Solutions for safe and efficient food supply chains

Introduction

The different temperature ranges of different products within a transport are a frequently mentioned complaint of food processing and transporting companies. Frozen food must often be transported at the same time as products at refrigerator temperature. Interactions between the different temperatures cause quality losses and in the worst case even financial losses due to spoiled goods. Acquiring refrigerated vehicles is usually the conventional solution. However, this does not solve the problem in every case and is also cost-intensive. This challenge is made even more difficult by legal requirements for maintaining the cold chain.

Legal basis

The so-called HACCP (Hazard Analysis Critical Control Point) concept, which was developed in the USA in 1959, is regarded as the worldwide standard tool in the food producing and transporting industry. Any operator producing, storing, supplying or distributing food must implement an HACCP system. The specific task is to identify hazards associated with the processing of food or arising from finished products and to assess the risks. Appropriate measures can only be taken when all factors that could affect the purity of the food have been identified. The aim is to understand possible risks and to avoid them in advance in the production process. In this way all risk factors can be eliminated.

The European Union has also adopted the HACCP concept and developed it further in the EU Regulation 852/2004 on food hygiene. It ensures consumer protection in terms of food safety within the EU. The regulation contains clear rules on transport and storage. As a matter of principle, the goods must always be protected from contamination.

The cold chain is also an elementary component of the EU regulation: transport containers used for transporting food must keep the products at a suitable temperature. Whether this is achieved with a permanent supply of thermal energy from outside (active systems, such as refrigerated vehicles) or without a supply of energy (passive systems) is left to the discretion of food producers and transporters.

All containers and transport boxes which come into contact with the goods must be cleaned before each new use and then disinfected in a suitable manner. All surfaces that come into contact with the goods must be protected from contamination as well. Furthermore, it must be ensured that the means of transport used can withstand the chemicals and conditions during disinfection. They must also be made of smooth, abrasion-resistant, corrosion-resistant and non-toxic material. In addition, it must be possible to close them to protect them from external environmental influences (e.g. dust, condensation water).

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HACCP principles:

I. Definition of the processing method and product
II. Identification of risk factors
III. Determination of risky process sections
IV. Assumption of control of high-risk process sections
V. Monitoring of risk-prone process sections
VI. Development of a system for error correction
VII. Verification of the effectiveness of the HACCP system

Source: Regulation (EC) No 852/2004 (Article 5) of the European Parliament and of the Council of 29.4.2004.

Practical requirements

Practical experience in the field of food logistics shows that maintaining the legally required cold chain and protection against contamination are the central challenges.

On the last mile from the wholesaler or middleman to the end customer, the transport time is usually several hours. Additionally, the number of different products within one load is very high. This means that the required temperature ranges of the products during transport are very different: Frozen products which require temperatures below -15 °C are placed directly next to fresh products that have to be stored and transported at 2 °C to 8 °C.

The specific use of dry ice is not only cost-intensive and dangerous, it is also not a sustain-able alternative for environmental reasons. The last shipment stage often involves the delivery to many individual addresses. The transport vehicle is opened and closed at each station to unload products. A conventional refrigerated vehicle reaches its limits in this case: On the one hand, it can only maintain one temperature in its transport chamber, on the other hand the temperature fluctuates when the loading flap is permanently opened and closed. Despite insulation, the cooling function is often not reliably guaranteed, when the engine is switched off, especially in the summer months and the cargo space heats up. Food producers complain of up to 20% loss of their perishable goods due to incorrect storage and non-compliance with cold chains which is also a considerable financial loss. In addition, active temperature-maintaining systems such as refrigerated transporters use a lot of energy in the form of fossil fuels to maintain the temperature inside. In times of driving bans in city centers and rising fuel costs, this is a problem that should not be neglected - especially for the supply of food stores in city centers. Electric vehicles are currently not an alternative due to insufficient battery power and range.

In the import and export business, where the goods must be kept at a stable temperature for days on end, further challenges are added. On long-distance transports, lengthy delays can occur at any time: In the case of road transport due to traffic jams or long diversions, in the case of air transport due to flight cancellations or delays in loading.

In order to guarantee the hygiene requirements required by the EU standard, safe and uncomplicated cleaning of the means of transport is important. Narrow edges and corners are difficult to clean by hand. Long cleaning processes with strong chemicals are necessary. For this reason, most companies have industrial washing facilities where disinfection is carried out with hot water and the addition of detergents.

Special requirements are also placed on the material of the means of transport. Parallel to the legal requirements for food safety and resistance to cleaning agents and chemicals, the product must be robust and stable in shape. Time pressure arises during deliveries which leads to means of transport being handled roughly or falling down. Intelligent product design and the right choice of materials are important to cope with this. The means of transport must withstand shocks, impacts, high temperatures and chemical cleaning agents in industrial car washes - and it has to do so over many uses.

Especially regarding sustainability aspects, reusable products are always preferable to disposable products. Not only are they more cost-effective, but frequent reuse means that less raw materials and energy are required for their use. They have a better ecological balance sheet and are more climate friendly.

va-Q-tecs solutions

va-Q-tec is a pioneer of highly efficient products and solutions in the field of thermal insulation and TempChain logistics. The company develops, produces and sells highly efficient and thus thin vacuum insulation panels („VIPs“) for insulation as well as thermal energy storage components (Phase Change Materials - „PCMs“) for reliable and energy-efficient temperature control. In addition, va-Q-tec manufactures passive thermal packaging systems (containers and boxes) by optimally combining VIPs and PCMs. Depending on the type, these systems are able to maintain constant temperatures for up to 200 hours without the supply of external energy. For the execution of temperature sensitive logistics chains va-Q-tec maintains a fleet of rental containers and boxes in a global partner network, with which demanding thermal protection standards can be met. In addition to Healthcare & Logistics as the main market, the following other markets are also addressed by va-Q-tec: Appliances& food, Technics & Industry, Construction and Mobility. Founded in 2001 and growing strongly, the company has its headquarters in Würzburg.

In times of sustainability, CO2-neutrality and cost pressure, the above-mentioned demands on food producers and transporters and their means of transport are constantly increasing.

Especially for the requirements of food storage and transport, the company va-Q-tec has developed innovative solutions which all have highly efficient insulation properties for temperature control. This is made possible because vacuum insulation panels (VIPs) are used as insulation material. Due to their low thickness, the usable volume of a transport box insulated with VIPs is significantly larger compared to conventional insulated solutions. The temperature holding time can be extended individually by equipping it with high-tech thermal energy storage components (PCMs).

The means of transport are made of polypropylene (PP). The material is food-safe and considered unbreakable and it also has a temperature resistance of -20 °C to +75 °C. Therefore, it is suitable for automatic cleaning systems. Rounded corners and edges make the transport equipment easy to clean.

The use of va-Q-tec's transport solutions can make the purchase of a refrigerated vehicle superfluous. Due to their above-average insulation properties, va-Q-tec's transport solutions are so-called passive systems, as they can maintain the temperature inside without the supply of external energy (e.g. by cooling units in refrigerated vehicles). This means that the temperature-sensitive goods can also be transported in conventional delivery vans. The insulation properties of the va-Q-tec solutions even allow boxes with different temperatures to be stacked on top of each other without any interaction between the different temperature ranges and thus without any loss of temperature holding time. In the catering area, for example, hot food can be transported directly next to chilled desserts.

va-Q-tray

A solution for the special requirements of the last mile of food logistics is the va-Q-tray. The product was developed for the storage and transport of bulk and loose goods of catering, gastronomy and food companies.

The box can maintain temperatures between -30 °C and +70 °C reliably for several hours - depending on the goods being transported. The integration into existing production sequences and processes is problem-free: The external dimensions correspond to the EU standard (600x400mm - half a euro-pallet). This simplifies deliveries on vans, as their loading areas are optimized for this size. The internal dimensions are 522x322x150mm, which makes it suitable for 1/1 standardized containers.

The design makes the handling of the va-Q-trays very comfortable: Due to carrying handles it can be held safely and without the fear of it slipping. When stacked, the boxes snap into each other so that the boxes also cannot slip. The bottom of the va-Q-tray isolates the element below from above. For single use, an optional VIP insulated lid can be added to protect against contamination.

va-Q-box

va-Q-tec has also developed a solution for large-volume orders. The transport box va-Q-proof stores food and temperature sensitive goods in a temperature range from -40 °C (through dry ice) to +25 °C. A modular system makes it possible to adapt the box individually to different requirements regarding size, temperature and holding time. The portfolio offers variants with a temperature holding time from 96h to approx. 168h, the available internal volume is 4 L to 264 L.

va-Q-tec offers an additional service for the va-Q-proof. In so-called TempChain Service Centers, the box can be pre-conditioned - i.e. pre-cooled or preheated - so that it is delivered at the ideal temperature.

va-Q-proof

va-Q-tec's means of transport are also a solution for the temperature-controlled import and export of food: Due to the high-tech insulation, a constant internal temperature between -35 °C and +25 °C can be maintained in the va-Q-box. The combination of VIPs and PCMs enables food and other temperature-sensitive goods to be stored and transported at a stable temperature for four to six days without power supply.

The va-Q-box is available in 2 sizes optimized for GN containers (27 L for 1/3 GN containers and 43 L for 2/3 GN containers). Both variants can be loaded with up to 70 kg.

The handling is also very convenient: With a special grip the box can be opened easily and carrying handles that fold automatically provide additional safety during transport and handling.

Conclusion

Legal requirements regarding material and cold chain and practical benefits through design and size - the demands on means of transport in food logistics are increasing. One answer to these challenges is provided by va-Q-tec's transport solutions.

Efficient insulation and intelligent product design ensure that the legally required cold chain is guaranteed. Even when transporting goods at different temperatures at the same time, temperature fluctuations no longer occur.

The passive reusable systems are also convincing in practice. They are not only ecologically more sustainable and thus more cost-efficient but thanks to the well-thought-out product design, they are easy to handle and can also be integrated into existing production processes without any problems.

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