H-BAU TECHNIK

ISOPRO®

Thermal insulation units 80mm
DIN EN 1992-1-1

Forward
Constructing.

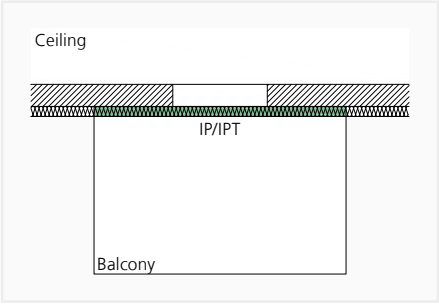
OUR MISSION:
FORWARD CONSTRUCTING.

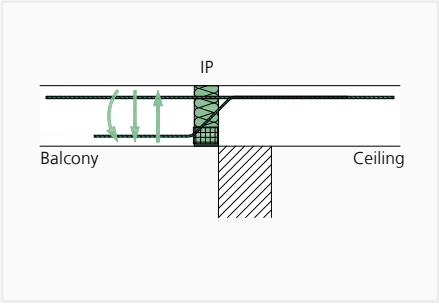
It is our mission not only to provide the very latest building technology, but to also be one crucial step ahead of the game at all times. That is why we are constantly undertaking pioneering work in all product areas. Our employees consistently put their extensive practical experience and creativity to use in the interests of our customers. In constant dialogue with our target groups on a partnership basis, we are already developing the products today that will be needed tomorrow. Our momentum continues to set new benchmarks in structural engineering – yesterday, today and tomorrow, too. This is what we mean by "forward constructing".

INHALT

TYPE OVERVIEW

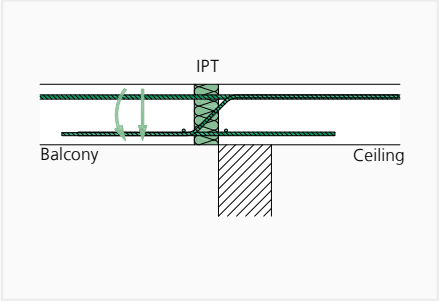
CANTILEVERED STRUCTURES





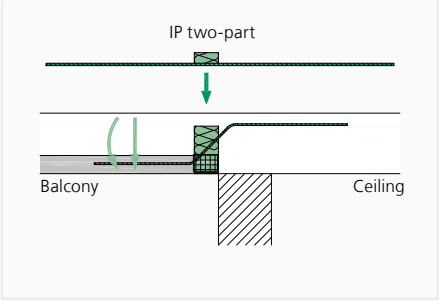
ISOPRO® IP

- Transfer of negative moments as well as positive shearing forces
- Transfer of negative moments as well as positive and negative shearing forces with version IP QX
- Version with concrete compression bearings
- P. 26



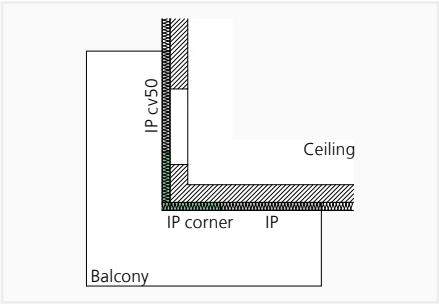
ISOPRO® IPT

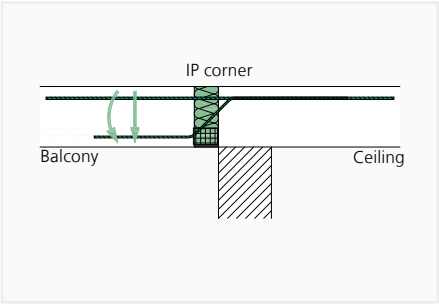
- Transfer of negative moments and positive shearing forces
- Version with steel pressure rods
- P. 26



ISOPRO® IP TWO-PART

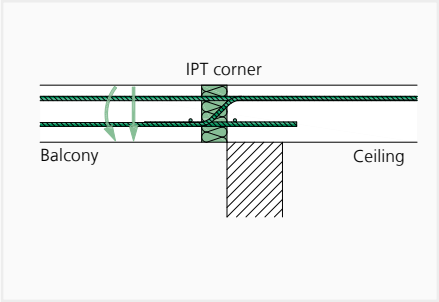
- Transfer of negative moments and positive shearing forces
- Version with concrete compression bearings
- Two-part version for prefab slabs
- P. 40





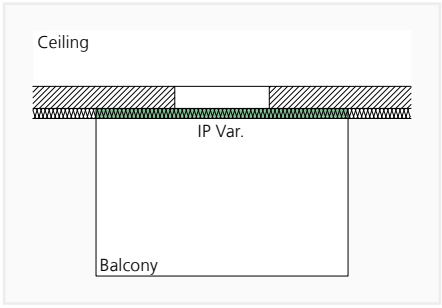
ISOPRO® IP CORNER, IPT CORNER

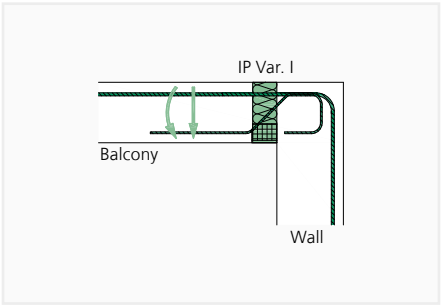
- Transfer of negative moments and positive shearing forces
- Version IP with concrete compression bearings
- Version IPT with steel pressure rods
- Solution for corner balconies
- P. 52



TYPE OVERVIEW

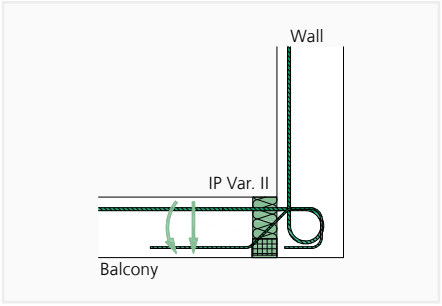
CANTILEVERED STRUCTURES AT WALL CONNECTIONS/VERTICALLY OFFSET CEILINGS





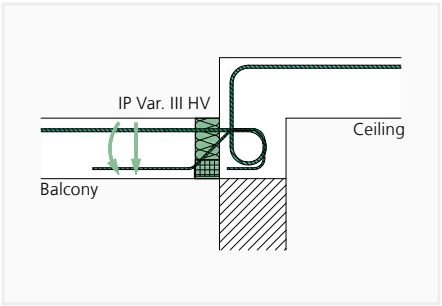
ISOPRO® IP VAR. I

- Transfer of negative moments and positive shearing forces
- Version with concrete compression bearings
- Connection to a wall leading downwards
- P. 44



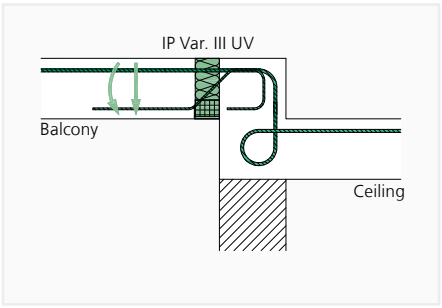
ISOPRO® IP VAR. II

- Transfer of negative moments and positive shearing forces
- Version with concrete compression bearings
- Connection to a wall leading upwards
- P. 44



ISOPRO® IP VAR. III HV

- Transfer of negative moments and positive shearing forces
- Version with concrete compression bearings
- Connection to a ceiling vertically offset upwards
- P. 44

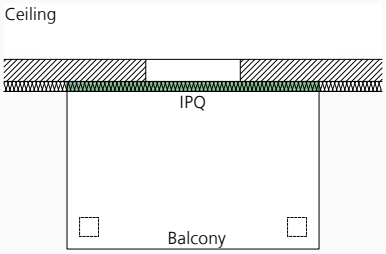


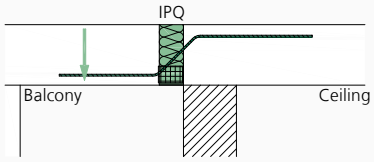
ISOPRO® IP VAR. III UV

- Transfer of negative moments and positive shearing forces
- Version with concrete compression bearings
- Connection to a ceiling vertically offset downwards
- P. 44

TYPE OVERVIEW

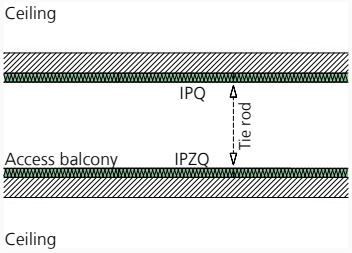
SUPPORTED STRUCTURES

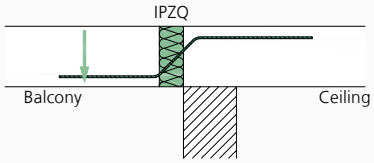




ISOPRO® IPQ

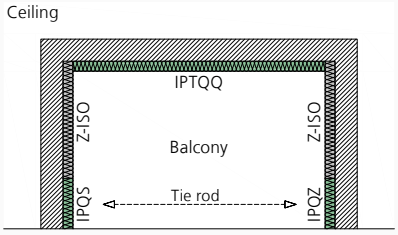
- Transfer of positive shearing forces
- Version with concrete compression bearings
- P. 60

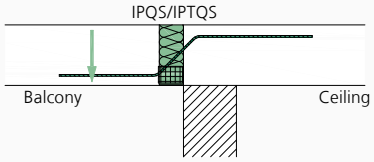




ISOPRO® IPZQ

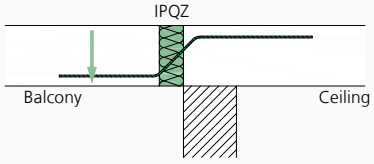
- Transfer of positive shearing forces
- Version without compression bearing for constraint-free connections
- P. 60





ISOPRO® IPQS/IPTQS

- Transfer of positive shearing forces
- IPQS version with concrete compression bearings
- IPTQS version with steel pressure rods
- Short unit for bearing loads at specific points
- P. 60

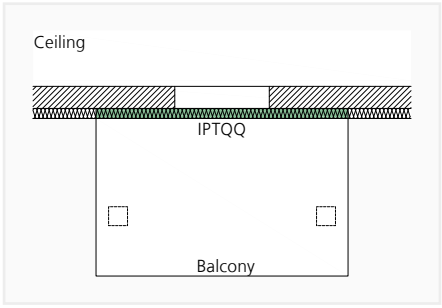


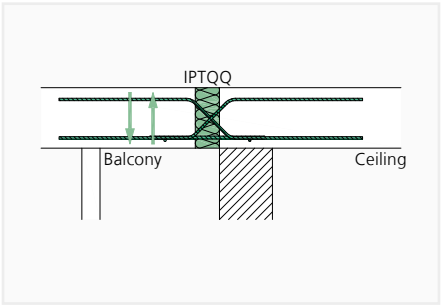
ISOPRO® IPQZ

- Transfer of positive shearing forces
- Version without compression bearing for constraint-free connections
- Short unit for bearing loads at specific points
- P. 60

TYPE OVERVIEW

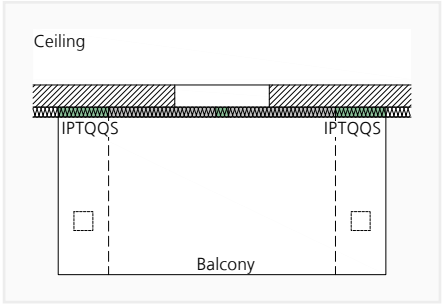
SUPPORTED STRUCTURES WITH LIFTING LOADS

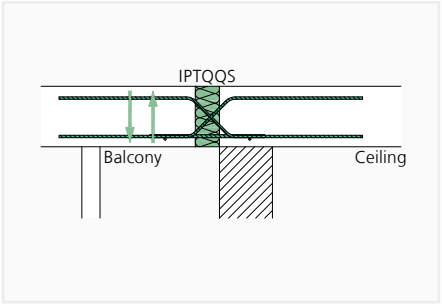




ISOPRO® IPTQQ

- Transfer of negative and positive shearing forces
- Version with steel pressure rods
- P. 68

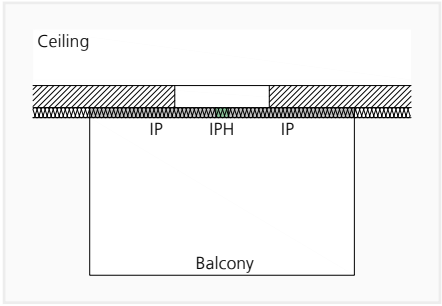


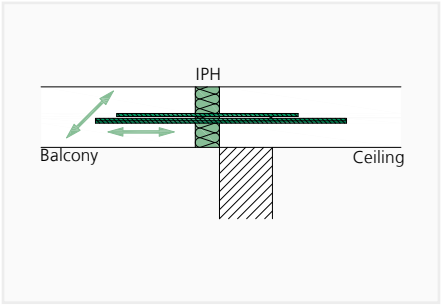


ISOPRO® IPTQQS

- Transfer of negative and positive shearing forces
- Version with steel pressure rods
- Short unit for bearing loads at specific points
- P. 68

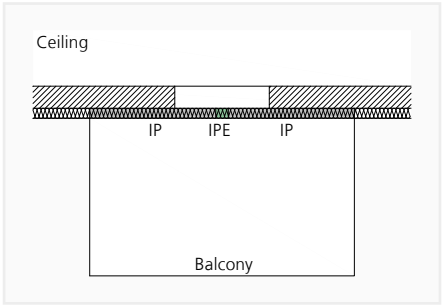
HORIZONTAL LOADS AND EARTHQUAKE LOADS

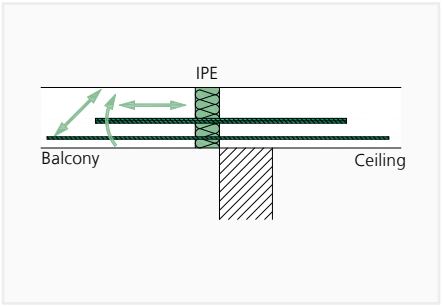




ISOPRO® IPH

- Transfer of horizontal loads parallel and/or perpendicular to the insulation plane
- P. 80



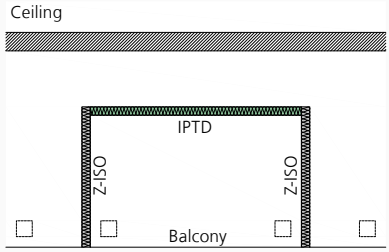


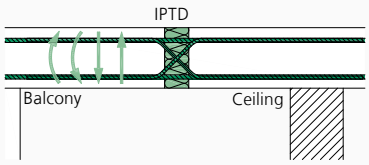
ISOPRO® IPE

- Transfer of horizontal loads parallel and perpendicular to the insulation plane
- In combination with the ISOPRO® units IP, IPT and IPTD: Transfer of positive moments
- Used for earthquake
- P. 84

TYPE OVERVIEW

CONTINUOUS SLABS

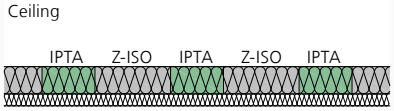


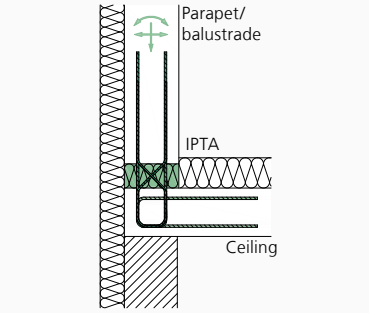


ISOPRO® IPTD

- Transfer of positive and negative moments and shearing forces
- Version with tension/pressure rods
- P. 74

PARAPETS AND BALUSTRADES CONNECTED TO THE HORIZONTAL FACE

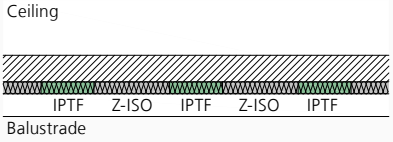


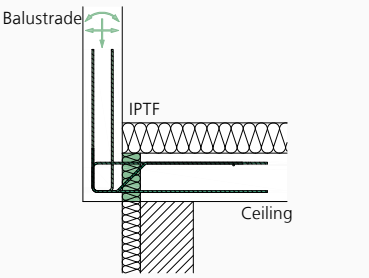


ISOPRO® IPTA

- Transfer of moments, normal forces and horizontal forces
- Used at specific points
- P. 88

BALUSTRADE CONNECTED TO THE VERTICAL FACE

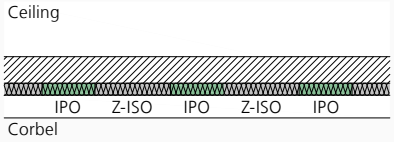


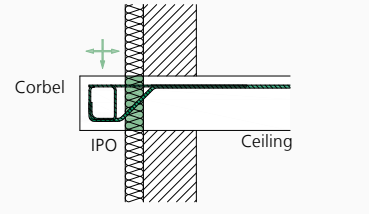


ISOPRO® IPTF

- Transfer of moments, shearing forces and horizontal forces
- Used at specific points
- P. 92

CORBEL



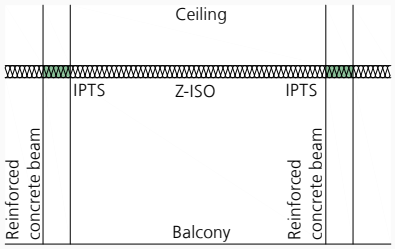


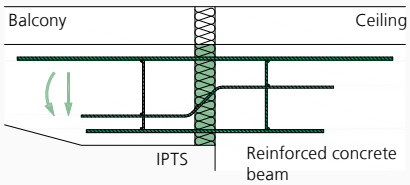
ISOPRO® IPO

- Transfer of shearing forces and horizontal forces
- Used at specific points
- P. 96

TYPE OVERVIEW

BEAMS

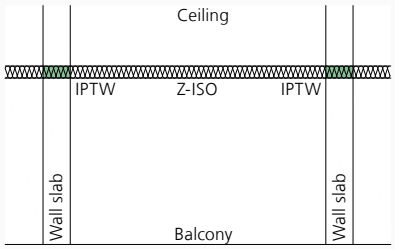


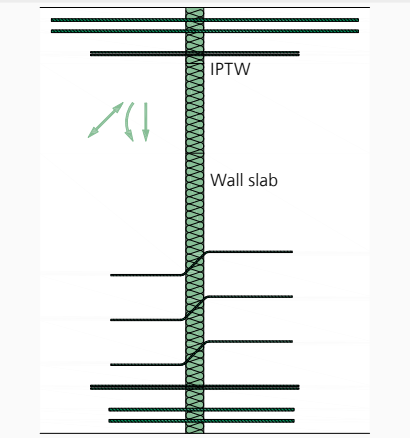


ISOPRO® IPTS

- Transfer of negative moments and positive shearing forces
- Version with pressure rods
- P. 100

WALLS

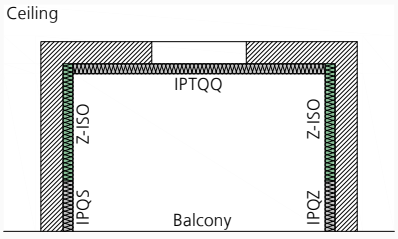


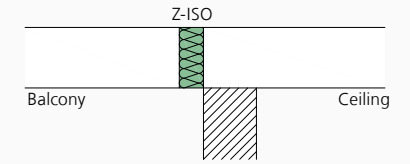


ISOPRO® IPTW

- Transfer of negative moments, positive shearing forces and horizontal forces
- Version with pressure rods
- P. 104

INTERMEDIATE INSULATION





ISOPRO® Z-ISO

- No structural function
- Intermediate insulation for support at specific points
- P. 110

PRODUCT INFORMATION

FUNCTION OF THE ISOPRO® UNIT

As a load-bearing thermal insulation unit, ISOPRO® undertakes the following functions:

- Thermal separation of reinforced concrete components to resolve structural problems at the transition between internal and external components
- Frictional connection of the reinforced concrete components across the insulating joint.

The load transfer across the joint is carried out by means of tension and shear rods as well as a pressure component. Depending on the ISOPRO® type, the pressure component is designed as a pressure unit made of special concrete (IP unit) or as a steel pressure rod (IPT unit). For corrosion-protection reasons, and to reduce heat transition through the structural components, stainless steel reinforcement units are implemented in the area of the insulating body. The transition from stainless steel to carbon steel is carried out using a special welding method. In the area of the insulating body the tension rods of standard units are made of stainless steel and have a reduced diameter compared to the adjoining carbon steel rods.
The ISOPRO® unit is available in different load-bearing capacities. With regard to the load-bearing capacities, the units vary in terms of the number and diameter of tension and shear rods, as well as the number of pressure components. To increase stability, constructive connectors are fitted on the ceiling side for large rod diameters. In principle, the units are available in heights from 160 mm. However, depending on the diameter of the shear rod used, there may be restrictions in terms of the minimum height.
During installation it is crucial to note the direction of installation indicated on the label. The direction of installation is marked clearly on each unit by the indication of the top and an arrow to the balcony side (of the cold area).

MATERIALS OF THE ISOPRO® UNIT

Tension, shear, pressure rod:	Reinforcing steel B500B Stainless steel rebar according to general technical approval Material no. 1.4571, 1.4362 or 1.4482
Compression bearing:	High-performance special concrete
Insulating body:	NEOPOR®* Rigid polystyrene foam, λ = 0.031 W/mK
Fireproof panels:	Fibre-cement panels of building material class A1

GENERAL TECHNICAL APPROVALS

ISOPRO®:	Z-15.7-243 and Z-15.7-244, DIBt Berlin

MATERIALS OF THE ADJOINING PARTS

Concrete:	Standard concrete acc. to DIN 1045-1 or DIN EN 206-1 with a raw density of 2000 to 2600 kg/m³
Concrete strength classes:	External components ≥ C25/30 Internal components ≥ C20/25
Reinforcing steel:	B500B

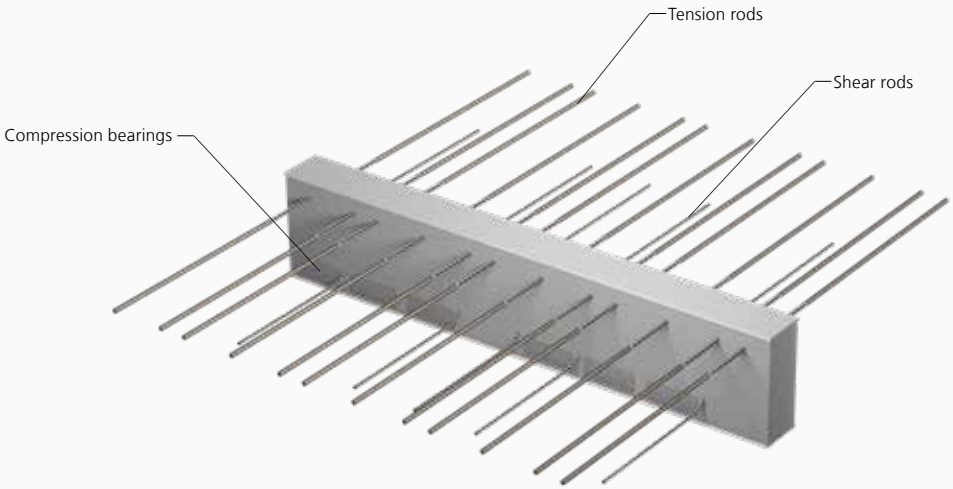
SUPPLEMENTARY REINFORCEMENT

The components adjoining the ISOPRO® units are reinforced in accordance with the structural engineer´s design based on the structurally required reinforcement.

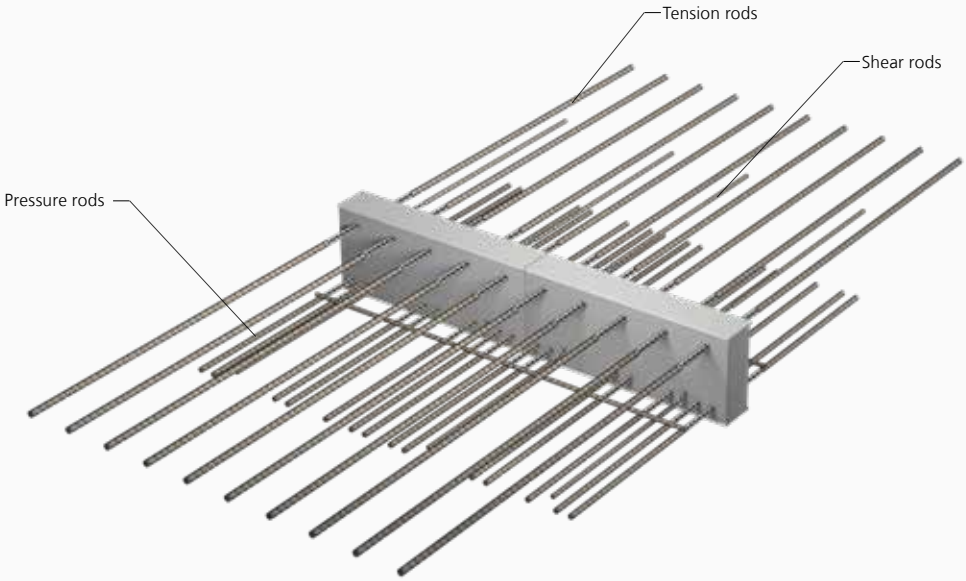
*Neopor® is a registered trademark of BASF, Ludwigshafen

PRODUCT COMPONENTS

ISOPRO® IP



ISOPRO® IPT



CONCRETE COVERING

EXPOSURE CLASS AND CONCRETE COVERING

The minimum concrete strength for the components adjoining the ISOPRO® units as well as the required concrete covering cv for the ISOPRO® units are calculated according to the exposure class and the approval. The higher minimum concrete strength class is definitive in each case.

Reinforcement corrosion		Minimum concrete strength class			Concrete covering [mm]	
DIN EN 1992-1-1		DIN EN 1992-1-1/NA	Approval for internal components	Approval for external components	Components c_{nom}	ISOPRO® cv
XC3	Moderate humidity, external components, wet areas	C20/25	C20/25	C25/30	35	30
XC4	Alternately wet and dry, external components directly exposed to rain	C25/30			40	35
XD1	Moderate humidity, spray zone from road surfaces	C30/37			55	50
XS1	Salty air, external components near coast	C30/37			55	50
XD1	Moderate humidity, spray zone from road surfaces	C30/37			55	50
XS1	Salty air, external components near coast	C30/37			55	50

ISOPRO® CONCRETE COVERING

- In accordance with DIN EN 1992-1-1/NA, the cv dimension of the ISOPRO® units may be reduced by Δc_{dev} = 5 mm using suitable quality measures during production.
- For ISOPRO® types IP/IPT two-part/IPT/IP Var., cv35 or cv50 can be selected for the tension rod concrete covering.
- The ISOPRO® IP corner and IPT corner unit is available with the concrete covering of cv35/cv50 for the tension rods.
- For the shear units, the concrete covering at the top is cv35 to cv85, depending on the height.
- The concrete covering for pressure rods and shear rods at the bottom is generally cv30 (usually lower exposure compared to the top side of the balcony).
- ISOPRO® IPTD units have a bottom concrete covering of cv30 for the selected top concrete covering of cv35, and a bottom concrete covering of cv50 for the selected top concrete covering of cv50.

GENERAL INFORMATION

NOTES ON DESIGN

- The design for the reinforced concrete components adjoining the ISOPRO® units is provided by the structural engineer.
- When there are different concrete qualities in the adjoining components (e.g. balcony C25/30; ceiling C20/25), the lower concrete quality is definitive for designing ISOPRO® units.
- The specified design values apply to concrete qualities ≥ C25/30. Values for C20/25 on request.
- The specified table values for supplementary reinforcement apply to full utilisation of the ISOPRO® units. A reduction by m_{Ed}/m_{Rd} or v_{Ed}/v_{Rd} is permissible.
- The specified minimum heights depending on the shearing force load-bearing capacity apply to concrete cover cv35. The minimum heights must be increased by 20 mm accordingly for cv50.
- To bear planned horizontal loads, the ISOPRO® IP and IPT units must be combined with ISOPRO® IPH or IPE short units.
- ISOPRO® units for cantilevered constructions without live load, but with an ordinary moment from a load not increasing the shear forces, must be proven separately by our application technology
- For reinforcement, please note ability for concrete pouring. This applies in particular to ISOPRO® units with a high number of rods.

SPECIAL UNITS

- Beyond the standard units listed in this documentation, we also offer special structures tailored to the construction project, resultant forces and component geometry. Planning, design and production of special structures is carried out in compliance with the requirements of the approvals and according to DIN EN 1992-1-1 and DIN EN 1992-1-1/NA.

HANDLING AND INSTALLATION ON SITE

- When using ISOPRO® units with concrete compression bearings, please ensure that the frictional connection between the compression bearing and the concrete of the component is guaranteed. When using prefab slabs, an in-situ concrete or grouting strip at least 100 mm wide must be taken into account.
- For simultaneous use of ISOPRO® units with steel pressure rods and prefab slabs on the ceiling side, it must be ensured that the width of the in-situ concrete strip is matched to the length of the pressure rods.
- When using ISOPRO® units with fire protection version R 90/REI 120, please ensure that the fireproof panels are not damaged.
- Please note that subsequent bending of the reinforcement rods on site will render the approval and warranty by H-BAU Technik GmbH void.
- On site partition of ISOPRO® metre units is possible – reduced load-bearing capacity and minimal edge distance of the ISOPRO® components must be taken into consideration.
- In highly reinforced structures (e.g. joists) it should be considered to install the ISOPRO® unit before the supplementary reinforcement.

Our Applications Technology department would be pleased to assist in finding further solutions.
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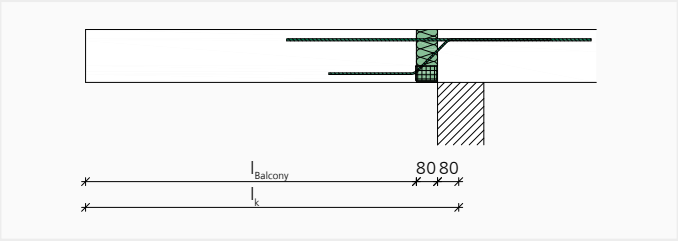
DESIGN

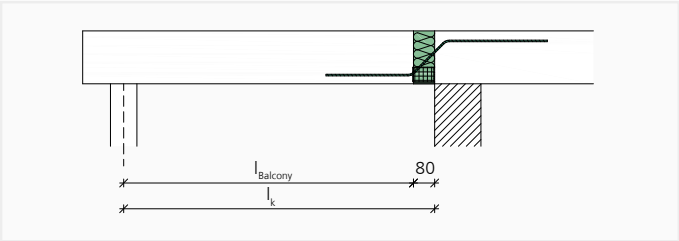
DESIGN OF ISOPRO® UNITS – FEM CALCULATION/MANUAL CALCULATION

SYSTEM CALCULATION

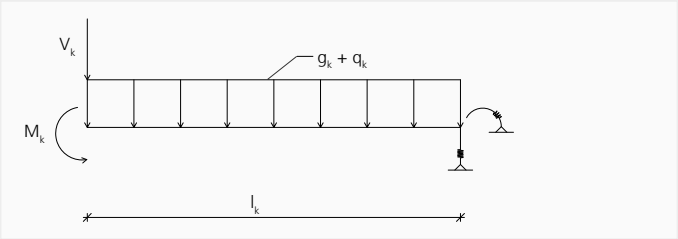
Cantilevered balcony

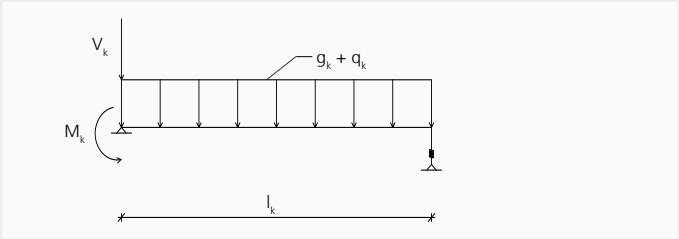


Supported balcony



Model





SUPPORT CONDITIONS

	Clamped	Hinged
Manual calculation:		
FEM calculation:		
Torsion spring:	10.000 kNm/rad/m	Torsion spring: –
Vertical spring:	250.000 kN/m/m	Vertical spring: 250.000 kN/m/m

LOAD ASSUMPTIONS

g_k: Permanent loads (dead load + superimposed load)
q_k: Live load
V_k: Edge load (railings, balustrade, plinth, etc.)
M_k: Edge moment (due to horizontal load on railings, balustrade, etc.)

METHOD FOR FEM CALCULATION

- Calculate the balcony slab as a separate system from the load-bearing structure of the building
- Define supports in the connecting area with the aforementioned rigidities
- Calculate resultant forces using linear-elastic approach
- Select ISOPRO® units
- Set the calculated resultant forces as the edge load for the load-bearing structure of the building

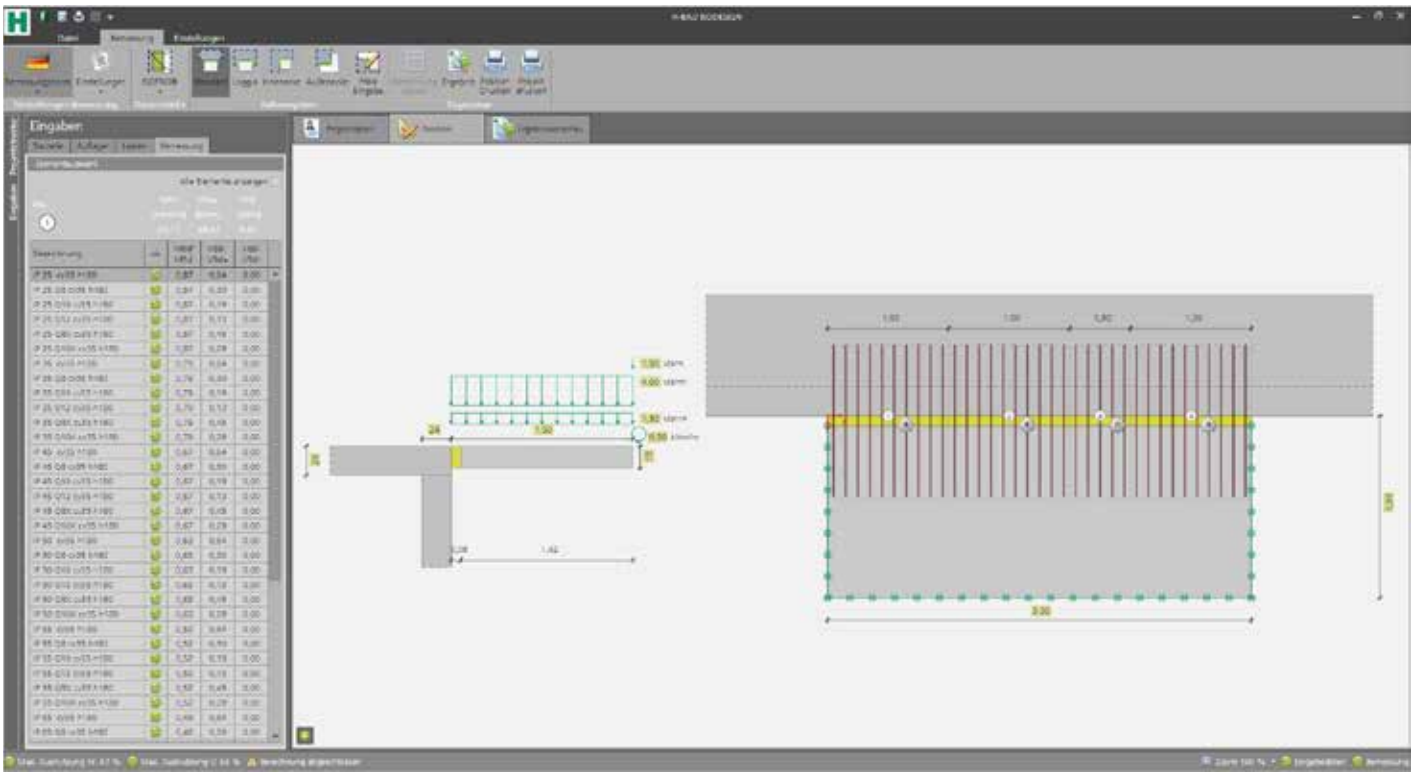
NOTE

If the rigidity ratios along the slab edge vary significantly (e.g. supports along the slab edge and no continuous wall), the balcony slab should not be calculated as a system separate from the building. In this case, a hinged line should be defined along the edge of the balcony slab, with the aforementioned rigidities. The ISOPRO® units can be determined based on the joint forces.

DESIGN

DESIGN OF ISOPRO® UNITS – SOFTWARE ISODESIGN

The program ISODESIGN allows us to pass on to you our many years of experience in designing our ISOPRO® thermal insulation units for the most common balcony systems.
You can choose between different balcony systems comprising a cantilevered balcony, balcony on supports, loggia, internal corner balcony and external corner balcony or you can work with the free input tool to enter unsusual geometries. After entering the geometric data and the applied loads, you can select the corresponding ISOPRO® units.
The arrangement and geometric parameters of the ISOPRO® units can be checked for feasibility in the layout and cross-section. A static printout and a parts list are available for further processing.



ADVANTAGES

- All common balcony systems can be selected
- Design with FEM-module
- Log output including proof

Our Applications Technology department would be pleased to assist in finding further solutions.
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PROOF OF SERVICABILITY

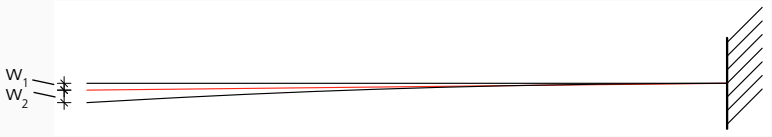
CAMBERS AND BENDING SLENDERNESS

CAMBERS

A cantilevered slab deforms under load, with the maximum deflection occurring at the end of the cantilever arm. If a cantilevered slab is connected to an ISOPRO® unit, the share of deflection from the slab itself must be superimposed with that of the ISOPRO® unit in order to calculate the maximum deflection.
The ISOPRO® tension and pressure components behave in approximately the same way as a spring system that is stretched or compressed. The resulting angle of rotation α is used to calculate the maximum deflection by the ISOPRO® unit.
We recommend providing proof of the limit state of serviceability for the quasi-permanent load case combination. To calculate the required camber of the cantilevered slab, the deflection should be rounded up or down according to the direction of the planned drainage.

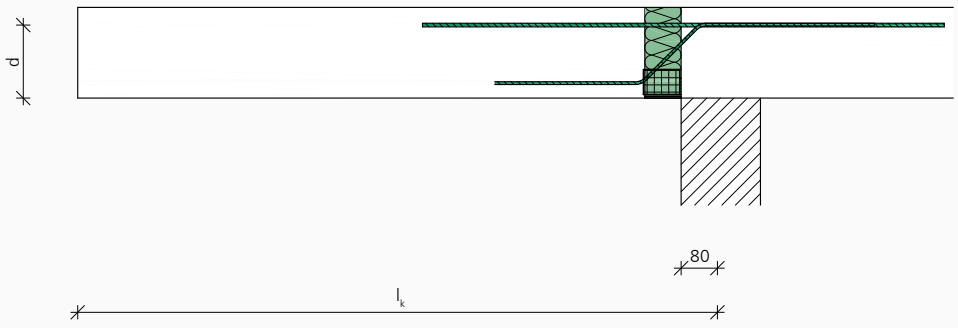
For the calculation of the deflection of the ISOPRO® units please refer to product chapters.

W_1 = deflection due to slab
W_2 = deflection due to thermal insulation unit



BENDING SLENDERNESS

The bending slenderness is defined as the ratio of the static height d of the balcony slab to the cantilever length l_k. The bending slenderness of a slab has an impact on its vibration characteristics. We therefore recommend limiting the bending slenderness. Limits for the bending slenderness are specified on page 33.

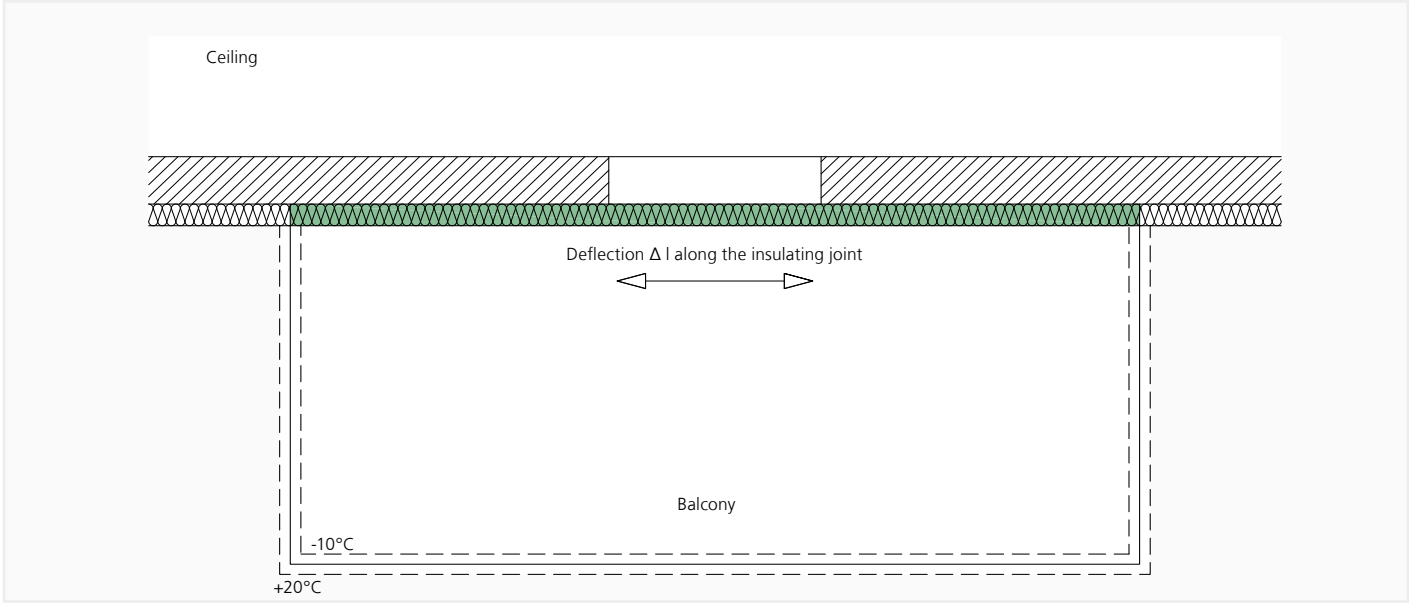


ISOPRO® IP – Static system

DISTANCE BETWEEN EXPANSION JOINTS

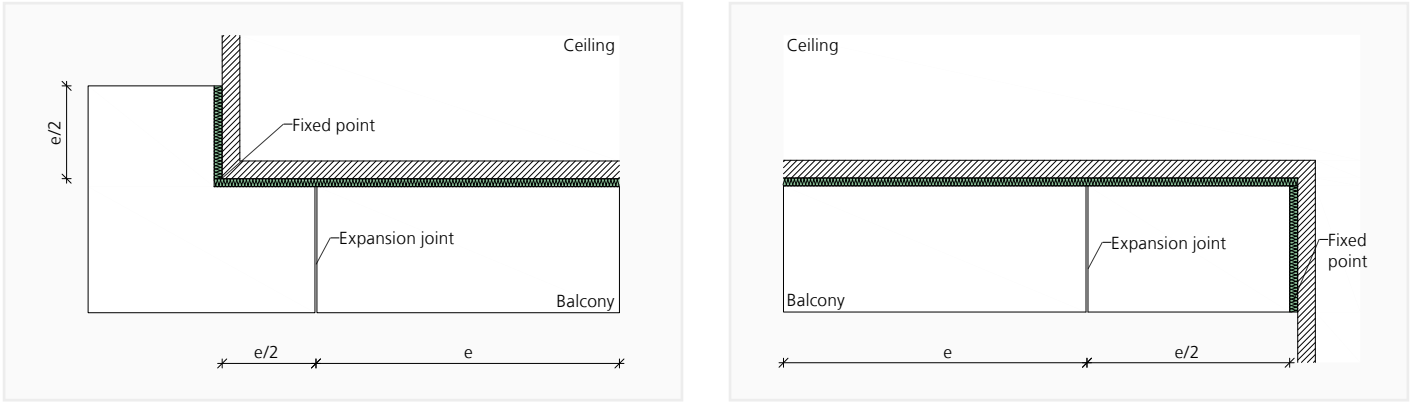
DISTANCE BETWEEN EXPANSION JOINTS

Due to the influence of temperature on external components such as balconies or canopies, deflection of reinforced concrete components can occur. These components expand when heated and contract when cooled. If the reinforced concrete components are thermally separated with ISOPRO® units, then deflection of the ISOPRO® components parallel to the insulating joint occurs due to the deflection of the reinforced concrete slab.



Balcony slab under influence of temperature

To limit the stress on ISOPRO® units as a result of the influence of temperature, very long reinforced concrete components must be separated using expansion joints. The maximum permissible distance between expansion joints e is regulated in the technical approval. The maximum permissible distance between expansion joints e is dependent on the rod diameter and therefore on the ISOPRO® types used. Details can be found in the respective product sections. The use of fixed points such as corner supports or the use of ISOPRO® IPH or IPE units results in increased constraints, which means the maximum permissible distance between expansion joints must be reduced to e/2. To prevent uneven settlement of the structural components separated by expansion joints, we recommend connecting the slabs with longitudinally displaceable shear dowels type HED.



Expansion joint layout for different balcony systems

THERMAL INSULATION

THERMAL BRIDGES

Thermal bridges are weak points in the heat-conducting building envelope, which result in a locally increased heat loss in comparison with standard components. We distinguish between thermal bridges caused by geometric factors, where there is a larger external surface opposite the thermal outflow of the internal surface, and thermal bridges caused by material factors, where an increased heat loss occurs due to local installation parts or material changeovers.

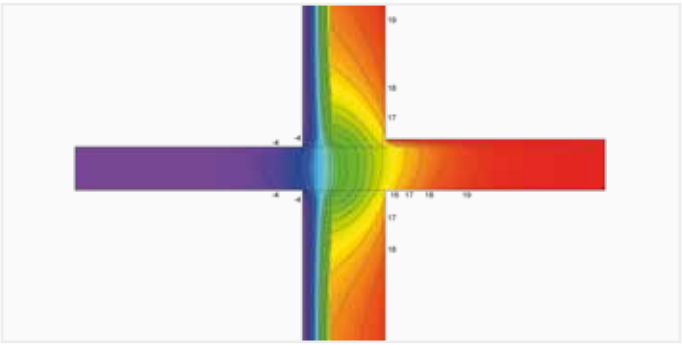
IMPACT OF THERMAL BRIDGES

Thermal bridges have a significantly higher heat flow in comparison with the rest of the envelope surface. This increased heat flow causes the inside surface temperature to fall sharply in this area. The consequence is an increased heating energy requirement.
If a further drop in the surface temperature causes the temperature to fall below the dew point temperature, the humidity in the room air condenses, which causes condensation to form on the cold surfaces concerned. This can lead to the formation of mould and the resulting health burdens.

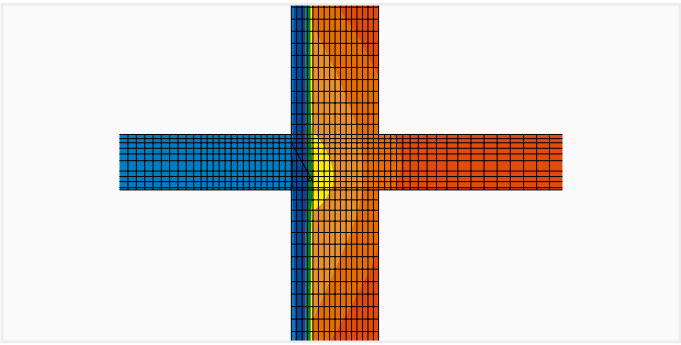
THE BALCONY THERMAL BRIDGE

A balcony designed as a projecting reinforced concrete slab is the classic example of a linear thermal bridge.
If a highly heat-conductive reinforced concrete slab penetrates the thermal insulation layer of the building, the effects of the thermal bridges – caused by geometric factors – are superimposed by the large external surface and the effects of the material-dependent thermal bridge. The results are a significant cooling of the ceiling in the rooms and, as a result, increased heating costs, condensation and mould formation.

If ISOPRO® thermal insulation units are used in the connecting area between the reinforced concrete slabs and the building, thermal bridges are minimised.



Temperature distribution in balcony with continuous reinforced concrete slab



Temperature distribution in balcony with thermally separated reinforced concrete slab

THERMAL INSULATION

THERMAL INSULATION CERTIFICATE – THERMAL BRIDGES IN ACCORDANCE WITH EnEV

For the energy performance certificate according to the German Energy Saving Regulation EnEV, all losses caused by thermal bridges must be accounted for. There are three methods of recording the calculations.

If there is no documentation of thermal bridges or if their design does not comply with the construction examples in accordance with DIN 4108 supplementary sheet 2:2006-03, a penalty surcharge on the mean U-value of the entire building of $\Delta U_{WB} = 0.10$ W/(m²K) must be taken into consideration. Further documentation is not necessary.

The thermal bridge surcharge may be reduced to $\Delta U_{WB} = 0.05$ W/(m²K) if all thermal bridges in the building are implemented in compliance with DIN 4108 supplementary sheet 2:2006-03. Conformity of balcony insulation units with DIN 4108 supplementary sheet 2:2006-03 fig. 70 is regulated in the general technical approval. In accordance with approvals Z-15.7-243 and Z-15.7-244, ISOPRO® units meet the requirements according to DIN 4108 supplementary sheet 2:2006-03, which enables use of the reduced thermal bridge surcharge $\Delta U_{WB} = 0.05$ W/(m²K).

Another option for consideration of thermal bridges is providing detailed evidence of each individual thermal bridge present in the building, in accordance with DIN V 4108-6:2003-06. In this case, the thermal bridge coefficients of loss ψ for linear thermal bridges and χ for thermal bridges at specific points as well as the temperature factors $f_{RSi} \geq 0.7$ must be calculated for all thermal bridges in a building.

OVERVIEW OF THE METHODS ACCORDING TO EnEV

	Method 1	Method 2	Method 3
Description	The thermal bridges of the building are not documented individually and do not comply with the design according to DIN 4108 supplementary sheet 2:2006-03	The thermal bridges of the building are designed in compliance with DIN 4108 supplementary sheet 2:2006-03	The thermal bridges have been calculated in detail and documented according to DIN V 4108-6:2003-06 in connection with other recognised rules of technology (DIN EN ISO 10211)
Proof	No further proof	Regulated in the approvals for the balcony insulation units	Proven through detailed, three-dimensional thermal bridge calculation
Consideration	General: $\Delta U_{WB} = 0.10$ W/(m²K)	General: $\Delta U_{WB} = 0.05$ W/(m²K)	Detailed: $H_T = \sum U_i \cdot A_i \cdot F_{x,i} + \sum \psi_i \cdot l_i \cdot F_{x,i} + \sum \chi_i \cdot F_{x,i}$

NOTES

- It is not permissible to use a combination of the different methods.
- Object-related calculation of the ψ values on request.

THERMAL INSULATION – IMPACT SOUND INSULATION

THERMAL INSULATION – BUILDING PHYSICS CHARACTERISTICS

The general technival approval for ISOPRO® requires the assessment of the risk of condensation or the undercutting of the condensation water temperature for the building components.
Herefore the mathematical verification shall be performed in accordance with DIN 4108-2, Section 6.2. The temperature factor shall be verified at the most unfavourable point for the minimum requirements of $f_{RSi} \geq 0.7$ and $\theta_{si} \geq 12.6$ °C in accordance with DIN EN ISO 10211.
All ISOPRO® thermal insulation elements meet the requirements by far. The following table gives examples of the physical characteristics of some ISOPRO® elements:

ISOPRO® Type	Installation situation ETICS [mm]	ψ-value [W/mK]	f_{RSi} [ ]	θ_{si} [°C]	λ_{eq} [W/mK]	R_{eq} [m²K/W]
IP 10 h200	140	0.188	0.900	17.5	0.128	0.625
IP 50 h180	140	0.319	0.864	16.6	0.277	0.289
IP 100 h200	140	0.378	0.852	16.3	0.315	0.254
IPT 110 Q10 h200	140	0.356	0.856	16.4	0.288	0.278
IPT 150 Q10 h200	140	0.416	0.840	16.0	0.368	0.217
IPQ 10 h200	140	0.168	0.904	17.6	0.113	0.708
IPQ 100 h200	140	0.219	0.892	17.3	0.152	0.526

The general technical approval also regulates the consideration of the increased transmission heat loss according to DIN V 4108-6:
The slab connection may be regarded as a thermally separated construction within the meaning of DIN 4108, sheet 2, if no more precise proof is provided. Therefore, the reduced specific thermal bridge surcharge of ΔUWB = 0.05 W/m²K can be calculated for the entire surrounding area when the flat-rate verification method is applied.

IMPACT SOUND INSULATION – NORMATIVE FRAMEWORKS

The revised version of DIN 4109 of January 2018 shows minimum sound insulation requirements for balconies of multi-family houses, office buildings and mixed-use buildings, as no requirements had been set for them earlier.
People on balconies cause noises that are transmitted to the adjacent, so-called vulnerable rooms if sound insulation is missing.For balconies connected with thermal insulation units the transmission of structure-borne noise to vulnerable rooms is lower in comparison to through-cast reinforced concrete slabs.
Noise levels are classified by the evaluated standard impact sound level $L'_{n,w}$. The reduction of impact sound by the use of thermal insulation units is measured by the assessed impact sound level difference $\Delta L_{n,v,w}$.

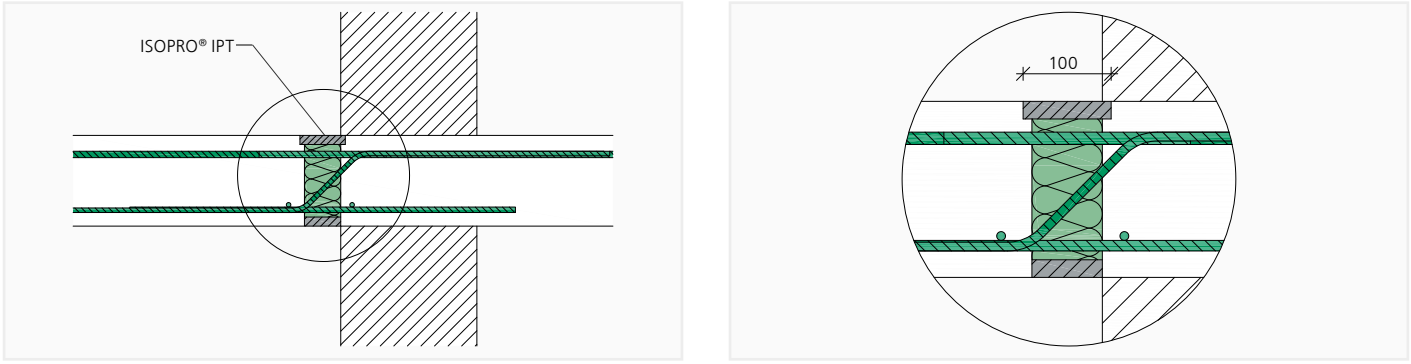
FIRE PROTECTION

FIRE RESISTANCE CLASSES R 90/REI 120

Where there are fire protection requirements regarding the fire resistance class of components, all ISOPRO® units with concrete compression bearings are available in fire resistance class REI 120 and all ISOPRO® units with a steel pressure plane are available in fire resistance class R 90.
To this end, the ISOPRO® units are fitted with fireproof panels on the top and bottom ex works. The short elements IPQS / IPQZ / IPTQQS / IPTA / IPTF / IPO as well as the elements for beams and walls IMTS and IMTW are produced with all-round fireproof panels ex works.

The prerequisite for classification into R 90/REI 120 is that the adjoining components meet the requirements of the respective fire resistance class. If a physical barrier (E) and heat shielding (I) are also required in the event of fire, then it must be ensured that ISOPRO® Z-ISO FP1 in EI 120 is used as the intermediate insulation where ISOPRO® units are used at specific points.

ISOPRO® element with concrete compression bearings in REI 120 version with fireproof panels overhanging at top, flush at bottom



ISOPRO® unit with steel pressure rods in R 90 version with fireproof panels overhanging at top, flush at bottom

FIRE RESISTANCE CLASSES OF ISOPRO® UNITS

ISOPRO® units achieve the following fire resistance classes:

ISOPRO®	IP, IP two-part, IP corner, IP Var., IPQ, IPZQ, IPQS, IPQZ, IPH, IPE, IPO	IPT, IPT corner, IPTQS, IPTQQ, IPTQQS, IPTD, IPTA, IPTF, IPTS, IPTW	Z-ISO FP1
Fire resistance class	REI 120	R 90	EI 120

FIRE PROTECTION

FIRE PROTECTION REGULATIONS FOR BALCONIES

According to DIN EN 13501-2:2010-02 (1a), balconies are considered to be load-bearing components without a separating function. The Model Building Regulation Section 31 does not set any specific requirements in terms of fire protection for balconies. As a result, the fire protection requirements must be checked in each individual case.

FIRE PROTECTION REGULATIONS FOR ACCESS BALCONIES

According to DIN EN 13501-2:2010-02 (1a), access balconies are considered to be load-bearing components without a separating function. To the extent that access balconies do not function as a "necessary corridor", the Model Building Regulation Section 31 does not set any specific requirements in terms of fire protection. Necessary corridors must be designed to be fireproof, highly fire resistant or fire resistant, depending on the building class. Whether or not the thermal insulation connection must be designed with a separating function must be checked in each individual case.

REQUIREMENTS OF ACCESS BALCONIES AS NECESSARY CORRIDORS:

Building class according to Model Building Regulation Section 2	Requirements of access balconies as necessary corridors		
	Model Building Regulation Section 31	DIN EN 13501-2	DIN 4102-2
1	Load-bearing and separating	N/A	N/A
2	Load-bearing and separating, fire-resistant	REI 30	F 30-B
3	Load-bearing and separating, fire-resistant	REI 30	F 30-AB (separating)
4	Load-bearing and separating, highly fire-resistant	REI 60	F 60-AB (separating)
5	Load-bearing and separating, fireproof	REI 90	R 90-AB (separating)

NOTE

For fire protection requirements, please note that even a possible insulation layer between individual ISOPRO® units must also meet the fire protection requirements. This can be implemented with ISOPRO® Z-ISO FP1 in EI 120.

FIRE BARRIES*

Fire barriers are required for buildings with a thermal insulation composite system made of EPS insulating materials with a thickness greater than 100 mm if there are more than three floors, in every second floor. This is achieved by the complete horizontal interruption of the insulation. Balconies, loggias and access balconies, which interrupt a ETICS completely horizontally, can take over the function of a fire barrier, so that can be dispensed with in this area on the additional execution of fire barriers. However, the fire barrier must connect laterally to the cantilever slabs, so that the fire protection interruption of the insulation is continuous. In the situation described ISOPRO® units in the fire protection versions REI 120 or R 90 must be used.

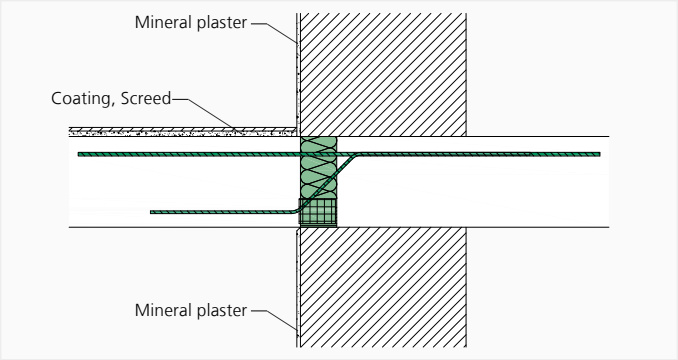
*Source: "Technische Systeminformation WDVS und Brandschutz" Fachverband Wärmedämm-Verbundsysteme, March 2016

FIRE PROTECTION

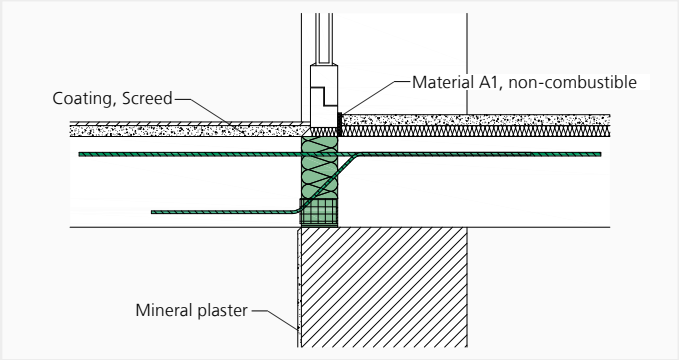
FIRE RESISTANCE CLASS REI 30

All ISOPRO® standard units can be classified in fire resistance class REI 30 if the following requirements for the overall structure are met:

- The components adjoining the ISOPRO® unit are clad with mineral protective layers on the surface or
- The components adjoining the ISOPRO® unit are clad with protective layers made of non-combustible materials on the surface and
- The ISOPRO® unit is embedded in the overall structure with protection against exposure to direct flames from above and below.



REI 30 formation in wall area

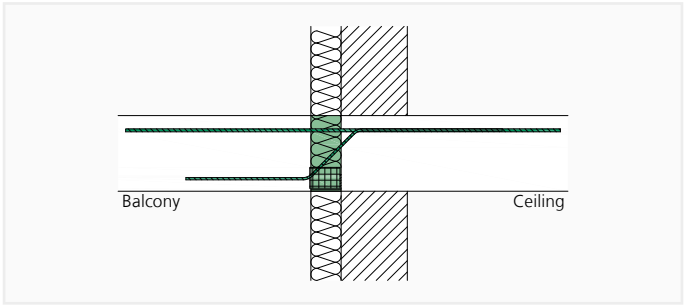


REI 30 formation in door area

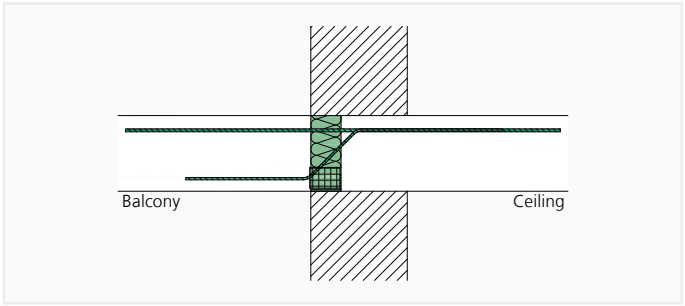
INSTALLATION INSTRUCTIONS

POSITION IN COMPONENT

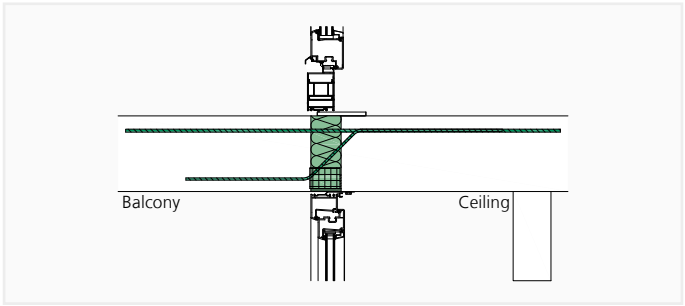
To reliably prevent thermal bridges, the ISOPRO® units are installed in the insulation plane.



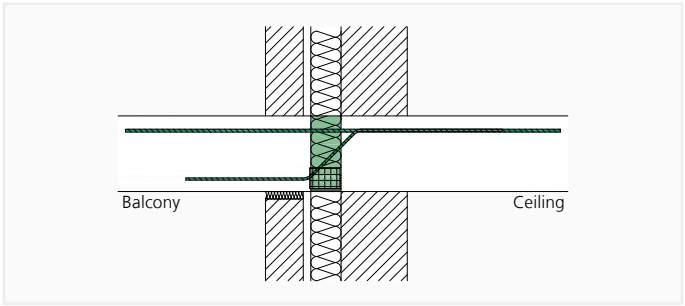
ISOPRO® IP – Installation cross-section for external thermal insulation composite system



ISOPRO® IP – Installation cross-section for single-leaf masonry



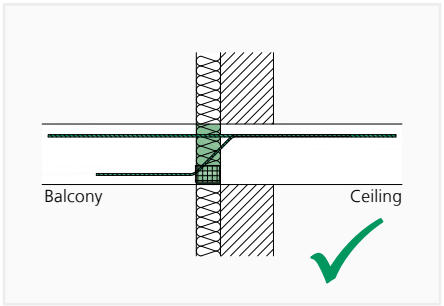
ISOPRO® IP – Installation cross-section for glass façade



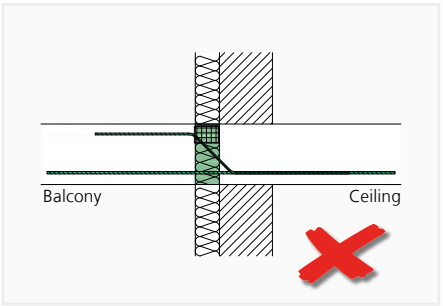
ISOPRO® IP – Installation cross-section for double leaf masonry

DIRECTION OF INSTALLATION

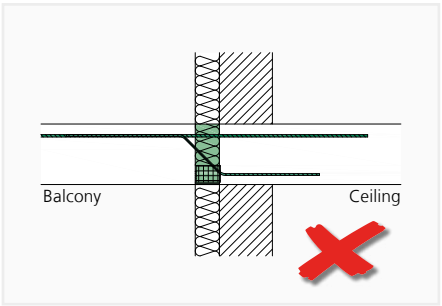
During installation, note the correct direction of installation on the balcony/ceiling as well as at the top/bottom. Ensure that the tension rods are at the top and the compression bearings/pressure rods are at the bottom. Starting at the bottom on the balcony, the shear rod runs diagonally through the ISOPRO® unit and ends at the top of the ceiling.



ISOPRO® IP – Correct installation



ISOPRO® IP – Incorrect installation, tension rod must be at the top



ISOPRO® IP – Incorrect installation, shear rod must be on the bottom side of the balcony

Our Applications Technology department would be pleased to assist in finding further solutions.
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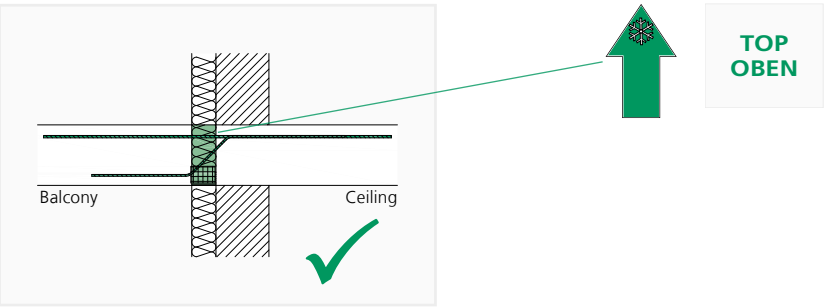
INSTALLATION – PRESSURE JOINT

DIRECTION OF INSTALLATION

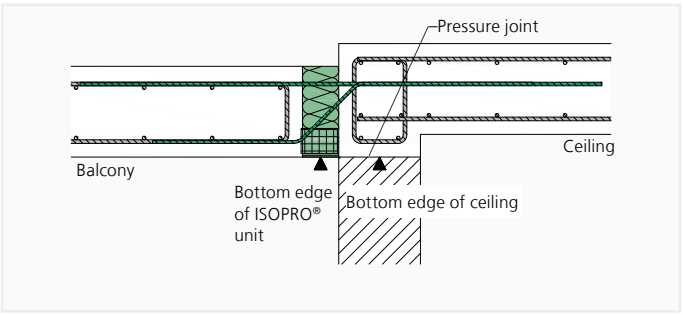
During installation it is crucial to note the direction of installation indicated on the label. The direction of installation is marked clearly on each unit by the indication of the top and an arrow to the balcony side (of the cold area).



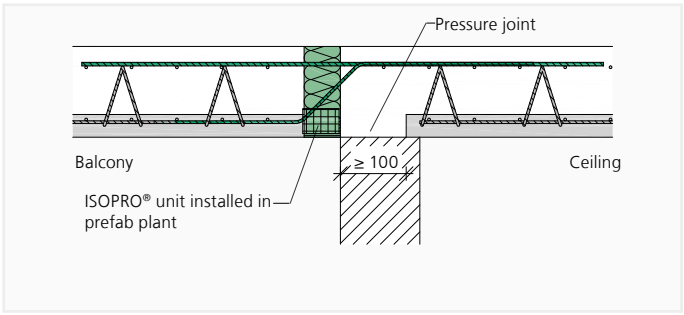
ISOPRO® IP – correct installation

PRESSURE JOINT

- During installation, care must be taken to ensure that the compression bearing is tightly seated with fresh concrete. For this purpose, a pressure joint of ≥ 100 mm must be provided, the concreting section limits must be selected accordingly.
- Between ISOPRO® elements and prefabricated parts or element slabs, an in-situ concrete or grouting strip ≥ 100 mm must be provided.



ISOPRO® units for in-situ concrete construction and height-shifted ceiling slabs



ISOPRO® units in combination with prefab slabs

ISOPRO®
IP und IPT

UNITS FOR CANTILEVERED BALCONIES

ISOPRO® IP

- For transferring negative moments as well as positive and, depending on the verion (QX), negative shearing forces
- Pressure plane with concrete compression bearings
- Load-bearing capacities IP 10 to IP 100
- Shearing force load-bearing capacities, standard, Q8, Q10, Q12, Q8X and Q10X
- Concrete covering of tension rods cv35 or cv50
- Unit heights depending on the shearing force load-bearing capacity starting from h_{min} = 160 mm
- Fire resistance class REI 120 available

ISOPRO® IPT

- Pressure plane with steel pressure rods
- Load-bearing capacities IPT 110 and IPT 150
- Shearing force load-bearing capacities Q10, Q12 and Q14
- Concrete covering of tension rods cv35 or cv50
- Unit heights depending on the shearing force load-bearing capacity starting from h_{min} = 180 mm
- Fire resistance class R 90 available

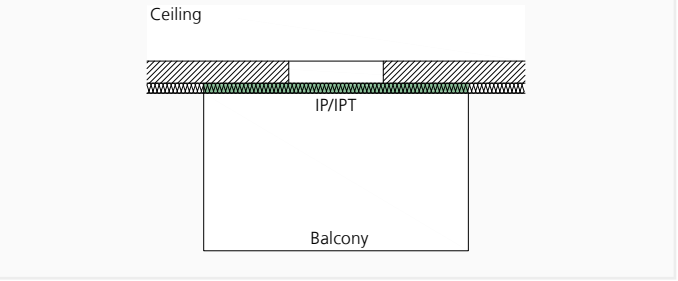
TYPE DESIGNATION

IP 65 Q8 cv35 h200 REI 120

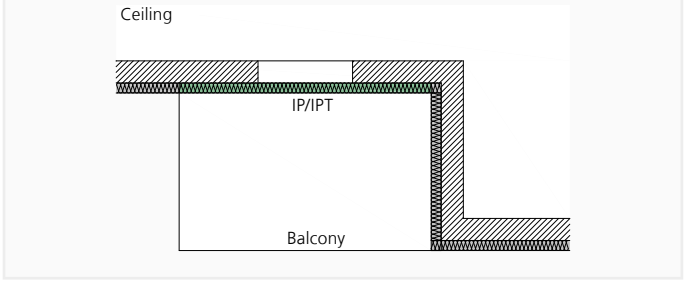
- Fire protection version
- Unit height
- Concrete covering
- Shearing force load-bearing capacity
- Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

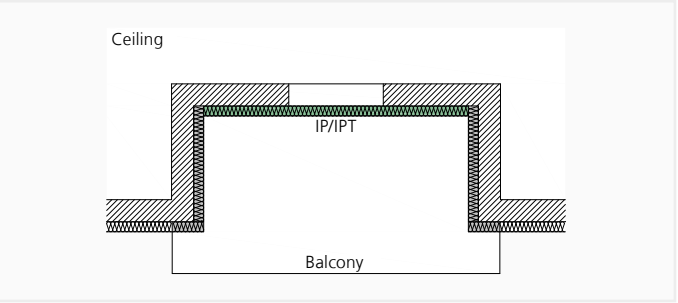
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



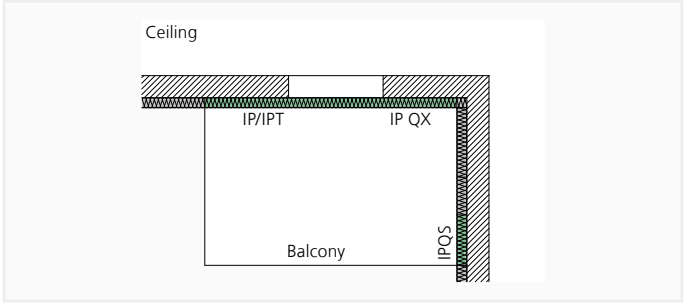
ISOPRO® IP/IPT – Cantilevered balconies



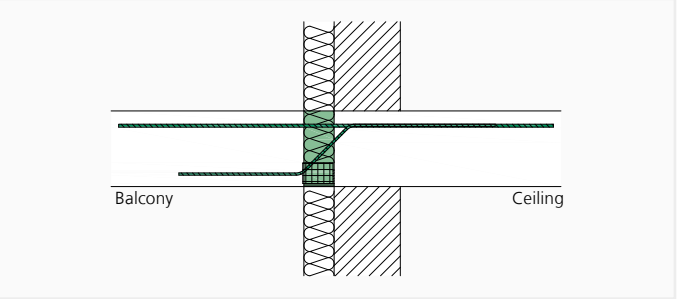
ISOPRO® IP/IPT – Cantilevered balconies in façade extensions



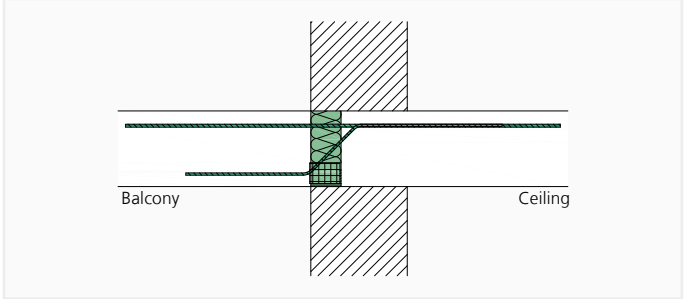
ISOPRO® IP/IPT – Cantilevered balconies in façade recesses



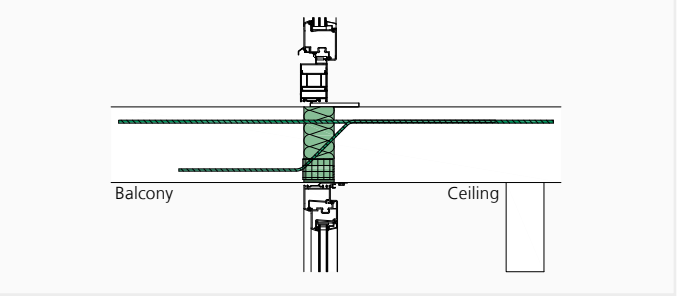
ISOPRO® IP/IPT in combination with IP QX and IPQS for internal corner balconies



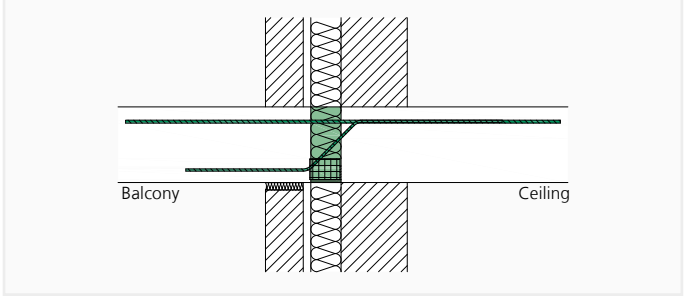
ISOPRO® IP – Installation cross-section for external thermal insulation composite system



ISOPRO® IP – Installation cross-section for single-leaf masonry



ISOPRO® IP – Installation cross-section for glass façades



ISOPRO® IP – Installation cross-section for double leaf masonry

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS m_{Rd} [kNm/m]

Unit height [mm] depending on cv [mm]		ISOPRO®					
		≥ C25/30					
35	50	IP 10	IP 15	IP 20	IP 25	IP 35	IP 45
160	–	9.0	13.2	15.4	21.7	23.8	28.0
–	180	9.5	14.0	16.2	22.9	25.1	29.5
170	–	10.0	14.8	17.1	24.1	26.5	31.1
–	190	10.5	15.5	18.0	25.3	27.8	32.7
180	–	11.1	16.3	18.9	26.6	29.2	34.3
–	200	11.6	17.1	19.8	27.8	30.5	35.9
190	–	12.2	17.9	20.7	29.1	31.9	37.5
–	210	12.7	18.6	21.6	30.3	33.3	39.1
200	–	13.3	19.4	22.5	31.6	34.7	40.7
–	220	13.8	20.2	23.4	32.9	36.0	42.3
210	–	14.4	21.0	24.3	34.2	37.5	44.0
–	230	14.9	21.8	25.2	35.4	38.8	45.6
220	–	15.5	22.6	26.2	36.8	40.3	47.3
–	240	16.0	23.4	27.1	38.0	41.7	48.9
230	–	16.6	24.3	28.1	39.4	43.1	50.6
–	250	17.2	25.1	29.0	40.6	44.5	52.2
240	–	17.8	25.9	30.0	42.0	46.0	53.9
250	–	18.9	27.6	31.9	44.7	48.9	57.3

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN/m]

Capacity	h_{min} [mm]	IP 10	IP 15	IP 20	IP 25	IP 35	IP 45
Standard	160		34.8			43.5	
Q8	160			92.7			
Q10	170			144.9			
Q12	180			208.6			
Q8X	160			+61.8/-46.4			
Q10X	170			+96.6/-72.5			

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IP 10	IP 15	IP 20	IP 25	IP 35	IP 45
Unit length [mm]			1.000			
Tension rods	4 Ø 8	6 Ø 8	7 Ø 8	10 Ø 8	11 Ø 8	13 Ø 8
Tension rods QX	5 Ø 8	7 Ø 8	8 Ø 8	12 Ø 8	13 Ø 8	15 Ø 8
Compression bearings		4			5	
Standard shear rods		4 Ø 6			5 Ø 6	
Shear rods Q8			6 Ø 8			
Shear rods Q10			6 Ø 10			
Shear rods Q12			6 Ø 12			
Shear rods Q8X			4 Ø 8/3 Ø 8			
Shear rods Q10X			4 Ø 10/3 Ø 10			

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS m_{Rd} [kNm/m]

Unit height [mm] depending on cv [mm]		ISOPRO®					
		≥ C25/30					≥ C30/37
35	50	IP 50	IP 55	IP 65	IP 75	IP 90	IP 100
160	–	30.1	36.3	39.5	–	–	–
–	180	31.7	38.3	41.7	–	–	–
170	–	33.4	40.4	44.0	47.6	51.1	57.1
–	190	35.1	42.4	46.2	49.9	53.6	60.0
180	–	36.8	44.6	48.5	52.4	56.1	63.0
–	200	38.5	46.6	50.7	54.8	58.6	65.9
190	–	40.3	48.7	53.0	57.3	61.2	68.9
–	210	42.0	50.8	55.3	59.7	63.7	71.8
200	–	43.7	52.9	57.6	62.2	66.2	74.7
–	220	45.5	55.0	59.8	64.7	68.8	77.6
210	–	47.2	57.2	62.2	67.2	71.3	80.4
–	230	49.0	59.2	64.4	69.6	73.8	83.3
220	–	50.8	61.4	66.8	72.2	76.3	86.1
–	240	52.5	63.5	69.1	74.6	78.9	89.0
230	–	54.3	65.7	71.5	77.2	81.4	91.8
–	250	56.1	67.8	73.8	79.7	83.9	94.7
240	–	57.9	70.1	76.1	82.3	86.5	97.5
250	–	61.5	74.4	80.5	87.4	91.5	103.2

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN/m]

Capacity	h_{min} [mm]		IP 50	IP 55	IP 65	IP 75	IP 90	IP 100
Standard	160			43.5			–	
Q8	160			92.7			–	
Q10	170			144.9			144.9	
Q12	180			208.6			208.6	
Q8X	160			+61.8/-46.4			–	
Q10X	170	180		+96.6/-72.5			+139.0/-72.5	

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IP 50	IP 55	IP 65	IP 75	IP 90	IP 100
Unit length [mm]	1.000				500 + 500 (QX units 1000 mm)	
Tension rods	14 Ø 8	11 Ø 10	12 Ø 10	13 Ø 10	10 Ø 12	12 Ø 12
Tension rods QX	16 Ø 8	12 Ø 10	13 Ø 10	14 Ø 10	11 Ø 12	12 Ø 12
Compression bearings	6	7			8	
Standard shear rods	5 Ø 6				–	
Shear rods Q8	6 Ø 8				–	
Shear rods Q10	6 Ø 10				6 Ø 10	
Shear rods Q12	6 Ø 12				6 Ø 12	
Shear rods Q8X	4 Ø 8/3 Ø 8				–	
Shear rods Q10X	4 Ø 10/3 Ø 10				4 Ø 12/3 Ø 10	

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS m_{Rd} [kNm/m]

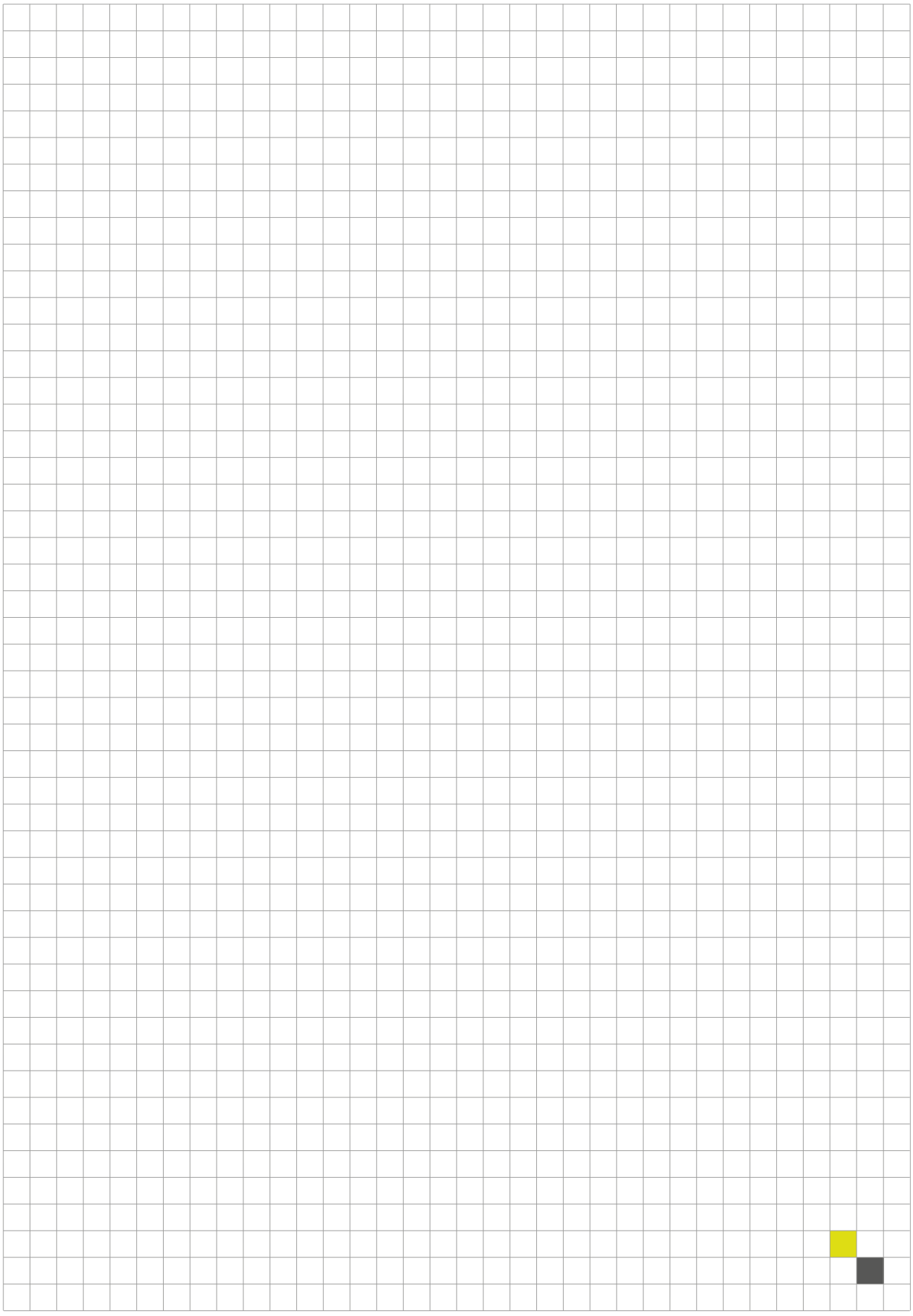
Unit height [mm] depending on cv [mm]		ISOPRO®	
35	50	IPT 110	IPT 150
180	–	68.3	89.2
–	200	71.6	93.6
190	–	75.0	98.0
–	210	78.3	102.4
200	–	81.7	106.7
–	220	85.0	111.1
210	–	88.3	115.5
–	230	91.7	119.8
220	–	95.0	124.2
–	240	98.4	128.6
230	–	101.7	133.0
–	250	105.1	137.3
240	–	108.4	141.7
250	–	115.1	150.5

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN/m]

Capacity	h_{min} [mm]		IPT 110	IPT 150
Q10	170		96.6	96.6
Q12	170	180	144.9	139.1
Q14	180	190	208.6	189.3

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IPT 110	IPT 150
Unit length [mm]	500 + 500	
Tension rods	10 Ø 14	14 Ø 14
Pressure rods	14 Ø 12	18 Ø 12
Shear rods Q10	4 Ø 10	
Shear rods Q12	6 Ø 10	4 Ø 12
Shear rods Q14	6 Ø 12	4 Ø 14



DEFLECTION AND CAMBER

DEFLECTION

During their construction, cantilevered reinforced concrete structures are elevated to take into account the anticipated deflection. If these structures are thermally separated with ISOPRO® units, when calculating the pre-set, the deflection due to the ISOPRO® unit itself is superimposed with the deflection due to flexion of the slab in accordance with DIN EN 1992-1-1/NA. It must be ensured that the required pre-set is rounded up or down, according to the planned drainage direction. If a drainage system is installed at the building façade, the value must be rounded up, but for drainage at the end of the cantilever arm, it must be rounded down. We recommend providing proof of suitability for use in the serviceability limit state for the quasi-continuous load combination (γ_G = 1.0, γ_Q = 1.0, ψ_2 = 0.3). The tables below show the deflection factors tan α for calculating the deflection due to ISOPRO®.

DEFLECTION DUE TO THE ISOPRO® CANTILEVER SLAB CONNECTION

$$w = \tan \alpha \cdot (m_{Ed}/m_{Rd}) \cdot l_k \cdot 10$$

With

w = Deflection at the end of the cantilever arm [mm]

tan α = Deflection factor, see product sections

m_{Ed} = Bending moment for determining the camber as a result of the ISOPRO® unit. The definitive load combination for the servicability limit state is determined by the structural engineer

m_{Rd} = Resistance moment of the ISOPRO® unit, see product section

l_k = System length [m]

DEFLECTION FACTOR TAN α FOR CONCRETE ≥ C 25/30

ISOPRO®	Concrete covering cv [mm]	Height h [mm]									
		160	170	180	190	200	210	220	230	240	250
IP 10 to IP 50	35	0.94	0.85	0.79	0.72	0.67	0.63	0.59	0.56	0.53	0.50
	50	–	–	0.89	0.81	0.75	0.70	0.65	0.61	0.57	0.54
IP 55 to IP 90	35	1.12	1.01	0.93	0.85	0.79	0.74	0.69	0.65	0.61	0.58
	50	–	–	1.06	0.97	0.89	0.82	0.76	0.71	0.67	0.63
IPT 110, IPT 150	35	–	–	1.70	1.55	1.42	1.32	1.22	1.15	1.08	1.00
	50	–	–	–	–	1.62	1.48	1.37	1.27	1.18	1.15

DEFLECTION FACTOR TAN α FOR CONCRETE ≥ C 30/37

ISOPRO®	Concrete covering cv [mm]	Height h [mm]									
		160	170	180	190	200	210	220	230	240	250
IP 100	35	–	1.04	0.95	0.87	0.81	0.75	0.70	0.66	0.62	0.58
	50	–	–	1.09	0.99	0.91	0.84	0.78	0.72	0.68	0.64

BENDING SLENDERNESS – DISTANCE BETWEEN EXPANSION JOINTS

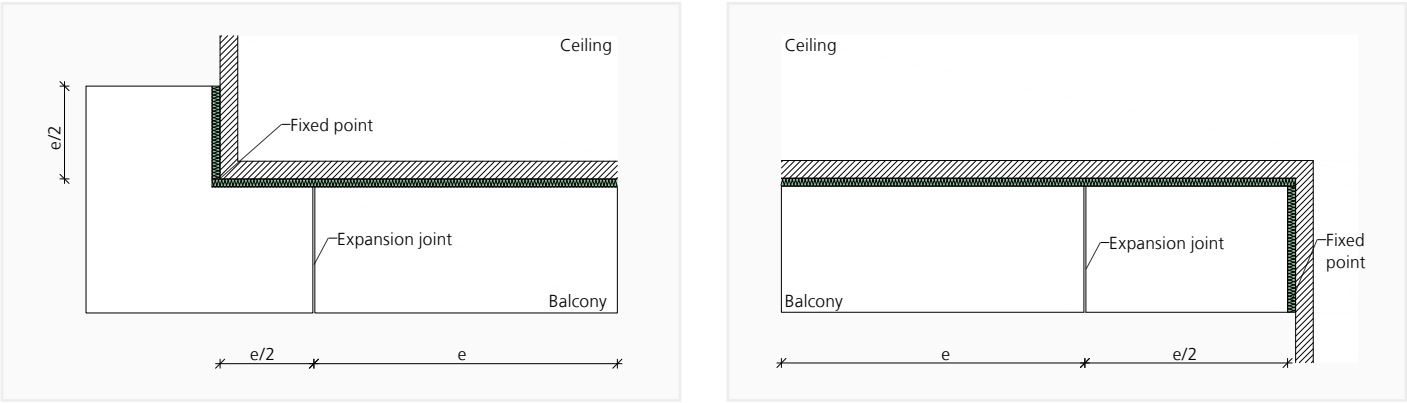
BENDING SLENDERNESS

The bending slenderness is defined as the ratio of the static height d of the balcony slab to the cantilever length l_k. The bending slenderness of a slab has an impact on its vibration characteristics. We therefore recommend limiting the bending slenderness for cantilevered reinforced concrete structures in accordance with DIN EN 1992-1-1 to a maximum value of $l_k/d = 14$. This results in the following maximum recommended cantilever lengths l_k:

Concrete covering	Max. l_k [m] depending on unit height h [mm]									
	160	170	180	190	200	210	220	230	240	250
cv35	1.68	1.82	1.96	2.10	2.24	2.38	2.52	2.66	2.80	2.94
cv50	1.47	1.61	1.75	1.89	2.03	2.17	2.31	2.45	2.59	2.73

DISTANCE BETWEEN EXPANSION JOINTS

If the component dimensions exceed the maximum permissible distance between expansion joints, expansion joints must be arranged perpendicular to the insulation plane. The maximum permissible distance between expansion joints e is dependent on the maximum rod diameter guided across the expansion joint and is thus type-dependent.
The use of fixed points such as corner supports or the use of ISOPRO® IPH or IPE units results in increased constraints, which means the maximum permissible distance between expansion joints must be reduced to e/2. Half of the maximum distance between expansion joints is always measured from the fixed point.



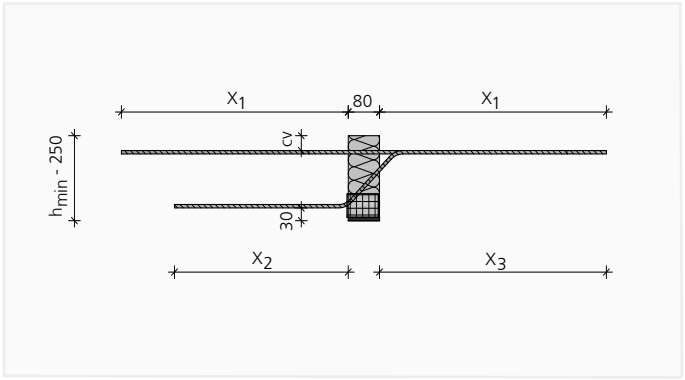
Expansion joint layout for different balcony systems

MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IP 10 to IP 65		IP 75 to IP 100		IPT 110, IPT 150
Shear force load-bearing capacity	Standard, Q8, Q10, Q8X, Q10X	Q12	Q10	Q12, Q10X	Q10, Q12, Q14
Distance between joints e [m]	13.0	11.3	13.0	11.3	10.1

UNIT STRUCTURE

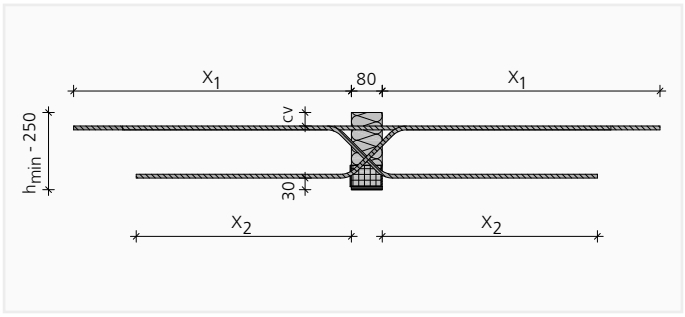
ISOPRO® IP 10 TO IP 50 - POSITIVE SHEARING FORCES



Length tension rod [mm]	IP 10 – IP 50	IP 55 – IP 75	IP 90 – IP 100
X_1	580	720	840

Length shear rod [mm]	Shear force load-bearing capacity			
	Standard	Q8	Q10	Q12
X_2	330	450	560	670
X_3	≤ 475	≤ 530	≤ 640	≤ 745
h_{min}	160	160	170	180

ISOPRO® IP 10 TO IP 100 - POSITIVE AND NEGATIVE SHEARING FORCES

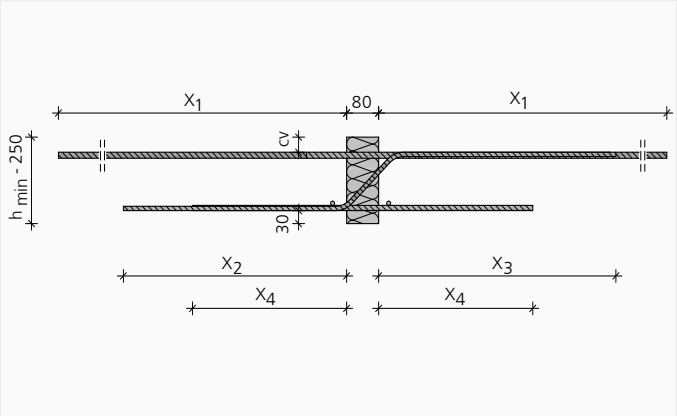


Length tension rod [mm]	IP 10 – IP 50	IP 55 – IP 75	IP 90 – IP 100
X_1	580	720	840

Length shear rod [mm]	Shear force load-bearing capacity	
	Q8X	Q10X
X_2	≤ 450	≤ 670
h_{min}	160	170

UNIT STRUCTURE

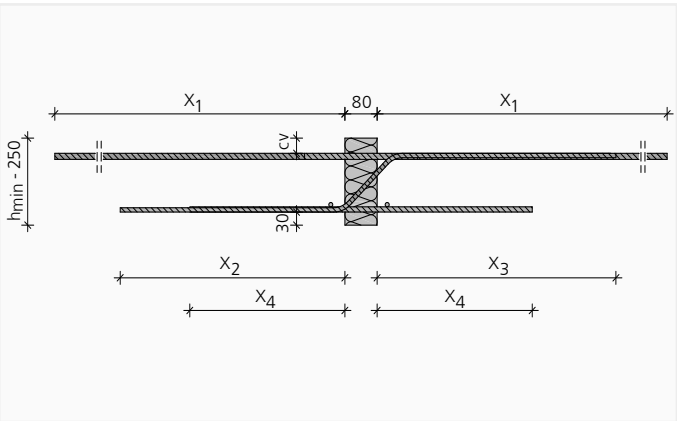
ISOPRO® IPT 110



Length tension/ pressure rod [mm]	IPT 110
Tension rod X_1	960
Pressure rod X_4	385

Length shear rod [mm]	Shear force load-bearing capacity		
	Q10	Q12	Q14
X_2	560	560	670
X_3	≤ 640	≤ 640	≤ 745
h_{min}	170	170	180

ISOPRO® IPT 150



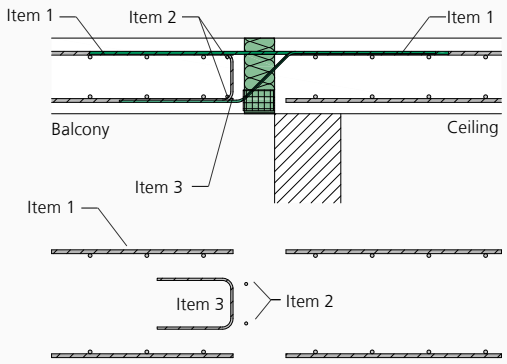
Length tension/ pressure rod [mm]	IPT 150
Tension rod X_1	960
Pressure rod X_4	385

Length shear rod [mm]	Shear force load-bearing capacity		
	Q10	Q12	Q14
X_2	560	670	780
X_3	≤ 640	≤ 745	≤ 860
h_{min}	170	180	190

SUPPLEMENTARY REINFORCEMENT

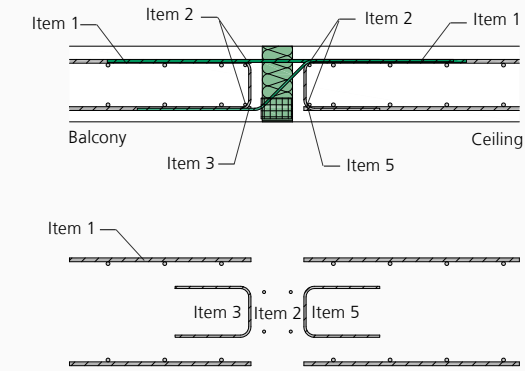
ISOPRO® IP 10 TO IP 100

DIRECT SUPPORT



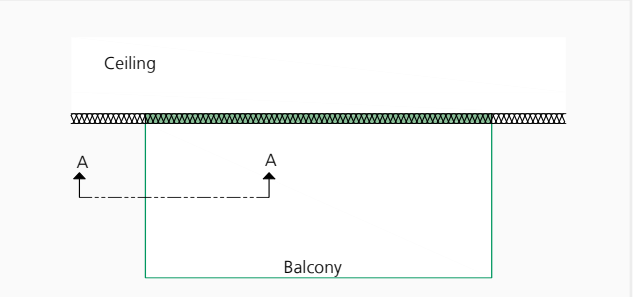
- Item 1 connection reinforcement for the ISOPRO® unit – p. 38
- Item 2 spacing bar 2 Ø 8 balcony side
- Item 3 structural edging parallel to the ISOPRO® IP unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)

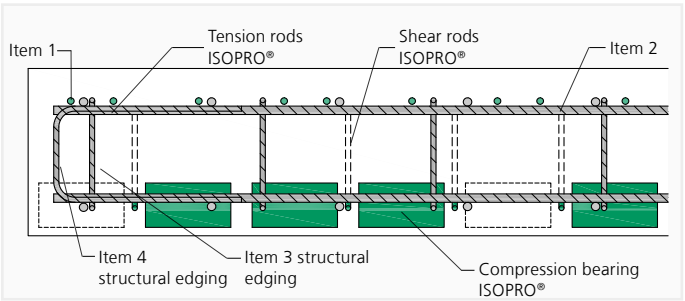
INDIRECT SUPPORT



- Item 1 connection reinforcement for the ISOPRO® unit – p. 38
- Item 2 spacing bar 2 x 2 Ø 8 balcony and ceiling side
- Item 3 structural edging parallel to the ISOPRO® IP unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 Edging or supplementary stirrup - p. 38

EDGING STIRRUP AT THE FREE BALCONY EDGE



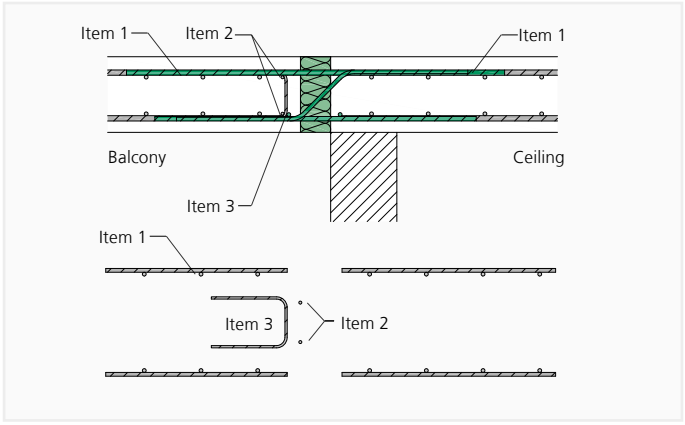


ISOPRO® IP – Section A-A

SUPPLEMENTARY REINFORCEMENT

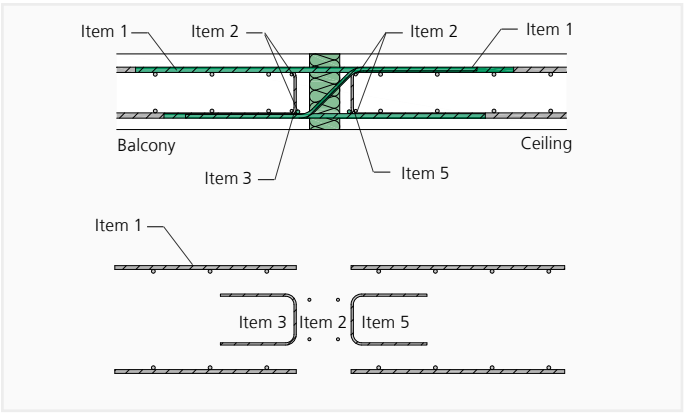
ISOPRO® IPT 110 TO IPT 150

DIRECT SUPPORT



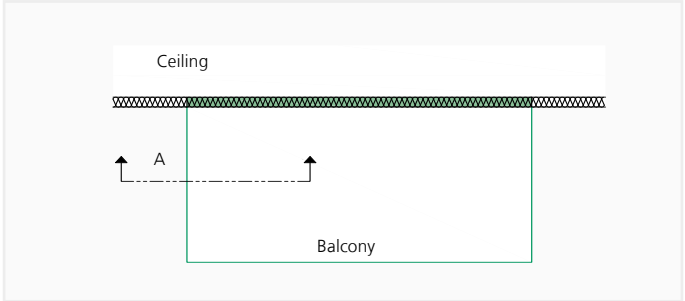
- Item 1 connection reinforcement for the ISOPRO® unit – p. 38
- Item 2 spacing bar 2 Ø 8 balcony side
- Item 3 structural edging parallel to the ISOPRO® IP unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)

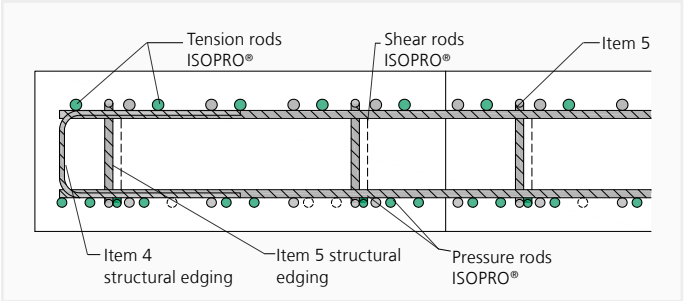
INDIRECT SUPPORT



- Item 1 connection reinforcement for the ISOPRO® unit – p. 38
- Item 2 spacing bar 2 x 2 Ø 8 balcony and ceiling side
- Item 3 structural edging parallel to the ISOPRO® IP unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 Edging or supplementary stirrup - p. 38

EDGING STIRRUP AT THE FREE BALCONY EDGE





ISOPRO® IPT – Section A-A

SUPPLEMENTARY REINFORCEMENT

CONNECTION REINFORCEMENT ITEM 1

ISOPRO® IP 10 TO IP 100 AND ISOPRO® IPT 110 AND IPT 150

ISOPRO®	$a_{s,erf}$ [cm²/m]	Suggestion Reinf. steel B500
IP 10	2.37	5 Ø 8
IP 15	3.47	7 Ø 8
IP 20	4.00	8 Ø 8
IP 25	5.62	12 Ø 8
IP 35	6.14	13 Ø 8
IP 45	7.20	15 Ø 8
IP 50	7.73	16 Ø 8
IP 55	9.40	12 Ø 10
IP 65	10.17	13 Ø 10
IP 75	11.04	14 Ø 10
IP 90	11.62	11 Ø 12
IP 100	13.11	12 Ø 12
IPT 110	15.39	10 Ø 14
IPT 150	20.10	14 Ø 14

EDGING / SUPPLEMENTARY STIRRUPS FOR INDIRECT SUPPORT ITEM 5

ISOPRO® IP 10 TO IP 100, IPT 110 AND IPT 150

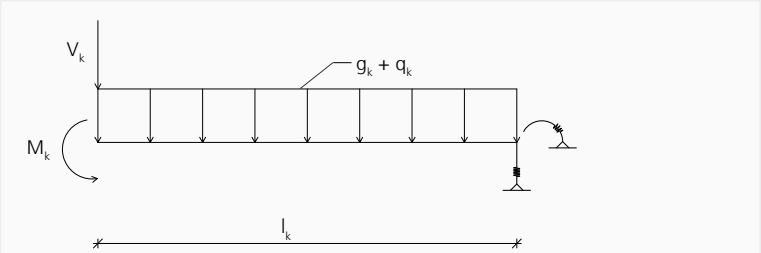
Shear force load-bearing capacity	ISOPRO®				
	IP 10 to IP 20	IP 25 to IP 65	IP 75 to IP 100	IPT 110	IPT 150
	$a_{s,erf}$ [cm²/m]	$a_{s,erf}$ [cm²/m]	$a_{s,erf}$ [cm²/m]	$a_{s,erf}$ [cm²/m]	$a_{s,erf}$ [cm²/m]
Standard	1.13	1.00	–	–	–
Q8	2.13	2.13	–	–	–
Q10	3.33	3.33	3.33	2.22	2.22
Q12	4.79	4.79	4.79	3.33	3.20
Q14	–	–	–	4.79	4.35
Q8X	1.42	1.42	–	–	–
Q10X	2.22	2.22	3.20	–	–

DESIGN EXAMPLE

SELECTION OF ISOPRO® UNIT, DEFLECTION AND CAMBER

SYSTEM:

Cantilever arm
Length of cantilever l_k = 2.0 m
Slab thickness balcony = 180 mm
Concrete cover cv35
Concrete class C25/30 balcony and ceiling



LOAD ASSUMPTIONS:

Dead load g_k = 4.50 kN/m²
Superimposed load g_k = 1.50 kN/m²
Live load q_k = 4.00 kN/m²
Edge load/railing V_k = 1.50 kN/m
Edge moment M_k = 0.00 kNm/m

RESULTANT FORCES:

$m_{Ed} = (g_k \cdot 1.35 + q_k \cdot 1.5) \cdot l_k^2 /2 + (G_k \cdot 1.35) \cdot l_k$
$v_{Ed} = (g_k \cdot 1.35 + q_k \cdot 1.5) \cdot l_k + (G_k \cdot 1.35)$
$m_{Ed} = (6.00 \cdot 1.35 + 4.00 \cdot 1.5) \cdot 2.00^2 /2 + (1.5 \cdot 1.35) \cdot 2.00 =$ <u>32.25 kNm/m</u>
$v_{Ed} = (6.00 \cdot 1.35 + 4.00 \cdot 1.5) \cdot 2.00 + (1.5 \cdot 1.35) =$ <u>30.23 kN/m</u>

DESIGN:

Chosen: IP 50, cv35, h = 180 mm $m_{Rd} = 36.80$ kNm/m ≥ 32.25 kNm/m (see page 29)
$v_{Rd} = 43.50$ kN/m ≥ 30.23 kN/m

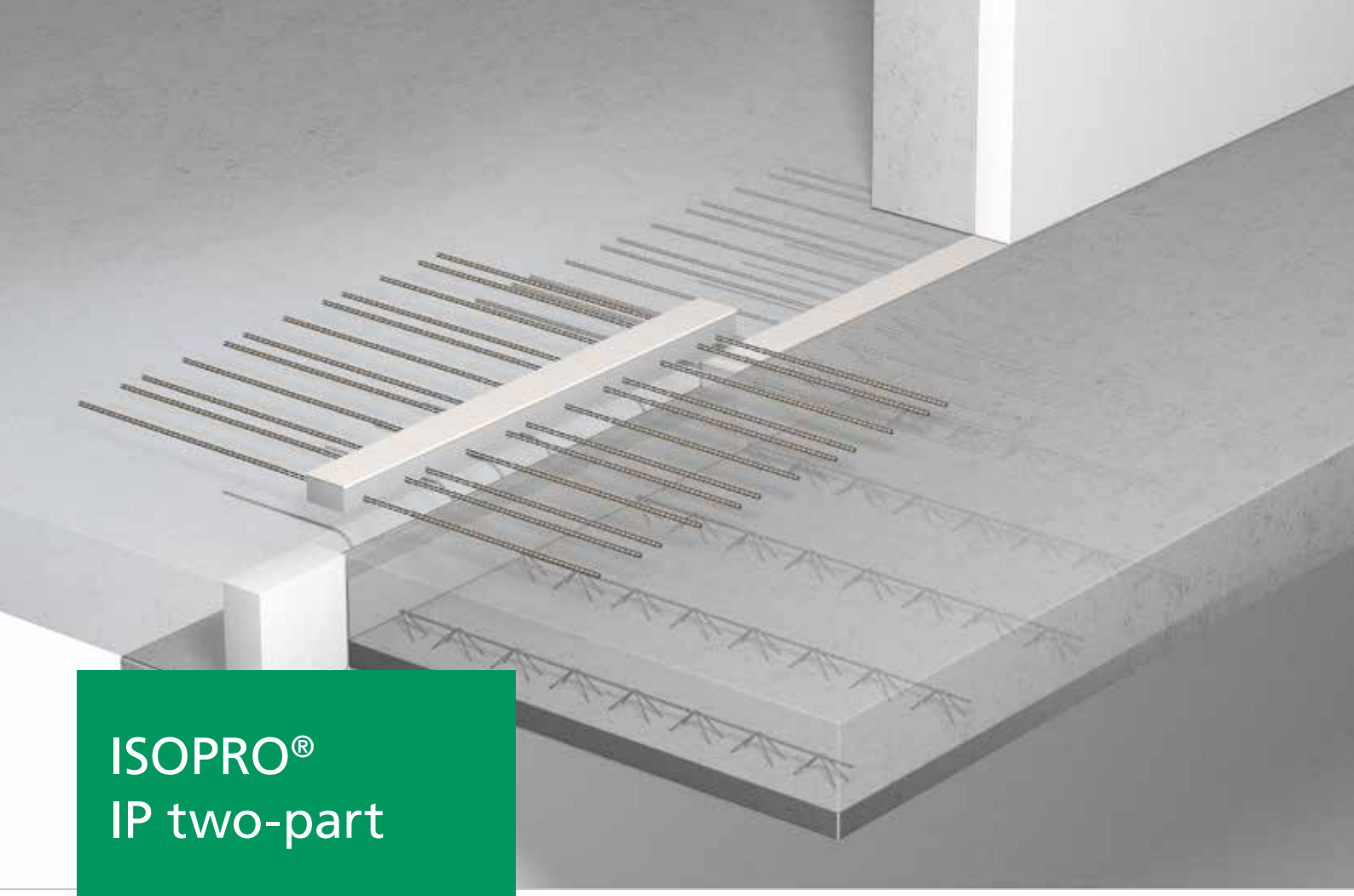
DEFLECTION DUE TO THERMAL INSULATION UNIT:

Quasi-permanent load-combination $\Psi_2 = 0.30$, $\gamma_G = 1.00$, $\gamma_Q = 1.00$
$m_{Ed,perm} = m_{gk} + m_{qk} \cdot \Psi_2$
$m_{Ed,perm} = (g_k + q_k \cdot \Psi_2) \cdot l_k^2 /2 + G_k \cdot l_k$
$m_{Ed,perm} = (6.00 + 4.00 \cdot 0.3) \cdot 2.00^2 /2 + 1.50 \cdot 2.00 =$ <u>17.40 kNm/m</u>
$w_1 = \tan \alpha \cdot (m_{Ed,perm}/m_{Rd}) \cdot l_k \cdot 10$
$\tan \alpha = 0.79$ (see page 32)
$w_1 = 0.79 \cdot (17.40 / 36.80) \cdot 2.00 \cdot 10 =$ <u>7.47 mm (~ 7.00 mm)</u>*

*) w_1 = deflection due to thermal insulation unit. Factor w_2 due to slab deflection has to be added to w_1 by the structural designer. w_2 is in general much smaller than the deflection from the thermal insulation units. (Rough rule of thumb: $w_2 \sim 0.25 \cdot w_1$).

CAMBER:

Case 1) Dewatering towards end of cantilever chosen: camber 7.00 mm **(rounded off)**
Case 2) Dewatering toward building chosen: camber 10.00 mm **(rounded up)**



ISOPRO®
IP two-part

UNITS FOR CANTILEVERED BALCONIES WITH PREFAB SLABS

ISOPRO® IP TWO-PART

- Two-part units for installing the bottom section in element slabs in the prefabricated parts factory and fitting the upper section on the construction site
- For transferring negative moments and positive shearing forces
- Pressure plane with concrete compression bearings
- Load-bearing capacities IP 10 two-part to IP 100 two-part
- Shearing force load-bearing capacities, standard, Q8, Q10 and Q12
- Concrete covering of tension rods cv35 or cv50
- Unit heights depending on the shearing force load-bearing capacity starting from h_{min} = 160 mm
- Fire resistance class REI 120 available

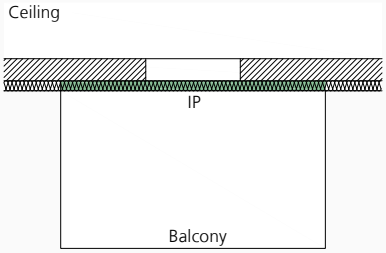
TYPE DESIGNATION

IP 65 Q8 cv35 h200 REI 120 two-part

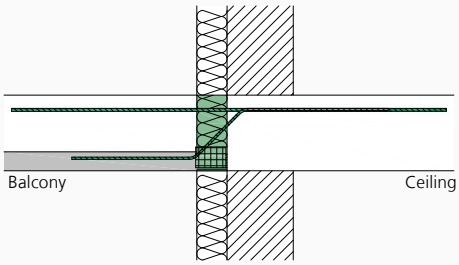
- Two-part design
- Fire protection version
- Unit height
- Concrete covering
- Shearing force load-bearing capacity
- Type and load-bearing capacity

APPLICATION – UNIT STRUCTURE

This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.

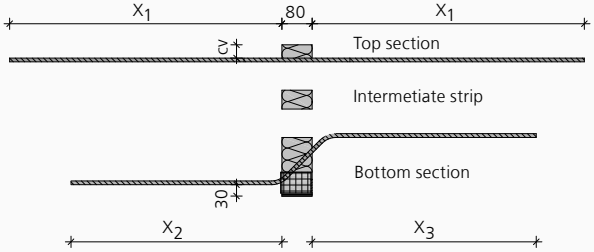


ISOPRO® IP two-part – Cantilevered balconies



ISOPRO® IP two-part – Installation cross-section thermal insulation composite system

ELEMENTAUFBAU ISOPRO® IP 10 2-TEILIG BIS IP 100 2-TEILIG



Length tension rod[mm]	IP 10 – IP 50	IP 55 – IP 75	IP 90 – IP 100
X_1	580	720	840

Length Shear rod [mm]	Shearing force load-bearing capacity			
	Standard	Q8	Q10	Q12
X_2	330	450	560	670
X_3	≤ 475	≤ 530	≤ 640	≤ 745
h_{min}	160	160	170	180

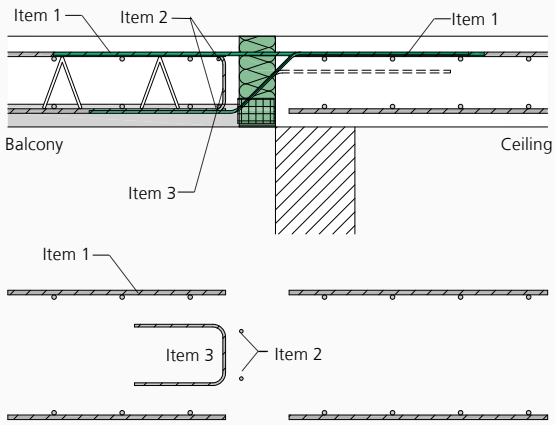
DESIGN AND UNIT STRUCTURE OF THE TWO-PART UNITS

- Design, unit structure and assignment of the units is identical to the corresponding one-part units – p. 28 – 30
- Design of the insulating body comprising a bottom section and a top section.
- Prefabricated parts factories have the option of ordering units in most current heights and doubling them as needed to create additional heights by adding intermediate strips. The shear rod is designed for the basic height and is not raised into the tension plane of the unit.
- Camber, bending slenderness and maximum permissible distance between expansion joints – p. 32 – 33

SUPPLEMENTARY REINFORCEMENT

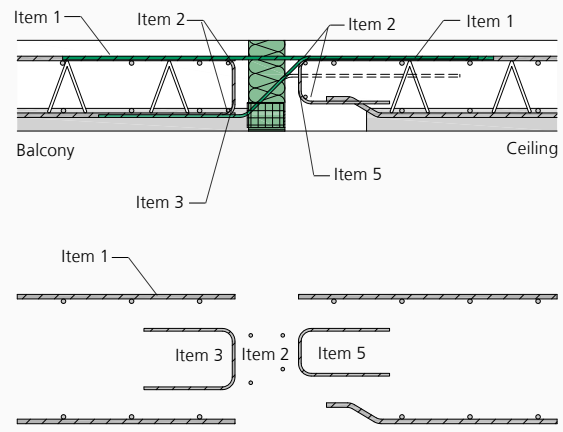
ISOPRO® IP 10 TWO-PART TO IP 100 TWO-PART

DIRECT SUPPORT



- Item 1 connection reinforcement for the ISOPRO® unit – p. 43
- Item 2 spacing bar 2 Ø 8 balcony side
- Item 3 structural edging parallel to the ISOPRO® IP unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)

INDIRECT SUPPORT



- Item 1 connection reinforcement for the ISOPRO® unit – p. 43
- Item 2 spacing bar 2 x 2 Ø 8 balcony and ceiling side
- Item 3 structural edging parallel to the ISOPRO® IP unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 Edging or supplementary stirrup – p.43

SUPPLEMENTARY REINFORCEMENT

ISOPRO® IP 10 TWO-PART TO IP 100 TWO-PART

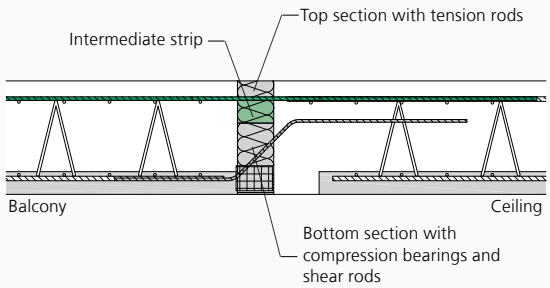
CONNECTION REINFORCEMENT ITEM 1

ISOPRO®	$a_{s,erf}$ [cm²/m]	Suggestion Reinf. steel B500
IP 10	2.37	5 Ø 8
IP 15	3.47	7 Ø 8
IP 20	4.00	8 Ø 8
IP 25	5.62	12 Ø 8
IP 35	6.14	13 Ø 8
IP 45	7.20	15 Ø 8
IP 50	7.73	16 Ø 8
IP 55	9.40	12 Ø 10
IP 65	10.17	13 Ø 10
IP 75	11.04	15 Ø 10
IP 90	11.62	11 Ø 12
IP 100	13.11	12 Ø 12

EDGE / SUPPLEMENTARY REINFORCEMENT ITEM 5

Shearing force load-bearing capacity	ISOPRO®		
	IP 10 to IP 20	IP 25 to IP 65	IP 75 to IP 100
	$a_{s,erf}$ [cm²/m]	$a_{s,erf}$ [cm²/m]	$a_{s,erf}$ [cm²/m]
Standard	1.13	1.00	–
Q8	2.13	2.13	–
Q10	3.33	3.33	3.33
Q12	4.79	4.79	4.79

INSTALLATION OF TOP SECTION



- The two-part ISOPRO® unit consists of a top section and a bottom section. The bottom section is concreted into the element slab in the prefabricated parts factory.
- The top section is installed on the construction site.
- The top section and bottom section are labelled so that they can be combined correctly. Please make sure you use the right combination on the construction site.
- When fitting the top section, ensure the correct direction of installation is observed.
- Without the top section, the load-bearing capacity of the connection is not guaranteed.

ISOPRO®
IP Variants

UNITS FOR CANTILEVERED BALCONIES

ISOPRO® IP VAR.

- For transferring negative moments and positive shearing forces
- Pressure plane with concrete compression bearings
- Load-bearing capacities IP 20 Var. to IP 75 Var.
- Shearing force load-bearing capacities standard and Q8
- Concrete covering of tension rods cv35 or cv50
- Unit heights depending on the shearing force load-bearing capacity starting from h_{min} = 160 mm
- Wall thickness WD 175, 200, 220 und ≥ 240
- Fire resistance class REI 120 available

CONNECTION GEOMETRY

- Var. I – Connection to a wall, downwards
- Var. II – Connection to a wall, upwards
- Var. III HV – Connection to a ceiling vertically offset upwards
- Var. III UV – Connection to a ceiling vertically offset downwards

TYPE DESIGNATION

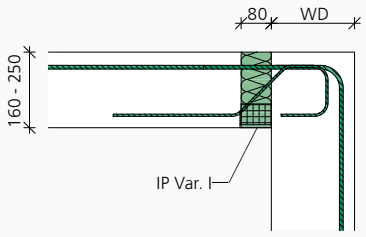
IP 65 Q8 cv35 h200 Var. III HV 100 WD 220 REI 120

- Fire protection version
- Wall/underlay thickness WD 175, 200, 220, ≥ 240
- Variant version incl. indication of vertically offset
- Unit height
- Concrete covering
- Shearing force load-bearing capacity
- Type and load-bearing capacity

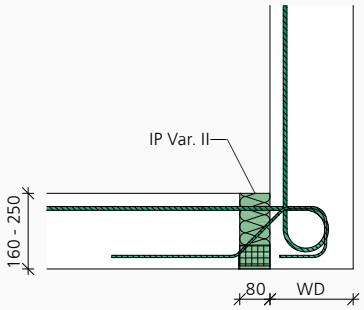
APPLICATION

CONNECTION TO A WALL

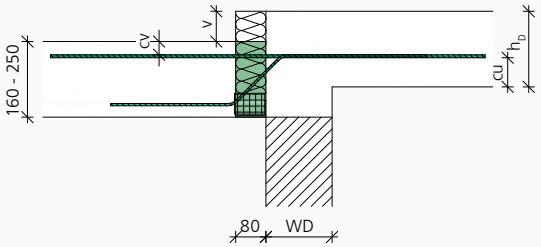
WALL CONNECTION DOWNWARDS – IP VAR. I



WALL CONNECTION UPWARDS – IP VAR. II



CONNECTION TO A SLIGHTLY VERTICALLY OFFSET CEILING WITH A STANDARD ISOPRO®

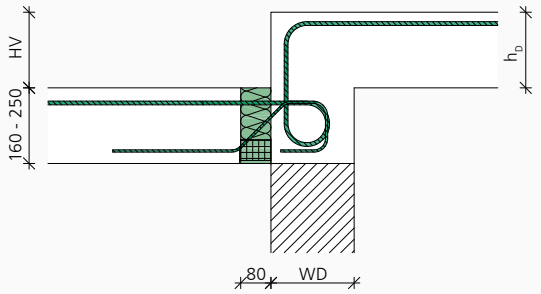


$v \leq h_D - cv - d_s - cu$

with
v – Height offset
h_D – Ceiling thickness
cv – Concrete covering of the tension rods of the ISOPRO® unit
d_s – Diameter of the tension rods of the ISOPRO® unit
cu – Concrete covering of the tension rods of the ISOPRO® unit at the bottom edge of ceiling

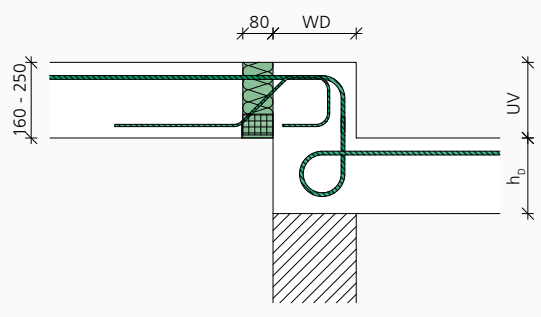
CONNECTION TO CEILINGS WITH AN OFFSET OF 90 TO 240 MM

HIGHER CEILINGS – IP VAR. III HV



Var. III HV	Height offset [mm]
HV 100	90 - 149
HV 150	150 - 199
HV 200	200 - 240

LOWER CEILINGS – IP VAR. III UV



Var. III UV	Height offset [mm]	Var. III UV	Height offset [mm]
UV 80	≤ 80	UV150	141 to ≤ 150
UV 90	81 to ≤ 90	UV160	151 to ≤ 160
UV100	91 to ≤ 100	UV170	161 to ≤ 170
UV110	101 to ≤ 110	UV180	171 to ≤ 180
UV120	111 to ≤ 120	UV190	181 to ≤ 190
UV130	121 to ≤ 130	UV200	191 to ≤ 200
UV140	131 to ≤ 140		

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS m_{Rd} [kNm/m]

Unit height [mm] depending on cv [mm]		ISOPRO®			
35	50	IP 20 Var.	IP 25 Var.	IP 30 Var.	IP 45 Var.
160	–	15.4	21.7	23.4	26.6
–	180	16.2	22.9	24.7	28.1
170	–	17.1	24.1	26.1	29.7
–	190	18.0	25.3	27.4	31.2
180	–	18.9	26.6	28.8	32.7
–	200	19.8	27.8	30.1	34.2
190	–	20.7	29.1	31.5	35.8
–	210	21.6	30.3	32.8	37.3
200	–	22.5	31.6	34.2	38.9
–	220	23.4	32.9	35.6	40.4
210	–	24.3	34.2	37.0	42.1
–	230	25.2	35.4	38.4	43.6
220	–	26.2	36.8	39.8	45.2
–	240	27.1	38.0	41.2	46.8
230	–	28.1	39.4	42.6	48.4
–	250	29.0	40.6	44.0	50.5
240	–	30.0	42.0	45.5	51.6
250	–	31.9	44.7	48.3	54.9

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN/m]

Shearing force	h_{min} [mm]	IP 20 Var.	IP 25 Var.	IP 30 Var.	IP 45 Var.
Standard	160	52.2			
Q8	160	92.7			

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IP 20 Var.	IP 25 Var.	IP 30 Var.	IP 45 Var.
Unit length [mm]	1.000			
Tension rods	7 Ø 8	10 Ø 8	7 Ø 10	8 Ø 10
Compression bearings	4	4	5	5
Shear rods Standard	6 Ø 6			
Shear rods Q8	6 Ø 8			

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS m_{Rd} [kNm/m]

Unit height [mm] depending on cv [mm]		ISOPRO®			
35	50	IP 50 Var.	IP 55 Var.	IP 65 Var.	IP 75 Var.
160	–	29.8	33.1	39.5	42.7
–	180	31.5	34.9	41.7	45.1
170	–	33.2	36.8	44.0	47.6
–	190	34.9	38.7	46.2	49.9
180	–	36.7	40.6	48.5	52.4
–	200	38.4	42.5	50.7	54.8
190	–	40.1	44.4	53.0	57.3
–	210	41.8	46.3	55.3	59.7
200	–	43.6	48.3	57.6	62.2
–	220	45.3	50.2	59.8	64.7
210	–	47.1	52.1	62.2	67.2
–	230	48.8	54.0	64.4	69.6
220	–	50.6	56.0	66.8	72.2
–	240	52.4	58.0	69.1	74.6
230	–	54.2	60.0	71.5	77.2
–	250	55.9	61.9	73.8	79.7
240	–	57.8	63.9	76.1	82.3
250	–	61.4	67.9	80.5	87.4

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN/m]

Shearing force	h_{min} [mm]	IP 50 Var.	IP 55 Var.	IP 65 Var.	IP 75 Var.
Standard	160	52.2			
Q8	160	92.7			

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IP 50 Var.	IP 55 Var.	IP 65 Var.	IP 75 Var.
Unit length [mm]	1.000			
Tension rods	9 Ø 10	10 Ø 10	12 Ø 10	13 Ø 10
Compression bearings	6	6	7	8
Shear rods Standard	6 Ø 6			
Shear rods Q8	6 Ø 8			

This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.

DEFLECTION AND CAMBER

DEFLECTION

During their construction, cantilevered reinforced concrete structures are elevated to take into account the anticipated deflection. If these structures are thermally separated with ISOPRO® units, when calculating the camber, the deflection due to the ISOPRO® unit itself is superimposed with the deflection due to flexion of the slab in accordance with DIN EN 1992-1-1/NA. It must be ensured that the required camber is rounded up or down, according to the planned drainage direction. If a drainage system is installed at the building façade, the value must be rounded up, but for drainage at the end of the cantilever arm, it must be rounded down. We recommend providing proof of suitability for use in the serviceability limit state for the quasi-continuous load combination (γ_G = 1.0, γ_Q = 1.0, ψ_2 = 0.3). The tables below show the deflection factors tan α for calculating the deflection due to ISOPRO®.

DEFLECTION DUE TO THE ISOPRO® CANTILEVER SLAB CONNECTION

$$w = \tan \alpha \cdot (m_{Ed}/m_{Rd}) \cdot l_k \cdot 10$$

with

w = Deflection at the end of the cantilever arm [mm]

$\tan \alpha$ = Deflection factor, see product sections

m_{Ed} = Bending moment for determining the camber as a result of the ISOPRO® unit. The definitive load combination for the servicability limit state is determined by the structural engineer

m_{Rd} = Resistance moment of the ISOPRO® unit, see product section

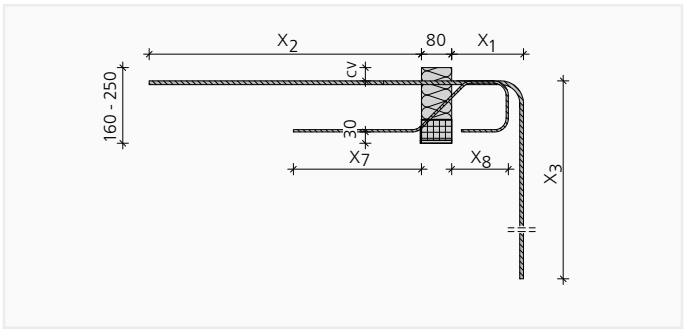
l_k = System length [m]

DEFLECTION FACTOR TAN α FOR CONCRETE ≥ C 25/30

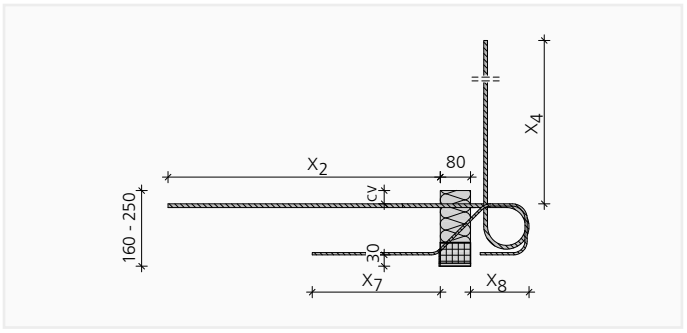
ISOPRO®	Concrete covering cv [mm]	Height h [mm]									
		160	170	180	190	200	210	220	230	240	250
IP 20 Var. to IP 25 Var.	35	0.63	0.57	0.53	0.49	0.45	0.42	0.40	0.37	0.35	0.34
	50	–	–	0.60	0.55	0.50	0.47	0.44	0.41	0.38	0.36
IP 30 Var. to IP 75 Var.	35	0.73	0.66	0.61	0.56	0.52	0.48	0.45	0.43	0.40	0.38
	50	–	–	0.69	0.63	0.58	0.54	0.50	0.47	0.44	0.42

UNIT STRUCTURE

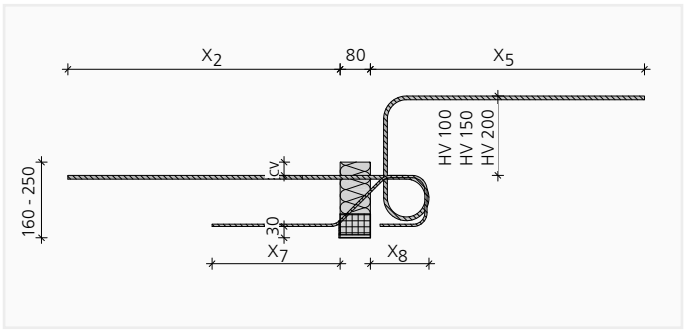
IP VAR. I



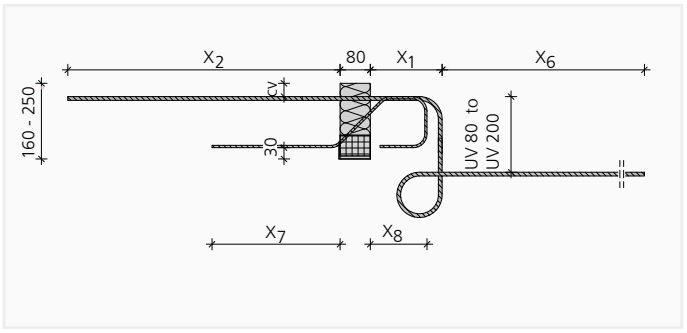
IP VAR. II



IP VAR. III HV



IP VAR. III UV



TENSION ROD DIMENSIONS [MM]

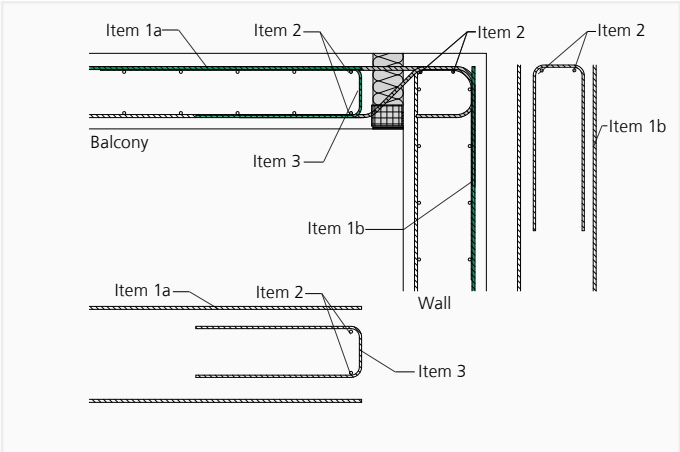
ISOPRO®	IP 20 + IP 25				IP 30 to IP 75			
WD	175	200	220	≥ 240	175	200	220	≥ 240
X_1	155	170	190	210	–	170	190	210
X_2	620				760			
X_3	589				794			
X_4	482				616			
X_5	≤ 744				≤ 854			
X_6	≤ 584				≤ 705			

SHEAR ROD DIMENSIONS [MM]

Shear force load-bearing capacity	Standard		Q8	
WD	175	≥ 200	175	≥ 200
X_7	344		383	
X_8	150		155	170

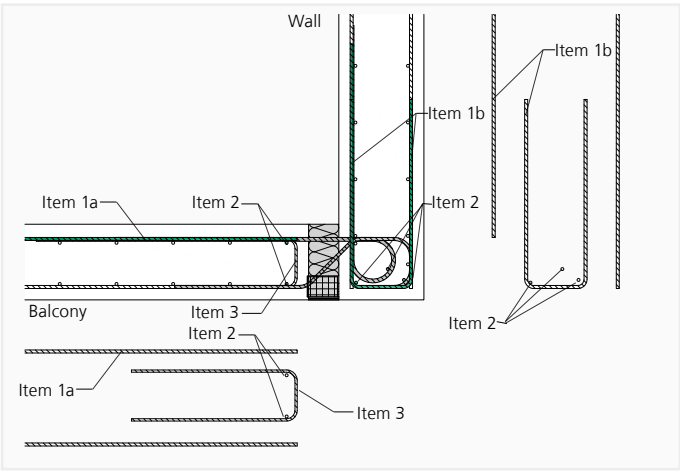
SUPPLEMENTARY REINFORCEMENT

CONNECTION TO A WALL, DOWNWARDS – IP VAR. I



- Item 1a connection reinforcement on the balcony for the ISOPRO® unit – see table
- Item 1b connection reinforcement for the ISOPRO® unit to bear the connection moment in the wall in accordance with the structural engineer's specifications
- Item 2 spacing bar 2 Ø 8 on the balcony, 2 Ø 8 in the wall
- Item 3 structural edging parallel to the ISOPRO® unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 slab and wall reinforcement and structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- The ISOPRO® unit ideally is installed before the wall reinforcement is fitted.

CONNECTION TO A WALL, UPWARDS – IP VAR. II



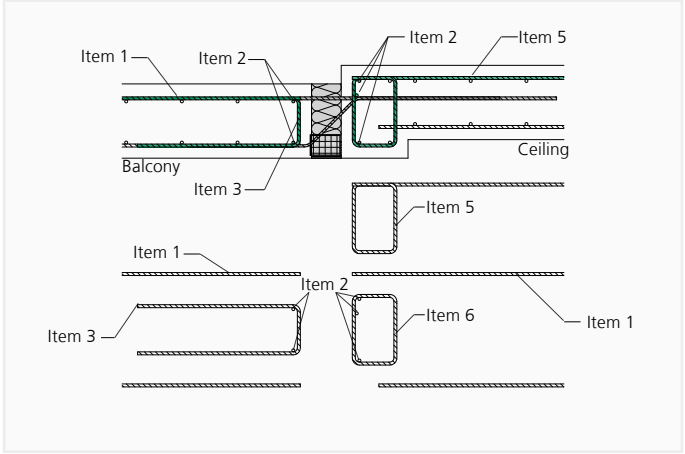
- Item 1a connection reinforcement on the balcony for the ISOPRO® unit – see table
- Item 1b connection reinforcement for the ISOPRO® unit to bear connection moment and shear force in the wall in accordance with the structural engineer's specifications
- Item 2 spacing bar 2 Ø 8 on the balcony, 3 Ø 8 in the wall
- Item 3 structural edging parallel to the ISOPRO® unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 slab and wall reinforcement and structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- The ISOPRO® unit ideally is installed before the wall reinforcement is fitted.

CONNECTION REINFORCEMENT ITEM 1

ISOPRO®	IP 20 Var.	IP 25 Var.	IP 30 Var.	IP 45 Var.	IP 50 Var.	IP 55 Var.	IP 65 Var.	IP 75 Var.
$a_{s,erf}$ [cm²/m]	3.79	5.36	5.84	6.65	7.46	8.26	9.87	13.60
Suggestion	8 Ø 8	11 Ø 8	8 Ø 10	9 Ø 10	10 Ø 10	11 Ø 10	13 Ø 10	14 Ø 10

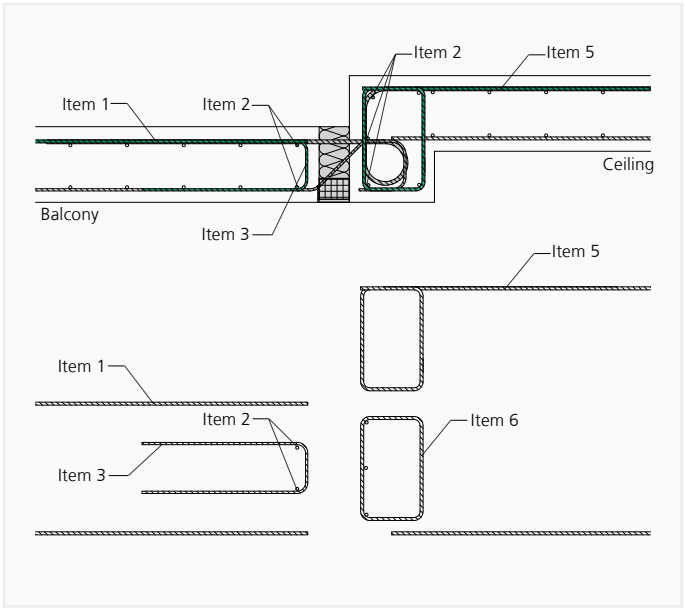
SUPPLEMENTARY REINFORCEMENT

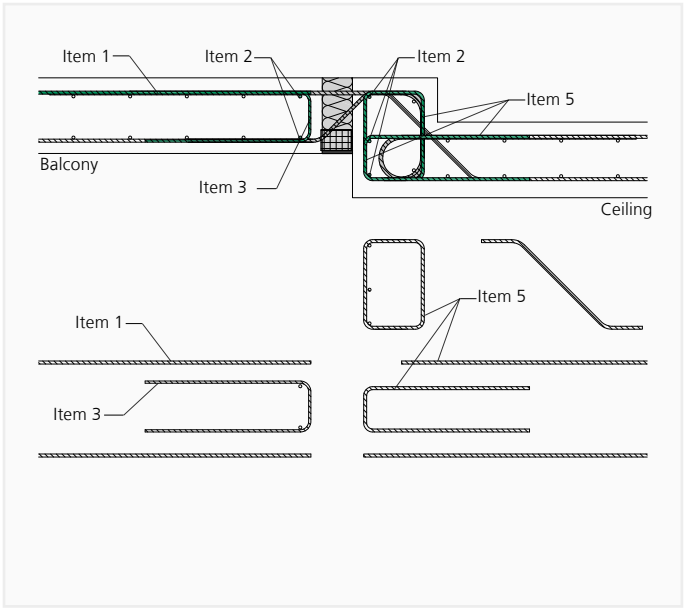
CONNECTION TO A SLIGHTLY VERTICALLY OFFSET CEILING WITH A STANDARD ISOPRO®



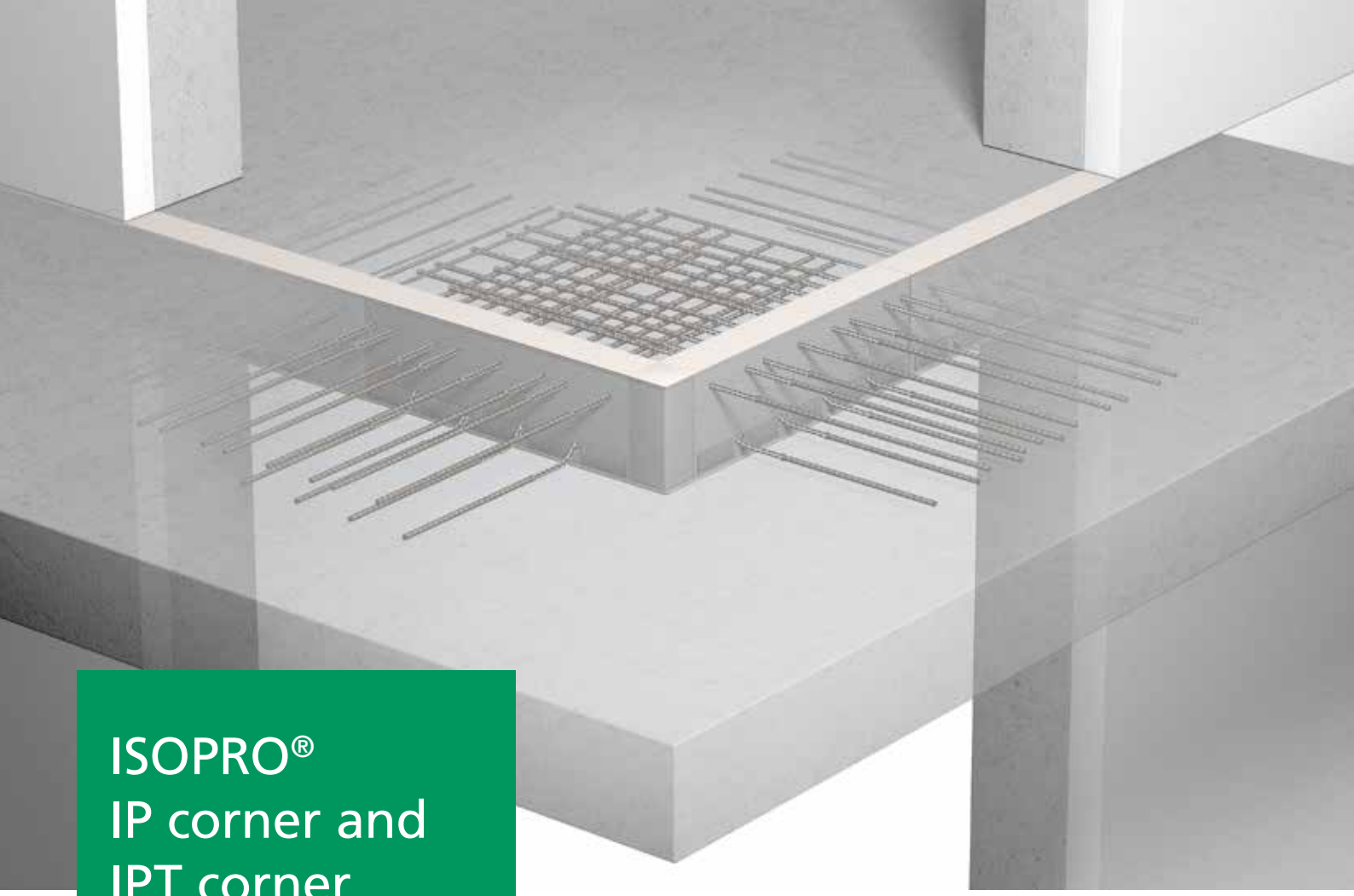
- Item 1 connection reinforcement for the ISOPRO® unit - p. 38
- Item 2 spacing bar 2 Ø 8 on the balcony, 3 Ø 8 on the ceiling
- Item 3 structural edging parallel to the ISOPRO® unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 slab reinforcement and structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 stirrup for deflecting the tensile force in the joist to the upper tensile reinforcement in accordance with the structural engineer's specifications. The overlap length with the tensile reinforcement must be guaranteed.
- Item 6 Shear reinforcement of the joist in accordance with the structural engineer's specifications.

CONNECTION TO VERTICALLY OFFSET CEILING – ISOPRO® IP VAR. III





- Item 1 connection reinforcement for the ISOPRO® unit - see table p. 50
- Item 2 spacing bar 2 Ø 8 on the balcony, 3 Ø 8 on the ceiling
- Item 3 structural edging parallel to the ISOPRO® unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 stirrup for deflecting the tensile force in the joist to the upper tensile reinforcement in accordance with the structural engineer's specifications. The overlap length with the tensile reinforcement must be guaranteed.
- Item 6 shear reinforcement of the joist in accordance with the structural engineer´s specifications.
- The ISOPRO® unit must be installed before the joist reinforcement is fitted.



ISOPRO®
IP corner and IPT corner

UNITS FOR CANTILEVERED CORNER BALCONIES

ISOPRO® IP CONRER AND IPT CORNER

- IP corner – Pressure plane with concrete compression bearings
- IPT corner – Pressure plane with steel pressure rods
- Shearing force load-bearing capacity, standard
- A corner unit comprises an EL unit (left corner) in cv35 and an ER unit (right corner) in cv50 and a corner insulation body 80 x 80 mm
- Unit heights starting from h_{min} = 180 mm
- Fire resistance class REI 120 available for IP corner, R 90 available for IPT corner

ISOPRO® IP (T) SUB-UNIT EL/ER

- Sub-unit IP EL/ER – Pressure plane with concrete compression bearings
- Sub- unit IPT EL/ER – Pressure plane with with steel pressure rods
- Shearing force load-bearing capacity, standard
- Concrete covering of tension rods cv35 (EL) or cv50 (ER)
- Unit heights from 180 mm
- Fire resistance class REI 120 available for IP EL and IP ER, R 90 available for IPT EL and IPT ER

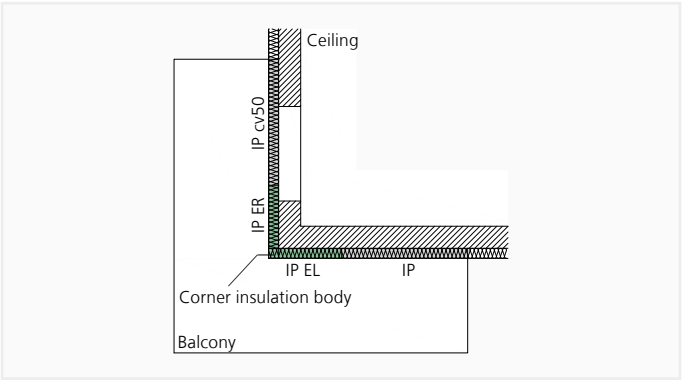
TYPE DESIGNATION

IP corner 20 cv35 h200 REI 120

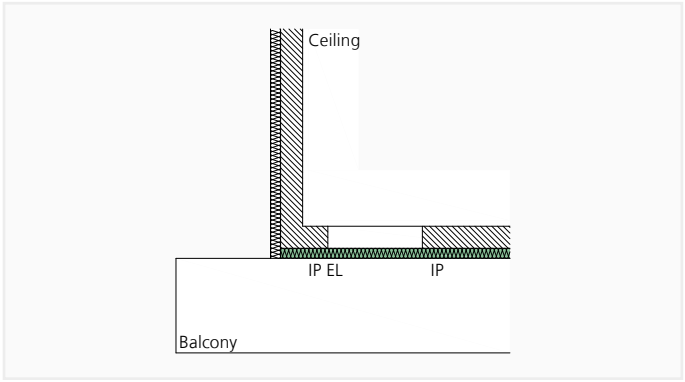
- Fire protection version
- Unit height
- Concrete covering
- Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

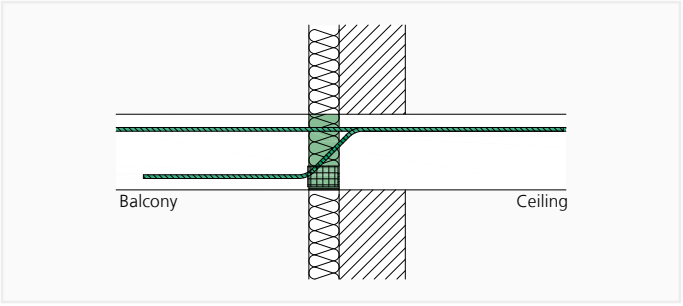
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



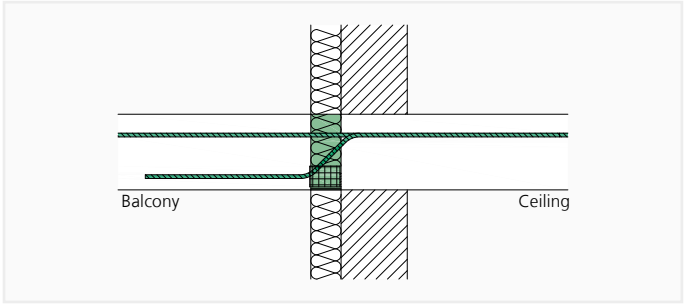
ISOPRO® IP corner – Cantilevered external corner balcony



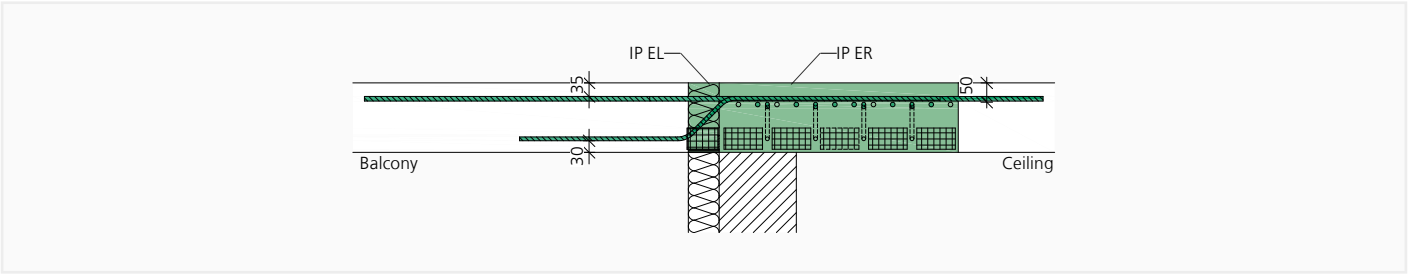
ISOPRO® IP EL – Cantilevered balcony with slab protruding over the support



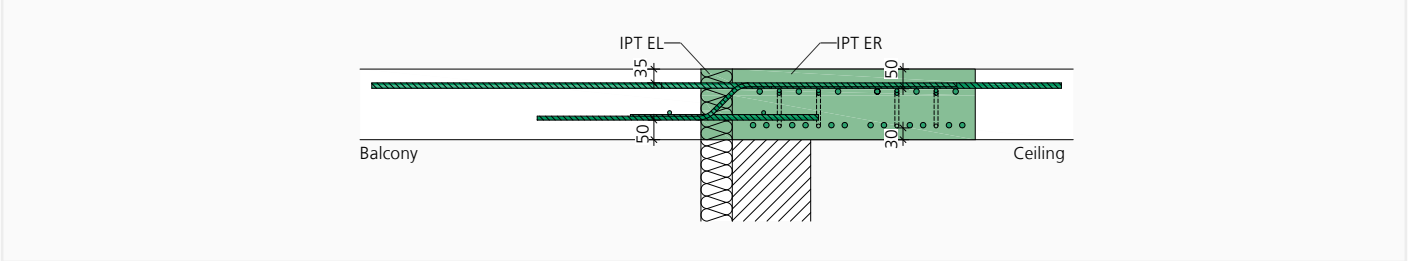
ISOPRO® IP EL/ER – Installation cross-section cv35



ISOPRO® IP EL/ER – Installation cross-section cv50



ISOPRO® IP corner – Cross-section through the corner situation



ISOPRO® IPT corner – Cross-section through the corner situation

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS M_{RD} [kNm] PER SUB-UNIT EL/ER

Unit height [mm] depending on cv [mm]	ISOPRO®		
	IP corner 20	IP corner 30	IPT corner 50
180	17.9	30.1	32.3
190	19.9	33.4	36.2
200	21.9	36.7	40.1
210	23.9	39.8	44.1
220	25.9	43.0	48.0
230	27.9	46.1	51.9
240	29.8	49.3	55.9
250	31.7	52.5	59.8

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN] PER SUB-UNIT EL/ER

Shearing force	IP corner 20	IP corner 30	IPT corner 50
h = 180 - 190 mm	46.4	96.6	96.6
h = 200 - 250 mm	46.4	139.1	139.1

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IP corner 20	IP corner 30	IPT corner 50
Unit length [mm]	500 + 500	620 + 620	620 + 620
Tension rods	2x 5 Ø 10	2x 6 Ø 12	2x 6 Ø 14
Compression bearings (CBs)/ Steel pressure rods (SRs)	2x 3 CBs	2x 5 CBs	SRs 2x 12 Ø 14
Shear rods h = 180 - 190 mm	2x 3 Ø 8	2x 4 Ø 10	2x 4 Ø 10
Shear rods h = 200 - 250 mm	2x 3 Ø 8	2x 4 Ø 12	2x 4 Ø 12

NOTES

- With small cantilever arm lengths, a combination of a standard ISOPRO® IP unit in cv35 and an ISOPRO® IP unit in cv50 can also be used instead of the ISOPRO® IP/IPT corner unit.
- Sub-units of the corner unit are also available individually for use where high moments and shearing forces occur at specific points
- With an ISOPRO® IP/IPT corner, the IP EL unit is always produced in cv35 and the IP ER unit in cv50. Arranged to the left and right of the ceiling viewpoint.
- Adjoining the ER unit, an ISOPRO® IP unit in cv50 is required when using a corner unit. It is then possible to proceed in cv35 or cv50. The reinforcement can be simplified by continuing in cv50.

DEFLECTION – DISTANCE BETWEEN EXPANSION JOINTS

DEFLECTION

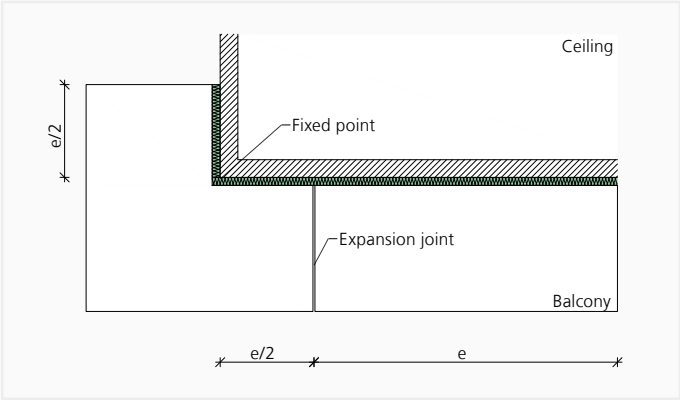
The required camber of the reinforced concrete components is calculated in the same way as for the ISOPRO® units on page 32 using the deflection factors below.

DEFLECTION FACTOR TAN α FOR CONCRETE ≥ C 25/30

ISOPRO®	Concrete covering cv [mm]	Height h [mm]							
		180	190	200	210	220	230	240	250
IP corner 20	35/50	1.10	1.00	0.92	0.85	0.79	0.74	0.70	0.65
IP corner 30	35/50	1.10	1.00	0.92	0.85	0.78	0.73	0.68	0.64
IPT corner 50	35/50	1.76	1.56	1.41	1.28	1.18	1.09	1.01	0.94

DISTANCE BETWEEN EXPANSION JOINTS

For balconies that overhang corners, it must be taken into consideration that the corner is a fixed point. This reduces the maximum permissible distance between expansion joints to e/2. If the component dimensions exceed the maximum distance between expansion joints, expansion joints must be arranged perpendicular to the insulation plane.



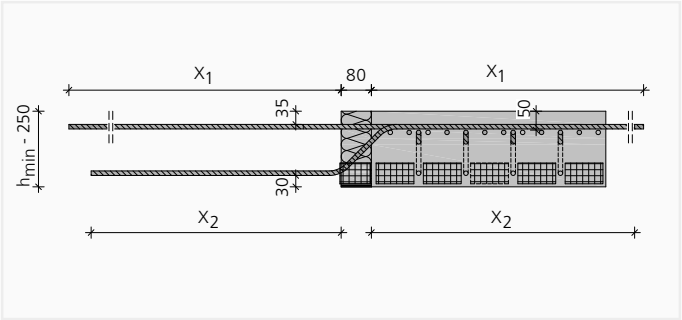
Expansion joint layout for corner balconies

MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IP corner 20	IP corner 30	IPT corner 50
Distance between joints e/2 [m]	6.50	5.65	5.05

UNIT STRUCTURE

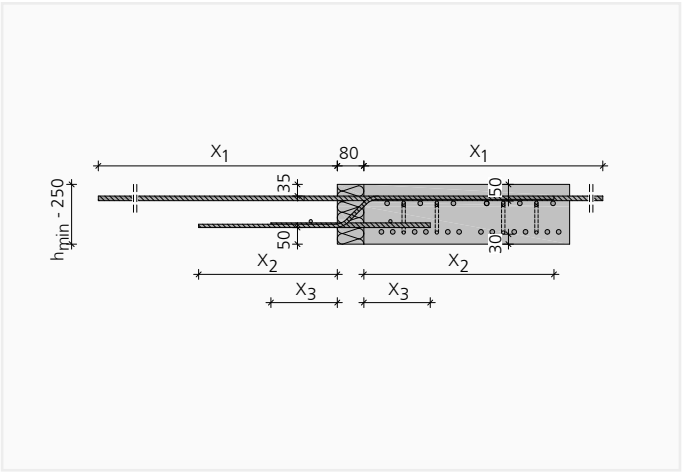
ISOPRO® IP CORNER



Length tension rod [mm]	IP corner 20	IP corner 30
X_1	720	860

Length shear rod [mm]	IP corner 20	IP corner 30
h=180 - 190mm, X_2	450	560
h=200 - 250mm, X_2	450	670

ISOPRO® IPT CORNER

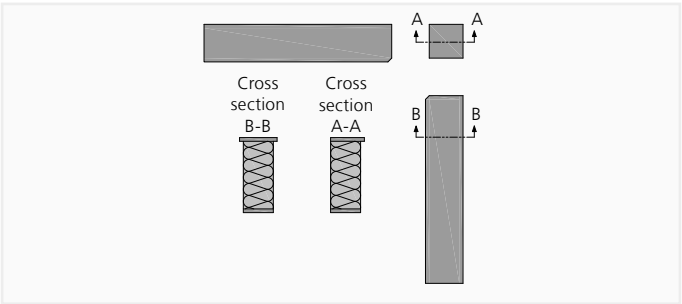


Length tension rod [mm]	IPT corner 50
X_1	980

Length shear rod [mm]	IPT corner 50
h=180 - 190mm, X_2	560
h=200 - 250mm, X_2	670

Length steel pressure rod [mm]	IPT corner 50
X_3	200

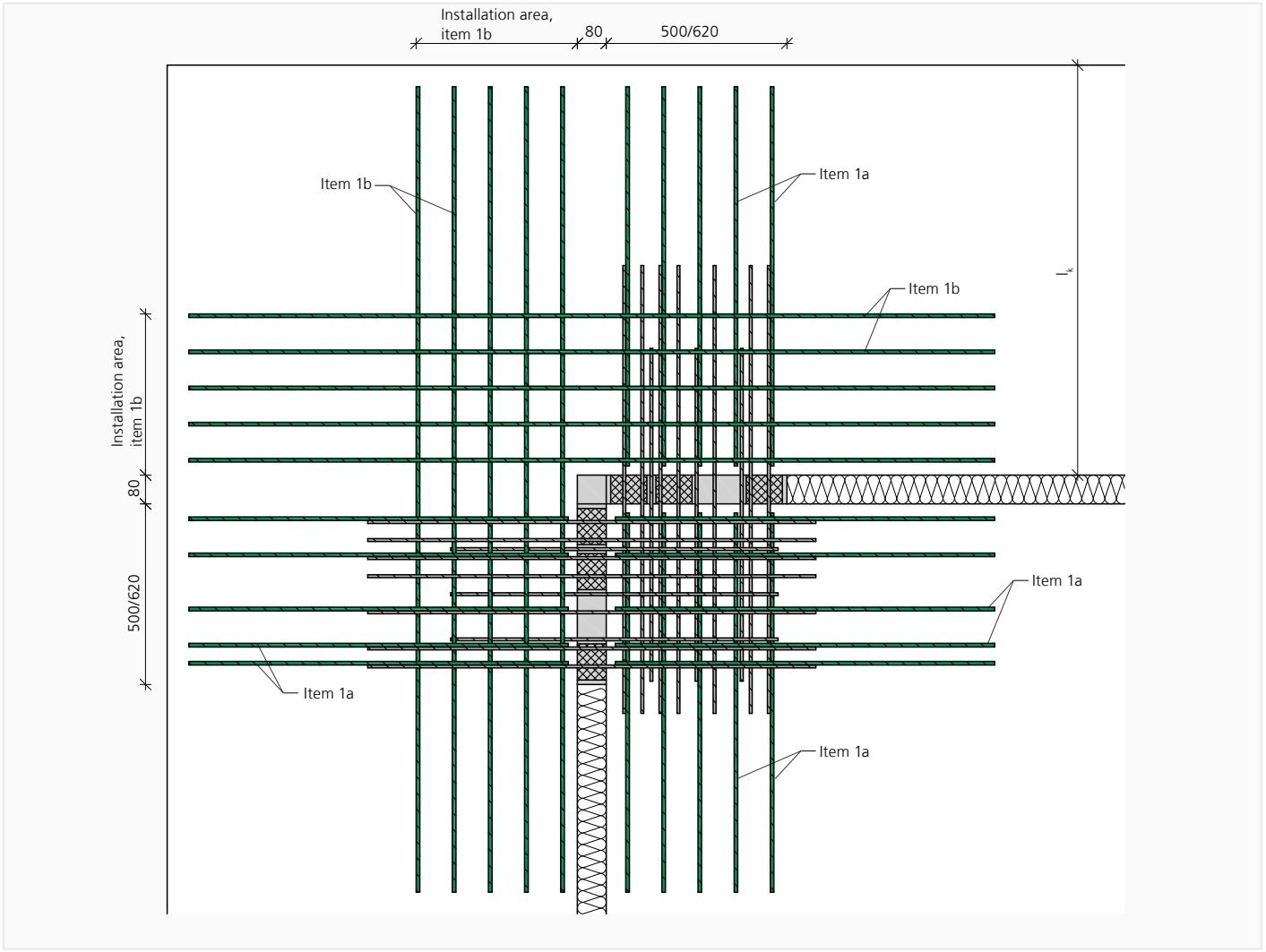
ISOPRO® IP CORNER FIRE PROTECTION VERSION, SCHEMATIC DESCRIPTION INSULATING BODY



ISOPRO® IP corner – Fire protection version, schematic description of the insulating body

SUPPLEMENTARY REINFORCEMENT

ISOPRO® IP CORNER AND IPT CORNER

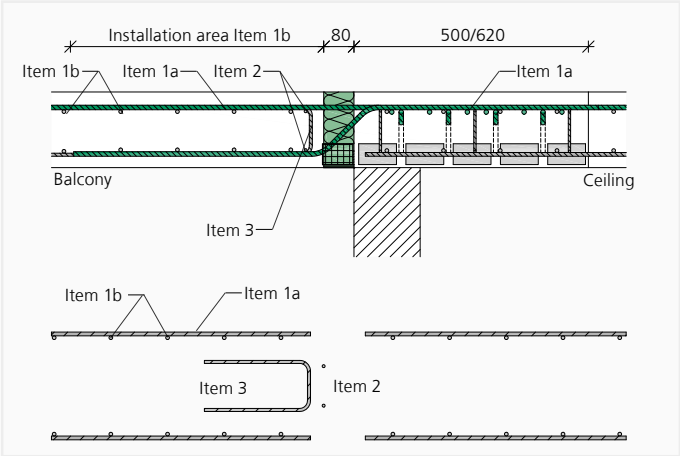


ISOPRO® IP corner – Plan view of supplementary reinforcement

SUPPLEMENTARY REINFORCEMENT

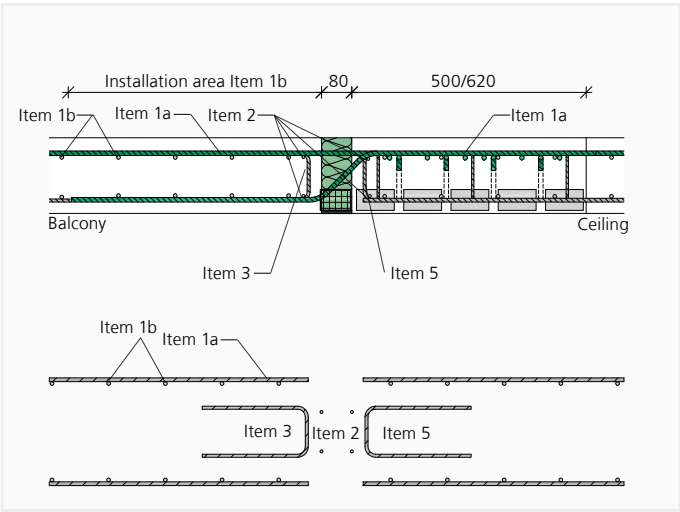
ISOPRO® IP CORNER AND IPT CORNER

DIRECT SUPPORT



- Item 1a connection reinforcement and Item 1b additional reinforcement for the ISOPRO® unit – see table
- Item 2 spacing bar 2 Ø 8 on the balcony
- Item 3 structural edging parallel to the ISOPRO® unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)

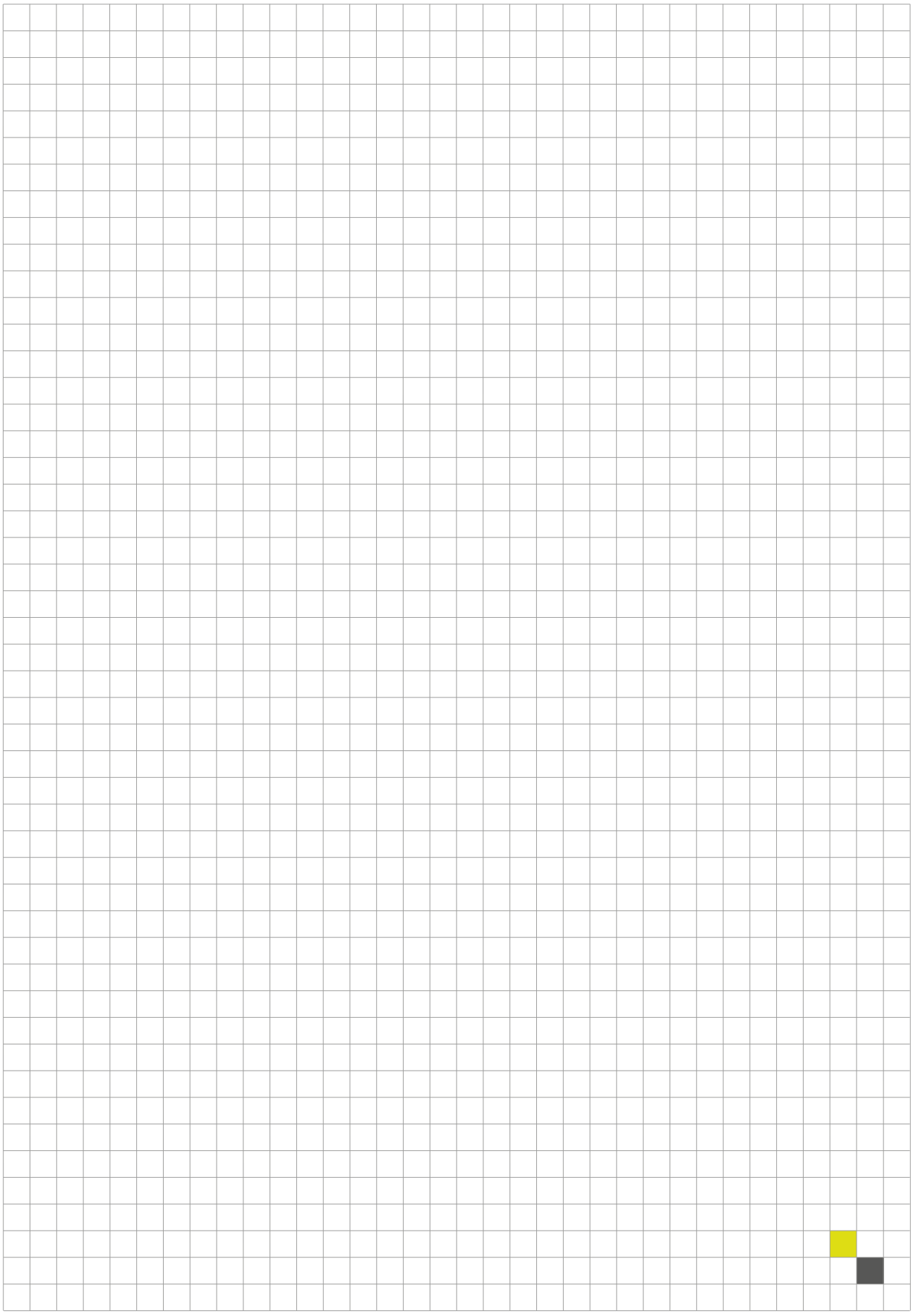
INDIRECT SUPPORT



- Item 1a connection reinforcement and Item 1b additional reinforcement for the ISOPRO® unit – see table
- Item 2 spacing bar 2 x 2 Ø 8 balcony and ceiling side
- Item 3 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 supplementary reinforcement for the ISOPRO® unit – see table

CONNECTION AND ADDITIONAL REINFORCEMENT

ISOPRO®	IP corner 20	IP corner 30	IPT corner 50
Connection reinforcement, item 1a	5 Ø 10	6 Ø 12	5 Ø 14
Rod length, item 1a	l_k - 70	l_k - 70	l_k - 70
Additional reinforcement, item 1b	2 x 5 Ø 10/100	2 x 6 Ø 12/100	2 x 5 Ø 14/100
Rod length, item 1b	2 x l_k	2 x l_k	2 x l_k
Intallation area, item 1b	460	570	460
Supp. reinforcement, item 5	3 Ø 8	4 Ø 12	4 Ø 12



ISOPRO®
IPQ and IPZQ, IPQS/IPTQS and IPQZ

UNITS FOR SUPPORTED BALCONIES

ISOPRO® IPQ, IPZQ

- For transferring positive shearing forces
- Unit length 1.0 m
- ISOPRO® IPQ pressure plane with concrete compression bearings
- ISOPRO® IPZQ for constraint-free support without pressure components
- Unit heights depending on the load-bearing capacity starting from h_{min} = 160 mm
- Fire resistance class REI 120 available

ISOPRO® IPQS/IPTQS, IPQZ

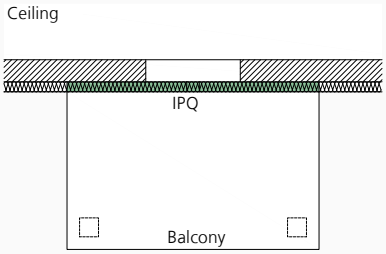
- Short units for load peaks at specific points
- Unit length depending on the load-bearing capacity 0.3 m, 0.4 m or 0.5 m
- ISOPRO® IPQS pressure plane with concrete compression bearings
- ISOPRO® IPTQS pressure plane with steel pressure rods
- ISOPRO® IPQZ for constraint-free support without pressure components
- Unit heights depending on the load-bearing capacity starting from h_{min} = 160 mm
- Fire resistance class REI 120 available for IPQS and IPQZ, R 90 available for IPTQS

TYPE DESIGNATION

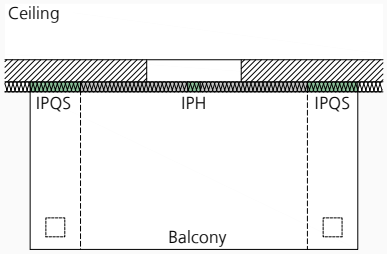
IPQ 20 h200 REI 120

- REI 120 — Fire protection version
- h200 — Unit height
- IPQ 20 — Type and load-bearing capacity

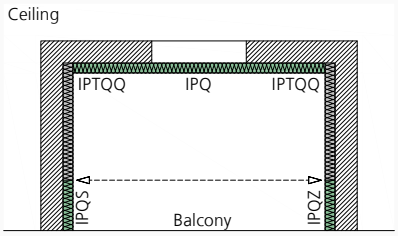
APPLICATION – UNIT ARRANGEMENT



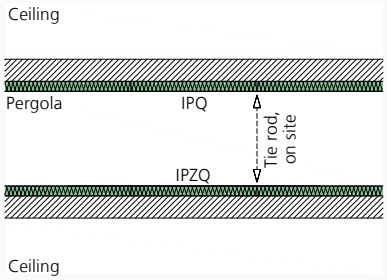
ISOPRO® IPQ – Supported balcony



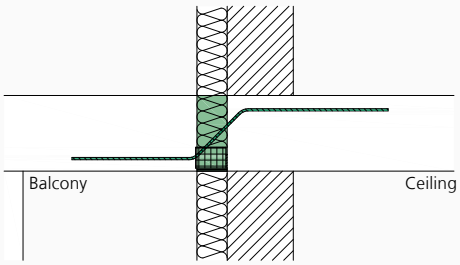
ISOPRO® IPQS – Supported balcony with beams and support at specific points with ISOPRO® IPQS units



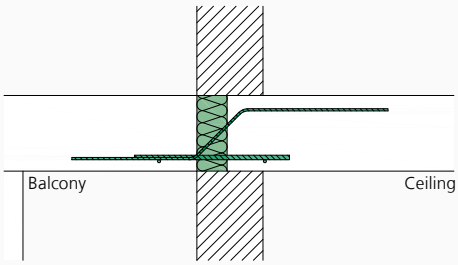
ISOPRO® IPQ, IPTQQ, IPQS/IPTQS, IPQZ – Loggia balcony with load peaks at specific points and constraint-free support at the front



ISOPRO® IPQ, IPZQ – Pergola with constraint-free support

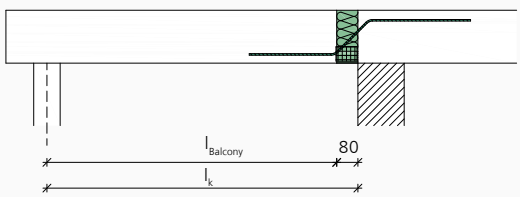


ISOPRO® IPQ, IPQS – Installation cross-section of thermal insulation composite system

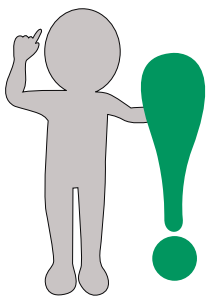


ISOPRO® IPTQS – Installation cross-section of single-leaf masonry

STATIC SYSTEM



ISOPRO® IPQ – Static system



For balconies connected with shear units, appropriate support must be provided in all construction conditions. Temporary supports may only be removed if the permanent supports, which may have been installed at a later date, are sufficiently strong and frictionally connected to the balcony.

DESIGN TABLES FOR CONCRETE ≥ C25/30

ISOPRO® IPQ – DESIGN VALUES OF ALLOWABLE SHEARING FORCE v_{RD} [kN/m]

ISOPRO®	Shearing force v_{Rd} [kN/m]	Unit height [mm]	Unit length [mm]	Shear rods	Compression bearings (CBs)
				Assignment	Assignment
IPQ 10	34.8	≥ 160	1000	4 Ø 6*	4 CBs
IPQ 20	43.5	≥ 160	1000	5 Ø 6*	4 CBs
IPQ 30	52.2	≥ 160	1000	6 Ø 6*	4 CBs
IPQ 40	69.5	≥ 160	1000	8 Ø 6*	4 CBs
IPQ 50	86.9	≥ 160	1000	10 Ø 6*	4 CBs
IPQ 70	92.7	≥ 160	1000	6 Ø 8	4 CBs
IPQ 80	108.2	≥ 160	1000	7 Ø 8	4 CBs
IPQ 85	123.6	≥ 160	1000	8 Ø 8	4 CBs
IPQ 90	154.5	≥ 160	1000	10 Ø 8	4 CBs
IPQ 100	193.2	≥ 170	1000	8 Ø 10	4 CBs
IPQ 110	217.3	≥ 170	1000	9 Ø 10	4 CBs
IPQ 120	241.5	≥ 170	1000	10 Ø 10	4 CBs

ISOPRO® IPZQ – DESIGN VALUES OF ALLOWABLE SHEARING FORCE v_{RD} [kN/m]

ISOPRO®	Shearing force v_{Rd} [kN/m]	Unit height [mm]	Unit length [mm]	Shear rods	Compression bearings (CBs)
				Assignment	Assignment
IPZQ 10	34.8	≥ 160	1000	4 Ø 6*	–
IPZQ 20	43.5	≥ 160	1000	5 Ø 6*	–
IPZQ 30	52.2	≥ 160	1000	6 Ø 6*	–
IPZQ 40	69.5	≥ 160	1000	8 Ø 6*	–
IPZQ 50	86.9	≥ 160	1000	10 Ø 6*	–
IPZQ 70	92.7	≥ 160	1000	6 Ø 8	–
IPZQ 80	108.2	≥ 160	1000	7 Ø 8	–
IPZQ 85	123.6	≥ 160	1000	8 Ø 8	–
IPZQ 90	154.5	≥ 160	1000	10 Ø 8	–
IPZQ 100	193.2	≥ 170	1000	8 Ø 10	–
IPZQ 110	217.3	≥ 170	1000	9 Ø 10	–
IPZQ 120	241.5	≥ 170	1000	10 Ø 10	–

This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.

DESIGN TABLES FOR CONCRETE ≥ C25/30

ISOPRO® IPQS – DESIGN VALUES OF ALLOWABLE SHEARING FORCE v_{RD} [kN/m]

ISOPRO®	Shearing force v_{Rd} [kN/m]	Unit height [mm]	Unit length [mm]	Shear rods	Compression bearings (CBs)/steel pressure rods (SRs)
				Assignment	Assignment
IPQS 5	26.1	≥ 160	400	3 Ø 6*	2 CBs
IPQS 10	30.9	≥ 160	300	2 Ø 8	1 CB
IPQS 15	34.8	≥ 160	500	4 Ø 6*	2 CBs
IPQS 20	46.4	≥ 160	400	3 Ø 8	2 CBs
IPQS 30	61.8	≥ 160	500	4 Ø 8	2 CBs
IPQS 40	48.3	≥ 170	300	2 Ø 10	1 CB
IPQS 50	72.4	≥ 170	400	3 Ø 10	2 CBs
IPQS 55	96.6	≥ 170	500	4 Ø 10	2 CBs
IPTQS 60	69.5	≥ 180	300	2 Ø 12	SRs 3 Ø 14
IPQS 70	104.3	≥ 180	400	3 Ø 12	2 CBs
IPQS 75	139.1	≥ 180	500	4 Ø 12	3 CBs
IPTQS 80	94.7	≥ 190	300	2 Ø 14	SRs 4 Ø 14
IPTQS 90	142.0	≥ 190	400	3 Ø 14	SRs 6 Ø 14

ISOPRO® IPQZ – DESIGN VALUES OF ALLOWABLE SHEARING FORCE v_{RD} [kN/m]

ISOPRO®	Shearing force v_{Rd} [kN/m]	Unit height [mm]	Unit length [mm]	Shear rods	Compression bearings (CBs)
				Assignment	Assignment
IPQZ 5	26.1	≥ 160	400	3 Ø 6*	–
IPQZ 10	30.9	≥ 160	300	2 Ø 8	–
IPQZ 15	34.8	≥ 160	500	4 Ø 6*	–
IPQZ 20	46.4	≥ 160	400	3 Ø 8	–
IPQZ 30	61.8	≥ 160	500	4 Ø 8	–
IPQZ 40	48.3	≥ 170	300	2 Ø 10	–
IPQZ 50	72.4	≥ 170	400	3 Ø 10	–
IPQZ 55	96.6	≥ 170	500	4 Ø 10	–
IPQZ 60	69.5	≥ 180	300	2 Ø 12	–
IPQZ 70	104.3	≥ 180	400	3 Ø 12	–
IPQZ 75	139.1	≥ 180	500	4 Ø 12	–
IPQZ 80	94.7	≥ 190	300	2 Ø 14	–
IPQZ 90	142.0	≥ 190	400	3 Ø 14	–

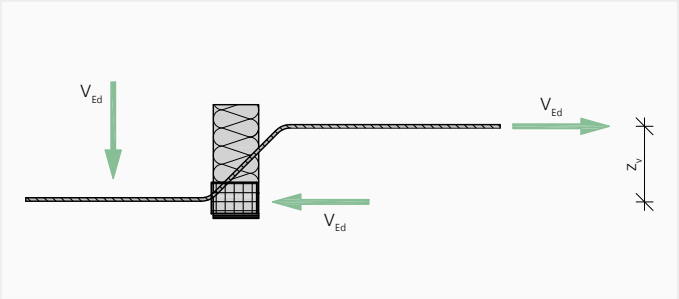
* Units with shear rods Ø 6 have a looped rod on the ceiling side. For all other units, the shear rod on the ceiling side is straight (see also page 65).

DESIGN – EXPANSION JOINTS

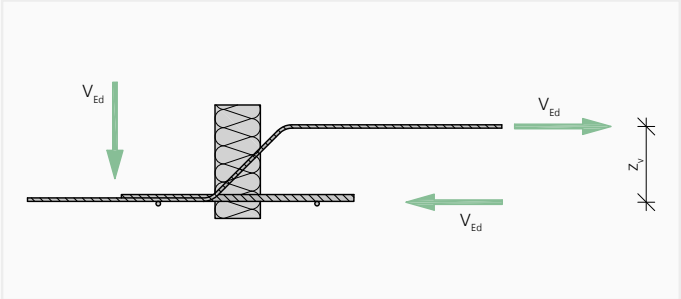
MOMENT RESULTING FROM ECCENTRIC CONNECTIONS

When designing the connection reinforcement on the ceiling for shear units, a moment resulting from eccentric connections must also be considered. This moment is to be superimposed on the moments resulting from the planned loads if the moments are both positive or both negative. The moment is calculated ΔM_{Ed} on the basis of the assumption that the units are fully utilised.

$$\Delta M_{Ed} = V_{Ed} \cdot z_v$$



ISOPRO® IPQ, IPQS – Units with concrete compression bearings
z_v – Lever arm for determining the offset moment



ISOPRO® IPTQS – Units with steel pressure rods
z_v – Lever arm for determining the offset moment

OFFSET MOMENTS FOR TYPE IPQ, IPZQ

ISOPRO®	Δm_{Ed} [kNm/m]	
	h < 200 mm	h ≥ 200 mm
IPQ/IPZQ 10	3.3	4.7
IPQ/IPZQ 20	4.1	5.8
IPQ/IPZQ 30	4.9	7.0
IPQ/IPZQ 40	6.5	9.3
IPQ/IPZQ 50	8.2	11.6
IPQ/IPZQ 70	8.6	12.3
IPQ/IPZQ 80	10.1	14.4
IPQ/IPZQ 85	11.5	16.4
IPQ/IPZQ 90	14.4	20.6
IPQ/IPZQ 100	17.8	25.5
IPQ/IPZQ 110	20.0	28.7
IPQ/IPZQ 120	22.2	31.9

OFFSET MOMENTS FOR TYPE IPQS/IPTQS, IPQZ

ISOPRO®	ΔM_{Ed} [kNm]	
	h < 200 mm	h ≥ 200 mm
IPQS/IPQZ 5	2.5	3.5
IPQS/IPQZ 10	2.9	4.1
IPQS/IPQZ 15	3.3	4.7
IPQS/IPQZ 20	4.3	6.2
IPQS/IPQZ 30	5.7	8.2
IPQS/IPQZ 40	4.4	6.4
IPQS/IPQZ 50	6.7	9.6
IPQS/IPQZ 55	8.9	12.7
IPTQS/IPQZ 60	7.1	8.5
IPQS/IPQZ 70	9.5	13.7
IPQS/IPQZ 75	12.7	18.2
IPTQS/IPQZ 80	10.5	11.5
IPTQS/IPQZ 90	15.8	17.2

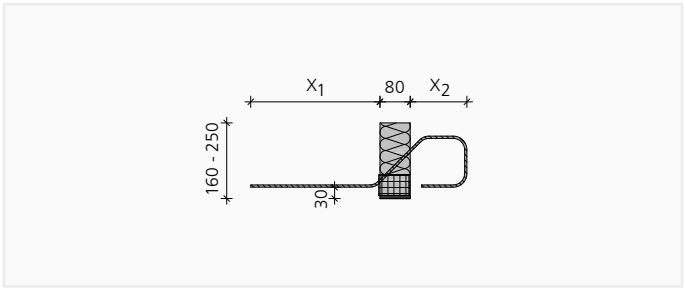
MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IPQ/IPZQ 10 to 120 IPQS/IPQZ 5 to 40, 50, 55	IPQS/IPQZ 45, 70, 75	IPTQS/IPQZ 60, 80, 90
Distance between joints e [m]	13.0	11.3	10.1

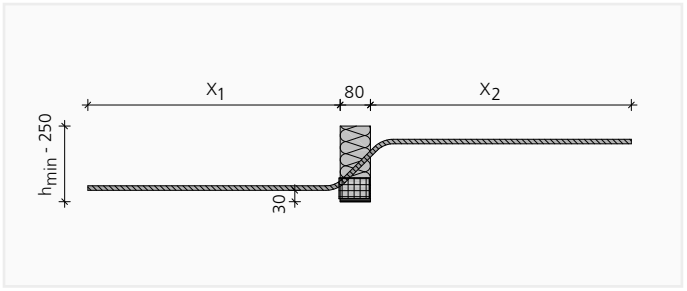
UNIT STRUCTURE

ISOPRO® IPQ, IPQS, IPZQ*, IPQZ*

SHEAR ROD Ø 6



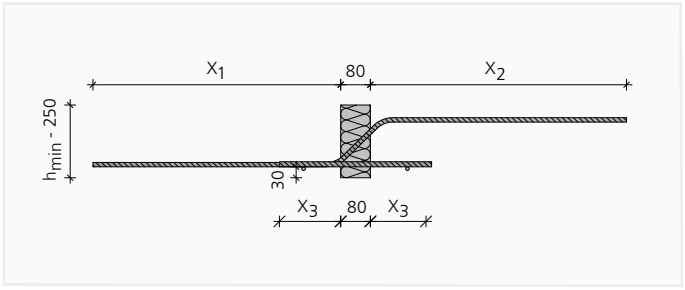
SHEAR ROD ≥ Ø 8



* IPZQ and IPQZ units do not have a pressure plane

ISOPRO® IPTQS

SHEAR ROD ≥ Ø 12



DIMENSIONS [MM]

Length shear rod [mm]	IPQ 10 - IPQ 50 IPZQ 10 - IPZQ 50 IPQS 5, IPQS 15 IPQZ 5, IPQZ 15	IPQ 70 – 90 IPZQ 70 – 90 IPQS 10 – 30 IPQZ10 – 30	IPQ 100 – 120 IPZQ 100 – 120 IPQS 40 – 55 IPQZ 40 – 55	IPQS 70 – 75 IPQZ 60 – 75 IPTQS 60	IPQZ 80 – 90 IPTQS 80 – 90	IPTQS 60 IPTQS 80 – 90
	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Pressure rod Ø 14
X_1	340	450	560	670	780	–
X_2	150	≤ 530	≤ 640	≤ 745	≤ 855	–
X_3	–	–	–	–	–	165
h_{min}	160	160	170	180	190	–

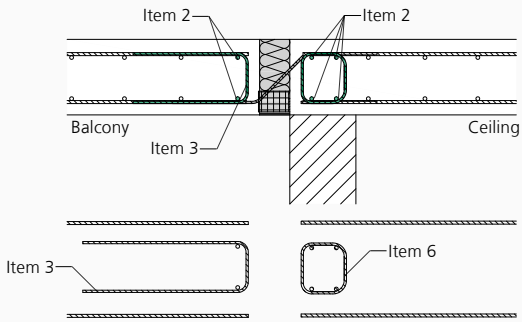
NOTES

- The concrete covering of the shear rods at the bottom is generally 30 mm.
- The concrete covering of the shear rods at the top is cv35 to cv85 depending on the height and the rod diameter.

SUPPLEMENTARY REINFORCEMENT

ISOPRO® IPQ, IPZQ, IPQS, IPQZ WITH SHEAR ROD Ø 6 – LOOPED ON THE CEILING SIDE

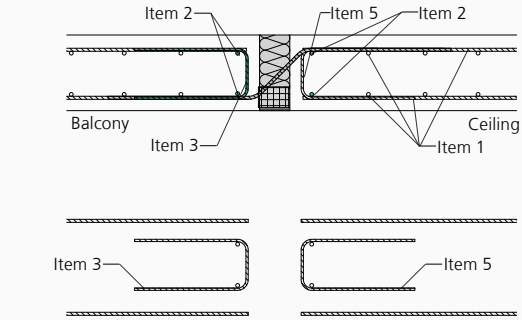
DIRECT SUPPORT



- Item 1 slab reinforcement in accordance with DIN EN 1992-1-1 in accordance with the structural engineer's specifications (not shown in detail)
- Item 2 spacing bar 2 Ø 8 on the balcony, 4 Ø 8 on the ceiling
- Item 3 structural edging parallel to the ISOPRO® unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 6 stirrup (edge beam) Ø 6/200.
- For indirect support, a supplementary reinforcement must be arranged on the ceiling side – see table, item 5

ISOPRO® IPQ, IPZQ, IPQS/IPTQS, IPQZ – SHEAR ROD ON THE CEILING, STRAIGHT

INDIRECT SUPPORT



- Item 1 slab reinforcement in accordance with DIN EN 1992-1-1 in accordance with the structural engineer's specifications
- Item 2 spacing bar 2 x 2 Ø 8 on the balcony and ceiling
- Item 3 structural edging parallel to the ISOPRO® unit in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 Supplementary reinforcement with indirect support on the ceiling side – see table

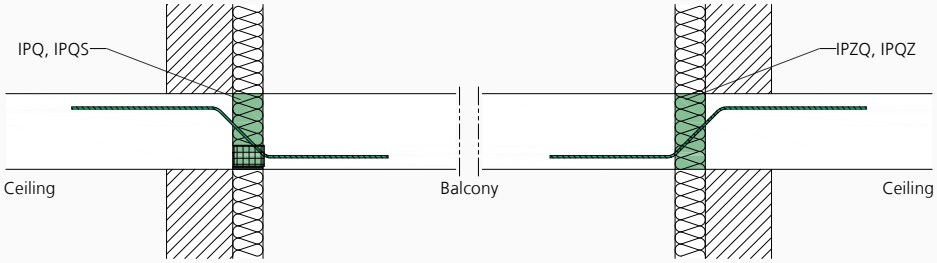
SUPPLEMENTARY REINFORCEMENT FOR CONCRETE ≥ C25/30

ISOPRO®	Supplementary reinforcement Item 5 $A_{s,erf}$ [cm²]
IPQ/IPZQ 10	0.80
IPQ/IPZQ 20	1.00
IPQ/IPZQ 30	1.20
IPQ/IPZQ 40	1.60
IPQ/IPZQ 50	2.00
IPQ/IPZQ 70	2.13
IPQ/IPZQ 80	2.49
IPQ/IPZQ 85	2.84
IPQ/IPZQ 90	3.55
IPQ/IPZQ 100	4.44
IPQ/IPZQ 110	5.00
IPQ/IPZQ 120	5.55

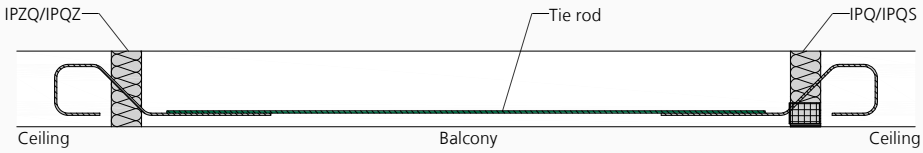
ISOPRO®	Supplementary reinforcement Item 5 $A_{s,erf}$ [cm²]
IPQS/IPQZ 5	0.60
IPQS/IPQZ 10	0.71
IPQS/IPQZ 15	0.80
IPQS/IPQZ 20	1.07
IPQS/IPQZ 30	1.42
IPQS/IPQZ 40	1.11
IPQS/IPQZ 50	1.66
IPQS/IPQZ 55	2.22
IPTQS/IPQZ 60	1.60
IPQS/IPQZ 70	2.40
IPQS/IPQZ 75	3.20
IPTQS/IPQZ 80	2.18
IPTQS/IPQZ 90	3.26

SUPPLEMENTARY REINFORCEMENT

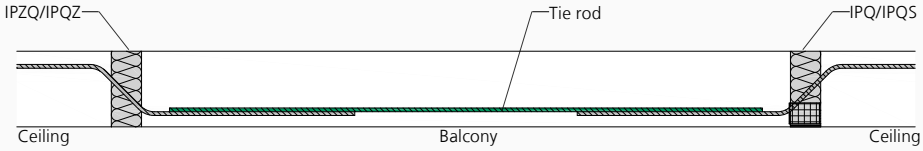
SUPPLEMENTARY REINFORCEMENT WITH CONSTRAINT-FREE SUPPORT



ISOPRO® IPQ/IPZQ, IPQS/IPQZ – Installation cross-section with opposite types of same load bearing capacity



ISOPRO® IPZQ/IPQ, IPQZ/IPQS – On-site tie rod in the bottom layer of reinforcement – Shear rod Ø 6 on the ceiling, looped



ISOPRO® IPZQ/IPQ, IPQZ/IPQS – On-site tie rod in the bottom layer of reinforcement – Shear rod on the ceiling, straight

For constraint-free support with an ISOPRO® IPZQ or IPQZ unit, a corresponding IPQ or IPQS/IPTQS unit must be used opposite. A tie rod must be installed between the two units in accordance with the shear reinforcement of the ISOPRO® units.

TIE ROD ISOPRO® IPZQ

ISOPRO®	IPZQ 10	IPZQ 20	IPZQ 30	IPZQ 40	IPZQ 50	IPZQ 70
Tie rod	4 Ø 6	5 Ø 6	6 Ø 6	8 Ø 6	10 Ø 6	6 Ø 8

ISOPRO®	IPZQ 80	IPZQ 85	IPZQ 90	IPZQ 100	IPZQ 110	IPZQ 120
Tie rod	7 Ø 8	8 Ø 8	10 Ø 8	8 Ø 10	9 Ø 10	10 Ø 10

TIE ROD ISOPRO® IPQZ

ISOPRO®	IPQZ 5	IPQZ 10	IPQZ 15	IPQZ 20	IPQZ 30	IPQZ 40
Tie rod	3 Ø 6	2 Ø 8	4 Ø 6	3 Ø 8	4 Ø 8	2 Ø 10

ISOPRO®	IPQZ 50	IPQZ 55	IPQZ 60	IPQZ 70	IPQZ 75	IPQZ 80	IPQZ 90
Tie rod	3 Ø 10	4 Ø 10	2 Ø 12	3 Ø 12	4 Ø 12	2 Ø 14	3 Ø 14

ISOPRO® IPTQQ and IPTQQS

UNITS FOR SUPPORTED BALCONIES WITH LIFTING LOADS

ISOPRO® IPTQQ

- For transferring positive and negative shearing forces, unit length 1.0 m
- Pressure plane with steel pressure rods
- Load-bearing capacities IPTQQ 10 to IPTQQ 110
- For constraint-free support there are also IPZQQ units without steel pressure rods available
- Unit heights depending on diameter of shear rod starting from h_{min} = 160 mm
- Fire resistance class R 90 available

ISOPRO® IPTQQS

- Unit length depending on the load-bearing capacity 0.3 m, 0.4 m or 0.5 m
- Pressure plane with steel pressure rods
- Load-bearing capacities IPTQQS 10 to IPTQQS 90
- For constraint-free support there are also IPZQQS units without steel pressure rods available
- Unit heights depending on diameter of shear rod starting from h_{min} = 160 mm
- Fire resistance class R 90 available

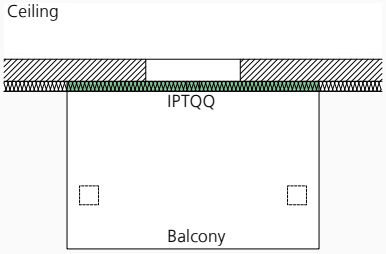
TYPE DESIGNATION

IPTQQ 20 h200 R 90

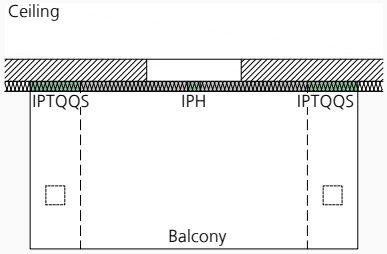
- R 90 — Fire protection version
- h200 — Unit height
- IPTQQ 20 — Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

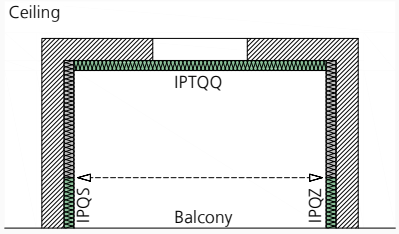
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



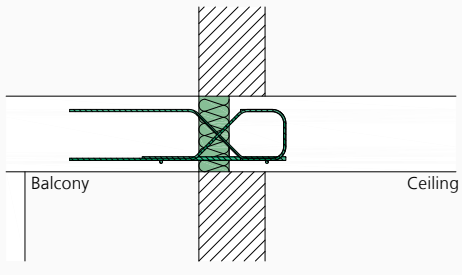
ISOPRO® IPTQQ – Supported balcony with recessed support position



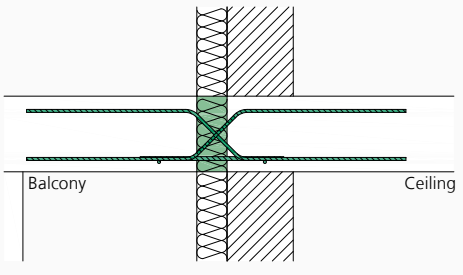
ISOPRO® IPTQQS – Supported balcony with joists and support at specific points with ISOPRO® IPTQQS units



ISOPRO® IPTQQ, IPQS, IPQZ – Loggia balcony with load peaks at specific points at the front and lifting loads in the rear corner area



ISOPRO® IPTQQ – Installation cross-section of single-leaf masonry – Shear rod on the ceiling, looped



ISOPRO® IPTQQ, IPTQQS – Installation cross-section of thermal insulation composite system – Shear rod on the ceiling, straight

For balconies connected with shear units, appropriate support must be provided in all construction conditions. Temporary supports may only be removed if the permanent supports, which may have been installed at a later date, are sufficiently strong and frictionally connected to the balcony.

DESIGN TABLES FOR CONCRETE ≥ C25/30

ISOPRO® IPTQQ – DESIGN VALUES OF ALLOWABLE SHEARING FORCE v_{RD} [kN/m]

ISOPRO®	Shearing force v_{Rd} [kN/m]	Unit height [mm]	Unit length [mm]	Shear rods	Pressure rods
				Assignment	Assignment
IPTQQ 10	± 34.8	≥ 160	500 + 500	2 x 4 Ø 6*	4 Ø 10
IPTQQ 30	± 52.2	≥ 160	500 + 500	2 x 6 Ø 6*	4 Ø 10
IPTQQ 40	± 69.5	≥ 160	500 + 500	2 x 8 Ø 6*	6 Ø 10
IPTQQ 50	± 86.9	≥ 160	500 + 500	2 x 10 Ø 6*	6 Ø 10
IPTQQ 70	± 92.7	≥ 160	500 + 500	2 x 6 Ø 8	6 Ø 10
IPTQQ 90	± 144.9	≥ 170	500 + 500	2 x 6 Ø 10	8 Ø 10
IPTQQ 110	± 208.6	≥ 180	500 + 500	2 x 6 Ø 12	12 Ø 10

* Units with shear rods Ø 6 have a looped rod on the ceiling side. For all other units, the shear rod bar on the ceiling side is straight (see also page 72).

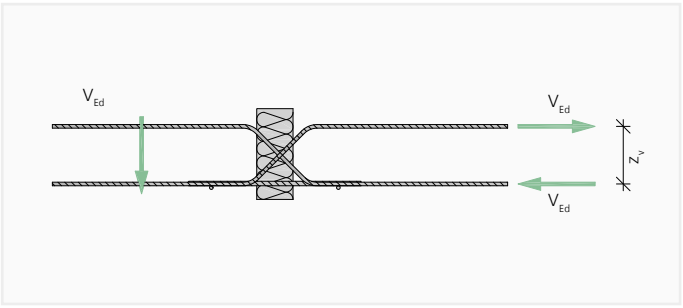
ISOPRO® IPTQQS – DESIGN VALUES OF ALLOWABLE SHEARING FORCE V_{RD} [kN]

ISOPRO®	Shearing force v_{Rd} [kN/m]	Unit height [mm]	Unit length [mm]	Shear rods	Pressure rods
				Assignment	Assignment
IPTQQS 10	± 30.9	≥ 160	300	2 x 2 Ø 8	2 Ø 10
IPTQQS 20	± 46.4	≥ 160	400	2 x 3 Ø 8	3 Ø 10
IPTQQS 40	± 48.3	≥ 170	300	2 x 2 Ø 10	3 Ø 10
IPTQQS 50	± 72.4	≥ 170	400	2 x 3 Ø 10	4 Ø 10
IPTQQS 60	± 69.5	≥ 180	300	2 x 2 Ø 12	4 Ø 10
IPTQQS 70	± 104.3	≥ 180	400	2 x 3 Ø 12	6 Ø 10
IPTQQS 80	± 94.7	≥ 190	300	2 x 2 Ø 14	4 Ø 14
IPTQQS 90	± 142.0	≥ 190	400	2 x 3 Ø 14	6 Ø 14

MOMENTS RESULTING FROM ECCENTRIC CONNECTIONS

MOMENTS RESULTING FROM ECCENTRIC CONNECTIONS

When designing the connection reinforcement on the ceiling for the ISOPRO® IPTQQ and IPTQQS shear units, a moment resulting from eccentric connections must also be considered. This moment is to be superimposed on the moments resulting from the planned loads if the moments are both positive or both negative. The moment is calculated ΔM_{Ed} on the basis of the assumption that the units are fully utilised.



$$\Delta M_{Ed} = V_{Ed} \cdot z_v$$

ISOPRO® IPTQQ, IPTQQS – Units with steel pressure rods
z_v – Lever arm for determining the offset moment

OFFSET MOMENTS FOR TYPE IPTQQ

ISOPRO®	Δm_{Ed} [kNm/m]	
	h < 200 mm	h ≥ 200 mm
IPTQQ 10	3.0	4.4
IPTQQ 30	4.5	6.6
IPTQQ 40	6.1	8.8
IPTQQ 50	7.6	11.0
IPTQQ 70	8.0	11.7
IPTQQ 90	13.8	18.1
IPTQQ 110	19.8	26.1

OFFSET MOMENTS FOR TYPE IPTQQS

ISOPRO®	ΔM_{Ed} [kNm]	
	h < 200 mm	h ≥ 200 mm
IPTQQS 10	2.7	3.9
IPTQQS 20	4.0	5.9
IPTQQS 40	4.6	6.0
IPTQQS 50	6.9	9.1
IPTQQS 60	7.2	8.6
IPTQQS 70	10.9	12.9
IPTQQS 80	10.5	11.5
IPTQQS 90	15.8	17.2

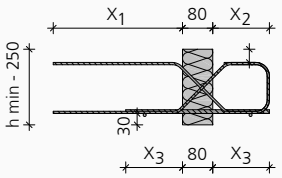
MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IPTQQ 10 to 90 IPTQQS 10 to 50	IPTQQ 110 IPTQQS 60 to 70	IPTQQS 80 to 90
Distance between joints e [m]	13.0	11.3	10.1

UNIT STRUCTURE

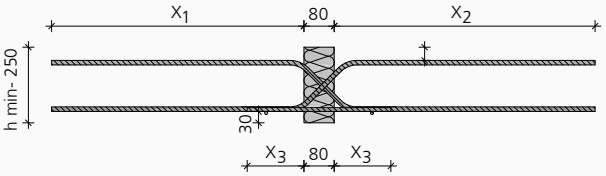
ISOPRO® IPTQQ

SHEAR ROD Ø 6



ISOPRO® IPTQQ, IPTQQS

SHEAR ROD ≥ Ø 8



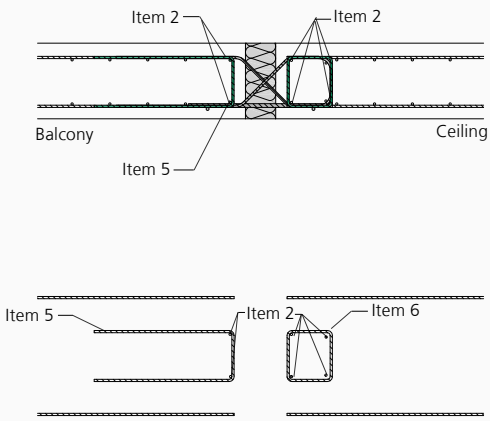
DIMENSIONS [MM]

Length shear rod [mm]	IPTQQ 10 – 50	IPTQQ 10 – 50	IPTQQ 70 IPTQQS 10 IPTQQS 20	IPTQQ 90 IPTQQS 40 IPTQQS 50	IPTQQ 110 IPTQQS 60 IPTQQS 70	IPTQQS 80 IPTQQS 90	IPTQQ 70 – 110 IPTQQS 10 – 70	IPTQQS 80 – 90
	Ø 6	Pressure rod Ø 10	Ø 8	Ø 10	Ø 12	Ø 14	Pressure rod Ø 10	Pressure rod Ø 14
X_1	340	–	450	560	670	780	–	–
X_2	150	–	≤ 530	≤ 640	≤ 745	≤ 855	–	–
X_3	–	150	–	–	–	–	150	165
h_{min}	160	–	160	170	180	190	–	–

- The concrete covering of the pressure and shear rods at the bottom is generally 30 mm.
- The concrete covering of the shear rods at the top is cv35 to cv85 depending on the height and the rod diameter.

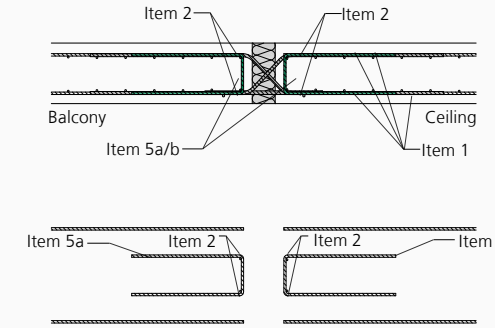
SUPPLEMENTARY REINFORCEMENT

ISOPRO® IPTQQ 10 TO 50 WITH SHEAR ROD Ø 6 – LOOPED ON THE CEILING



- Item 1 slab reinforcement in accordance with the structural engineer's specifications
- Item 2 spacing bar 2 Ø 8 on the balcony, 4 Ø 8 on the ceiling
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 supplementary reinforcement balcony side – see table
- Item 6 stirrup (edge beam) Ø 6/200

ISOPRO® IPTQQ 70 TO 110, IPTQQS 10 TO 90 – SHEAR ROD STRAIGHT ON THE CEILING



- Item 1 slab reinforcement in accordance with the structural engineer's specifications
- Item 2 spacing bar 2 x 2 Ø 8 on the balcony and ceiling
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5a supplementary reinforcement balcony side
- Item 5b supplementary reinforcement with indirect support on the ceiling side – see table

SUPPLEMENTARY REINFORCEMENT FOR CONCRETE ≥ C25/30

ISOPRO® IPTQQ

ISOPRO®	Supplementary reinforcement Item 5 $A_{s,erf}$ [cm²/m]
IPTQQ 10	0.80
IPTQQ 30	1.20
IPTQQ 40	1.60
IPTQQ 50	2.00
IPTQQ 70	2.13
IPTQQ 90	3.33
IPTQQ 110	4.80

ISOPRO® IPTQQS

ISOPRO®	Supplementary reinforcement Item 5 $A_{s,erf}$ [cm²]
IPTQQS 10	0.71
IPTQQS 20	1.07
IPTQQS 40	1.11
IPTQQS 50	1.66
IPTQQS 60	1.60
IPTQQS 70	2.40
IPTQQS 80	2.18
IPTQQS 90	3.26

ISOPRO®
IPTD

UNITS FOR CONTINUOUS SLABS

ISOPRO® IPTD

- For transferring positive and negative moments and positive and negative shearing forces
- Tension and pressure plane with steel tension/pressure rods
- Load-bearing capacities IPTD 20 to IPTD 100
- Shearing force load-bearing capacities, standard, Q8 and Q10
- Concrete covering of tension rods cv35 or cv50
- Concrete covering of the pressure rods at the bottom 30 mm for cv35 and 50 mm for cv50
- Unit heights depending on the shearing force load-bearing capacity starting from h_{min} = 160 mm
- Fire resistance class R 90 available

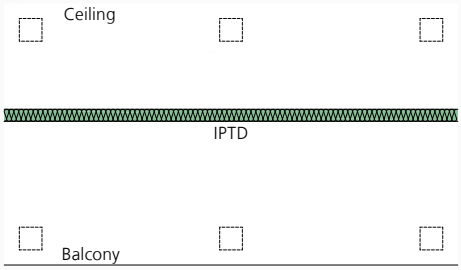
TYPE DESIGNATION

IPTD 50 Q8 cv35 h200 R 90

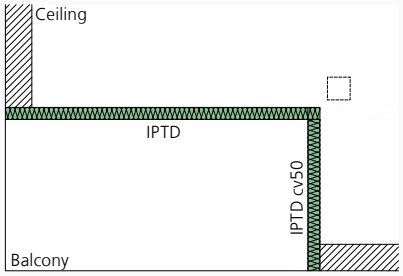
- Fire protection version
- Unit height
- Concrete covering
- Shearing force load-bearing capacity
- Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

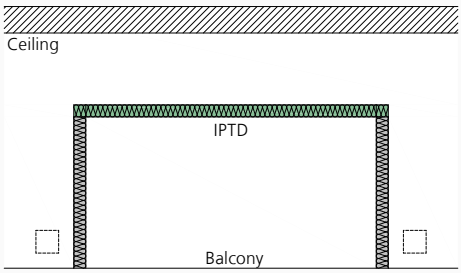
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



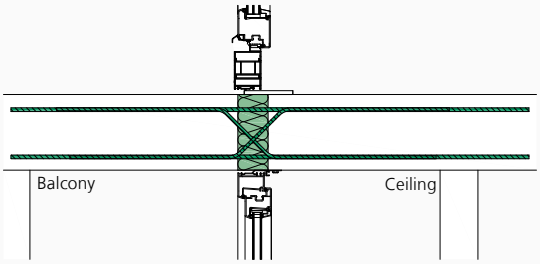
ISOPRO® IPTD – Continuous slab with a glass façade



ISOPRO® IPTD – Internal corner balcony with large dimensions and loads



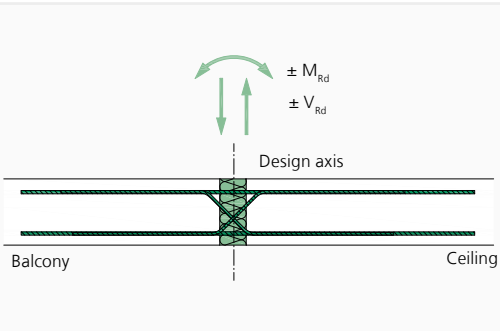
ISOPRO® IPTD – Inset balcony with glass façade, without direct support



ISOPRO® IPTD – Installation cross-section of glass façade

NOTE FOR DESIGN

- The gap between the balcony and the ceiling slab must be taken into account for the calculation in the FEM program
- With the ISOPRO® IPTD units only bending moments perpendicular to the insulation joint can be transferred
- When calculating the resultant forces, the spring stiffness of the ISOPRO® IPTD units must be iteratively included in the calculation. First, an assumption is made for the spring stiffness of the thermal insulation unit. A unit is then selected via the resulting static design values. In the next step, the definitive spring stiffness of the selected unit is included in the calculation. Possibly another iterative step is required to come to final solution.
- To transfer forces parallel and perpendicular to the joint, the IPTD units can be combined with ISOPRO® IPE units.



ISOPRO® IPTD – Static System

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS m_{Rd} [kNm/m]

Unit height [mm] depending on cv [mm]		ISOPRO®								
35	50	IPTD 20	IPTD 20 Q8	IPTD 20 Q10	IPTD 30	IPTD 30 Q8	IPTD 30 Q10	IPTD 50	IPTD 50 Q8	IPTD 50 Q10
160	–	± 14.6	± 13.0	–	± 22.0	± 20.4	–	± 30.1	± 28.5	–
–	200	± 15.5	± 13.7	–	± 23.3	± 21.6	–	± 31.9	± 30.2	–
170	–	± 16.3	± 14.5	± 12.5	± 24.7	± 22.8	± 20.8	± 33.7	± 31.9	± 29.9
–	210	± 17.2	± 15.3	± 13.1	± 26.0	± 24.1	± 22.0	± 35.5	± 33.6	± 31.5
180	–	± 18.1	± 16.0	± 13.8	± 27.3	± 25.3	± 23.1	± 37.3	± 35.3	± 33.1
–	220	± 18.9	± 16.8	± 14.4	± 28.6	± 26.5	± 24.2	± 39.1	± 37.0	± 34.7
190	–	± 19.8	± 17.5	± 15.1	± 30.0	± 27.8	± 25.3	± 40.9	± 38.7	± 36.3
–	230	± 20.7	± 18.3	± 15.7	± 31.3	± 29.0	± 26.4	± 42.8	± 40.5	± 37.9
200	–	± 21.5	± 19.1	± 16.4	± 32.6	± 30.2	± 27.6	± 44.6	± 42.2	± 39.5
–	240	± 22.4	± 19.8	± 17.0	± 33.9	± 31.4	± 28.7	± 46.4	± 43.9	± 41.1
210	–	± 23.2	± 20.6	± 17.7	± 35.3	± 32.7	± 29.8	± 48.2	± 45.6	± 42.7
–	250	± 24.1	± 21.4	± 18.4	± 36.6	± 33.9	± 30.9	± 50.0	± 47.3	± 44.3
220	–	± 25.0	± 22.1	± 19.0	± 37.9	± 35.1	± 32.0	± 51.8	± 49.0	± 45.9
230	–	± 26.7	± 23.7	± 20.3	± 40.6	± 37.6	± 34.3	± 55.4	± 52.4	± 49.2
240	–	± 28.4	± 25.2	± 21.6	± 43.2	± 40.0	± 36.5	± 59.1	± 55.9	± 52.4
250	–	± 30.1	± 26.7	± 22.9	± 45.9	± 42.5	± 38.8	± 62.7	± 59.3	± 55.6

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN/m]

ISOPRO®	IPTD 20	IPTD 20 Q8	IPTD 20 Q10	IPTD 30	IPTD 30 Q8	IPTD 30 Q10	IPTD 50	IPTD 50 Q8	IPTD 50 Q10
Shearing force v_{Rd} [kN/m]	± 53.0	± 92.0	± 135.0	± 53.0	± 92.0	± 135.0	± 53.0	± 92.0	± 135.0

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IPTD 20	IPTD 20 Q8	IPTD 20 Q10	IPTD 30	IPTD 30 Q8	IPTD 30 Q10	IPTD 50	IPTD 50 Q8	IPTD 50 Q10
Unit length [mm]	500 + 500								
Tension/pressure rods	6 Ø 10			6 Ø 12			8 Ø 12		
Shear rods	2 x 4 Ø 8	2 x 6 Ø 8	2 x 6 Ø 10	2 x 4 Ø 8	2 x 6 Ø 8	2 x 6 Ø 10	2 x 4 Ø 8	2 x 6 Ø 8	2 x 6 Ø 10

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS m_{Rd} [kNm/m]

Unit height [mm] depending on cv [mm]		ISOPRO®								
35	50	IPTD 70	IPTD 70 Q8	IPTD 70 Q10	IPTD 90	IPTD 90 Q8	IPTD 90 Q10	IPTD 100	IPTD 100 Q8	IPTD 100 Q10
160	–	± 38.1	± 36.5	–	± 46.2	± 44.6	–	± 49.8	–	–
–	200	± 40.4	± 38.7	–	± 49.0	± 47.3	–	± 52.9	–	–
170	–	± 42.7	± 40.9	± 38.9	± 51.8	± 50.0	± 48.0	± 56.0	± 54.0	–
–	210	± 45.0	± 43.1	± 41.0	± 54.6	± 52.6	± 50.5	± 59.1	± 57.0	–
180	–	± 47.3	± 45.3	± 43.1	± 57.3	± 55.3	± 53.1	± 62.1	± 60.0	± 57.7
–	220	± 49.6	± 47.5	± 45.2	± 60.1	± 58.0	± 55.7	± 65.2	± 62.9	± 60.5
190	–	± 51.9	± 49.7	± 47.3	± 62.9	± 60.7	± 58.3	± 68.3	± 65.9	± 63.4
–	230	± 54.2	± 51.9	± 49.4	± 65.7	± 63.4	± 60.9	± 71.4	± 68.9	± 66.3
200	–	± 56.5	± 54.1	± 51.5	± 68.5	± 66.1	± 63.4	± 74.4	± 71.8	± 69.1
–	240	± 58.8	± 56.3	± 53.6	± 71.3	± 68.8	± 66.0	± 77.5	± 74.8	± 72.0
210	–	± 61.1	± 58.5	± 55.7	± 74.0	± 71.4	± 68.6	± 80.6	± 77.8	± 74.8
–	250	± 63.4	± 60.7	± 57.8	± 76.8	± 74.1	± 71.2	± 83.7	± 80.7	± 77.7
220	–	± 65.7	± 62.9	± 59.8	± 79.6	± 76.8	± 73.7	± 86.7	± 83.7	± 80.5
230	–	± 70.3	± 67.3	± 64.0	± 85.2	± 82.2	± 78.9	± 92.9	± 89.6	± 86.3
240	–	± 74.9	± 71.7	± 68.2	± 90.7	± 87.6	± 84.1	± 99.0	± 95.6	± 92.0
250	–	± 79.5	± 76.1	± 72.4	± 96.3	± 92.9	± 89.2	± 105.2	± 101.5	± 97.7

DESIGN VALUES OF ALLOWABLE SHEARING FORCES v_{Rd} [kN/m]

ISOPRO®	IPTD 70	IPTD 70 Q8	IPTD 70 Q10	IPTD 90	IPTD 90 Q8	IPTD 90 Q10	IPTD 100	IPTD 100 Q8	IPTD 100 Q10
Shearing force v_{Rd} [kN/m]	± 53.0	± 92.0	± 135.0	± 53.0	± 92.0	± 135.0	± 92.0	± 135.0	± 180.0

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IPTD 70	IPTD 70 Q8	IPTD 70 Q10	IPTD 90	IPTD 90 Q8	IPTD 90 Q10	IPTD 100	IPTD 100 Q8	IPTD 100 Q10
Unit length [mm]	500 + 500								
Tension/pressure rods	10 Ø 12			12 Ø 12			12 Ø 14		
Shear rods	2 x 4 Ø 8	2 x 6 Ø 8	2 x 6 Ø 10	2 x 4 Ø 8	2 x 6 Ø 8	2 x 6 Ø 10	2 x 6 Ø 8	2 x 6 Ø 10	2 x 6 Ø 12

DISTANCE BETWEEN EXPANSION JOINTS – UNIT STRUCTURE

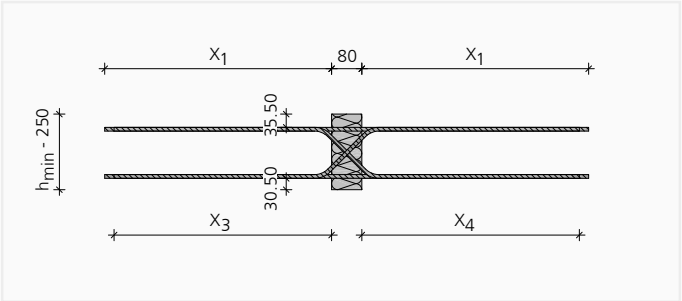
DISTANCE BETWEEN EXPANSION JOINTS

If the component dimensions exceed the maximum permissible distance between expansion joints, expansion joints must be arranged perpendicular to the insulation plane. The maximum permissible distance between expansion joints e is dependent on the maximum rod diameter guided across the expansion joint and is thus type-dependent.
The use of fixed points such as corner supports or the use of ISOPRO® IPH or IPE units results in increased constraints, which means the maximum permissible distance between expansion joints must be reduced to e/2. Half of the maximum distance between expansion joints is always measured from the fixed point.

MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IPTD 20	IPTD 30 to IPTD 90	IPTD 100
Distance between joints e [m]	13.0	11.3	10.1

UNIT STRUCTURE ISOPRO® IPTD

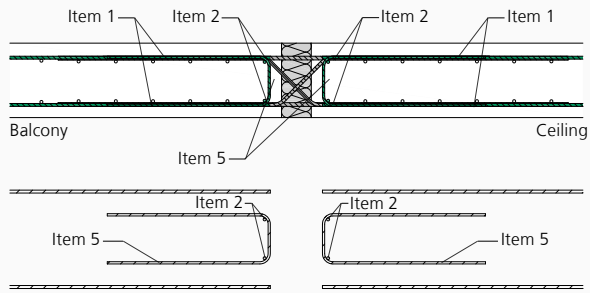


Length tension and pressure rod [mm]	IPTD 20	IPTD 30	IPTD 50	IPTD 70	IPTD 90	IPTD 100
X_1	740	860	860	860	860	980

Length shear rod [mm]	IPTD 20 to IPTD 90 Shear force load-bearing capacity			IPTD 100 Shear force load-bearing capacity		
	Standard	Q8	Q10	Standard	Q8	Q10
X_3	450	450	560	450	560	670
X_4	≤ 530	≤ 530	≤ 640	≤ 530	≤ 640	≤ 750
h_{min}	160	160	170	160	170	180

SUPPLEMENTARY REINFORCEMENT

ISOPRO® IPTD



- Item 1 connection reinforcement for the ISOPRO® unit – for negative moments at the top, for positive moments at the bottom – see table below
- Item 2 spacing bar 2 x 2 Ø 8 on balcony and ceiling side
- Item 4 structural edging at the free balcony edge in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications (not shown here)
- Item 5 supplementary reinforcement on balcony and ceiling side – see table

CONNECTION REINFORCEMENT ITEM 1

ISOPRO®	IPTD 20	IPTD 30	IPTD 50	IPTD 70	IPTD 90	IPTD 100
$a_{s,erf}$ [cm²/m]	4.71	6.79	9.05	11.31	13.57	18.47
Suggestion	6 Ø 10	6 Ø 12	8 Ø 12	10 Ø 12	12 Ø 12	12 Ø 14

SUPPLEMENTARY REINFORCEMENT ITEM 5

ISOPRO®	IPTD 20 bis IPTD 90			IPTD 100		
	Standard	Q8	Q10	Standard	Q8	Q10
$a_{s,erf}$ [cm²/m]	1.21	2.13	3.10	2.13	3.10	4.14
Suggestion	Ø 6/200	Ø 8/200	Ø 10/200	Ø 8/200	Ø 10/200	Ø 10/150

ISOPRO®
IPH

UNITS FOR PLANNED HORIZONTAL LOADS

ISOPRO® IPH

- Load-bearing capacities IPH 1, IPH 2 and IPH 3
- ISOPRO® IPH 1 for transferring horizontal forces parallel to the insulating joint
- ISOPRO® IPH 2 for transferring horizontal forces perpendicular to the insulating joint
- ISOPRO® IPH 3 for transferring horizontal forces parallel and perpendicular to the insulating joint
- Clearly defined concrete covering, see product details
- Unit heights starting from h_{min} = 160 mm
- Fire resistance class REI 120 available

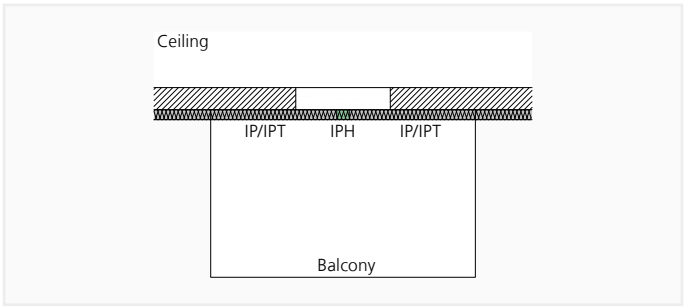
TYPE DESIGNATION

IPH 2 h200 REI 120

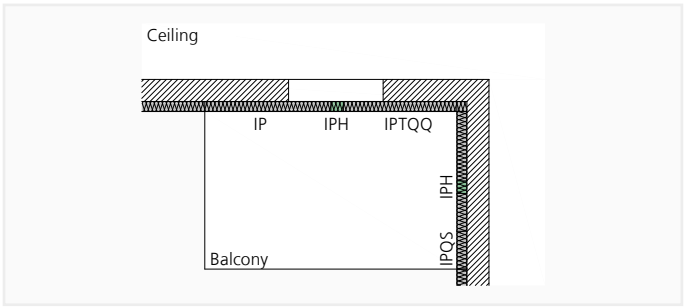
- REI 120 — Fire protection version
- h200 — Unit height
- IPH 2 — Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

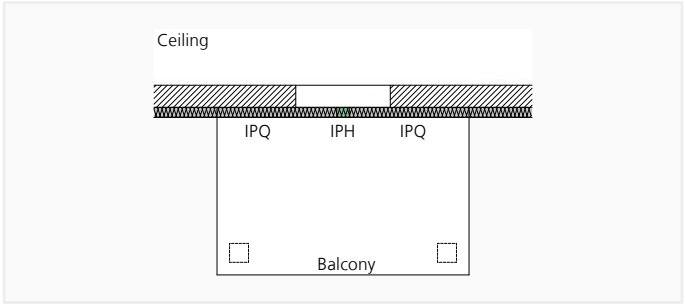
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



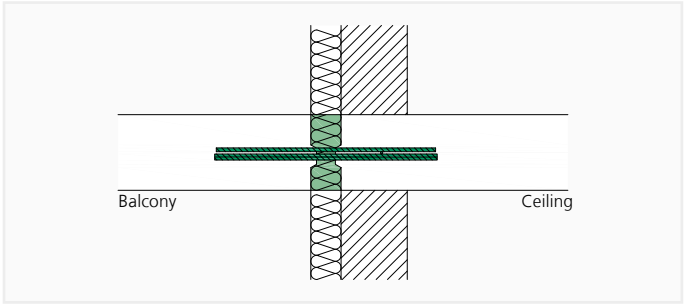
ISOPRO® IPH – Cantilevered balcony with planned horizontal loads



ISOPRO® IPH – Internal corner balcony with planned horizontal loads



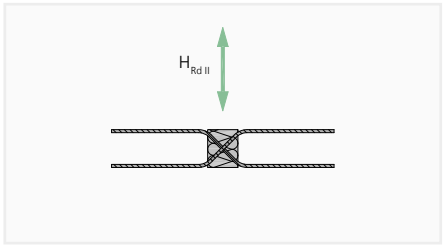
ISOPRO® IPH – Balcony on hinged supports with IPH structural units



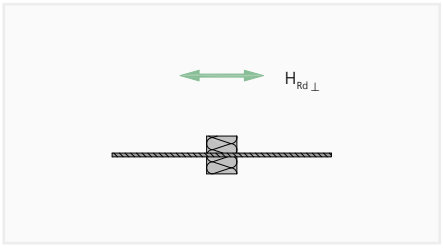
ISOPRO® IPH 3 – Installation cross-section of thermal insulation composite system

DESIGN VALUES OF ALLOWABLE HORIZONTAL LOADS H_{Rd} [kN] FOR CONCRETE ≥ C25/30

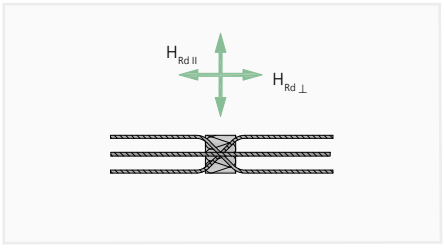
ISOPRO®	IPH 1	IPH 2	IPH 3
Horizontal force, parallel $H_{Rd\,II}$ [kN]	± 8.6	–	± 8.6
Horizontal force, vertical $H_{Rd\,\perp}$ [kN]	–	± 20.9	± 20.9



IPH 1



IPH 2



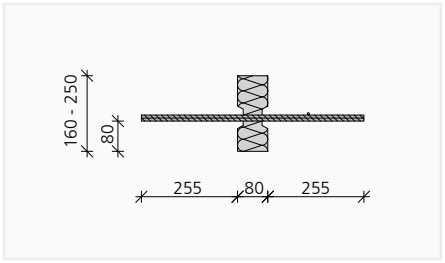
IPH 3

DESIGN – DISTANCE BETWEEN EXPANSION JOINTS

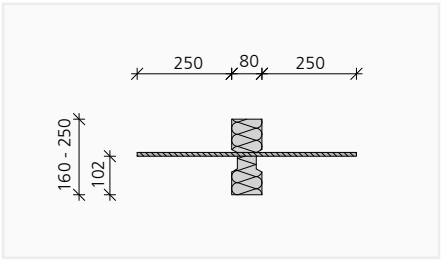
NOTES ON DESIGN

- The quantity and position of the ISOPRO® IPH units are in accordance with the structural engineer's specifications.
- When using ISOPRO® IPH units, it must be ensured that the length and therefore also the load-bearing capacity of the linear connection is reduced by the proportion of the IPH units used.
- The steel rods of the ISOPRO® IPH units are anchored on both sides of the insulaton joint. Therefore there is no connection reinforcement required.

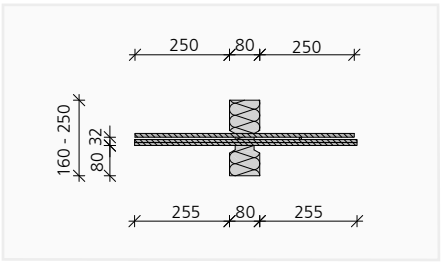
UNIT STRUCTURE ISOPRO® IPH



IPH 1



IPH 2



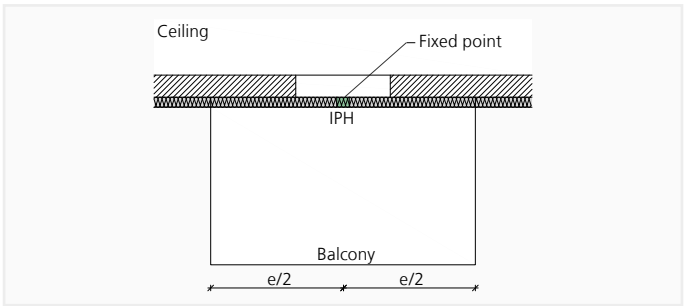
IPH 3

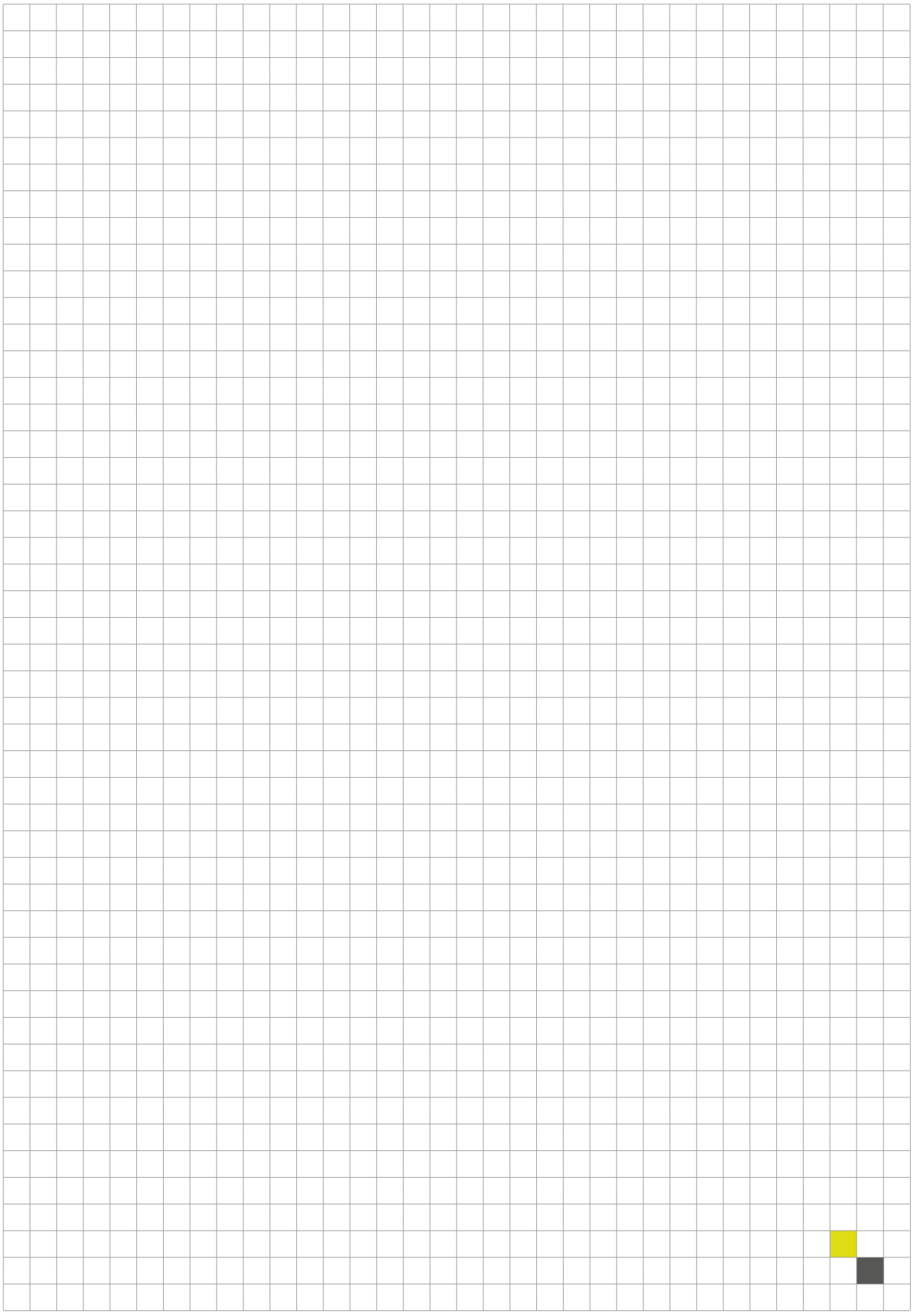
DIMENSIONS AND ASSIGNMENT

ISOPRO®	IPH 1	IPH 2	IPH 3
Unit length [mm]		100	
Shear rods	2 x 1 Ø 8	–	2 x 1 Ø 8
Tension/pressure rods	–	1 Ø 10	1 Ø 10

DISTANCE BETWEEN EXPANSION JOINTS

By using ISOPRO® IPH units, a fixed point is created, resulting in increased constraints. The maximum permissible distance between expansion joints is therefore reduced to e/2 when ISOPRO® IPH units are used. Half of the maximum distance between expansion joints is always measured from the fixed point.





ISOPRO®
IPE

UNITS FOR EARTHQUAKE LOADS

ISOPRO® IPE

- For cantilevered, continuous or supported slabs as a supplement to the ISOPRO® units with moments and/or shearing force load-bearing capacities
- For transferring horizontal forces parallel and perpendicular to the insulating joint and lifting (positive) moments in connection with an ISOPRO® IP/IPT unit
- Load-bearing capacities IPE 1 and IPE 2
- Clearly defined concrete covering, see design table
- Unit heights starting from h_{min} = 160 mm
- Fire resistance class REI 120 available

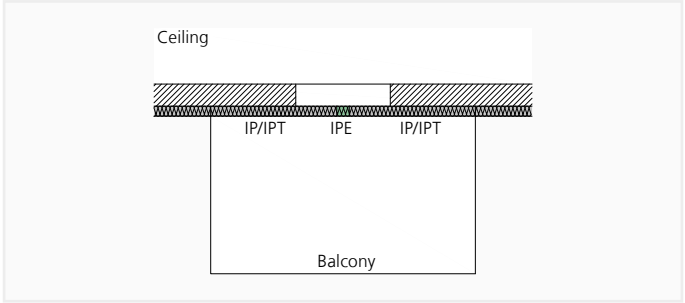
TYPENBEZEICHNUNG

IPE 2 h200 REI 120

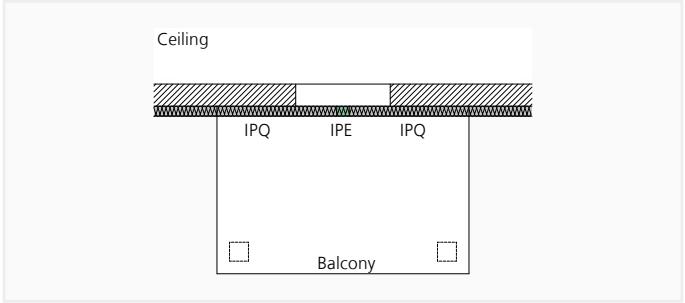
- Fire protection version
- Unit height
- Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

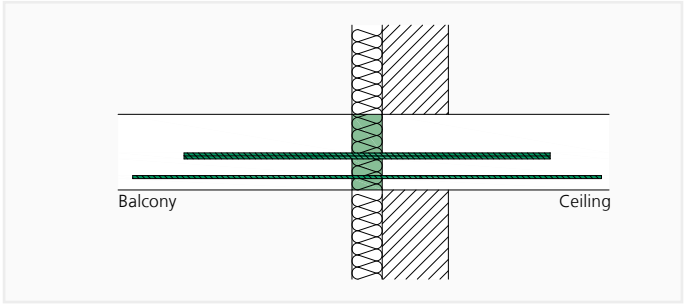
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



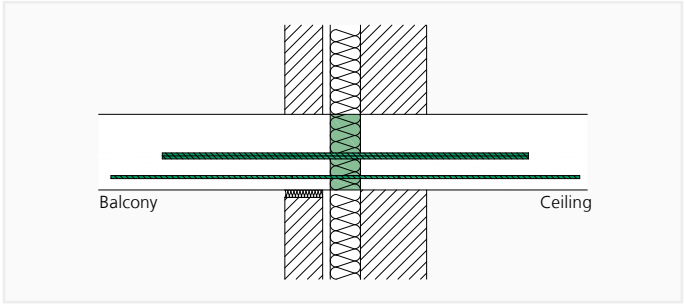
ISOPRO® IPE – Cantilevered balcony with lifting moments



ISOPRO® IPE – Supported balcony with high horizontal forces

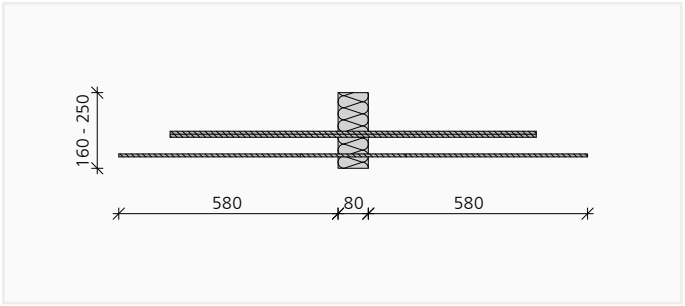


ISOPRO® IPE – Installation cross-section of thermal insulation composite system

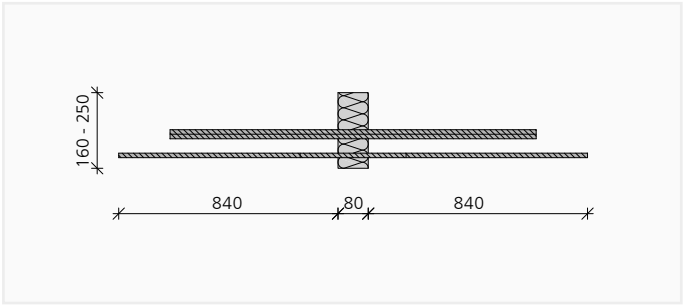


ISOPRO® IPE – Installation cross-section of two-leaf masonry

UNIT STRUCTURE



ISOPRO® IPE 1

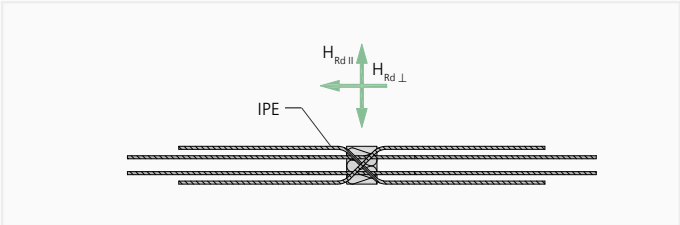


ISOPRO® IPE 2

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IPE 1	IPE 2
Unit length [mm]	100	
Shear rods	2 x 1 Ø 8	2 x 1 Ø 12
Tension rods	2 Ø 8	2 Ø 12

DESIGN TABLE FOR CONCRETE ≥ C25/30



DESIGN VALUES OF ALLOWABLE HORIZONTAL FORCES H_{Rd} [kN]

ISOPRO®	IPE 1	IPE 2
Horizontal load, parallel $H_{Rd\,II}$ [kN]	± 15.4	± 34.7
Horizontal load, vertical $H_{Rd\,\perp}$ [kN] für M_{Rd} = 0	± 40.6	± 97.2

DESIGN VALUES OF ALLOWABLE LIFTING MOMENTS m_{Rd} [kNm]

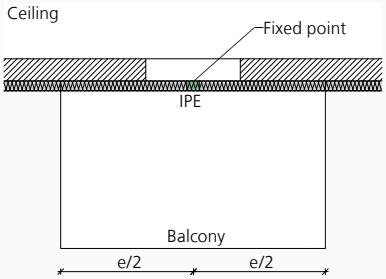
Unit height [mm] depending on cv [mm]		ISOPRO®	
35	50	IPE 1	IPE 2
160	–	3.7	8.2
–	180	3.9	8.7
170	–	4.1	9.1
–	190	4.4	9.6
180	–	4.6	10.1
–	200	4.8	10.6
190	–	5.0	11.1
–	210	5.2	11.6
200	–	5.5	12.1
–	220	5.7	12.6
210	–	5.9	13.1
–	230	6.1	13.6
220	–	6.3	14.1
–	240	6.5	14.6
230	–	6.8	15.0
–	250	7.0	15.5
240	–	7.2	16.0
250	–	7.6	17.0

DESIGN – DISTANCE BETWEEN EXPANSION JOINTS

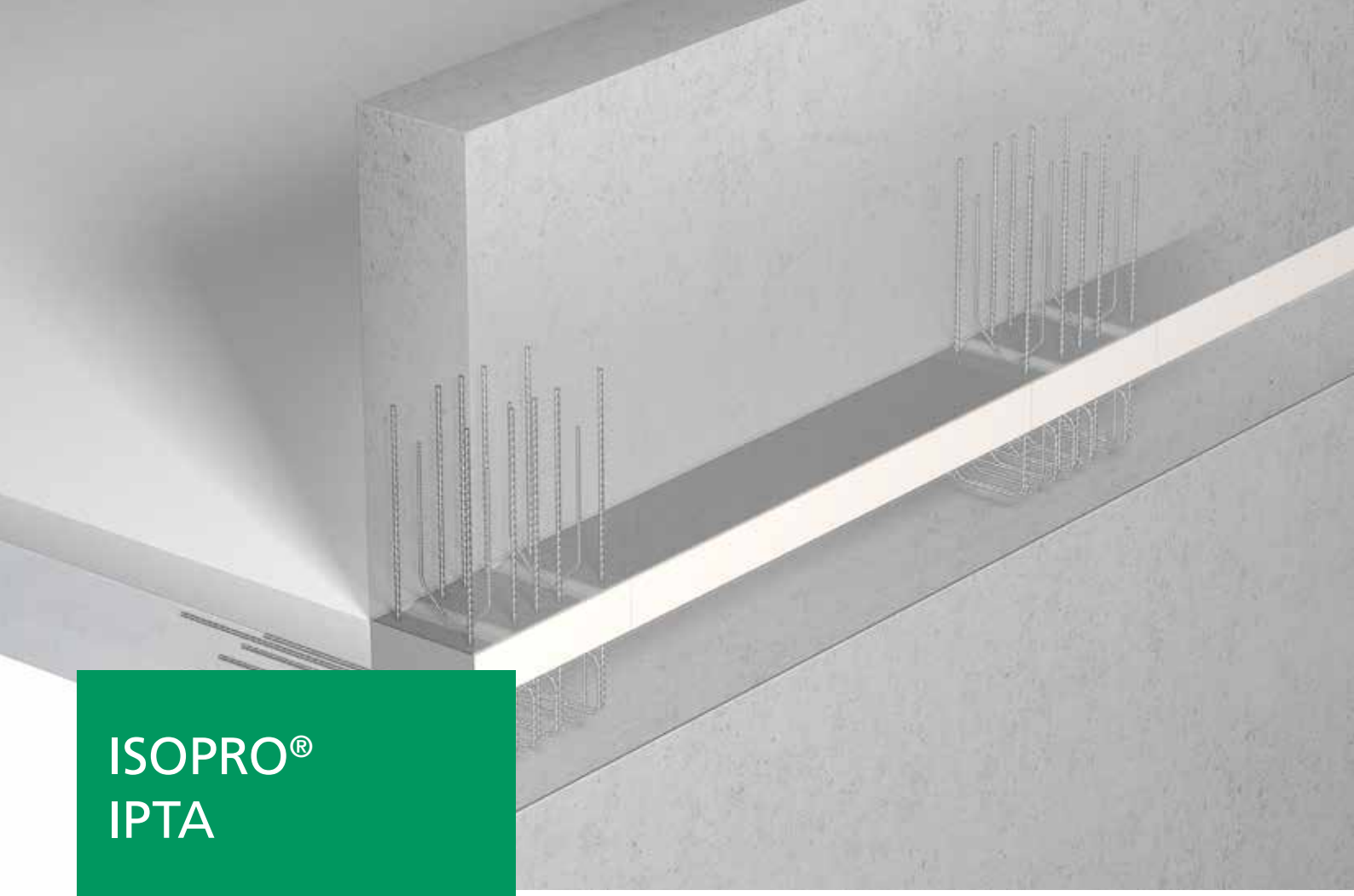
NOTES ON DESIGN

- Moments can only be transferred in connection with adjoining ISOPRO® IP or IPT units.
- To transfer the positive moments indicated in the table, the tension rods of the ISOPRO® IP or IPT units adjacent to the ISOPRO® unit IPE are activated as pressure rods. To ensure this, at least the following adjacent units are recommended:
  When using IPE 1 at least ISOPRO® IP35, when using IPE 2 at least ISOPRO® IP55.
- For the design, either $H_{Rd\perp}$ or M_{Rd} can be applied. This means that either a tensile force or a moment can be transferred with the unit; not both at the same time.
- The quantity and position of the ISOPRO® IPE units are in accordance with the structural engineer's specifications.
- When using ISOPRO® IPE units, ensure that the load-bearing capacity of the linear connection is reduced by the proportion of the length of the IPE units in relation to the total connection length.
- The use of ISOPRO® IPE elements creates fixed points, the maximum permissible distance between expansion joints must be taken into account.
- The tension rods at the bottom are to be overlapped with rods of the same diameter. The shear rods are anchored and require no further connection reinforcement.

DISTANCE BETWEEN EXPANSION JOINTS



If the component dimensions exceed the maximum permissible distance between expansion joints, expansion joints must be arranged perpendicular to the insulation plane. The maximum permissible distance between expansion joints e is dependent on the maximum rod diameter across the expansion joint and is thus type-dependent. The maximum permissible distance between expansion joints for the ISOPRO® units is specified in the respective individual sections.
By using ISOPRO® IPE units, a fixed point is created, resulting in increased constraints. The maximum permissible distance between expansion joints is therefore reduced to e/2 when ISOPRO® IPE units are used. Half of the maximum distance between expansion joints is always measured from the fixed point.



ISOPRO®
IPTA

UNITS FOR PARAPETS AND BALUSTRADES

ISOPRO® IPTA

- For transferring normal forces, positive and negative moments and horizontal forces
- Load-bearing capacities IPTA 1 and IPTA 2
- Unit length 350 mm
- Parapet/balustrade width 150 to 250 mm
- Concrete covering varies depending on parapet thickness – see unit structure
- Ceiling thickness ≥ 160 mm
- Insulation thickness 80 mm – 60 mm possible as an option
- Fire resistance class R 90 available

TYPE DESIGNATION

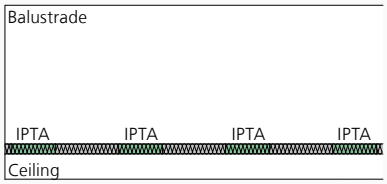
IPTA 1 b200 R 90

- Fire protection version
- Parapet/balustrade width
- Type and load-bearing capacity

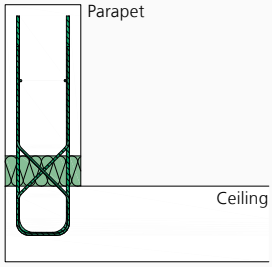
APPLICATION – UNIT ARRANGEMENT

This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.

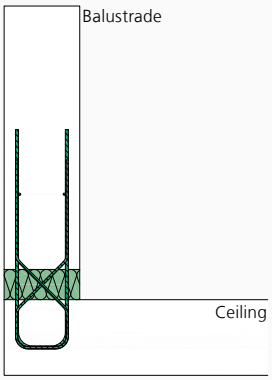
ISOPRO® IPTA – View of parapet connected to the horizontal face



ISOPRO® IPTA – View of balustrade connected to the horizontal face

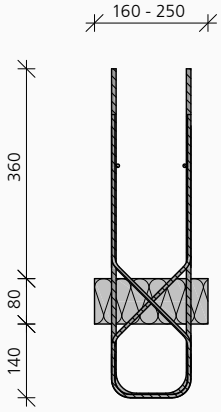


ISOPRO® IPTA – Installation cross-section of parapet connected to the horizontal face

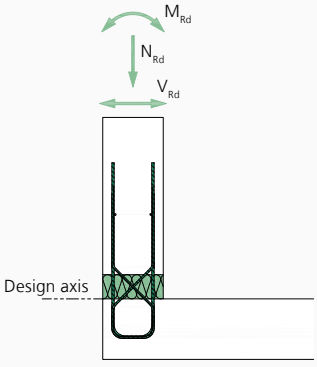


ISOPRO® IPTA – Installation cross-section of balustrade connected to the horizontal face

UNIT STRUCTURE



SIGN REGULATION/STATIC SYSTEM



DESIGN – UNIT STRUCTURE

DESIGN TABLE IPTA 1 FOR CONCRETE ≥ C25/30

ISOPRO®		IPTA 1 – b < 200 mm	IPTA 1 – b ≥ 200 mm
Moment M_{Rd} [kNm]	N_{Ed} = 0 kN	± 1.75	± 2.5
	N_{Ed} > 0 kN	±(1.75 - N_{Ed}/2 · 0.092)	±(2.5 - N_{Ed}/2 · 0.132)
Normal force N_{Rd} [kN]	M_{Ed} = 0 kNm	38.0	38.0
	M_{Ed} ≠ 0 kNm	38.0 - |M_{Ed}|/0.092 · 2	38.0 - |M_{Ed}|/0.132 · 2
Horizontal force V_{Rd} [kN]		± 12.0	± 12.0

DESIGN TABLE IPTA 2 FOR CONCRETE ≥ C25/30

ISOPRO®		IPTA 2 – b < 200 mm	IPTA 2 – b ≥ 200 mm
Moment M_{Rd} [kNm]	N_{Ed} = 0 kN	± 4.4	± 6.3
	N_{Ed} > 0 kN	±(4.4 - N_{Ed}/2 · 0.092)	±(6.3 - N_{Ed}/2 · 0.132)
Normal force N_{Rd} [kN]	M_{Ed} = 0 kNm	95.0	95.0
	M_{Ed} ≠ 0 kNm	95.0 - |M_{Ed}|/0.092 · 2	95.0 - |M_{Ed}|/0.132 · 2
Horizontal force V_{Rd} [kN]		± 12.0	± 12.0

NOTES ON DESIGN

- As normal force only compressive force can be transferred.
- The normal force N_{Rd} indicated in the table corresponds to the maximum transmissible compressive force depending on the type and concrete quality.

CONCRETE COVERING

Parapet/balustrade width b [mm]	Concrete covering cv [mm]
150	25
160	30
170	35
180	40
190	45
200	30
210	35
220	40
230	45
240	50
250	55

ASSIGNMENT AND DIMENSIONS

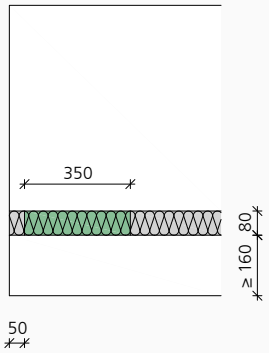
ISOPRO®	IPTA 1	IPTA 2
Unit length [mm]	350	
Width of parapet/balustr. b	150 - 250	
Tension / pressure rods	2 Ø 8	5 Ø 8
Horizontal force rods	2 x 2 Ø 6	2 x 2 Ø 6

DISTANCE BETWEEN EXPANSION JOINTS – SUPPLEMENTARY REINFORCEMENT

MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IPTA 1 and IPTA 2
Distance between joints e [m]	13.0

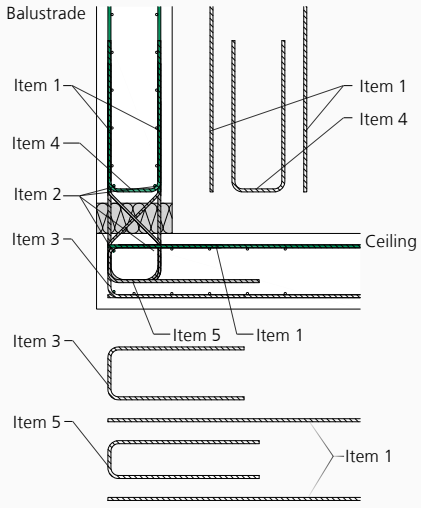
DISTANCE FROM THE EDGE



The following distances must be maintained around the edges of ceilings or balustrades and around expansion joints

- Distance from the edge is not required around balustrades.
- A 50 mm distance from the edge must be maintained around ceilings.

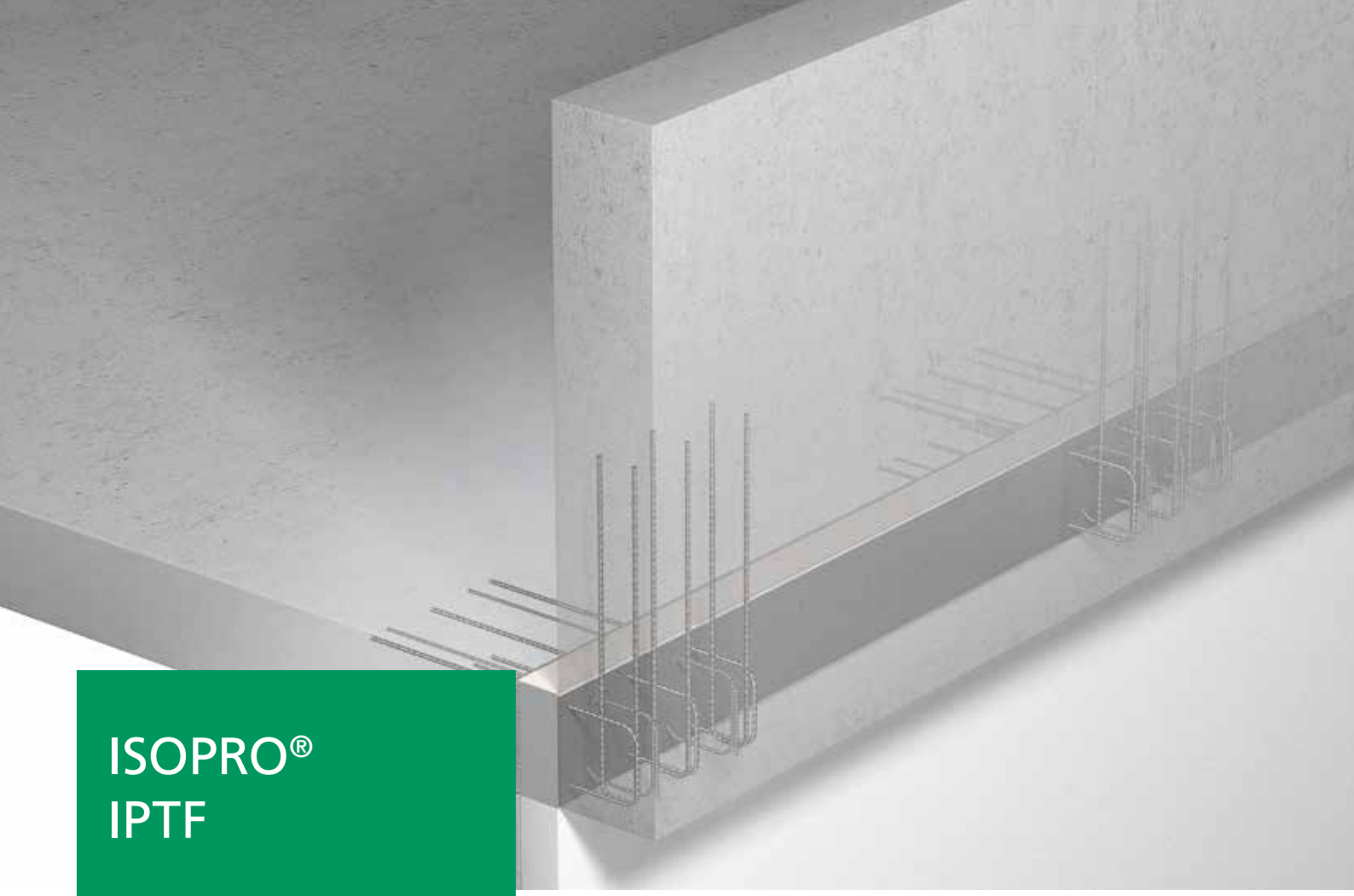
ISOPRO® IPTA



- Item 1 connection reinforcement for the ISOPRO® unit in the balustrade and in the ceiling – see table
- Item 2 spacing bar 2 x 2 Ø 8 on balustrade and ceiling side
- Item 3 structural edging in accordance with DIN EN 1992-1-1 min. Ø 6/250 respectively in accordance with the structural engineer's specifications
- Item 4 supplementary reinforcement for the ISOPRO® unit in the balustrade – see table below
- Item 5 connecting stirrup supplied ex works
- For ISOPRO® IPTA units with widths of 150, 160 and 200 mm, the supplementary reinforcement of the parapet/balustrade must be arranged within the unit reinforcement, as this has a concrete covering of cv < 35 mm.

CONNECTION AND SUPPLEMENTARY REINFORCEMENT

	Connection reinforcement Item 1		Suppl. reinforcement Item 4
ISOMAXX®	IPTA 1	IPTA 2	IPTA 1 and IPTA 2
$a_{s,erf}$ [cm²/m]	0.50	1.10	0.30
Suggestion	2 Ø 8	4 Ø 8	Ø 6/250



ISOPRO®
IPTF

UNITS FOR BALUSTRADES CONNECTED TO THE VERTICAL FACE

ISOPRO® IPTF

- For transferring positive and negative shearing forces, positive and negative moments and horizontal forces
- Unit length 350 mm
- Unit heights 160 to 250 mm
- Concrete covering depending on the unit height – see unit structure
- Balustrade width ≥ 150 mm
- Insulation thickness 80 mm – 60 mm possible as an option
- Fire resistance class R 90 available

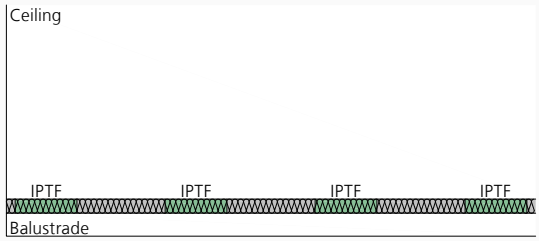
TYPE DESIGNATION

IPTF h200 R 90

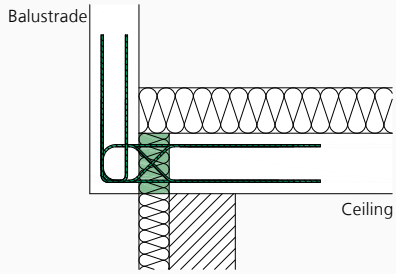
- R 90 — Fire protection version
- h200 — Unit height
- IPTF — Type

APPLICATION – UNIT ARRANGEMENT

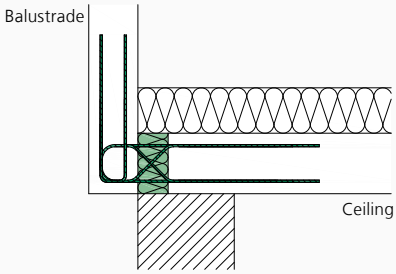
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



ISOPRO® IPTF – Plan view of balustrade connected to the vertical face



ISOPRO® IPTF – Installation cross-section of a balustrade connected to the vertical face with a thermal insulation composite system

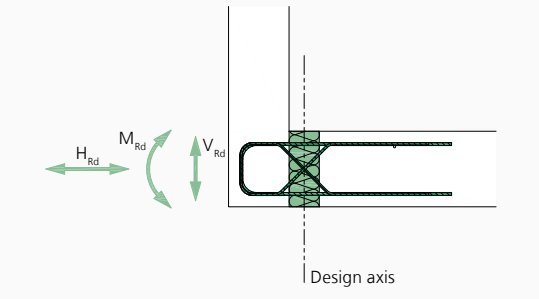


ISOPRO® IPTF – Installation cross-section of a balustrade connected to the vertical face with thermally insulating masonry

DESIGN TABLE FOR CONCRETE ≥ C25/30

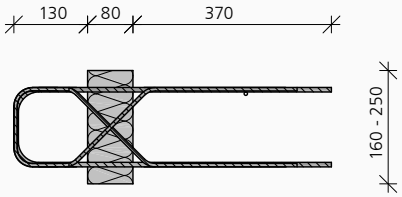
ISOPRO®	IPTF h < 200 mm	IPTF h ≥ 200 mm
Moment M_{Rd} [kNm]	± 2.1	± 3.0
Horizontal force H_{Rd} [kN]	± 3.5	± 3.5
Shearing force V_{Rd} [kN]	± 12.0	± 12.0

SIGN REGULATION/STATIC SYSTEM



UNIT STRUCTURE – DISTANCE BETWEEN EXPANSION JOINTS

UNIT STRUCTURE ISOPRO® IPTF



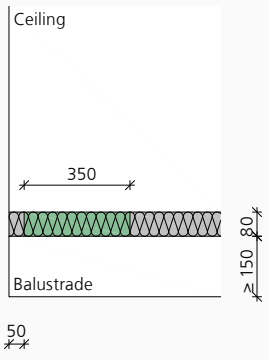
ASSIGNMENT AND DIMENSIONS

ISOPRO®	IPTF
Unit length [mm]	350
Unit height h [mm]	160 - 250
Tension/pressure rods	3 Ø 8
Shear rods	2 Ø 6

MAX. PERMISSIBLE DISTANCE BTW. EXP. JOINTS

ISOPRO®	IPTF
Distance between joints e [m]	13.0

DISTANCE FROM THE EDGE



CONCRETE COVERING

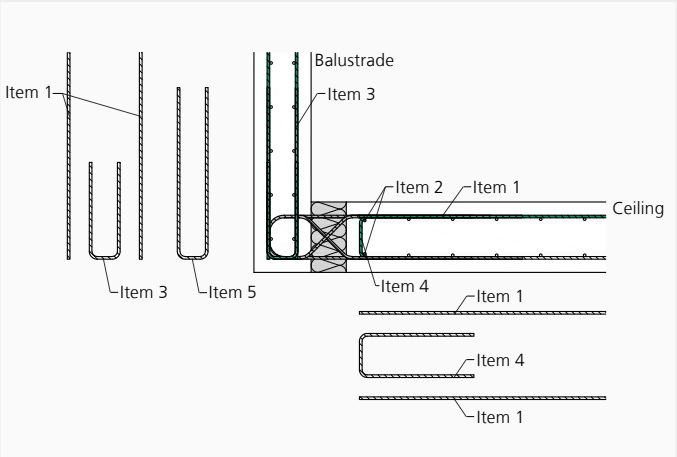
Unit height h [mm]	Concrete covering cv [mm]
160	30
170	35
180	40
190	45
200	30
210	35
220	40
230	45
240	50
250	55

The following distances must be maintained around the edges of ceilings or balustrades and around expansion joints:

- A 50 mm distance from the edge must be maintained around balustrades.
- Distance from the edge is not required around ceilings.

SUPPLEMENTARY REINFORCEMENT

ISOPRO® IPTF



- Item 1 connection reinforcement for the ISOPRO® unit in the balustrade and in the ceiling – see table
- Item 2 spacing bar 2 x 2 Ø 8 on balustrade and ceiling side
- Item 3 connecting bars for the ISOPRO® unit in the balustrade – see table below
- Item 4 supplementary reinforcement for the ISOPRO® unit
- Item 5 connecting bars supplied ex works 3 Ø 8

CONNECTION AND SUPPLEMENTARY REINFORCEMENT

ISOPRO®	Connection reinforcement Item 1	Connecting stirrup Item 3	Suppl. reinforcement Item 4
$a_{s,erf}$ [cm²/m]	0.60	1.51	1.13
Suggestion	3 Ø 8	3 Ø 8	Ø 6/250

NOTES

- For the reinforcement and selection of distances between the ISOPRO® IPTF units, note the ability for concreting.
- For ISOPRO® IPTF units with widths of 160 to 190 mm, item 3 can be omitted, as this is covered by item 5.

Our Applications Technology department would be pleased to assist in finding further solutions.
Phone: +49 (0) 7742 9215-300
Fax: +49 (0) 7742 9215-319
E-mail: technik@h-bau.de

ISOPRO® IPO

UNITS FOR CORBELS

ISOPRO® IPO

- For corbels that are used to support masonry or prefabricated units
- For transferring positive shearing forces, the resulting negative moments and horizontal forces
- Load-bearing capacities IPO 16 and IPO 20
- Unit length 350 mm
- Unit heights 180 to 250 mm
- Concrete covering varies depending on the unit height – see unit structure
- Corbel width IPO 16 ≥ 160 mm – IPO 20 ≥ 200 mm
- Insulation thickness 80 mm – 60 mm possible as an option
- Fire resistance class REI 120 available

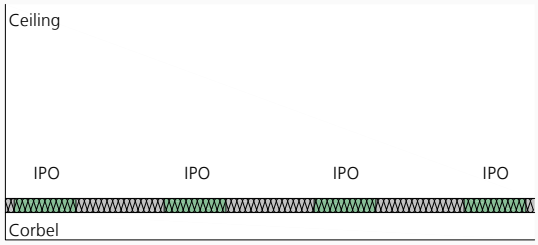
TYPE DESIGNATION

IPO 20 h200 REI 120

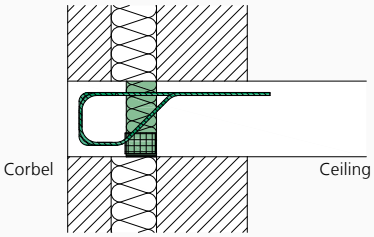
- Fire protection version
- Unit height
- Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

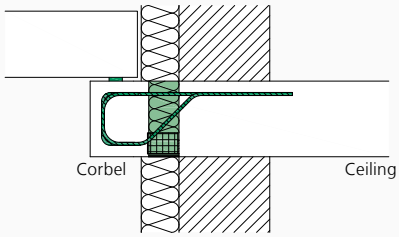
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



ISOPRO® IPO – Plan view of corbel

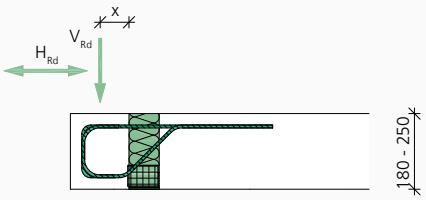


ISOPRO® IPO – Corbel with facing masonry



ISOPRO® IPO – Corbel as support for a prefabricated component, support with centring bearing

SIGN REGULATION/STATIC SYSTEM



DESIGN – UNIT STRUCTURE

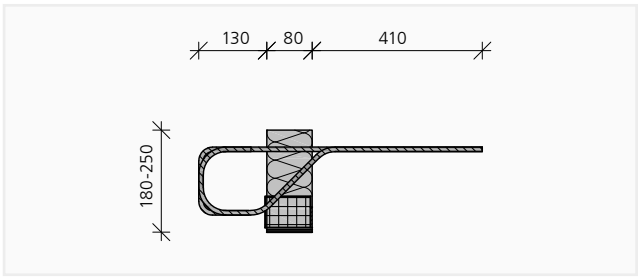
DESIGN TABLE IPO 16 FOR CONCRETE ≥ C25/30

ISOPRO®		IPO 16		
Load transfer point x [mm]		60 - 90	100	110
Shearing force V_{Rd} [kN] depending on the unit height h [mm]	180	26.9	25.9	17.3
	200	26.9	26.9	20.3
	220	26.9	26.9	23.3
	240	26.9	26.9	23.1
	250	26.9	26.9	22.9
Horizontal force H_{Rd} [kN]		± 2.5		

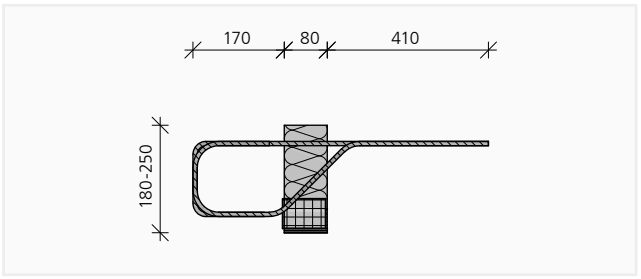
DESIGN TABLE IPO 20 FOR CONCRETE ≥ C25/30

ISOPRO®		IPO 20			
Load transfer point x [mm]		60 - 120	130	140	150
Shearing force V_{Rd} [kN] depending on the unit height h [mm]	180	29.1	25.2	18.5	12.7
	200	29.1	29.1	21.7	14.9
	220	29.1	29.1	24.9	17.1
	240	29.1	29.1	24.8	16.9
	250	29.1	29.1	24.6	16.8
Horizontal force H_{Rd} [kN]		± 2.5			

UNIT STRUCTURE IPO 16



UNIT STRUCTURE IPO 20



ASSIGNMENT AND DIMENSIONS

ISOPRO®	IPO 16 and 20
Unit length [mm]	350
Unit height h [mm]	180 – 250
Tension rods	2 Ø 8
Shear rods	3 Ø 8
Compression bearings	2

CONCRETE COVERING

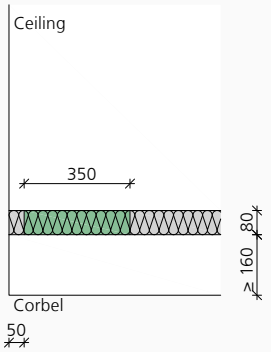
Unit height h [mm]	Concrete covering at top cv [mm]	Concrete covering at bottom cv_u [mm]
180	30	30
190	40	30
200	30	30
210	40	30
220	30	30
230	40	30
240	40	40
250	50	40

EXPANSION JOINTS – SUPPLEMENTARY REINFORCEMENT

MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IPO
Distance between joints e [m]	13.0

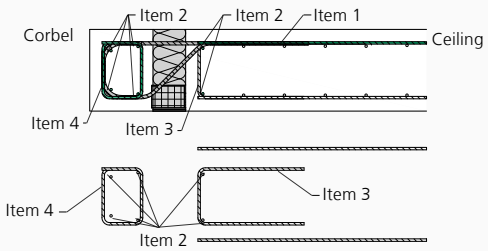
DISTANCE FROM THE EDGE



The following distances must be maintained around the edges of ceilings or balustrades and around expansion joints:

- A 50 mm distance from the edge must be maintained around corbels.
- Distance from the edge is not required around ceilings.

SUPPLEMENTARY REINFORCEMENT IPO



- Item 1 connection reinforcement for the ISOPRO® unit 3 Ø 8
- Item 2 spacing bar 2 Ø 8 on the ceiling and at least 4 Ø 8 in the corbel
- Item 3 structural edging in accordance with DIN EN 1992-1-1 min. Ø 6/250
- Item 4 closed bar in the corbel in accordance with the structural engineer's specifications

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ISOPRO®
IPTS

UNITS FOR CANTILEVERED JOISTS

ISOPRO® IPTS

- For transferring negative moments and positive shearing forces
- Load-bearing capacities IPTS 1 to IPTS 4
- Unit widths 220 to 300 mm
- Unit heights 300 to 600 mm
- Concrete covering cv 50 mm at the top, bottom and side
- Fire resistance class R 90 available

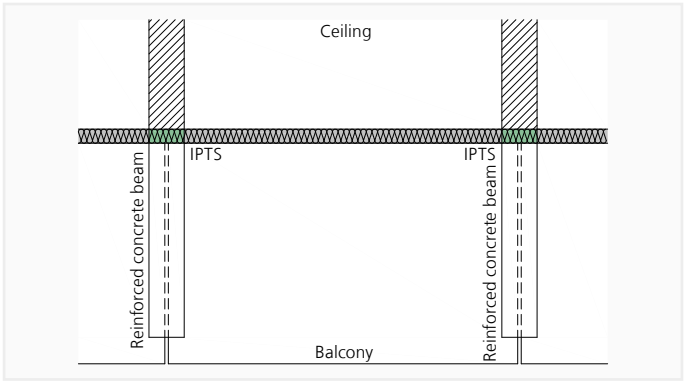
TYPE DESIGNATION

IPTS 2 b/h = 220/400 R 90

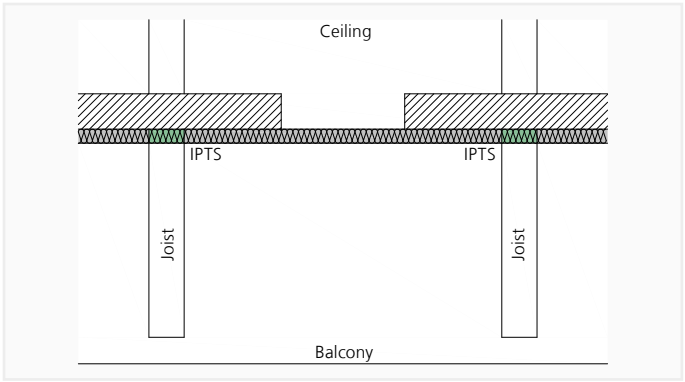
- Fire protection version
- Unit dimensions
- Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

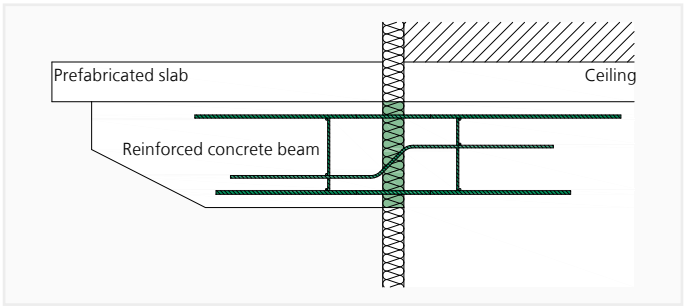
This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



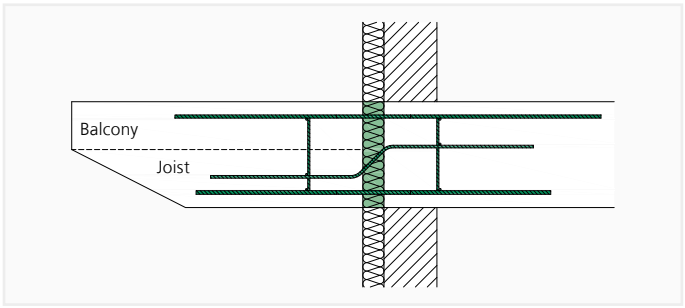
ISOPRO® IPTS – Balcony structure with prefabricated slabs joined by a non-static connection, and load-carrying reinforced concrete beams



ISOPRO® IPTS – Balcony structure with joists connected to the balcony slab monolithically



ISOPRO® IPTS – Installation cross-section with prefabricated slabs



ISOPRO® IPTS – Installation cross-section with joists connected to the balcony slab monolithically

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS M_{Rd} [kNm]

Unit height [mm]	ISOPRO®			
	IPTS 1	IPTS 2	IPTS 3	IPTS 4
300	19.4	26.4	36.1	47.7
350	24.5	33.5	45.9	60.8
400	29.6	40.5	55.7	73.9
600	50.1	68.8	94.7	126.4

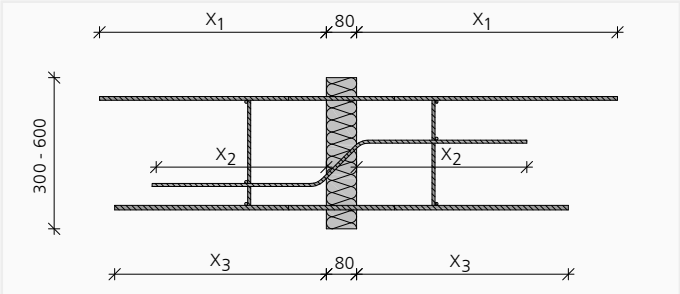
DESIGN VALUES OF ALLOWABLE SHEARING FORCES V_{Rd} [kN]

ISOPRO®	IPTS 1	IPTS 2	IPTS 3	IPTS 4
Shearing force V_{Rd} [kN]	30.9	48.3	69.5	94.6

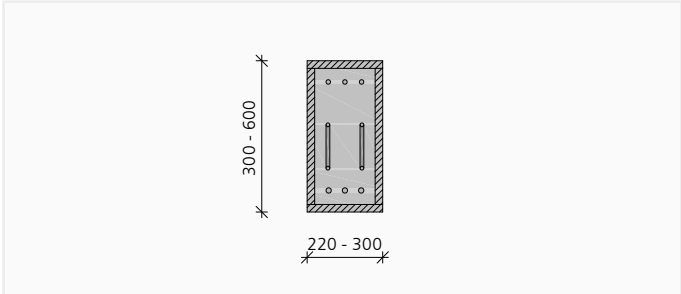
DIMENSIONS AND ASSIGNMENT

ISOPRO®	IPTS 1	IPTS 2	IPTS 3	IPTS 4
Unit width [mm]	220 – 300			
Unit height [mm]	300 – 600			
Tension rods	3 Ø 10	3 Ø 12	3 Ø 14	3 Ø 16
Shear rods	2 Ø 8	2 Ø 10	2 Ø 12	2 Ø 14
Pressure rods	3 Ø 12	3 Ø 14	3 Ø 16	3 Ø 20

UNIT STRUCTURE



ISOPRO® IPTS



ISOPRO® IPTS – Version with fireproof panels – R 90

ISOPRO®	IPTS 1	IPTS 2	IPTS 3	IPTS 4
Length tension rod* X_1	750	860	980	1270
Length Shear rod X_2	460	575	680	790
Length pressure rod X_3	580	650	785	955

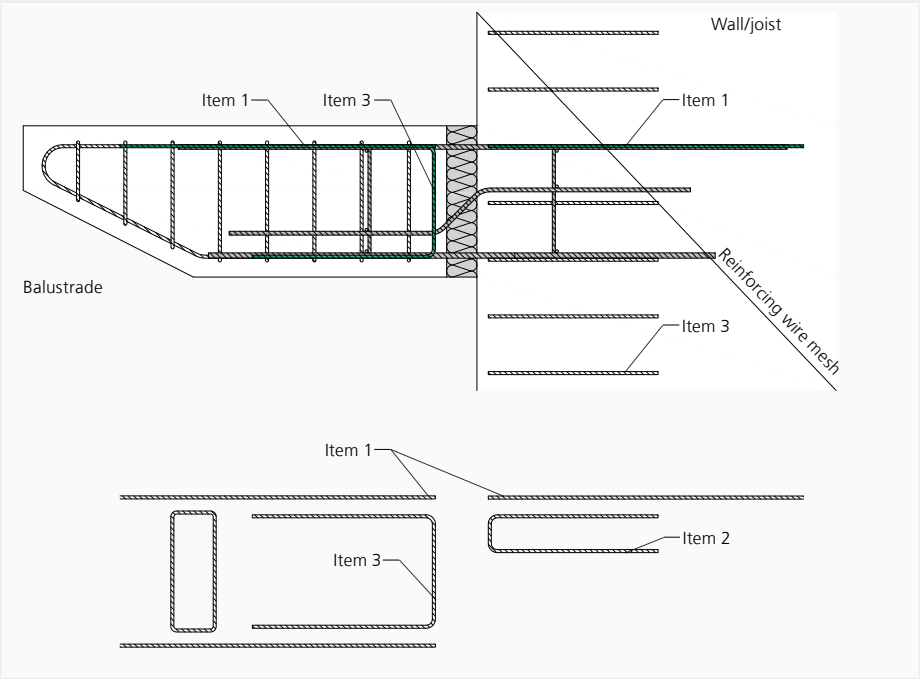
* The anchoring length of the tension rods is designed for bonding area 1, "good bonding conditions". On request, the anchoring length of the tension rods can also be designed for bonding area 2, "moderate bonding conditions".

EXPANSION JOINTS – SUPPLEMENTARY REINFORCEMENT

MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IPTS 1	IPTS 2	IPTS 3	IPTS 4
Distance between joints e [m]	11.3	10.1	9.2	8.0

ISOPRO® IPTS SUPPLEMENTARY REINFORCEMENT



- Item 1 connection reinforcement for the ISOPRO® unit – see table
- Item 2 structural edging in accordance with DIN EN 1992-1-1 min. Ø 6/250
- Item 3 supplementary reinforcement for the ISOPRO® unit – see table

CONNECTION REINFORCEMENT ITEM 1

ISOPRO®	IPTS 1	IPTS 2	IPTS 3	IPTS 4
$a_{s,erf}$ [cm²/m]	2.35	3.39	4.61	6.03
Suggestion	3 Ø 10	3 Ø 12	3 Ø 14	3 Ø 16

SUPPLEMENTARY REINFORCEMENT ITEM 3

ISOPRO®	IPTS 1	IPTS 2	IPTS 3	IPTS 4
$a_{s,erf}$ [cm²/m]	0.71	1.11	1.59	2.17
Suggestion	2 Ø 8	2 Ø 10	2 Ø 10	2 Ø 12

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ISOPRO®
IPTW

UNITS FOR CANTILEVERED RC WALLS

ISOPRO® IPTW

- For transferring negative moments, positive shearing forces and horizontal forces
- Load-bearing capacities IPTW 1 to IPTW 4
- Unit widths 150 to 250 mm
- Unit heights 1.500 to 3.500 mm
- The anchoring length of the tension rods is designed for bonding area 2 – "moderate bonding conditions"
- Concrete covering cv 50 mm at the top and bottom and cv 25 to cv 50 at the side, depending on the unit width
- Fire resistance class R 90 available
- Delivery of the units in at least three sub-units – bottom section with pressure and shear rods, intermediate section and top section with tension rods. For large unit heights, additional intermediate sections are added.

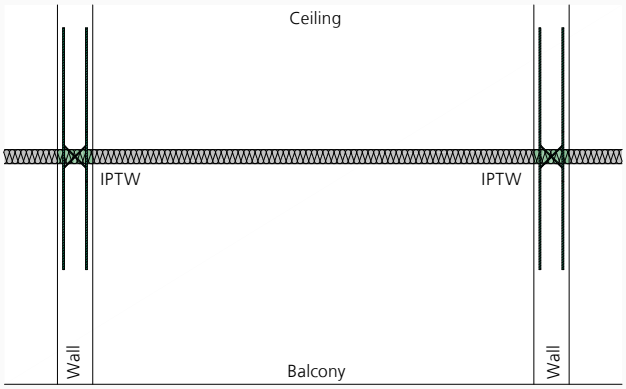
TYPE DESIGNATION

IPTW 2 b/h = 220/2.000 R 90

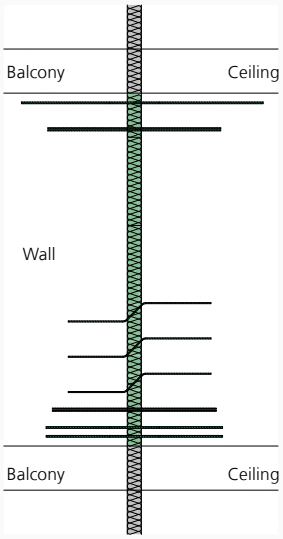
- R 90 – Fire protection version
- 220/2.000 – Unit dimensions
- IPTW 2 – Type and load-bearing capacity

APPLICATION – UNIT ARRANGEMENT

This chapter provides planning aids and specific information about this product. In addition, the general information on materials, design, building physics, installation on site, etc. on pages 10 – 25 has also to be considered.



ISOPRO® IPTW – Arrangement of units in the floor plan in combination with a balcony slab



ISOPRO® IPTW – Installation cross-section with wall slab connected to the balcony slab monolithically

DESIGN TABLE FOR CONCRETE ≥ C25/30

DESIGN VALUES OF ALLOWABLE MOMENTS M_{Rd} [kNm]

Unit height [mm]	ISOPRO®			
	IPTW 1	IPTW 2	IPTW 3	IPTW 4
≥ 1.500	64.7	115.3	178.7	178.7
≥ 1.750	76.6	136.8	212.7	212.7
≥ 2.000	88.4	158.4	246.8	246.8
≥ 2.250	100.3	179.9	280.8	280.8
≥ 2.500	112.1	201.4	314.8	314.8
≥ 2.750	124.0	222.9	348.8	348.8
≥ 3.000	135.8	244.4	382.9	382.9

DESIGN VALUES OF ALLOWABLE SHEARING FORCES V_{Rd} [kN] AND HORIZONTAL FORCES H_{Rd} [kN]

ISOPRO®	IPTW 1	IPTW 2	IPTW 3	IPTW 4
Shearing force V_{Rd} [kN]	52.1	92.7	154.5	241.3
Horizontal force H_{Rd} [kN]	± 17.4	± 17.4	± 17.4	± 17.4

DIMENSIONS AND ASSIGNMENT

ISOPRO®	IPTW 1	IPTW 2	IPTW 3	IPTW 4
Unit width [mm]	150 – 250			
Unit height [mm]	1.500 – 3.500			
Tension rods	2 Ø 10	4 Ø 10	4 Ø 12	4 Ø 12
Shear rods	6 Ø 6	6 Ø 8	10 Ø 8	10 Ø 10
Horizontal rods	2 x 2 Ø 6			
Pressure rods	4 Ø 10	4 Ø 10	6 Ø 12	6 Ø 14

NOTES ON DESIGN

- The anchoring length of the tension rods is designed for bonding area 2, "moderate connection conditions".
- Moments from wind loads perpendicular to the wall slab cannot be borne by the ISOPRO® IPTW unit. These loads are transferred through the stiffening effect of the monolithically connected balcony slabs. If this is not possible, the ISOPRO® IPTW unit can be supplemented with an ISOPRO® IPTD unit. This then replaces the intermediate component.

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DISTANCE BETWEEN EXPANSION JOINTS – UNIT STRUCTURE

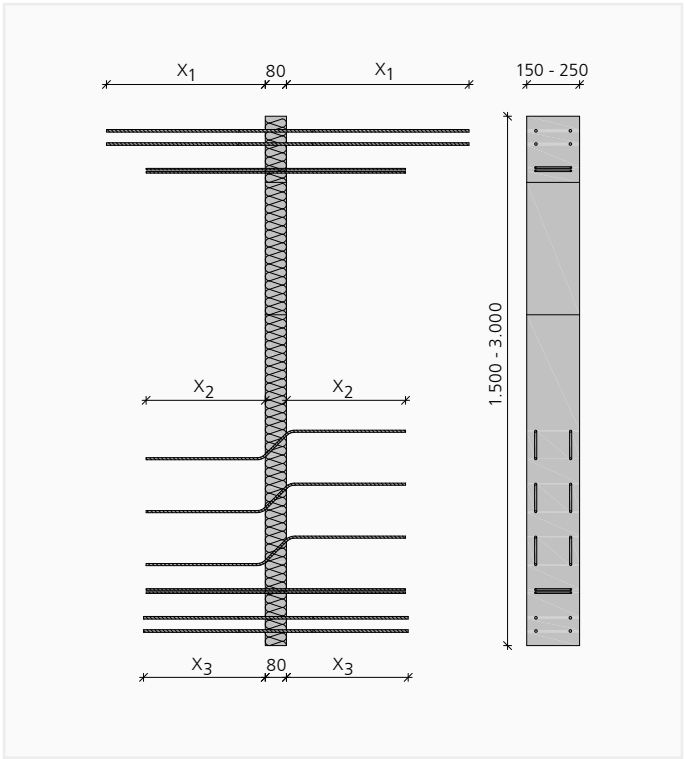
DISTANCE BETWEEN EXPANSION JOINTS

If the component dimensions exceeds the maximum permissible distance between expansion joints, expansion joints must be arranged perpendicular to the insulation plane. The maximum permissible distance between expansion joints e is dependent on the maximum rod diameter guided across the expansion joint and is thus type-dependent.
Fixed points, such as support above a corner, result in increased constraints. As a result, the maximum permissible distance between expansion joints must be reduced to e/2. Half of the maximum distance between expansion joints is always measured from the fixed point.
If walls joined using ISOPRO® IPTW have a rigid connection with long balcony slabs, the maximum distances between expansion joints specified below shall apply.

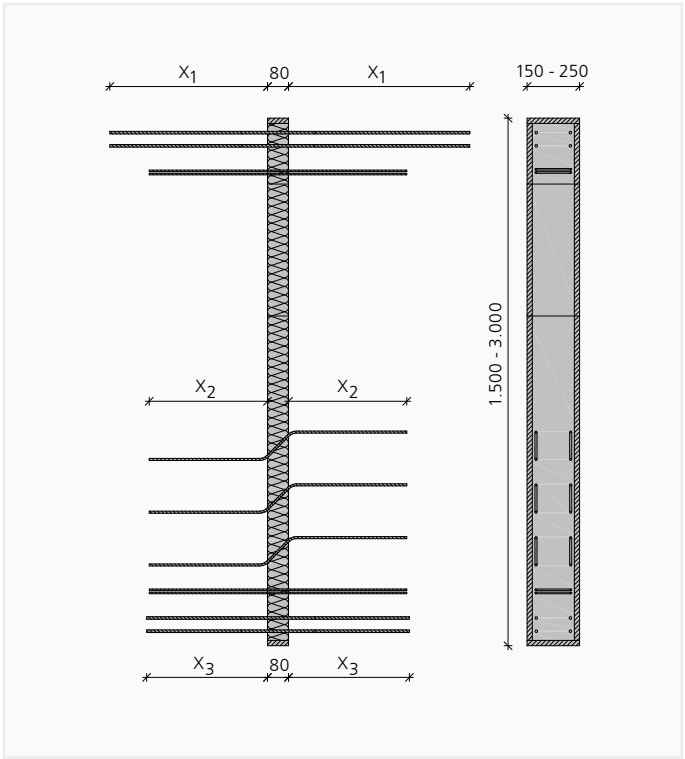
MAXIMUM PERMISSIBLE DISTANCE BETWEEN EXPANSION JOINTS

ISOPRO®	IPTW 1/IPTW 2	IPTW 3	IPTW 4
Distance between joints e [m]	13.0	11.3	10.1

UNIT STRUCTURE ISOPRO® IPTW



ISOPRO® IPTW

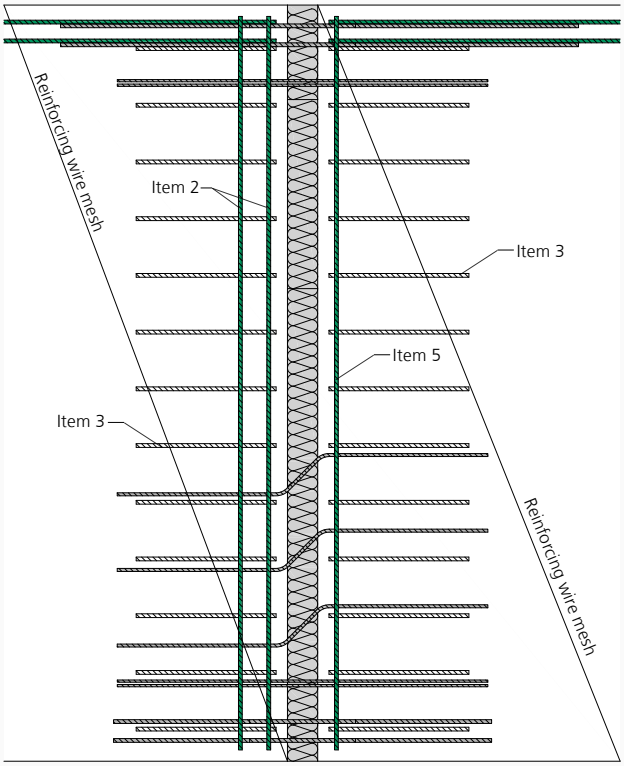


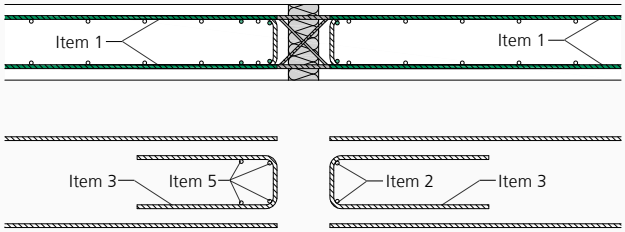
ISOPRO® IPTW – Version with fireproof panels – R 90

ISOPRO®	IPTW 1	IPTW 2	IPTW 3	IPTW 4
Length tension rod X_1	740	740	860	860
Length shear rod X_2	350/410	460	460	575
Length horizontal shear rod	450	450	450	450
Length pressure rod X_3	480	480	570	650

SUPPLEMENTARY REINFORCEMENT

ISOPRO® IPTW





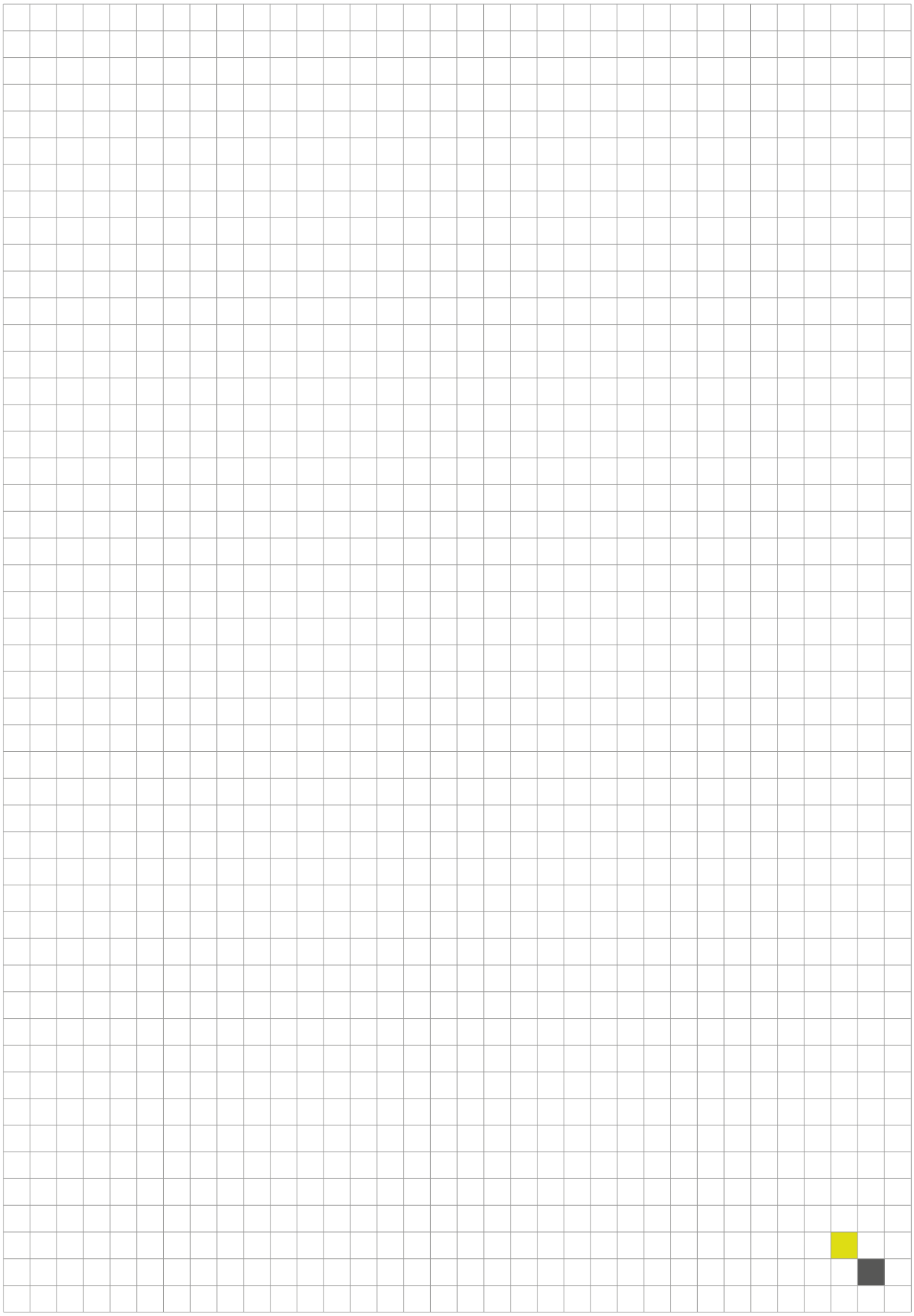
- Item 1 connection reinforcement for the ISOPRO® unit – see table
- Item 2 spacing bar 2 Ø 8
- Item 3 structural edging in accordance with the structural engineer's specifications
- Item 5 supplementary reinforcement for the ISOPRO® unit, anchored with stirrups – see table
- During concreting, even filling and compression on both sides must be ensured, as well as secure positioning.

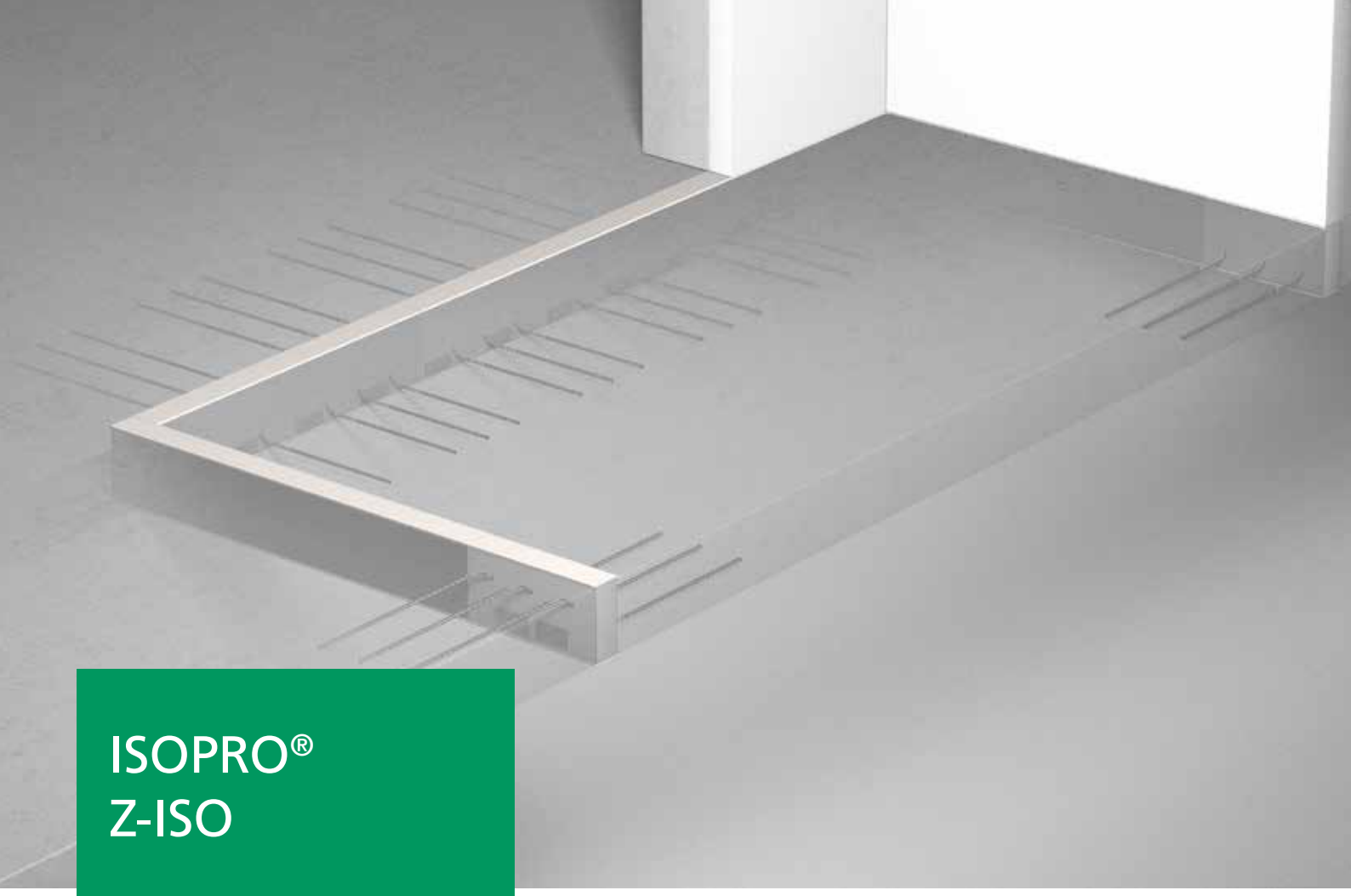
CONNECTION REINFORCEMENT ITEM 1

ISOPRO®	IPTW 1	IPTW 2	IPTW 3	IPTW 4
$a_{s,erf}$ [cm²/m]	1.57	3.14	4.5	4.5
Suggestion	2 Ø 10	4 Ø 10	4 Ø 12	4 Ø 12

SUPPLEMENTARY REINFORCEMENT ITEM 5

ISOPRO®	IPTW 1	IPTW 2	IPTW 3	IPTW 4
$a_{s,erf}$ [cm²/m]	1.19	2.13	3.55	5.54
Suggestion	2 x 2 Ø 8	2 x 2 Ø 10	2 x 2 Ø 12	2 x 2 Ø 14





ISOPRO®
Z-ISO

UNITS AS INTERMEDIATE INSULATION

ISOPRO® Z-ISO

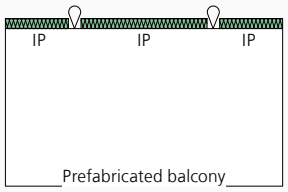
- Intermediate insulation without static function
- Length 1000 mm
- Unit heights starting from 160 mm
- Short units available on request.
- Fire resistance classes EI 120 (FP 1) with fireproof panels

TYPE DESIGNATION

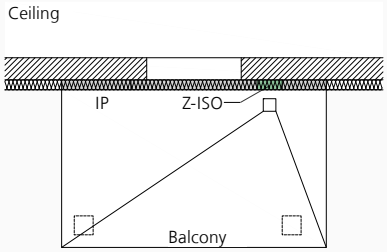
IP Z-ISO h200 FP1

- Fire protection version
- Unit height
- Type and load-bearing capacity

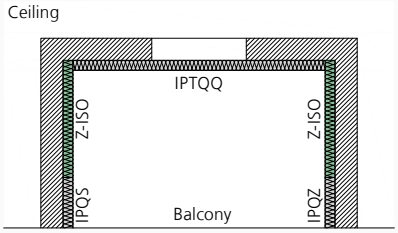
APPLICATION – UNIT ARRANGEMENT



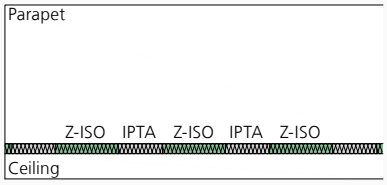
ISOPRO® Z-ISO – Balcony as prefabricated component with transport anchor – the Z-ISO units are added on site



ISOPRO® Z-ISO – Balcony on supports – Z-ISO units in the drainage recess area

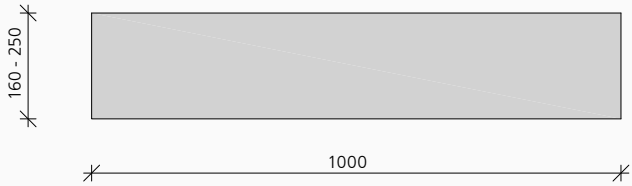


ISOPRO® Z-ISO – Loggia with support at specific points with IPQS/IPQZ

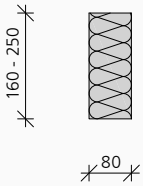


ISOPRO® Z-ISO – Use of parapet units at specific points ISOPRO® IPTA

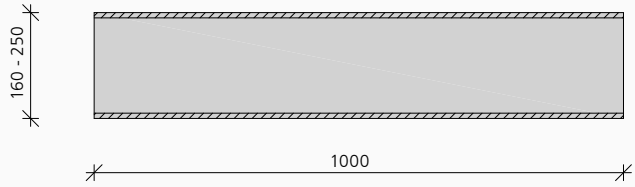
UNIT STRUCTURE



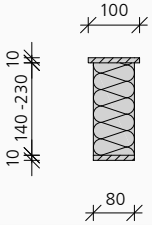
ISOPRO® Z-ISO – Product view



ISOPRO® Z-ISO – Product cross-section



ISOPRO® Z-ISO FP1 – Product view with fireproof panels at the top and bottom



ISOPRO® Z-ISO FP1 – Product cross-section

NOTES

- When using ISOPRO® Z-ISO units, it must be ensured that the length and thus also the load-bearing capacity of the line connection are reduced by the percentage of the length of the Z-ISO elements in relation to the total connection length.
- The fire resistance class of the Z-ISO FP1 unit corresponds to the maximum fire resistance class of the statically load-bearing ISOPRO® units used in the line connection. E.g. Z-ISO in combination with ISOPRO® IP - REI 120; Z-IS0 in combination with ISOPRO® IPT - R 90.

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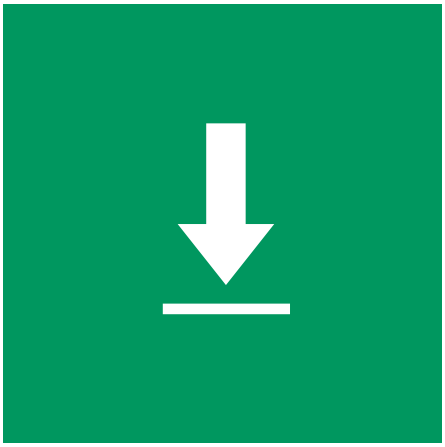

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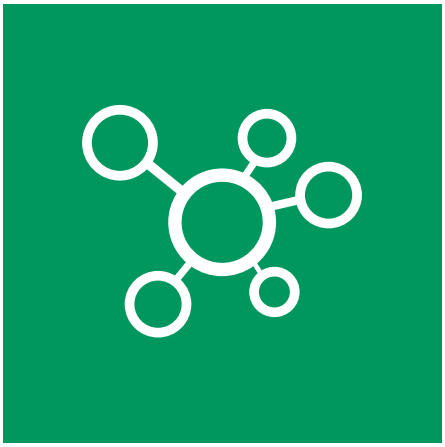

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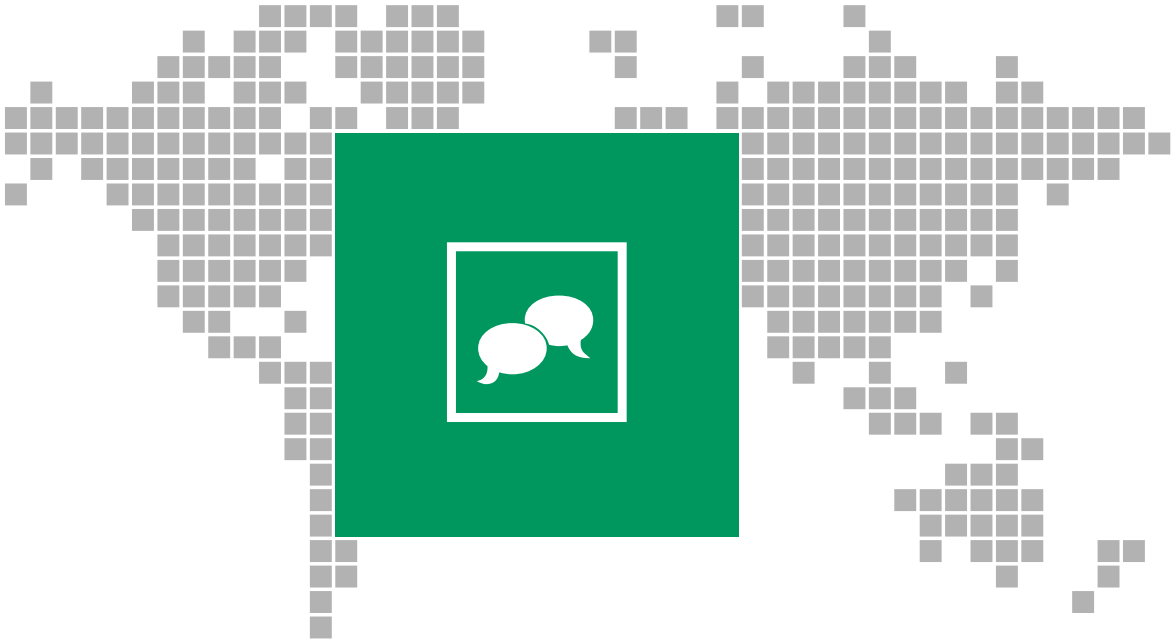

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