

TECHSHEET SILYNT

VACUUM INSULATION WITH INTEGRATED THERMOELECTRIC COOLING FOR APPLIANCES WITH TIGHT INSTALLATION SPACE.

Product description

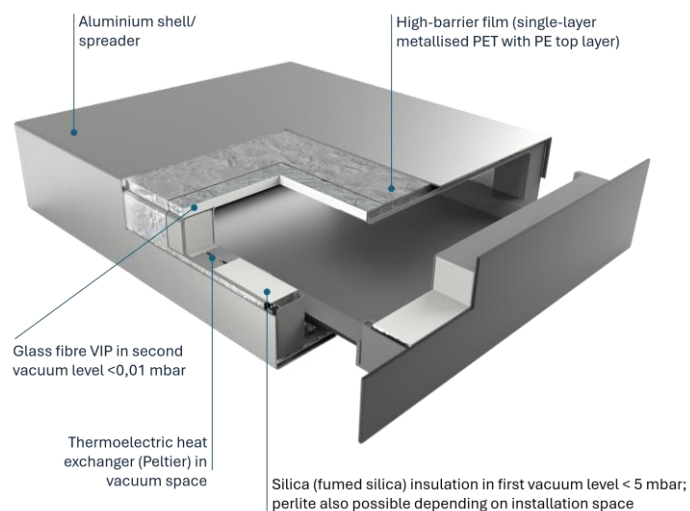
SILYNT combines insulation and active cooling in a single component. Thermoelectric elements sit directly in the vacuum space of an almost thermal-bridge-free vacuum insulation body with an embedded glass fibre panel. Because heat ingress through the wall is very low, they operate at a point where thermoelectric cooling becomes efficient.

There is no compressor at all. The system therefore runs silently and without vibration, needs very little installation space and enables form factors that conventional refrigeration cannot achieve, such as a flat refrigerated drawer.

In a refrigerated drawer, around four watts are enough for a temperature difference of twenty kelvin. SILYNT is in series development. The underlying vacuum insulation has been in series production since 2019 and in high-volume production since 2022.

Design

- Two-stage vacuum insulation body enclosed in a metallised high-barrier film
- First vacuum level with perlite as core material, or fumed silica where installation space is very tight
- Second vacuum level with an embedded glass fibre panel, which retains its very low thermal conductivity over the product's service life
- Thermoelectric elements with heat exchanger, fitted directly into the vacuum space
- Aluminium shell acting as heat spreader, coupled to the outer wall of the customer's product. No active cooling of the hot side is required.
- *SILYNT design, illustrated using a refrigerated drawer*



Features

- Silent in operation, with no moving parts and no vibration, so it can also be used in living rooms, bedrooms and offices
- Very little installation space required, as there is no compressor, refrigerant circuit or machine compartment
- High share of usable volume within unchanged outer dimensions, enabling new form factors and installation positions
- No refrigerant in the system, no requirements under the EU F-gas Regulation
- Precise, continuously variable temperature control without on/off cycling
- Maintenance-free over the product's service life, closed system
- As a volcanic rock, perlite is non-combustible, inert and pH-neutral, and free of blowing agents

Applications

SILYNT is designed for refrigeration appliances with tight installation space, where a compressor is a nuisance or simply does not fit. These include refrigerated drawers, built-in solutions, minibars and refrigerated furniture, as well as small, stationary medical refrigeration units.

SILYNT is not intended for large volumes, high temperature differences, mobile applications or transport and pharma boxes. We implement these applications with STRATMO, as volume, cooling capacity and passive hold time are the priority. We determine which technology fits based on temperature level, installation space and usage profile.

Properties

Property	SILYNT
Heat ingress value, insulation body	< 0.3 W/K
System heat ingress	determined for each project
Cooling performance, refrigerated drawer reference case	20 K temperature difference at around 4 W electrical power
Extended cooling performance	Temperature difference of up to 40 K possible
Operating temperature range	-30 °C to +43 °C
Control behaviour	continuously variable, no on/off cycling, control accuracy down to 0.1 °C
Electrical connection	USB-C standard
Heat dissipation, hot side	via aluminium heat spreader to the outer wall of the customer's product, no active cooling required
Noise and vibration	silent in operation, no moving parts
Refrigerant	none
Minimum practical insulation thickness	10 mm, 40 mm in the active area
Weight	depends on design, weight of the aluminium cover layers is the decisive factor
Service life	more than 20 years
Fire behaviour	Core material non-combustible, classification of the complete build-up per application
Maintenance	maintenance-free, closed system
Geometries	drawers, compartments and compact built-in units
Maximum dimensions	on request
Maturity	series development

The heat ingress value refers to the insulation body. System heat ingress is the relevant value for design.

Design notes

- Thermoelectric cooling only becomes economical because insulation losses are so low. What matters is therefore not cooling capacity alone, but the ratio of heat ingress through the wall to the required temperature difference. TerraVac determines this operating point for each project.
- The hot side is coupled directly to the outer wall of the customer's product via an aluminium heat spreader. Installation position, available outer surface and free convection at that surface are therefore part of the design and must be clarified early.
- The efficiency of thermoelectric cooling drops significantly as the temperature difference increases. We therefore implement applications with freezing temperatures or large volumes using STRATMO and conventional refrigeration.
- Manufacturing the vacuum body requires a dedicated process step with film handling, filling and evacuation. One-to-one integration into existing production lines is not possible. TerraVac initially sets up this step at its own plant and supplies the customer until volumes justify a dedicated line.

Test standards and quality assurance

- Thermal conductivity measurements to EN 12667
- Batch-wise incoming inspection of the core material, covering gas-pressure-dependent thermal conductivity based on EN 12667 and compressibility under uniaxial load
- Batch-wise incoming inspection of the high-barrier film by permeation rate measurement
- Every vacuum body goes through quarantine storage and is then leak-tested with a heat flux sensor. Quality assurance is carried out entirely at TerraVac using methods proven in high-volume production
- Gas analysis on the finished component, e.g. after ageing (destructive test)

Contact

TerraVac GmbH, Weinbergstraße 7, 97753 Karlstadt, Germany; www.terravac.de;
info@terravac.de

The information describes typical properties and does not constitute guaranteed properties. Binding values are defined for each project.