

Non-Electric Refrigeration

A solution for large scale and complex food production sites

By John Hokkeling, FCSI, CMC

Everyone knows how difficult it is to maintain chilled food temperatures within large scale catering operations. Cook-chill units experience one of the biggest challenges when transporting food from the central production kitchen to outlying user sites. A proven – but for many, an as yet unknown system – solves this problem quite easily. Across the globe, as larger CPU projects are being commissioned, this system could be a suitable solution.

Due mainly to three factors – the new mountain of food temperature legislation, the movement to-wards cook-chill operations and the growing trend of using central catering logistic facilities [all of which have occurred over a short period of time] – there has been a quiet but revolutionary development behind the dunes of the North Sea coast in The Netherlands.

Central logistic catering facilities, able to do everything except food production itself, have emerged and meal distribution systems have had not only to develop rapidly in response but also to be much more flexible in their operation. Traditional compressor refrigeration systems have

struggled in their performance and capability, and have been unable to cope properly with demands placed upon them. A new system has emerged and risen to the challenge: Carbo-Fresh.

What is Carbo-Fresh?

ISECO the manufacturer of trolleys, in collaboration with Air Liquide (a global player in the production of industrial gases) has developed and adapted a very simple system of refrigerating trolleys. The trolley is equipped internally with a special cassette to accept liquefied carbon dioxide (CO₂). The cassette is injected and loaded with liquefied CO₂ through an external nozzle, instantly reducing the internal temperature

The system chills the food product itself at the microscopic level to ensure food safety.



The Carbo-Fresh trolley is equipped internally with a special cassette to accept liquefied carbon dioxide (CO₂) which enables it to keep food cold with no mechanical or moving parts.

of the trolley to 3°C while at the same time charging the cassette with dry-ice [snow].

The trolley loaded with chilled food is kept refrigerated by the CO₂ (snow) which gradually sublimates and absorbs heat creating the required chill effect, whatever the ambient air-temperature. When no heat is absorbed (because the food is loaded at the correct cold temperature) there is hardly any sublimation of CO₂. Ambient air temperature, duration time of transportation, and the actual contents of the trolley all combine to determine the volume of CO₂ required to be injected. This process involves no mechanical moving parts or refrigerants.

The system has been proven to be very reliable and capable of handling complex working conditions. The maintenance of cold is assured where no electricity supply or cold room is available. The trolley emits no heat or noise, and refrigeration is pro-

duced for up to 20 hours with a single charge of CO₂. Additionally the absence of the requirement for a compressor reduces the weight of the trolley by about 50kg.

Other systems utilize compressors or Glycol – good solutions but these don't offer the same flexibility. Where compressor equipped vehicles are not permitted and the cargo space within a truck or lorry is opened frequently, the Carbo-Fresh system will maintain refrigeration of product. Remarkably it can be used for either chilled or frozen foods because it adapts naturally to the ambient air temperature in which the trolley is working. The higher the ambient temperature the more efficiently Carbo-Fresh performs, unlike compressor driven refrigeration systems which struggle as ambient temperature rises.

Trolleys can also be equipped with a full HACCP track and trace system to monitor



performance 24/7, with the collected data transferred wirelessly to a receiving computer.

Disadvantages

The CO₂ injection installation requires initial infra-structure investment and an ongoing agreement with the CO₂ supplier.

Does Carbo-Fresh add to global warming? In fact, all methods of cold production add to global warming. The CO₂ that is used in this system is a cleaned, purified and recycled bi-product of the chemical industry (collected during the production of industrial grade ammonia), adding very little to global warming. Although appearing to be contradictory, it is a very sustainable system. Even when all the effects of CO₂ transportation and supply are taken into account, surveys show a huge decrease of emissions compared with any conventional refrigeration technology.

Since its first introduction in The Netherlands, Carbo-Fresh is being used in more than 40 large catering operations across Europe. Currently it is used most widely in healthcare catering, but there has been a growing interest in the system from both general catering and event-catering operations.

With increases in cook-chill operations across North America, the Middle East and Asia, the system is in demand. Designers realise the development of a cook-chill operation starts with the design of logistics and the technology available for those logistics, which then determine the flow of the operation.

CO₂ chilling has many advantages other than for use in logistics. Vehicles don't need compressor refrigeration, and buildings don't require large refrigerated trolley storage areas or electrical sockets to plug in compressor equipped trolleys; handling is

To refill, simply plug the patented injection gun into the trolley, and use the programmable wall mounted control panel to automatically inject the correct amount of Dry Ice required.

Low Temp

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reduced to an absolute minimum. Pre-chilling with this system only takes seconds within the flow-cycle of the logistic process.

The big three

Three important matters should always be considered by designers: cost, food safety and labour. Compared with traditional technology, food operations producing 500 meals or more per day, will find the CO₂ system more cost efficient. The volume of meals refrigerated lowers the cost of the system. By comparison, the operational cost increases with volume in traditional refrigeration systems. Savings can be made by reduced initial investment, significantly reduced maintenance, and reduced repair and replacement costs.

The system chills the food product itself at the microscopic level to ensure food safety; CO₂ is bacteriostatic, reducing bacterial growth in the food while cleansing the inside of the trolley during every injection.

For catering operatives the trolleys are lighter in weight (no integral compressors) and are therefore easier to manoeuvre causing less physical strain and potentially fewer injuries. For total safety while loading the CO₂ cassette there is constant monitoring of the injection station area by specialist detection equipment. An air-extraction/ventilation system is used to extract any superfluous CO₂ at floor level during the injection process (CO₂ is heavier than oxygen and falls to low level).

In summary, in my opinion there are many good mobile chilling systems but the relative unknown Carbo-Fresh has strong cards. It has proven to be a very interesting alternative to the traditional refrigeration systems and adaptable to all kinds operations and circumstances, but especially beneficial when designed for use in large scale or complex catering operations.

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**Top: Refilling the trolley.
Middle: Interior of cart.
Bottom: The trolley can be rolled to the filling station.**

La Gourmande

In August 2007, la Gourmande opened its new central kitchen at an industrial area near the city of Zwolle in The Netherlands. This private company is owned by the Isala Hospital Group in Zwolle, and supplies meals to its own two hospitals, a clinic, two nursing homes and a rehabilitation centre. In total, some 1,500 meals day are being processed in bulk as well as being individually plated and transported to these five destinations. With 32 employees, this full service is provided seven days a week.

The kitchen is just 1,100 sq m and has a few interesting innovative,

sustainable solutions, like an underground storage for organic waste (for production of biogas), a rubber anti-slip floor made of recycled car tyres, motion-sensor operated illumination and flexible floor space for as well logistics as storage.

For meal delivery some 80 CO₂ refrigerated transport/regeneration trolleys are being used. Between the loading of the trolleys and serving the meals there are approx. 5 hours. The CO₂ maintains the temperature permanently at 3 to 4°C. At the moment the regeneration process (automatically) starts, the temperature will rise to the desired level in 50

minutes, while cold starters and desserts (on the same tray) are still being chilled by the CO₂.

The trace and tracking system monitors all temperatures and performances in every single trolley. All the collected data is wireless transferred every day for verification.

The use of this sustainable refrigeration system was preferred by La Gourmande, but more important were the manageable costs, reliability, operational flexibility and the strong performance. Because the catering department only has external deliveries, it relies completely on the logistic system. 🌍

Beech Oven

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