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European Technical Assessment

ETA 15/0090-v06 of 12/01/2022

General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011:	Kiwa Nederland B.V., represented by Kiwa BDA Expert Centre Building Envelope and Kiwa BDA Testing B.V.
Trade name of the construction Product	Kingspan OPTIM-R®
Product family to which the construction Product belongs	PAC 4 Vacuum Insulation Panels (VIPs) and VIPs with factory applied protection layers
Manufacturer	Kingspan Insulation Ltd. Pembridge, Leominster Herefordshire, HR6 9LA U.K.
Manufacturing plant(s)	Kingspan Insulation Ltd. Torvale Industrial Estate Pembridge, Leominster Herefordshire, HR6 9LA U.K.
This European Technical Assessment contains	17 pages including 4 Tables and 1 Annex which form an integral part of this assessment
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	European Assessment Document EAD 040011-00-1201 2017

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1 Technical description of the Product

1.1 Definition of the Product

This European Technical Assessment (ETA) applies to the thermal insulation boards with the trade name Kingspan Optim-R®, hereinafter referred to as Product.

The Product is a rectangular shaped Vacuum Insulation Panel (VIP) without protection layers, containing a micro-porous (fumed silica based) core material, within an envelope of a three layer laminate of metallized polyester film and LLDPE heat seal layer, where the internal pressure within the envelope is much lower than the ambient air pressure.

The Product has the following dimensional properties (nominal values):

- working length (min., max.) : 300, 1200 mm
- working width (min., max.) : 300, 600 mm
- thickness (range) : 20 - 60 mm
- Product mass*
  - 40 mm thickness : 3.80 $kg.m^{-2}$
  - 25 mm thickness : 4.75 $kg.m^{-2}$
  - 30 mm thickness : 5.70 $kg.m^{-2}$
  - 40 mm thickness : 7.60 $kg.m^{-2}$
  - 50 mm thickness : 9.50 $kg.m^{-2}$
  - 60 mm thickness : 11.50 $kg.m^{-2}$

* Other incremental thicknesses between 20 mm & 60 mm manufactured on request

The ETA is issued for the Product with the chemical composition and the other properties which are deposited with *Kiwa Nederland B.V.* Modifications to the materials, their composition or their properties shall be immediately notified to *Kiwa Nederland B.V.* which will decide whether a new evaluation will be necessary.

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use

The thermal insulation boards are used for insulation of roofs, walls and floors in buildings. The assessment of the Product only applies when the Product is used in structures where it is protected from weathering.

The provisions made in this European Technical Assessment (ETA) are based on an assumed working life of the thermal insulation boards of minimum 25 years, provided that the conditions laid down in sections 4.2, 5.1 and 5.2 for packaging, transport, storage, installation and use are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right Products in relation to the expected economically reasonable working life of the works.

2.2 General assumptions

The insulation boards are manufactured in accordance with the provisions of this European Technical Assessment (ETA) using the manufacturing process as identified is the inspection of the manufacturing plant by *Kiwa Nederland B.V.* and laid down in the technical file.

It is the responsibility of the holder of this ETA to ensure that all necessary information on design and installation is submitted to those responsible for specification and installation of the construction.

Only constructions where the Product is well-protected as shown in the technical information of the manufacturer are allowed under this ETA; in any case the specifier will have to cooperate closely with the holder of this ETA.

2.2.1. Manufacture of the Product

The ETA has been issued for the Product on the basis of agreed data/information, deposited with *Kiwa Nederland B.V. (TAB)*, which identifies the Product that has been assessed. Changes to the Product /Production process, which could result in this deposited data/information being incorrect, should be notified to the TAB before the changes are introduced. The TAB will decide whether or not such changes affect this ETA and consequently the validity of the CE marking and if so whether further assessment/alterations to the ETA, shall be necessary.

2.2.2. Packaging, transport and storage of the Product

Concerning Product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the holder of this ETA to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the Product as he considers necessary.

2.2.3. Installation and use of the Product in the works

Only undamaged/intact insulation boards which have been protected from wetting, weathering, sunlight and mechanical damage of the used multilayer high barrier foil shall be used.

When installing the manufacturer's installation instructions shall be followed. The manufacturer's installation instructions have been assessed by the TAB. The insulation board shall only be installed in structures where it is protected from weathering.

The Product shall not be damaged (e.g. by cutting or drilling) during installation and be protected against damage during the working life by suitable constructional arrangements.

The Product shall only be installed by competent and/or trained individuals or companies stated in a list of the manufacturer. These companies shall have adequate experience in installing the Product. Before installation the thermal insulation boards shall be checked by the installation contractor by means of visual control. The substrate shall be sufficiently flat and clean of construction debris and sharp objects.

As to the application of the insulation board and the design values of thermal conductivity/thermal resistance, the respective national regulations shall in addition be observed.

3 Essential characteristics and relevant assessment methods and criteria

3.1 Essential characteristics of the Product

Table 1 shows how the performance of the thermal insulation boards has been established in relation to the essential characteristics.

Table 1: Essential characteristics of the Product and methods and criteria for assessing the performance of the Product in relation to those essential characteristics

No	Essential characteristic	Method of verification and assessment, see the relevant clause	Expression of Product performance, for result see the relevant clause
(1)	(2)	(3)	(4)
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	3.2.1	class according to EN 13501-1
Basic Works Requirement 6: Energy economy and heat retention			
2	Thermal conductivity	3.2.2	level
3	Thickness	3.2.3	level
4	Water vapour resistance	3.2.4	level
5	Squareness	3.2.5	level
6	Flatness	3.2.6	level
7	Density	3.2.7	level
8	Mass per square metre of the multilayer high barrier foil of the Product	3.2.8	level
9	Length and width	3.2.9	level
10	Oxygen permeability of the multilayer high barrier foil of the Product	3.2.10	level
11	Compressive stress / strength at 10% deformation	3.2.11	level
12	Dimensional stability under constant normal laboratory temperature as well as specified temperature and humidity	3.2.12	level
13	Deformation under specified load and temperature	3.2.13	level
14	Tensile strength of the multilayer high barrier foil of the Product	3.2.14	level
15	Internal pressure	3.2.15	level

16	Tensile strength perpendicular to the faces of the thermal insulation boards	3.2.16	level
17	Behaviour under point load	3.2.17	No performance assessed (see 3.2.17)
18	Shear strength of the thermal insulation boards	3.2.18	No performance assessed (see 3.2.18)

3.2 Methods and criteria for assessing the performance of the Product in relation to essential characteristics of the Product

3.2.1 Reaction to fire

Classification of reaction to fire performance in accordance with EN 13501-1 is E/EFL.

3.2.2 Thermal conductivity

3.2.2.1 Thermal conductivity $\lambda_{90/90}$

The thermal conductivity $\lambda_{90/90}$ has been determined with the following results: for **t = 20 mm** $\lambda_{90/90}$ = 0.0044 $W.m^{-1}.K^{-1}$, for t = 25 mm through t = 50 mm $\lambda_{90/90}$ = 0.0041 $W.m^{-1}.K^{-1}$ and for **t = 60 mm** $\lambda_{90/90}$ = 0.0043 $W.m^{-1}.K^{-1}$

3.2.2.2 Thermal conductivity after ageing

The thermal conductivity after ageing has been measured according to EN 12667 with the following results concerning the increase of λ after ageing ($\Delta\lambda_a$): for **t = 20 mm** $\Delta\lambda_a$ = 0.001 $W.m^{-1}.K^{-}1$ and for **t = 60 mm** $\Delta\lambda_a$ = 0.001 $W.m^{-1}.K^{-1}$.

3.2.2.3 Thermal conductivity λ_D ($W.m^{-1}.K^{-1}$)

The thermal conductivity for external and internal application (Category 1) for panels with minimum dimensions of **400 mm x 300 mm**, considering the influence of ageing and the effect of thermal bridges has been determined, according to Annex A, clause A.2, taking the effect of the thermal bridging correction factor F_{tb} = 1.10:
For **t = 20 mm** $\lambda_{90/90}$ = 0.0044, so $\boldsymbol{\lambda_D}$ = (0.0044 + 0.001)·1.10 = 0.00594, to be taken as **0.007** and
for t = 25, 30, 40 and 50 mm $\lambda_{90/90}$ = 0.0041, so $\boldsymbol{\lambda_D}$ = (0.0041 + 0.001)·1.10 = 0.00561, to be taken as **0.007** and for **t = 60 mm** $\lambda_{90/90}$ = 0.0043, so $\boldsymbol{\lambda_D}$ = (0.0043 + 0.001)·1.10 = 0.00583, to be taken as **0.007**

A panel of **300 mm x 300 mm** (the smallest Product which is put on the market) has been calculated according to Annex A, clause A.3 of the EAD, with the following results for λ_D:
For **t = 20** mm F_{td} =1.13 $\Delta\lambda_a$ = 0.001, so $\boldsymbol{\lambda_D}$ = (0.0044 + 0.001)·1.13 = 0.006102, to be taken as **0.007 and**
For **t = 25 mm** Ftd =1.1333 Δλa = 0.001, so $\boldsymbol{\lambda_D}$ = (0.0041 + 0.001)·1.1333 = 0.005779, to be taken as **0.007**
For **t = 30 mm** Ftd =1.1366 Δλa = 0.001, so $\boldsymbol{\lambda_D}$ = (0.0041 + 0.001)·1.1366 = 0.005796, to be taken as **0.007**
For **t = 40 mm** Ftd =1.1433 Δλa = 0.001, so $\boldsymbol{\lambda_D}$ = (0.0041 + 0.001)·1.1433 = 0.005830, to be taken as **0.007**
For **t = 50 mm** Ftd =1.15 Δλa = 0.001, so $\boldsymbol{\lambda_D}$ = (0.0041 + 0.001)·1.15 = 0.005865, to be taken

as **0.007**

For **t = 60 mm** Ftd =1.1566 Δλa = 0.001, so λ_D = (0.0043 + 0.001)·1.1566 = 0.006129, to be taken as **0.007**

3.2.3 Thickness

When measured according to the principles of EN 823 with a pressure of 250 Pa (± 5 Pa) the thicknesses as given in clause 1.1 show no greater deviation than the tolerances -2 mm/+2 mm.

3.2.4 Water vapour resistance

The water vapour resistance could not be determined according to EN 12086 and has to be taken as infinite.

3.2.5 Squareness

The squareness Sb as determined in accordance with the principles of method described in EN 824 does not exceed 5 $mm.m^{-1}$.

3.2.6 Flatness

The flatness, S_{max} as determined in accordance with the principles of method described in EN 825 does not exceed 5 $mm.m^{-1}$.

3.2.7 Density

The range of density is 170 $kg.m^{-3}$ to 210 $kg.m^{-3}$ when determined according to EN 1602.

3.2.8 Mass per square metre of the multilayer high barrier foil of the Product

The mass per unit area of the multilayer high barrier foil of Product ranges from 100 $g.m^{-2}$ to 110 $g.m^{-2}$.

3.2.9 Length and width

When determined according to the principles of EN 822 the tolerances on length (l) and width (w) are as follows:

For l ≤ 1000 mm: -3 mm/+3 mm (minimum length = 300 mm)
l > 1000 mm: -5 mm/+5 mm
w ≤ 1000 mm: -3 mm/+3 mm (minimum width = 300 mm)
w > 1000 mm: -5 mm/+5 mm

3.2.10 Oxygen permeability of the multilayer high barrier barrierfoil of Product (OTR)

The oxygen gas transmission rate (OTR) through the film at 23±2 °C, 0±5%rh was determined in accordance with ASTM D3985-05 using Oxtran 2/21 apparatus with computer control. This resulted in a **level** of $OTR_{decl.}$< 0.5 $\mu l.m^{-2}.day^{-1}$

3.2.11 Compressive stress/strength at 10% deformation

The compressive stress at 10% deformation, when determined according to the principles of EN 826, $\sigma_{10} \geq 150$ kPa (class CS(10\Y)150).

3.2.12 Dimensional stability under specified temperature and humidity

The dimensional stability under specified temperature and humidity conditions have been determined in accordance with the principles of method described in EN 1604, with the following results:

Dimensional stability (EN 1603):		
at 23±2 °C and 50±5%		
requirement: change <[± 0.5] % (L/L)		
- change length and width	: 0	% (L/L)
Dimensional stability (EN 1604):		
at 70±2 °C and 90±5%		
requirement: change <[± 1.0] % (L/L)		
- change length	: -0.3	% (L/L)
- change width	: 0	% (L/L)
- change thickness	: -0.3	% (L/L)
at 40 kPa and 70±1 °C		
requirement: change ≤ 5% (L/L)		
- change thickness	: -1.5	% (L/L)

3.2.11 Deformation under specified load and temperature

The deformation in thickness under specified load and temperature when determined according to EN 1605 with at least 3 test samples for test condition 2 (40 Pa / 70 °C / 168 h) is less than 5% (class DLT(2)5).

3.2.12 Tensile strength of the multilayer high barrier foil of the Product

The tensile strength of the multilayer high barrier foil has been determined with test specimen "type 2" according to EN ISO 527-3 before and after ageing according to Annex B of EAD 040011-00-2101 2014. For each test condition, five test pieces 25 mm wide by 150 mm in length were cut from the material in the machine and transverse directions in general accordance with BS EN ISO 527-3: 1996.

The test results are given in tables 2 and 3.

Table 2: Tensile strength and elongation at different conditions – machine direction, mean

Test condition	Tensile strength (MPa)	Elongation (%)
Unaged	87	96
3 days 70 ºC	85	96
7 days 70 ºC	90	108
14 days 70 ºC	88	104
30 days 70 ºC	88	99
90 days 70 ºC	84	86

Table 3: Tensile strength and elongation at different conditions – transverse direction, mean

Test condition	Tensile strength (MPa)	Elongation (%)
Unaged	75	94
3 days 70 ºC	74	78
7 days 70 ºC	74	85
14 days 70 ºC	76	91
30 days 70 ºC	76	90
90 days 70 ºC	73	74

3.2.13 Internal pressure

The internal pressure has been determined 24 h after the Product was manufactured (PL), using a foil lift-off procedure, in which the Product was exposed to negative pressure either with a foil-lift device or in a vacuum chamber until it was lifted off the Product core. The distance between the Product core and the foil was measured with the help of a laser distance measuring device and used to determine the internal pressure of the Product.

The internal pressure PL $\leq$ 5 mbar.

3.2.14 Tensile strength perpendicular to the faces of the thermal insulation boards

The tensile strength perpendicular to the faces (σ_{mt}) of the thermal insulation boards has been determined in accordance with the principles of the method described in EN 1607.

The tensile strength perpendicular to the faces $\sigma_{mt} \geq$ 80 kPa.

3.2.15 Behaviour under point load

Not applicable, see clause 1.1 of this ETA (there are no protection layers).

3.2.16 Shear strength of the thermal insulation boards

Not applicable, see clause 1.1 of this ETA (there are no protection layers).

4 Assessment and verification of constancy of performance

4.1 System(s) of assessment and verification of constancy of performance to be applied

For the verification and assessment of constancy of performance System 3 applies, because the Product is for uses subject to reaction to fire regulations with Euroclass E/E_{FL}, see clause 3.2.1 of this ETA.

4.2 Tasks of the manufacturer

4.2.1 Actions to be undertaken by the manufacturer

The corner stones of the actions to be undertaken by the manufacturer of the thermal insulation board in the procedure of verification and assessment of constancy of performance are laid down in Table 4.

Table 4: Control plan for the manufacturer, corner stones

No	Subject / type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control *)
(1)	(2)	(3)	(4)	(5)	(6)
Factory Production Control (FPC) [**including testing of samples taken at the factory in accordance with a prescribed test plan***]					
1	Reaction to fire	EN ISO 11925-2 and clause 3.2.1	Control plan	1	once per year and indirectly once per month
2	Thermal resistance / conductivity	Direct: EN 12667 or EN 12939 and clause 3.2.2	Control plan	1	once per month
3	Thickness	EN 823 and clause 3.2.3	Control plan	see clause 3.2.3 and EN 823	twice per day
4	Squareness	EN 824 and clause 3.2.5	Control plan	see clause 3.2.5 and EN 824	once per day
5	Flatness	EN 825 and clause 3.2.6	Control plan	see clause 3.2.6 and EN 825	once per day
6	Density	EN 1602 and clause 3.2.7	Control plan	see clause 3.2.7 and EN 1602	once per day
7	Length and width	EN 822 and clause 3.2.9	Control plan	see clause 3.2.9 and EN 822	once per day
8	Air permeability of the multilayer high barrier foil of the VIP	see clause 3.2.10 of this ETA	Control plan	see clause 3.2.10 of this ETA	once per year
9	Compressive stress / strength at 10 % deformation	EN 826 and clause 3.2.11	Control plan	see clause 3.2.11 and EN 826	once per month
10	Internal pressure	see clause 3.2.15	Control plan	see clause 3.2.15	once per day

11	Tensile strength perpendicular to the faces of the thermal insulation boards	EN 1607 and clause 3.2.16	Control plan	see clause 3.2.16 and EN 1607	once per year

*) In case of discontinuous production these minimum frequencies should be adapted to an equivalent frequency.

4.2.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, the manufacturer shall issue a declaration of performance.

4.3 Tasks of the notified body

There are no further tasks for the notified body, because System 3 applies.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

The thermal insulation boards shall be packed such that they are protected from moisture and mechanical damage during transport and storage, and the vacuum is not destroyed by causing damage to the high-barrier foil.

5.2 Use, maintenance, repair

In the information accompanying the CE marking the manufacturer shall specify that the Product shall be installed following the installation instructions of the manufacturer (only by trained specialized companies) and shall be protected from moisture and mechanical damage during transport, storage and installation.

Issued in Rijswijk on (12-01-2021) by

Ron Scheepers
Kiwa Nederland B.V.

ANNEX 1

Reference Documents

The latest edition of the referenced document (including any amendments) applies unless a dated reference is given in clause 3.2 of this ETA. In this case only the edition cited applies.

EN 822	Thermal insulating Products for building applications - Determination of length and width
EN 823	Thermal insulating Products for building applications - Determination of thickness
EN 824	Thermal insulating Products for building applications - Determination of squareness
EN 825	Thermal insulating Products for building applications - Determination of flatness
EN 826	Thermal insulating Products for building applications - Determination of compression behaviour
EN 1602	Thermal insulating Products for building applications - Determination of the apparent density
EN 1603	Thermal insulating products for building applications - Determination of dimensional stability under constant normal laboratory conditions (23 °C/ 50 % relative humidity)
EN 1604	Thermal insulating Products for building applications - Determination of dimensional stability under specified temperature and humidity conditions
EN 1605	Thermal insulating Products for building applications - Determination of deformation under specified compressive load and temperature conditions
EN 1607	Thermal insulating Products for building applications - Determination of tensile strength perpendicular to faces
EN 11925-2	Reaction to fire tests – Ignitability of building Products subjected to direct impingement of flame – Part 2: Single-flame source test
EN 12667	Thermal performance of building materials and Products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance

BDA Agrément® BAE 18-035/02/A - Kingspan Optim-R®, 2018-02-20

WF Classification Report No. 376767 Classification of reaction to fire performance in accordance with EN/TS 15117: 2005, Exova Warringtonfire, 2016.11.16

FIW report L1-14-097 Kingspan Optim-R: Mechanical tests on vacuum insulation panels (VIP) for the granting of a national technical approval according to the DIBt testing program, reference number: II 52-1.23.11-740, 2014.11.19

FIW report B3-18/14 Numerical analysis of thermal bridging effects on the edges of vacuum insulation panels consisting of a pressure resistant support core (fumed silica) welded in multilayer metallized plastic films using the finite-difference method, 2014.11.25

FIW report L1-15-048 Indicative tests of thermal conductivity on vacuum insulation panels (VIP) “Kingspan Optim-R”, 2015.05.04

Report of Inspection of Factory and Factory Production Control, Kiwa Ltd., Cheltenham, UK, February 2015

FIW Test report E3.2-2018/01, Determination of long-term thermal conductivity on a single batch and thickness of Kingspan Optim R vacuum insulation panel in accordance with European assessment document draft 13-04-001112.01 (version of May 2014), 2018-01-22

Smithers RAPRA Confidential Technical Report 62375 Testing of VIP multi-layer laminate film, 2018-03-14

Kiwa BDA report 12-B-0796/5 Calculations of the $\lambda_{90/90}$ and λ_D-values of Kingspan OPTIM-R® 20 mm – 60 mm, 2019-10-21