Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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European Technical Assessment ETA-20/0219 of 16 August 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	STYRODUR 3000 SQ, STYRODUR 3000 BMB SQ, STYRODUR 4000 SQ, STYRODUR 5000 SQ
Product family to which the construction product belongs	Extruded polystyrene foam boards as load bearing layer and /or thermal insulation outside the waterproofing
Manufacturer	BASF SE Carl-Bosch-Straße 38 67056 Ludwigshafen am Rhein DEUTSCHLAND
Manufacturing plant	BASF SE Carl-Bosch-Straße 38 67056 Ludwigshafen am Rhein DEUTSCHLAND
This European Technical Assessment contains	11 pages including 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	040650-00-1201
This version replaces	ETA-20/0219 issued on 19 July 2022

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Specific part

1 Technical description of the product

The multilayer extruded polystyrene foam boards are manufactured from up to four layers of extruded polystyrene foam boards (single boards). The single boards are bonded together by full-surface thermal welding. The single boards are made of rigid cellular plastics material extruded from polystyrene or one of its copolymers and which has a closed cell structure. The blowing agent mixture is carbon dioxide (CO_2), isobutane and additives.

The multilayer extruded polystyrene foam boards have a foam skin on both surfaces and a special edge treatment (shiplap).

The multilayer extruded polystyrene foam boards do not contain Hexabromocyclododecane (HBCD).

The multilayer extruded polystyrene foam boards have the following designations:

"STYRODUR 3000 SQ",

"STYRODUR 3000 BMB SQ",

"STYRODUR 4000 SQ" and

"STYRODUR 5000 SQ".

The multilayer extruded polystyrene foam boards "STYRODUR 3000 SQ" and "STYRODUR 3000 BMB SQ" are made of single boards with thicknesses from 50 mm to 70 mm, "STYRODUR 4000 SQ" and "STYRODUR 5000 SQ" with thicknesses from 70 mm to 85 mm.

The multilayer extruded polystyrene foam boards are manufactured with the following dimensions:

Nominal thicknesses:	160 mm to 240 mm
Nominal length:	1250 mm
Nominal widths:	600 mm

The European Technical Assessment has been issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed. The European Technical Assessment applies only to products corresponding to this agreed data/information.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The multilayer extruded polystyrene foam boards are intended to be used as load bearing layer and/or thermal insulation also outside the waterproofing. The boards are laid uniformly and even on the substrate to which they are applied. In particular the following applications are covered:

- Load bearing layer and thermal insulation underneath foundation slabs for boards "STYRODUR 3000 SQ" and "STYRODUR 3000 BMB SQ",
- External horizontal and vertical thermal insulation of in-ground constructions in non-structural applications (also in case of groundwater)
- Inverted roof insulation (including park deck and green roof applications)

The performance according to section 3 only applies if the multilayer extruded polystyrene foam boards are installed according to the manufacture's installation instructions and if they are protected from precipitation, wetting or weathering during transport and storage before installation.

Concerning the application of the multilayer extruded polystyrene foam boards, also the respective national regulations shall be observed.

Where the multilayer extruded polystyrene foam boards are fixed by using adhesives, only such adhesions shall be used, which are suitable for this purpose. The assessment of these fixings is not subject of this European Technical Assessment.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the extruded polystyrene foam boards of at least 50 years. 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.

3 Performance of the product and references to the methods used for its assessment

For sampling, conditioning and testing the provisions of the EAD No 040650-00-1201 "Extruded polystyrene foam boards as load bearing layer and / or thermal insulation outside the waterproofing" apply.

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Compressive stress at 10 % deformation or compressive strength test acc. to EN 826:2013 "STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	Level (individual values may fall below this level up to 10 %): ≥ 300 kPa
Compressive stress or compressive strength in the transverse and longitudinal directions	No performance assessed
Slip deformation	No performance assessed
Characteristic value of compressive stress or compressive strength 5 %-fractile value for a one-sided confidence level of 75 % under unknown or known variance using ISO 12491:1997 "STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	 $\sigma_{0,05}$ = 371 kPa (n = 50; σ_{mean} = 428 kPa; s_σ = 33 kPa)
Compressive creep "STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	 See Annex A
Behaviour under shear load (large-sized specimen) test acc. to the EAD and the guidelines in EN 12090:2013 "STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	 τ_{large} = 104 kPa
Creep under shear load "STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	 See Annex A
Creep under combined compressive and shear load "STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	 See Annex A
Compressive modulus of elasticity	No performance assessed
Adhesion behaviour under compressive and shear load on large-sized samples	No performance assessed
Shear strength test acc. EN 12090:2013	

Essential characteristic	Performance
"STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	$\tau \geq 250$ kPa
Density test acc. to EN 1602:2013 "STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	density range: 33 kg/m³ - 38 kg/m³

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire test acc. to EN ISO 11925-2:2010	Class E acc. to EN 13501-1:2007 + A1:2009

3.3 Energy economy and heat retention (BWR 6

Essential characteristic	Performance
Thermal conductivity at mean reference temperature of 10 °C test acc. to EN 12667:2001 or EN 12939:2001 and aging procedure acc. EN 13164:2012+A1:2015, Annex C with deviating storage time period (sliced specimen) of (90 +2/-2) days prior to testing	
"STYRODUR 3000 SQ", "STYRODUR 3000 BMB SQ"	$\lambda_{D(90d)}$ = 0,033 W/(m ·K)
"STYRODUR 4000 SQ"	$\lambda_{D(90d)}$ = 0,035 W/(m ·K)
"STYRODUR 5000 SQ"	$\lambda_{D(90d)}$ = 0,035 W/(m ·K)
Moisture conversion coefficient	No performance assessed

Essential characteristic	**Performance**
Water absorption Long term water absorption by total immersion test acc. to EN 12087:2013 (method 2A) Long term water absorption by diffusion test acc. to EN 12088:2013	 WL(T)0,7 (W_{lt} ≤ 0,7 Vol.%) WD(V)3 (W_{dV} ≤ 3,0 Vol.%)
Freeze-thaw resistance test acc. to EN 12091:2013 using the wet test specimens from having done the water diffusion test in accordance with EN 12088:2013 Reduction in compressive stress at 10 % deformation or in compressive strength of the re-dried specimens, when tested in accordance with EN 826:2013 Reduction of shear strength of the wet and re-dried specimens, when tested in accordance with EN 12090:2013	 FTCD2 (W_V ≤ 2,0 Vol.%) ≤ 10 % ≤ 10 %
Water vapour diffusion resistance factor acc. to EN 12086:2013 and EAD	 see Annex A
Geometrical properties Thickness test acc. EN 823:2013 (clause 7.2, figure 2, measuring set-up 3) Length, width test acc. EN 822:2013 Squareness in direction of length and width; in direction of thickness test acc. EN 824:2013 Flatness in direction of length and width test acc. EN 825:2013	tolerance + 4/-2 mm ± 8 mm 5 mm/m 3 mm

Essential characteristic	Performance
Density test acc. to EN 1602:2013 "STYRODUR 4000 SQ" "STYRODUR 5000 SQ"	 density range: 39 kg/m³ - 44 kg/m³ 45 kg/m³ - 50 kg/m³
Compressive stress at 10 % deformation or compressive strength test acc. to EN 826:2013 "STYRODUR 4000 SQ" "STYRODUR 5000 SQ"	 ≥ 500 kPa ≥ 700 kPa
Deformation under specified compressive load and temperature conditions test acc. to EN 1605:2013	 load: 40 kPa; temperature: (70 ± 1) °C; time: (168 ± 1) h ≤ 3 %
Dimensional stability under specified conditions test acc. to EN 1604:2013	 temperature: 70 °C and 90 % R.H. DS(70,90) ($\Delta\varepsilon_l \leq 5$ %, $\Delta\varepsilon_b \leq 5$ %, $\Delta\varepsilon_d \leq 5$ %)
Tensile strength perpendicular to faces test acc. to EN 1607:2013	 TR150 ($\sigma_{mt} \geq 150$ kPa)
Volume percentage of closed cells test acc. to EN ISO 4590:2016 (method 1 with correction)	 ≥ 95 %

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 040650-00-1201, the applicable European legal acts are: 1995/467/EC and 1999/91/EC

The systems to be applied are:

System 1 for Essential characteristics concerning Mechanical resistance and stability (BWR 1)

System 3 all other Essential characteristics

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 16. August 2024 by Deutsches Institut für Bautechnik

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beglaubigt:
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STYRODUR 3000 SQ,
STYRODUR 3000 BMB SQ,
STYRODUR 4000 SQ,
STYRODUR 5000 SQ

Annex A

1. Compressive creep

test acc. to EN 1606:2013 and EAD 040650-00-1201

STYRODUR 3000 SQ **STYRODUR 3000 BMB SQ**	**thickness 160 mm (50+60+50 mm)**			**thickness 300 mm (80+70+70+80 mm)**		
density (kg/m³)	35			34		
compressive stress/ deformation acc. EN 826 (kPa / %)	432/3			479/2		
load stage (kPa)	**100**	**130**	**185**	**100**	**130**	**185**
X_0 (mm)	0,60	0,80	1,28	0,95	1,22	1,69
X_{ct} (mm)	0,81	0,26	0,98	0,39	0,54	0,87
X_{ct50}(mm)	1,15	1,19	1,90	1,06	1,34	2,20
X_{t50}(mm)	**1,75**	**1,99**	**3,18**	**2,01**	**2,56**	**3,89**

2. Creep under shear load

test acc. to EAD 040650-00-1201

STYRODUR 3000 SQ **STYRODUR 3000 BMB SQ**	**thickness 300 mm (80+70+70+80 mm)**
density (kg/m³)	35
shear strength/ deformation acc. EN 12090 (kPa)	104/-
load stage (kPa)	**36,4**
$X_{\tau 0}$ (mm)	1,48
$X_{\tau ct}$ (mm)	0,54
$X_{\tau ct50}$(mm)	1,23
$X_{\tau t50}$(mm)	**2,71**

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STYRODUR 3000 SQ,
STYRODUR 3000 BMB SQ,
STYRODUR 4000 SQ,
STYRODUR 5000 SQ

Annex A

3. Creep under combined compressive and shear load
test acc. to EAD 040650-00-1201

STYRODUR 3000 SQ **STYRODUR 3000 BMB SQ**		
thickness	**300 mm (80+70+70+80 mm)**	
density (kg/m³)	35	
compressive stress/deformation acc. EN 826 (kPa / %)	397/-	
shear strength/ deformation acc. EN 12090 (kPa)	104/-	
load stage (kPa)	**36,4**	**139**
deformation under	shear load	compressive load
$X_{\tau 0}$ /X_0 (mm)	1,80	2,54
$X_{\tau ct}$ /X_{ct} (mm)	0,36	0,73
$X_{\tau ct50}$/X_{ct50}(mm)	0,52	1,97
$X_{\tau t50}$/X_{t50}(mm)	**2,32**	**4,51**

4. Water vapour transmission
in accordance with EN 12086

STYRODUR 3000 SQ **STYRODUR 3000 BMB SQ**	**thickness 200 mm (70+60+70 mm)**	**thickness 240 mm (50+70+70+50 mm)**
density (kg/m³)	-	33
sliced thickness of the specimens in mm		
Skin layer	5	5
Adhesion layer	30	10
Core layer	30	30
water vapour diffusion resistance factor (mean values for the sliced thickness)		
μ_{skin}	260	285
μ_{ad}	130	145
μ_{core}	90	115

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STYRODUR 3000 SQ,
STYRODUR 3000 BMB SQ,
STYRODUR 4000 SQ,
STYRODUR 5000 SQ

Annex A

STYRODUR 5000 SQ	**thickness 200 mm (60+80+60 mm)**	**thickness 240 mm (80+80+80 mm)**
density (kg/m^3)	50	47
sliced thickness of the specimens in mm		
Skin layer	50	5
Adhesion layer	30	10
Core layer	40	50
water vapour diffusion resistance factor (mean values for the sliced thickness)		
μ_{skin}	118	250
μ_{ad}	100	140
μ_{core}	112	115