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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

European Technical Assessment ETA-22/0229 of 2022/04/28

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S	
Trade name of the construction product:	CELO ResiTHERM® 16
Product family to which the above construction product belongs:	Distance fixing system
Manufacturer:	CELO Befestigungssysteme GmbH Industriestraße 6 DE-86551 Aichach Tel + 49 8251 90 485 0 Internet: www.celofixings.com
Manufacturing plant:	CELO Befestigungssysteme GmbH Industriestraße 6 DE-86551 Aichach
This European Technical Assessment contains:	27 pages including 22 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EAD 331985-01-0604 – Distance fixing system
This version replaces:	

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product

Technical description of the product
CELO ResiTHERM® 16 is a post-installed anchor system placed into predrilled holes in concrete, in masonry and autoclaved aerated concrete and anchored by bonding.

CELO ResiTHERM® 16 distance fixing system consists of a M16 threaded rod made from carbon steel or stainless steel and a thermal separation module made from polyamid. The fixing system is placed into a pre-drilled hole perpendicular to the surface (maximum deviation 5°) in masonry or concrete, and anchored by bonding the threaded rod element to the wall of the drilled hole.

The product description is given in Annex A.

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

The intended use is fixings through an ETICS into the loadbearing wall of heavy-duty fixtures such as awnings, French balconies, canopies, satellite dishes, etc.
The system is used for distance installations in the following insulated base materials:

- Normal weight cracked or non-cracked concrete (base material group a)
- Solid masonry bricks (base material group b)
- Perforated or hollow bricks (base material group c)
- autoclaved aerated concrete (base material group d)

Reference to base material group in EAD 330284-00-0604 and EAD 330076-00-0604.

Anchorages subject to: Static or quasi-static loads
Temperature range:

- T1: -40°C to +40°C (max. short term temperature +40°C and max. long-term temperature +24°C)
- T2: -40 °C to +80 °C (max long term temperature +50 °C and max short term temperature +80 °C)

The minimum and the maximum installation temperature are specified by the manufacturer within the above range

Use categories in respect of use:
Category d/d: Use in dry masonry and concrete
Category w/w: Use in wet masonry only

This ETA applies only where concrete or masonry members which the distance fixing systems are embedded are subject to static or quasi static actions in tension, pressure, shear or combined tension and shear or pressure and shear or bending. The distance fixing system are intended to be used in areas with no and very low seismicity as defined in EN 1998-1, Clause 3.2.1.

In case of a product use in ETICS, it must be ensured that no ETICS influence the installation

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B1 to B5

The provisions made in this European Technical Assessment are based on an assumed intended working life of the anchor of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, 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

3.1 Characteristics of product

Safety in case of fire (BWR 2):
No Performance assessed

Safety in use (BWR4):
Resistance of the M16 anchor rod fixed with injection mortar in the base material masonry, and autoclaved aerated concrete.:
The M16 rod with material specification as stated in annex A5 are covered by the following ETA's based on EAD 330076-00-0604 which provides the relevant performances:

- ETA-15/0320 (ResiFIX VYSF)
- ETA-20-0065 (ResiFIX VY Eco)
- ETA-14/0101 (ResiFIX EYSF)
- ETA-17/0720 (ResiFIX PYSF)

Resistance of the M16 anchor rod fixed with injection mortar in the base material concrete:
The M16 rod with material specification as stated in annex A5 are covered by the following ETA's based on EAD 330499-01-0601 which provides the relevant performances:
For cracked concrete

- ETA-10/0134 (ResiFIX VY)
- ETA-20/0066 (ResiFIX VY Eco)

For uncracked concrete:

- ETA-12/0107 (ResiFIX EYSF)
- ETA-17/0721 (ResiFIX PYSF)
- ETA-12/0112 (ResiFIX EY)
- ETA-17/0805 (ResiFIX PY)

Resistance of the plastic part

- Characteristic resistance of the plastic part transferring load to failure under tension loading
- Characteristic resistance of the plastic part transferring load to failure under pressure loading
- Characteristic resistance of the plastic part transferring load to failure under shear loading
- Characteristic resistance to failure under pressure load and displacement (buckling of cantilever arm)
- Characteristic resistance to failure under combined shear and pressure load and displacements (buckling of cantilever arm)
- Characteristic resistance to failure under shear loads and displacements (failure of plastic part transferring load, cantilever arm)
- Maximum installation torque moment

The above essential characteristics are detailed in Annex C.

Energy economy and heat retention (BWR6)

- Point thermal transmittance
- Equivalent thermal conductivity

The above essential characteristics are detailed in Annex C.

Durability
The verification of durability is part of testing of the essential characteristics. Durability is only ensured if the specifications of intended use according to Annex B are taken into account.

3.2 Methods of assessment

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Requirements 4 has been made in accordance with the EAD 331985-01-0604 – Distance fixing system.

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 97/463/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

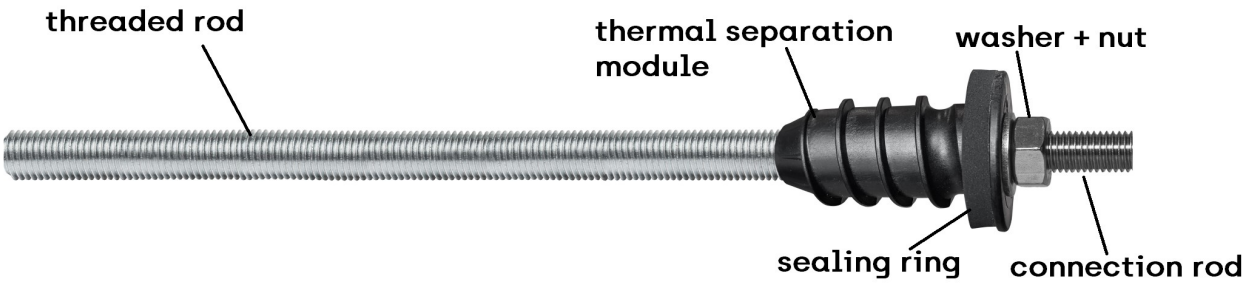
5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

Issued in Copenhagen on 2022-04-28 by

Thomas Bruun
Managing Director, ETA-Danmark

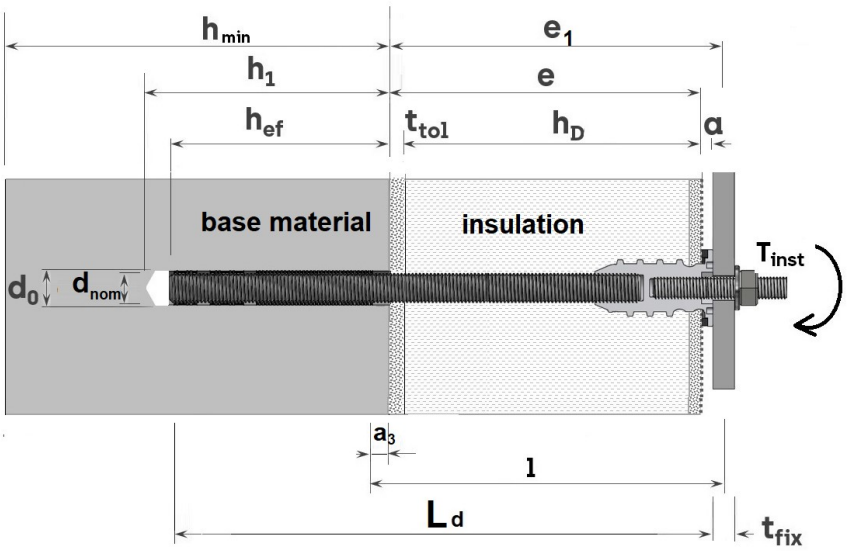
Distance fixing system ResiTHERM® 16



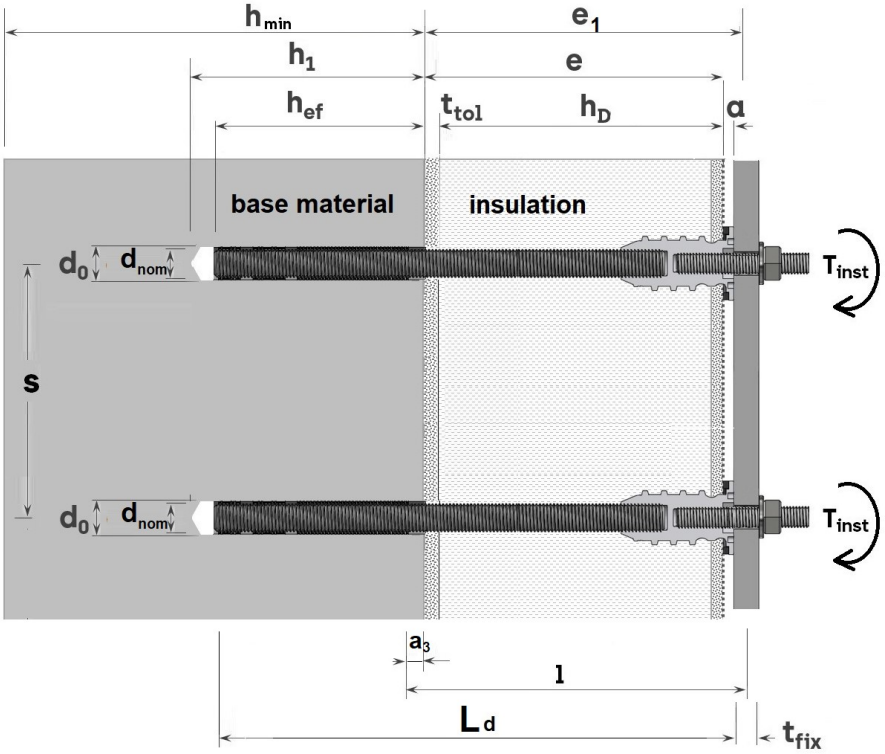
ResiTHERM® 16	**Annex A1**
Product description View and profile of the product	

ResiTHERM® 16 installed conditions

Single fixing – anchor's free end is rotatable under an acting shear load



Multiple fixing – anchor's free end is not rotatable under an acting shear load, provided that the fixed baseplate is sufficiently rigid



ResiTHERM® 16	**Annex A2**
Product description Installed conditions single fixing and multiple fixings	

ResiTHERM® 16 installed conditions

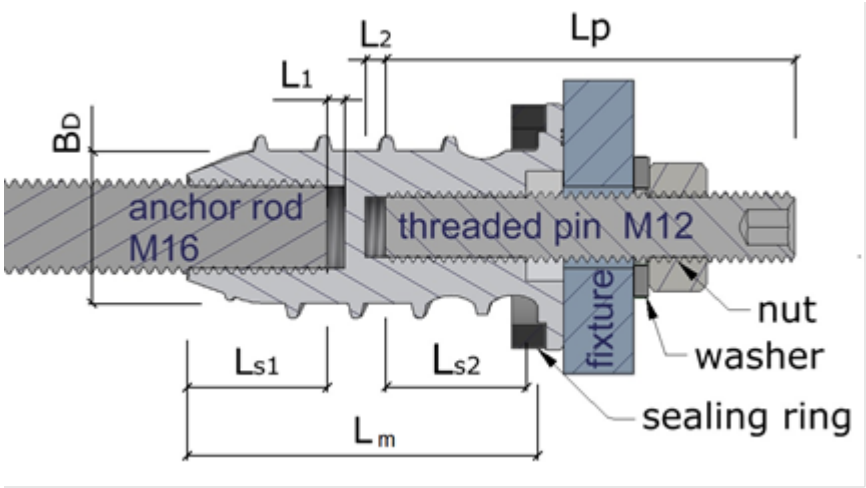
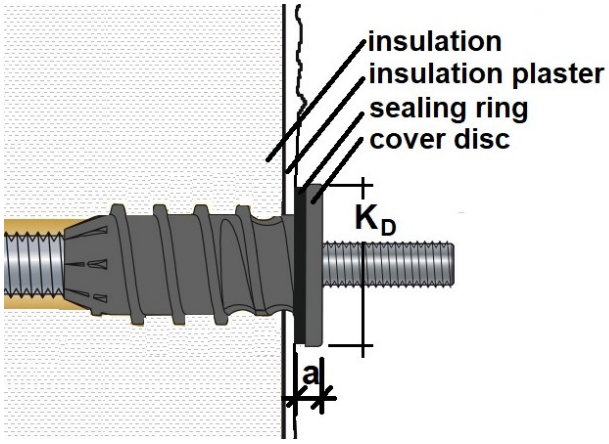
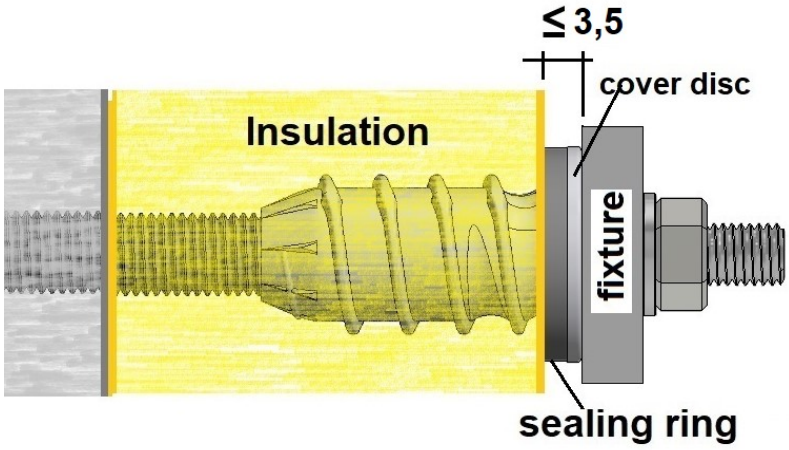


Table A3.1: Specifications for the installation

ResiTHERM® 16			
Total length ResiTHERM® 16 incl. anchor rod	L_d	[mm]	≤ 387
Length of the thermal separation module	L_m	[mm]	60
Core diameter of the thermal separation module	B_D	[mm]	26
Diameter cover disc	K_D	[mm]	42
Diameter of anchor rod	d_{nom}	[mm]	16
Thickness of non-load bearing plaster, adhesive or similar materials	t_{tol}	[mm]	optional
Insulation thickness (incl. insulation plaster)	h_D	[mm]	60 - 300
Lever arm for shear laod for calculation of shear load with lever arm	l	[mm]	$a_3 + e_1$
Distance between surface of base material to the plaster surface (non bearing materials)	e	[mm]	$h_D + t_{tol}$
Distance between shear load and surface of the member	e_1	[mm]	e + a
Gap between plaster surface and fixture	a	[mm]	3 – 3,5
Additional length for lever arm	a_3	[mm]	0,5 * d_{nom}
Min. screw-in depth M16	L_{s1}	[mm]	24
Min. screw-in depth M12 (pin)	L_{s2}	[mm]	24
Adjusting length M16 (base material side)	L_1	[mm]	3
Adjusting length M12 (fixture side)	L_2	[mm]	3,5
Spacing between anchor rods	s	[mm]	acc. ETA of injection mortar

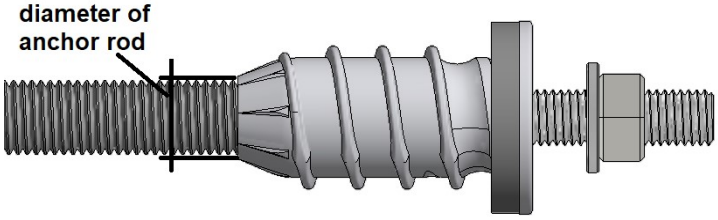
ResiTHERM® 16 installed conditions to ensure sealing against driving rain





Installation with max. distance of plaster to fixture to ensure water tightness (a ≤ 3,5 mm)

ResiTHERM® 16 marking



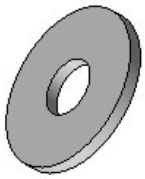
Marking:	Brand	Type	diameter of anchor rod
Example:	**CELO**	**RESITHERM®**	**16**

ResiTHERM® 16	**Annex A4**
Product description Installed conditions for sealing. Marking.	

ResiTHERM® 16 single parts and materials

Accessories:

Pos 3a



Pos 7

Table A 5.1: Parts and Materials

Pos	Designation	Material
1	**Anchor rod M16**	Steel zinc plated galvanised ≥ 5µm acc. EN ISO 4042:2018 Property class EN-ISO 898-1 (2013) f_{yk} ≥ 640 N/mm², f_{uk} ≥ 800 N/mm² or Stainless steel A4 according to EN 10088-3:2014, material 1.4401 or 1.4571 f_{yk} ≥ 450 N/mm², f_{uk} ≥ 700 N/mm² strength class 70
2	**Thermal separation module**	Polyamide PA 6 with glass fibre
3 3a 3b	**Threaded pin M12** **or alternative** **reduction threaded pin M12/M10** **or alternative M12 screw**	Stainless steel A4 according to EN 10088-3:2014, material 1.4401 or 1.4571 f_{yk} ≥ 450 N/mm², f_{uk} ≥ 700 N/mm²
4	**sealing ring**	Material: EPDM min. 41,5 x 37,5 x 6 mm
5	**Hexagon nut M12**	Stainless steel A4 according to EN 10088-3:2014, material 1.4401 or 1.4571 nut acc. DIN EN ISO 4032
6	**Washer**	Stainless steel A4, DIN 125 or DIN 440
7	**Optional: distance washer for M12, acc. DIN 9021**	Polyamide, 37 x 13 x 3 mm, white or black

Specification of intended use

Anchorages subject to:
- Static and quasi-static actions in tension, pressure, shear or combined tension and shear or combined pressure and shear load. The anchor shall not be used for the transmission of dead loads of the thermal insulation composite system.

Base material:
Masonry and autoclaved aerated concrete:
According to ETA's
- ETA-15/0320 (ResiFIX VYSF)
- ETA-20-0065 (ResiFIX VY Eco)
- ETA-14/0101 (ResiFIX EYSF)
- ETA-17/0720 (ResiFIX PYSF)

Concrete
According to ETA's
For cracked concrete
- ETA-10/0134 (ResiFIX VY)
- ETA-20/0066 (ResiFIX VY Eco)

For uncracked concrete:
- ETA-12/0107 (ResiFIX EYSF)
- ETA-17/0721 (ResiFIX PYSF)
- ETA-12/0112 (ResiFIX EY)
- ETA-17/0805 (ResiFIX PY)

Temperature Range for use:
Masonry
- T_a: -40°C to +40°C (max. short term temperature +40°C and max. long-term temperature +24°C)
- T_b: -40 °C to +80 °C (max long term temperature +50 °C and max short term temperature +80 °C)

Concrete
- T1: -40°C to +40°C (max. short term temperature +40°C and max. long-term temperature +24°C)
- T2: -40 °C to +80 °C (max long term temperature +50 °C and max short term temperature +80 °C)

Use conditions (Environmental conditions)
The use conditions for the base materials are given in the above-mentioned ETA's for the respective substrates.

Steel parts
Inner side of thermal separation module and sealing ring
The sealing ring ensures the watertightness of the penetration

For all conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class:

- Stainless steel class A4 according to Annex A5, Table A5.1: CRC III
- Galvanized steel according to Annex A5, Table A5.1: CRC III, provided that the anchor and sealing ring is installed in accordance with annex A4 and with displacement less than 1.0 mm under tension loads and less than 3.0 mm under shear loads, and with a render with a maximum grain size K3.
- Galvanized carbon steel according to Annex A5, Table A5.1: CRC III, provided that another suitable sealing measures are taken, such as a hybrid joint compound or e.g., a sheet metal cover is applied

Outer side of the thermal separation module and sealing ring
The steel parts (threaded pin or screw as well as nut and washer) shall be made of stainless steel according to Annex A5, Table A 5.1.

Use conditions in respect of installation and use

Masonry and aerated autoclaved concrete base material:

- Category d/d: Installation and use in dry masonry
- Category w/w: Installation and use in wet or dry masonry (incl. w/d installation in wet masonry and use in dry masonry)

Concrete base material:

- I1 – installation in dry or wet (water saturated) concrete and use in service in dry or wet concrete
- I2 – installation in water-filled drill holes (not sea water) and use in service in dry or wet concrete

Design:

- The anchorages are to be designed under the responsibility of an engineer experienced in anchorages and masonry work with the applicable safety factors.
- Verifiable calculation notes and drawings shall be prepared taking account of the loads to be anchored, the nature and strength of the base materials and the dimensions of the anchorage members as well as of the relevant tolerances. The position of the anchor is indicated on the design drawings.
- The fastener is anchored in the substrate of concrete, masonry or autoclaved aerated concrete. Any other layer, e.g. tolerance levelling layers, adhesives, plaster covering the substrate or outside plasters are considered as to be non load bearing.
- Anchorages in concrete under static or quasi-static actions are designed in accordance with EN 1992-4
- $\alpha_{pressure}$ = 1 for compression load for solid base material and for hollow base material with more than 4 penetrated webs.

Installation:

- Dry or wet structures
- Anchor Installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Hole drilling in concrete by hammer or compressed air drill mode
- Temperature of the plug at installation from -20°C to + 40°C.
- Exposure to UV due to solar radiation of the plastic part not protected ≤ 6 weeks.

ResiTHERM® 16	**Annex B1**
Product description Specification of intended use	

Table B 2.1 Installation parameters in base material (see drawing in Annex 2)

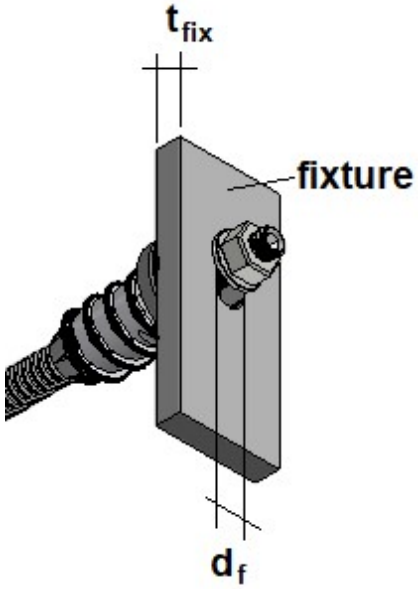
Anchor type			ResiTHERM® 16
Insulation thickness incl. insulation plaster	h_D	[mm]	60 - 300
Min. thickness of member	h_{min}	[mm]	acc. ETA of injection mortar
Effective anchorage depth	$h_{ef} \geq$	[mm]	acc. ETA of injection mortar
Drill hole diameter	d_0	[mm]	acc. ETA of injection mortar
Depth of drill hole in the base material	$h_1 \geq$	[mm]	acc. ETA of injection mortar
Diameter of clearance hole in the fixture for the M12 threaded pin	$d_f \geq$	[mm]	13
Diameter of clearance hole in the fixture for the M12/M10 threaded pin	$d_f \geq$	[mm]	11
Length of threaded pin	Lp ≥	[mm]	50
Thickness of fixture	t_{fix}	[mm]	0 – 24 a) max. 200 b)
Installation torque to fix the fixture *	$T_{inst} \leq$	[Nm]	19

For hollow base material a perforated sleeve must be used for the injection mortar, acc. ETA of injection mortar

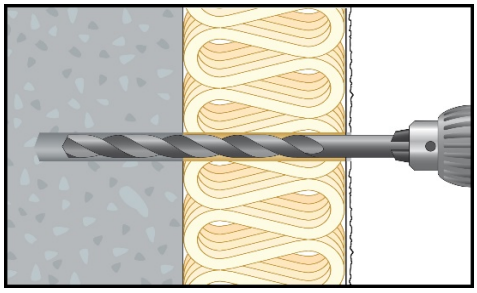
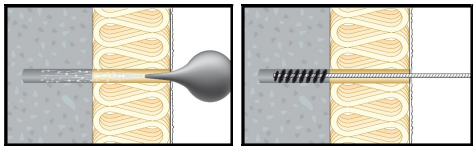
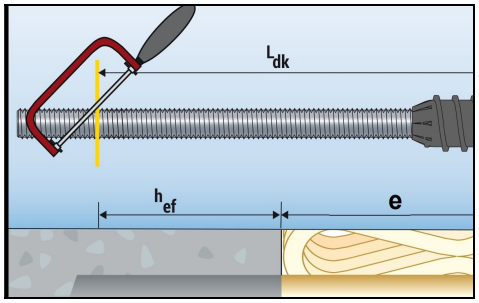
* T_{inst} = 19 Nm is valid for the thermal separation module. Max. T_{inst} given in ETAs of injection mortar must also be observed.

a) as delivered with threaded pin M12 or with reduction threaded pin M12/M10

b) with any longer threaded rod, washer and nut which complies to the specifications given in table A 5.1 position 3 and 3a. The introduction of bending moment is not allowed. Constructive measures must be applied to exclude any bending moment.

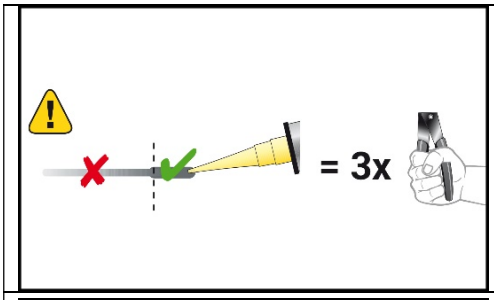


Installation instruction (installation in concrete or full base material)

Mounting in concrete/solid brick:	
	1. Drill a hole: Observe the drilling method of the approval/assessment of the injection mortar. Concrete/solid brick: hammer drilling; aerated concrete: Rotary drilling - without impact Drill hole diameter = 18 mm Concrete: Drill hole depth h_1 (+ e = insulation thickness incl. plaster) Solid brick: Drill hole depth h_1 (+ e = insulation thickness incl. plaster)
	2. Clean the drill hole: The drill hole must be cleaned properly; see approval/assessment of the injection system.
	3. Cut the ResiTHERM® 16 to length: The pre-assembled threaded rod M16 is already completely screwed into the thermal separation module. Correct length L_{dK} from the tip of the threaded rod to the lower edge of the cover plate of the thermal separation module (see table): After determining the correct length, cut the threaded rod M16 to length with a metal saw or similar.

Correct length L_{dk} = Anchorage depth h_{ef} + insulation thickness h_D	Anchoring in concrete	Anchoring in aerated concrete/solid brick
$L_{dk} = h_{ef} + e$	**L_{dk} = 80 mm + e**	**L_{dk} = 100 mm + e**

Installation instruction (installation in concrete or full base material)



5.1 Squeeze out the injection mortar until the mortar has a uniform grey mixing colour - discard the pre-run of at least 3 pumps.

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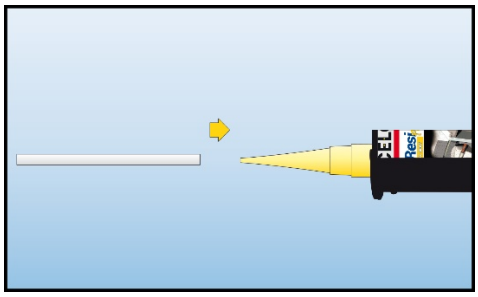
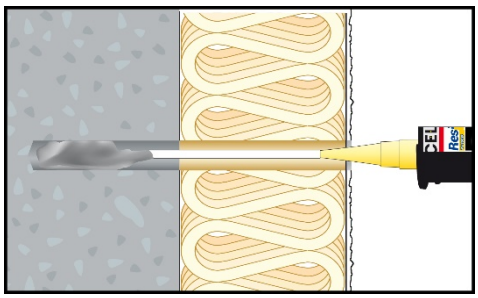


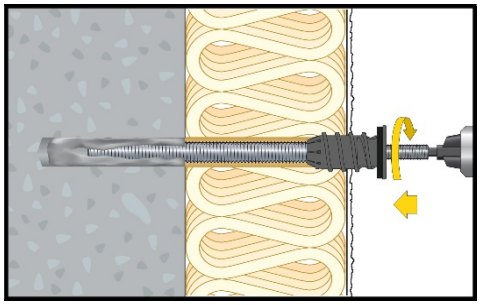
5.2 Attach the mixing nozzle extension to the mixing nozzle



6. Fill the drill hole with injection mortar (start from the bottom of drill hole):

Drill hole depth	165/280/300 ml	345 ml	410 ml
h_1 [mm]	Number of pumps	Number of pumps	Number of pumps
Concrete: 90	5	5	4-5
Solid brick/aerated concrete: 110	6	6	5-6

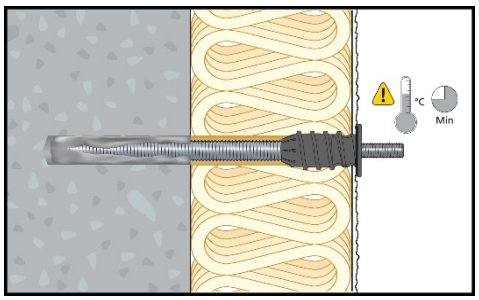
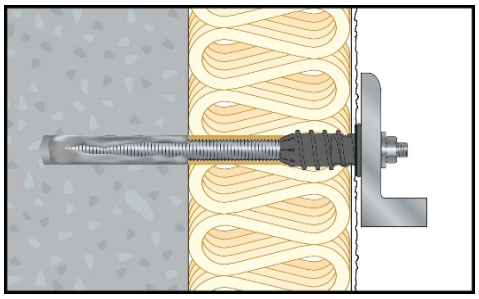
Important: Follow the installation instructions and processing time of the injection mortar used in accordance with the approval/assessment.



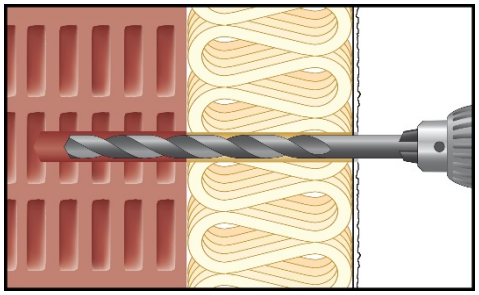
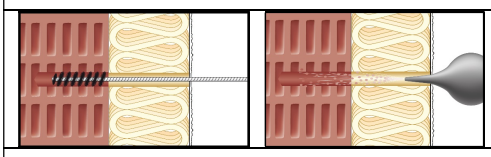
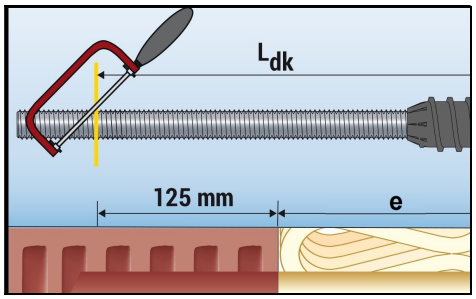
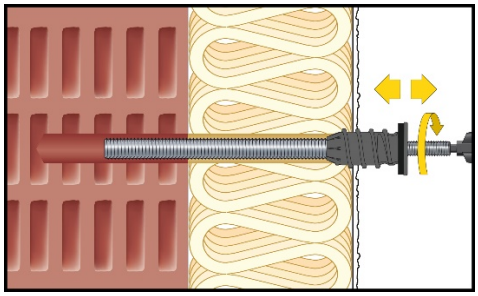
7. Insert the hexagon bit (included in the set) into the M12 threaded stud and screw in the ResiTHERM® 16 using a cordless screwdriver until the seal is pressed firmly against the plaster. A standard cordless screwdriver is sufficient for this.

Note: The thermal separation module drills itself through the insulation. The foamed EPDM sealing ring ensures optimum sealing and prevents the entry of driving rain into the insulation, if the distance between the plaster surface and the bottom side of the cover plate is ≤ 0,5 mm (additional sealing with e.g. acrylic is not necessary, unless the plaster is very rough).
In case of very rough plaster or larger distance than 0,5 mm a suitabel hybrid sealing material should be used to seal against intrusion of water.

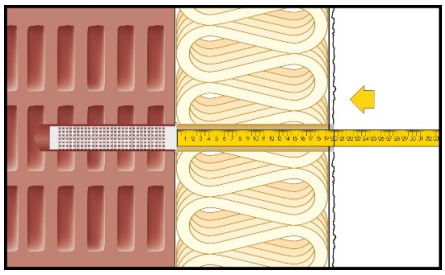
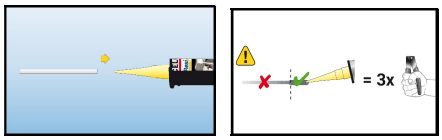
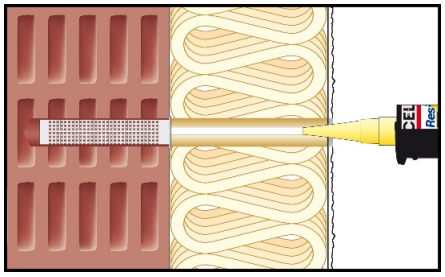
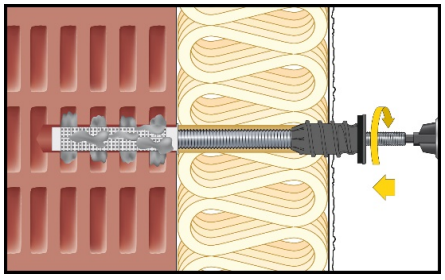
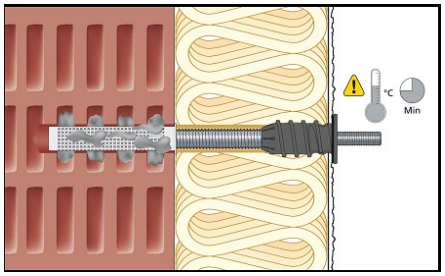
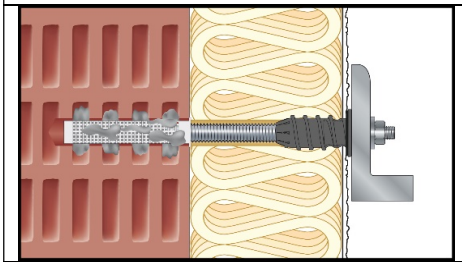
Installation instruction (installation in concrete or full base material)

	8. Observe the curing time of the injection system, see cartridge label of the injection mortar.
	9. Afterwards, the attachment can be mounted (max. torque T_{inst} = 19 Nm). Note: Observe an eventually varying installation torque in the ETA assessment of the used injection system. **Note**: The screw insertion depth of the M12 threaded stud in the ResiTHERM® 16 is min. 30,4 mm, max. 34 mm. (Measured from outside of the cover plate). This means, that it can be unscrewed by max. 3,5 mm.

Installation instruction (installation in hollow material)

	1. Drill a hole Observe the drilling method of the approval/assessment of the injection mortar. Perforated bricks: Rotary drilling without impact Drill hole diameter = 20 mm Drill hole depth ≥ 140 mm + insulation thickness (incl. plaster)
	2. Clean the drill hole: The drill hole must be cleaned properly; see approval/assessment of the injection system:
	3. Cut the ResiTHERM® 16 to length: The pre-assembled threaded rod M16 is already completely screwed into the thermal separation module. Correct length L_{dK} from the tip of the threaded rod to the lower edge of the cover plate of the thermal separation module: Anchorage depth in plastic sleeve (125 mm) + insulation thickness e (incl. plaster) After determining the correct length, cut the threaded rod M16 to length with a metal saw or similar.
	4. Enlarge the opening in the plaster for the collar of the plastic sleeve to 26 mm. To do this: Screw the thermal separation module only approx. 2 thread turns through the plaster using a cordless screwdriver and the bit included in the set. Then screw it out again.

Installation instruction (installation in hollow material)

	5. Push the plastic sleeve into the drill hole with the help of a folding ruler or similar. Then remove the folding ruler or similar from the drill hole. Note: This is an ideal way to ensure that the perforated sleeve SH 20x130 is correctly inserted in the drill hole.
	6.1 Squeeze out the injection mortar until the mortar has a uniform grey mixing colour - discard the pre-run of at least three full strokes. 6.2 Attach the mixing nozzle extension to the mixing nozzle.
	7. Fill the plastic sleeve completely with injection mortar (start from the bottom/back of the sleeve): 165/280/300 ml: 13 pumps = 38 mm Scale shares 345 ml: 12 pumps = 34 mm Scale shares 410 ml: 13 pumps = 24 mm Scale shares **Important:** Follow the installation instructions and processing time of the injection mortar. The necessary information is on the label, for further information see approval/assessment.
 	8. Insert the hexagon bit (included in the set) into the M12 threaded stud and screw in the ResiTHERM® 16 using a cordless screwdriver until the sealing ring is pressed firmly against the plaster. A standard cordless screwdriver is sufficient for this. **Note:** The thermal separation module drills itself through the insulation. The foamed EPDM sealing ring ensures optimum sealing and prevents the entry of driving rain into the insulation, if the distance between the plaster surface and the bottom side of the cover plate is ≤ 0,5 mm (additional sealant material is not necessary, unless the plaster is very rough). In case of very rough plaster or larger distance than 0,5 mm a suitable hybrid sealing material should be used to seal against intrusion of water. 9. Observe the curing time of the injection mortar
	10. Afterwards, the attachment can be mounted (max. torque T_{inst} = 19 Nm). Note: Observe an eventually varying installation torque in the ETA approval of the used injection system . **Note**: The screw insertion depth of the M12 threaded stud in the ResiTHERM® 16 is min. 30,4 mm, max. 34 mm. (Measured from outside of the cover plate).

ResiTHERM® 16	**Annex B7**
Intended use Installation instruction in hollow material	

Table C1.1: Characteristic tensile load resistance $N_{Rk,s}$ of the anchor rods

ResiTHERM® 16				
Type	**Cross section of M16 anchor rod A_s**	**Tensile strength of anchor rod f_{uk}**	**Char. tensile load resistance $N_{Rk,s}$**	**safety factor γ_{Ms}***
	[mm²]	**[N/mm²]**	**[kN]**	**[-]**
ResiTHERM® 16 (M16 rod 8.8)	157,0	800	125,6	1,5
ResiTHERM® 16 (M16 rod A4-70)	157,0	700	109,9	1,87

$\mathbf{N}_{Rk,s} = A_s * f_{uk}$

*In absence of other national regulations

Table C1.2: Characteristic shear load resistance $V_{Rk,s}$ without lever arm and char. bending moment $M_{Rk,s}$ of the anchor rods

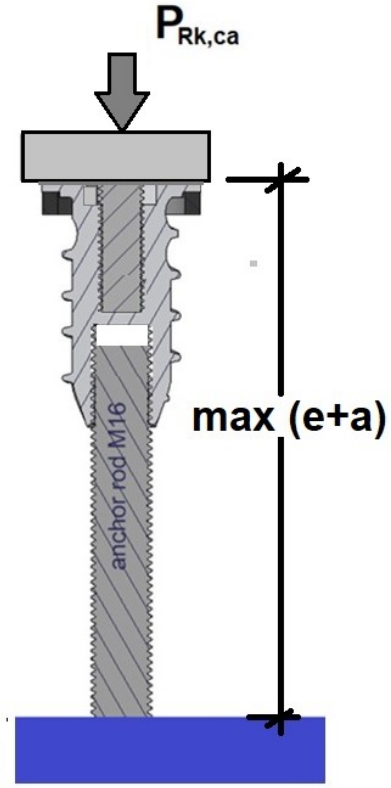
ResiTHERM® 16				
	Tensile strength of anchor rod f_{uk}	**Char. shear load resistance $V_{Rk,s}$**	**Char. bending moment $M_{Rk,s}$**	**safety factor γ_{Ms}***
Type	**[N/mm²]**	**[kN]**	**[Nm]**	**[-]**
ResiTHERM® 16 (M16 rod 8.8)	800	62,8	265,5	1,25
ResiTHERM® 16 (M16 rod A4-70)	700	55,0	232,3	1,56

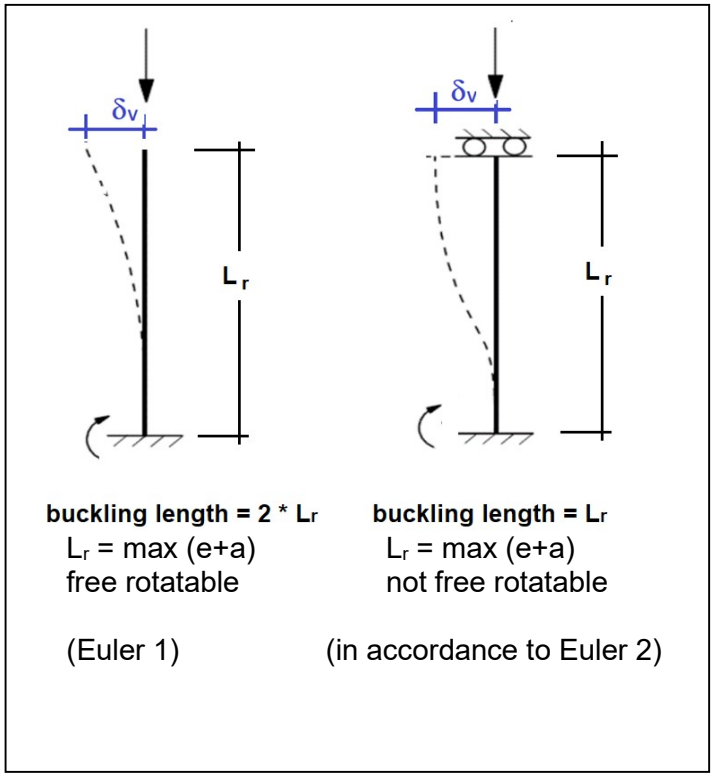
$\mathbf{V}_{Rk,s} = 0{,}5 * A_s * f_{uk}$

$\mathbf{M}_{Rk,s} = 1{,}2 * W_{el} * f_{uk}$ with $W_{el} = \pi * d_s^3 / 32$ $d_s = 14{,}14$ mm (for M16)

*In absence of other national regulations

Table C2.1: Characteristic buckling load resistance PRk,ca for the system of threaded rod and thermal separation module under pressure load with or without shear load displacement (δ_V)





ResiTHERM® 16					
			ResiTHERM® 16 Free rotatable	ResiTHERM® 16 Not free rotatable	Safety factor
Insulation thickness (incl. insulation plaster) h_D	Shear load displacment δ_V	max (e+a)	Char. buckling load resistance $P_{Rk,ca}$	Char. buckling load resistance $P_{Rk,ca}$	γ_{Mca} *
[mm]	[mm]	[mm]	[kN]	[kN]	[-]
60 - 300	0 - 5	304,4	≥ 14,3	≥ 15,0	1,3

* γ_{Mca} for buckling acc. TR 07

Table C3.1: Characteristic tensile load resistance N_{Rk} short and long term for the thermal separation module

ResiTHERM® 16		
Type	**N_{Rk}**	**γ_{Mtk}**
	24°C/40°C and 50°C/80°C	**safety factor**
	[kN]	**[-]**
ResiTHERM® 16	15	2,5

γ_{Mtk} for plastic material Polyamide acc. TR 077

The min. screw in depths of the rods (L_{s1}, L_{s2}) must be observed

Table C3.2: Characteristic pressure load resistance P_{Rk} short and long term for thermal separation module

ResiTHERM® 16		
Type	**P_{Rk}**	**γ_{Mtk}**
	24°C/40°C and 50°C/80°C	**safety factor**
	[kN]	**[-]**
ResiTHERM® 16	15	2,5

γ_{Mtk} for plastic material Polyamide acc. TR 077

Pressure load in base material must be considered

Table C4.1: Characteristic shear load resistance $V_{Rk,pol}$ for single thermal separation module, free end rotatable

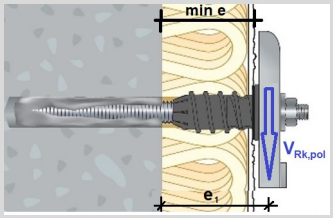
ResiTHERM® 16					
 free end rotatable					
Type	**$V_{Rk,pol}$**	**$V_{Rk,pol}$**	**$V_{Rk,pol}$**	**$V_{Rk,pol}$**	**γ_{Mtk}**
	Short term, 24°C/40°C	**Long term, 24°C/40°C**	**Short term, 50°C/80°C**	**Long term, 50°C/80°C**	**Safety factor**
	[kN]	**[kN]**	**[kN]**	**[kN]**	
ResiTHERM® 16	5,5	5,5	5,5	3,8	2,5

Table C4.2: Characteristic shear load resistance $V_{Rk,pol}$ for single thermal separation module, free end not rotatable

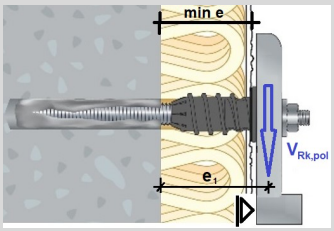
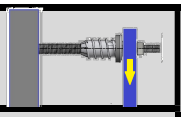
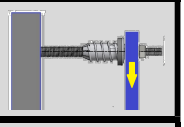
ResiTHERM® 16					
 free end not rotatable					
Type	**$V_{Rk,pol}$**	**$V_{Rk,pol}$**	**$V_{Rk,pol}$**	**$V_{Rk,pol}$**	**γ_{Mtk}**
	Short term, 24°C/40°C	**Long term, 24°C/40°C**	**Short term, 50°C/80°C**	**Long term, 50°C/80°C**	**Safety factor**
	[kN]	**[kN]**	**[kN]**	**[kN]**	
ResiTHERM® 16	6,0	6,0	6,0	4,2	2,5

Table C5.1: Shear load V values for single ResiTHERM® 16 for displacements w = 1, 2, 3, 4 or 5 mm, free end rotatable, short term load

ResiTHERM® 16 										
For insulation thickness incl. insulation's plaster and t_{tol} if applicable	Shear load V Temp. 24°C / 40°C [kN]					Shear load V Temp. 50°C / 80°C [kN]				
	Deviation w					Deviation w				
[mm]	1 mm	2 mm	3 mm	4 mm	5 mm	1 mm	2 mm	3 mm	4 mm	5 mm
60	0,58	1,06	1,57	1,57	1,57	0,58	1,06	1,57	1,57	1,57
80	0,50	0,96	1,38	1,57	1,57	0,50	0,96	1,38	1,57	1,57
100	0,39	0,74	1,06	1,37	1,57	0,39	0,74	1,06	1,37	1,57
120	0,29	0,52	0,75	0,97	1,19	0,29	0,52	0,75	0,97	1,19
140	0,24	0,44	0,63	0,82	1,00	0,24	0,44	0,63	0,82	1,00
160	0,20	0,36	0,52	0,67	0,82	0,20	0,36	0,52	0,67	0,82
180	0,15	0,28	0,41	0,52	0,64	0,15	0,28	0,41	0,52	0,64
200	0,13	0,25	0,36	0,46	0,56	0,13	0,25	0,36	0,46	0,56
220	0,11	0,22	0,31	0,40	0,49	0,11	0,22	0,31	0,40	0,49
240	0,10	0,18	0,26	0,34	0,42	0,10	0,18	0,26	0,34	0,42
250	0,09	0,17	0,24	0,31	0,38	0,09	0,17	0,24	0,31	0,38
260	0,08	0,15	0,21	0,28	0,34	0,08	0,15	0,21	0,28	0,34
280	0,06	0,12	0,17	0,22	0,27	0,06	0,12	0,17	0,22	0,27
300	0,05	0,08	0,12	0,16	0,19	0,05	0,08	0,12	0,16	0,19

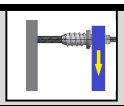
Intermediate values can be interpolated/ Data are limited due to ultimate limit state verifications of the performance given in Annex C4 under consideration of γ_M=2.5 and γ_F=1.4

Table C5.2: Shear load V values for single ResiTHERM® 16 for displacements w = 1, 2, 3, 4 or 5 mm, free end rotatable, long term load

ResiTHERM® 16 										
For insulation thickness incl. insulation's plaster and t_{tol} if applicable	Shear load V Temp. 24°C / 40°C [kN]					Shear load V Temp. 50°C / 80°C [kN]				
	Deviation w					Deviation w				
[mm]	1 mm	2 mm	3 mm	4 mm	5 mm	1 mm	2 mm	3 mm	4 mm	5 mm
60	0,58	1,06	1,57	1,57	1,57	0,41	0,75	1,10	1,10	1,10
80	0,50	0,96	1,38	1,57	1,57	0,35	0,67	0,97	1,10	1,10
100	0,39	0,74	1,06	1,37	1,57	0,27	0,52	0,74	0,96	1,10
120	0,29	0,52	0,75	0,97	1,19	0,20	0,36	0,52	0,68	0,83
140	0,24	0,44	0,63	0,82	1,00	0,17	0,31	0,44	0,58	0,70
160	0,20	0,36	0,52	0,67	0,82	0,14	0,25	0,36	0,47	0,57
180	0,15	0,28	0,41	0,52	0,64	0,10	0,20	0,28	0,37	0,45
200	0,13	0,25	0,36	0,46	0,56	0,09	0,17	0,25	0,32	0,39
220	0,11	0,22	0,31	0,40	0,49	0,08	0,15	0,22	0,28	0,34
240	0,10	0,18	0,26	0,34	0,42	0,07	0,13	0,18	0,24	0,29
250	0,09	0,17	0,24	0,31	0,38	0,06	0,12	0,17	0,22	0,27
260	0,08	0,15	0,21	0,28	0,34	0,06	0,10	0,15	0,19	0,24
280	0,06	0,12	0,17	0,22	0,27	0,04	0,08	0,12	0,15	0,19
300	0,05	0,08	0,12	0,16	0,19	0,03	0,06	0,08	0,11	0,14

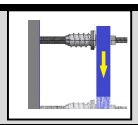
Intermediate values can be interpolated/ Data are limited due to ultimate limit state verifications of the performance given in Annex C4 under consideration of γ_M=2.5 and γ_F=1.4

Table C6.1: Shear load V values for single ResiTHERM® 16 for displacements w = 1, 2, 3, 4 or 5 mm, free end not rotatable, short term load

ResiTHERM® 16 										
For insulation thickness incl. insulation's plaster and t_{tol} if applicable	Shear load V Temp. 24°C / 40°C [kN]					Shear load V Temp. 50°C / 80°C [kN]				
	Deviation w					Deviation w				
[mm]	1 mm	2 mm	3 mm	4 mm	5 mm	1 mm	2 mm	3 mm	4 mm	5 mm
60	1,56	1,57	1,57	1,57	1,57	1,56	1,57	1,57	1,57	1,57
80	1,04	1,57	1,57	1,57	1,57	1,04	1,57	1,57	1,57	1,57
100	0,79	1,45	1,57	1,57	1,57	0,79	1,45	1,57	1,57	1,57
120	0,55	1,03	1,47	1,57	1,57	0,55	1,03	1,47	1,57	1,57
140	0,44	0,83	1,20	1,51	1,57	0,44	0,83	1,20	1,51	1,57
160	0,33	0,64	0,92	1,17	1,41	0,33	0,64	0,92	1,17	1,41
180	0,23	0,44	0,64	0,83	1,02	0,23	0,44	0,64	0,83	1,02
200	0,20	0,39	0,57	0,73	0,90	0,20	0,39	0,57	0,73	0,90
220	0,17	0,34	0,49	0,63	0,78	0,17	0,34	0,49	0,63	0,78
240	0,15	0,28	0,41	0,53	0,65	0,15	0,28	0,41	0,53	0,65
250	0,13	0,26	0,37	0,48	0,59	0,13	0,26	0,37	0,48	0,59
260	0,12	0,23	0,33	0,43	0,53	0,12	0,23	0,33	0,43	0,53
280	0,09	0,18	0,26	0,33	0,41	0,09	0,18	0,26	0,33	0,41
300	0,07	0,12	0,18	0,23	0,29	0,07	0,12	0,18	0,23	0,29

Intermediate values can be interpolated/ Data are limited due to ultimate limit state verifications of the performance given in Annex C4 under consideration of γ_M=2.5 and γ_F=1.4

Table C6.2: Shear load V values for single ResiTHERM® 16 for displacements w = 1, 2, 3, 4 or 5 mm, free end not rotatable, long term load

ResiTHERM® 16 										
For insulation thickness incl. insulation's plaster and t_{tol} if applicable	Shear load V Temp. 24°C / 40°C [kN]					Shear load V Temp. 50°C / 80°C [kN]				
	Deviation w					Deviation w				
[mm]	1 mm	2 mm	3 mm	4 mm	5 mm	1 mm	2 mm	3 mm	4 mm	5 mm
60	1,56	1,57	1,57	1,57	1,57	1,09	1,10	1,10	1,10	1,10
80	1,04	1,57	1,57	1,57	1,57	0,73	1,10	1,10	1,10	1,10
100	0,79	1,45	1,57	1,57	1,57	0,56	1,02	1,10	1,10	1,10
120	0,55	1,03	1,47	1,57	1,57	0,38	0,72	1,03	1,10	1,10
140	0,44	0,83	1,20	1,51	1,57	0,31	0,58	0,84	1,06	1,10
160	0,33	0,64	0,92	1,17	1,41	0,23	0,45	0,64	0,82	0,99
180	0,23	0,44	0,64	0,83	1,02	0,16	0,31	0,45	0,58	0,71
200	0,20	0,39	0,57	0,73	0,90	0,14	0,27	0,40	0,51	0,63
220	0,17	0,34	0,49	0,63	0,78	0,12	0,24	0,34	0,44	0,54
240	0,15	0,28	0,41	0,53	0,65	0,10	0,20	0,29	0,37	0,46
250	0,13	0,26	0,37	0,48	0,59	0,09	0,18	0,26	0,34	0,42
260	0,12	0,23	0,33	0,43	0,53	0,08	0,16	0,23	0,30	0,37
280	0,09	0,18	0,26	0,33	0,41	0,07	0,12	0,18	0,23	0,29
300	0,07	0,12	0,18	0,23	0,29	0,05	0,09	0,13	0,16	0,20

Intermediate values can be interpolated/ Data are limited due to ultimate limit state verifications of the performance given in Annex C4 under consideration of γ_M=2.5 and γ_F=1.4

Table C7.1: Displacements of the fixing system under tension load, temp. range 24°C/ 40°C

Fixing system	Tension load	Displacement	Displacement
	N	δ_{NO}	$\delta_{N\infty}$
	[kN]	[mm]	[mm]
ResiTHERM® 16 (M16 anchor rod)	4,29	0,43	0,67*

* acc. test results

The displacement in the base material must be added

Table C7.2: Displacements of the fixing system under pressure load, temp. range 24°C/ 40°C

Fixing system	Pressure load	Displacement	Displacement
	P	δ_{PO}	$\delta_{P\infty}$
	[kN]	[mm]	[mm]
ResiTHERM® 16 (M16 anchor rod)	4,29	0,26	0,50*

* according test results

Table C7.3: Displacements of the fixing system under tension load, temp. range 50°C/ 80°C

Fixing system	Tension load	Displacement	Displacement
	N	δ_{NO}	$\delta_{n\infty}$
	[kN]	[mm]	[mm]
ResiTHERM® 16 (M16 anchor rod)	4,29	0,26	0,78*

* acc. test results

The displacement in the base material must be added

Table C7.4: Displacements of the fixing system under pressure load, temp. range 50°C/ 80°C

Fixing system	Pressure load	Displacement	Displacement
	P	δ_{PO}	$\delta_{P\infty}$
	[kN]	[mm]	[mm]
ResiTHERM® 16 (M16 anchor rod)	4,29	0,26	0,78*

* according test results

Point thermal transmittance

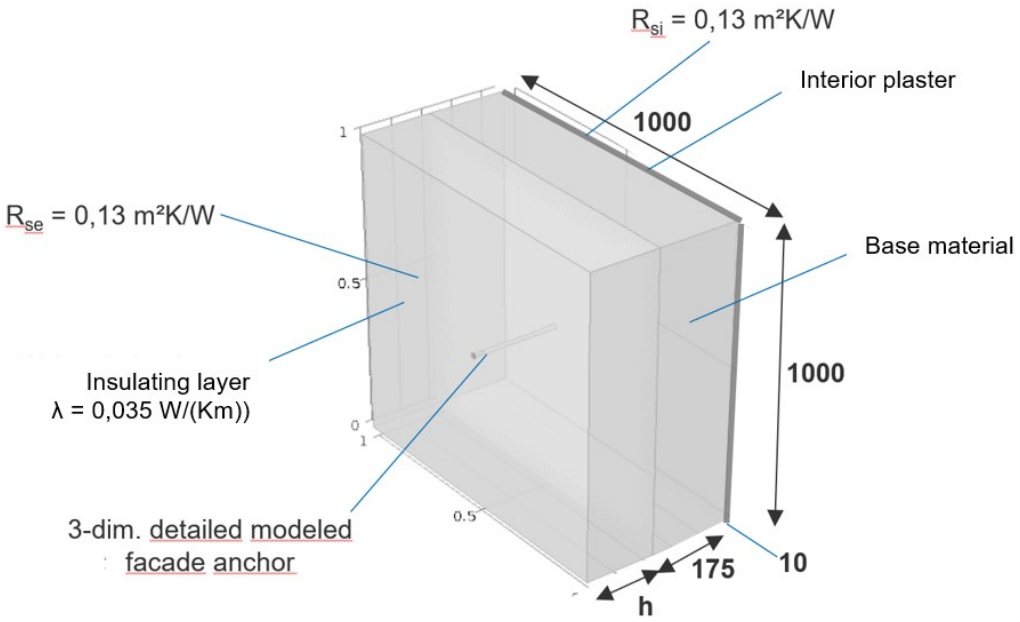


Table C8.1: Equivalent thermal conductivity values

Base material group	Description	Value of thermal conductivity λ
		[W/(m·K)]
Plaster	Gypsum plaster without aggergate	0,57
Base material	Normal weight concrete	2,30
Insulation	Insulation material	0,035
Anchor rod	Normal steel anchor rod M16	50
Anchor	Stainless steel anchor rod	17
Separation module	Thermal separation module PA6 GF	0,335

Table C9.1: The equivalent thermal conductivity λ_{eq}

concrete		ResiTHERM® 16 with anchor rod M16 8.8			ResiTHERM® 16 with anchor rod M16 A4		
Thickness of insulation hD	[mm]	60	150	300	60	150	300
		$\lambda_{eq\ 60}$	$\lambda_{eq\ 150}$	$\lambda_{eq\ 150}$	$\lambda_{eq\ 60}$	$\lambda_{eq\ 150}$	$\lambda_{eq\ 300}$
Equivalent thermal conductivity λ_{eq}	[W/mK]	1,1	8,5	22,6	0,9	7,5	11,2

Table C9.2 Point thermal transmittances for thermal conductivity

concrete		RESITHERM 16 with anchor rod M16 8.8			RESITHERM 16 with anchor rod M16 A4		
Thickness of insulation hD	[mm]	60	150	300	60	150	300
		$\chi_{\ 60}$	$\chi_{\ 150}$	$\chi_{\ 300}$	$\chi_{\ 60}$	$\chi_{\ 150}$	$\chi_{\ 300}$
Point thermal transmittance χ	[W/K]	0,0026	0,0049	0,0064	0,0025	0,0040	0,0041