3knots	± (3%rdg + 0.6knots)
Beaufort Force	1 to 17 BF	1 BF	± 1
Temperature	0 to 122°F (-18 to 50°C)	0.1°F/°C	±1.8°F/±1°C
Relative Humidity (Model 45158)	10% to 95%	1%	± 4%
Dew Point (Model 45158)	32°F to 122°F	1°	± 2%
Power	CR2032 Lithium battery		
Dimensions	5.25 x 2.75 x 0.75" (133 x 70 x 19 mm)		
Vane	1" (24 mm) diameter		
Weight	3oz (95g)		

## Index to Advertisers

bitzer	15
Carrier Midea	7
Desiccant rotars	17
ebm-papst India Pvt Ltd	3
Flir Systems Pvt Ltd	IFC
Guntner GmbH & Co. KG	67
Hitachi	21
HMX	IBC

India Cold Chain 2016	23
Infinity	63
LTI Ventilation	9
Meco Instruments Pvt Ltd	19
RV Cooling Tech	55
Samsung	12
TSI India Pvt Ltd	BC
UL India	5

## Converting the introvert look into an extrovert one



*With VRF, a more dramatic look was possible without compromising the original building's architecture...*

**B**ound between Boston's historic brickwork and manicured riverfront, Boston University (BU) strives to exist as a traditional campus – housed in an urban environment. The school recently renovated with this goal in mind, transforming the old BU Hillel House into the Alan and Sherry Leventhal Admissions Center. There VRF systems updated the building's aesthetics and performance to meet the needs of the 1,400 daily visitors, and helped the project achieve LEED Gold certification.

Todd Symonds, Project Manager and associate principal of design firm Goody Clancy, described the need to expand the space in order to maximise its appeal, "When the building was the Hillel House, it had been a very introverted and inward-looking building... We had the opportunity to transform the building from an introvert into an extrovert, to meet the needs of the University's programme for Admissions."

The design team selected VRF technology to help expand this 'inward' space, as the systems offered a smaller footprint than traditional HVAC. With VRF, a more dramatic look was possible without compromising the original building's architecture – a success recognised by the Boston Preservation Alliance with a 2015 Preservation Achievement Award. ■

## Performance plus energy guarantee to Atlanta homebuyers

**B**eginning from September 2015, houses under construction in select Acadia Homes & Neighborhoods' communities throughout the Metro Atlanta area are coming complete with a very special guarantee. As a builder that has been dedicated to green building practices since its inception with a number of Georgia Power Earth Cents New Home Communities to its credit, Acadia is extending its new Performance Plus Energy Guarantee to Atlanta homebuyers.

Performance Plus Homes by Acadia Homes & Neighborhoods will boast an energy usage guarantee, cleaner air, greater comfort, increased energy efficiency and enhanced durability. In addition to showcasing Acadia's signature brand of quality craftsmanship, Performance Plus Homes will boast high performance HVAC systems, HERS scores (measure of energy efficiency) of 75 or better, energy usage guarantees and more. Founded in 2010 on the principles of integrity, quality and an unyielding devotion to customer satisfaction, Acadia Homes & Neighborhoods is the shared vision of real estate and construction veterans – Gregg Goldenberg, Jon Roby and Thomas Olson. ■



*These homes will boast an energy usage guarantee, cleaner air, greater comfort, increased energy efficiency and enhanced durability...*

## Sunseap Group to draw power from Panasonic's factory rooftop solar PV systems



*A total of approximately 12,000 solar panels have been installed at PAPERDSC...*

**S**unseap Group is the leading solar energy system developer, owner and operator in Singapore. It is the Singapore's largest clean energy provider. Panasonic has a 2.4 megawatts (MW) photovoltaic (PV) system at its factory. At its peak, the factory's PV system is expected to power, on an average, 10% of its entire operations.

The installation, comprising 10,124 pieces of Panasonic's proprietary solar panel HIT(TM) with 19.0% module efficiency, marks the largest solar system installation on a single site for the consumer electronics sector in Singapore, covering more than 20,000 square metres of roof area across five factory buildings.

Recently, PAPERDSC (Panasonic Appliances Refrigeration Devices Singapore) has signed a new 25-year leasing agreement with Sunseap to draw power. It will begin drawing from the 2.4 MW PV system within this year (2015).

Through their solar leasing collaboration with Sunseap, the Panasonic Group not only hopes to reduce carbon footprint, but also plans to drive uptake of solar energy in businesses and industries. Panasonic's solar initiative is exemplary. ■

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