va-Q-tec

WE SOLVE THERMAL CHALLENGES

Appliances

Energy Saving Potential for Appliances in Households, Businesses, and Laboratories

We produce our brochure sustainably:

EU Ecolabel
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By producing our brochure in accordance with the provisions of EU Ecolabel, we emphasize our claim for sustainability. The EU Ecolabel is awarded to products and services that have a lower environmental impact than comparable products. This allows the identification of environmentally friendlier and healthier products and services.

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The EU Ecolabel places high demands on the entire manufacturing process, including the paper used. The wood fibers used in the paper come from sustainably managed forests. The product meets strict environmental and usability criteria. Certified regional waste disposal companies ensure resource-saving waste disposal and responsible wastewater policies.

Low-pollution printing with organic printing inks and varnishes

Our *bonitasprint* print shop uses low-pollution consumables in all printing processes and prints completely alcohol-free. Workflows and processes are constantly optimized in order to make the entire production process as sustainable as possible.

Renewable raw materials are the basis for organic printing inks and organic varnishes, which are used in our brochure.

Print product
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The *bonitasprint* company building is powered by electricity from 100% renewable energy sources. For this purpose, the company operates its own photovoltaic system. The waste heat from the printing machines and compressors is used to supply heat to the company building. Additional heating is obtained from climate-neutral natural gas with emission compensation.

bonitasprint has a continuous in-house production chain. The company's own fleet includes electric and natural gas vehicles. This prevents transport-related CO_2 emissions. The climate neutrality of these va-Q-tec printed products is also demonstrated by the "climate-neutral printing" logo.

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Content

About va-Q-tec

va-Q-tec is a pioneer of sophisticated solutions for thermal energy efficiency as well as temperature-controlled supply chains. The company develops, manufactures and sells thin, highly efficient Vacuum Insulation Panels (“VIPs”) for thermal insulation as well as intelligent Phase Change Materials (“PCMs”) for reliable temperature control.

Through the targeted combination of VIPs and PCMs, va-Q-tec manufactures thermal packaging systems (boxes) that maintain constant temperatures for food and pharmaceuticals for up to five days during transportation without an external energy supply. In addition, VIPs and PCMs optimize the energy footprints of various applications, such as buildings, hot water storage tanks, local and district heating pipes as well as household appliances and laboratory equipment.

The products of va-Q-tec enable a global improvement in thermal energy efficiency and thus make a valuable contribution to climate protection. The company has been operating climate-neutral at all locations since 2021. Permanent process optimizations minimize the CO_2 footprint.

The company was founded in 2001, and has its headquarters in Würzburg.

Dr. Joachim Kuhn and Dr. Roland Caps, the founders and inventors of the technology, characterized the “Q” in the company name, which continues to stand for highest quality today. The “Q” is visible, measurable and firmly anchored in all processes of va-Q-tec – quality is the foundation on which the company is built on.

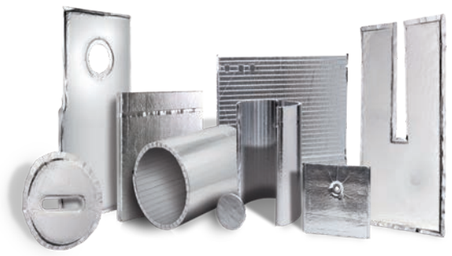
As an established **premium supplier**, we enable our customers to optimize their products ecologically and economically with targeted solutions by saving valuable energy or **dispensing with external energy sources**.

va-Q-tec is a **pioneer** in vacuum insulation technology and has more than **100 international IP rights** and applications. More than **70 international awards** confirm the leading role of the company in the industry.

va-Q-tec promotes resource-conserving and **CO_2-neutral production** and generates 1.7 million kWh annually from renewable energies, which underlines its **sustainable focus**.

Using strict quality controls, we enable **highest product quality** and offer exceptional **longevity**, **reliability** and **safety**.

Thermal Energy Efficiency by means of VIPs and PCMs



Vacuum Insulation Panels (VIPs)

va-Q-tec relies on state-of-the-art insulation technologies that significantly outperform conventional solutions. The centerpiece is Vacuum Insulation Panels (VIPs) with insulation performance up to ten times higher than that of traditional materials such as PU foam or mineral wool. A VIP layer just 2 cm thick achieves the same insulation effect as around 20 cm of PU foam.
The result is significantly more useful interior space with the same or even better insulation performance.

Phase Change Materials (PCMs)

This technology is supplemented by the use of Phase Change Materials (PCMs).
Thermal energy is stored as latent heat in the transition between the liquid and solid states of matter and vice versa, without any change in temperature. As such, the temperature inside appliances remains constant and stable, even if doors are opened or during peak demand, regardless of whether the aim is to preserve cold or retain heat for longer.

Sustainability:
Lower energy demand, smaller carbon footprint and improved environmental balance

Support:
Provision of specific advice by the Thermal Engineering Center, from project inquiry to series production, for smooth integration

Larger Useful Volume:
More storage space thanks to ultra-thin VIP walls, without compromising performance

Low Thermal Losses:
Constant temperature thanks to PCM buffering and VIP insulation, as well as durably stable insulation performance throughout the entire service life

Optimal Temperature Distribution:
Consistent conditions for food, medicines, or sensitive samples

Prevention of Condensation:
Reliable protection against moisture even in extreme outdoor conditions

Energy Efficiency & Cost Saving:
Reduced power consumption and highest energy efficiency classes

Long-term Durability:
Consistently high performance due to high-quality materials and optimized panel design

VIPs and PCMs

Two key technologies form the basis for all va-Q-tec solutions: Vacuum Insulation Panels (VIP) and Phase Change Materials (PCM). Both technologies are the result of intensive research as well as decades of development and set standards for thermal performance in their respective fields.

Due to their special structure, VIPs permit exceptionally high thermal efficiency in the smallest of spaces. They form the basis for compact appliances that achieve excellent insulation figures, despite their slim design.

PCMs, on the other hand, act as intelligent energy storage devices: they utilize the physical effect of phase change to absorb energy in the form of latent heat, without raising the temperature or requiring additional energy for cooling. In this way the influence of external temperature fluctuations is minimized.

When combined, VIPs and PCMs open up completely new options for thermal management in a wide range of applications. The following pages provide a detailed introduction to both technologies – from how they work and their structure, to their specific advantages compared to conventional materials.

VIPs compared

Vacuum Insulation Panels (VIPs) form the centerpiece of va-Q-tec insulation technology. They combine **maximum insulation performance** with **minimal material thickness**, opening up new options for **efficient thermal management**.

va-Q-tec offers a broad portfolio of VIP solutions characterized by specific material properties and performance profiles. In principle, all VIPs can be used in household and commercial appliances, as well as in highly sensitive laboratory applications. Which solution is best suited to the specific project and whether a combination with PCM technology makes sense depends on the specific customer requirements. These requirements are analyzed together during a personal consultation to develop a **bespoke solution** that combines **maximum efficiency** and **quality**.

The possible uses of VIPs are manifold. They demonstrate their strengths particularly in the following applications.

Household Appliances: refrigerators & freezers, dishwashers, washing machines, ovens

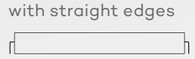
Commercial Appliances: dishwashers, washing machines, ovens, coffee machines, refrigerators and freezers, solar direct drive (SDD), mobile refrigerators, vending machines, refrigerated cabinets

Laboratory Appliances: ultra-low temperature freezers, incubators, sterilizers, laboratory ovens

va-Q-vip

Rectangular classic with maximum useful space

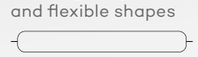
Thermal Conductivity:	0.005 W/(m*K)
Length/Width:	100 - 1,000 mm
Thickness:	5 - 50 mm
Shape:	Rectangular panels with straight edges



va-Q-plus

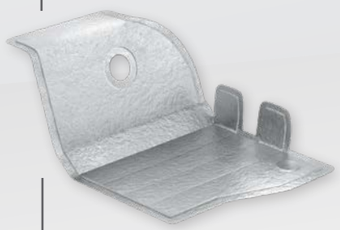
Price-performance-optimized VIP with high flexibility

Thermal Conductivity:	0.0035 W/(m*K)
Length/Width:	250 - 1,800 mm
Thickness:	8 - 30 mm
Shape:	Rectangular panels and flexible shapes



va-Q-pro

Bespoke solution for maximum energy efficiency



Thermal Conductivity:	0.0035 W/(m*K)
Length/Width:	60 - 1,800 mm
Thickness:	5 - 16 mm
Shape:	Panels in various free-forms

va-Q-steel

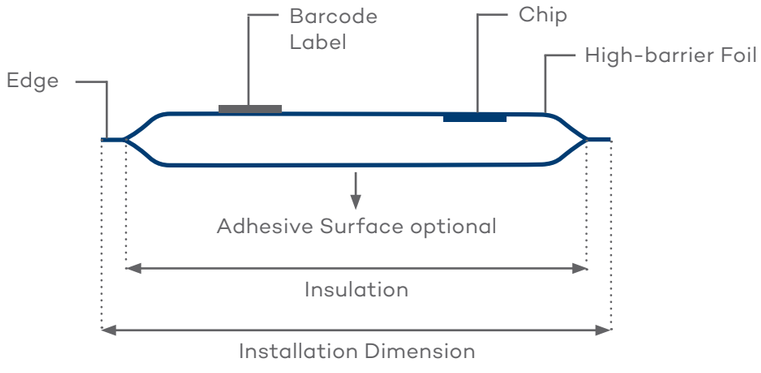
Extreme temperature resistance from -196 °C to +400 °C thanks to robust stainless steel foil

Thermal Conductivity:	< 0.0045 – 0.0060 W/mK or < 0.008 W/mK
Length/Width:	175 – 1,000 mm
Thickness:	10 oder 20 mm
Shape:	Rectangular panels

- **Smooth edges** thanks to patented va-Q-seam® technology
- **Improved mechanical stability** for greater robustness
- **Attractive price-performance ratio** with high efficiency
- **Good pliability** and flexibility due to optional groove embossing
- **Maximum space utilization** due to custom shapes
- **High flexibility** due to optional embossing
- **Maximum safety** thanks to non-flammable materials
- **Minimal aging** thanks to low air and vapor permeability

Structure of a VIP

The basic structure of a Vacuum Insulation Panel can be explained particularly well using the example of a va-Q-plus. A VIP consists of a highly porous core material sealed into a multi-layer high-barrier foil. Evacuating the trapped air creates a vacuum, which greatly reduces heat transfer. Supplemented by special technologies such as va-Q-seam® for leakproof sealing and va-Q-check® for quality inspection, the result is a high-performance insulating material with exceptionally low thermal conductivity.



va-Q-check®

va-Q-check® is a globally patented inspection system that ensures the quality of every single vacuum insulation panel. The internal gas pressure is measured in a few seconds. This value is crucial for performance and service life.

Each panel is equipped with a sensor disk and a barcode. As a consequence, measurements can be recorded accurately and documented permanently. In this way, it is ensured that every product meets the high standards of va-Q-tec before it leaves production.

- **Quick, precise quality control**
- **Significant reduction in invisible VIP errors**
- **Complete traceability due to unambiguous labeling**

PCMs compared

Phase Change Materials (PCM) are the second key va-Q-tec technology. They store thermal energy during the phase change, without altering the required temperature or needing energy for cooling or heating. As a consequence, **temperatures remain stable over long periods**, even if external fluctuations occur.

In principle, all PCM products are suitable for use in household, commercial and laboratory appliances. In close cooperation with the customer, we specify the form, quantity, or combination in which the materials can be optimally integrated into the related product and to what extent the additional use of VIPs offers added value. The result is **bespoke solutions** that enable **constant temperatures**, **high energy efficiency** and **reliable process stability**.

The temperature-stabilizing and energy storage properties of PCMs are particularly effective in the following applications:

Household Appliances: refrigerators & freezers, ovens

Commercial Appliances: ovens, refrigerators & freezers, solar direct drive (SDD), mobile refrigerators, vending machines, refrigerated cabinet

Laboratory Appliances: ultra-low temperature freezers, incubators, incubating cabinets, sterilizers, laboratory ovens

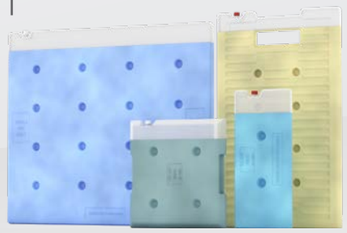
va-Q-gel

Leakproof and with maximum energy density for stable temperatures

Shape/Filling/ Packaging:	Gel Phase Change Material in sealed blister packs
Application Range:	From -26 °C to +23 °C

va-Q-accu

Robust and reliable for long periods of use



Shape/Filling/ Packaging:	Liquid or gel Phase Change Material in HDPE shells
Application Range:	From -68 °C to +38 °C

Bulk PCM

Flexible solution for large quantities

Shape/Filling/ Packaging:	Colorless, aqueous or oily liquid, available in drums, IBCs or canisters
Application Range:	From -27 °C to +23 °C

- **High Energy Density** for maximum heat storage
- **Stable Temperature Control** compensates for fluctuations
- **Specific Application** due to drip-proof materials
- **Robust Construction** for frequent use
- **Versatile Temperature Ranges** from deep freezing to room temperature
- **Long Periods of Use** and consistent performance over many hours
- **Maximum Flexibility** due to specific quantities
- **Straightforward Integration** into existing processes and products
- **Efficient Energy Storage** for stable temperatures

Appliances

Whether in private households, commercial use, or highly sensitive laboratories, appliances everywhere face the same challenge: they must operate reliably, consume as little energy as possible and, at the same time, guarantee maximum performance.

With Vacuum Insulation Panels and Phase Change Materials, va-Q-tec offers solutions that meet precisely these requirements. They increase efficiency, stabilize temperatures and create additional interior space – regardless of whether food needs to be kept fresh, large quantities need to be processed in continuous operation, or extreme laboratory conditions need to be maintained.

The following chapters show how VIPs and PCMs are used in household, commercial and laboratory appliances and what advantages they bring.

Household Appliances

Our high-performance insulation enables household appliances such as refrigerators, freezers or ovens to operate more energy-efficiently. The energy consumption is significantly reduced and the useful volume increased. In this way, appliances achieve the highest efficiency classes while maintaining a compact design.

Commercial Appliances

In professional applications, such as coffee machines, vending machines or commercial refrigerators, our technologies enable stable temperature control and reduced energy losses, lower operating costs and a longer service life for the appliances, even in demanding operating conditions.

Laboratory Appliances

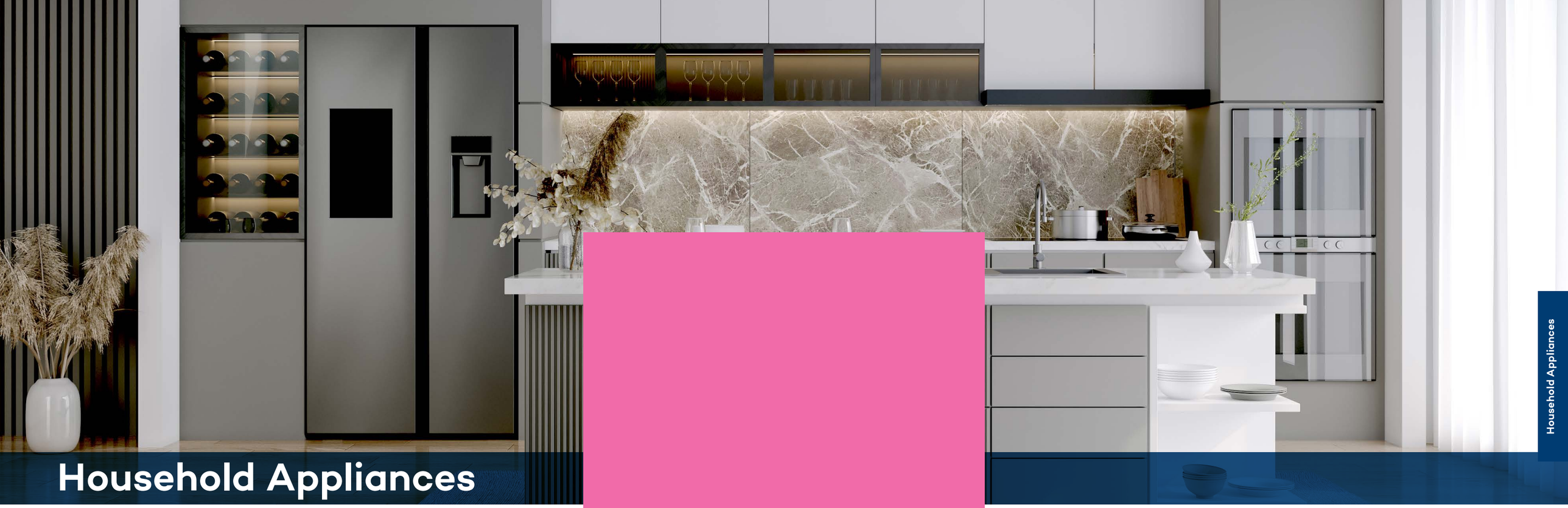
Precision is key when it comes to laboratory appliances such as ultra-low temperature freezers or incubators. Our VIPs and PCMs enable constant temperatures, even during peak demand, and significantly reduce energy consumption. In this way the reliability of the appliances is increased and efficiency improved sustainably in everyday laboratory work.

Household Appliances

Household appliances shape the everyday lives of millions of people and are increasingly becoming the focus of energy efficiency and sustainability. They should reliably cool, freeze, wash or heat while consuming as little energy as possible. At the same time, consumers expect compact designs with maximum interior space and low operating costs.

va-Q-tec makes this possible by means of intelligent thermal management using Vacuum Insulation Panels and Phase Change Materials. The high-tech insulation enables maximum surface coverage, as even complex areas such as compressor compartments or irregular geometries can be insulated using VIPs. They permit significantly better insulation performance with the same material thickness or, conversely, more useful internal volume with the same insulation effect. Power consumption and costs for the end user are significantly reduced, while also providing more space inside the appliance.

This advantage is particularly evident in everyday life with refrigerators and freezers, however, VIPs and PCMs also contribute to reducing the power consumption of ovens and dishwashers, thus improving their sustainability balance.

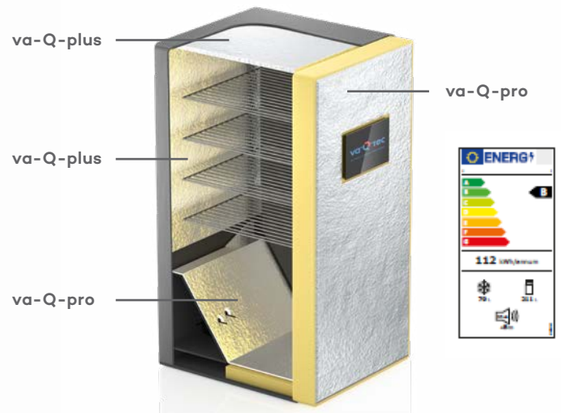


Household Appliances

Weitere Einsparpotentiale und Vorteile

on VIPs

Kühlschrank mit
konventioneller Dämmung



Kühlschrank mit
integrierten VIPs

Commercial Appliances

In commercial environments, appliances are subject to significant demands: they often run continuously, have to handle large quantities reliably and, at the same time, function economically and sustainably. Energy efficiency, consistent product quality and compact design play a central role here.

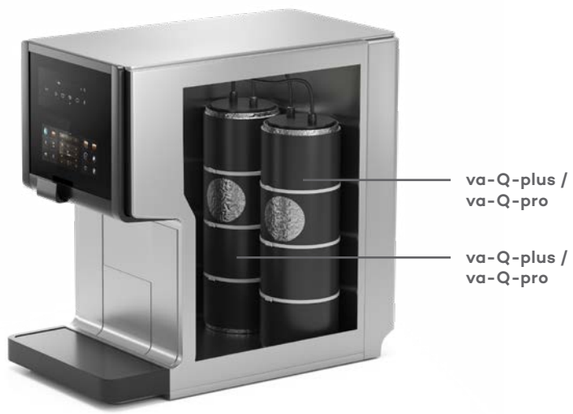
The solutions from va-Q-tec support these requirements by means of precise temperature control and optimal insulation. Vacuum Insulation Panels reduce thermal losses in thin walls and save energy in the standby mode, while Phase Change Materials compensate for temperature fluctuations.

Applications such as coffee machines and vending machines in particular demonstrate how precise temperature control, higher efficiency and long service life offer crucial advantages and potential savings in everyday use. Other commercial applications in the restaurant and retail trade also benefit from these characteristics.

Professional Coffee Machines

Professional coffee machines usually run continuously throughout the day. Even when utilization is low, hot water boilers must be kept at a constant temperature. This situation leads to high energy losses in the standby mode and thus considerable operating costs.

The use of Vacuum Insulation Panels significantly reduces these losses and at the same time enables a stable temperature. Operators in hotels, canteens or cafés benefit from significantly lower energy costs, an improved sustainability balance and consistently high product quality. The result is a clear competitive advantage in the professional environment.



Professional Coffee Machine with integrated VIPs

Cost Reduction due to the Use of VIPs

30 % less energy consumption per day in real use

30 % saving in the standby mode due to lower thermal losses

> 20 % less energy per cup during the brewing process

10 % saving in a measurement according to the standards, significantly higher potential in real use

Further Potential Savings and Advantages

Lower carbon footprint due to reduced energy consumption

Noticeable cost reduction, especially during long downtimes

Constant brewing temperature for consistent coffee quality

Quick amortization within **one year**

Vending Machines

Vending machines are often subject to extreme conditions: they operate continuously, are often exposed to direct sunlight, high humidity or limited space and must deliver constant cooling performance at the same time. The energy demand is correspondingly high, while the limited installation space restricts both the insulation performance and the useful volume. Additionally, there is regulatory pressure due to stricter EU efficiency directives.

VIPs are used to meet these challenges. They minimize thermal losses even in limited installation spaces and permit compact designs with high efficiency. As a consequence, the energy consumption is reduced while maintaining consistent and reliable cooling in the interior. As such the temperature of food and beverages remain optimal even in difficult conditions.

Vending Machine with integrated VIPs

Cost Reduction due to the Use of VIPs

15 % saving in thermal losses due to integration into existing insulation

Up to 45 % reduction with targeted optimization, including insulation of critical areas

Further Potential Savings and Advantages

- **Noticeable cost reduction** due to reduced power consumption in continuous operation
- **Compliance with future efficiency directives** as a clear competitive advantage
- **Sustainability and ESG goals** due to a lower carbon footprint
- **Longer compressor cycles,** less wear and tear and lower maintenance costs

Secure Cold Chain all the Way to the Vending Machine without refrigerated Vehicles

va-Q-lid
available with and without integrated PCM

va-Q-trays
available in different sizes, stackable

va-Q-box fresh
with integrated PCM in the lid

Reusable Transport Solutions
Enable that the cold chain is maintained during transport to the vending machine

Other Applications in the Commercial Environment

In addition to coffee machines and vending machines, many other professional appliances are subject to continuous demands on a daily basis. Whether in the restaurant trade, in retail or in commercial kitchens, constant temperatures, high energy efficiency and reliable performance are required everywhere. The use of VIPs and PCMs opens up additional options. Energy losses are reduced, processes are stabilized and the service life of the appliances is extended.

Refrigerated Cabinets

Refrigerated cabinets are a central element in the restaurant trade and in retail. They must continuously keep food at low temperatures, even if the appliances are opened frequently. VIPs reduce thermal losses despite their slim design, thus providing more useful interior space. In addition, PCMs stabilize the temperature by absorbing short-term fluctuations during opening. The result is lower energy costs and consistently high product quality.

Recommended VIPs:
- va-Q-plus for cost-optimized insulation performance and rectangular surfaces
- va-Q-pro for maximum surface coverage and high efficiency with complex geometry

Recommended PCMs:
- va-Q-gel for the typical refrigeration area in food retail
- Optional va-Q-accus for modular packs depending on the filling

Commercial Refrigerators

Professional refrigerators in kitchens or canteens are in continuous operation and often subject to difficult environmental conditions such as heat and high humidity. The combination of VIPs and PCMs reduces energy consumption, extends compressor cycles and thus reduces wear. Operators benefit from lower operating costs and greater appliance reliability.

Recommended VIPs:
- va-Q-plus for thin walls without the need for recesses
- va-Q-pro, if maximum coverage and highest efficiency classes are required

Recommended PCMs:
- va-Q-gel for stable cooling temperatures
- Additional va-Q-accus if variable pack sizes or logistics concepts are required

Dishwashers

Efficient thermal insulation also plays a crucial role in dishwashers. The appliances operate at high temperatures, which are quickly lost without suitable insulation. VIPs minimize these thermal losses with their compact design, while PCMs temporarily store heat, enabling more stable processes. As a consequence the energy consumption per wash cycle is reduced and it is easier for the appliances to meet stricter efficiency requirements.

Recommended VIPs:
- va-Q-pro as insulating material for complex shapes in confined spaces

Recommended PCMs:
- va-Q-accus or bulk PCM with a higher melting point for heat storage in hot processes

Laboratory Appliances

Appliances in laboratories must meet special requirements: precision, very stable temperatures over long periods and optimal utilization of the available internal volume are key criteria. At the same time, energy consumption and thermal losses must be minimized, as many appliances run continuously.

va-Q-tec assists in meeting these requirements with technologies that combine thin, highly efficient insulation with sophisticated temperature management. Vacuum insulation panels permit thin appliance walls with extremely good insulation performance, maximizing the internal volume. In combination with phase-change materials, temperature fluctuations can be dampened and thermal losses reduced.

Ultra-low temperature freezers clearly demonstrate how high-precision temperature control and energy efficiency can lead to decisive advantages in the laboratory environment. A stable thermal environment also plays a key role in incubators, incubating cabinets, sterilizers and laboratory ovens. The use of PCM assists in meeting these requirements, as temperature fluctuations are reliably compensated and additional reliability is provided during peak demand.

Laboratory Appliances – BINDER Case Study

Laboratory appliances must meet the highest requirements on temperature stability, precision and energy efficiency. Systems such as ultra-low temperature freezers, incubators or climatic chambers often run continuously and require constant conditions over long periods.

BINDER, one of the leading manufacturers of environmental simulation chambers, utilizes va-Q-tec technologies to increase further the performance of its ultra-low temperature freezers. A comparison of laboratory appliances with conventional insulation and appliances with VIPs integrated clearly shows that the energy consumption can be significantly reduced. At the same time, temperatures remain stable even during power failures or when doors are opened.

The results underscore the great potential of VIP technology in the laboratory environment: lower operating costs, improved sustainability and greater operational reliability. Manufacturers and operators benefit from more efficient, longer-lasting appliances that ensure the highest levels of precision and reliability.

BINDER battery test chamber
for temperature and safety tests in the laboratory

Advantages due to the Use of VIPs

Significantly lower energy consumption due to highly efficient VIP insulation

Temperature maintained for significantly longer during power failures or door opening

More useful internal volume due to slim panel construction

Further Potential Savings and Advantages

Stable temperature control even with frequent opening

Sustainability due to lower energy demand and CO_2 emissions

Compact design with more interior space while maintaining the same external dimensions

High operational reliability as the temperature is maintained for longer during power failures

Longer service life due to lower demand on the cooling appliances

Development & Implementation Support

For the development of optimal solutions, va-Q-tec supports projects from the initial inquiry through to series production. The pooled expertise in the Thermal Engineering Center provides support at every stage, from design, through implementation, to quality assurance.

Concept & Simulation

- Specification of individual requirements
- Development of a bespoke solution for temperature and energy optimization
- Efficient concept evaluation by means of advanced in-house simulations and analyses

Prototype & Laboratory Tests

- Manufacture and testing of an initial prototype
- More than 30 in-house climatic chambers and thermal measuring systems for precise testing

Qualification & SOP

- Initial sample testing and validation of the results
- Maximum in-house quality assurance with the patented va-Q-check system

Support during Series Operation

- Analysis of results after the initial operating phase
- Comprehensive support and advice during integration into the production process

va-Q-tec

WE SOLVE THERMAL CHALLENGES

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