European Technical Assessment

ETA-17/0466
of 28 January 2022

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Slab connection ISOPRO IP and ISOMAXX IM
Product family to which the construction product belongs	Load bearing thermal insulating elements which form a thermal break between balconies and internal floors
Manufacturer	PohlCon GmbH Nobelstraße 51 12057 Berlin DEUTSCHLAND
Manufacturing plant	PohlCon GmbH Am Güterbahnhof 20 79771 Klettgau DEUTSCHLAND
This European Technical Assessment contains	34 pages including 4 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 050001-00-0301
This version replaces	ETA-17/0466 issued on 15 June 2021

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Specific Part

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[1] of this European Technical Assessment.

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

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 European 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 Protection against noise (BWR 5)

Essential characteristic	Performance
Impact sound insulation	No performance assessed

3.4 Energy economy and heat retention (BWR 6)

Essential characteristic	Performance
Thermal resistance	No performance assessed

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[1] The technical documentation of this European technical assessment is deposited at the Deutsches Institut für Bautechnik and, as far as relevant for th tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

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

In accordance with EAD No. 050001-00-0301, the applicable European legal act is: [1997/0597/EC].
The systems to be applied is: 1+

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

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

The following standards and references are referred to in this European Technical Assessment:

− EN 206: 2013+A1:2016	Concrete – Specification, performance, production and conformity
− EN 1992–1–1: 2004/A1:2014	Eurocode 2: Design of concrete structures – Part 1-1: General design rules and rules for buildings
− EN 1992–1–2:2004 + AC:2008	Eurocode 2: Design of concrete structures – Part 1-2: General rules – structural fire design
− EN 1993-1-1:2005 + AC:2009	Eurocode 3: Design of steel structures – Part 1-1: General design rules and rules for buildings
− EN 1993-1-4:2006 + A1:2015	Eurocode 3: Design of steel structures – Part 1-4: General rules – Supplementary rules for stainless
− EN 13163:2012 + A2:2016	Thermal insulation products for buildings – Factory made expanded polystyrene (EPS) products – Specification
− EN 13245-1:2010	Plastics – Unplasticized poly (vinyl chloride) (PVC-U) profiles for building applications – Part 1: Designation of PVC-U profiles
− EN 13245-2:2008 + AC:2009	Plastics – Unplasticized poly (vinyl chloride) (PVC-U) profiles for building applications – Part 2: PVC-U profiles and PVC-UE profiles for internal and external wall and ceiling
− EN 13501-1:2007 + A1:2009	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
− EN 13501-2:2018	Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services
− ETA-11/0458	"AESTUVER" fire protective board, 30. September 2014

Issued in Berlin on 28 January 2022 by Deutsches Institut für Bautechnik
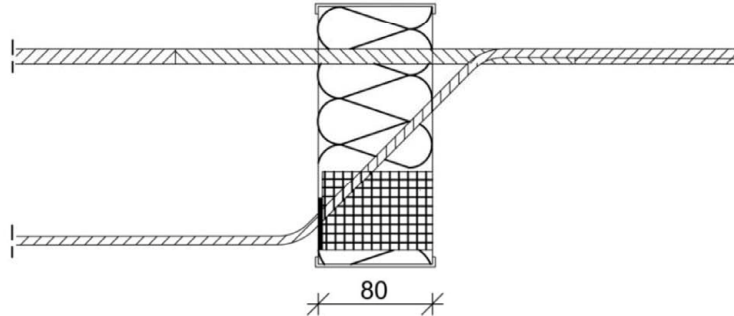
Dipl.-Ing. Beatrix Wittstock   *beglaubigt:*
Head of Section   Kisan

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**A.1 Type overview
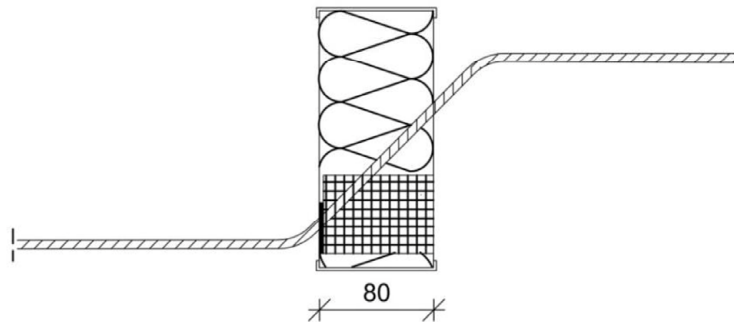ISOPRO (80 mm joint width)
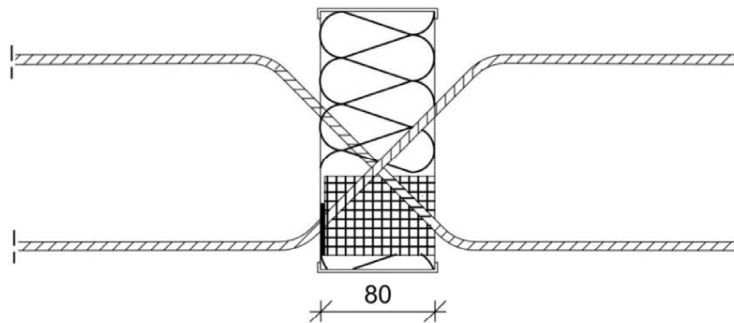Type for transmission of bending moments and shear forces**
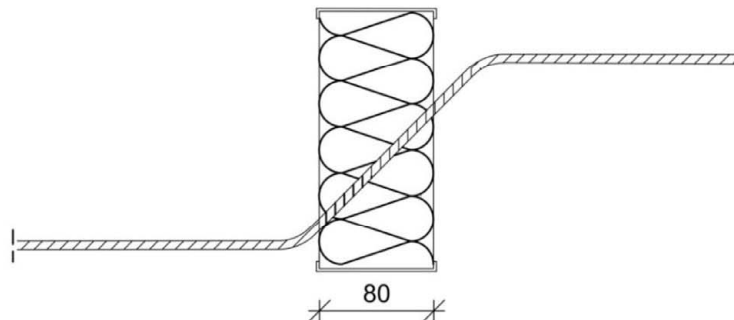
TYPE IP

Type for transmission of shear forces

TYPE IPQ
TYPE IPQS

TYPE IPQQ
TYPE IPQQS

TYPE IPQZ
TYPE IPZQ
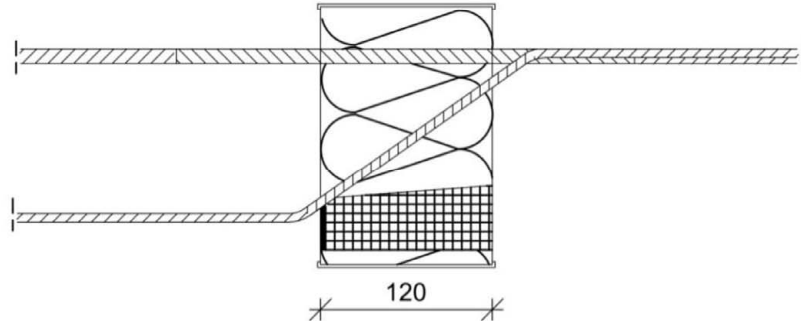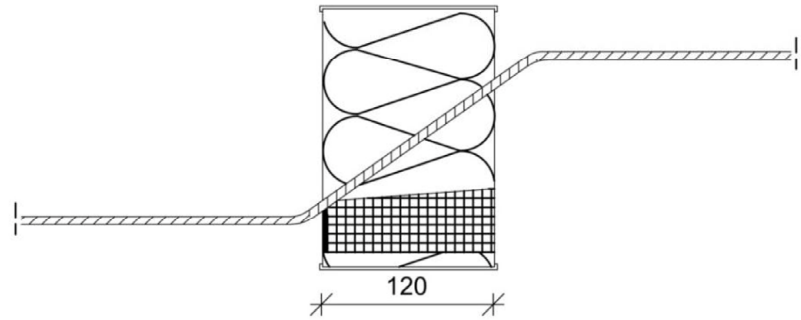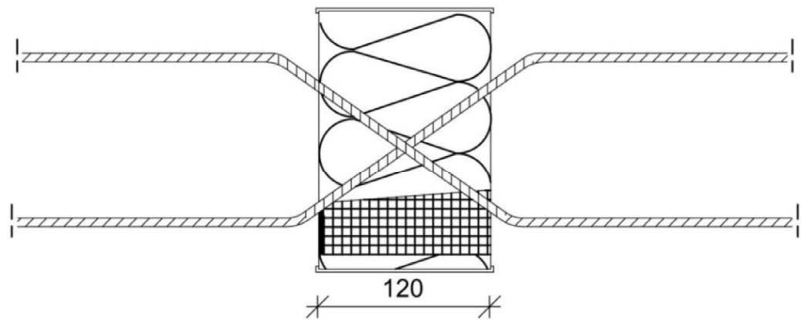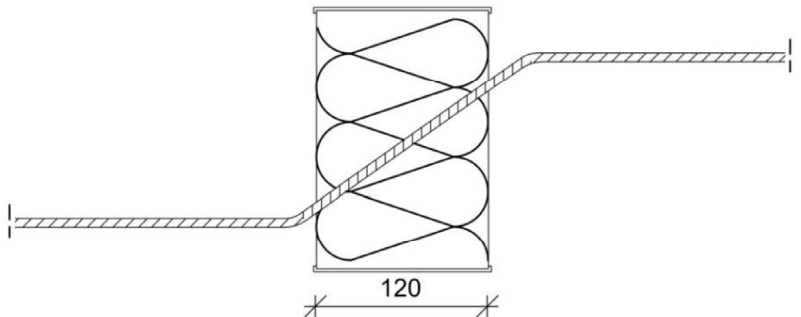

Slab connection ISOPRO IP and ISOMAXX IM	Annex A 01
Product description: overview elements type ISOPRO	

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**ISOMAXX (120 mm joint width)
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

Slab connection ISOPRO IP and ISOMAXX IM

Product description: overview elements type ISOMAXX

Annex
A 02

A.2   Dimensions and positions of the bars and pressure units in the area of the insulation joint

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

- Tension bars:
  - Diameterr: $\varnothing \leq 14$ mm
                                          Graduated nominal diameter according to annex A 06
  - Quantity per metre: $4 \leq n \leq 16$
  - Axial distance: ≤ 300 mm, average ≤ 250 mm

- Shear bars:
  - Quantity per metre: $n \geq 4$ pcs./m
  - Diameter: $\varnothing \leq 12$ mm
  - Inclination in the insulation joint: 30°-60°
  - Axial distance: ≤ 300 mm, average ≤ 250 mm
  - In the concrete free area: Bars must not have any bend
  - Madrel diameter: According to annex A 07 and subject to the rules of EN 1992-1-1
  - Starting point of bend: $n \geq 2 \cdot \varnothing$ of free concrete surface, measured in bar direction

- Concrete compression bearing:
  - Quantity per metre: $4 \leq n \leq 8$
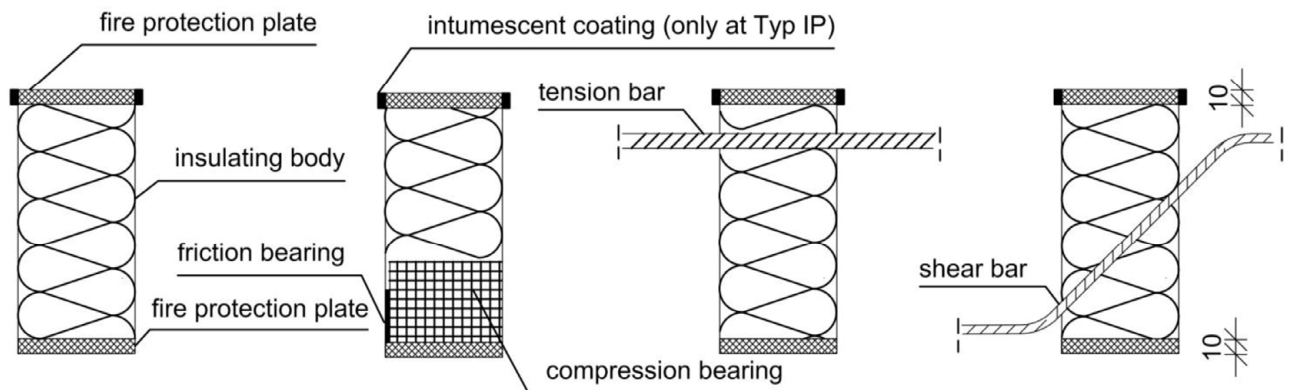 - Clear distance: ≤ 250 mm

Slab connection ISOPRO IP and ISOMAXX IM	Annex A 03
Product description: dimensions	

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Structure of elements type ISOPRO
Without fire protection
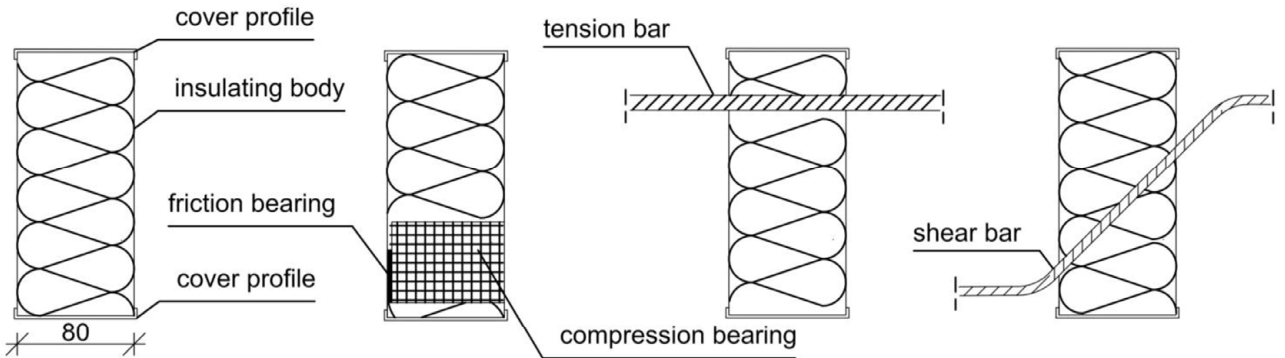
- cover profile
- insulating body
- tension bar
- friction bearing
- cover profile
- shear bar
- compression bearing
- 80

Configuration fire protection R120

- fire protection plate
- intumescent coating (only at Typ IP)
- tension bar
- insulating body
- friction bearing
- fire protection plate
- shear bar
- compression bearing
- 10
- 10

View without fire protection
Ceiling side

- L
- cv
- 160-500
- 10
- tension bar (only at Typ IP)
- shear bar
- compression bearing (not at Typ IPQZ/ IPZQ)

Balcony side

- L
- cv
- 160-500
- 30
- 10
- tension bar (only at Typ IP)
- shear bar
- compression bearing (not at Typ IPQZ/ IPZQ)

Slab connection ISOPRO IP and ISOMAXX IM	Annex A 04
Product description: structure of elements type ISOPRO	

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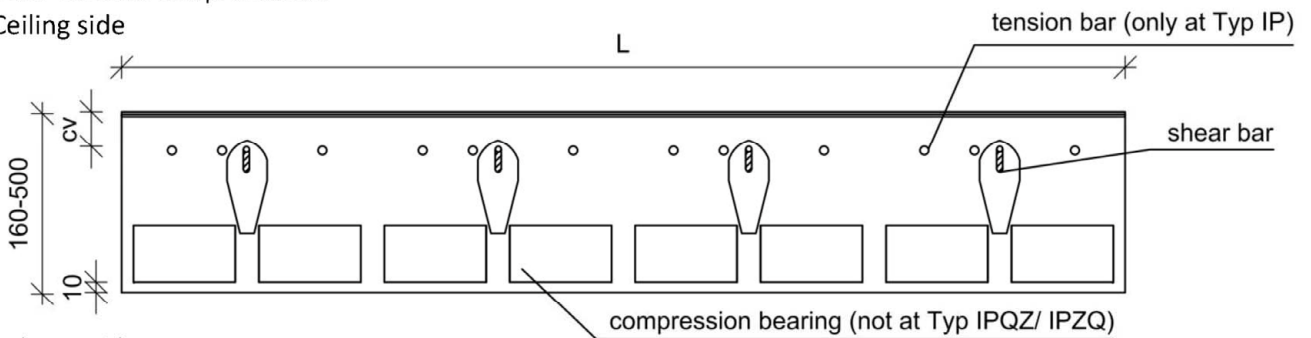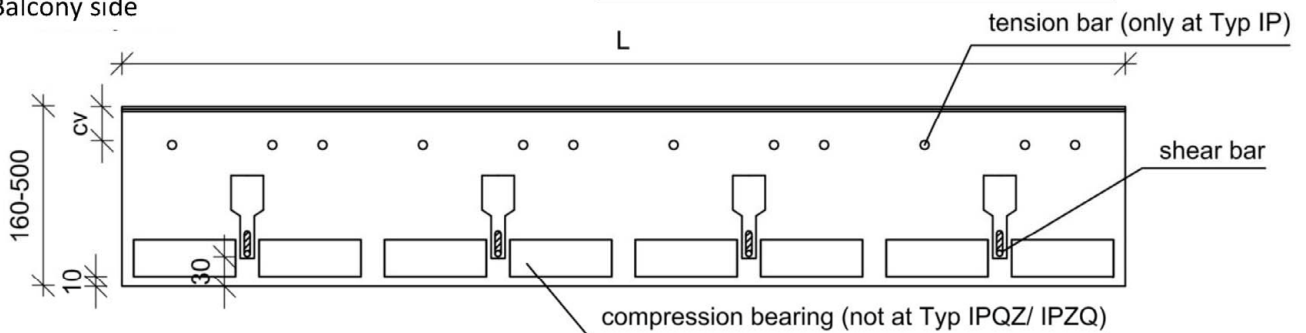
Structure of elements type ISOMAXX
Without fire protection
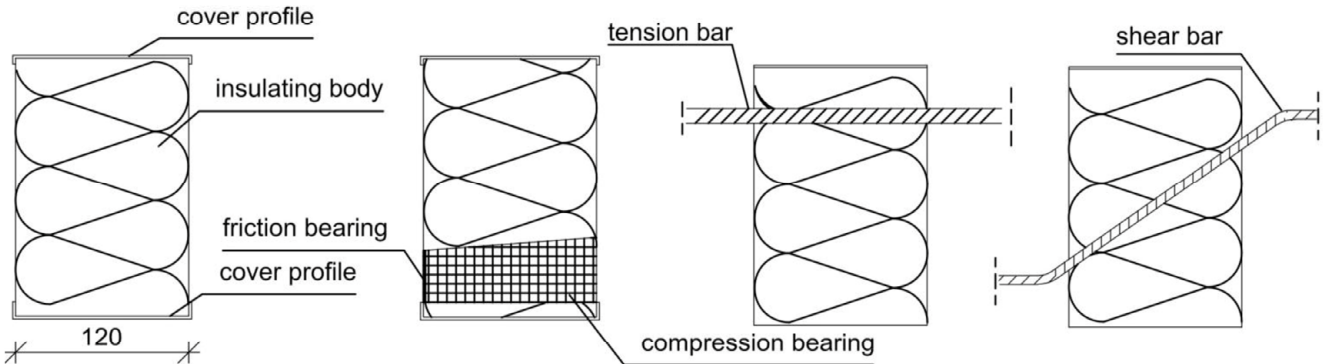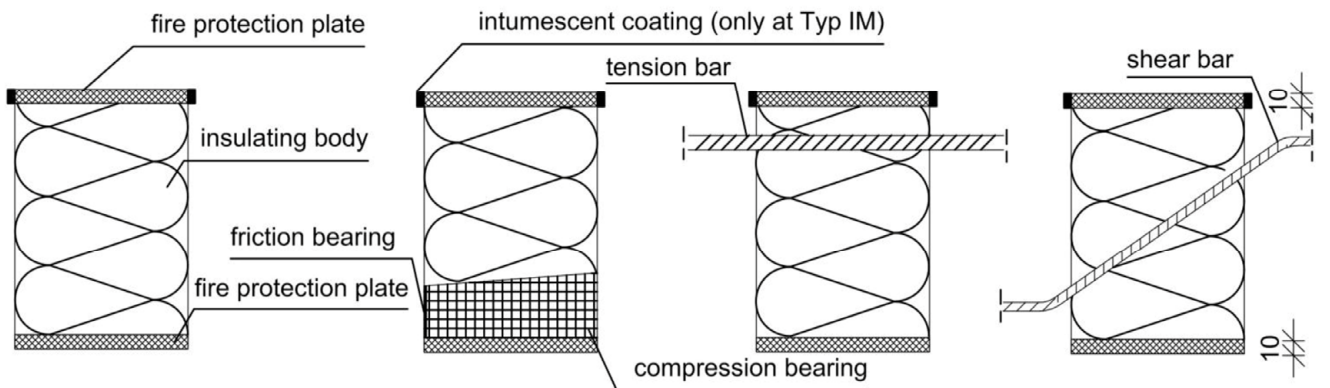
cover profile
insulating body
friction bearing
cover profile
120
tension bar
compression bearing
shear bar

Configuration fire protection REI120

fire protection plate
insulating body
friction bearing
fire protection plate
intumescent coating (only at Typ IM)
tension bar
compression bearing
shear bar

View without fire protection
Ceiling side

L
cv
160-500
10
tension bar (only at Typ IM)
shear bar
compression bearing (not at Typ IMQZ/ IMZQ)

Balcony side

L
cv
160-500
10
30
tension bar (only at Typ IM)
shear bar
compression bearing (not at Typ IMQZ/ IMZQ)

Slab connection ISOPRO IP and ISOMAXX IM	Annex A 05
Product description: Structure of elements type ISOMAXX	

Tension bar version 1

B500 B | 100 | insulation body | 100 | B500 B

RA>ll | stainless steel | RA>ll

Tension bar version 2

B500 B | $+\Delta\ l_0$ | 100 | insulation body | 100 | B500 B | $+\Delta\ l_0$

RA>ll | stainless steel | RA>ll

Tension bar version 3

insulation body | 100 | B500 B

stainless steel | RA>ll

Tension bar version 4

insulation body

stainless steel

Tension bar versions 1 and 2					
Tension bar diameter			steel bar	stainless steel	
$\varnothing_1$	$\varnothing_2$	$\varnothing_1$	$\varnothing_1$	$\varnothing_2$	
[mm]			[N/mm²]	$R_{p\ 0,2}$ [N/mm²]	$\Delta\ l_0$ [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

Slab connection ISOPRO IP and ISOMAXX IM

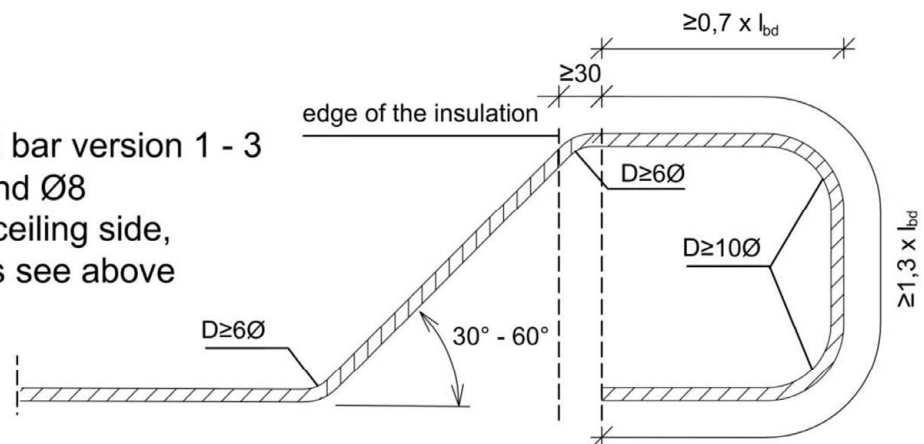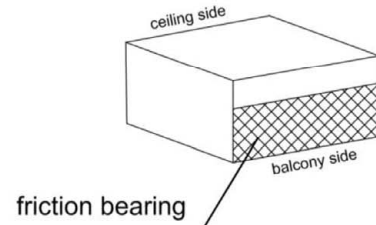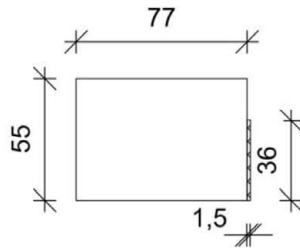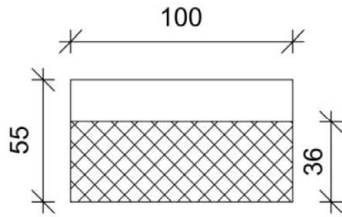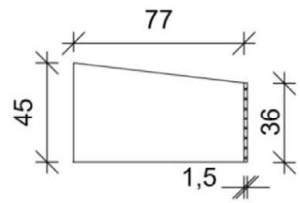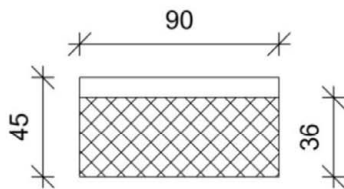Product description: version of tension bars

Annex
A 06

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Diagonal bar version 1

RA>II

D≥6Ø

B500 B

B500 B

D≥6Ø

stainless steel

30° - 60°

RA>II

Diagonal bar version 2

D≥6Ø

B500 B

D≥6Ø

stainless steel

30° - 60°

RA>II

Diagonal bar version 3

D≥6Ø

D≥6Ø

stainless steel

30° - 60°
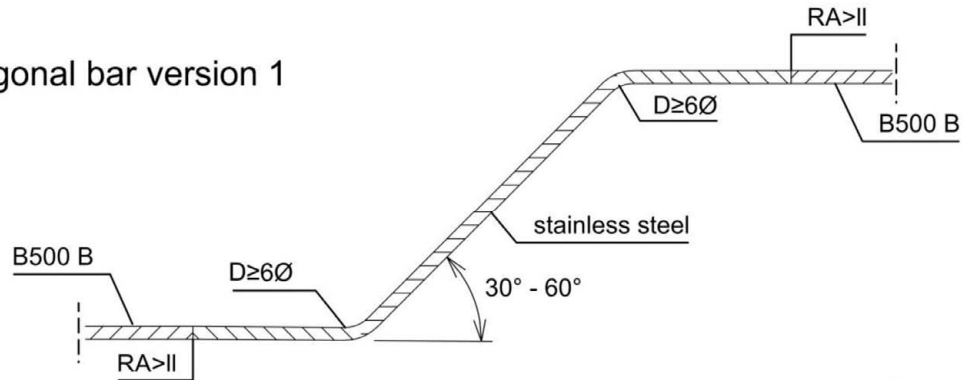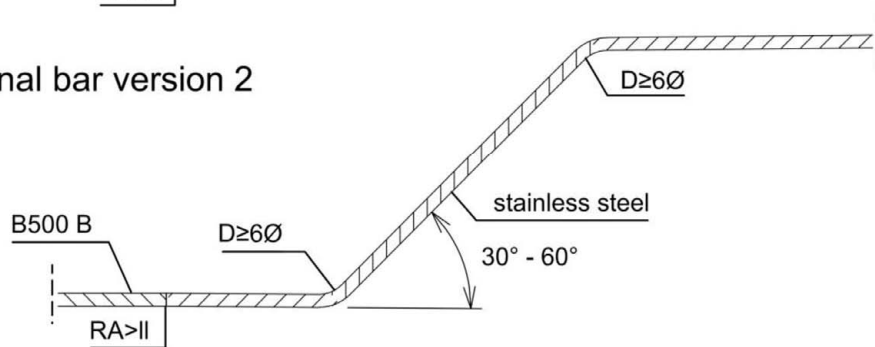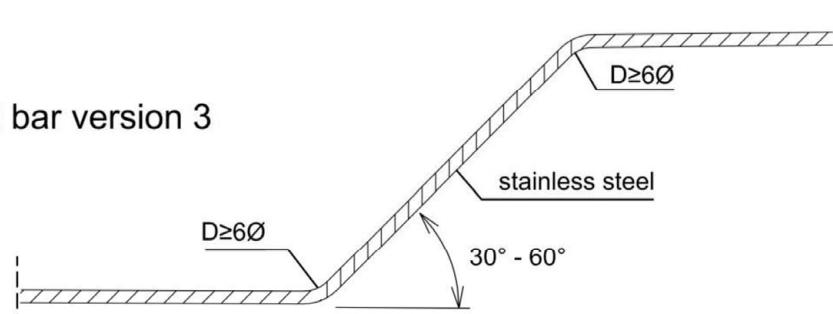
Diagonal bar version 1 - 3
for Ø6 and Ø8
bent on ceiling side,
materials see above

≥0,7 x l_{bd}

≥30

edge of the insulation

D≥6Ø

D≥10Ø

≥1,3 x l_{bd}

D≥6Ø

30° - 60°

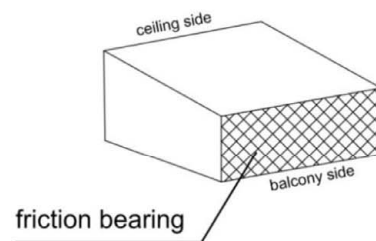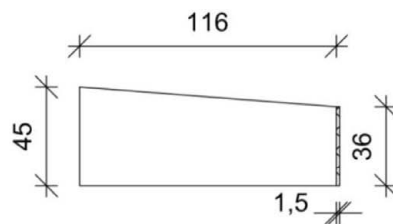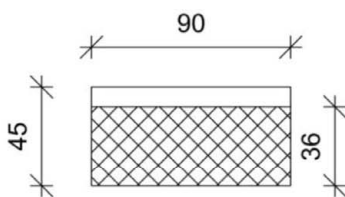| Slab connection ISOPRO IP and ISOMAXX IM	Annex
	A 07
Product description: versions of transversal bars	

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ISOPRO concrete compression bearing
Version 1

ISOPRO concrete compression bearing
Version 2
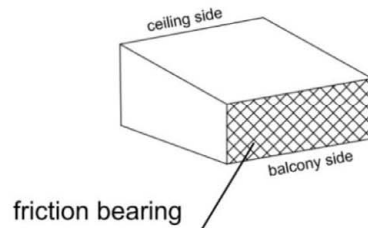
ISOMAXX concrete compression bearing

Slab connection ISOPRO IP and ISOMAXX IM	Annex
Product description: versions of concrete compression bearings	A 08

A.3   Materials:

- Tension- and shear bar
    - Reinforcing steel: B500 B, reaction to fire class A1
    - Stainless steel: B500 NR with corrosion resistance class III according to EN 1993-1-4, 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 is not assessed according to EN 13501-1

- Plastic U-profile: PVC-U according to EN 13245-1 and EN 13245-2, Performance is not assessed according to EN 13501-1

- Insulation: Polystyrene-rigid foam (EPS) according to DIN EN 13163, class E according to DIN EN 13501-1

- Fire protection plates: Cement-bonded, weather-resistant construction plates of the type "Aestuver fire protection plate" according to European Technical Assessment No. ETA-11/0458, Class A1 according to DIN EN 13501-1

- Intumescent coating: PROMASEAL PL, class E as per EN 13501-1

Slab connection ISOPRO IP and ISOMAXX IM	Annex
Product description: materials	A 09

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; C20/25, for exterior components C25/30
- For the connections of slabs with thicknesses of 160 mm to 500 mm

B.1.1 Design

For design EN 1992-1-1 and EN 1993-1-1 along with the provisions of annex D apply.

- The slab connections have to 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 European Technical Assessment
- 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 taken into account
- Stresses of the slab connections due to local torsional moments shall be avoided
- Small normal forces from constraints in the girder bars (at the end of 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 (example see annex B 02)
- The ratio of height to width 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 and one concrete compression bearing per element). The shear force bars must be arranged symmetrically in relation to the compression bearing. These elements can also be installed for the multi-sided support of slabs, provided that it is ensured that the individual short pieces are uniformly loaded and that the slab is supported without constraint in the plan view.
- IPQZ and IMQZ type connecting elements may also be installed 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 tensile force resulting from these types must be connected frictionally in the supporting structure on both sides of the insulation joint.

Slab connection ISOPRO IP and ISOMAXX IM	Annex B 01
Intended use / installation requirements	

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B.2   Installation requirements
B2.1   Axial and joint distances

- Tension and compression components, shear bars (Regulations according to section D.1.2.3):
  50 mm $\leq s_1 \leq$ ½ $s_{2,max}$
  with: s_1 centre distance from the free edge or expansion joint
  $s_{2,max}$ permissible maximum distance between bars

- External structural components: expansion joints shall be arranged rectangular to the insulation joint (see annex B 02)
- Joint distances: table B.1
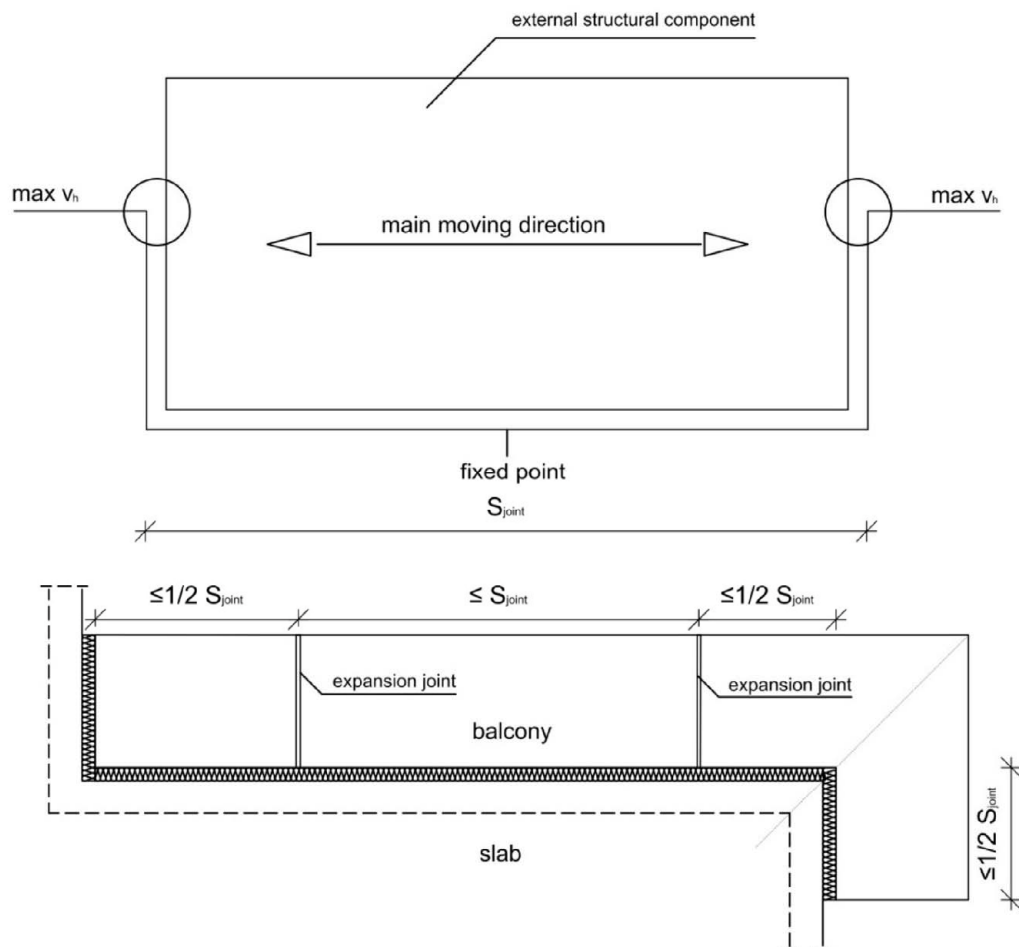
Table B.1: permissible expansion joint distances s_{joint} in [m]

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

Slab connection ISOPRO IP and ISOMAXX IM

Intended use: distance of expansion joints

Annex
B 02

B.2.2   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 B 04 to B 07)

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 $\varnothing \geq 6$ mm, $s \leq 250$ mm and 2 longitudinal bars $\varnothing \geq 8$ mm.

Lattice girders with a maximum distance of 100 mm from the insulation joint according to Annex B 09 may be taken into account.

The supplementary reinforcement has to be executed as follows:

- Transmission of moments and shear forces:
  - → tension bars have to be overlapped
- Transmission of shear forces only:
  - → The shear reinforcement in the area of the slab connection shall not be staggered
  - → The tensile reinforcement at the free edge of the slab shall be anchored by hooks in the compression zone. Alternatively stirrups can be placed at each shear bar
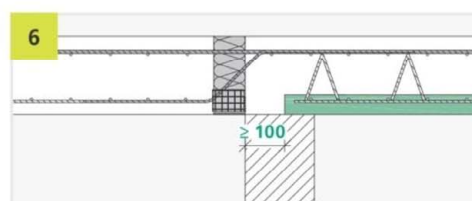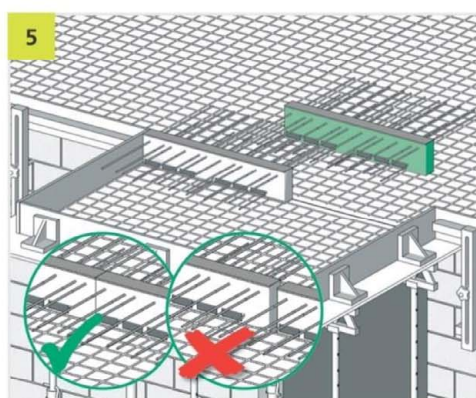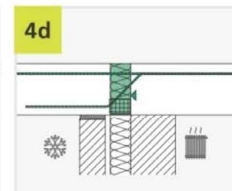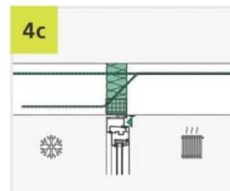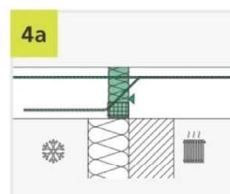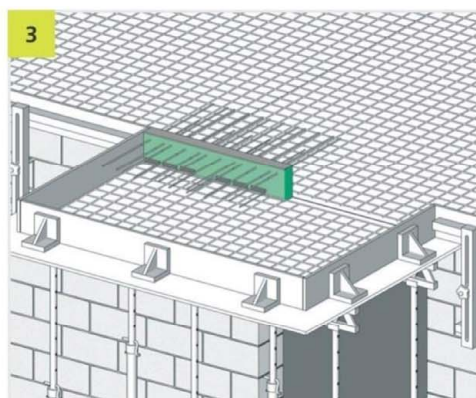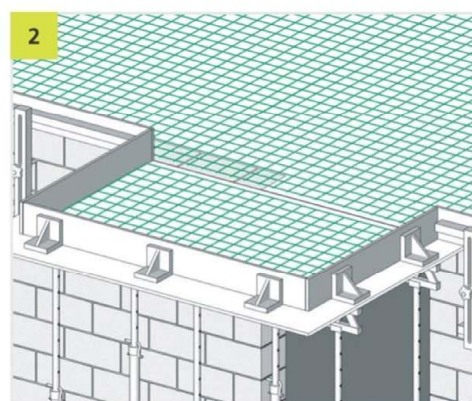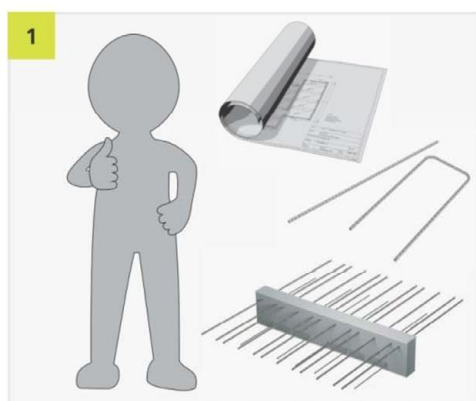
Subsequent bending of the bars of the slab connection is not permitted.

Slab connection ISOPRO IP and ISOMAXX IM	Annex
Intended use: structural design	B 03

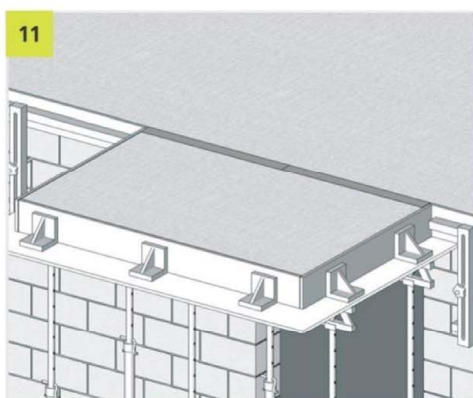ISOPRO® IP & ISOMAXX® IM

INSTALLATION INSTRUCTIONS
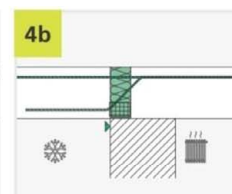
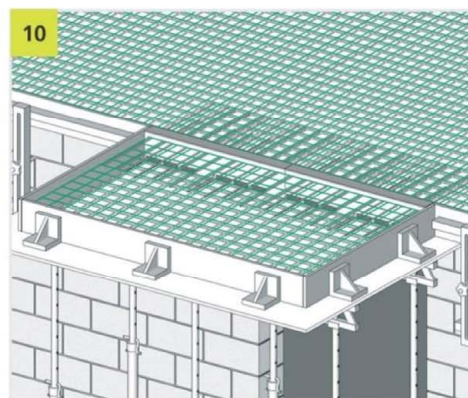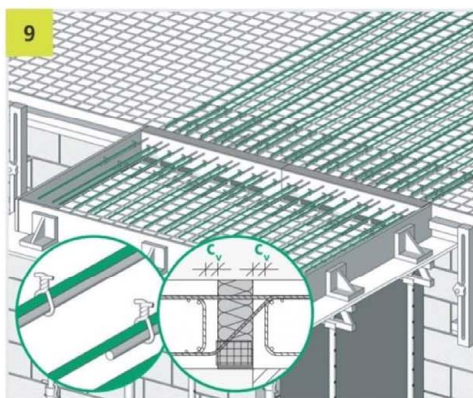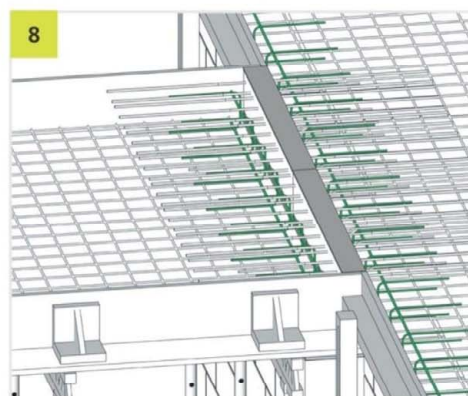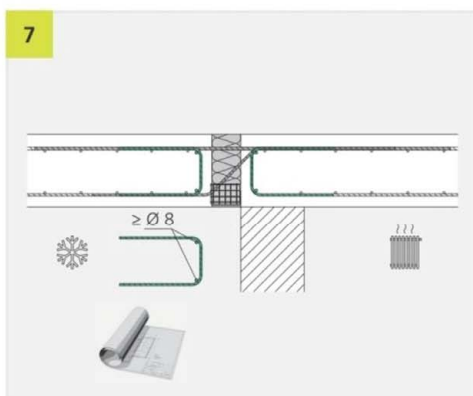| Slab connection ISOPRO IP and ISOMAXX IM	Annex
Intended use: installation instructions	B 04

ISOPRO® IP & ISOMAXX® IM

01/2018

Slab connection ISOPRO IP and ISOMAXX IM

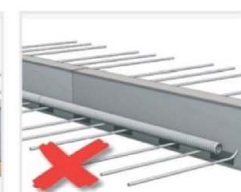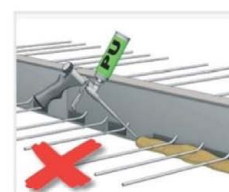Intended use: installation instructions

Annex
B 05

ISOPRO® IPQ & ISOMAXX® IMQ

INSTALLATION INSTRUCTIONS

H-BAU TECHNIK
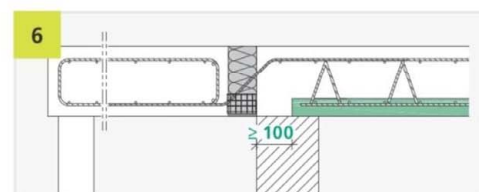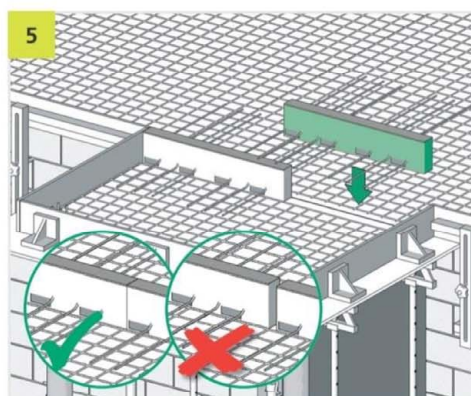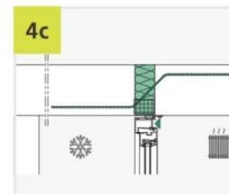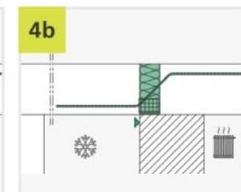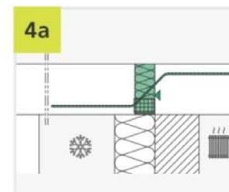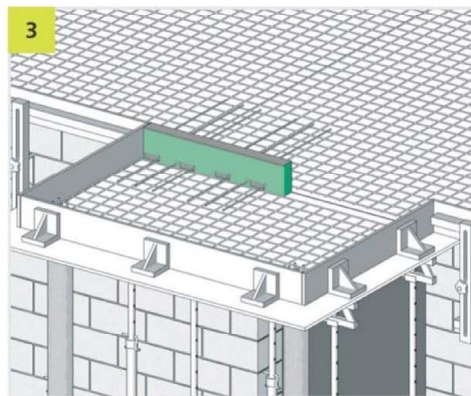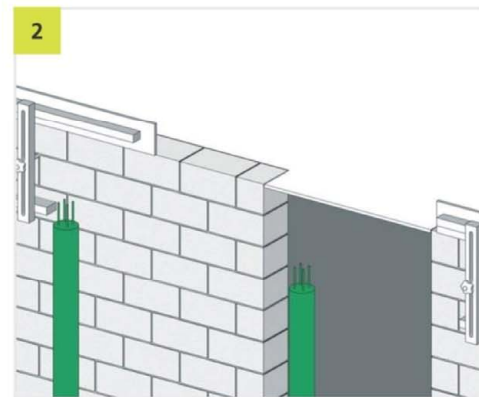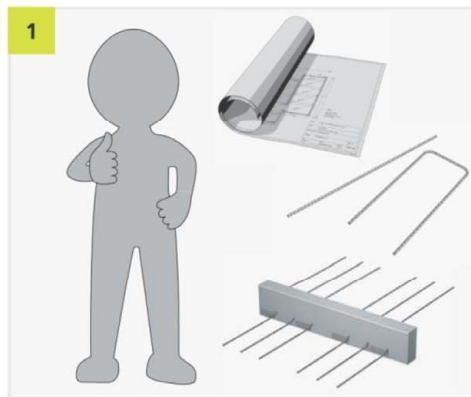
Slab connection ISOPRO IP and ISOMAXX IM	Annex B 06
Intended use: installation instructions Q-elements	

ISOPRO® IPQ & ISOMAXX® IMQ
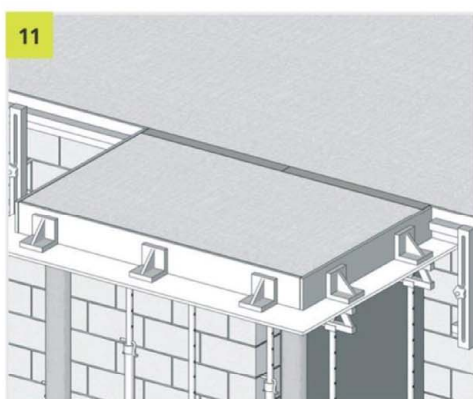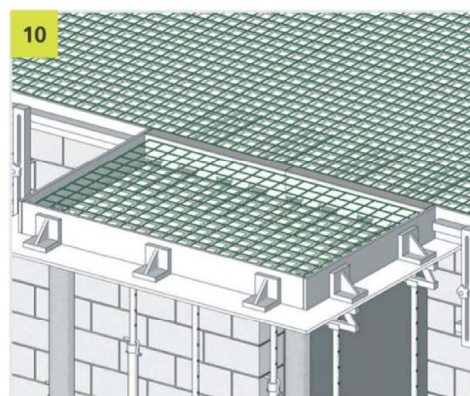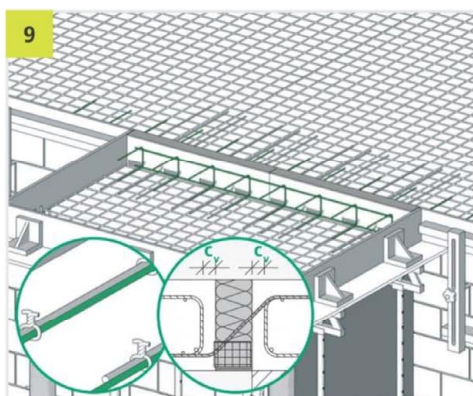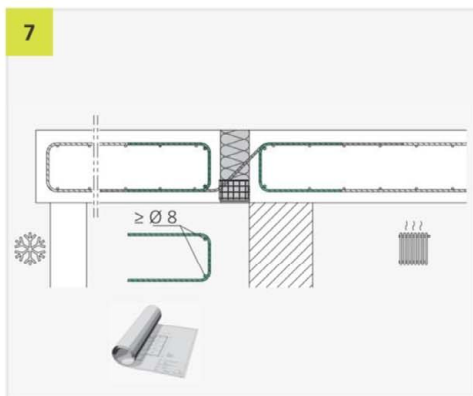
Slab connection ISOPRO IP and ISOMAXX IM	Annex
Intended use: installation instruction Q-elements	B 07

ISOPRO/ISOMAXX: two-part structure
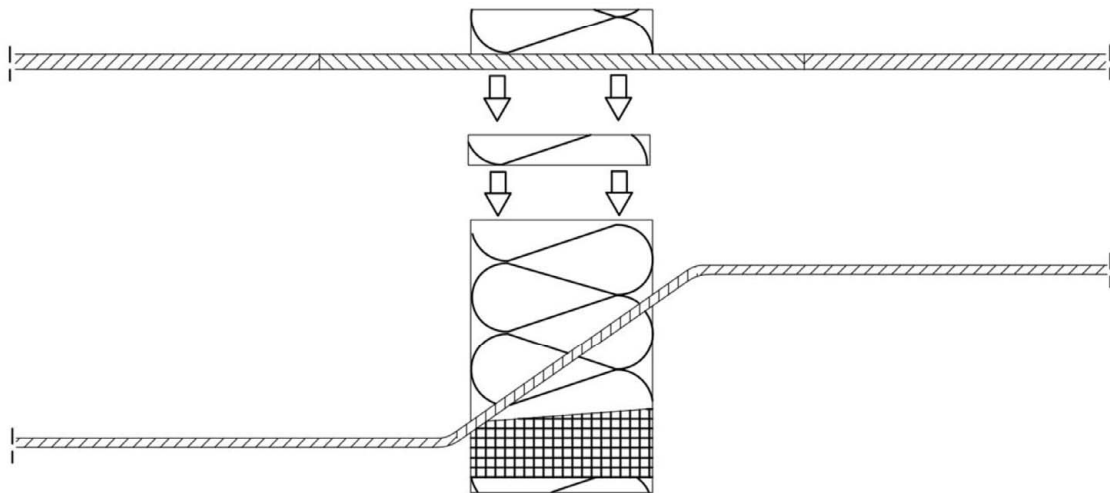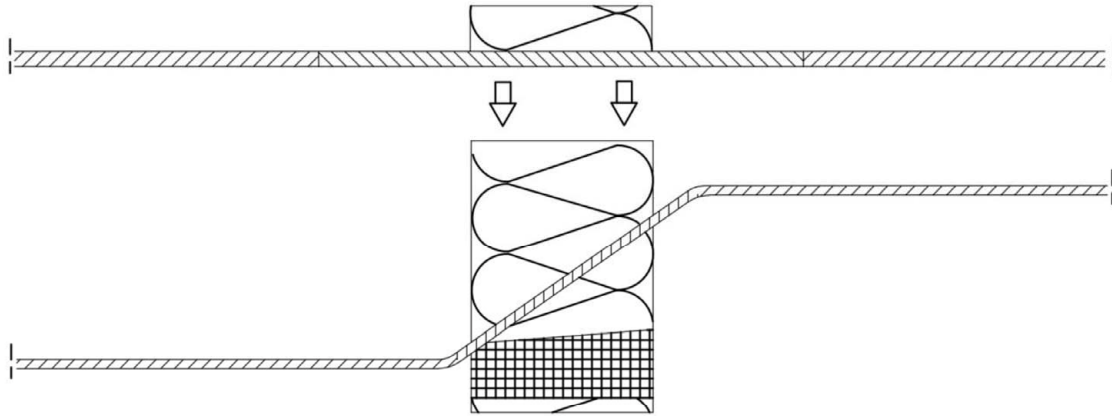
Slab connection ISOPRO IP and ISOMAXX IM

Intended use: installation instructions

Annex
B 08

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ISOPRO/ISOMAXX: structural edge reinforcement with and without girder
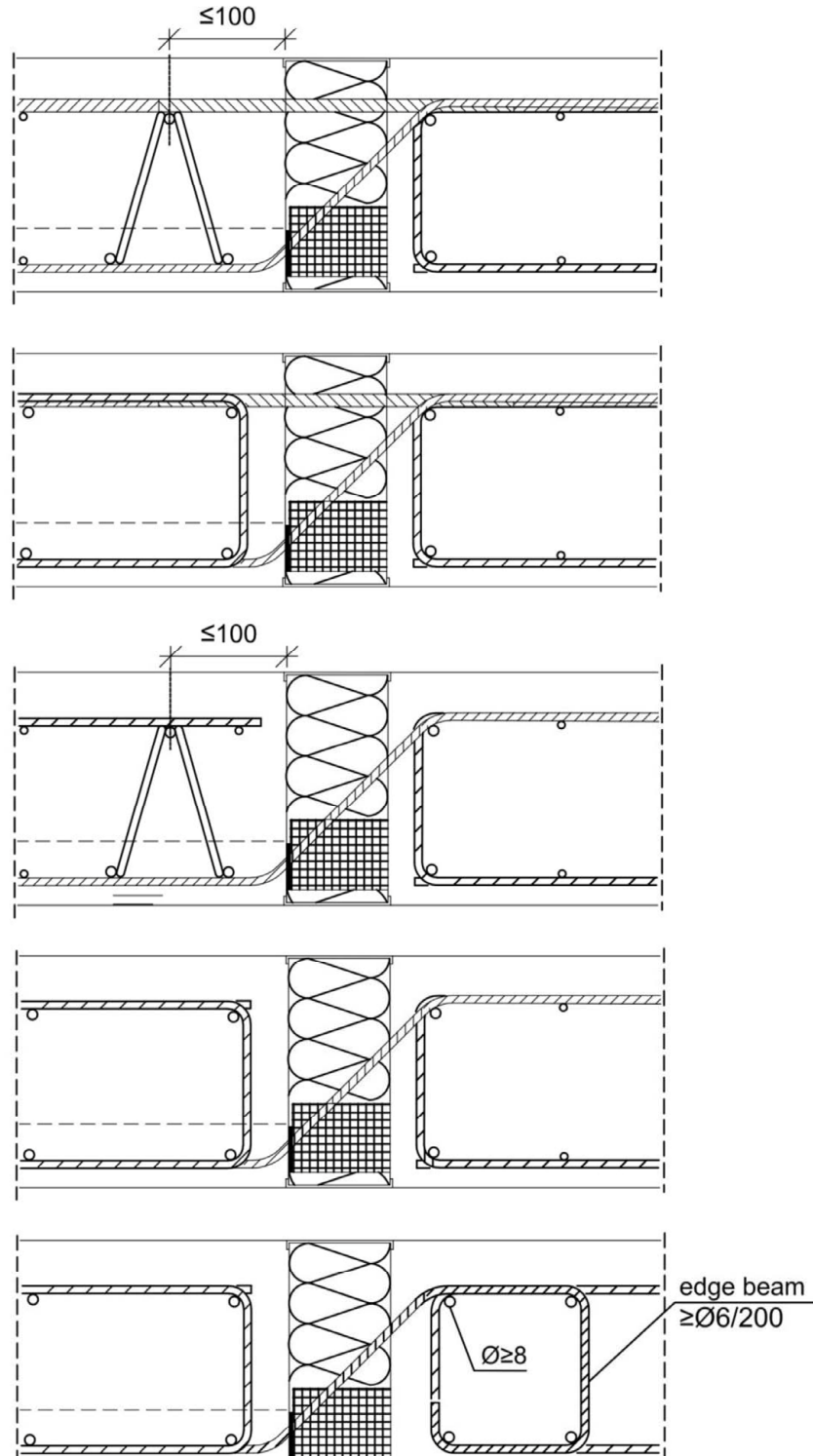
≤100

≤100

edge beam
≥Ø6/200

Ø≥8

Slab connection ISOPRO IP and ISOMAXX IM

Intended use: Installation instructions

Annex
B 09

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 100 mm wide shall be taken into account
- The concrete mixture of the in-situ concrete joint (maximum aggregate size d_g) shall be adjusted to this distance
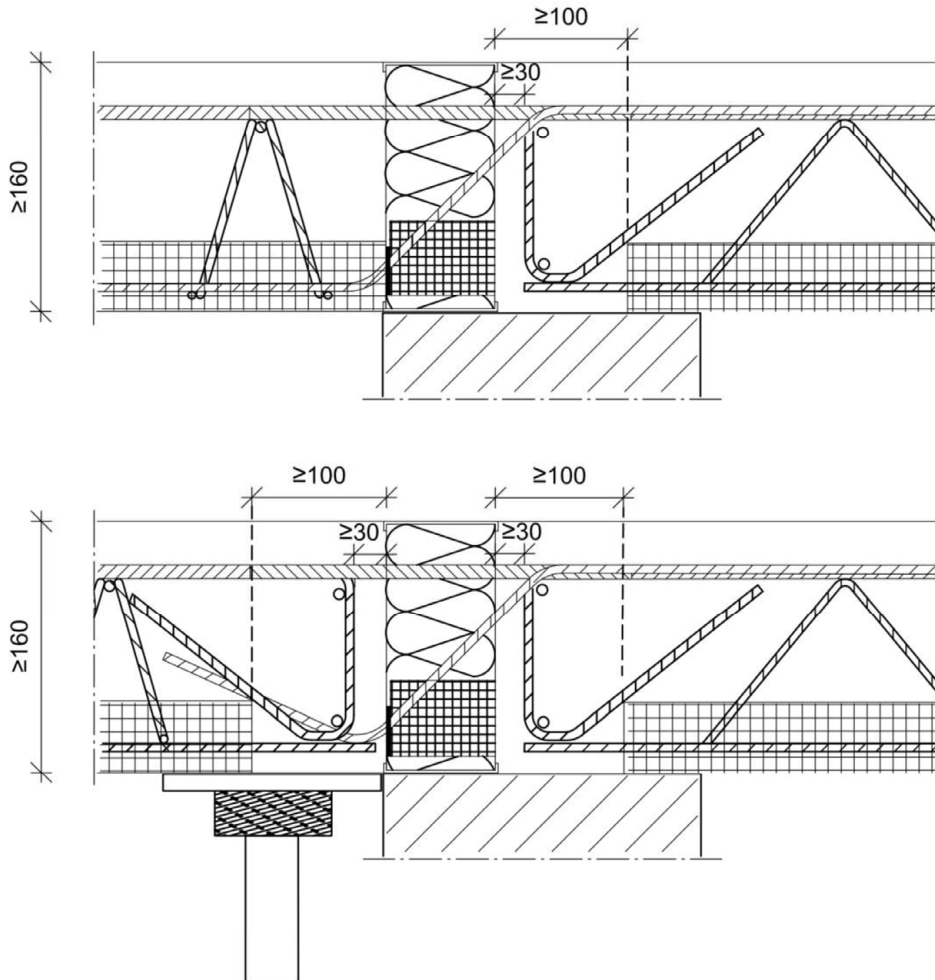
B.2.3 Instruction for use with fire protection requirements

When using the slab connectors to connect reinforced concrete slabs that are subject to fire protection requirements, the provisions of section C.2 shall be observed.

Slab connection ISOPRO IP and ISOMAXX IM	Annex
	B 10
Intended use: installation instructions	

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C.1 Load-bearing capacity
C.1.1 Bearing capacity of single components

- Concrete compression bearing
  Design values of the concrete compression bearings D_{Rd} depending 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 loadings $Z_{v,Rd}$ and shear force loadings V_{Rd} depending on different inclination angles:

	$Z_{v,Rd}$	$V_{Rd, 30°}$	$V_{Rd,45°}$	$V_{Rd,60°}$
$\varnothing$= 6 mm:	12,3 kN	6,2 kN	8,7 kN	10,7 kN
$\varnothing$= 8 mm:	21,9 kN	11,0 kN	15,5 kN	19,0 kN
$\varnothing$=10 mm:	34,1 kN	17,1 kN	24,2 kN	29,6 kN
$\varnothing$=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}:
  - $\varnothing_1$= 8 mm: 21,9 kN
  - $\varnothing_1$=10 mm: 34,1 kN
  - $\varnothing_1$=12 mm: 49,2 kN
  - $\varnothing_1$=14 mm: 66,9 kN

  $\varnothing_1$ according to annex A 06

Slab connection ISOPRO IP and ISOMAXX IM	Annex C 01
Performance parameters: load-bearing capacity	

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C.2 Fire resistance
C.2.1 Performance parameters regarding load-bearing capacity in case of fire

Design version A: concrete compression bearing consisting of ISOPRO or ISOMAXX pressure unit

If the performance characteristics for the design under normal temperatures as specified in Annex C 01 are complied with, the load-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 EN 1992-1-2, section 2.4.2 to $\eta_f = 0.7$ for designs in accordance with annex C 03 and under compliance with the following boundary conditions:

- The connection joint provided with the ISOPRO/ISOMAXX slab connection shall be completeley covered on the top and bottom side with fire protection plates according to annex A09 (see annex C 03).
- In the area of planned tensile stresses, the fire protection plates shall be designed either with a lateral projection of 10 mm from the insulation body or with additional intumescent layer formers on both side surfaces
- For required thickness t of the fire protection plates and minimum axial distance of the reinforcement see annex C 03.

Slab connection ISOPRO IP and ISOMAXX IM	Annex
Performance parameters: Load-bearing capacity in case of fire	C 02

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intumescent coating

fire protection plate

intumescent coating

10

u ≥35

10

fire protection plate

fire protection plate

10

u ≥35

10

fire protection plate
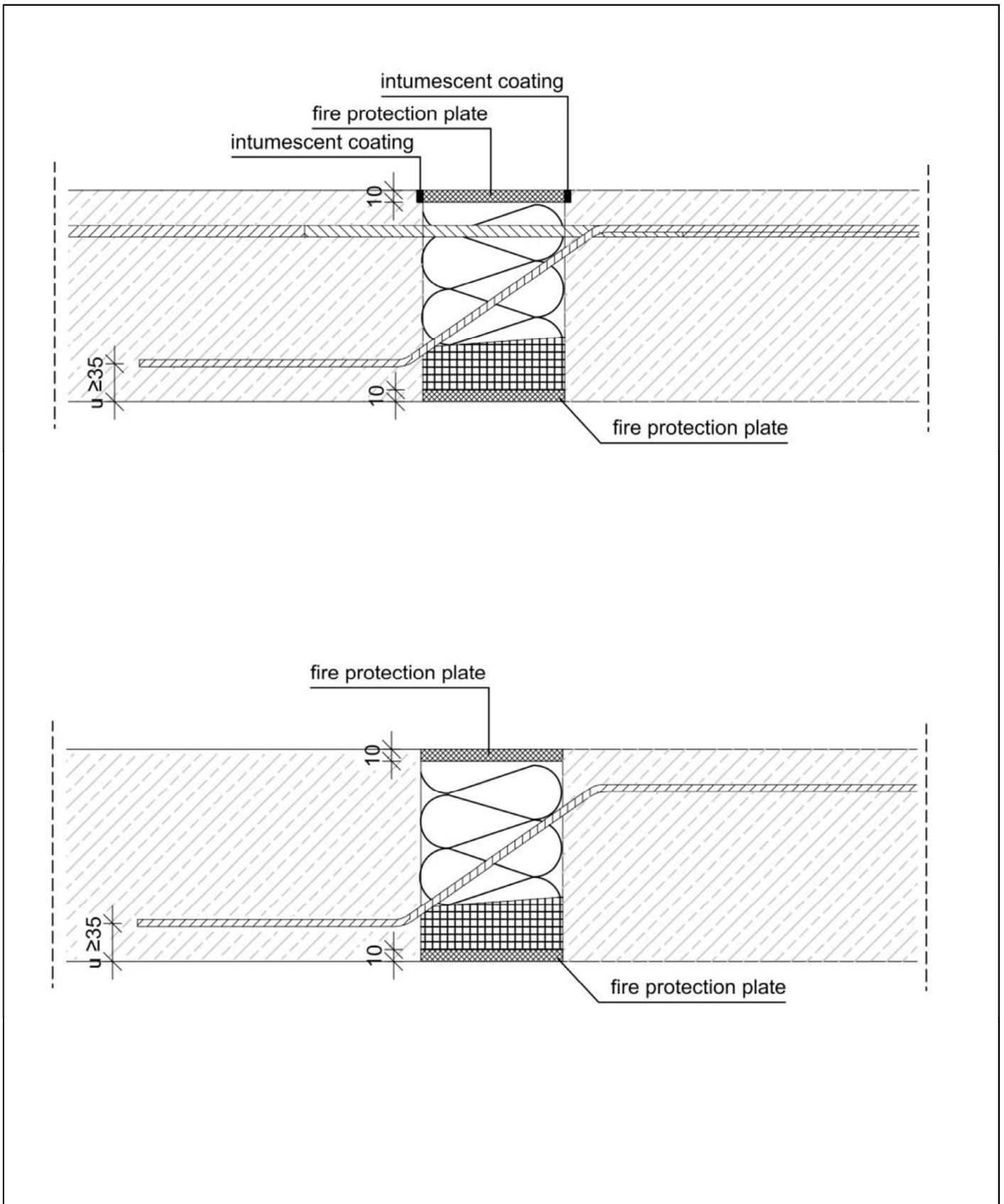
Slab connection ISOPRO IP and ISOMAXX IM

Performance parameters: Load-bearing capacity in case of fire

Annex
C 03

C.2.2   Fire resistance of structural components (for information)

Floor and roof structures as well as balcony and walkways, which are connected to reinforced concrete components according to their intended use with the ISOPRO/ISOMAXX slab connector, as shown in annex C 03, can be classified with regard to fire resistance according to EN 13501-2, as shown in table C.1. The following boundary conditions shall be observed:

- The performance in terms of load-bearing capacity in case of fire has been declared for the ISOPRO/ISOMAXX slab connector
- See annex C 02, items 1 bis 3
- In case of floor and roof structures, the connections of the remainig edges of the floor or roof structures not connected with the ISOPRO/ISOMAXX slab connection to adjoining or supporting building componenets shall be verified in accordance with the regulations of the Member States for the corresponding fire resistance.

Table C.1, classification of component

Design version	Floor or roof construction with fire separating function	Balconies and walkways
Design according annex C03	REI 90	R 90
Design according annex C03	REI 120	R 120

|	Annex
Slab connection ISOPRO IP and ISOMAXX IM	C 04
Classification of components (for information): Fire resistance	

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-tested design tables may be used

Determination of internal forces:
- By linear-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 D 02 to D 03 with $z = z_{strut-and-tie}$
- For the calculation of $z_{strut-and-tie}$ 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 tension forces only
- Variable moments and shear forces along the edge of the slab shall be taken into account (see section B.1.1)
- 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 B.2.2. A lattice girder which ist arranged parallel to the insulation joint may be used if it encloses the shear force bars and is brought as close as possible to the insulation joint while maintaining the required concrete cover (see annex B 09). 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 B.2.2

Slab connection ISOPRO IP and ISOMAXX IM	Annex D 01
Structural analysis: general	

Type IP/IM
direct support
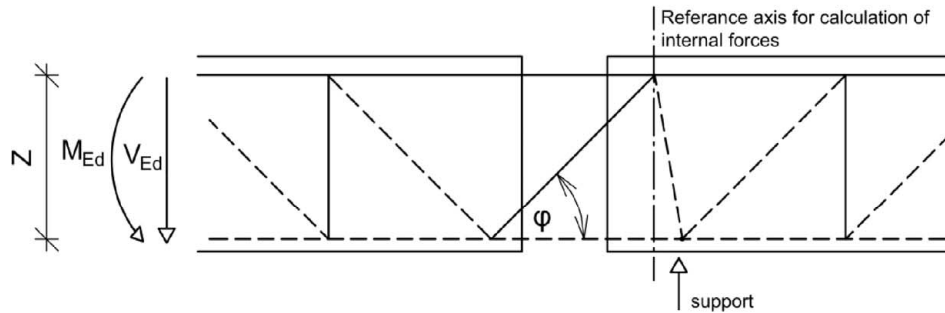
Type IP/IM
indirect support
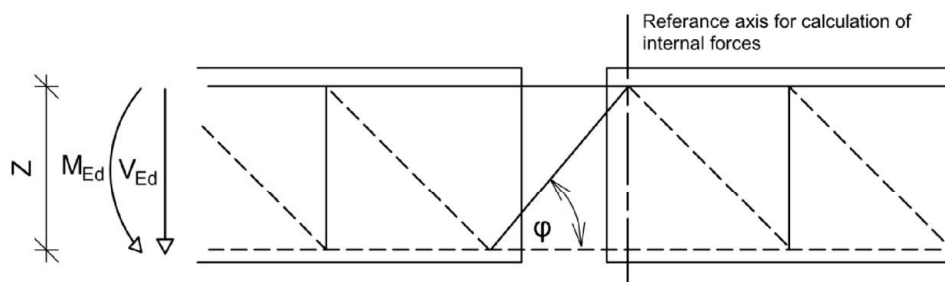
Type IPQQ(S)/IMQQ(S) (positive shear force only)
Type IPQ(S)/IMQ(S)
direct support
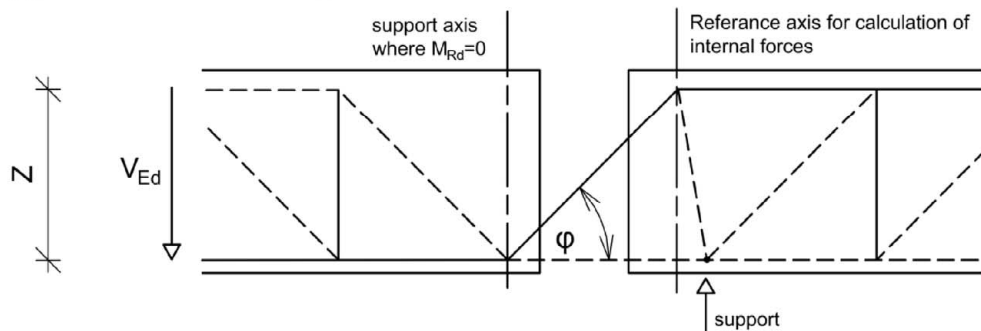
Type IPQQ(S)/IMQQ(S) (positive shear force only)
Type IPQ(S)/IMQ(S)
Indirect support
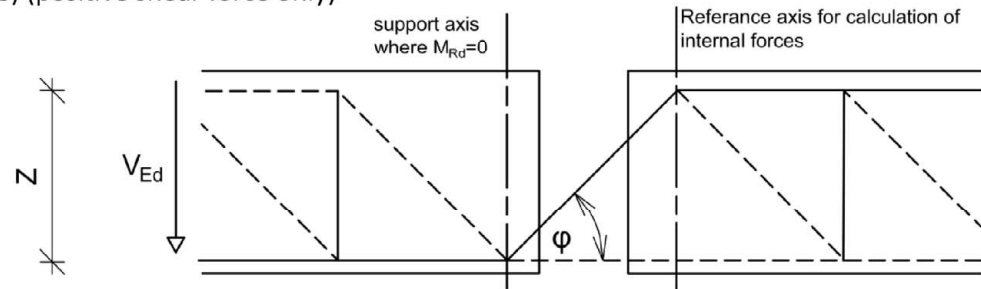
Slab connection ISOPRO IP and ISOMAXX IM	Annex
Structural analysis: Strut-and-tie models	D 02

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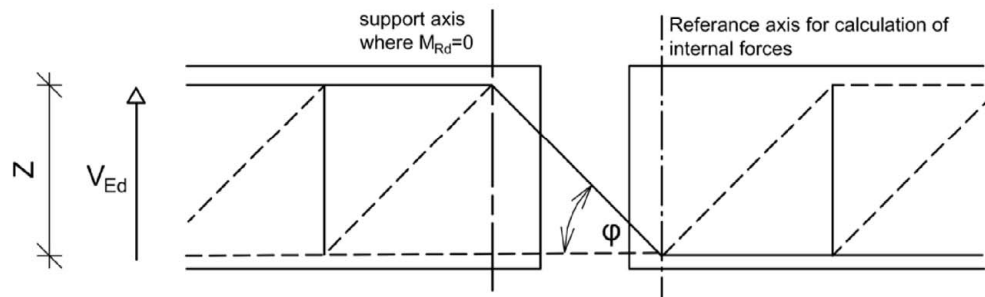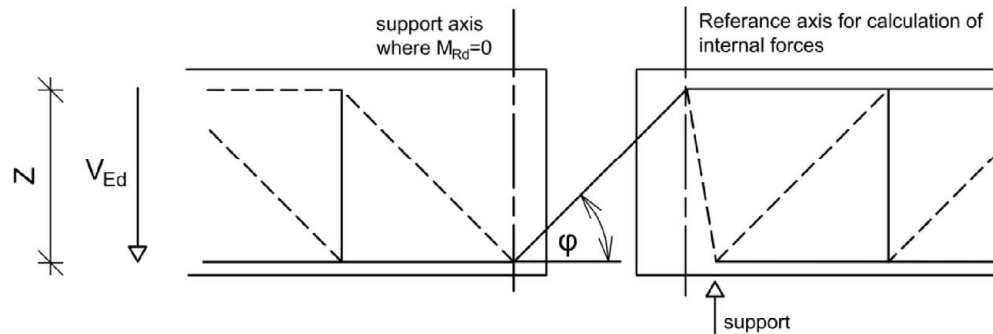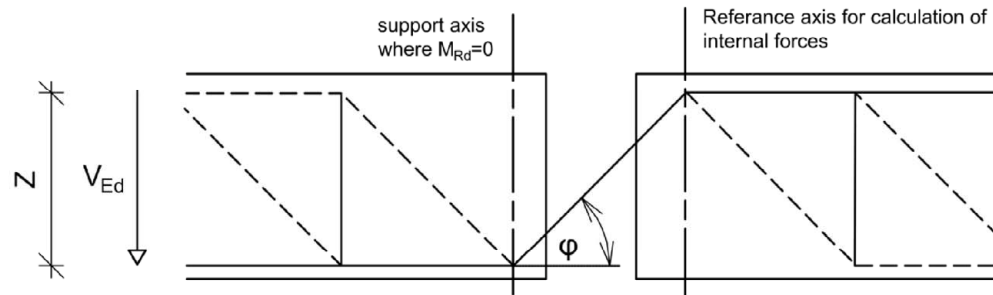direct support
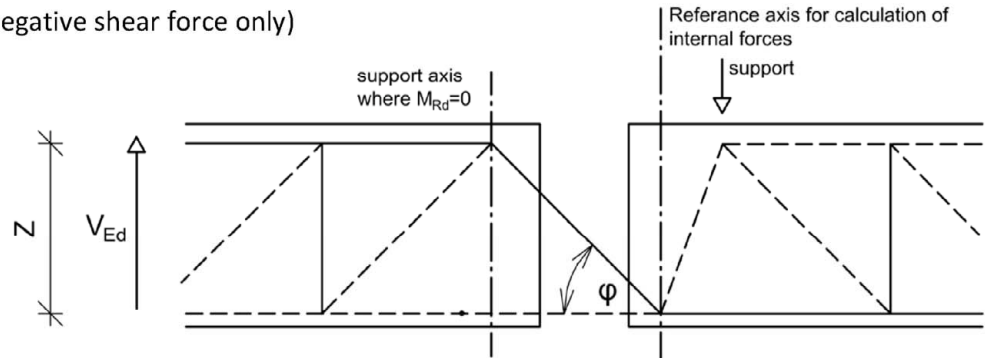
Type IPQQ(S)/IMQQ(S) (negative shear force only)
indirect support

Type IPQZ/IMQZ
Type IPZQ/IMZQ
direct support

Type IPQZ/IMQZ
Type IPZQ/IMZQ
indirect support

Slab connection ISOPRO IP and ISOMAXX IM	Annex
	D 03
Structural analysis: Strut-and-tie models	

D.1.2   Ultimate limit staes
D.1.2.1   Verification of compression members
D.1.2.1.1 Concrete compression bearing

- Design value D_{Rd} according to section C.1.1

D1.2.2   Verification of tension and shear bars

- Verification according to EN 1993-1-4 with design values according to annex C 01
- Load-bearing capacity of welded joints between reinforcing steel and stainless steel or round steel does not need to performec seperately

D1.2.3   Shear force bearing capacity in the area of the insulation joint

- Shear force bearing capacity of the connection 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 A 07
    - Average axial distance of the shear force bars and to the free edge or the expansion joint (see annex A03)

D1.2.4   Verification of fatigue due to temperature difference

- Verification by limiting the joint distances according to table B.1

D.1.2.5   Provision of 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.

Slab connection ISOPRO IP and ISOMAXX IM	Annex
Structural analysis: Ultimate limit states	D 04

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D.1.2.6 Anchoring lengths and overlap joints of the bars leading through the thermal insulation layer

- Only use the ribbed bar sections for anchoring and overlapping
- When using graduated tension bars (see annex A 06) the supplement of the lap length Δ_{l0} according to annex A 06 shall be taken into account
- 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 1992-1-1 / NA, equation (8.4) overlap with tensile reinforcement of the slab to be connected
  - Anchoring in compression zone with l_{bd}; if shear force bars and compression bearings are not laid in one plane, determine 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 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 A 07 or A 08 is possible, if an edge beam is designed with the construction details given in annex B11
- 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 lower chords of the lattice girders.

D.1.3   Serviceability limit states
D.1.3.1 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 introduction if the provisions of this European Technical Assessment are observed

D1.3.2   Limitation of deformations

The following influencing factors shall be taken into account when calculating the 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 determination of bending deformation in the joint, see annex D 07 and D 08
- elastic deformation of tension bars as function of the applicable yield strengths, according to annex A 06

Slab connection ISOPRO IP and ISOMAXX IM	Annex
Structural analysis: Ultimate limit states	D 05

Torsion in the joint caused by torque load
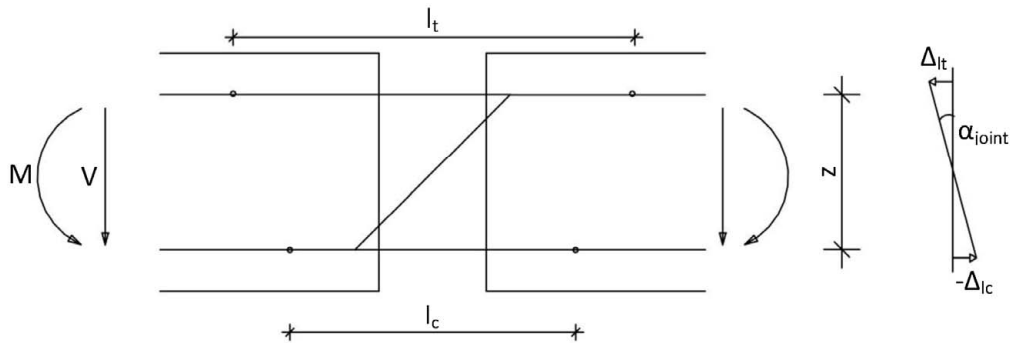
Deformation in consequence of torque load M

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

Tension bar:

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

    - $F_t = \dfrac{M/z}{n_t}$:   force/tension bar

        n_t :   number of tension bars

    - E_1 :   160.000 N/mm^2
    - E_2 :   200.000 N/mm^2

    - l_{t1} :   Joint width
    - l_{t2} :   effective length B500 NR
    - l_{t3} :   effective length B500 B

        For B500 NR
        $\varnothing \leq 10$ mm: $\rightarrow l_{t2} = 2\cdot10\cdot\varnothing$ and $l_{t3} = 0$ mm
        $\varnothing > 10$ mm: $\rightarrow l_{t2} = 2\cdot100$ mm and $l_{t3} = 2\cdot10\cdot\varnothing\text{-}2\cdot100$ mm

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Slab connection ISOPRO IP and ISOMAXX IM

Structural analysis: Model for the determination of the torsion in the joint

Annex
D 06

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 (see annex A 08)

    100 · 36 mm   for ISOPRO version 1 (see annex A 08)

  - $F_c = \dfrac{M/z}{n_c}$:

    force/compression unit

    n_c :   number of compression units

  - $l_{c,CB}$:   joint width (80 mm for type ISOPRO and 120 mm for type ISOMAXX)

  - $E_{cm,cB}$:

    41.000 N/mm^2 for ISOPRO and ISOMAXX compression unit

    19.455 N/mm^2 for ISOPRO and ISOMAXX HLB-compression unit

Deformations as a consequence of shear force V can be neglected.

Slab connection ISOPRO IP and ISOMAXX IM	Annex
Structural analysis: Model for the determination of the torsion in the joint	D 07