

# ContainerLINE

## Experts Committed to Sustainability



**Hamburg Süd Saves Energy With PrimeLINE®**  
Page 2



**SeaCare™ Success for Hapag-Lloyd**  
Page 4



**Building Gen Sets Better**  
Page 6



improve



shipping™

## Turning Over an Iconic Leaf



## Hamburg Süd with PrimeLINE®



The iconic leaf on the cover, while a universal symbol for the environment, represents some long-standing core values of Carrier Corp. As discussed further and throughout this issue, the leaf is a new branding element symbolizing our ongoing commitment to environmental stewardship. Coupled with the word “improve,” it represents our culture of continuous improvement toward sustainability.

Through innovation and care for the environment, we improve our production processes, our products and services and, ultimately, we help you to improve your business. Our energy-efficient PrimeLINE® container refrigeration unit and QUEST power-saving mode are two great examples. Both reduce the need for onboard power generation, which in turn lowers related emissions. Shipping lines and shippers benefit from smaller carbon footprints. As shown in the adjacent article, one such beneficiary is Hamburg Süd, which began acquiring PrimeLINE units in 2008 after extensive testing and has been adding more of these units over the last two years.

When refrigerated containers are transferred to truck or rail for overland distribution, the FuelWise™ option for PowerLINE® generator sets helps to improve your bottom line by conserving diesel fuel without compromising refrigeration demand.

Carrier’s SeaCare™ Solutions warranty and maintenance programs help customers such as Hapag-Lloyd improve operations by keeping equipment running in peak condition. The program can also benefit customers by reducing the hassles of paperwork associated with traditional repair authorizations.

Process improvement within our own organization is revealed elsewhere in these pages, as we introduce a new generator set manufacturing line and showcase Carrier’s exceptional compressor remanufacturing capabilities. Our sustainable production processes result in unmatched product quality.

Clearly, it’s not a new leaf we’re turning over. We started sowing these sustainable seeds 20 years ago. As long-time shipping industry veterans know, a major advance in refrigerated container shipping was the phasing out of ozone depleting refrigerants, a cause that Carrier Transicold championed. Thanks in large part to Carrier’s leadership, non-ozone-depleting R-134a is used almost universally today for container applications. In search for ever-more sustainable solutions, Carrier researchers continue to explore and test potential next-generation refrigerants, targeting those with lower global warming potential (GWP) than those currently used. Until those new refrigerants become commercially available, R-134a remains the most environmentally sound choice for container units, with the lowest GWP of any non-ozone-depleting refrigerant used in container applications.

In keeping with our theme of improvement, we are encouraged about recent signs suggesting a return to positive growth in refrigerated trade. In step with that, Carrier’s Container Products Group hit a significant milestone earlier this year: we have now sold more than three-quarters of a million container refrigeration units. Our business is sustainable, thanks to your continued confidence in us.

**Kartik Kumar**  
Director of Marketing and Strategic Planning  
Global Container Refrigeration

Charting a course to lower operating costs, Hamburg Süd Group recently embarked on a voyage that ultimately led the carrier to PrimeLINE container refrigeration units.

For recent upgrades of its refrigerated fleet, the Hamburg, Germany-based shipping line took delivery of 3,000 PrimeLINE units through 2009 – and an additional 2,000 units as this issue went to press – following a comprehensive review that included both operational trials and laboratory analysis.

With 148 ships and 340,000 containers, Hamburg Süd operates globally and is also the largest container carrier serving South America. Part of Germany’s Oetker Group, it is one of the top five reefer container carriers in the world and prides itself on its quality of service and use of new and emerging technologies. Hamburg Süd’s integrated containers, like the 40-foot, high-cube containers on which the PrimeLINE units are installed, have the greatest interior volume available on the market today, according to the shipping line.

Hamburg Süd’s refrigerated service comprises a proportionately larger part of its business than any other container line – 15 percent of its containers are refrigerated. “We are very reefer driven,” said Hamburg Süd’s Martin Schoeler, deputy director – Logistics Technology, explaining that with so much of its business dependent on refrigerated trade, total cost of ownership of refrigerated containers is especially important.

“With the increase in fuel prices over much of the last two years, the industry changed a lot,” Schoeler said, explaining that energy consumption issues “got more important from the cost side, from the environmental side and from the customer side, because they are looking at that in more detail.”

In response to those concerns, Schoeler said Hamburg Süd committed to operational trials and lab analysis at Cambridge Refrigeration Technology in Cambridge, England, testing “all reefer machinery and energy-saving software solutions on the market. Ultimately, the PrimeLINE unit scored as one of the best.”

The high-performance PrimeLINE unit, featuring digital scroll technology, was designed specifically to improve energy

# Sails to Energy Savings Units

efficiency and reduce environmental impact and lifecycle costs for refrigerated containers. The unit's reduced power requirements also help shipping lines conserve precious fossil fuel, thereby reducing emissions related to shipboard power generation. It uses environmentally sound R-134a, which has the lowest global warming potential of all contemporary container refrigerants.

"The lower the energy consumption, the smaller the carbon footprint you generate, so that's also an important factor," Schoeler said.

Hamburg Süd, also known also by its full name, Hamburg-Südamerikanische Dampfschiffahrts-Gesellschaft, was founded in 1871 serving the South America-to-Europe trade lanes. In 1906, Hamburg Süd launched its first temperature-controlled service between the South American east coast and Europe, later adding ships with dedicated reefer holds in the 1930s and full reefer vessels in the 1950s.

The company took its first steps with refrigerated containers in the 1970s, deploying them on routes serving Australia/New Zealand-to-North America routes.

Hamburg Süd purchased its first Carrier Transicold refrigeration unit in 1980, in time to launch refrigerated container service between the east coast of South America and northern Europe. Since that time, Hamburg Süd has relied on thousands of Carrier units, including StreamLINE®, EliteLINE® and now PrimeLINE units. For perishables requiring a precisely controlled environment, Hamburg Süd also offers customers a variety of atmosphere management options, including containers employing Carrier's Everfresh® controlled-atmosphere system.

Given recent fuel price trends, "Carrier's decision to invest in development of the PrimeLINE unit came at the right time," Schoeler said.

"Hamburg Süd sets high standards for quality and performance; not only for their own organization and operations, but also for their suppliers," said Remco Balkestein, Carrier's container products account manager for Europe. "As we look back on our 30-year relationship with Hamburg Süd, we are pleased that Carrier's advanced refrigeration products and exceptional service keep us as relevant as ever today."



Some of Hamburg Süd's new integrated containers with PrimeLINE® units.



The Rio de la Plata, with a slot capacity of 5,900 TEU, is one of Hamburg Süd's largest and newest vessels. Ships in its class have 1,365 reefer container plugs.



Hamburg Süd's 5,000 PrimeLINE units can improve shipping by saving enough energy over their operating life to avoid more than 100,000 tons of carbon emissions compared to industry averages, the equivalent of removing more than 1,650 cars from the road.



# SeaCare™ Keeps Hapag-Lloyd “Ship Shape”

Continuous process improvement is one of the many ways Hapag-Lloyd AG strives to be among the shipping industry’s leaders in innovation and quality.

To this end, Hapag-Lloyd takes advantage of SeaCare™ Global Container Solutions, Carrier’s comprehensive worldwide program for container refrigeration service and support. SeaCare Solutions helps the shipping line streamline maintenance processes while also improving equipment reliability and uptime.

Hapag-Lloyd uses the multi-faceted SeaCare Solutions program in two distinct ways: preventive maintenance for its inventory of Carrier Transicold generator sets in North America, and warranty renewal for some of the Carrier container refrigeration units that make up one of the world’s largest refrigerated container fleets.

## Preventive Maintenance for Gen Sets

The preventive maintenance (PM) program for generator sets benefits customers in several ways. It places a fixed cost on what is normally a variable and sometimes unpredictable expense. It can improve generator set reliability, as has been demonstrated by a reduced number of warranty claims where PM programs are used. And attention to preventive maintenance also helps in significantly reducing the likelihood of in-service equipment failures due to normal wear and tear.

For Hapag-Lloyd, PM services are provided annually for all generator sets covered by the program, which includes units purchased as far back as 2002. Carrier keeps track of anniversary dates and each week tells Hapag-Lloyd which units are due for service. Hapag-Lloyd’s asset tracking system determines unit location so Carrier can dispatch personnel from the appropriate service centers. The work is handled through any of 11 service centers aligned with Hapag-Lloyd operations from Halifax down the East Coast and from Long Beach to Seattle on the West Coast.

“It’s a lot cleaner, faster process,” said Hapag-Lloyd’s Gene Tusa, manager of Maintenance and Repair, based in Hapag-Lloyd’s Corporate Logistics office in Piscataway, N.J. According to Tusa, the program removes the administrative steps required for specific repair authorizations and payments.



*A service technician conducts diagnostics on one of Hapag-Lloyd’s generator sets during an annual SeaCare Solutions preventive maintenance check-up.*

“The service centers have the list, it’s in the yard, they do the PM. There’s no guesswork. If they find a problem, they know it’s under contract and they follow Carrier procedures to fix it. The service work is done to factory specifications, and the gen set’s back up and running on the spot.

“The PM program keeps the service levels the same throughout the U.S. and Canada,” he said. “No matter where it’s at it will be serviced and repaired by a Carrier dealer. Only Carrier OEM parts are used for the repair, and that’s important to us.”

## Extended Warranties for Refrigeration Units

While the PM program has been in place for a number of years for Hapag-Lloyd’s North American generator set inventory, more recently the company has taken advantage of the SeaCare Solutions warranty renewal (WR) program for some of the Carrier container refrigeration units in its mixed fleet.

WR helps shipping lines keep monthly maintenance and repair (M&R) costs fixed and predictable by extending major component warranties beyond the standard five-year original equipment warranty. Coverage is flexible. Terms can extend from



Carrier’s SeaCare Solutions program provides a sustainable customer partnership by providing world-class aftermarket support and programs that help shipping lines increase their operational efficiency.



Hapag-Lloyd's Osaka Express with 730 reefer plugs.

one to 12 years and can be applied to the full unit or any one or combination of the compressor, fan motors and controller. Parts, as well as labor, are included. If a covered part needs to be replaced for any reason, it will be done at any of Carrier's nearly 420 worldwide service centers.

With this comprehensive approach, Frank Nachbar, Hapag-Lloyd's director of container engineering, considers the program to be more like an extended service agreement and not just a traditional warranty, which may only cover parts replacement due to defects. About the only things not included are consumables and pre-trip inspections, although these, too, can be covered under a SeaCare service contract.

Hapag-Lloyd obtained three-year WR extensions for its newest Carrier units, purchased in 2008, and also added one-year coverage in the second half of 2009 for a portion of its older Carrier refrigeration units ranging in age from six to 10 years. In all, about 41 percent of Hapag-Lloyd's Carrier units – mostly ThinLINE models – are fully covered.

Nachbar said Hapag-Lloyd will benchmark differences in parts replacement under the program against historical costs for unit care to determine savings from the program. "Lifecycle costs are a very important issue," Nachbar said, adding that Hapag-Lloyd's sophisticated M&R system uses the company's information management systems to track repairs and costs by unit and location for later analysis.


"We like to have permanent improvement of processes and systems," he said, "and this cooperation between Carrier and Hapag-Lloyd can help.

"From an operations point of view, it is less burden – certainly easier for our inspectors if major parts are covered, like if you have to change a compressor," Nachbar said.

And after all, helping shipping lines like Hapag-Lloyd run at peak efficiency while holding the line on M&R costs is the whole point of SeaCare Solutions.

# Experts Committed to Sustainability



turn to the experts™ 

Emphasizing roots in environmental stewardship and an ongoing commitment to the development of sustainable solutions, Carrier Corp., parent of Carrier Transicold, unveiled an enhanced brand identity that combines the elements of a stylized green leaf with the existing "turn to the experts" tag line.

The leaf represents the universal symbol for the environment with a unique design created exclusively for Carrier's advertising, marketing literature, service vehicles and more. Also, a new marketing icon builds on the leaf element with the word "improve" to visually unite Carrier's sustainable products and services across brand segments and diverse product markets. The icon represents Carrier's commitment to improving products and services in sustainable ways and the company's culture of improvement that will not rest when it comes to the natural environment.

"Carrier has been an environmental leader for decades, with a clear and consistent strategy," said Carrier President Geraud Darnis. "The new brand identity represents our longstanding environmental commitment in our products, services and operations."

Since 1994, Carrier has led the industry in the phase-out of ozone depleting refrigerants while introducing many of the world's most energy efficient heating, air conditioning and refrigeration systems. In the marine shipping sector, Carrier Transicold was instrumental in leading the industry away from ozone-depleting refrigerants such as R-12 to R-134a, reducing the global warming potential (GWP) more than 80 percent historically. With the lowest GWP of any non-ozone-depleting refrigerant used today, R-134a is now used almost universally in container refrigeration systems.

Carrier Transicold helps its shipping customers improve their carbon footprint by enabling them to ship perishables while producing the least amount of carbon emissions. The PrimeLINE® unit with QUEST power-saving mode reduces shipboard power generation requirements and related emissions of greenhouse gases and particulates at a rate unmatched in the industry.

In 2007, the U.S. Environmental Protection Agency awarded Carrier its "Best of the Best" Stratospheric Ozone Protection Award. Carrier's environmental commitment extends into the global community, as the only company in the world to be a founding member of the U.S., India and China Green Building Councils.

"Carrier's environmental strategy has been clear and consistent for years and now defines our brand identity," said

John Mandyck, Carrier vice president for Sustainability & Environmental Strategies. "We are the first company in the HVACR industry to directly incorporate sustainability into our brand, reinforcing our environmental leadership."





# Building Gen Sets Better

What does a PowerLINE® generator set have in common with a sleek BMW Z4 roadster? For starters, an innovative fusion of craftsmanship and automation that raises the bar when it comes to quality, according to industrial engineers at Carrier Transicold's Athens, Ga., plant where a new manufacturing line now produces the world-class generator sets.

At this facility, located in the southeastern United States, each generator set is hand-assembled by skilled technicians, but the contemporary twist is that those technicians now use some of the most advanced computer-assisted manufacturing technologies available anywhere – the same type of tools and systems used by BMW and other automakers that Athens engineers benchmarked prior to developing the production line.

Originally opened in 1987, the Athens plant serves as the North American manufacturing hub for Carrier Transicold truck and trailer refrigeration systems and air-conditioning systems for buses. In 2009 generator set production moved into a dedicated area in the Athens plant. Athens management also set aside part of its warehouse for generator set finished goods to support customer delivery needs.

“The investment in Athens has launched a new era of gen set production for Carrier,” said Charu Mahajan, product manager for generator sets. “The entire production process was designed to optimize flexibility for quick changeovers, allowing for a mixed-model assembly and more responsive delivery times.”

## Parading Robots and Thinking Tools

One of the most dramatic differences from conventional manufacturing is that the traditional conveyor line gave way to a production system that uses automated guided carts (AGCs) that move partially finished assemblies from one workstation to the next.

As employees complete each assembly step, AGCs advance to the next workstations pulled by robotic “tuggers” underneath. Using optical guidance technology, the tuggers follow a path drawn on the plant floor in bright orange tape. When assembly steps are completed,

musical tones sound from the carts, cueing workers that in two minutes the carts will slowly move in synch like a single-file parade to their next stops. When each unit reaches the “run test” booth, its AGC signals the booth doors to open automatically, allowing the cart to enter the enclosed booths.

The use of AGCs, rather than conveyors, gives assemblers greater access to the equipment, according to Troy Rector, Athens plant manager. This helps to assure better assembly of each unit.

“It gives us the ability to work all around the unit, so you can work on the ends, the top, front side or back side without having to stand on a piece of conveyor,” Rector said. “From an ergonomic standpoint the access gives our workers an advantage, and that, in turn, drives quality because they can do their jobs better.”

Production team members are equipped with cordless “smart tools” that communicate with nearby computers by way of wireless technology. The computers keep track of every assembly step completed on each generator set. Tools are programmed to know precisely how much torque to apply to each bolt, screw or nut. With the assembly tools communicating with computers that, in turn, maintain a record, Carrier Transicold has greatly increased information traceability about any generator set's assembly.

“These processes and tools improve assembly times and product quality,” Rector said, explaining that greater consistency is assured because the electric tools provide the same amount of torque on the first bolt as the 50th bolt, unlike pneumatic tools that rely on a compressed air supply, which can vary. Also the risk of missing assembly steps is virtually eliminated.

Not only does the new system help Carrier enhance quality, but it also provides greater flexibility in terms of how the assembly line is set up, Rector said. Layout pathways can be removed from the floor and retaped, and steps can be reprogrammed into the support computers far more easily than rebuilding a traditional assembly line.



## PowerLINE Gen Sets

Just as Carrier Transicold's container refrigeration systems lead the industry, so too do its diesel-powered generator sets, which are used to power refrigeration units when refrigerated containers are transferred from ships for overland distribution by truck or rail. Recent advancements include a diesel engine that dramatically reduces particulate matter emissions and the FuelWise™ option capable of boosting fuel efficiency by up to 37 percent. Carrier's Athens plant produces both models of PowerLINE generator sets – the UG15, which mounts to the underside of a container chassis, and the RG15, which mounts directly on the front of the container refrigeration unit.



**Technologies Advancing Assembly (clockwise from upper left)** – Automated tools know exactly how much torque to apply to a bolt. Troy Rector, plant manager, and Geoffrey Mack, business unit manager, at the Athens plant where PowerLINE generator sets are now made. Orange lines on the floor guide automated carts to workstations. A cart scoots out of a test booth after automatically activating doors.

### Committed to Customers

Seeing the generator sets produced in this modern facility reinforces Carrier's commitment to delivering a quality product, as customers who recently toured the facility observed.

"We were impressed with the organization of the factory operation in Athens. In particular, the robotic line movement of the units from station to station under timer gives a state of the art appearance. Also the enclosed test booth is a nice feature," said David Esposito, technical manager, Maersk Lines.

Equally impressed was Delvin Johnson, technical services manager for Crowley Maritime Corp., who said, "The new gen set assembly line is a tremendous improvement, and it was evident how much pride Carrier and its employees take in producing the generator sets."

Rector explained that the implementation of advanced manufacturing processes reflects a commitment from the highest company levels and is in keeping with the Achieving Competitive

Excellence (ACE) program from parent company United Technologies Corp. (UTC). In the ACE program the Athens plant is distinguished as a Silver site.

Athens follows UTC's "visual factory" protocols with white-painted ceilings, upgraded energy-efficient lighting and color-coded pipes. The brighter, whiter lighting also led to productivity and quality improvements, because assemblers have an easier time seeing intricate components or spotting aesthetic issues before products are shipped.

The Athens plant is certified in accordance with the International Organization for Standardization (ISO) for quality management practices (ISO 9000) and environmental management (ISO 14000).

"It's part of a corporate commitment to continuous improvement, or 'Kaizen,' to use the Japanese word for it," Rector said in describing the facility and its flexible advanced manufacturing processes. "We're taking it to a different level at this plant."



**At the Athens plant, high-efficiency lighting improves assembly quality and saves enough energy to reduce greenhouse gas emissions by 842 metric tons annually. A water recovery system and related improvements saved the equivalent of 22 households' annual water usage per year.**



# Sage Advice: Choose FuelWise™ Option

Conserving resources and saving money are always wise choices when it comes to precious fuel. With that in mind, the fuel-saving dual-speed option for PowerLINE® generator sets has a new name: FuelWise™.

Introduced in 2008 for both PowerLINE undermount and clip-on generator sets, the FuelWise option delivers fuel efficiency boosts of up to 37 percent, depending on conditions, cargo and the refrigeration unit being used.

The FuelWise option achieves this performance by enabling the generator set to run at two speeds. Initially, it runs at 1,800 rpm, providing maximum pull-down power during the short startup period. Then it automatically reduces speed to a fuel-conserving 1,500 rpm for the duration of a trip.

At a slower 1,500 rpm the generator operates at 50 Hz, delivering requisite power and voltage, while conserving fuel. “The moment the engine slows down, the fuel savings begin,” said Charu Mahajan, product manager for generator sets. “By saving diesel, distances traveled on a tank are extended, and the carbon footprint is reduced.

“Customers often ask what their savings will be based on a specific commodity, so we recently ran new tests to show the gains that can be anticipated for some of the most commonly hauled fruits,” Mahajan said. “Using the ThinLINE unit, we tested for bananas, mangoes, melons and frozen loads, using appropriate set-points for each and measuring against different ambient temperatures.”

## FuelWise™

In these test situations fuel savings ranged from 26 to 28 percent at 38°C (100°F) ambient. These fuel savings can be boosted 8-10 percent more when refrigeration units are equipped with the QUEST power-saving mode. In tests with ThinLINE® units using QUEST mode and PowerLINE generator sets with FuelWise option, the fuel savings ranged from 33 to 37 percent compared to standard issue units.

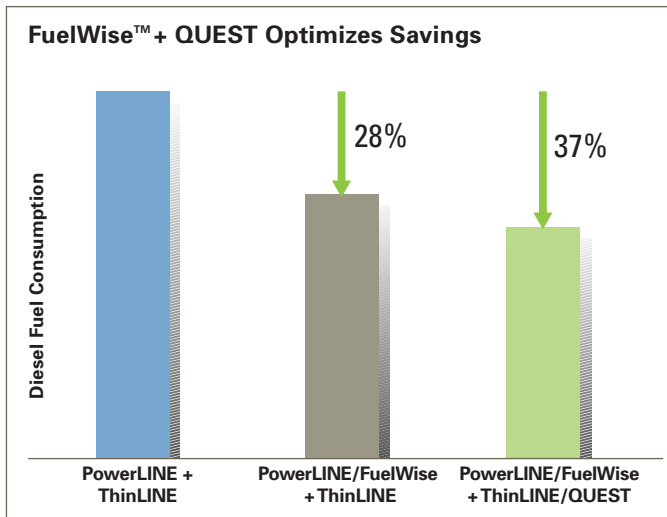
Not surprisingly, given the rising cost of diesel fuel there has been considerable interest in the option, especially among shipping lines that pay for generator set fuel.

For typical applications, based on an average of \$2.95 per gallon diesel fuel cost in the United States – the approximate price at the time of printing – the FuelWise option provides payback in just under five months.

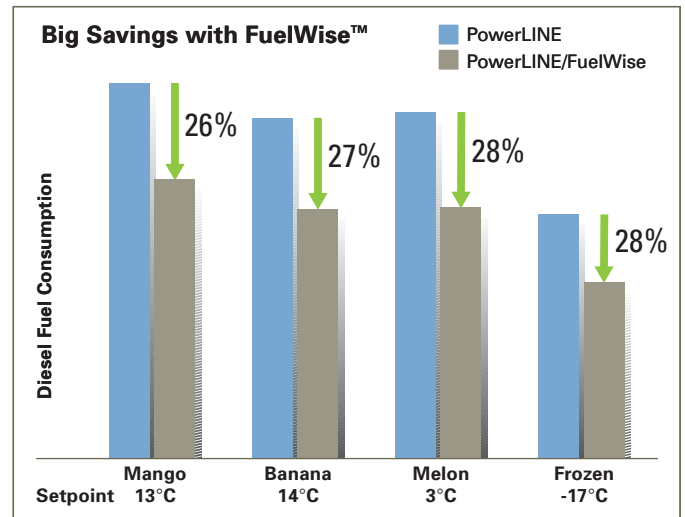
If the container unit already has the QUEST option, the payback period is shortened by a month.

“Using the FuelWise option, customers can enjoy the dual benefits of direct fuel savings and longer hauls prior to refueling,” said Phil Laros, global service program manager for Carrier’s Container Products Group. “FuelWise option retrofit kits are relatively simple to install, so customers can either choose to order and install them or have Carrier handle installations. All Carrier generator sets with Tier4i engines can be retrofitted with the FuelWise option.”

Given the proven results and return on investment for customers, it’s clear that the wise thing to do for generator set fuel economy is to install FuelWise from Carrier Transicold.



Test conditions shown at 25°C (77°F) ambient using ThinLINE container unit with a setpoint of 1.5°C (35°F).



All test conditions at 38°C (100°F) ambient using ThinLINE container unit.

Note: Chart has been updated from printed version.



For overland shipping of refrigerated containers, PowerLINE generator sets equipped with the new FuelWise option use less diesel fuel, considerably extending the range that refrigerated cargo can travel between fill-ups.



# Tap the Power of QUEST

With capital tight for investment in new, more energy-efficient equipment, is the goal of reducing operating costs while also improving environmental stewardship simply too lofty? Not for shipping lines that take advantage of the QUEST power-saving mode for their existing Carrier refrigeration units.

“Offering a relatively short payback period, the QUEST control software option refreshes older container refrigeration units with contemporary energy-saving efficiency,” said Phil Laros, global service program manager for Carrier’s Container Products Group. “The QUEST option is also an appropriate upgrade for new units.”

QUEST, which stands for Quality and Energy efficiency in Storage and Transport, governs the run-time of container refrigeration systems and cycles refrigeration on and off based on temperature settings for specific perishables. This technique maintains the *temperature of produce* in transit, whereas the conventional refrigeration approach is to precisely control the *supply air temperature*.

Allowing the refrigeration system to cycle on and off in a controlled fashion results in a significant energy savings – up to 50 percent on containers equipped with Carrier’s ThinLINE® refrigeration unit – without compromising protection of perishable cargoes. QUEST mode is backed by research from leading specialists in post-harvest food quality preservation and transport, the Agrotechnology and Food Sciences Group of Wageningen University and Research Center in the Netherlands.

QUEST mode can be specified for newly purchased equipment, and an increasing number of fleets are doing just that. As many leading fleets are finding, it can also be added to units already deployed by the experts from Carrier’s service center network. Installation is a matter of changing controller configuration software files and uploading the QUEST protocols into the controller during pre-trip inspections, according to Laros.

One major shipping line recently conducted a QUEST mode upgrade for its fleet, comprised 90 percent of older ThinLINE units and the rest EliteLINE® units. In doing so, the fleet can potentially

reduce carbon emissions by up to 220,100 metric tons a year, the equivalent of removing nearly 40,200 cars from the road annually. The prospective energy savings over the life of the units is also substantial.

For fleets considering upgrades and wanting to know the possible financial savings with QUEST mode, Carrier has an Energy Cost Model that can help, Laros said. The model factors in variables such as the type of on-board electrical power generation systems used by the fleet, fuel type, engine thermal efficiency and fuel consumption. Calculations also take into consideration number of refrigeration system running days on board per year, container size, type and temperature of cargo carried and type of Carrier units used.

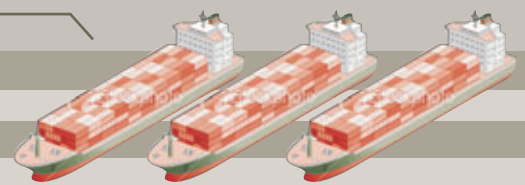
Although significant savings will be had with all types of Carrier refrigeration systems, the percentage of savings is greater with ThinLINE units than EliteLINE and PrimeLINE® units, because those units are more energy efficient to start with. So the mix of units is another consideration, Laros said.

Fuel prices, which vary weekly and by location, are also factored. The model has helped select shipping lines decide to upgrade based on their own anticipated usage.

“A growing number of shipping lines have found that they can significantly improve operations and boost their bottom lines through technology enhancements to equipment they are already using,” said Laros. “QUEST mode makes existing equipment more energy efficient, which in turn reduces operating costs and improves its overall environmental impact.”

In this age of high fuel prices and growing concern over what gets dispersed into the atmosphere, shipping lines are exploring every possible way to reduce their energy needs and carbon footprint. QUEST mode answers the call.

In this example, QUEST mode saves about enough fuel over 12 years to operate three containerships for one year. Lower power requirements for the refrigeration units reduce fuel consumption and CO<sub>2</sub> emissions related to power generation.



### SIMPLIFIED QUEST ENERGY COST MODEL EXAMPLE

Number of 40' Containers with QUEST-equipped ThinLINE Units	10,000
Fuel Cost	\$480 (USD/t)
Type of Fuel	IFO 380
Trips per Year	4
Chilled / Frozen Split	50:50
Days on Vessel Power per Trip	21
Days on Shore Power per Trip	6
Annual Fuel Savings	6,400 tonnes
<b>12-YEAR FUEL SAVINGS</b>	<b>76,600 tonnes / \$21 million (net present value)</b>
<b>12-YEAR CO<sub>2</sub> REDUCTION</b>	<b>&gt;300,000 tonnes</b>



When installed on Carrier container units, QUEST mode reduces the amount of electricity a ship must generate to run refrigeration units. Emissions related to power generation are reduced proportionately too, helping to further shrink a shipping line’s carbon footprint.

# Remanufactured Means Reliable

The ThinLINE® unit's reciprocating compressor has earned a reputation as a well-engineered workhorse. Each is manufactured by Carrier's Carlyle Compressor factory in Stone Mountain, Ga., near Atlanta, a facility recently named by *IndustryWeek* as one of the 10 Best Plants in North America. The distinction was earned in part due to product quality and reliability at a competitive cost.

While the ThinLINE unit's compressor is designed for long years of reliable service, when maintenance calls for replacing one, the unit is unique in that it can take advantage of a genuine Carrier remanufactured compressor.

To be sure, there are other remanufactured compressors on the market. But what you see isn't always what you get. Carrier Carlyle remanufactured compressors provide the same reliability and global warranty support as new ones. More important is the depth of quality, engineering and care that goes into Carrier's compressor remanufacturing, let alone the distinction between remanufactured compressors and those "rebuilt" by third-party vendors.

In what some might consider the ultimate recycling operation, each year thousands of Carlyle compressors are removed from ThinLINE units, as well as other types of Carrier heating, air-conditioning and refrigeration equipment from around the world, and returned to the Carlyle facility to be born anew.

At the plant, employees are evenly split between compressor manufacturing for new units and remanufacturing operations for compressor replacements. According to Mickey Halsey, a product management specialist in Carrier's Performance Parts Group, housing both operations under the same roof provides advantages. "You tap into the knowledge of the new compressor with the remanufacturing team – there's that exchange of information, expertise and institutional knowledge that you don't get anywhere else."

On the remanufacturing side of the plant, compressors are not repaired. Rather, they are carefully and completely disassembled piece by piece and then rebuilt to original equipment manufacturer (OEM) specifications, in much the same manner as the new compressors being made on the other side of the plant. About 40 percent of the material from each incoming compressor is scrapped and ultimately replaced with factory-fresh parts. Reusable parts are put through an environmentally responsible multistage cleaning process to remove dirt, foreign material and passageway obstructions.

Crankcases are visually inspected for integrity, and cylinder bores are dimensionally inspected using tools that measure

to within an accuracy of .00005 inch. If cylinder walls do not meet Carlyle specifications, they are remachined. Crankshafts are polished and gauged to ensure compliance. Valve plates are reground and measured to meet specifications.

Rods and pistons are inspected for damage and processed to remove minor burrs. Oil pump components are dimensionally inspected using precision air gauging and then reassembled and tested for functionality. Electric motors are remanufactured, including complete rewinding with new wire. Then they are varnish dipped and electrically tested to stringent specifications.

Technicians carefully reassemble each compressor, and each one is leak- and run-tested to verify performance by measuring flow, loaded-amp draw and oil pressure. Painting is the final step. The quality control doesn't end there, however. The plant employs several full-time quality auditors whose job responsibilities include testing, auditing and calibration control, as well as pulling units randomly from production for dismantling and inspection.



**Your Needs. Your Choice.**  
Carrier offers two remanufactured compressor options. The tier-one offering is the blue Performance Parts compressor, featuring a double powder paint coating, the latest OEM-specified oil pump and a two-year warranty. It remains the most popular replacement compressor.



For the budget-conscious, the less expensive tier-two Select Line remanufactured compressor is growing in popularity due to economic conditions. It has a single liquid coat of gray paint, a classic style reversible oil pump and a one-year global warranty against mechanical failure. Both are remanufactured at the Carlyle plant and subject to the same rigorous testing and assembly processes.





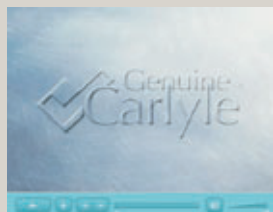
# Welcome Aboard

Halsey said there are significant differences between Carlyle remanufacturing and what's done by third-party, local rebuilders. "Small shops look at what's broken, try to fix it and put it back together," he said. "The basis for superior reliability is making the investment to dismantle, upgrade and re-qualify prior to assembly to ensure that the components meet OEM specifications. Most rebuilders aren't willing to go through the time and expense of those processes."

Carlyle's high-volume assembly-line operation, with consistent processes, advanced manufacturing tools and quality-control measures, provides advantages that a small rebuilder cannot match. Carlyle also uses better, OEM-quality parts, according to Halsey.

"For example, many rebuilders use parts of untraceable origin. On the other hand, in a Carlyle compressor, we use the same type of metal gasket on the cylinder heads that we used in the original compressor. This gasket has better sealing and bolt torque retention properties. Once you torque it down it's not going to change.

"Carrier's service and warranty coverage is unmatched," Halsey said. "If a unit from a rebuilder fails halfway around the world, who's going to handle it? With Carrier, you've got the peace of mind that our global network provides. That's what our remanufactured compressor does for you. It gives you that opportunity to save money while buying something that's well designed, well manufactured and backed extensively by the company."



Get a peek inside Carrier's Carlyle compressor remanufacturing operations by watching a video available at [www.carlyleccrp.com/video/carlyle1.html](http://www.carlyleccrp.com/video/carlyle1.html) (English language only).



The Carlyle facility, opened in 2001, where both new and remanufactured compressors are produced.

With nearly 420 container refrigeration service centers worldwide in all major and developing ports, Carrier Transcold offers the most comprehensive sales and service network in the industry. The following locations recently joined our expanding global base.

#### **Manama – Bahrain**

Trans-Continental Shipping  
Contact: Mr. Yusuf Al Rayes  
Transco@batelco.com.bh  
+973-17532989

#### **Aqaba – Jordan**

BADR  
Contact: Mr. Mahmoud Kurdi  
badr@badrmarine.com  
+962 (3) 2035965

#### **Apia – Samoa**

Climate Air Conditioning and Refrigeration  
Contact: Mr. Steve Cleverley  
climate@samoa.ws  
+685-25233

#### **Felixstowe – United Kingdom**

Maritime Transport Limited  
Contact: Mr. Chris Mee  
c.mee@maritimetransport.com  
+44 (1394) 677778



Carrier's remanufacturing operations improve shipping by providing customers with high quality, economical compressor replacements. Each year, 4,150 tons of Carrier compressors are saved from landfills, and 99 percent of material that does not meet design criteria is removed and recycled.

# Personnel Update

## Carrier Transicold Welcomes New President



**David Appel** has been named president of Carrier Transicold, succeeding Mark Cywilko, who has retired after 38 years of dedicated service to Carrier's transport refrigeration and air

conditioning businesses.

Appel brings extensive industry knowledge and more than 27 years of experience with United Technologies Corp., including 16 with Carrier. Most recently he served as president of Carrier Heating Ventilation and Air Conditioning (HVAC) for Europe, Middle East and Africa (EMEA). Between 2002 and 2009, Appel held various leadership positions, including managing director for Toshiba Carrier UK Ltd., vice president of Carrier European HVAC Distribution and president of Carrier Building Systems & Services for EMEA. Prior to that he held several executive finance assignments. He is based in London.



"We thank Mark for his incomparable leadership and distinguished service to Carrier," said Carrier President Geraud Darnis. "Throughout his career he has earned the respect of co-

workers and customers, is a recognized industry expert, and has been an incredible asset to Carrier and UTC. I have relied greatly on Mark's advice and counsel and wish him only the best as he transitions to this next phase in life."

### Global Service Organization:



#### General Manager – Global Container Services

Michael Dormer returns to the Container Products Group as general manager, Global Container Services.

In his new role, Dormer will focus on driving growth of Carrier's value-added service programs throughout the worldwide service organization, including

responsibilities for Smith Holland, Tianjin YuanChang Reefer (TYR) Services and Refrigerated Container Services (RCS) Group. He also oversees Global Service Engineering, adding leadership in helping the organization deliver its industry-leading after-sales technical and service support.

#### Mike Dormer

Tel: +1-315-432-7522

Fax: +1-315-432-7698

michael.dormer@carrier.utc.com



#### Regional Manager – Americas

Chris McHugh has also returned to the Container Products Group, as regional manager, Service Engineering – Americas.

Chris is responsible for managing the Field Service Engineering team, customer aftermarket support and the Service Center Network for North, Central and South America. Chris brings over 22 years of Engineering and Management experience to this position.

#### Chris McHugh

Tel: +1-315-432-7161

Fax: +1-860-998-1099

chris.mchugh@carrier.utc.com



#### Service Engineering Project Manager

David Whyte has been appointed Service Engineering project manager. In his new role, Whyte is responsible for

managing special major Service Engineering projects, including aftermarket product assignments, service training, response to California Air Resources Board regulations and initiatives related to Achieving Competitive Excellence (ACE).

#### David Whyte

Tel: +1-315-432-6411

Fax: +1-315-432-7698

david.whyte@carrier.utc.com



#### Global Container Service Training Manager

Jack Kurz has transitioned to the Service Engineering organization as container service training

manager. He is responsible for the overall quality of customer technician training carried out by service engineers worldwide, as well as developing new courses and aligning courses with customer needs. Kurz will continue to instruct customer classes as well as integrate training programs throughout the entire Service Engineering team.

#### Jack Kurz

Tel: +1-315-432-7608

Fax: +1-315-432-7698

jack.kurz@carrier.utc.com



#### Field Service Manager – Central America

Jorge Bazan has accepted the assignment of field service manager for Central America, with territorial responsibility

extending from Mexico to Panama. Among his current responsibilities are banana producers in Costa Rica and the service center network throughout his region.

#### Jorge Bazan

Tel: +52-55-91260300

Fax: +52-55-91260383

jorge.bazan@carrier.utc.com



#### Field Service Manager – South America

Chile-based Andres Catalan has changed departments, moving from Customer Training into Service Engineering as field

service manager for the "cone" of South America. He also continues to provide Spanish-language technician-training courses within the Americas.

#### Andres Catalan

Tel: +56-2-724-8448

Fax: +1-860-353-6826

andres.catalan@carrier.utc.com

## ContainerLINE

Please send your comments and story ideas to:  
jon.shaw@carrier.utc.com  
ContainerLINE  
Carrier Transicold  
Communications Department  
P.O. Box 4805  
Syracuse, New York 13221 U.S.A.

Editors: Jon Shaw, Melanie Heaphy  
Telephone: +1-315-432-6442  
FAX: +1-860-998-1351  
www.containerline.com

**A member of the United Technologies Corporation Family. UTX.**

Printed on recycled paper. © Carrier Corporation, June 2010.