

## **Partial Translation**

**General Technical Approval number Z -23.11-1662**

**Date: 11 May 2017**

**Please note:**

**This translation of the original version has not been audited by the German Institute for Building Technology (DIBt).**

## General Technical Approval

### Approval body for building products and methods

#### Testing authority for building technology

An agency funded jointly by  
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**Z-23.11-1662**

This approval is valid

from: **11 May 2017**

to: **21 May 2020**

#### Applicant:

**Porextherm Dämmstoffe GmbH**  
Heisinger Straße 8/10 87437 Kempten (Allgäu)

#### Approved Item:

Fumed silica vacuum insulation panels  
"Vacupor® NT-B2-S" and "Vacuspeed®", "  
"Vacupor® PS-B2-S" and "Vacuspeed® PS"  
"Vacupor® RP-B2-S" and "Vacuspeed® RP"  
"Vacupor® XPS-B2-S" and "Vacuspeed® XPS"  
"Vacupor® TS-B2-S" and "Vacuspeed® TS"  
"Vacupor® PIR-B2-S" and "Vacuspeed® PIR"  
"Vacupor® BIT-B2-S" and "Vacuspeed® BIT"  
"Vacupor® MW-B2-S" and "Vacuspeed® MW"  
"Vacupor® Roof" and "Vacuspeed® Roof"

The above-mentioned approved item is hereby granted General Technical Approval.

This General Technical Approval consists of ten pages.

This General Technical Approval replaces General Technical Approval

No. Z-23.11-1662 of 21 May 2015.

DIBt

## I GENERAL PROVISIONS

- 1 The General Technical Approval is evidence of the usability and applicability of the approved item within the meaning of the state building regulations.
- 2 The General Technical Approval does not replace the permits, approvals and certificates required by law for the operation of construction projects.
- 3 General Technical Approval is granted irrespective of the rights of third parties, in particular private industrial property rights.
- 4 The manufacturer and distributor of the approved item must, irrespective of further regulations in the Special Provisions, provide to the user or operator of the approved item copies of the General Technical Approval and should point out that the General Technical Approval must be available at the place of use. On request copies of the General Technical Approval must be provided to the authorities concerned.
- 5 The General Technical Approval must not be duplicated in its entirety. Publication of extracts requires the approval of the German Institute for Structural Engineering. The texts and diagrams in advertising materials must not conflict with the General Technical Approval. Translations of General Technical Approvals must contain the notice, "This translation of the original version has not been audited by the German Institute for Building Technology (DIBt)".
- 6 The General Technical Approval, once granted, may be revoked. The provisions of the General Technical Approval can be subsequently supplemented and amended, in particular, where new technical discoveries require this.

## II SPECIAL PROVISIONS

### 1 Approved Item and Area of Application

#### 1.1 Approved Item

The General Technical Approval applies to the manufacture and use of vacuum insulation panels (VIP) bearing designations in accordance with Table 1 (hereinafter referred to as VIP elements).

The "Vacupor NT-B2" and "Vacuspeed" VIP elements consist of a supporting core made of micro-perforate fumed silica, heat-sealed under vacuum in triple-metallised barrier foil.

The upper and lower foil layer is welded at the shorter edges of the "Vacupor NT-B2" VIP elements, then reversed and attached by means of adhesive tape. Over the areas of the VIP elements there are two more weld seams running longitudinally and these are also attached by adhesive tape to the surface.

Alternatively a circular sealing seam, which is also folded over and secured with adhesive tape fitting, can also be formed at the edges.

If required, the sides of the VIP elements can be secured with duct tape.

The "Vacupor® NT-B2-S" and "Vacuspeed®" can be laminated on the upper and undersides with particular linings bonded over the entire surfaces in accordance with Table 1.

The protruding foil strips in the laminated VIP elements are concealed by their respective particular lining.

Table 1: VIP elements

Designation	Particular lining (one side or both sides)	Particular lining Thickness	Areas of application
Vacupor® NT-B2-S Vacuspeed®			DAD, DAA, DZ, DI, DEO, WAB, WAA, WH, WTR, WI
Vacupor® PS-B2-S Vacuspeed® PS	Rigid polystyrene foam (EPS)	10 - 20 mm	DAD, DZ, DI, DEO, WAB, WAA, WH, WTR, WI
Vacupor® RP-B2-S Vacuspeed® RP	Rubber granulate mat	3 - 5 mm	DAD, DAA, DZ, DEO
Vacupor® XPS-B2-S Vacuspeed® XPS	Extruded polystyrene foam (XPS)	3 - 10 mm	DAD, DAA, DZ, DI, DEO, WAB, WAA, WH, WTR, WI
Vacupor® TS-B2-S Vacuspeed® TS	hard polyester hardboard	3 - 15 mm	DAD, DAA, DZ, DI, DEO, WAB, WAA, WH, WTR, WI
Vacupor® PIR-B2-S Vacuspeed® PIR	Rigid polyisocyanurate foam	10 - 30 mm	DAD, DAA, DZ, DI, DEO, WAB, WAA, WH, WTR, WI
Vacupor® BIT-B2-S Vacuspeed® BIT	Bituminous sheeting	2 mm	DAD, DAA, DZ, DI, DEO
Vacupor® MW-B2-S Vacuspeed® MW	Mineral wool panel	10 - 30 mm	DAD, DZ, WAB, WH, WTR
Vacupor® Roof Vacuspeed® Roof	Rubber granulate mat (one side) and rigid polyisocyanurate foam (one side)	3 - 5 mm  20 mm	DAD, DAA, DZ, DI, DEO

## 1.2 Area of application

The VIP elements must be used in accordance with the areas of application listed in Table 1 in accordance with the DIN 4108-10<sup>1</sup> standard.

All VIP elements must also be used in prefabricated façade panels with a composition similar to insulating glass.

## 2 Provisions relating to the building project

### 2.1 Characteristics and composition

#### 2.1.1 Composition and manufacturing process

After the composition and manufacturing process the VIP elements must correlate to those, which formed the basis of the approval trials.

The composition and manufacturing process is recorded at the German Institute for Structural Engineering. Amendments may be made only with the approval of the German Institute for Structural Engineering.

#### 2.1.2 Properties and Condition

The VIP elements must be of uniform thickness at all points. They must have straight, parallel sides.

The VIP elements must be perpendicular to faces and their surfaces must be even. The requirement for perpendicularity is satisfied, if, when the elements are tested in accordance with DIN EN 824<sup>2</sup>, the discrepancy for each individual dimension in length and width does not exceed 0.6% of the respective side length.

The foil strips must not protrude more than 150 mm.

#### 2.1.3 Dimensions

(1) The dimensions (nominal dimensions) of the VIP elements are as follows:

Length:  $\geq 400$  mm

Width:  $\geq 300$  mm

Thickness: 10 mm to 50 mm (without particular lining)

For fitting elements special formats, which deviate from the foregoing length and width dimensions, are permissible.

Length and width are determined in accordance with DIN EN 822<sup>3</sup>. Thickness must be determined in accordance with DIN EN 823<sup>4</sup>.

The permissible deviation of the measured individual values from the specified nominal dimensions is + 5mm.

(2) The dimensions of the particular linings are as follows:

Length:  $\geq 400$  mm

Width:  $\geq 300$  mm

Thickness: EPS panel: 10 to 20 mm, the permissible deviation is  $\pm 1$  mm

Rubber granulate 3 to 5 mm, the permissible deviation is + 2 mm

XPS panel: 3 to 10 mm, the permissible deviation is  $\pm 1$  mm

1	DIN 4108-10:2012-15	Thermal insulation and energy economy in buildings Part 10: Application-oriented requirements in thermal insulation materials; Factory-made thermal insulation materials
2	DIN EN 824:2013-05	Thermal insulation materials for Civil Engineering: Determination of perpendicularity; German version EN 824:2013
3	DIN EN 822:2013-05	Thermal insulation materials for Civil Engineering: Determination of length and width; German version EN 822:2013
4	DIN EN 823:2013-05	Thermal Insulation Materials for Civil Engineering: Determination of thickness; German version EN 823:2013

Polyester fibre panel	3	to 15	mm, the permissible deviation is $\pm 1$ mm
Polyiso panel:	10	to 30	mm, the permissible deviation is $\pm 1$ mm
Mineral wool panel:	10	to 30	mm, the permissible deviation is $\pm 1$ mm
Bituminous sheeting	2	mm	

Length and width are determined in accordance with DIN EN 822<sup>3</sup>. Thickness must be determined in accordance with DIN EN 823<sup>4</sup>.

#### 2.1.4 Bulk density

On the basis of testing in accordance with DIN EN 1602<sup>5</sup> individual values in the bulk density (without high barrier film) in the "Vacupor® NT-B2-S" and "Vacuspeed®" VIP elements must be at least 170 kg/m<sup>3</sup> and at most 210 kg/m<sup>3</sup>.

#### 2.1.5 Basis weight

The basis weight of the high barrier film must be at least 100 g/m<sup>2</sup>.

#### 2.1.6 Thermal conductivity

In the case of the "Vacupor® NT-B2-S" and "Vacuspeed® VIP elements (without particular lining) the measured value of thermal conductivity of  $A_{10, tr}$  (initial values before weathering) at 10°C mean temperature when tested in accordance with DIN 52612-1<sup>6</sup> or DIN EN 12667<sup>7</sup> must not exceed the limit value of  $A_{v, limit} = 0.0044$  W/(m K).

#### 2.1.7 Compressive strain at 10% compression

When the VIP elements (with the exception of "Vacupor® PS-B2-S", "Vacuspeed® PS", "Vacupor® MW-B2-S", "Vacuspeed® MW", "Vacupor® BIT-B2-S" and "Vacuspeed® BIT") are tested in accordance with DIN EN 826<sup>8</sup>, each individual value in the compressive strain at 10 % compression must be at least  $a_{10\%} = 180$  kPa.

In the case of the "Vacupor® PS-B2-S", "Vacuspeed® PS", "Vacupor® BIT-B2-S" and "Vacuspeed® BIT" VIP elements on the basis of testing in accordance with DIN EN 826<sup>8</sup> each individual value in the compressive strain at 10% compression must be at least  $c_{T10O/O} = 120$  kPa.

#### 2.1.8 Dimensional stability under defined conditions of temperature and humidity

The dimensional stability of the VIP elements at 70°C and 90% relative air humidity must be determined in accordance with DIN EN 1604<sup>9</sup>.

The relative amendments in length, width and thickness must not exceed 1%.

Exception: In the case of the "Vacupor® TS-B2-S" and "Vacuspeed® TS" VIP elements coated with a polyester fibre panel the relative amendment must not exceed 3%.

#### 2.1.9 Deformation under defined pressure and thermal stresses

The deformation of the VIP elements (with the exception of "Vacupor® PS-B2-S" and "Vacuspeed® PS", "Vacupor® MW-B2-S", "Vacuspeed® MW") must be determined at 40 kPa and 70°C in accordance with DIN EN 1605<sup>10</sup>.

5	DIN EN 1602:2013-05	Thermal Insulation Materials for Civil Engineering: Determination of the bulk density; German version EN 1602:2013
6	DIN 52612-1:1979-09	Thermal insulation tests: Determination of the thermal conductivity with the hot plate method; Operation and assessment
7	DIN EN 12667:2001-05	Thermal behaviour of building materials and products: Determination of the thermal resistance in accordance with the hot plate method and the guarded heat flow meter device; Products with high and medium thermal resistance; German version EN 12667:2001
8	DIN EN 826:2013-05	Thermal Insulation Materials for Civil Engineering: Determination of behaviour under compressive stress; German version EN 826:2013
9	DIN EN 1604:2013-05	Thermal Insulation Materials for Civil Engineering: Determination of dimensional stability under defined temperature and humidity conditions; German version EN 1604:2013

The amendment in thickness must not exceed 3%.

#### 2.1.10 Tensile strength perpendicular to the panel surface

The tensile strength of the VIP elements (with the exception of "Vacupor® PIR-B2-S", "Vacuspeed® PIR", "Vacupor® MW-B2-S" and "Vacuspeed® MW") perpendicular to the panel plane must be determined in accordance with DIN EN 1607<sup>11</sup>.

No test result must fall below the value of 30 kPa.

In the case of the "Vacupor® PIR-B2-S" and "Vacuspeed® PIR" VIP elements no test result must fall below the value of 15 kPa.

#### 2.1.11 Fire characteristics

When tested in accordance with DIN4102-1<sup>12</sup>, the VIP elements must satisfy the requirements for normally flammability for building materials (Building Material Class DIN 4102-B2).

#### 2.1.12 Internal pressure

The internal pressure of the VIP elements must be determined in a vacuum chamber by means of a laser distance meter. The internal pressure must not exceed the value of 5 mbar on delivery of the VIP elements.

### 2.2 Manufacture, packaging, transport, storage and marking

#### 2.2.1 Manufacture

The provisions in Section 2.1 must be complied with for the manufacture of the VIP elements.

#### 2.2.2 Packaging, transport, storage

The VIP elements must be packed in such a way that the vacuum cannot be destroyed by damage to the high barrier film during transport and storage.

#### 2.2.3 Marking

The building product and the packaging of the building product must be identified by the manufacturer with the conformity mark (CE mark) in accordance with the conformity marking regulations of the states. The product should be marked only when the provisions in Section 2.3 are satisfied.

Furthermore the following data must be attached:

- "Vacupor® NT-B2-S" (or "Vacuspeed®" or "Vacupor® PS-B2-S" or "Vacuspeed® PS" or "Vacupor® RP-B2-S" or "Vacuspeed® RP" or "Vacupor® XPS- B2-S" or "Vacuspeed® XPS" or "Vacupor® TS-B2-S" or "Vacuspeed® TS" or "Vacupor® PIR-B2-S" or "Vacuspeed® PIR" or "Vacupor® BIT-B2-S" or "Vacuspeed® BIT" or "Vacupor MW-B2-S" or "Vacuspeed® MW" or "Vacupor® Roof" or "Vacuspeed® Roof") VIP elements in accordance with General Technical Approval No. Z-23.11-1662
- Application range
- Design value for thermal conductivity
- Nominal thickness, nominal length and nominal width in mm
- Nominal thicknesses of the individual layers in mm
- Normally flammable (Building Product Class DIN 4102-B2)
- Porextherm Dämmstoffe GmbH, 87437 Kempten
- Manufacturing plant<sup>13</sup> and date of manufacture<sup>13</sup>

10	DIN EN 1605:2013-05	Thermal Insulation Materials for Civil Engineering: Determination of the deformation under defined pressure and thermal stresses; German version EN 1605:2013
11	DIN EN 1607:2013-05	Thermal Insulation Materials for Civil Engineering: Determination of the tensile strength perpendicular to the panel surface; German version EN 1607:2013
12	DIN 4102-1:1998-05	Fire characteristics of building materials and components Part 1: Building materials; Terms, requirements and tests

- Note: The "Vacupor® NT-B2-S" (or "Vacuspeed®" or "Vacupor® PS-B2-S" or "Vacuspeed® PS" or "Vacupor® RP-B2-S" or "Vacuspeed® RP" or "Vacupor® XPS-B2-S" or "Vacuspeed® XPS" or "Vacupor® TS-B2-S" or "Vacuspeed® TS" or "Vacupor® PIR-B2-S" or "Vacuspeed® PIR" or "Vacupor® BIT-B2-S" or "Vacuspeed® BIT" or "Vacupor® MW-B2-S" or "Vacuspeed® MW" or "Vacupor® Roof" or "Vacuspeed® Roof) VIP elements in accordance with the General Technical Approval No. Z-23.11-1662 must be installed only by qualified specialist companies, a list of which is provided by the Applicant.

The delivery note must contain the following information:

- Vacupor® NT-B2-S" (or "Vacuspeed®" or "Vacupor® PS-B2-S" or "Vacuspeed® PS" or "Vacupor® RP-B2-S" or "Vacuspeed® RP" or "Vacupor® XPS- B2-S" or "Vacuspeed® XPS" or "Vacupor® TS-B2-S" or "Vacuspeed® TS" or "Vacupor® PIR-B2-S" or "Vacuspeed® PIR" or "Vacupor® BIT-B2-S" or "Vacuspeed® BIT" or "Vacupor MW-B2-S" or "Vacuspeed® MW" or "Vacupor® Roof" or "Vacuspeed® Roof) VIP elements in accordance with General Technical Approval No. Z-23.11-1662.

## 2.3 Compliance Certificate

### 2.3.1 General

The conformity of the building product with the provisions of this General Technical Approval must be confirmed for each manufacturing plant by means of a conformity certificate based on in house production control and a regular external monitoring, including initial testing of the building product in accordance with the following provisions.

In order to be granted the conformity certificate and the external monitoring service the manufacturer of the building product must call in a recognised certification body and a recognised monitoring body.

The manufacturer must declare that a conformity certificate has been granted by marking the building products with the conformity mark (CE mark), with reference to the designated purpose.

The certification body must send the German Institute for Structural Engineering an information copy of the conformity certificate issued by them.

### 2.3.2 In-house production control

Each manufacturing plant must organise and implement an in-house production control system. In-house production control is understood to mean the continuous monitoring by the manufacturer of production, by means of which it is ensured that the building products manufactured by it satisfy the provisions of this General Technical Approval.

The in-house production control system must include, as a minimum, the measures listed in Table 2.

The results of the in-house production control must be recorded and assessed. The records must include the following information as a minimum:

- Designation of the building product or the raw materials and components
- Type of control or test
- Date of manufacture and test of the building product or the raw materials and components
- Result of the controls and test and, if applicable, comparison with the requirements



- Signature of the person responsible for the in-house production control

The records must be retained for a minimum of five years and submitted to the monitoring body called in to carry out the external monitoring. On request they must be submitted to the German Institute for Structural Engineering and the highest competent building inspection authority.

In the case of unsatisfactory test results the manufacturer must immediately take the necessary measures to rectify the default. Building products, which do not satisfy the requirements, must be handled in such a way that they cannot be confused with products, which are in conformity with the requirements. Once the default has been rectified, insofar as this is technically possible and required to prove that the default has been rectified, the relevant test must be immediately repeated.

**2.3.3 External monitoring**

The in-house production control in each manufacturing plant must be monitored regularly by an external monitoring body, at least twice annually.

This external monitoring must comprise an initial test of the building product; samples must be taken and tested in accordance with the established test schedule and the sampling process may also be inspected. In each case the taking of samples and testing are the responsibility of the recognised monitoring body.

The tests listed in Table 2, plus the inspection of marking must be undertaken as a minimum.

The results of certification and external monitoring must be retained for at least five years. They must be submitted by the certification body or the monitoring body to the German Institute for Structural Engineering and on request to the highest competent building inspection authority.

Table 2: Type and scope of proof of conformity.

Capacity	Inspection section	by	Minimum frequency	
			In-house production control*	External monitoring**
Source materials	-		routine control	-
Properties and condition	2.1.2		daily	twice annually
Dimensions	2.1.3		daily	twice annually
Bulk density	2.1.4		daily	twice annually
Basis weight/film	2.1.5		-	twice annually
Thermal conductivity	2.1.6		daily***	twice annually
Nominal compressive strength	2.1.7		once weekly	twice annually
Dimensional stability at 70°C/90%	2.1.8			twice annually
Deformation at 40 kPa/70°C	2.1.9			twice annually
Tensile strength	2.1.10		-	twice annually
Fire characteristics	2.1.11		once monthly	twice annually
Internal pressure	2.1.12		daily	-
* on three samples ** on two nominal thicknesses *** subsequent to manufacture				

### 3 Provisions relating to design and dimensioning

#### 3.1 Design value for thermal conductivity

As mathematical evidence of thermal resistance of the building components the following design value for

thermal conductivity applies to the VIP elements (without the respective particular lining):

$$\lambda = 0.0070 \text{ W/(m K)}$$

This includes allowance for additional thermal losses due to the thermal bridging effect of the border area of the VIP elements.

The effects of securing elements, (anchors, rails and rawplugs) and supporting structures are not taken into account in the design value of the thermal conductivity.

The particular linings must not be taken into account in calculating the thermal resistance.

#### 3.2 Minimum thermal insulation

The components, in which the VIP elements are used, must also satisfy the minimum thermal installation requirements of DIN 4108-2:14, Table 3, in the event of failure of the vacuum of the VIP elements.

The following design value for thermal conductivity applies for the ventilated VIP elements:

$$\lambda = 0.020 \text{ W/(m K)}$$

#### 3.3 Nominal thickness

When calculating thermal resistance, the nominal thickness (without the particular lining) of the "Vacupor® NT-B2-S" or "Vacuspeed®" VIP elements should be assumed.

#### 3.4 Fire characteristics

The VIP elements are normally flammable (Building Material Class DIN 4102-B2).

### 4 Provisions relating to performance

The VIP elements must be installed only by qualified specialist staff, who have adequate experience and can handle the VIP elements with the appropriate care.

The following points in particular must be observed:

- On every delivery the VIP elements must be visually inspected. The high barrier film must enclose the supporting core tightly.
- The VIP elements must not be damaged by mechanical processes such as sawing, cutting or boring.
- The underfloor for installing the VIP elements must be even and must be free from edges or burrs.
- Sufficient protection from damage must also be provided for the VIP elements during the utilisation phase, e.g. by installing ancillary shuttering.

14      DIN 4108-2:2013-02      Thermal insulation and energy economy in buildings Part 2: Minimum requirements for thermal insulation

The Applicant must draw up a list of qualified companies and without being requested, must submit this list in its current version to the German Institute for Structural Engineering.

Frank Iffländer  
Head of  
Division

Attested

