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STRUCTURAL ELEMENT FOR HEAT INSULATIONDescription

5 The present invention relates to a structural element for thermal insulation according to the preamble of claim 1 or 7.

10 In the prior art, various embodiments of structural elements for thermal insulation are known, which mainly serve to support building parts overhanging buildings, such as balcony slabs, by a thermally insulated structural joint. The integrated reinforcing elements provide the necessary force or torque transmission, while the insulator body is responsible for complaining the two components apart from one another while leaving a joint thermally insulated.

15 As a rule, tensile reinforcing elements are provided in the relevant prior art which are usually made of a rod material made of metal, which consists in particular of stainless steel in the region of the insulator body and in the region outside the insulator body is made of concrete reinforcement steel. Stainless steel is used in the region of the insulator body or the structural joint on the one hand because of its corrosion resistance and on the other hand because of its poor thermal conductivity and is therefore preferable to concrete reinforcement steel material in the region of the insulator
20 body. The concrete reinforcement steel material, however, is usually used in the region outside the insulator body, where it is important for its corrosion resistance and thermal insulation properties, since the concrete reinforcement steel extends completely in the region of one of the two structural components.

25 More recently, efforts have been made to further optimise these structural elements for thermal insulation, wherein attempts have been made to produce the tensile reinforcing elements, which have in the past been almost entirely made of metal, from plastic, as this is significantly less expensive than stainless steel and also has a lower thermal conductivity than stainless steel. An example of such a structural element for thermal insulation with tensile reinforcing elements made
30 of plastic material can be found in DE-U 20 2012 101 574. The tensile reinforcing elements referred to in this document as tension relief rods are made of glass-fibre-reinforced plastic, wherein two mutually adjacent rods may respectively be connected to each other via a transverse plate at their ends in order to achieve a higher and more stable tensile force transfer. With this cumbersome

anchoring of two tension relief rods by means of a transverse plate, which anchoring causes installation problems in the connection of the structural component reinforcement, it can be easily deduced that plastic tensile reinforcing elements are especially poorly anchored in the adjacent structural components if they are smooth-walled as in the described prior art, and therefore require an end anchoring in the form of a transverse plate.

An alternative solution to the use of tensile reinforcing elements made of glass fibre or carbon fibre-reinforced plastic material can be found in WO-A 2012/071596, in which the tensile reinforcing elements consist of closed loops, which form an interlocking connection with the adjacent structural component due to their loop shape and so provide the necessary anchoring. Loop-shaped tensile reinforcing elements have been repeatedly proposed in the prior art. However, because of their short bond length in the adjacent structural component and their resulting lower ability to transmit larger tensile forces, they had significant drawbacks, wherein the loop shape itself regularly caused a collision with the connecting reinforcement and thus caused installation problems similar to the transverse plates described above.

These structural elements for thermal insulation with tensile reinforcing elements made of plastic material could not previously be successful, since their anchoring in the adjacent structural components led to previously unresolved problems. This is due to the fact that either the tensile reinforcing elements must enter into a reliable positive engagement with the adjacent structural component by special geometries (e.g. by loop shape, transverse plates and the like), which in turn causes installation problems due to the connecting reinforcement to be arranged in this region; or else it is necessary to attempt to provide the fibre-reinforced plastic tensile reinforcing elements from tube or rod material with profiling or ribbing provided on their outside. However, the anchoring of these ribbed plastic tensile reinforcing elements in the adjacent structural component suffers in that the fibre-reinforced plastic on the one hand and the concrete material of the adjacent structural component on the other hand usually have such different temperature elasticity values that inevitably different temperature dependent relative movements arise, which cause stresses or strains in the mutual contact regions. This leads to destruction by shearing either the ribs or the so-called concrete brackets between the ribs. It follows that the tensile reinforcing elements usually can no longer fulfil their function.

Another disadvantage of the tensile reinforcing elements made of plastic material is the lack of subsequent flexibility compared to steel, which makes it necessary that the desired shape and length of the tensile reinforcing elements is already taken into account in the rod manufacturing. As a result, the number of tensile reinforcing elements to be held in stock increases considerably
5 due to correspondingly high number of variants, which means significant disadvantages logistically.

In WO 2005 035 892 A1 fibre-reinforced plastic rods having an external thread are used, which are screwed along with the reinforcing bars into threaded sleeves. From this document, the features of the preamble of claims 1 and 7 are known. EP 2 000 605 A2 has set itself the task of avoiding welding
10 of reinforcing bars and proposes for this purpose a connection piece consisting of polymeric fibre or resin material for connection to the reinforcing bars. In DE 199 47 912 A1, a fastening element formed from a glass-fibre-reinforced plastic pipe is fastened with standard fittings on reinforcing bars.

15 Based on this prior art, it is the object of the present invention, to develop a structural element for thermal insulation with the features of the preamble of claim 1 or 7, such that it avoids the disadvantages of tensile reinforcing elements made of plastic material described and in particular allows an improved anchoring of tensile reinforcing elements in the adjacent concrete components.

20 This object is achieved according to the present invention by a structural element of the thermal insulation with the features of claim 1 or 7. Advantageous developments of the invention are the subject matter of the dependent claims, the wording of which is hereby incorporated by express reference into the description in order to avoid unnecessary text repetitions.

25 According to the invention, the tensile reinforcing elements are designed as multipart composite elements in that, at least in the region of the insulator body, they have a central portion which projects beyond the insulator body and at least partially consists of fibre-reinforced plastic material in that the tensile reinforcing elements in a region outside the insulator body have at least one anchoring portion with geometric and/or material properties deviating at least partially from the
30 central portion, which is connected to the central portion in a connection region, wherein the connection region is arranged at a distance from the insulator body, in that the central portion consists of an in particular cylindrical rod and/or tubular material and is formed on its radial outer

side substantially smooth-walled, at least in the region between insulator body and connection region.

5 This combination of materials is based on the finding that it is not necessary to forego the particular advantages of the plastic material in the region of the insulator body, just because in the region of the adjacent structural component it is preferred to replace the plastic material with other materials or geometries, especially ribbed steel, because of the anchoring problem. The result is thus the said multipart composite element with an unusual mix of materials, in that it is formed at least in the region of the insulator body of a corrosion-resistant and very poor heat-conducting
10 fibre-reinforced plastic material in the form of a cylindrical rod and/or tubular material, in that it is formed substantially smooth-walled on its radial outer side at least in the region between the insulator body and the connection region, and in that it has an anchoring portion in a region outside of the insulator body in the adjacent structural component, which can have other materials and/or geometries than the central portion and can be adapted to the installation conditions in the adjacent structural components, as is proven in the case of conventional metal tensile bars, but
15 which usually have a central portion made of stainless steel in the region of the insulator body.

Surprisingly, this composite element surpasses the previously known tensile reinforcing elements in every respect, but nevertheless makes it possible to select the materials used with regard to their
20 individual advantages for the different requirements in the insulator body or in the adjacent structural components and to disregard disadvantageous materials or geometries. Thus a central portion of fibre-reinforced plastic can be used in the region of the insulator body, which is less expensive and has significantly poorer heat conductivity than the stainless steel previously used there, while special requirements are not necessary in the region of the adjacent concrete
25 component, and therefore it is possible to work with cost-effective, easy to handle and subsequently flexible concrete reinforcement steel rods, which can be easily and inexpensively adapted to an optimal anchoring in the adjacent concrete structural components with appropriate external profiling.

30 The fact that the anchoring portions are preferably made of steel means that they can be anchored in a conventional manner in the adjacent structural components, without, as in the case with fibre-reinforced plastic rods, this requiring exotic transformations (in the form of the mentioned transverse plates, loops, etc.) and thereby causing installation problems with the connecting

reinforcement, or when using profiled plastic rods that this causes damage in the mutual contact region, which results from the different temperature elasticity values of concrete on the one hand and plastic rod on the other hand. In the case of reinforcing bars made of steel, however, such an anchoring is usually carried out by a ribbing of the lateral surface of the reinforcing bars, wherein said ribbing can be easily introduced during the manufacturing process of these reinforcing elements.

Expediently, the anchoring portion of the tensile reinforcing elements is fixed at a free end of the associated central portion. If, in this case, the anchoring portion of the tensile reinforcing elements is arranged in alignment with this central portion extending essentially horizontally in the installed state of the structural element, this results in an arrangement of the different parts of the tensile reinforcing elements behind one another or in a series connection, wherein each part is arranged where it has the most favourable material properties.

In this context, it is particularly preferred if the central portion of a tensile reinforcing element has an anchoring portion at each of its two free ends and thus results in the desired alternating arrangement of anchoring portion, central portion of fibre-reinforced plastic material and, again, anchoring portion.

As far as concerns the materials of the multipart composite element, i.e. the tensile reinforcing element, it is preferred that the anchoring portion consists of concrete reinforcement steel, which has a temperature elasticity value, i.e. a thermal expansion in the order of the temperature elasticity value or thermal expansion of concrete, and thus non-destructive corresponding temperature dependent deformation or expansion of the concrete can result. Furthermore, it is preferred that the central portion of the tensile reinforcing element consists of fibre-reinforced and in particular glass-fibre-reinforced plastic material, which is sufficiently resilient in the direction of tensile force and has poor thermal conductivity, as is desired in the region of the insulator body. It should be noted that the term "fibre-reinforced plastic material" also includes such fibre reinforcements, in particular glass fibre reinforcements whose fibre content, in particular glass fibre content, is higher than 85 wt.%, so that the weight of the matrix material used in addition to the fibres, such as resin, is less than 15% compared to the weight of this reinforcing element.

As in the case of the known tensile reinforcing elements, it is also possible to produce the tensile reinforcing elements from a tube or rod material both in the region of the anchoring portion and in the region of the central portion. The tensile reinforcing elements, and in particular the pipe or rod material, may be profiled or ribbed on the outside thereof to provide the desired interlocking with the adjacent concrete components, which provides the necessary anchoring of the tensile reinforcing elements in the adjacent structural components.

By means of suitable geometries and dimensions, the anchoring portion and associated central portion can be fixed to one another in such a way that they are capable of optimum tensile force transmission and thus can fulfil the function intended for them. As far as the mutual fixing is concerned, it is advisable to use interlocking, force-based and/or bonded measures, such as, for example, a socket connection, as disclosed, for example, in DE-A 102008018325, an adhesive or screw connection or the like.

In addition, in particular, a welded joint is recommended, which is particularly useful if in the non-weldable central portion, consisting of fibre-reinforced plastic, an internal anchoring element is used as a welding aid, as a so-called welding insert. This internal anchoring element can be inserted at any time, for example by screwing into the central portion. Instead, however, it is also of particular advantage if the internal anchoring element is already formed or laminated directly during the production of the central portion.

While this internal anchoring element can theoretically extend over the entire length of the central portion, in particular if it is already introduced during the production of the central portion, in order to ensure a reliable tensile force transmission in particular, it can be particularly advantageous if this internal anchoring element only extends over a part region in the axial direction to thereby avoid cold spots. A continuous metallic internal anchoring element as a welding aid means inevitably that the insulating function of the existing fibre-reinforced plastic central portion is interrupted and disturbed. In order for the internal anchoring element, which extends only over a part region in the axial direction, to be suitable for receiving the tensile force to be transferred by the anchoring portion to be connected, it must be anchored or supported in the central portion, for example, by an interlocking connection.

As far as the internal anchoring element extending over the entire length of the central portion is concerned, it can have a larger material cross section respectively in the intended welding region to improve the thermal insulation properties, than in the axial part regions outside of these weldable regions, in particular between two welding regions. This can be done, for example, even with a continuous production of the material for the central portion by a chain arrangement, that is, an alternating arrangement of welding portions and connecting links. For this purpose, in each case at the predetermined regions in which an anchoring portion is to be connected to the central portion, the welding portion of the welding aid has an enlarged material cross-section sufficient for welding, while the connecting links in the connection regions between two welding portions have a reduced material cross-section, which may consist of a material suitable for tensile force transmission, for example made of a steel cable.

The anchoring portion can be connected to the internal anchoring element by means of induction welding, laser welding or similar welding methods suitable for the plastic material of the central portion.

Since the concrete reinforcement steel of the terminal anchoring portions must meet a minimum concrete covering for corrosion protection reasons, the anchoring portions must not extend as far as the insulator body, in order to avoid corrosion of the anchoring portions. For this reason, it is expediently provided that the connection region in the installed state has a horizontal distance L_1 from the insulator body, which is at least once and at most five times as large as the diameter d_M of the central portion. Thereby, the fixing of the anchoring portion at the central portion outside of the insulator body can be done in a region which is protected from corrosion by the required minimum concrete covering.

However, the spacing of the connection region from the insulator body has a further significant effect and advantage. According to the invention, the central portion is designed to be substantially smooth-walled on its radial outer side, at least in the region between the insulator body and the connection region. This avoids excessive bonding between the central portion and the material surrounding the central portion of the adjacent structural component and forms a buffer zone which ensures that the flexural strength of the tensile reinforcing elements does not abruptly change but only gradually changes upon exiting the insulator body and entering the adjacent structural component. Because an abrupt jump in rigidity would lead to high loads in the tensile

reinforcing element and at the front edge of the adjacent structural component. On the one hand, the excessively high loads can cause a delamination of the tensile reinforcing element consisting of fibre-reinforced plastic material. On the other hand, the building material may flake off at the leading edge of the adjacent structural component, which in turn would destroy or reduce the required minimum concrete covering and thus eliminate the corrosion protection for the tensile reinforcing element.

The substantially smooth-walled central portion thus serves to prevent a close-to-joint anchoring of the tensile reinforcing element in the adjacent structural component, so that anchoring takes place only in the connection region and in the region of the tensile reinforcing element following in the axial direction, namely the anchoring portion. By displacing the connection region away from the close-to-joint edge region or from the insulator body into the adjacent structural component, the length of the portions of the tensile reinforcing element is increased with reduced flexural strength. As a result, the tensile reinforcing elements clamped in this way are overall more flexible and significantly better able to follow temperature dependent relative movements between the adjacent structural components in the transverse or thrust direction. This increase in the flexural or thrust softness avoids too rapid or severe fatigue of the tensile reinforcing elements.

In the prior art, instructions are to be found to the effect that the free, i.e. not radially supported length of a tensile reinforcing element consisting of fibre-reinforced plastic material between the two clamping points must be as short as possible in order to keep the total elongation of tensile reinforcing elements in the axial direction as small as possible. However, the object of the present invention intentionally accepts such an increase in axial expansion, in that the clamping points are shifted away from the insulator body into the adjacent structural components, thereby making the tensile reinforcing elements more flexible, which advantageously results in the desired reduction in material fatigue.

In other words: If, as usual in the prior art, a tensile reinforcing element consisting of a plastic material is provided with a ribbed circumferential surface and inserted directly into an adjacent concrete component and anchored there, the region with reduced flexural strength would be limited to the dimensions of the insulator body. It is obvious that such a too rigid tensile reinforcing element will not be able to sufficiently follow the usual temperature dependent relative movements of the two adjacent structural components. At the same time the tensile reinforcing element in the transition region between insulator body and adjacent structural components would

have a jump in rigidity due to the abrupt transition between the different surrounding materials, which would lead to excessive and possibly destructive loads associated with the tensile reinforcing element as well as the material of the adjacent structural component.

5 Although the length L_2 of the connection region differs depending on the connection technology between the centre portion and the anchoring portion, in most cases the connection technology ensures that the corrosion-prone anchoring portion, which is preferably made of concrete reinforcement steel, is shielded in the connection region by the plastic material of the central portion, so that the distance from the insulator body and thus the joint between the two adjacent
10 structural components is increased accordingly. Thus, the length L_2 of the connection region can be taken into account in these cases, even in determining the minimum concrete covering, if the anchoring portion would be located too close to the insulator body and thus at the joint, since the central portion surrounding the anchoring portion provides the necessary corrosion protection. It is therefore to be seen as an advantage of the present invention that the connection region in the
15 installed state has a length L_2 in the horizontal direction which is at least twice and at most ten times as large as the diameter d_V of the anchoring portion.

In order to provide the necessary anchoring of the tensile reinforcing elements in the adjacent structural components, the anchoring portion should extend in the installed state from the
20 connection region in the horizontal direction over a length L_3 which is at least twenty times as large as the diameter d_V of the anchoring portion. This ensures that the tensile reinforcing elements according to the invention can be used without end anchors such as transverse plates, loops, etc. and yet can provide the desired anchoring, even against the background that the smooth-walled region of the central portion between the insulator body and connection region and the terminal
25 region itself hardly contributes to anchoring.

The structural element according to the present invention for thermal insulation expediently has compression elements and/or lateral force elements in addition to the tensile reinforcing elements for pressure force and/or transverse force transmission between the adjacent structural
30 components, as is well known in the relevant prior art and as is usual in such structural elements for thermal insulation.

As far as is relevant in the present case with respect to the material of the adjacent structural components, in particular the building and the projecting outer part of concrete, this is to be understood as any form of a hardening and/or settable building material, especially a cementitious, fibre-reinforced building material such as concrete, such as high-strength or ultra-high-strength concrete or high-strength or ultra-high-strength mortar, a synthetic resin mixture or a reaction resin mixture.

Further features and advantages of the present invention will become apparent from the following description of exemplary embodiments with reference to the drawings. Shown in the drawings

Fig. 1 a structural element according to the present invention for thermal insulation in a schematic and partially sectioned side view;

Figs. 2 to 6 various exemplary variants for mutual fixing of a central portion made of fibre-reinforced plastic material and an anchoring portion of concrete reinforcement steel.

Fig. 1 shows a structural element for thermal insulation 1 with a multipart cuboid insulator body 2, which is intended to be arranged in a structural joint left between two concrete structural components (which are not shown here, but whose position is indicated only by the reference signs A, B), and to space these two concrete components A, B apart from each other in a thermally insulated manner. The insulator body 2 is composed of several parts to allow the installation of reinforcing elements in the form of tension rods 3, in the form of transverse force bars 4 and in the form of compression elements 5. The arrangement of the reinforcing elements takes place in the manner known and customary in the prior art, namely by the tensile reinforcing elements 3 being arranged in the upper region of the insulator body 2, said tensile reinforcing elements 3 extending in the installed state in the horizontal direction, and serving for the tensile force transmission between the two components A, B connected to the structural element for thermal insulation, and being anchored thereto in these components.

In the lower region, the so-called pressure zone of the insulator body 2, the compression elements 5 are arranged, and with a horizontal extension direction, wherein they do not protrude relative to the insulator body 2. Finally, transverse force bars 4 are still provided, which extend in the region of the insulator body 2 inclined to the horizontal and corresponding to the loads to be absorbed by

the reinforcing elements of the structural element for thermal insulation, from the tension zone on one side of the insulator body obliquely downward into the pressure zone on the other side of the insulator body, in order to be angled upwards vertically in the direction of the tensile zones and then to extend after another bending parallel to the tensile reinforcing elements.

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Essential for the present invention are the tensile reinforcing elements 3, from which it is possible to recognise a tubular central portion 3a of fibre-reinforced plastic in Fig. 1, which extends in the region of the insulator body 2 in the horizontal direction and somewhat on both sides of the insulating body, namely protrudes in the horizontal direction by an axial length $L_1 + L_2$ and is arranged with this projecting region in the installed state in the region of the adjacent structural components A, B. The length L_2 indicates the region where the central portion 3a and the anchoring portion 3b overlap, forming a connection region 3h, wherein the diameter of the central portion d_M is greater than the diameter of the anchoring portion d_V and thus the central portion engages over the anchoring portion.

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The length L_1 in turn means the axial distance of the connection region 3h from the insulator body 2. And the length L_3 indicates the extent to which the anchoring portion 3b extends from the connection region 3h or the end face of the central portion 3a into the structural component A. Fig. 1 does not show the full length of the anchoring portion 3a, and thus the dimension of the length L_3 in Fig. 1 does not correspond to the overall length of the anchoring portion 3b.

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The tensile reinforcing element 3 of Fig. 1 also has rod-shaped anchoring portions 3b made of concrete reinforcement steel, which are inserted into the tubular material of the central portion and fixed there.

25

Suitable examples of the mutual fixing of central portion and anchoring portion can be seen in Figs. 2 to 6, which will be discussed in more detail below.

Fig. 2 shows the insertion of the anchoring portion 3b into a cylindrical bore 3c of the central portion 3a. The interconnection of central portion and anchoring portion may, for example, be accomplished by a press fit and/or assisted by the additional use of an adhesive to actually provide a stable connection suitable for transferring tensile forces. The axial length, in which the anchoring

30

portion 3b and the central portion 3a overlap, is indicated in Fig. 2 as in Fig. 1 with the reference numeral L_2 and corresponds to the axial length of the connection region 3h.

Fig. 3 shows a variant of this, in which the free end 3d of the anchoring portion 3b inserted into the tubular material of the central portion 3a is provided on its outer side with a profiling that allows adhesive, mortar or similar connection means to find more space and a positive engagement with the profiling in order to improve the mutual connection or to be able to ensure this.

In Fig. 4, the free end 3d of the anchoring portion 3b has an external thread and enters the cylindrical opening 3c of the central portion 3a, which opening 3c again has an internal thread, thus allowing the anchoring portion 3b and central portion 3a to be screwed together.

Finally, Figs. 5 and 6 show two sleeve connections, i.e. the mutual fixing of anchoring portion 3b and central portion 3a with the interposition of a sleeve 3e, which has two mutually aligned bores 3f, 3g on its two opposite sides. However, the two bores are arranged in the sleeve so that they have no mutual connection. The one bore 3g is thus intended to receive the free end 3d of the anchoring portion 3b, either via a simple plug-in connection or with the additional use of adhesive or other connecting means. On the other side of the sleeve 3e the bore 3f is provided last, into which the free end 3h of the central portion 3a is inserted and fixed there, for example via a press connection, plug connection or adhesive connection.

As can be seen from Fig. 1, the central portion 3a extends with its plastic material far beyond the insulator body and thus makes it possible for the anchoring portions 3b consisting of concrete reinforcement steel to be connected to the central portion 3a in such a region, which is not yet at risk of corrosion. As a result, the advantages that are essential to the invention can be achieved, namely to be able to use the particularly advantageous plastic material of the central portion in the region of the insulator body, which is characterised in particular by lower costs and a particularly poor thermal conductivity compared to stainless steel. And also in the region outside of the insulator body, subsequently in the region of the structural components, the anchoring portions consist of concrete reinforcement steel, which has similar temperature elasticity values as the surrounding concrete structural component and thus can enter into an optimal connection with the concrete, through which the tensile force can be transmitted from the concrete into the tensile

reinforcing element and vice versa, without causing the destruction which would otherwise occur due to excessive relative movements.

5 In summary, the present invention has the advantage of providing a structural element for thermal insulation having tensile reinforcing elements in the form of multipart composite elements consisting of a central portion of fibre-reinforced plastic material on the one hand and at least one anchoring portion of steel and in particular concrete reinforcement steel on the other. As a result, the different materials can be used exactly according to their properties and advantages, which was previously not possible in the prior art.

List of reference signs

	1	Structural element for thermal insulation
	2	Insulator body
5	3	Tension rods
	3a	Central portion
	3b	Anchoring portions
	3c	Cylindrical opening of the central portion 3a
	3d	Free end of the anchoring portion 3b
10	3e	Sleeve
	3f	Bore in the sleeve 3e for anchoring portion 3b
	3g	Bore in the sleeve 3e for central portion 3a
	3h	Connection region
	4	Shear force rods
15	5	Compression elements
	A	Concrete component
	B	Concrete component
	d_M	Diameter of the central portion
	d_V	Diameter of anchoring portions
20	L_1	Axial distance of the connection region 3h from the insulator body
	L_2	Length of the connection region 3h in the axial direction
	L_3	Extent to which the anchoring rod portion extends from the connection region 3g into the structural component A or B respectively

Patentkrav

1. Bygningselement til varmeisolering mellem to bygningsdele, især mellem en bygning (A) og en fremstående yderdel (B), bestående af et isoleringslegeme (2),
5 der skal anbringes mellem de to bygningsdele, og af armeringselementer i form af i det mindste trækarmeringselementer (3), der i bygningselementets (10) indbyggede tilstand i det væsentlige forløber vandret gennem isoleringslegemet og på tværs af dettes i det væsentlige vandrette udstrækning i længden og hver især rager frem i vandret retning i forhold til isoleringslegemet og derved kan
10 sluttes til en af de to fortrinsvis af beton bestående bygningsdele, idet trækarmeringselementerne (3) er udformede som kompositelementer i flere dele, idet de i det mindste i isoleringslegemets (2) område har et midterafsnit (3a), der rager frem i forhold til isoleringslegemet og i det mindste delvis består af fiberforstærket kunststofmateriale, idet trækarmeringselementerne (3) i et
15 område uden for isoleringslegemet (2) i det mindste har et forankringsafsnit (3b) med i det mindste delvis fra midterafsnittet (3a) afvigende geometrisk form og/eller materialeegenskaber, der er tilsluttet til midterafsnittet (3a) i et tilslutningsområde (3h), idet tilslutningsområdet (3h) er anbragt i afstand fra isoleringslegemet, at midterafsnittet (3a) består af et især cylindrisk stav- og/eller
20 rørmateriale, og idet forankringsafsnittet (3b) og det tilhørende midterafsnit (3a) er fastlagt formbetinget, kraftbetinget og/eller stofsluttende til hinanden i tilslutningsområdet (3h), og den gensidige fastlæggelse af forankringsafsnittet (3b) og det tilhørende midterafsnit (3a) foregår over en som muffe (3e) dannet muffeforbindelse, og muffen (3e) på sine to over for hinanden liggende sider har
25 to med hinanden flugtende borer (3f, 3g), idet de to borer er anbragt således i muffen (3e), at de ikke har nogen gensidig forbindelse, og den ene boring (3g) er indrettet til at optage den frie ende (3d) af forankringsafsnittet (3b), og den frie ende (3h) af midterafsnittet (3a) er stukket ind i den boring (3f), der befinder sig på den anden side af muffen (3e), og fastlagt der, **kendetegnet**
30 **ved, at** midterafsnittet (3a) på sin radiale yderside i det mindste i området mellem isoleringslegemet (2) og tilslutningsområdet (3h) er udformet i det væsentlige glatvægget.

2. Bygningselement til varmeisolering ifølge i det mindste krav 1,

kendetegnet ved,

at trækarmerringselementernes (3) forankringsafsnit (3b) er tilsluttet til en fri ende af det tilhørende midterafsnit (3a) og anbragt flugtende med dette

5 midterafsnit (3a), der i bygningselementets (1) indbyggede tilstand i det væsentlige forløber vandret.

3. Bygningselement til varmeisolering ifølge i det mindste krav 2,

kendetegnet ved,

10 **at** et trækarmerringselements midterafsnit (3a) har et forankringsafsnit (3b) på hver af sine to frie ender.

4. Bygningselement til varmeisolering ifølge i det mindste krav 1,

kendetegnet ved,

15 **at** trækarmerringselementernes (3) forankringsafsnit (3b) består af stål, især betonstål, og/eller at trækarmerringselementernes (3) midterafsnit (3a) består af glasfiberforstærket kunststofmateriale.

5. Bygningselement til varmeisolering ifølge i det mindste krav 1,

20 **kendetegnet ved,**

at trækarmerringselementernes (3) forankringsafsnit (3b) og/eller trækarmerringselementernes (3) midterafsnit (3a) består af et stav- og/eller rørmateriale, og/eller at trækarmerringselementernes (3) forankringsafsnit (3b) på sin yderside har en udadtil, især radialt fremstående profilering, især med ribber.

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6. Bygningselement til varmeisolering ifølge i det mindste krav 1,

kendetegnet ved,

at den gensidige fastlæggelse af forankringsafsnittet (3b) og det tilhørende midterafsnit (3a) foregår via en klæbeforbindelse og/eller en skrueforbindelse.

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7. Bygningselement til varmeisolering mellem to bygningsdele, især mellem en bygning (A) og en fremstående yderdel (B), bestående af et isoleringslegeme (2), der skal anbringes mellem de to bygningsdele, og af armeringselementer i form af i det mindste trækarmerringselementer (3), som i bygningselementets (10)

35 indbyggede tilstand i det væsentlige forløber vandret og på tværs af

isoleringslegemets i det væsentlige vandrette udstrækning i længden gennem dette og hver især rager frem i vandret retning i forhold til isoleringslegemet og derved kan sluttes til en af de to fortrinsvis af beton bestående bygningsdele, idet trækarmringselementerne (3) er udformede som kompositelementer i flere dele, idet de i det mindste i isoleringslegemets (2) område har et midterafsnit (3a), som rager frem i forhold til isoleringslegemet og i det mindste delvis består af fiberforstærket kunststofmateriale, idet trækarmringselementerne (3) i et område uden for isoleringslegemet (2) i det mindste har et forankringsafsnit (3b) med i det mindste delvis fra midterafsnittet (3a) afvigende geometriske

egenskaber og/eller materialeegenskaber, der er sluttet til midterafsnittet (3a) i et tilslutningsområde (3h), idet tilslutningsområdet (3h) består af et især cylindrisk stav- og/eller rørmateriale, og idet forankringsafsnittet (3b) og det tilhørende midterafsnit (3a) i tilslutningsområdet (3h) er fastlagt til hinanden formbetings, kraftbetings og/eller stofslyttende, **kendetegnet ved, at** midterafsnittet (3a) på sin radiale yderside i det mindste i område mellem isoleringslegemet (2) og tilslutningsområde (3h) i det væsentlige er udformet glatvægget, og at den gensidige fastlæggelse af trækarmringselementernes forankringsafsnit og det tilhørende midterafsnit foregår via en svejseforbindelse, og at der hertil er indsat et indre forankringselement, der skal anbringes i midterafsnittet, som svejsehjælp i midterstavafsnittet, og at indsætningen af det indre forankringselement i midterstavafsnittet foregår under fremstillingen af midterafsnittet, især ved indformning eller indlaminering eller efterfølgende især ved indskruning eller indklæbning.

25 **8.** Bygningselement til varmeisolering ifølge i det mindste krav 1,

kendetegnet ved,

at tilslutningsområdet (3h) den i indbyggede tilstand har en vandret afstand (L_1) fra isoleringslegemet (2), som er mindst en gang og højst fem gange så stor som midterafsnittets (3a) diameter (d_M).

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9. Bygningselement til varmeisolering ifølge i det mindste krav 1,

kendetegnet ved,

at tilslutningsområdet (3h) i den indbyggede tilstand har en længde (L_2) i vandret retning, som er mindst to gange og højst ti gange så stor som

forankringsafsnittets (3b) diameter (d_v).

10. Bygningselement til varmeisolering ifølge i det mindste krav 1,
kendetegnet ved,

- 5 **at** forankringsafsnittet (3b) i den indbyggede tilstand ud fra tilslutningsområdet (3h) i vandret retning strækker sig over en længde (L_3), som er mindst tyve gange så stor som forankringsafsnittets (3b) diameter (d_v).

- 11.** Bygningselement til varmeisolering ifølge i det mindste krav 1,
10 **kendetegnet ved,**
at bygningselementet til varmeisolering (1) foruden trækarmerringselementerne (3) har trykelementer (5) og/eller radialkraftelementer (4).



