va-Q-tec vacuum insulation

Construction

Building Physic Award 2005,
Apartment and office building in Munich
(page 9)

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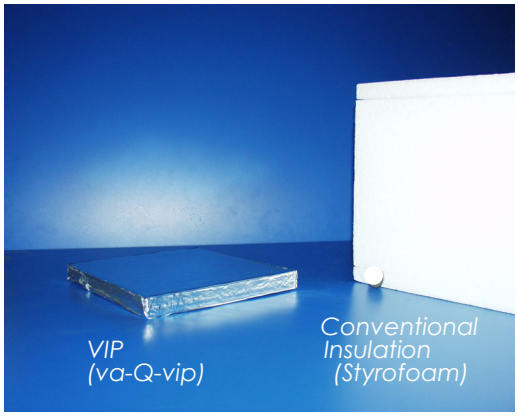
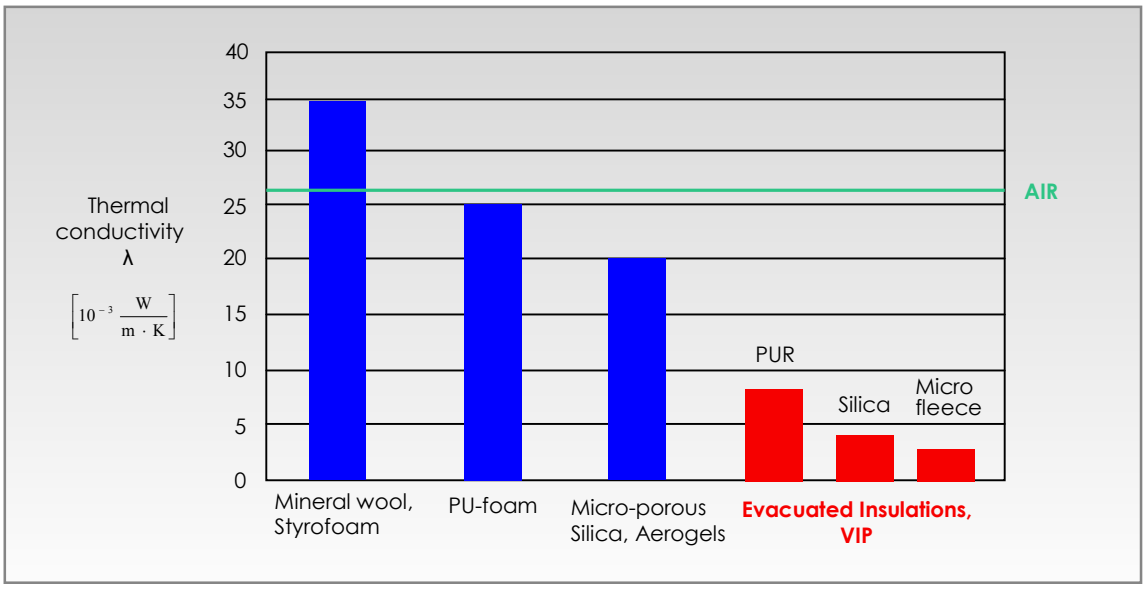
General Information

1. Vacuum Insulation Panel (VIP)

Vacuum insulation panels (VIP) provide extremely low thermal conductivities. VIP are built from open pore materials like pressed powder boards, glass fibers or open cell organic foams. The core materials are wrapped in a high gas barrier film using a special procedure and then evacuated and sealed. The thermal conductivity of VIP produced by va-Q-tec (va-Q-vip) is only one tenth of the conductivity of conventional insulation materials like mineral wool or foams (ca. 0.004 to 0.005 W/mK compared to 0.040 W/mK).



2. Thermal Conductivity of Various Materials



3. Thermal Performance and Weight (va-Q-*vip*)

* Initial thermal conductivity: 0.005 W/mK

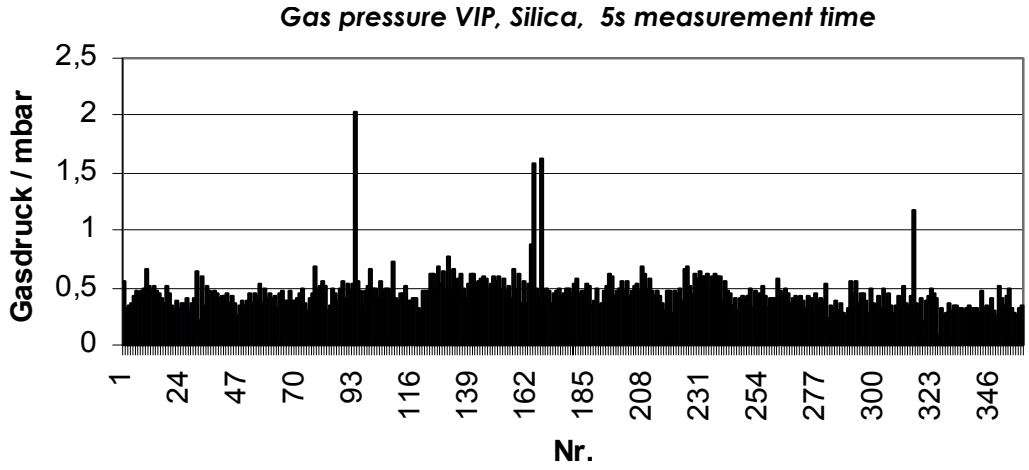
Thickness in mm	10	15	20	25	30	40
Thermal resistance* in m^2K/W	2	3	4	5	6	8
U-value in W/m^2K	0.50	0.33	0.25	0.20	0.16	0.12
Mass per area in kg/m^2	2.2	3.1	4.0	4.9	5.8	7.6

va-Q-tec´s Technologies

1. va-Q-*check*

The worldwide patented va-Q-*check* is a unique control system for VIPs. It makes a control of VIPs possible during production & installation.

- Measurement time : ca. 5 sec./VIP
- Direct contact with VIP is necessary
- All VIPs equipped with sensor chip und barcode-label
- Possible measurement ranges from 0.02 to 100 mbar

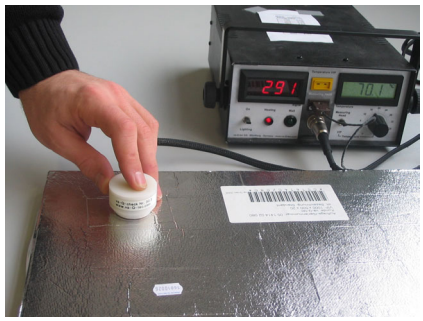


Advantage of quality control by va-Q-*check*

- 100% production control of VIP´s internal gas pressure
- Easy, fast and accurate measurements
- Check of vacuum by customer possible
- Life time assessment by repeated measurements
- Accuracy (repeatability) as low as 10% possible

va-Q-check
(unique control system of VIP)

va-Q-vip
with integrated sensor chip



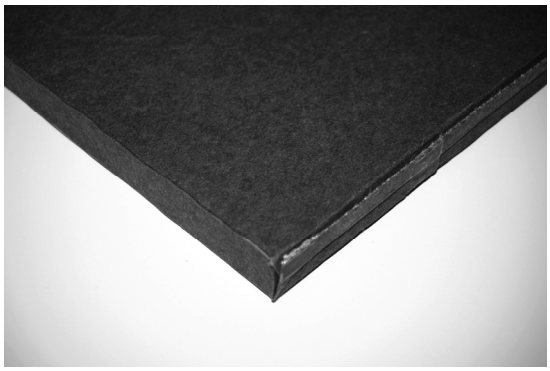
Check of the gas pressure in the panel

2. va-Q-*seam*

The rectangular shape of va-Q-*vip* is achieved with va-Q-*seam* technology. This technique is worldwide patented and unique of va-Q-tec vacuum insulation panels. By va-Q-*seam* technique it is possible to join the VIPs nearly without gaps and special effort.

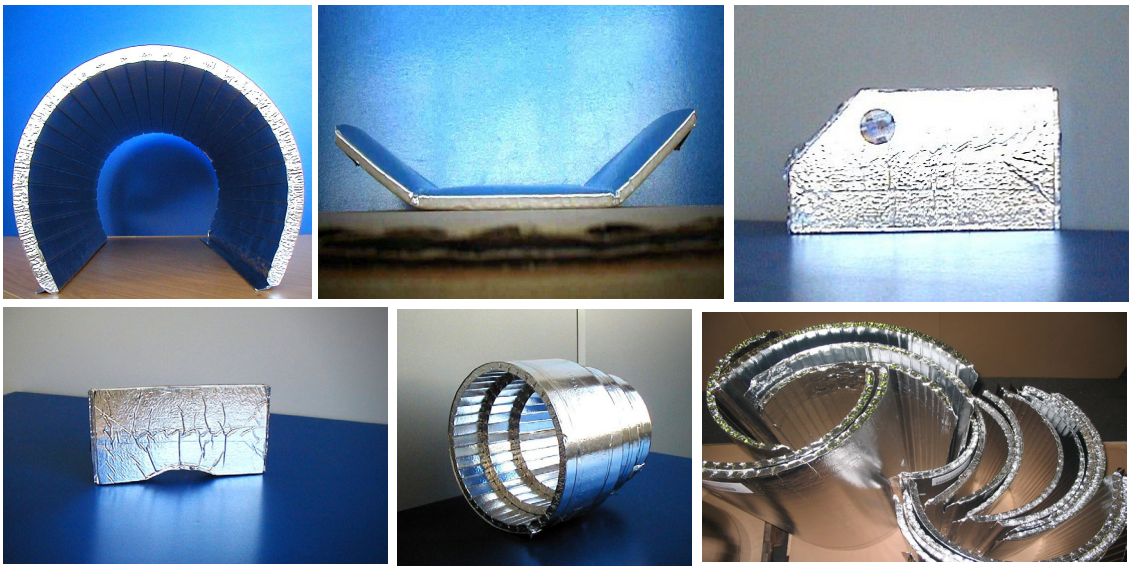
Advantage of va-Q-*seam* system:

- Accurately folded foil in the corner and edges (rectangular shape of the VIPs)
- Gapless assembly of individual VIPs
- Almost no heat bridge
- Simple construction possible
- Perfect industrial application



va-Q-vip B with protection fleece

3. Special Forms



va-Q-*vip B* for Building Application

1. va-Q-*vip* B

va-Q-*vip* B is an evacuated insulation panel with very low thermal conductivity. The core of the panel consists of a amorphous silicon dioxide powder and a inorganic opacifier, coated with a polyester fleece as dust shield and is sealed under vacuum into a metallized high barrier foil. The high barrier foil is covered on the exterior with a black protection fleece.

The flammability of vacuum insulation panel va-Q-*vip* B is classified as B2 according to DIN 4102-1. The application fields preliminarily are for internal areas (DI, WI and DEO according to the standard DIN V4108-10, table 1).

2. Specification

• Surface color:	Black
• Core materials:	Silicon dioxide powder, inorganic opacifier
• Weight per area:	ca. 4 kg/m² (20 mm thickness, U-value 0.25 W/m²K)
• Density (bulk, DIN EN 1602):	180 up to 210 kg(m³)
• Thermal conductivity (DIN 52612 at 10 °C)	
Initial value:	< 0.0053 W/mK
including aging and edge losses:	0.0080 W/mK
on ventilation:	0.020 W/mK
• Internal gas pressure :	0.5 to 3 mbar (at delivery)
• Increase of gas pressure:	ca. 1 mbar/year (20 mm thickness)
• Operating temperature:	-70 to +80 °C
• Operating humidity:	0 to 60%
• External pressure load (@ 10% compression):	> 150 kPa
• Dimension:	1200 mm x 1000 mm x 40 mm (max.), 400 mm x 300 mm x 10 mm (min.)
• Length and wide tolerance:	+2 / -5 mm
• Thickness tolerance:	+/- 1 mm

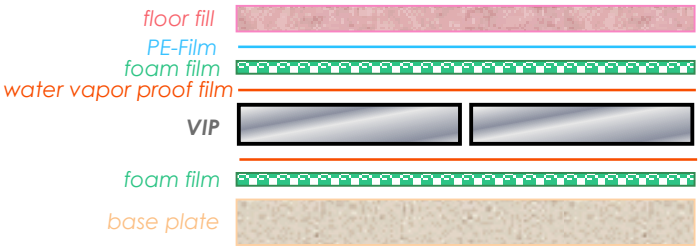
3. Life Time

• Initial gas pressure (typical):	1 mbar
• Thermal conductivity @ 100 mbar:	ca. 0.007 W/mK
• Life time:	ca. 30 – 50 years possible with increase of gas pressure of 1 mbar/year

Application Fields

1. Floor Insulation

▲ Sports hall in Nuernberg



▲ Structure of floor with va-Q-vip (example)

2. Balcony Insulation

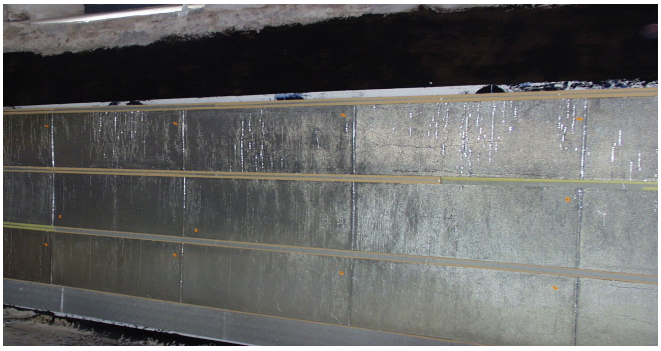
▲ Building renovation in Vienna: Glue on the VIP

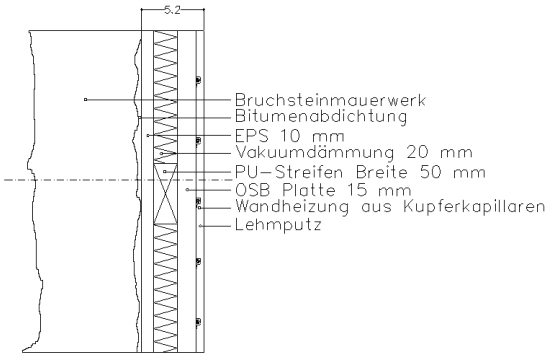
3. Internal Insulation

▲ Internal insulation with gypsum cardboard - VIP composite

Application Fields

4. Wall Heating





▲ In historic church, Wernfeld

5. Parapet Wall Element

inside

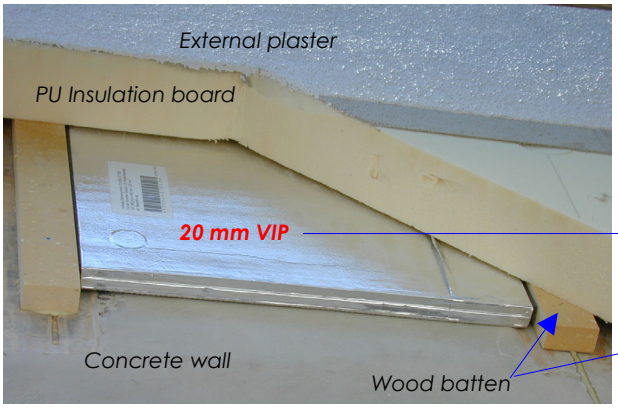
outside

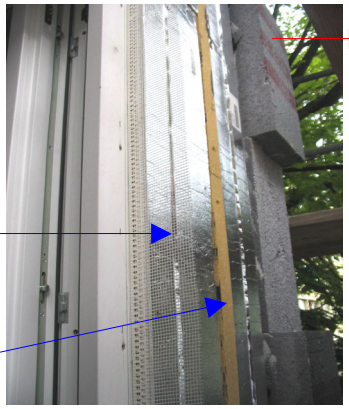
▲ VIP covered with glass/glass, metal/metal or glass/metal, spacer as in insulating glazing

▼ Fire station, Gerbrunn

Application Fields

6. External Insulation





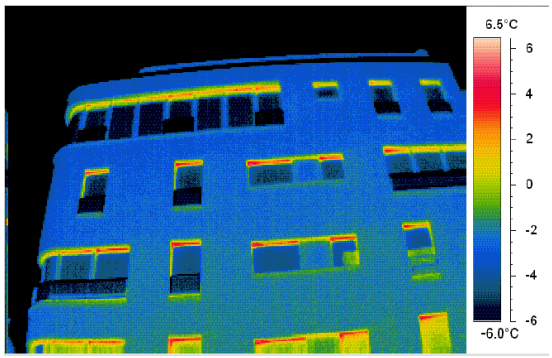
For comparison 25 cm conventional insulation on rear wall

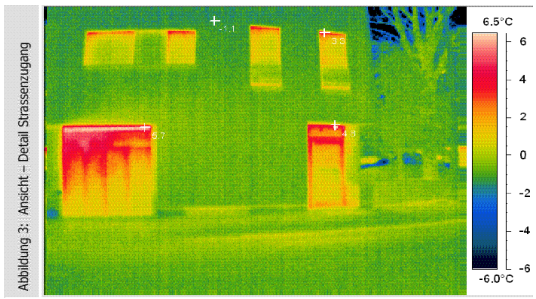
Structure of insulation in object Seitzstr. Munich

< Reference Object : Munich, Seitzstr. >

Data of the Building
- New building: Apartment and office building with ultra low energy consumption
- Location: Munich center
- Useable area: ca. 1200 m², 6 apartments, 6 offices, 2 underground parking areas

▾ Building Physic Award 2005 / Apartment and office building with VIP insulation in Munich





Analysedaten der einzigen Schwachstellen der Strassenseite: Zugangstüren / Aufzugstür	1
Wärmestau an den Leibungen in rel. engen Grenzen (tolerabel)	2

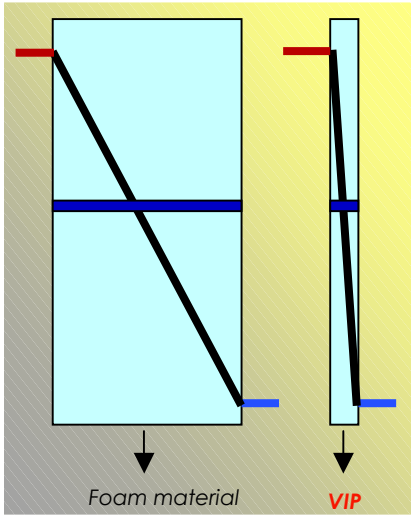
Application Reference

1. Thermal Bridges

- Temperature difference drops on very short distance

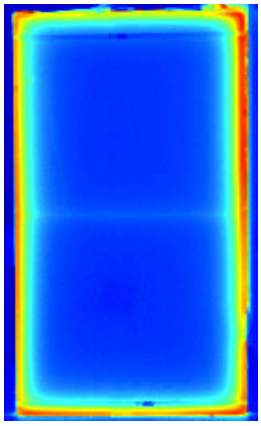
→ Higher heat flows by thermal bridges
than with conventional thermal insulations

→ Care necessary to minimize thermal bridges,
thermo-physical planning, joints, break-through etc.



2. Thermal Bridges with Parapet Wall Elements

Minimized thermal bridges

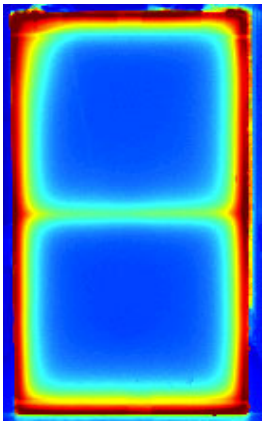


◂ Metallized film
High-quality edge combination

red: high losses
blue: low losses

Aluminum sandwich film
Normal edge combination ▸

Thermal bridges



3. Effect of Humidity and Temperature on Vacuum Insulation Panels

The vacuum insulated panel va-Q-*vip* should be protected from high temperature und humidity, because these may decrease the lifetime of VIPs. Even at low temperature constant high humidity has to be avoided on the panel surface. Use no alkaline, aqueous building adhesives since these drain badly and endanger the seal seams.

DIBT Approval

1. Official Approval of va-Q-*vip* B for Building Applications

- Approval No. Z-23.11-1658 from German Institute for Building Technology (DIBT)
- special requirement
  - Protection of vacuum insulation panel from damage
  - Building material class at least B2 according to DIN 4102-1

  reached by protection fleece

2. Test procedure for Approval

- Test process
  1) Test of thermal conductivity of panel with 10, 20 and 40 mm thickness
  2) Climate change test at +80 °C/-15°C with 8 cycles at 24 hours
  3) Afterward 90 days storage at 80 °C
  4) Test of thermal conductivity
  5) 90 days storage at 80 °C
  6) Test of thermal conductivity after aging

- Flammability according to DIN 4102-1 B2
- Pressure strength according to DIN EN 826
- Calculation of thermal bridge effect (ψ-value)

3. va-Q-tec internal control

- Test procedure of cover film (increase of gas pressure of test-VIPs)
- Testing silica core material (bulk density, thermal conductivity)
- Gas pressure control of all VIPs with va-Q-check before delivery
- Control possibility of gas pressure with va-Q-check during installation

4. Handling Instructions

The vacuum insulation panel has to be installed by trained technicians, who have sufficient experience for careful handling. The following has to be considered:

- ✓ The VIPs are to be examined by visual inspection. The high barrier foil must enclose the core material tightly.
- ✓ Before installation of VIPs the user may check the internal gas pressure with "va-Q-check".
- ✓ The vacuum insulation panel must not be damaged by sawing, cutting or boring.
- ✓ The underground for the installation of VIPs must be even and have no rough surface.
- ✓ Sufficient protection of the VIPs must be ensured during the installation .
- ✓ In the case of ventilating the vacuum insulation panels must provide a minimum thermal protection according to DIN 4108-2, table 3 (maximum value is 0.020 W/(mK)).

va-Q-tec AG ◆ Karl-Ferdinand-Braun-Str. 7 ◆ 97080 Wuerzburg / Germany
Tel. ++ 49 (0) 931 35 942 0 Fax. ++ 49 (0) 931 35 942 10
www.va-Q-tec.com info@va-Q-tec.com