

# Reefer machinery gets greener

Carrier Transicold, the world's largest manufacturer of reefer container machinery, used last month's Intermodal 2007 exhibition in Amsterdam to launch its new PrimeLINE design, one of a trio of "environmentally responsive refrigeration products designed to help shipping lines be more competitive and achieve energy savings."

Designed specifically to reduce environmental impact and lifecycle costs through optimised efficiency, PrimeLINE features a number of enhancements that simultaneously boost cooling capacity and energy efficiency.

## Digital scroll

Key to the PrimeLINE unit is the first digital scroll compressor developed specifically for use with R134a. The result of collaboration between Carrier and the Copeland team at Emerson Climate Technologies, the Copeland Digital Scroll compressor features a vapour injection system to deliver higher cooling capacity and compressor unloading through digital modulation to minimise energy consumption. Enhanced corrosion resistance is provided by an aluminised coating and the design is claimed to be lighter than other scroll compressors used in container refrigeration units.

Additional platform enhancements on the PrimeLINE include an efficiency-boosting redesign of the evaporator fan and stator, with blades optimised through aero modelling to reduce friction and resistance. A new 3-phase motor and improved assembly reduces power consumption, but not airflow, Carrier says.

Further boosting cooling capacity is a larger condenser coil, as well as other design enhancements made possible through computer modelling at Carrier's engineering centre.

**Reduced energy consumption, a higher coefficient of performance and lower life cycle costs are the hallmarks of a new raft of reefer container machinery designs that have recently come onto the market**

"Energy is the single largest component of lifecycle cost," said Jim Taeckens, senior product manager for Carrier's Container Products Group. "The PrimeLINE unit's exceptional efficiency results in a life cycle cost that is up to 30% lower than all competitive units. It

has the best coefficient of performance of any container refrigeration unit and will be particularly valued by those shipping lines that are systematically measuring their energy costs."

While more energy efficient, says Carrier, there are no compromises on per-

formance. The PrimeLINE design is claimed to have best-in-class pull-down capacity - nearly 10% better than its nearest rival - and the highest deep frozen capacity of any unit running on R134a. At ambient temperatures of 38degC (100degF) and box temperature of



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## CA on tap

Germany-based controlled atmosphere (CA) specialist Cargofresh AG has launched a new product that it claims makes the use of CA technology in containers more flexible and economical.

Designed for use on board ships, the Switch system consists of autonomously operating refrigerated containers, which have been inexpensively converted by Cargofresh to maintain a modified atmosphere (MA) automatically. MA, says Cargofresh is often sufficient when more robust kinds of fruit are carried over relatively short distances.

These containers can then be converted from MA to a finely adjustable CA system by switching on an external nitrogen supply, providing a flexible system adjustable between MA and CA in a single container.

A notable feature of the system is the way it can be adapted to given circumstances. On CA ships, for example, the central nitrogen supply, which already exists, can be connected to the Switch system containers, to provide CA conditions.

On ships without any CA facilities, either Cargofresh CA technology can be installed or, for increased flexibility, a separate Cargofresh container can be used for nitrogen production.

With all three options, says Cargofresh, the advantages of CA technology can be used for large volumes of cargo with individual regulation for each container.

Furthermore, the system means that the cost of CA technology per freight unit is significantly reduced.

"Thanks to the Switch System, we have been able to make CA technology available for mass markets. Switch demonstrates the versatility of Cargofresh technology whether in the MA range, or for CA conditions with or without CO<sub>2</sub> regulation, for trailers or containers," said Peter W Wich, managing director of Cargofresh. "It can be combined with various types of refrigeration systems and already existing components." □

-29degC (-20degF), it offers a cooling capacity of 4,400 watts (15,000 Btu/hr).

### Energy saving QUEST

Complementing the energy-saving features of the PrimeLINE unit is the new QUEST (Quality and Energy Efficiency in Storage and Transport) temperature management system.

Developed and tested by Wageningen University and Research Centre in the Netherlands in association with Carrier and Maersk Line, QUEST is a software-based control option compatible with all microprocessor

controllers used in current generation reefer machinery and available under licence from Wageningen University.

Aimed mainly at chilled cargoes, the new power-saving mode governs the run-time of container refrigeration systems and cycles the compressor on and off based on temperature settings for specific perishables. Where conventional refrigeration systems precisely control the supply air temperature, the QUEST power-saving mode is designed to maintain the actual temperature of produce cargo by monitoring both supply and return air temperatures and

the difference between the two.

Available as an option on Carrier ThinLINE, EliteLINE and PrimeLINE refrigeration units with ML3 and ML2i controls, Carrier says that QUEST can cut refrigeration energy requirements by up to 50% while reducing emissions related to power consumption.

Maersk Line, the first operator to adopt the QUEST power-saving mode, estimates that it should reduce Maersk's CO<sub>2</sub> emissions by 325,000t annually and significantly cut the company's energy costs when fully implemented across its fleet.



MCI's Mark Q reefer is now available with integrated Star Cool machinery

Also on show in Amsterdam was Carrier's new eAutoFresh fresh air exchange system with on-demand ventilation. Aimed particularly at high-respiring perishables such as asparagus, sweet corn, blueberries, grapefruit and lime, eAutoFresh is a further option that provides an energy-efficient alternative to the practice of continuous ventilation of reefer containers.

With eAutoFresh ventilation, the container's fresh-air vent is kept closed and only opens when a CO<sub>2</sub> sensor in the container determines that it is necessary due to product respiration. Driven by a reliable stepper motor, the vent opens automatically to draw in O<sub>2</sub> and exhaust CO<sub>2</sub> in order to optimise internal atmospheric composition. Ventilating only on demand enables faster temperature pull-down and means the refrigeration system works less, thereby further saving energy.

### Integrated Star Cool

Maersk Container Industri (MCI) also used the Intermodal 2007 exhibition to unveil the latest version of its reefer container machinery design - the Star Cool Integrated.

Traditionally, says MCI, refrigeration units are attached to the container frame by means of bolts and a thermal gasket. Over time, this joint has a tendency to loosen, which results in decreased racking strength and reduced air tightness.

Furthermore, says MCI, experience has shown that it is rarely necessary for a machinery unit to be removed from the container for replacement. Statistics show that the likelihood is less than 0.5% over the life of a reefer container.

There are, therefore, many good arguments for redesigning the way reefer machinery and the box are connected, MCI says. The new Star Cool Integrated design, with the Star Cool machinery built into MCI's Mark Q container end frame, addresses these

issues and at the same time results in savings in tare weight and material costs, improved resistance to damage, enhanced insulation and airflow and a reduction in energy requirement, leading in their turn to savings in total cost of ownership (TCO).

Elimination of the machinery unit frame results in a tare weight reduction of approximately 75 kg, which increases payload capacity and/or reduces energy consumption during transportation.

The machinery itself is divided into an inner evaporator module and an outer module comprising the controller, compressor and condenser. In the event of major damage the modules - individually or both - can easily be removed and replaced.

If the container is exposed to major impact damage, eg from a low-bridge, adds MCI, it is easier and more cost-effective to repair one frame instead of both a machinery and container frame.

Damage resistance is further improved in the new design through the use of a glass fibre-reinforced thermoplastic (GTP) baffle plate and back cover in place of the traditional aluminium, which is prone to impact damage from fork lift trucks, pallets etc. The GTP design allows the baffle plate to flex, thereby minimising the risk of impact damage, while an integrated baffle plate hinge ensures airtightness.

### Better insulation

Traditional designs suffer from significant thermal bridges in the contact area between the container and machinery frames, MCI says. This has been totally eliminated in the integrated design, with uninterrupted insulation of the entire front wall improving the total heat leakage of the box by around 5%. The result is reduced power consumption and improved cargo preservation.

Airflow is also improved in the new design as the airflow channel

covers the entire internal width of the container, thereby further enhancing temperature stability and cargo care.

The Star Cool Integrated, which will be put into commercial production in August this year, and the standard Star Cool machine are also now being offered with the QUEST temperature management system as an option for both OEM and retrofit applications. MCI claims that by virtue of its two-stage Bitzer aluminium compressor equipped with a Danfoss frequency converter which allows the motor speed to be infinitely varied for capacity control, the Star Cool design is already 50% more energy efficient than competing machinery designs. The addition of the QUEST system can result in a further 25% energy saving in certain chilled temperature ranges.

### Enter Magnum ETA

Thermo King has also just launched a new version of its Magnum machine, the Magnum ETA, which, the company claims, "further extends the already best-in-class energy efficiency and cargo temperature range Thermo King has proven with a digital scroll compressor and R404A refrigerant."

According to Dermott Crombie, vice president, Thermo King Global Marine Solutions, through hardware developments and ongoing research and development, Thermo King has been able to further improve the Magnum's performance without compromising the traditional benefits of the design, including "the lowest weight and highest cooling capacity on the market."

The Magnum ETA, which will shortly be undergoing customer trials, offers up to 20% lower energy consumption in typical operating conditions over the original Magnum in both chilled and frozen cargo modes. "This has been realised through a range of hardware improvements in order to continue to offer the fine temperature control shippers expect for their perishables. Saving energy should not require compromising cargo care," Crombie said.

In addition, the Magnum ETA's range of carrying temperatures now extends from -40degC to +30degC, thereby further boosting the possibility of carrying higher value, low temperature cargoes. □

## Daikin hits 100,000 machine mark early

Last September, some three months ahead of schedule, Japanese reefer machinery manufacturer Daikin Industries hit its target sale of 100,000 LXE10E units since the innovative scroll compressor/R134a design was launched in 2001.

According to Daikin, its market share has grown from 5% in 2002 to an estimated 26% today, cementing its position as the world's second largest supplier of reefer container machinery after Carrier Transcold.

As reported in the November 2007 issue of *WorldCargo News* (p16), this growth in market share together with increased global demand has prompted Daikin to establish a new manufacturing facility in China. Scheduled to be commissioned in October this year, Daikin Refrigeration (Suzhou) Co will have a designed production capacity of 40,000 units/year by 2010, adding to the 30,000 unit

annual capacity at its current production base in Osaka.

All major components for the new plant will be manufactured in-house, which will shorten lead time from production to product completion from 17 to nine days.

And with virtually all reefer container production now taking place in China, Daikin says the Suzhou plant will shorten distribution lead-times to reefer manufacturers from the current 10 days to just four days.

Daikin's growth in market share has been aided of late by a significant increase in orders from the container leasing sector. Over the past year, the company has sold just under 6,000 units to lessors, including CAI, Capital Intermodal, Exim, Florens, UES International (HK), Seacastle and Textainer. The latter has just come into the reefer market and has ordered 300 LXE10Es and 500 Carrier EliteLINE units. □