Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-22/6254 of 28/09/2022
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	Slab connection ISOPRO IP and ISOMAXX IM
Product family to which the construction product belongs:	Product code: 05 Load bearing thermal insulating elements which form a thermal break between balconies and internal floors
Manufacturer:	PohlCon Gmbh Nobelstrasse 51 12057 Berlin Germany
Manufacturing plant(s):	PohlCon GmbH, Am Güterbahnhof 20, 79771 Klettgau, Germany
This UK Technical Assessment contains:	35 pages including 4 annexes which form an integral part of this assessment
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	UKAD No. 050001-00-0301 *Load bearing thermal insulating elements which form a thermal break between balconies and internal floors*

1 Technical description of the product

The Slab connection ISOPRO IP and ISOMAXX IM is used as load-bearing thermal insulation element to connect reinforced concrete slabs under static or quasi-static load.

The product description is given in Annex A.

The characteristic material values, dimensions and tolerances of the Slab connection ISOPRO IP and ISOMAXX IM not indicated in Annexes A01 to A09 shall correspond to the respective values laid down in the technical documentation of this UK Technical Assessment.

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

The performances given in Section 3 are only valid if the Slab connection ISOPRO IP and ISOMAXX IM is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this UK Technical Assessment is based lead to the assumption of a working life of the Slab connection ISOPRO IP and ISOMAXX IM of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Load bearing capacity	See Annex C01

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire of materials	See Annex A09
Resistance to fire	See Annex C02 – C03

3.3 Health, hygiene and the environment (BWR 3)

Not relevant

3.4 Safety and accessibility in use (BWR 4)

Not relevant

3.5 Protection against noise (BWR 5)

Essential characteristic	Performance
Impact sound insulation	No performance assessed

3.6 Energy economy and heat retention (BWR 6)

Essential characteristic	Performance
Thermal resistance	No performance assessed

3.7 Sustainable use of natural resources (BWR 7)

No Performance assessed

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied

4.1 System of assessment and verification of constancy of performance

According to UKAD No. 050001 00 0301and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011 as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1+ applies.

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

5.1 UKCA marking for the product/ system must contain the following information:

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance
- UKTA number.

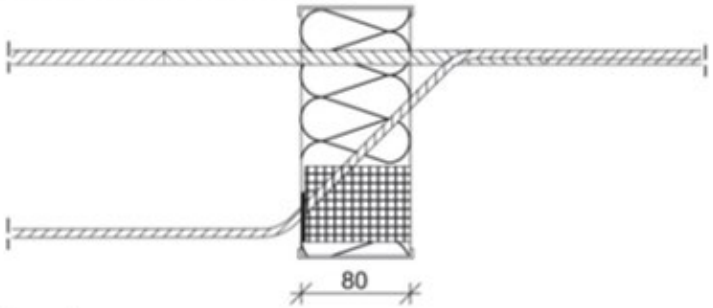
On behalf of the British Board of Agrément 	
Date of Issue: 28 September 2022	**Hardy Giesler** Chief Executive Officer

British Board of Agrément,
1st Floor Building 3,
Hatters Lane,
Croxley Park
Watford
WD18 8YG

ANNEX A1
Product description / overview elements type ISOPRO

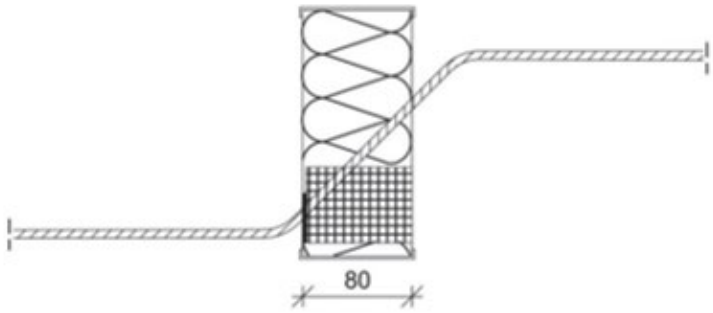
ISOPRO (80 mm joint width)
Type for transmission of bending moments and shear forces

TYPE IP



Type for transmission of shear forces

TYPE IPQ
TYPE IPQS



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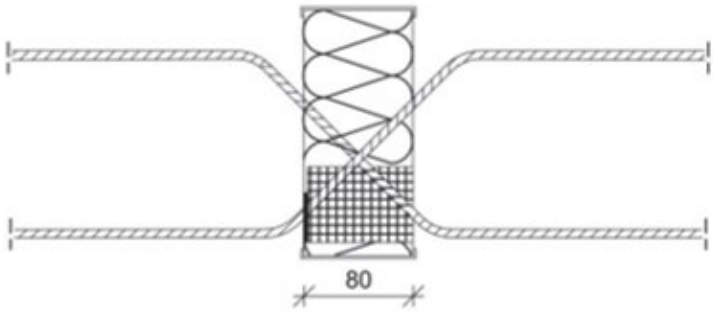
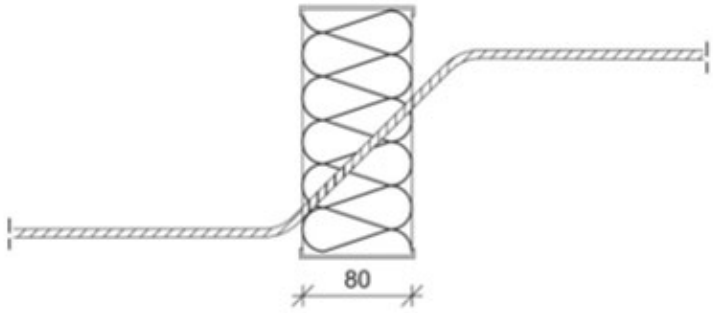
TYPE IPQQS



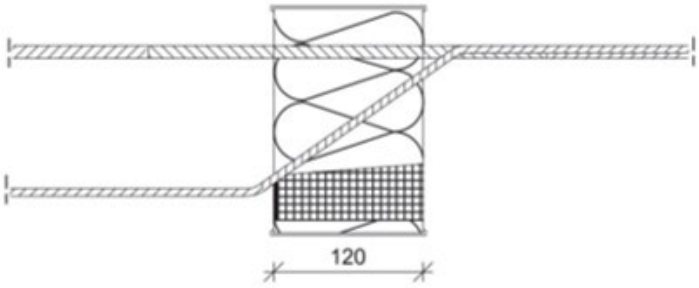
TYPE IPQZ
TYPE IPZQ



ANNEX A2
Product description / overview elements type ISOMAXX

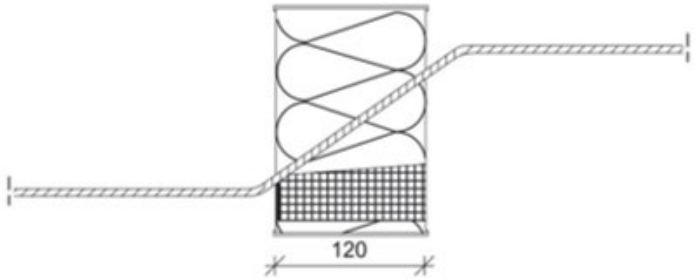
Type for transmission of bending moments and shear forces

TYPE IM

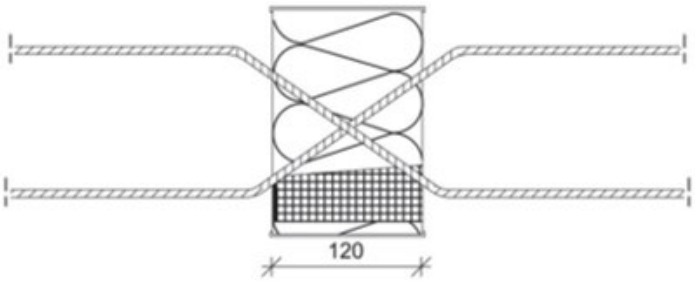


Type for transmission of shear forces

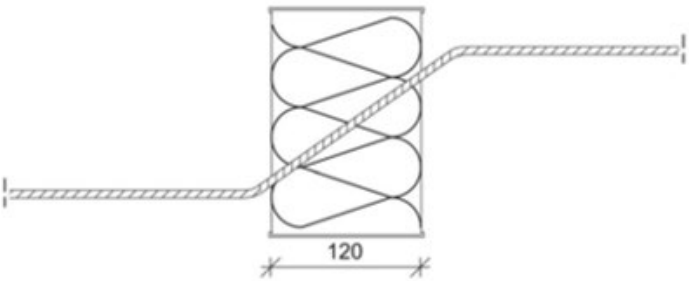
TYPE IMQ
TYPE IMQS



TYPE IMQQ
TYPE IMQQS



TYPE IMQZ
TYPE IMZQ

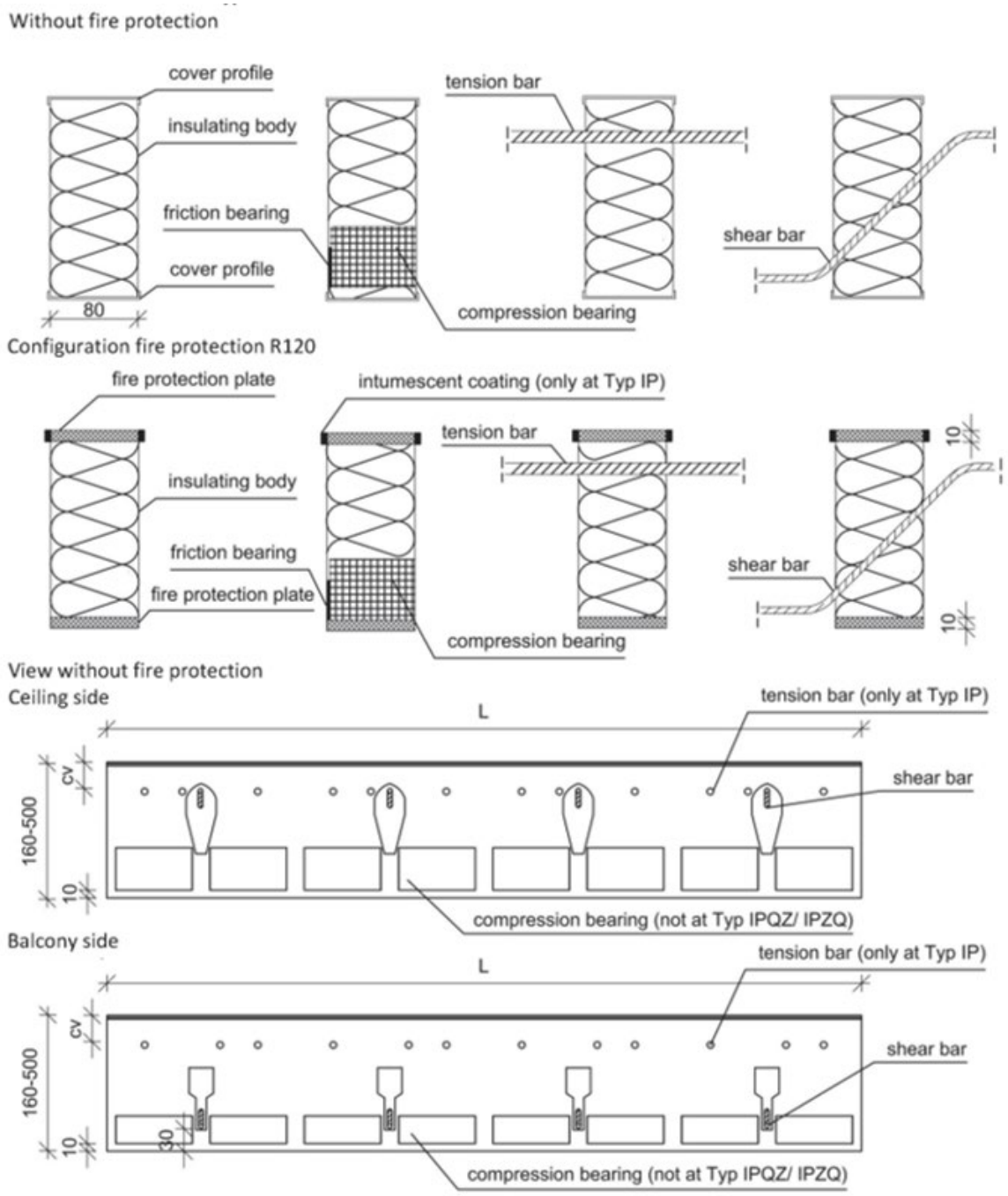


ANNEX A3
Product description / Dimensions

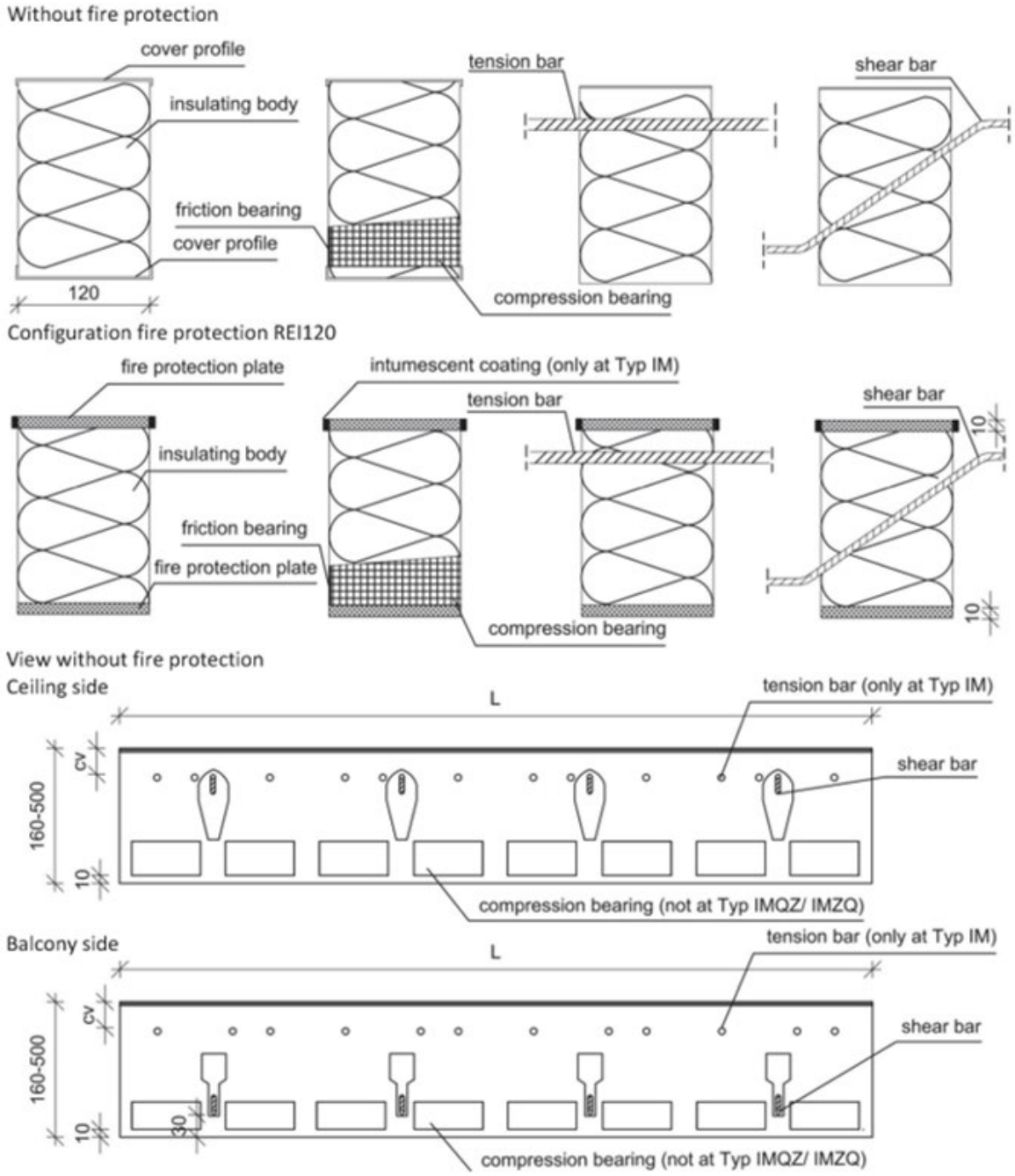
Tension and shear bars consist of stainless reinforcing steel or stainless round steel in the insulation joint (80 mm or 120 mm) over a length of at least 100 mm within the adjacent concrete components to the end of which reinforcing steel is welded.

Tension bars	Diameter	≤ 14 mm
	Quantity per metre	4 ≤ n ≤ 16
	Axial distance	≤ 300 mm, average ≤ 250 mm
Shear bars	Diameter	≤ 12 mm
	Quantity per metre	n ≥ 4
	Axial distance	≤ 300 mm, average ≤ 250 mm
	Inclination in the insulation point	30° - 60°
	In the concrete free area	Bars must not be bent
	Mandrel diameter	According to Annex A7 and subject to EN 1992-1-1
	Starting point of bend	n ≥ (2 x diameter) of free concrete surface, measured in bar direction
Concrete compression bearing	Quantity per metre	4 ≤ n ≤ 8
	Clear distance	≤ 250 mm

ANNEX A4
Product description / structure of elements type ISOPRO

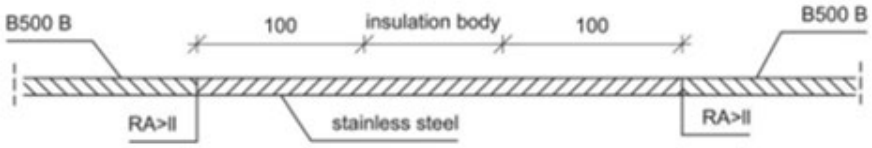


ANNEX A5
Product description / structure of elements type ISOMAXX

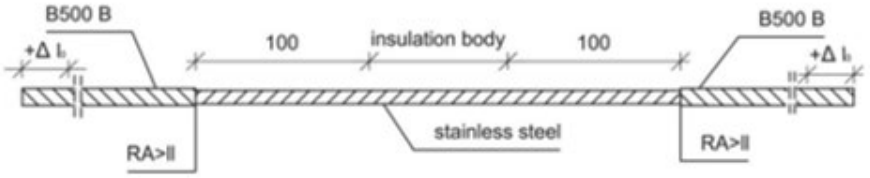


ANNEX A6
Product description / versions of tension bars

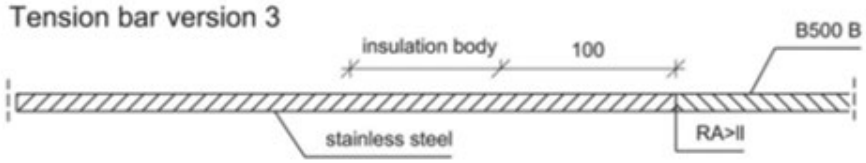
Tension bar version 1



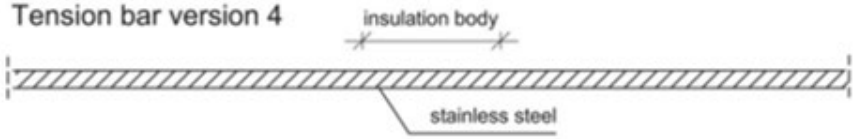
Tension bar version 2



Tension bar version 3

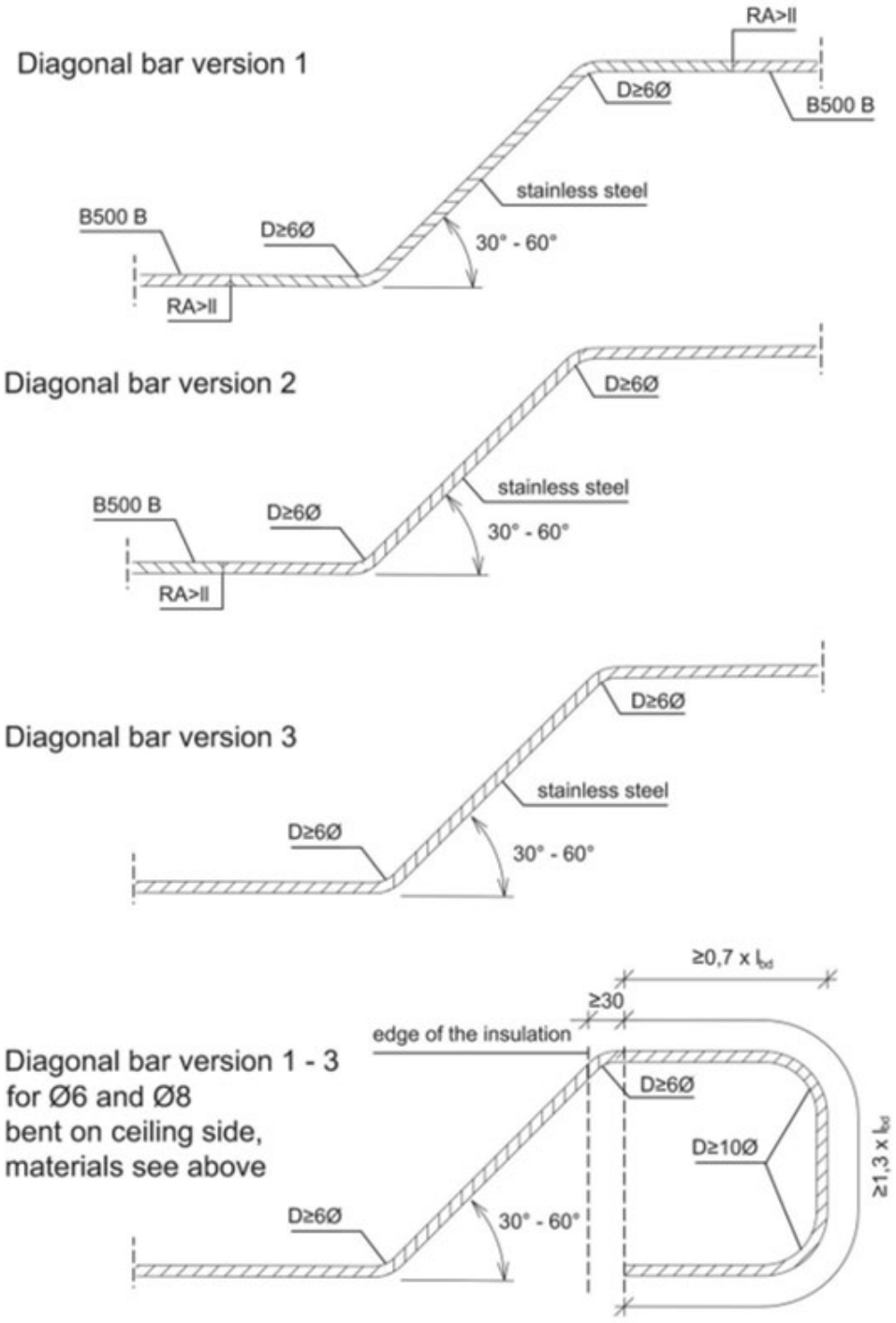


Tension bar version 4



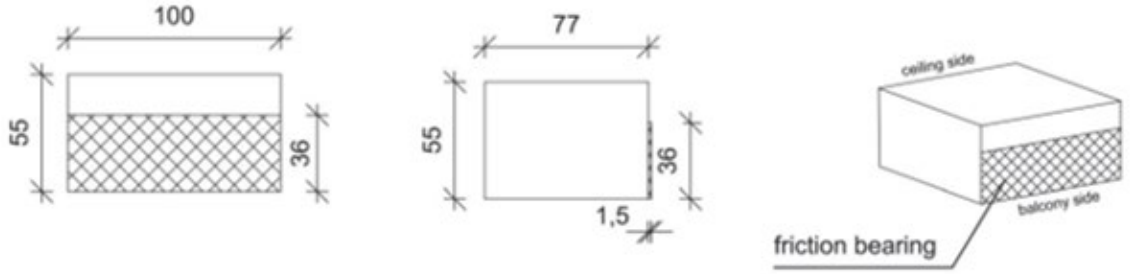
Tension bar versions 1 and 2					
Tension bar diameter $Ø_1$	$Ø_2$	$Ø_1$ [mm]	steel bar $Ø_1$ [N/mm²]	stainless steel $Ø_2$ $R_{p\,0.2}$ [N/mm²]	Δl_0 [mm]
6	6	6	500	500	-
8	8	8	500	500	-
8	7	8	500	700	12
8	6,5	8	500	800	18
10	10	10	500	500	-
10	8	10	500	820	20
12	12	12	500	500	-
12	10	12	500	760	16
14	14	14	500	500	-
14	12	14	500	700	14

ANNEX A7
Product description / versions of transversal bars

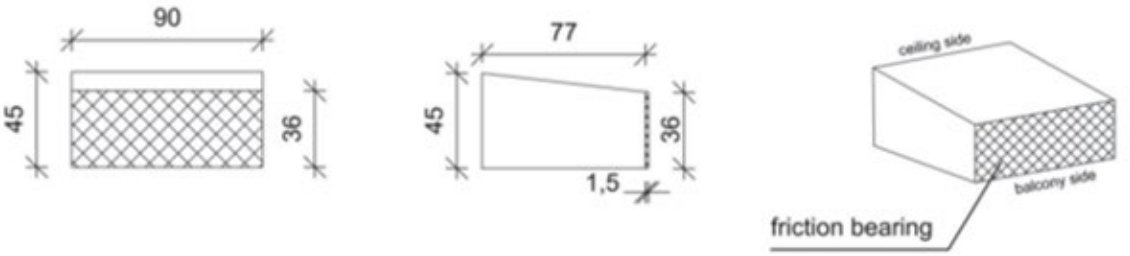


ANNEX A8
Product description / versions of concrete compression bearings

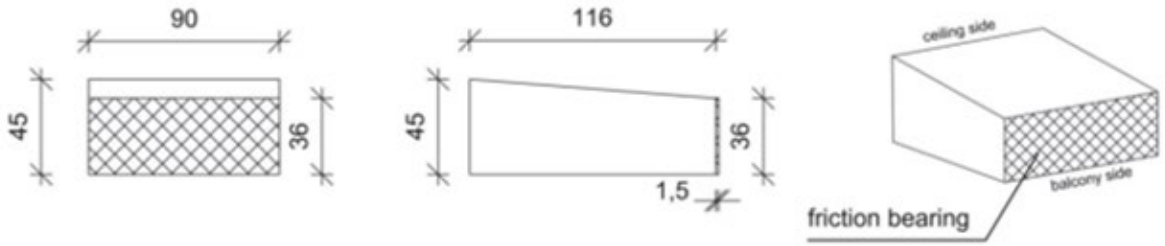
ISOPRO concrete compression bearing
Version 1



ISOPRO concrete compression bearing
Version 2



ISOMAXX concrete compression bearing



ANNEX A9
Product description / Materials

Tension and shear bar

Reinforcing steel	B500B, reaction to fire class A1
Stainless steel	B500NR with corrosion resistance class II according to EN1993-1-4, reaction to fire class A1

Concrete compression bearing

ISOPRO/ISOMAXX pressure unit	high performance concrete, class A1 acc. To EN 13501-1
ISOPRO/ISOMAXX HLB pressure unit	high performance concrete, class A1 acc. To EN 13501-1

Friction bearing	Performance not assessed, as per EN13501-1
Plastic U profile	PVC-U according to EN13245-1 and EN13245-2 Performance not assessed, as per EN13501-1
Insulation	Polystyrene rigid foam (EPS), according to EN 13163 Class E according to EN 13501-1
Fire protection plates	Cement-bonded, weather resistant construction plates, type *Aestuver fire protection plate* (ETA 11/0458), class A1 according to EN 13501-1
Intumescent coating	PROMASEAL PL, class E as per EN13501-1

ANNEX B1
Intended Use / Installation requirements

B.1 Intended use

- Static or quasi-static action combination
- Minimum concrete strength class of the reinforced components to be connected made of normal-strength concrete according to EN 206-1 (C20/25), for exterior components C25/30.
- For the connections of slabs with thickness of 160 to 500 mm

B.1.1 Design

For design EN1992-1-1 and EN 1993-1-1 along with the provision of Annex D apply

- The slab connections must be divided by expansion joints (arrangement of joints according to section B.2.1)
- The structural verification for the transmission of the forces from the tension and compression members to the connected structural components shall be carried out
- Deviations from the state of expansion of an identical slab without insulation joint are limited to the joint area and the adjoining edges by compliance with this UKTA
- At a distance h from the edge of the joint, the undisturbed state of expansion may be assumed
- Variable moments and shear forces along the connected edge shall be considered
- Stresses of the slab connections due to local torsional moments shall be avoided
- Small normal forces from constraints in the grinder bars (at the end of the line supports, e.g. next to free edges or expansion joints), may be neglected in the structural calculation. Constrained normal forces in the direction of the bars of the slab connection shall be avoided (see example Annex B2)
- The height to width ration of connected components shall be ≤ 1/3, if no dedicated calculation for the bearing of the transverse tensile stresses is carried out
- Connecting elements of type IMQS and IPQS may also be used in short pieces (l ≥ 300 mm, with at least two shear force bars per element) and may be installed as freely movable perpendicular to the insulation joint. The resulting tensile force from these types must be connected frictionally in the supporting structure on both sides of the insulation joint.

ANNEX B2
Intended Use / Distance of expansion joints

B.2 Installation requirements

B.2.1 Axial and joint distances

- Tension and compression components, shear bars (Regulation according to D.1.2.3): 50 mm ≤ s_1 ≤ ½ s_{2max}, with s_1 = centre distance from the free edge or expansion joint and S_{2max} = permissible maximum distance between bars
- External structural components: expansion joints shall be arranged rectangular to the insulation joint (see Annex B2)
- Joint distances: Table B1

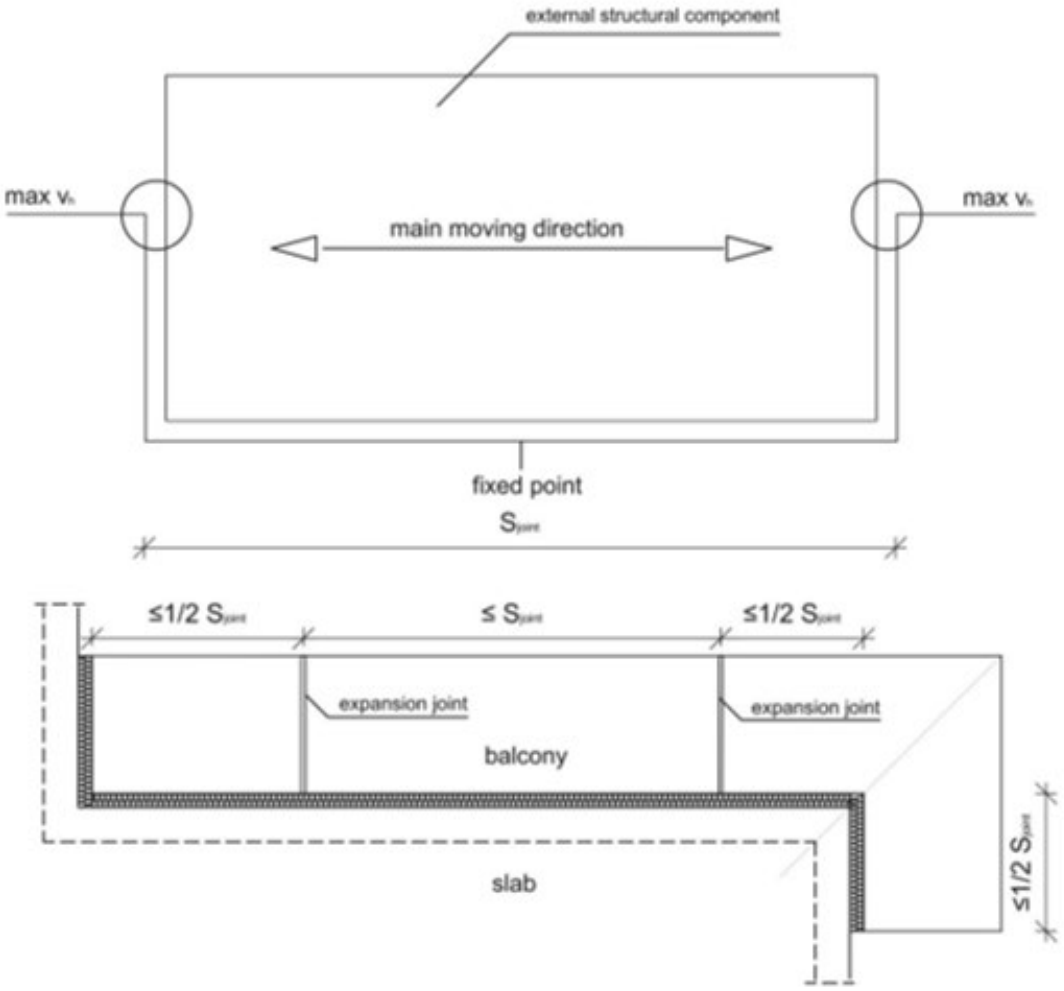


Table B1: permissible expansion joint distances, s_{joint} in m

Thickness of insulation joint (mm)	Bar diameter in the joint (mm)		
	≤ 10	12	14
80	13.0	11.3	10.1
120	21.7	19.8	17.0

ANNEX B3
Intended Use / Structural design

Minimum concrete cover according to EN 1992-1-1 for tension bars, shear reinforcement and supplementary reinforcement shall be observed.

Reinforcement of adjoining concrete components has to be extended up to the insulation layer considering the requirements for concrete covers according to EN 1992-1-1.

Transverse bars of the upper connection reinforcement shall normally lie on the outside of the longitudinal bars of the slab connections. Deviations are possible if the following conditions are met:

- Installation of the transverse bars right under the longitudinal bar is possible
- Installation is checked, e.g., by a construction supervisor
- Installation steps shall be described in the installation instructions (see Annex B4 to B7)

Free edges of the connected components shall be provided with structural edge reinforcement according to EN 1992-1-1, section 9.3.1.4, e.g. with stirrups of diameter ≥ 6mm, s ≤ 250mm and 2 longitudinal bars with diameter ≥ 8mm.

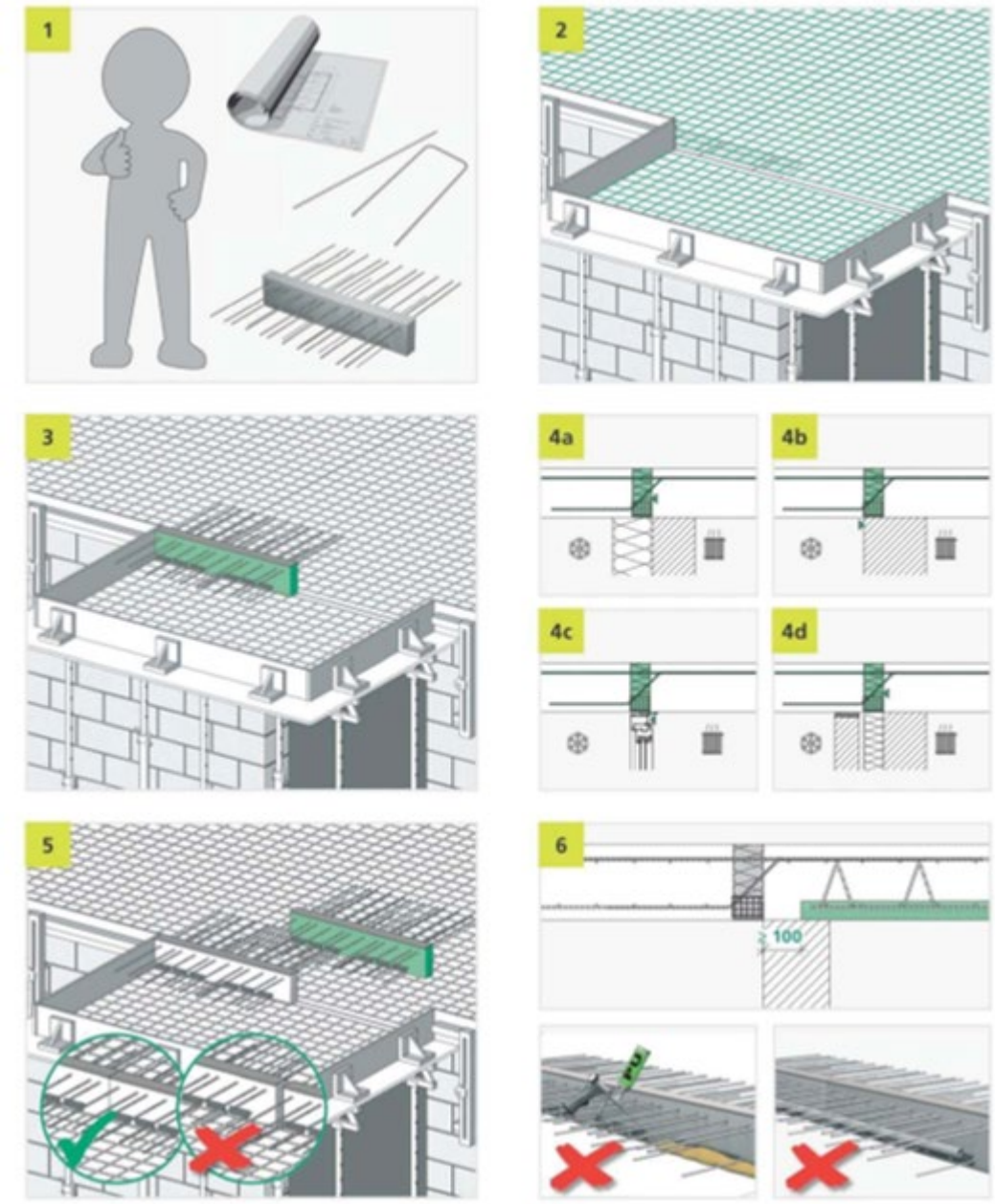
Lattice girders with a minimum distance of 100 mm from the insulation joint according to Annex B9 may be considered.

The supplementary reinforcement must be executed as follow:

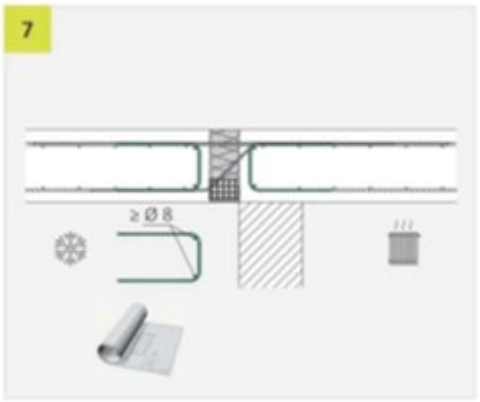
- Transmission of moments and shear forces: tension bars must be overlapped
- Transmission of shear forces only:
    - The shear reinforcement around the slab connection shall not be staggered
    - The tensile reinforcement of the free edge of the slab shall be anchored by hooks in the compression zone. Alternatively, stirrups can be placed at each shear bar

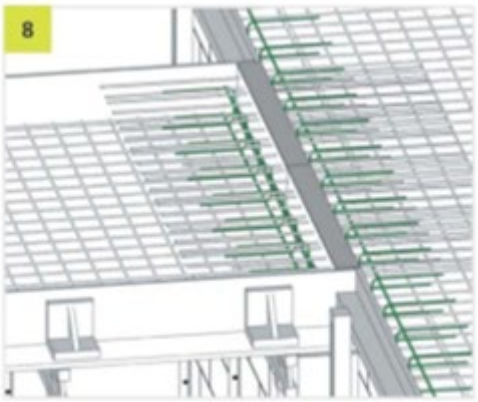
Subsequent bending of the bars of the slab connection is not permitted.

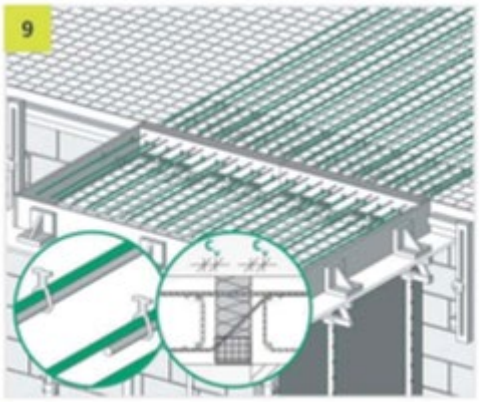
ANNEX B4
Intended Use / Installation instructions

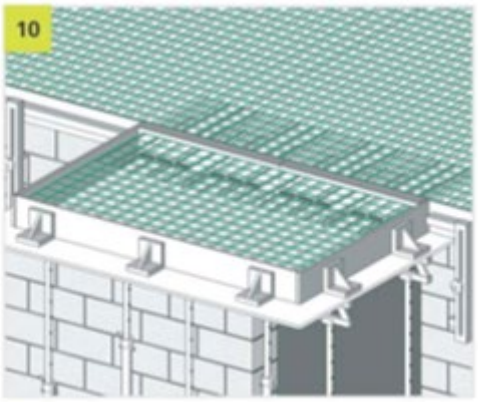


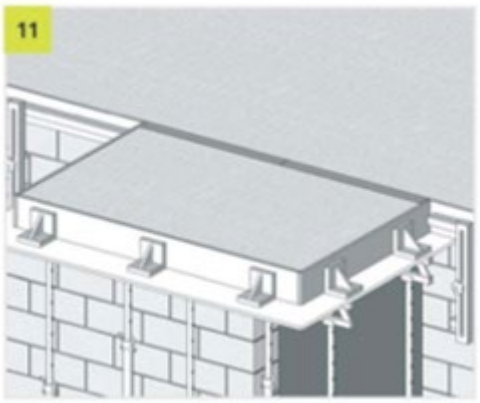
ANNEX B5
Intended Use / Installation instructions (continue)



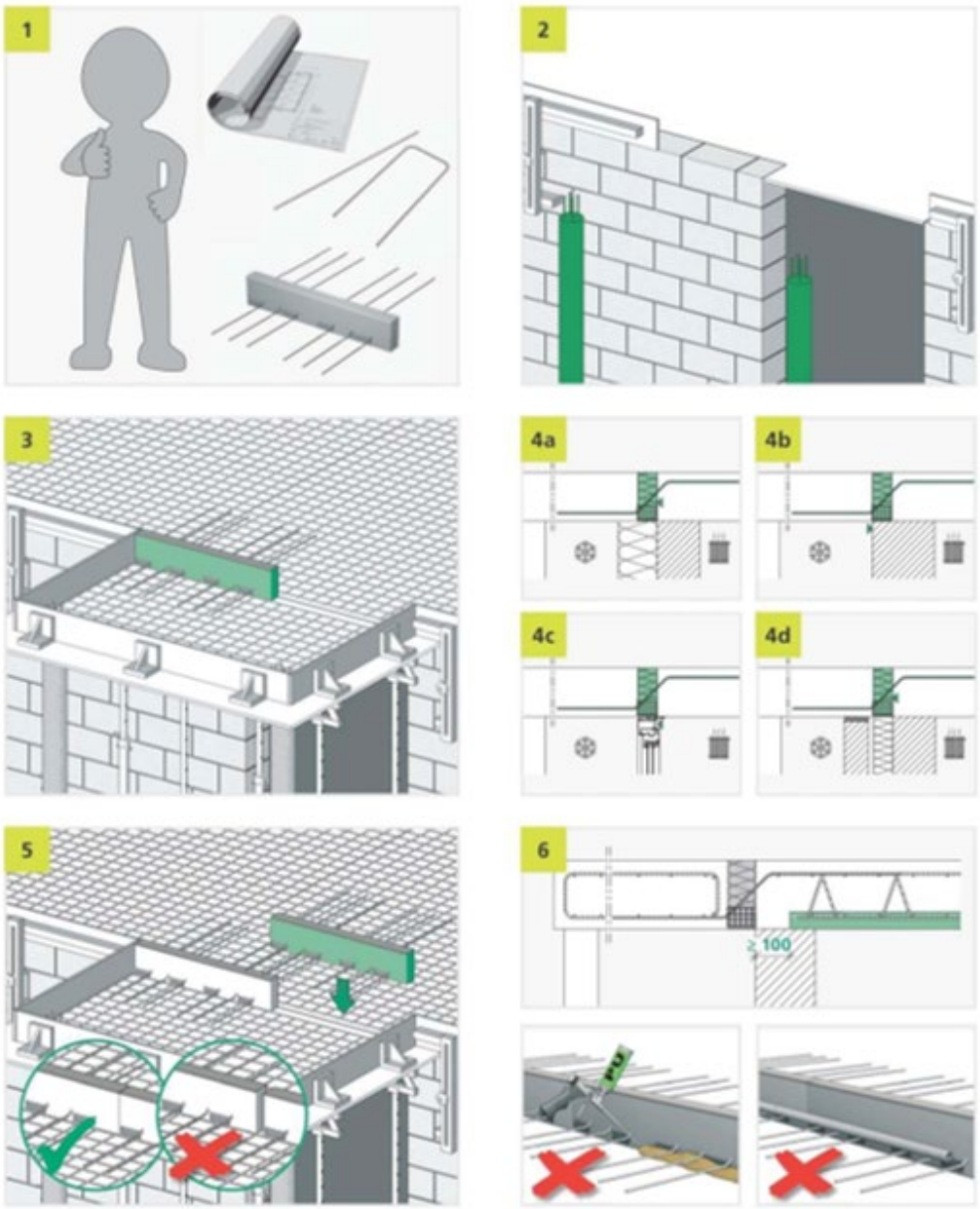




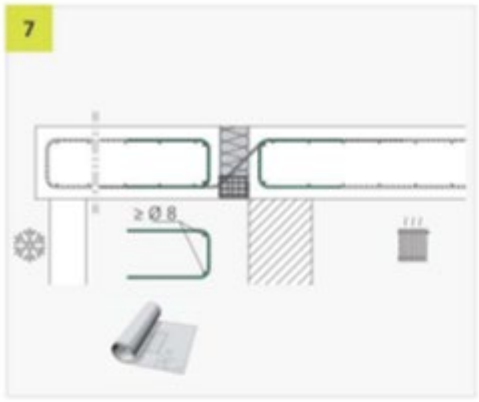


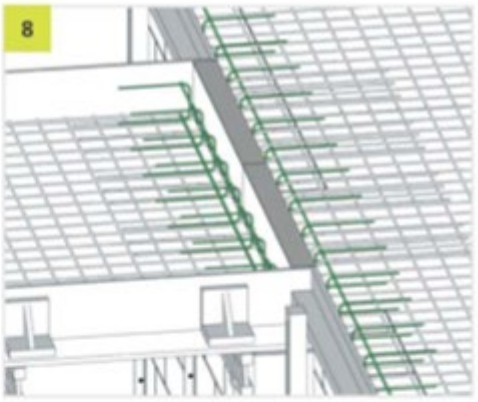


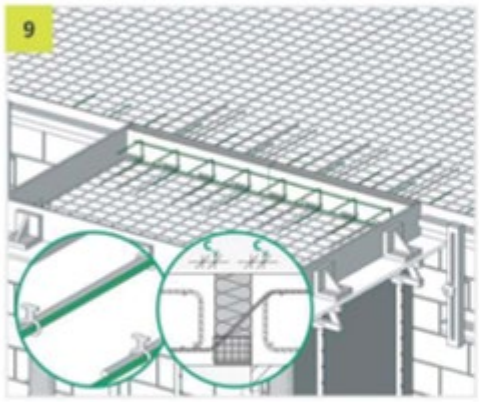
ANNEX B6
Intended Use / Installation instructions Q elements

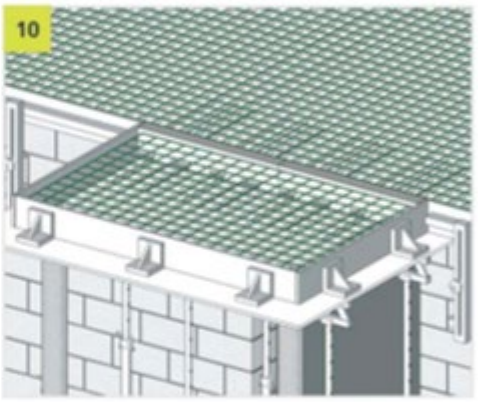


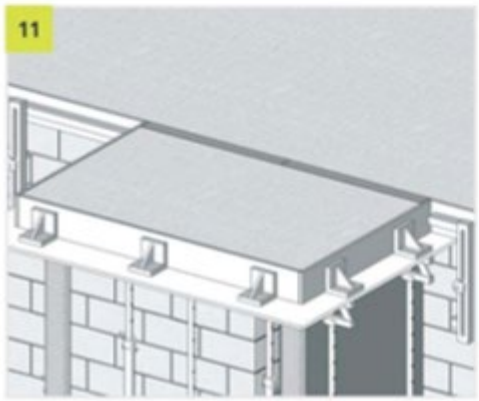
ANNEX B7
Intended Use / Installation instructions Q elements (continue)



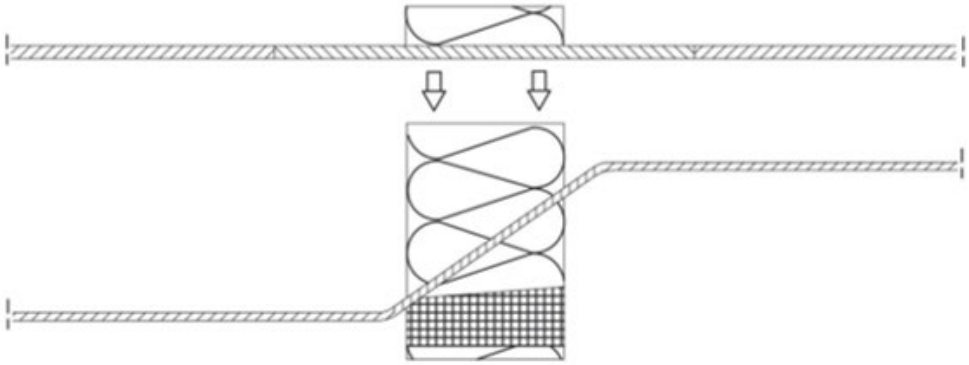


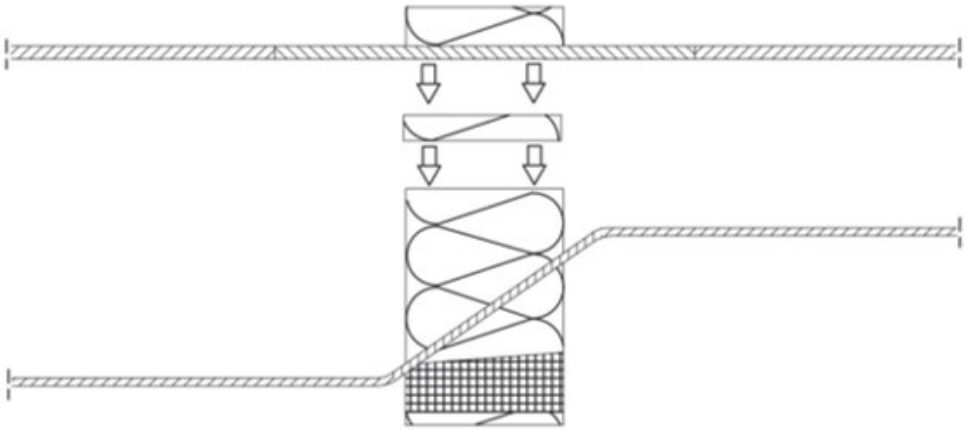




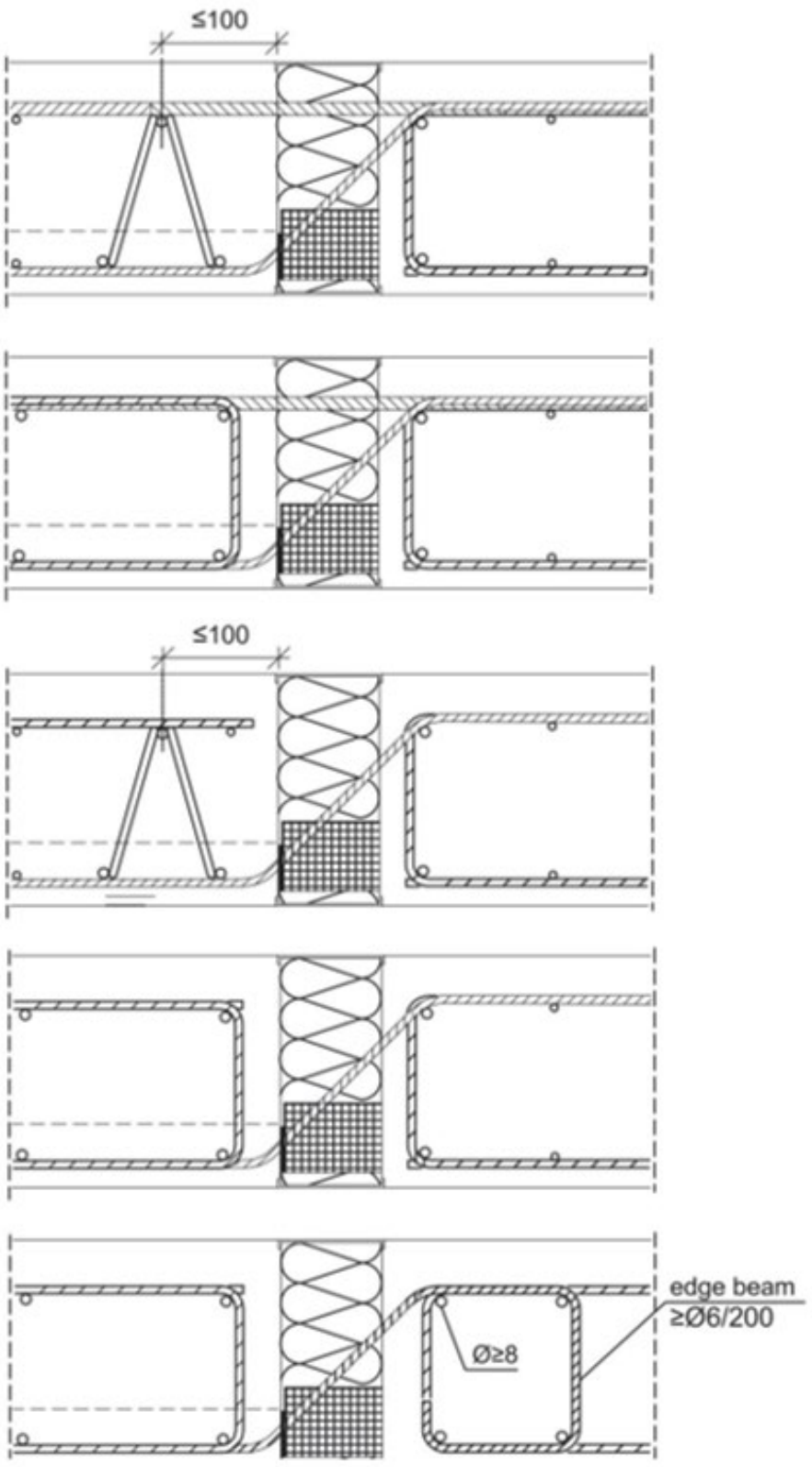


ANNEX B8
Intended Use / Installation instructions / two-part structure





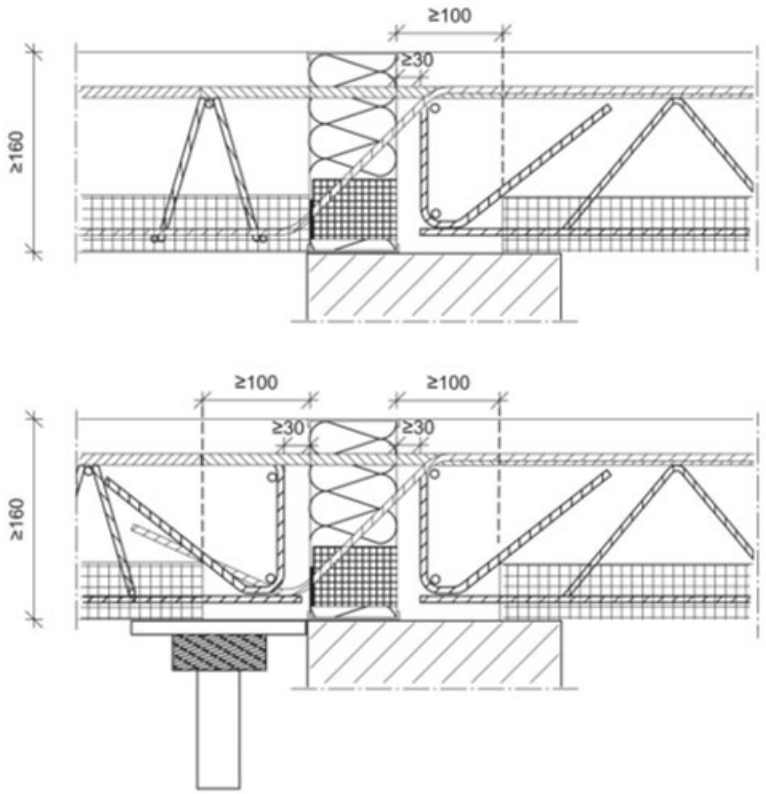
ANNEX B9
Intended Use / Installation instructions / Structural edge reinforcement with and without girder



ANNEX B10
Intended Use / Installation instructions

If the adjacent ceiling slabs connecting to slab connectors are designed as prefabricated slabs, the following conditions apply:

- When using prefab slabs and in-situ concrete, a grouting strip at least 100mm wide shall be considered
- The concrete mixture of the in-situ concrete joint (max aggregate size d_g) shall be adjusted to this distance



Instruction for fire protection requirements

When using the slab connectors to connect reinforced concrete slabs that are subject to fire protection requirements, the provision of annex C2 shall be observed.

ANNEX C1
Performance parameters / load-bearing capacity

C.1 Load bearing capacity

C1.1 Load-bearing capacity of single components

Concrete compression bearing

Design values of the concrete compression bearings D_{Rd} depend on the concrete strength class of the adjoining concrete components

≥ C20/25	54.4 kN
≥ C25/30	63.2 kN
≥ C30/37	71.3 kN

Shear bars

Design values of the shear force bar loading $Z_{v,Rd}$ and shear force loadings V_{Rd} depend on inclination angles

Diameter	$Z_{v,Rd}$	V_{Rd} 30°	V_{Rd} 45°	V_{Rd} 60°
6 mm	12.3 kN	6.2 kN	8.7 kN	10.7 kN
8 mm	21.9 kN	11.0 kN	15.5 kN	19.0 kN
10 mm	34.1 kN	17.1 kN	22.5 kN	39.0 kN
12 mm	49.2 kN	24.6 kN	34.8 kN	42.6 kN

Tension bars

Design values of the tension bar load capacities Z_{Rd}

Diameter (according to Annex A6)	Z_{Rd}
6 mm	21.9 kN
8 mm	34.1 kN
10 mm	49.2 kN
12 mm	66.9 kN

ANNEX C2
Performance parameters / load-bearing capacity in case of fire

C.2 Fire resistance

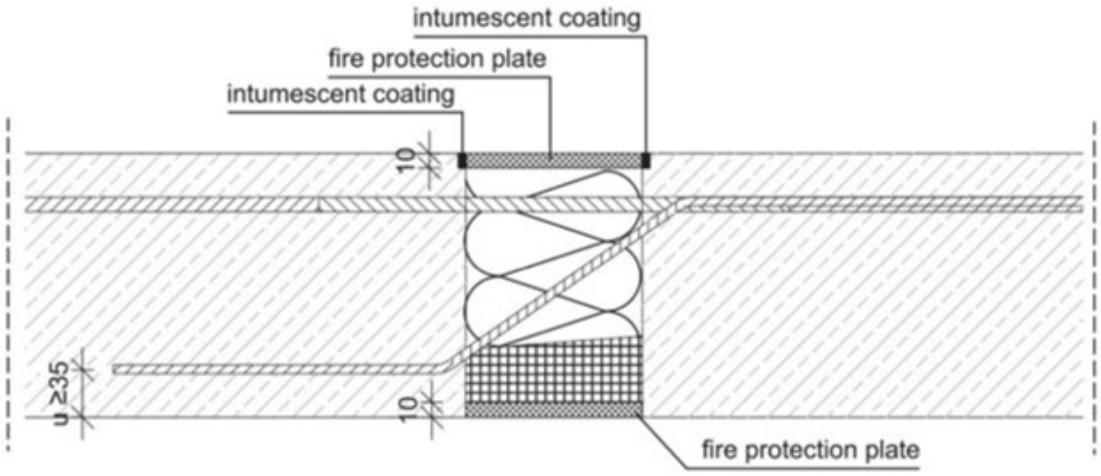
C.2.1 Performance parameters regarding load-bearing capacity in case of fire

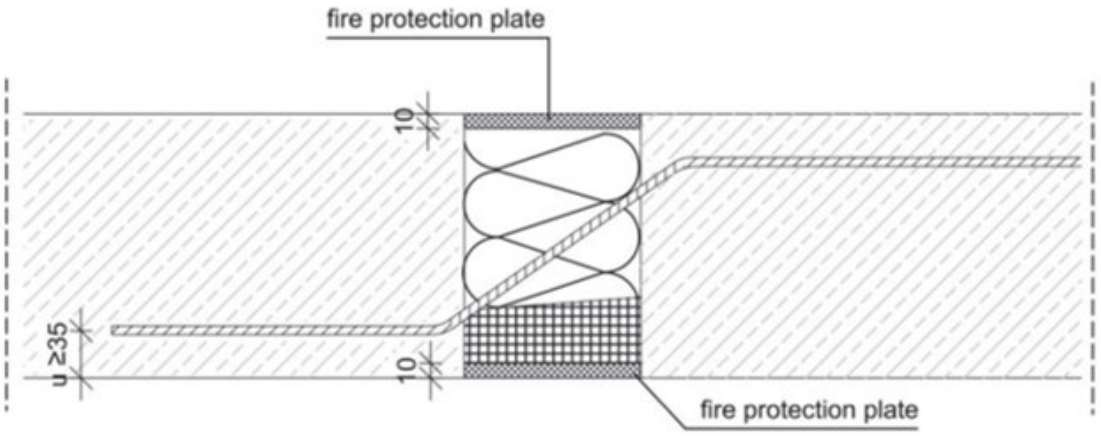
If the performance characteristics for the design under normal temperatures as specified in Annex C1 are complied with, the lead-bearing capacity of the ISOPRO/ISOMAXX slab connection is also guaranteed for a period of 120 minutes in the event of fire in accordance with the intended use.

This applies to a reaction coefficient η_f in accordance with EN1992-1-2, section 2.4.2 to η_f =0.7 for designs in accordance with Annex C3 and under compliance with the following boundary conditions:

- The connection joint provided with the ISOPRO/ISOMAXX slab connector shall be completely covered on top and bottom with fire protection plates according to Annex A9 (see Annex C3)
- In the area of planned tensile stress, the fire protection plates shall be designed either with a lateral projection of 10mm from the insulation body or with additional intumescent layer formers on both side surfaces
- For the required thickness t of the fire protection plates and minimum axial distance reinforcement see annex C3
- Concrete compression bearing consisting of ISOPRO or ISOMAXX pressure unit

ANNEX C3
Performance parameters / load-bearing capacity in case of fire





ANNEX C4
Performance parameters / Classification of components (for information) / Fire resistance

Floor and roof structures, balcony and walkaways, which are connected to reinforced concrete components according to their intended use with the ISOPRO/ISOMAXX slab connector, as shown in Annex C3, can be classified with regard to fire resistance according to EN13501-2, as shown in Table C1. The following boundary conditions shall be observed:

- The performance in terms of load-bearing capacity in case of fire has to be declared for the ISOPRO/ISOMAXX slab connector
- See Annex C2, item 1 to 4
- For floor and roof structures, the connections of the remaining edges of the floor or roof structures not connected with ISOPRO/ISOMAXX slab connector to adjoining or supporting building components shall be verified in accordance with the relevant fire resistance regulations.

Table C1: classification of the components

Design version	Floor or roof construction with fire separating function	Balconies and walkaway
According to Annex C3	REI 90	R 90
	REI 120	R 120

ANNEX D1
Structural analysis / General

D.1 Design

D 1.1 General

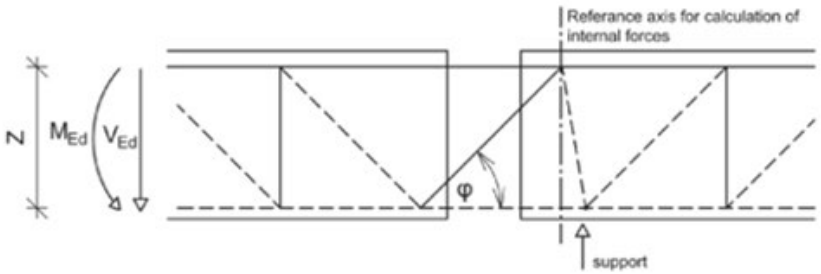
- Design according to EN 1992-1-1 and EN 1993-1-1 (in the insulation joint)
- Structural verification shall be provided for each individual case
- Type-testing design tables may be used

Determination of internal forces:

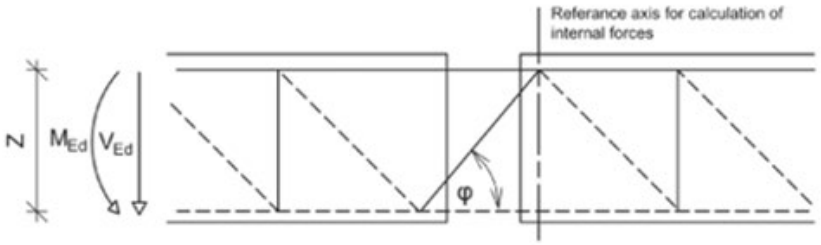
- By linear visco-elastic analysis only
- Analysis with redistribution of internal forces, plastic analysis and non-linear analysis may not be used
- Principles for the design of frameworks according to EN 1992-1-1, section 5.6.4 shall be applied
- Strut-and-tie models according to Annex D2 and D3 with $z=z_{strut\text{-}and\text{-}tie}$
- For the calculation of $z_{strut\text{-}and\text{-}tie}$, the resulting force in the compression unit has to be assumed in the middle of the friction bearing
- Internal forces M_{Ed} and V_{Ed} shall be applied on the referent axis
- Shear bars obtain shear forces only
- Variable moments and shear forces along the edge of the slab shall be considered (see section B1.1)
- The shear force reinforcement required in the insulation layer does not determine the minimum slab thickness according to EN 1992-1-1, section 9.3.2 (1)
- The front surface of the structural components to be connected, shall receive edge reinforcement in accordance with section B2.2. A lattice girder which is placed parallel to the insulation joint maybe used if it includes the shear bars and is bought as close as possible to the insulation joint while maintaining the required concrete cover (see Annex B9). The lattice girder shall be raised up to underneath the tensile reinforcement. If the design section is outside the bearing area, a suspended reinforcement shall be arranged on the slab side, which shall be designed for the total shear force V_{Ed}. The edge reinforcement may be taken into account according to section B2.2.

ANNEX D2
Structural analysis / Strut-and-ties models

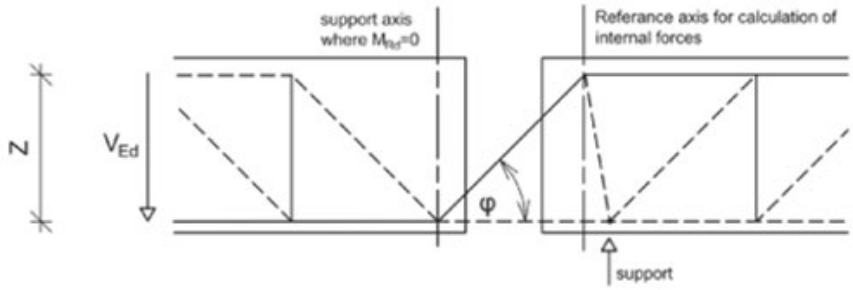
Type IP/IM
direct support



Type IP/IM
indirect support



Type IPQQ(S)/IMQQ(S) (positive shear force only)
Type IPQ(S)/IMQ(S)
direct support



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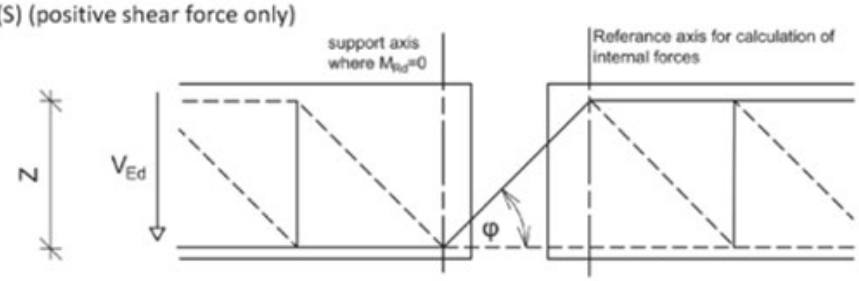
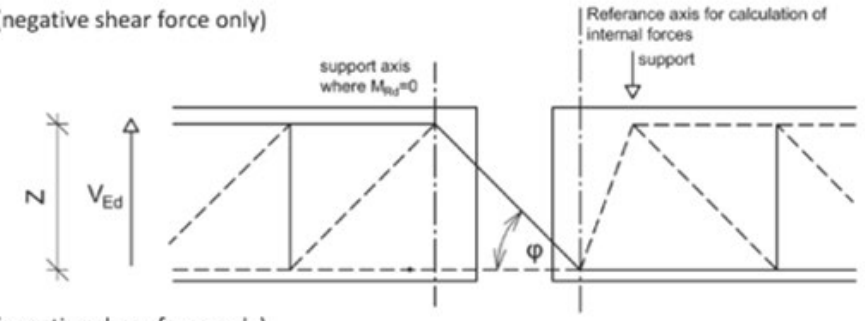
Type IPQ(S)/IMQ(S)
Indirect support

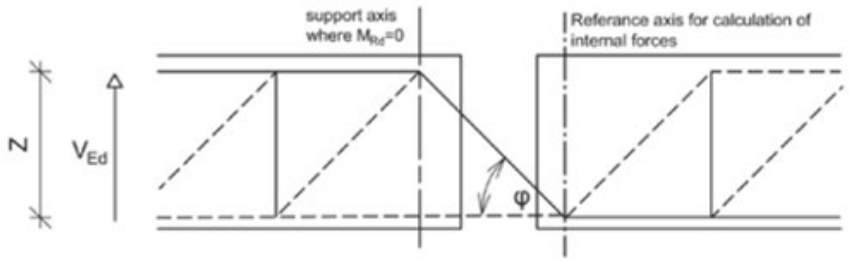


ANNEX D3
Structural analysis / Strut-and-ties models (continue)

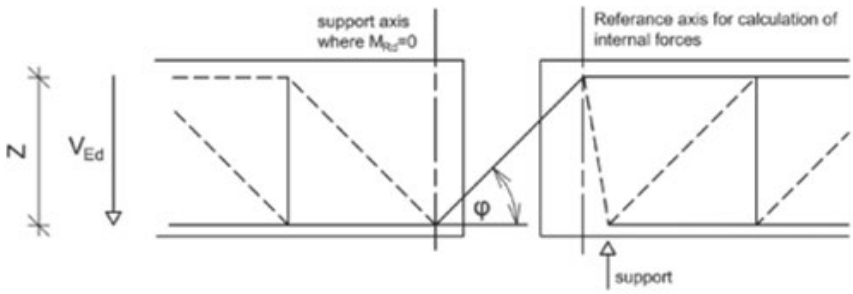
Type IPQQ(S)/IMQQ(S) (negative shear force only)
direct support



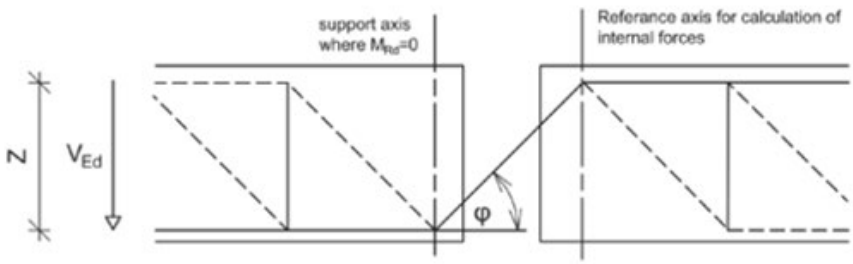
Type IPQQ(S)/IMQQ(S) (negative shear force only)
indirect support



Type IPQZ/IMQZ
Type IPZQ/IMZQ
direct support



Type IPQZ/IMQZ
Type IPZQ/IMZQ
indirect support



ANNEX D4
Structural analysis / Ultimate limit states / Verification of compressive members

Concrete compression bearing

Design value DRd according to section C.1.1

Verification of tension and shear bars

- Verification according to EN 1993-1-4 with design values according to Annex C1
- Load bearing capacity of welded joints between reinforcing steel and stainless steel or round steel does not need to perform separately

Shear forces bearing capacity in the area of the insulation joint

- Shear force bearing capacity of the connecting slabs according to EN 1992-1-1, section 6.2
- The required verification of the mandrel diameter can be omitted if the following two conditions are met: mandrel diameter according to Annex A7 AND Average axial distance of the shear force bars and to the free edge or expansion joint according to Annex A3

Verification of fatigue to temperature difference

Verification by limiting the joint distance according to table B1

Provision for the verification in the load introduction area of the concrete components

- Shear force bearing capacity of the undisturbed slabs according to EN 1992-1-1, section 6.2
- The design value of the shear force bearing capacity of the slabs without shear reinforcement is based on a shear force uniformly distributed over the concrete compression area. Therefore, the elements shall be installed with uniform spacing.

Anchoring lengths and overlap joints though the thermal insulation layer

- Only use ribbed bar sections for anchoring and overlapping
- When using graduated tension bars (see Annex A6), the supplement of the lap length Δ_{IO} according to Annex A6 shall be considered
- Anchoring of shear bars:
    - With straight legs in the slabs
    - In the tension zone with $1.3\ l_{bd} \geq 1.3\ l_{b,min}$ according to EN 1992-1-1 and EN 1991-1-1/NA, equation 8.4 overlap with tensile reinforcement of the slab connected
    - Anchoring in compression zone with l_{bd}. If share force bars and compression bearing are not laid in one plane, determine the anchorage length as in tension zone.
- To resist the arising transverse tensile forces, in addition to the shear reinforcement according to EN 1992-1-1, section 8.4.1 additional shear reinforcement shall be placed in the overlap area of the bars and anchored at the edge of the cross-section according to EN 1992-1-1, section 8.7.4
- In the area of the slab connections grading of the tensile reinforcement is not permitted
- The design of a bent shear force bar according to Annex A7 is possible, if an edge beam is designed with the construction details given in Annex B9
- For slab connections that only transfer shear forces, the tensile reinforcement of the slab to be connected shall be anchored in the compression zone by means of hooks on the frontal side. Alternatively, stirrups or lattice girders can be placed on each shear force bar. When using lattice girders, the tensile reinforcement shall lie over the chords of the lattice girders.

ANNEX D5
Structural analysis / Ultimate limit states / Serviceability limit states

Limitation of crack widths

- EN 1992-1-1, section 7.3 applies
- Additional verification is not required at the front faces of the joints or in the area of load introductions if the provisions of this UK Technical Assessment are observed

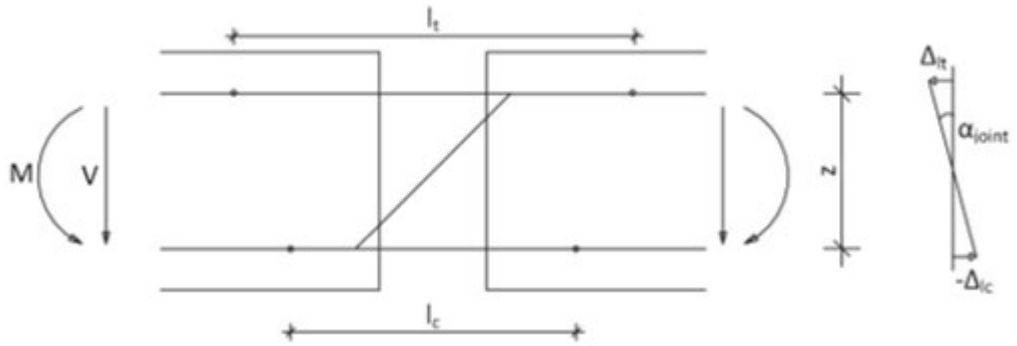
Limitation of deformations

The following influencing factors shall be considered when calculation deformation
- Elastic deformation of the load bearing thermal insulating element and the adjoining slab concrete
- Temperature expansions

Verification of the deformations:
- Quasi-permanent load combination shall be applied
- Model for the determination of bending deformation in the joint, see Annexes D7 and D8
- Elastic deformation of tension bars as function of the applicable yield strengths, according to Annex A6

ANNEX D6
Structural analysis / Model for the determination of the torsion in the joint

Torsion in the joint caused by torque load



Deformation because of torque load M

$$\alpha = \tan^{-1}\left(\frac{\Delta_{lt} - \Delta_{lc}}{z}\right)$$

Tension bar:

$$\Delta_{lt} = \frac{F_t}{A_{s,t}} \cdot \left(\frac{l_{t1}}{E_1} + \frac{l_{t2}}{E_1} + \frac{l_{t3}}{E_2}\right)$$

$F_t = \frac{M/z}{n_t}$	Force/tension bar
n_t	Number of tension bars
E_1	160000 N.mm^{-2}
E_2	200000 N.mm^{-2}
l_{t1}	Joint width
l_{t2}	Effective length B500 NR*
l_{t3}	Effective length B500 B

*For B500 NR

Diameter ≤ 10 mm, l_{t2} = 2.10 x diameter and l_{t3} = 0mm

Diameter > 10 mm, l_{t2} = 2.100 mm and l_{t3} = 2.10 x diameter - 2.100mm

ANNEX D7
Structural analysis / Model for the determination of the torsion in the joint

Concrete compression bearing:

$$\Delta_{lc} = \frac{F_c}{A_{co}} \cdot \frac{l_{c,CB}}{E_{cm,CB}}$$

$A_{c,0}$	90-36 mm	For ISOMAXX and ISOPRO version 2 (Annex A8)
	100 – 36 mm	For ISOPRO version 1 (Annex A8)
$F_c = \frac{M/z}{n_c}$	Force/compression units	
n_c	Number of compression units	
$L_{c,CB}$	Joint width (80 mm for type ISOPRO and 120mm for type ISOMAXX)	
$E_{cm,CB}$	41000 N.mm^{-2}	For ISOPRO and ISOMAXX compression unit
	19455 N.mm^{-2}	For ISOPRO and ISOMAXX HLB-compression unit

Deformation because of shear force V can be neglected.

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