

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

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European Technical Assessment

ETA-06/0107
of 29 September 2021

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

StoTherm Vario 4

Product family
to which the construction product belongs

Product area code: 4
External Thermal Insulation Composite System with
rendering on expanded polystyrene for the use as
external insulation of building walls

Manufacturer

Sto SE & Co. KGaA
Ehrenbachstraße 1
79780 Stühlingen
DEUTSCHLAND

Manufacturing plant

Sto SE & Co. KGaA
Ehrenbachstraße 1
79780 Stühlingen
DEUTSCHLAND

This European Technical Assessment
contains

25 pages including 5 annexes which form an integral part
of this assessment

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Specific Part

1 Technical description of the product

This product is an ETICS (External Thermal Insulation Composite System) with rendering - a kit comprising components which are factory-produced by the manufacturer or component suppliers. It's made up on site from these. The ETICS manufacturer is ultimately responsible for the ETICS.

The ETICS kit comprises a prefabricated insulation product of expanded polystyrene (EPS) to be bonded and if necessary additionally mechanically fixed onto a wall.

The insulation product is faced with a rendering system consisting of one base and finishing coat (site applied), the base coat contains reinforcement. The rendering system is applied directly to the insulating panels, without any air gap or disconnecting layer.

The ETICS may include special fittings (e.g. base profiles, corner profiles ...) for connection to adjacent building elements (apertures, corners, parapets...). Assessment and performance of these components is not addressed in this ETA, however the ETICS-manufacturer is responsible for adequate compatibility and performance within the ETICS when the components are delivered as a part of the kit.

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

The performances in Section 3 can only be assumed if the ETICS is used in accordance with the specifications and under the boundary conditions specified in Annexes 2 to 5.

The verifications and assessment methods on which this ETA is based lead to the assumption of a working life of the ETICS " StoTherm Vario 4" of at least 25 years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the assumed economically reasonable working life of the works.

For use, maintenance and repair, the finishing coat shall normally be maintained in order to fully preserve the ETICS performance. Maintenance includes at least:

- visual inspection of the ETICS,
- the repairing of localized damaged areas due to accidents,
- the aspect maintenance with products compatible with the ETICS (possibly after washing or ad hoc preparation).

Necessary repairs are to be carried out as soon as the need has been identified.

The information on use, maintenance and repair is given in the manufacturer's technical documentation.

It is the responsibility of the manufacturer to ensure that this information is made known to the concerned people.

3 Characteristics of products and methods of verification

3.1 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire of the ETICS	(see annex 2) Euroclass according to EN 13501-1
Reaction to fire of the EPS-insulation product	(see annex 2) Euroclass E according EN 13501-1
Apparent density EN 1602 of the EPS-insulation product	$\rho_a \leq 30$ [kg/m ³]

3.2 Hygiene, health and environment (BWR 3)

Essential characteristic	Performance
Release of dangerous substances	no performance assessed
Water absorption Base coat after 1 hour after 24 hours	(see annex 3.1) Average [kg/m ²] Average [kg/m ²]
Rendering system after 1 hour after 24 hours	Average [kg/m ²] Average [kg/m ²]
MW insulation product after 24 hours	Maximum value $\leq 0,5$ [kg/m ²]
Water-tightness of the ETICS Hygrothermal behaviour on the test wall	Pass without defects
Freeze/thaw behaviour	As the water absorption of the base coat as well as the rendering system with all finishing coats except "StoSil" and "StoMiral EKP (Edelkratzputz)" is less than 0.5 kg/m ² after 24 hours. The ETICS with the finishing coats "StoSil" and "StoMiral EKP (Edelkratzputz)" has been assessed as freeze/thaw resistant according to the simulated method.
Impact resistance	(see annex 3.2) Category
Water vapour permeability - Rendering system	(see annex 3.3) s_d value [m]
- EPS insulation product	$\mu = 20 - 78$ Thickness of the insulation product 400 [mm]

3.3 Safety and accessibility in use (BWR 4)

Essential characteristic	Performance
<p>Bond strength between base coat and EPS-insulation product</p> <p>between adhesive and substrate</p> <p>between adhesive and EPS insulation</p>	<p>(see annex 4.1)</p> <ul style="list-style-type: none"> - Minimal value/ average [kPa], rupture type: Initial state (28 d immersion) - Minimal value/ average [kPa], rupture type: after hygrothermal cycles (see annex 4.2) - Thickness [mm] of the used adhesives - Minimal value [kPa], rupture type: Initial state (dry conditions) - Minimal value/ average [kPa], rupture type: after 2 d immersion in water, 2 h drying - Minimal value/ average [kPa], rupture type: after 2 d immersion in water, 7 d drying <p>(see annex 4.3)</p> <ul style="list-style-type: none"> - Thickness [mm] of the used adhesives - Minimal value [kPa], rupture type: Initial state (dry conditions) - Minimal value/ average [kPa], rupture type: after 2 d immersion in water, 2 h drying - Minimal value/ average [kPa], rupture type:
Minimal bonded surface area	$S [\%] = 0.03 \text{ N} / \text{mm}^2 \times 100 / 0.80 \text{ N} / \text{mm}^2$ $S = 37.5 \%$ The minimal bonded surface S of bonded ETICS is 40 %
Fixing strength (displacement test)	Test not required therefore no limitation of ETICS length required.
<p>Wind load resistance of ETICS pull-through test of fixing static foam block test</p>	<p>(see annex 4.4)</p> <ul style="list-style-type: none"> - R_{panel} [kN/fixing], - R_{joint} [kN/fixing], - Plate diameter of anchor $\geq 60 \text{ mm}$, $\geq 90 \text{ res.} \geq 140 \text{ mm}$ - plate stiffness $\geq 0.3 \text{ [kN/mm}^2\text{]}$ - load resistance of the anchor plate $\geq 1.0 \text{ [kN]}$
<p>Tensile strength perpendicular to the faces in dry conditions standard EPS</p> <p>elastified EPS</p>	$\sigma_{\text{mt}} \geq 80 \text{ [kPa]}$ (bonded ETICS) $\sigma_{\text{mt}} \geq 100 \text{ [kPa]}$ (bonded ETICS with anchors) $\sigma_{\text{mt}} \geq 150 \text{ [kPa]}$ (bonded ETICS with profiles) $\sigma_{\text{mt}} \geq 80 \text{ [kPa]}$
Shear strength of the ETICS	$20 \leq f_{\text{rk}} \leq 170 \text{ [kPa]}$

Essential characteristic	Performance
Shear modulus of the ETICS standard EPS elastified EPS	$1,0 \leq G_m \leq 3,8$ [MPa] $0,3 \leq G_m \leq 1,0$ [MPa]
Render strip tensile test	(see annex 4.5) crack width w_{rk} [mm]
Bond strength after ageing finishing coat tested on the rig finishing coat not tested on the rig	(see annex 4.6) Minimal value/ average [kPa], rupture type Minimal value/ average [kPa], rupture type
Tensile strength of the glass fibre mesh in the as-delivered state Standard mesh Reinforced mesh	(see annex 4.7) Average [N/mm] Average [N/mm]
Residual tensile strength of the glass fibre mesh after aging Standard mesh Reinforced mesh	(see annex 4.7) Average [N/mm] Average [N/mm]
Relative residual tensile strength of the glass fibre mesh after aging Standard mesh Reinforced mesh	(see annex 4.7) Average [%] Average [%]
Elongation of the glass fibre mesh in the as-delivered state Standard mesh Reinforced mesh	(see annex 4.7) Average [N/mm] Average [N/mm]
Elongation of the glass fibre mesh after aging Standard mesh Reinforced mesh	(see annex 4.7) Average [%] Average [%]

3.4 Protection against noise (BWR 5)

Essential characteristic	Performance
Airborne sound insulation of ETICS	no performance assessed
Dynamic stiffness of the EPS insulation product	no performance assessed
Air flow resistance of the EPS insulation product	no performance assessed

3.5 Energy economy and heat retention (BWR 6)

Essential characteristic	Performance
Thermal resistance and thermal transmittance of ETICS	Calculated value or measurement value ($m^2 \cdot K$)/W, see annex 5.

English translation prepared by DIBt

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

According to the European Commission decision 97/556/EC amended by the European Commission decision 2001/596/EC, the assessment and verification of constancy of performance system (AVCP) applies suitable following table (see Annex V to Regulation (EU) No 305/2011).

The systems to be applied are:

Product	Intended use	Levels or classes (Reaction to fire)	Systems
"StoTherm Vario 4"	ETICS in external wall subject to fire regulations	A1 ⁽¹⁾ , A2 ⁽¹⁾ , B ⁽¹⁾ , C ⁽¹⁾	1
		A1 ⁽²⁾ , A2 ⁽²⁾ , B ⁽²⁾ , C ⁽²⁾ , D, E, (A1 to E) ⁽³⁾ , F	2+
	ETICS in external wall not subject to fire regulations	any	2+
<p>⁽¹⁾ Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e. g. an addition of fire retardants or a limiting of organic material)</p> <p>⁽²⁾ Products/materials not covered by footnote (1)</p> <p>⁽³⁾ Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of Classes A1 according to Commission Decision 96/603/EC)</p>			

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

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

Issued in Berlin on 29 September 2021 by Deutsches Institut für Bautechnik

Anja Rogsch
Head of Section

beglaubigt:
Windhorst

Annex 1

Composition of the ETICS

	Components	Coverage [kg/m ²]	Thickness [mm]
	National application documents shall be taken into account		
Insulation material with associated method of fixing	Bonded ETICS: <ul style="list-style-type: none"> • Insulation product factory-prefabricated expanded polystyrene (EPS)* <ul style="list-style-type: none"> - standard-EPS - elastified EPS • Adhesives <ul style="list-style-type: none"> - Sto-Baukleber (cement based powder requiring addition of 21 - 23 % of water) - StoLevell Uni (cement based powder requiring addition of 24 - 26 % of water) - StoLevell Duo (cement based powder requiring addition of 20 - 23 % of water) - StoLevell Duo plus (cement based powder requiring addition of about 25 % of water) - StoLevell Duo plus QS (cement based powder requiring addition of about 22 – 25 % of water) - StoLevell Novo (cement based powder requiring addition of about 37 % of water) - StoLevell FT (cement based powder requiring addition of about 28 % of water) - StoColl Mineral HP (cement based powder requiring addition of 23 – 25 % of water) - StoColl IP (cement based powder requiring addition of about 20 % of water) - StoLevell SW plus (cement based powder requiring addition of 21 - 23 % of water) - Sto-Dispersionskleber (organic based ready to use paste) - StoPrefa Coll (organic based ready to use paste) - StoLevell S 35 (organic based ready to use paste requiring addition of 30 % of cement) 		
	Mechanically fixed ETICS with profiles and supplementary adhesive: <ul style="list-style-type: none"> • Insulation product factory-prefabricated expanded polystyrene (EPS)* <ul style="list-style-type: none"> - standard EPS • Supplementary adhesive (equal to bonded ETICS) 		

	Components National application documents shall be taken into account	Coverage [kg/m ²]	Thickness [mm]
Insulation material with associated method of fixing	<ul style="list-style-type: none"> • Profiles <ul style="list-style-type: none"> – "Sto-Halteleiste PVC" – "Sto-Verbindungsleiste PVC" Polyvinyl chloride (PVC) profiles • Anchors for Profiles <ul style="list-style-type: none"> – WS 8 L – ejothem SDK U – SDF-K plus – ejothem NK U 		
	<p>Mechanically fixed ETICS with anchors and supplementary adhesive:</p> <ul style="list-style-type: none"> • Insulation product factory-prefabricated expanded polystyrene (EPS)* <ul style="list-style-type: none"> - standard-EPS - elastified EPS • Supplementary adhesives (equal to bonded ETICS) • Anchors for insulation product all anchors with ETA according to EAD 330196-01-0604¹ 	<p>–</p> <p>–</p>	<p>60 to 400</p> <p>60 to 200</p>
Base coat	<p>StoLevell Duo StoLevell Duo Plus Identical with the equally named adhesives given above.</p>	<p>4.5 to 6.0 (powder)</p>	<p>3.0 to 5.0</p>
Glass fibre mesh	<p>Sto-Glasfasergewebe Alkali- and slide-resistant glass fibre mesh with mass per unit area of about 165 g/m² and mesh size of about 6.0 mm x 6.0 mm</p>	–	–
	<p>Sto-Glasfasergewebe F Alkali- and slide-resistant glass fibre mesh with mass per unit area of about 165 g/m² and mesh size of about 4.0 mm x 4.0 mm</p>	–	–
	<p>Sto-Abschirmgewebe AES (Special mesh including a thin stainless yarn to reduce radiation of electric fields) Alkali- and slide-resistant glass fibre mesh with mass per unit area of about 165 g/m² and mesh size of about 4.0 mm x 4.0 mm.</p>	–	–
	<p>Sto-Panzergewebe (reinforced mesh implemented in addition to the mesh described above to improve the impact resistance) Alkali- and slide-resistant glass fibre mesh with mass per unit area of about 450 g/m² and mesh size of about 7.5 mm x 7.5 mm</p>	–	–

¹

EAD 330196-01-0604

Plastic anchors for fixing of external thermal insulation composite systems with rendering

	Components National application documents shall be taken into account	Coverage [kg/m ²]	Thickness [mm]
Key coat	StoPrep Miral Sto-Putzgrund Sto-Putzgrund QS StoPrep QS Ready to use pigmented acrylic-resin dispersion liquids. StoPrep Miral with additional potassium silicate binder For the compatibility with the finishing coats see below	0.3 to 0.4 l/m ²	– –
Finishing coat	To use with key coat "Sto-Putzgrund" / "StoPrep QS", if applicable** <ul style="list-style-type: none"> Ready to use pastes - acrylic binder: <ul style="list-style-type: none"> Stolit K (particle size 1.5 to 6.0 mm) 2.2 to 6.5 Stolit R (particle size 1.5 to 6.0 mm) 2.2 to 6.5 Stolit Effect (particle size 3.0 mm) 4.5 to 5.5 Stolit MP (thin, middle or thick layer) 2.2 to 4.7 Stolit Milano 2.0 to 4.0 Stolit K (particle size 1.5 mm) + Stolit Milano 4.7 to 5.6 StoMarlit K (Korngröße 1,5 bis 3,0 mm) 2.6 to 4.9 StoMarlit R (Korngröße 1,5 bis 3,0 mm) 2.5 to 4.4 Sto-Ispolit K (particle size 1.5 – 2.5 and 3.5 mm) 2.3 to 4.3 Sto-Ispolit R (particle size 1.5 and 3.5 mm) 2.3 to 4.3 Sto-Ispolit MP (thin, middle or thick layer) 2.3 to 4.3 StoSuperlit (particle size 2.0 mm) 4.5 to 6.0 StoLotusan K (particle size 1.5 and 3.0 mm) 2.2 to 4.3 StoLotusan MP (thin, middle or thick layer) 2.2 to 4.3 Ready to use paste – acrylic binder – associated with a decorative paint: <ul style="list-style-type: none"> StoNivellit + 3.0 to 3.5 StoColor Silco 0.2 to 0.4 l/m² Ready to use pastes – acrylic/siloxane binder: <ul style="list-style-type: none"> Sto-Silkolit K (particle size 1.5 to 3.5 mm) 2.3 to 4.3 Sto-Silkolit R (particle size 1.5 to 3.5 mm) 2.3 to 4.3 Sto-Silkolit MP (thin, middle or thick layer) 2.3 to 4.3 StoSilco K (particle size 1.5 to 3.0 mm) 2.2 to 4.3 StoSilco R (particle size 1.5 to 3.0 mm) 2.2 to 4.3 StoSilco MP (thin, middle or thick layer) 2.2 to 4.3 StoSilco blue K (particle size 1.5 to 3.0 mm) 2.2 to 4.7 StoSilco blue MP (thin, middle or thick layer) 2.2 to 4.0 	0.2 to 0.4 l/m ²	– regulated by particle size 1.5 to 3.5 1.0 to 2.0 2.0 to 3.0 regulated by particle size 1.5 to 3.5 1.0 to 1.5 regulated by particle size 1.5 to 3.0 regulated by particle size 1.5 to 3.5 regulated by particle size 1.5 to 3.5

	Components	Coverage [kg/m ²]	Thickness [mm]
	National application documents shall be taken into account		
Finishing coat	<p>To use with key coat "Sto-Putzgrund QS"/"StoPrep QS", if applicable: **</p> <ul style="list-style-type: none"> Ready to use pastes – acrylic binder (application between 0 °C and 15 °C): <ul style="list-style-type: none"> Stolit QS K (particle size 1.5 to 3.0 mm) Stolit QS R (particle size 1.5 to 3.0 mm) Stolit QS MP (thin, middle or thick layer) Ready to use paste – acrylic/siloxane binder (application between 0 °C and 15 °C): <ul style="list-style-type: none"> StoSilco QS K (particle size 1.5 to 3.0 mm) StoSilco QS R (particle size 1.5 to 3.0 mm) StoSilco QS MP (thin, middle or thick layer) <p>To use with key coat "StoPrep Miral", if applicable:**</p> <ul style="list-style-type: none"> StoSil K (particle size 1.0 to 3.0 mm) StoSil R (particle size 1.5 to 3.0 mm) StoSil MP (thin, middle or thick layer) Cement based powder requiring addition of about 25 % in weight of water: <ul style="list-style-type: none"> StoMiral K (particle size 1.5 to 6.0 mm) StoMiral R (particle size 1.5 to 6.0 mm) StoMiral MP (fine structure) Cement based powder requiring addition of about 20 to 23 % in weight of water associated with a decorative paint: <ul style="list-style-type: none"> Sto-Strukturputz K (particle size 2.0 and 3.0 mm) Sto-Strukturputz R (particle size 2.0 and 3.0 mm) Cement based powder requiring addition of about 24 to 32 % in weight of water: <ul style="list-style-type: none"> StoMiral EKP (Edelkratzputz) (particle size 2.0 to 4.0 mm) Ready to use paste – acrylic binder – associated with synthetic briquettes: <ul style="list-style-type: none"> StoClayer B or StoEcoshape embedded in Sto-Klebe und Fugenmörtel 	<p>2.2 to 4.3</p> <p>2.2 to 4.3</p> <p>2.2 to 4.3</p> <p>2.2 to 4.3</p> <p>2.2 to 4.3</p> <p>2.2 to 4.3</p> <p>2.2 to 4.3</p> <p>2.2 to 4.4</p> <p>2.4 to 3.9</p> <p>1.5 to 4.0</p> <p>1.7 to 5.0</p> <p>1.7 to 4.5</p> <p>1.5 to 4.0</p> <p>2.3 to 2.7</p> <p>2.4 to 2.7</p> <p>15.0 bis 25.0</p> <p>5.0 to 9.0</p>	<p>regulated by particle size 1.5 to 3.5</p> <p>regulated by particle size 1.5 to 3.5</p> <p>regulated by particle size 1.5 to 3.5</p> <p>regulated by particle size 1.5 to 3.5</p> <p>regulated by particle size 1.5 to 3.5</p> <p>regulated by particle size 1.5 to 3.5</p> <p>regulated by particle size 1.5 to 3.5</p> <p>8.0 to 10.0***</p> <p>4.7 to 7.0</p>

	Components National application documents shall be taken into account	Coverage [kg/m ²]	Thickness [mm]
Decorative paint (optional)	<ul style="list-style-type: none"> • Ready to use paint: StoColor Silco StoColor Silco G StoColor Lotusan StoColor Lotusan G StoColor Jumbosil StoColor Maxicryl StoColor Crylan StoColor X-black StoColor Solical StoColor Solical G StoColor Maxisil 	[l/ m ²] 0.2 to 0.4	
Ancillary material	Remains the responsibility of the manufacturer of ETICS.		
* Factory-prefabricated, uncoated panels made of expanded polystyrene (EPS) to EN 13163: 2015 shall be used. ** The instruction to the installer concerning the use of a key coat remains the responsibility of the manufacturer. *** The applied thickness of 10 to 25 mm is reduced to 8 to 10 mm by scraping.			

Annex 2
Safety in case of fire (BWR 2)
Reaction to fire

Configurations	Organic content	Flame retardant content	Euroclass according to EN 13501-1
Base coat	max. 1.9 %	no flame retardant	
EPS-insulation material	In quantity ensuring Euroclass E according to EN 13501-1	In quantity ensuring Euroclass E according to EN 13501-1	
Profiles	-	-	
anchors	-	-	
Rendering system: Base coat with finishing coat and compatible key coat indicated in annex 1:			
Stolit K/R (particle size 3,5 to 6,0 mm)	max. 9.6 %	min. 8.0 %	C – s2,d0
Stolit K/R (particle size 1,0 to 3,0 mm)			
Stolit Effect/MP			
Stolit Milano			
Stolit K1,5 + Stolit Milano			
StoMarlit K/R			
StoLotusan K/MP			
StoNivellit + StoSilco Color			
StoSilco K/R/MP			
StoSilco blue K/MP			
Stolit QS K/MP			
StoSilco QS K/R/MP			
Sto-Ispolit K/R/MP	max. 9.3 %	no flame retardant	B – s2,d0
Sto-Silkolit K/R/MP			
StoSil K/R/MP	max. 6.0 %		B – s1,d0
StoMiral K/R/MP	max. 1.7 %	no flame retardant	
StoMiral Nivell F associated with a decorative paint			
Sto-Strukturputz K/R associated with a decorative paint			
StoMiral EKP (Edelkratzputz)			
Sto-Klebe- und Fugenmörtel + StoClayer B/ StoEcoshape	max. 8.0 % max. 7.9 %	min. 15.0% min. 20.0 %	B – s2,d0
StoSuperlit	-	-	(no performance assessed)

Annex 3

Hygiene, health and environment (BWR 3)

3.1 Water absorption (capillarity test)

Base coat

Base coat	Average water absorption [kg/m ²]	
	after 1h	after 24h
StoLevell Duo	0.09	0.37
StoLevell Duo Plus	0.03	0.13

Rendering system

Base coat "StoLevell Duo" with finishing coat indicated hereafter	Average water absorption [kg/m ²]	
	after 1h	after 24h
Stolit K/R/Effect/MP	0.05	0.04
Stolit Milano	0.01	0.10
Stolit K1.5 + Stolit Milano	0.02	0.08
StoMarlit K/R	0.02	0.09
Sto-Ispolit K/R/MP	0.04	0.24
StoLotusan K/MP	0.01	0.08
Sto-Klebe- und Fugenmörtel + StoClayer B/ StoEcoshape	0.05	0.24
StoSuperlit	0.05	0.25
StoNivellit + StoSilco Color	0.04	0.24
Sto-Silkolit K/R/MP	0.05	0.36
StoSilco K/R/MP	0.04	0.23
StoSilco blue K/MP	0.03	0.21
Stolit QS K/R/MP	0.04	0.24
StoSilco QS K/R/MP	0.05	0.24
StoSil K/R/MP	0.18	0.72
StoMiral K/R/MP	0.03	0.30
StoMiral Nivell F, associated with a decorative paint	0.04	0.43
Sto-Strukturputz K/R associated with a decorative paint	0.05	0.44
StoMiral EKP (Edelkratzputz)	0.04	0.89

Base coat "StoLevell Duo Plus" with finishing coat indicated hereafter	Average water absorption [kg/m ²]	
	after 1h	after 24h
Stolit K/R/Effect/MP/	0.02	0.14
Stolit Milano	0.01	0.06
Stolit K1.5 + Stolit Milano	0.01	0.07
StoMarlit K/R	0.02	0.14
Sto-Ispolit K/R/MP	0.04	0.24
StoLotusan K/MP	0.02	0.20
Sto-Klebe- und Fugenmörtel + StoClayer B/StoEcoshape	0.06	0.33
StoSuperlit	0.07	0.31
StoNivellit + StoSilco Color	0.04	0.21
Sto-Silkolit K/R/MP	0.05	0.36
StoSilco K/R/MP	0.02	0.20
StoSilco blue K/MP	0.02	0.14
Stolit QS K/R/MP	0.01	0.16
StoSilco QS K/R/MP	0.01	0.16
StoSil K/R/MP	0.09	0.77
StoMiral K/R/MP	0.03	0.17
StoMiral Nivell F, associated with a decorative paint	0.02	0.16
Sto-Strukturputz K/R associated with a decorative paint	0.13	0.33
StoMiral EKP (Edelkratzputz)	0.21	0.74

3.2 Impact resistance

Standard mesh: "Sto-Glasfasergewebe" oder Sto-Glasfasergewebe F"

Rendering system: Base coat "StoLevell Duo" or "StoLevell Duo Plus" with finishing coats indicated hereafter:	Standard mesh	Standard mesh + Sto-Panzer- gewebe	Sto-Abschirm- gewebe AES
Stolit K/R/Effect/MP	Category II	Category I	Category II
Stolit Milano	Category III		
Stolit K1.5 + Stolit Milano	Category II		
Sto-Ispolit K/R/MP			
StoMarlit K/R	Category II		Category II
StoLotusan K/MP		Category I	
Sto-Klebe- und Fugenmörtel + StoClayer B/StoEcoshape	Category I		Category I
StoSuperlit	Category II	Category I	Category II
StoNivellit + StoColor Silco	Category III	Category II	Category III
Sto-Silkolit K/R/MP	Category I	Category II	
StoSilco K/R/MP	Category II	Category I	Category II
StoSilco blue K/MP	Category II	no performance assessed	no performance assessed
Stolit QS K/R/MP	Category II	Category I	Category II
StoSilco QS K/R/MP			
StoSil K/R/MP			
StoMiral K/R/MP		Category II	
StoMiral Nivell F			
Sto-Strukturputz K/R	Category II		
StoMiral EKP (Edelkratzputz)	Category I		

3.3 Water vapour permeability ETICS

Rendering system: Base coat "StoLevell Duo" or "StoLevell Duo Plus" with finishing coat indicated hereafter (evaluated without decorative coating or key coat unless otherwise noted)	Equivalent air thickness s_d (Test results obtained with a layer thickness of the base coat of 6 mm)
Stolit K/R/Effect/MP	≤ 1.0 m (Test result obtained with Stolit K2: 0.4 m)
Stolit Milano	≤ 1.0 m (Test result obtained with d = 1 mm: 0.5 m)
Stolit K1.5 + Stolit Milano	≤ 1.0 m (Test result obtained with d = 2.5 mm: 0.8 m)
Sto-Ispolit K/R/MP	≤ 1.0 m (Test result obtained with StoMarlit K2: 0.4 m)
StoMarlit K/R	≤ 1.0 m (Test result obtained with d = 2.5 mm: 0.41 m)
StoLotusan K/MP	≤ 1.0 m (Test result obtained with StoLotusan K2: 0.2 m)
Sto-Klebe- and Fugenmörtel + StoClayer B/ StoEcoshape	≤ 1.0 m (Test result obtained with size III: 0.6 m)
StoSuperlit	≤ 1.0 m (Test result obtained with "Farbsand" (special colour coated grain) K2: 0.4 m) (Test result obtained with "Silmer" (natural coloured grain) K2: 0.3m)
StoNivellit + StoColor Silco	≤ 1.0 m (Test result obtained with d = 1 mm: 0.4 m)
Sto-Silkolit K/R/MP	≤ 1.0 m (Test result obtained with d = 2.5 mm: 0.21 m)
StoSilco K/R/MP	≤ 1.0 m (Test result obtained with StoSilco K2: 0.3 m)
StoSilco blue K/MP	≤ 1.0 m (Test result obtained with StoSilco blue K2: 0.17 m)
Stolit QS K/R/MP	≤ 1.0 m (Test result obtained with Stolit QS K2: 0.3 m)
StoSilco QS K/R/MP	≤ 1.0 m (Test result obtained with StoSilco QS K2: 0.3 m)
StoSil K/R/MP	≤ 1.0 m (Test result obtained with StoSil K2: 0.2 m)
StoMiral K/R/MP	≤ 1.0 m (Test result obtained with StoMiral K2: 0.1 m)
StoMiral Nivell F associated with decorative paint	≤ 1.0 m (Test result obtained with d = 2 mm and a double coat of paint "StoSilco Color": 0.2 m) (Test result obtained with d = 2 mm and a double coat of paint "StoColor Jumbosil": 0.2 m)
Sto-Strukturputz K/R associated with decorative paint	≤ 1.0 m (Test result obtained with Sto-Strukturputz K3 and a double coat of paint "StoSilco Color": 0.2 m) (Test result obtained with Sto-Strukturputz K3 and a double coat of paint "StoColor Jumbosil": 0.3 m)
StoMiral EKP (Edelkratzputz)	≤ 1.0 m (Test result obtained with d = 11 mm: 0.4 m)

Annex 4

Safety and accessibility in use (BWR 4)

4.1 Bond strength between base coat and EPS

		Conditioning		
		Initial state [kPa]	After hygrothermal cycles [kPa]	After freeze/thaw test
StoLevell Duo	Average	90	95	Test not required because freeze/thaw cycles not necessary
	Minimal value	90	78	
StoLevell Duo Plus	Average	116	124	
	Minimal value	93	88	

4.2 Bond strength between adhesive and substrate

Substrate: concrete		Conditioning		
		Initial state [kPa]	2 d immersion in water and 2 hrs. drying [kPa]	2 d immersion in water and 7 d drying [kPa]
Sto-Baukleber	Average	1930	770	1890
	Minimal value	1770	631	1793
StoLevell Uni	Average	1700	445	1250
	Minimal value	1581	412	1019
StoLevell Duo	Average	1925	720	1360
	Minimal value	1356	607	1268
StoLevell Duo plus	Average	1522	746	1146
	Minimal value	1035	545	1056
StoLevell Duo plus QS	Average	1264	523	2001
	Minimal value	961	341	1691
StoLevell Novo	Average	515	350	490
	Minimal value	413	319	401
StoLevell FT	Average	855	390	710
	Minimal value	726	363	650
StoColl Mineral HP	Average	2080	184	1790
	Minimal value	1927	173	1732
StoColl IP	Average	1565	975	1830
	Minimal value	1407	577	1738
StoLevell SW plus	Average	131	141	211
	Minimal value	78	119	177
Sto-Dispersionkleber	Average	1525	1480	1043
	Minimal value	1364	1349	870
StoPrefa Coll	Average	690	250	430
	Minimal value	542	209	327
StoLevell S 35	Average	1997	682	2917
	Minimal value	1852	651	2442

4.3 Bond strength between adhesive and EPS

		Conditioning		
		Initial state [kPa]	2 d immersion in water and 2 hrs. drying [kPa]	2 d immersion in water and 7 d drying [kPa]
Sto-Baukleber	Average	110	90	145
	Minimal value	86	60	105
StoLevell Uni	Average	145	65	145
	Minimal value	110	55	115
StoLevell Duo	Average	90	80	140
	Minimal value	90	55	130
StoLevell Duo plus	Average	116	77	152
	Minimal value	93	66	144
StoLevell Duo plus QS	Average	85	50	81
	Minimal value	74	45	67
StoLevell Novo	Average	125	65	140
	Minimal value	106	50	129
StoLevell FT	Average	112	53	125
	Minimal value	87	44	118
StoColl Mineral HP	Average	100	90	90
	Minimal value	88	87	80
StoColl IP	Average	145	95	145
	Minimal value	138	90	141
StoLevell SW plus	Average	96	102	99
	Minimal value	82	89	93
Sto-Dispersionkleber	Average	148	183	160
	Minimal value	124	168	128
StoPrefa Coll	Average	145	150	150
	Minimal value	123	125	122
StoLevell S 35	Average	158	147	171
	Minimal value	127	136	149

4.4 Wind load resistance

The following failure loads only apply to the listed combination of component characteristics and the characteristics of the insulation product.

4.4.1 Safety in use of mechanically fixed ETICS using profiles

Characteristics of the EPS (standard EPS)	Dimensions	500 mm x 500 mm
	Thickness	≥ 60 mm
	Tensile strength perpendicular to the faces	≥ 150 kPa
	Shear modulus	≥ 1.0 N/mm ²
Failure loads [kN / panel] (Static Foam Block Test)	Horizontal profiles fixed every 30 cm and 49.4 cm long vertical connection profiles	Minimal: 0.95 Average: 1.01

4.4.2 Safety in use of mechanically fixed ETICS using anchors

Apply to all anchors listed in annex 1 mounted on the insulation panels surface				
Characteristics of the EPS (standard EPS)	Thickness	≥ 60 mm		
	Tensile strength perpendicular to the faces	≥ 100 kPa		
	Shear modulus	≥ 1.0 N/mm ²		
Plate diameter of anchor		Ø 60 mm	Ø 90 mm	
Failure loads [N]	Anchors not placed at the panel joints (Static Foam Block Test)	R _{panel}	Minimal: 0.51 Average: 0.52	Minimal: 0.72 Average: 0.73
	Anchors placed at the panel joints (Pull-through test)	R _{joint}	Minimal: 0.40 Average: 0.43	Minimal: 0.43 Average: 0.47

Apply to all anchors listed in annex 1 mounted on the insulation panels surface				
Characteristics of the EPS (elastified EPS)	Thickness	≥ 60 mm		
	Tensile strength perpendicular to the faces	≥ 80 kPa		
	Shear modulus	≥ 0.3 N/mm ²		
Plate diameter of anchor		Ø 60 mm		
Failure loads [N]	Anchors not placed at the panel joints (Static Foam Block Test)	R _{panel}	Minimal: 0.35 Average: 0.36.	
	Anchors placed at the panel joints (Pull-through test)	R _{joint}	Minimal: 0.30 Average: 0.31	

The failure loads of table 1 specified above only apply to the following anchors even with deep mounting but only under the given conditions of installation:

Anchor	Thickness of the EPS panel [t]	Conditions of installation *
ejothem STR U, ejothem STR U 2G (ETA-04/0023)	$t \geq 80$ mm	– Maximum installation depth of the anchor plate: 15 mm (\triangleq thickness of insulation cover) – Incision depth: 20 mm
	$t \geq 100$ mm	– Maximum installation depth of the anchor plate: 15 mm (\triangleq thickness of insulation cover) – Incision depth: 35 mm
TERMOZ 8 SV (ETA-06/0180)	$t \geq 80$ mm	– Maximum installation depth of the anchor plate: 15 mm (\triangleq thickness of insulation cover)

* according to the appropriate ETA of anchor

4.5 Bond strength after aging [kPa]

Finishing coat with base coat indicated hereafter		7 d immersion in water and 7 d drying [kPa] with base coat "StoLevell Duo Plus"	7 d immersion in water and 7 d drying [kPa] with base coat "StoLevell Duo"
Stolit K/R/Effect/MP	Average	156	120
	Minimal value	131	102
Stolit Milano	Average	148	115
	Minimal value	140	104
Stolit K1.5 + Stolit Milano	Average	100	120
	Minimal value	88	102
StoMarlit K/R	Average	128	115
	Minimal value	105	104
Sto-Ispolit K/R/MP	Average	121	121
	Minimal value	117	117
StoSuperlit	Average	158	125
	Minimal value	138	96
StoLotusan K/MP	Average	158	125
	Minimal value	149	118
StoNivellit	Average	150	115
	Minimal value	127	103
Sto-Klebe- und Fugenmörtel mit StoClayer B or StoEcoshape	Average	83	120
	Minimal value	67	96

Finishing coat with base coat indicated hereafter		7 d immersion in water and 7 d drying [kPa] with base coat "StoLevell Duo Plus"	7 d immersion in water and 7 d drying [kPa] with base coat "StoLevell Duo"
StoSilkolit K/R/MP	Average	119	119
	Minimal value	107	107
StoSilco K/R/MP	Average	143	125
	Minimal value	133	106
StoSilco blue K/MP	Average	110	110
	Minimal value	107	100
Stolit QS K/R/MP	Average	150	115
	Minimal value	147	109
StoSilco QS K/R/MP	Average	150	102
	Minimal value	136	99
StoSil K/R/MP	Average	153	120
	Minimal value	134	96
StoMiral K/R/MP	Average	129	110
	Minimal value	115	95
StoMiral Nivell F	Average	138	115
	Minimal value	101	89
Sto-Strukturputz K/R	Average	133	120
	Minimal value	95	103
StoMiral EKP (Edelkratzputz)	Average	140	115
	Minimal value	98	87

4.6 Render strip tensile test

The average value of crack width of the base coats reinforced with the different glass fibre meshes measured at a render strain value of 1.0 % is:

Base coat	Glass fibre mesh	Average value of crack width $w_{m(1\%)}$
StoLevell Duo	Sto-Glasfasergewebe	0.11 mm
	Sto-Glasfasergewebe F	no performance assessed
	Sto-Abschirmgewebe AES	no performance assessed
StoLevell Duo Plus	Sto-Glasfasergewebe	0.12 mm
	Sto-Glasfasergewebe F	0.12 mm
	Sto-Abschirmgewebe AES	0.10 mm

4.7 Reinforcement (glass fibre mesh)

Sto-Glasfasergewebe	Average warp	Average weft
Tensile strength in as-delivered state	2154 N / 50 mm	2883 N / 50 mm
Residual tensile strength after aging	1274 N / 50 mm	1807 N / 50 mm
Relative residual tensile strength after aging	59.1 %	62.7 %
Elongation in as-delivered state	3.7 %	3.8 %
Elongation after aging	1.8 %	2.1 %

Sto-Glasfasergewebe F	Average warp	Average weft
Tensile strength in as-delivered state	2236 N / 50 mm	2434 N / 50 mm
Residual tensile strength after aging	1494 N / 50 mm	1523 N / 50 mm
Relative residual tensile strength after aging	66.8 %	68.1 %
Elongation in as-delivered state	3.9 %	4.2 %
Elongation after aging	2.7 %	2.6 %

Sto-Abschirmgewebe AES	Average warp	Average weft
Tensile strength in as-delivered state	1812 N / 50 mm	2361 N / 50 mm
Residual tensile strength after aging	1085 N / 50 mm	1829 N / 50 mm
Relative residual tensile strength after aging	59.9 %	77.5 %
Elongation in as-delivered state	3.86 %	3.46 %
Elongation after aging	2.62 %	2.66 %

Annex 5

5 Energy economy and heat retention (BWR 6)

5.1 Thermal resistance

The nominal value of the additional thermal resistance R provided by the ETICS to the substrate wall is calculated in accordance with EN ISO 6946:2007 from the nominal value of the insulation product's thermal resistance R_D given accompanied to the CE marking and from the thermal resistance of the rendering system R_{render} which is about $0.02 \text{ (m}^2 \cdot \text{K)/W}$.

$$R = R_D + R_{render}$$

The thermal bridges caused by mechanical fixing (anchors, profiles) increases the thermal transmittance U . This influence had to take into account according to EN ISO 6946:2007

$$U_c = U + \chi_p \cdot n$$

Where:	U_c :	corrected thermal transmittance [$\text{W}/(\text{m}^2 \cdot \text{K})$]
	n :	number of anchors per m^2
	χ_p :	local influence of thermal bridge caused by an anchor. The values listed below can be taken into account if not specified in the anchor's ETA:
	$\chi_p = 0.004 \text{ W/K}$	for anchors with a galvanized steel screw with the head covered by a plastic material
	$\chi_p = 0.002 \text{ W/K}$	for anchors with a stainless steel screw covered by plastic anchors and for anchors with an air gap at the head of the screw