PohlCon

ISOPRO®120 Thermal insulation elements

Technical information

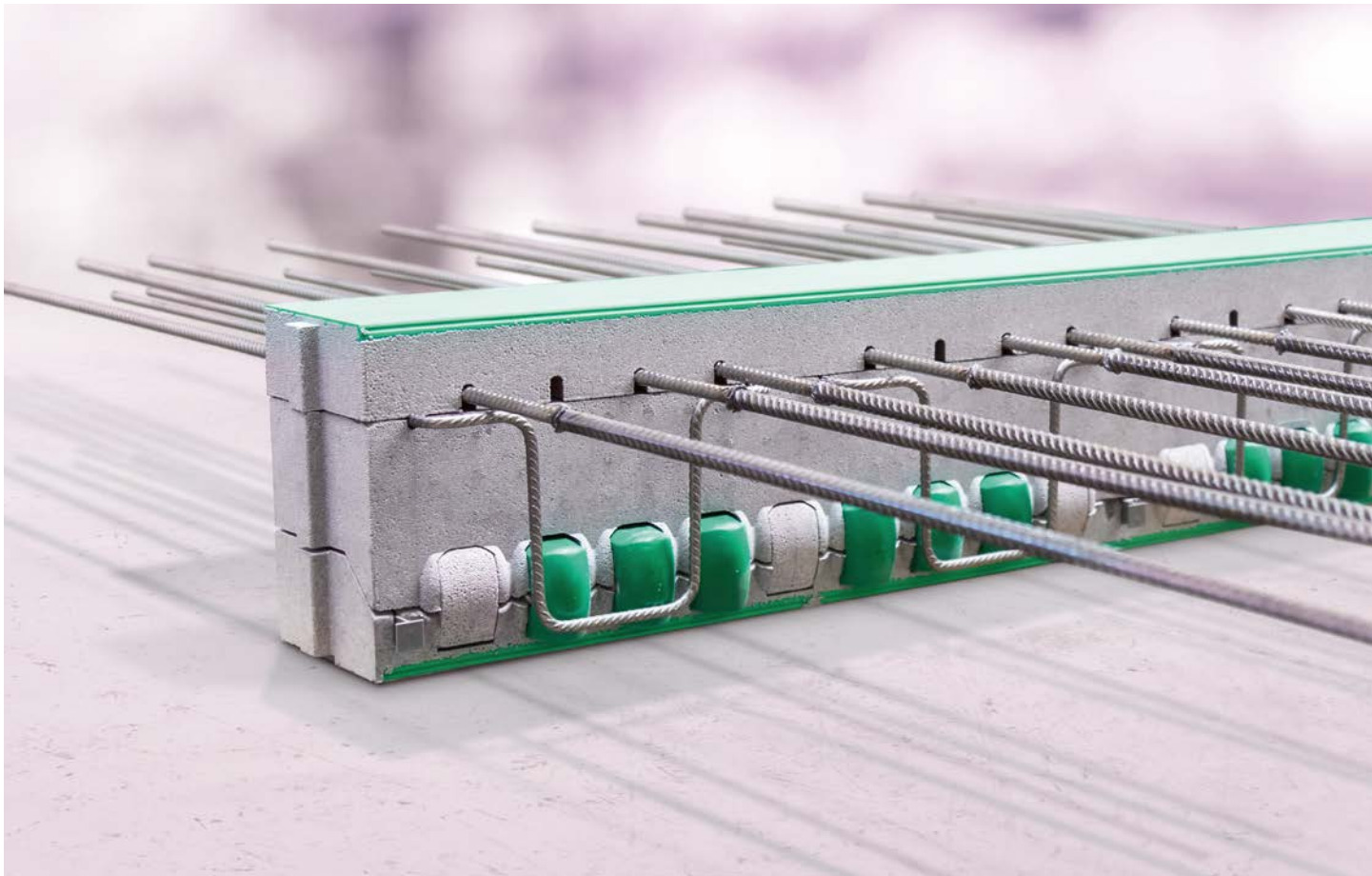


Table of contents

Application in balconies

PohlCon solutions for balconies

Balconies should be a pleasant extension to our living space, not a money sink due to increased energy costs. So to ensure that your balcony is securely anchored and minimise the amount of heat that adjacent rooms lose, we have taken a brand new approach to balcony design, from load-bearing thermal insulation elements through to railing fastening methods. Our carefully conceived solutions are optimised to reduce energy loss and keep the components securely in place. We also provide you with the appropriate advice and a custom software solution for the structural design. This enables you to plan architecturally challenging balconies quickly, easily and with confidence.

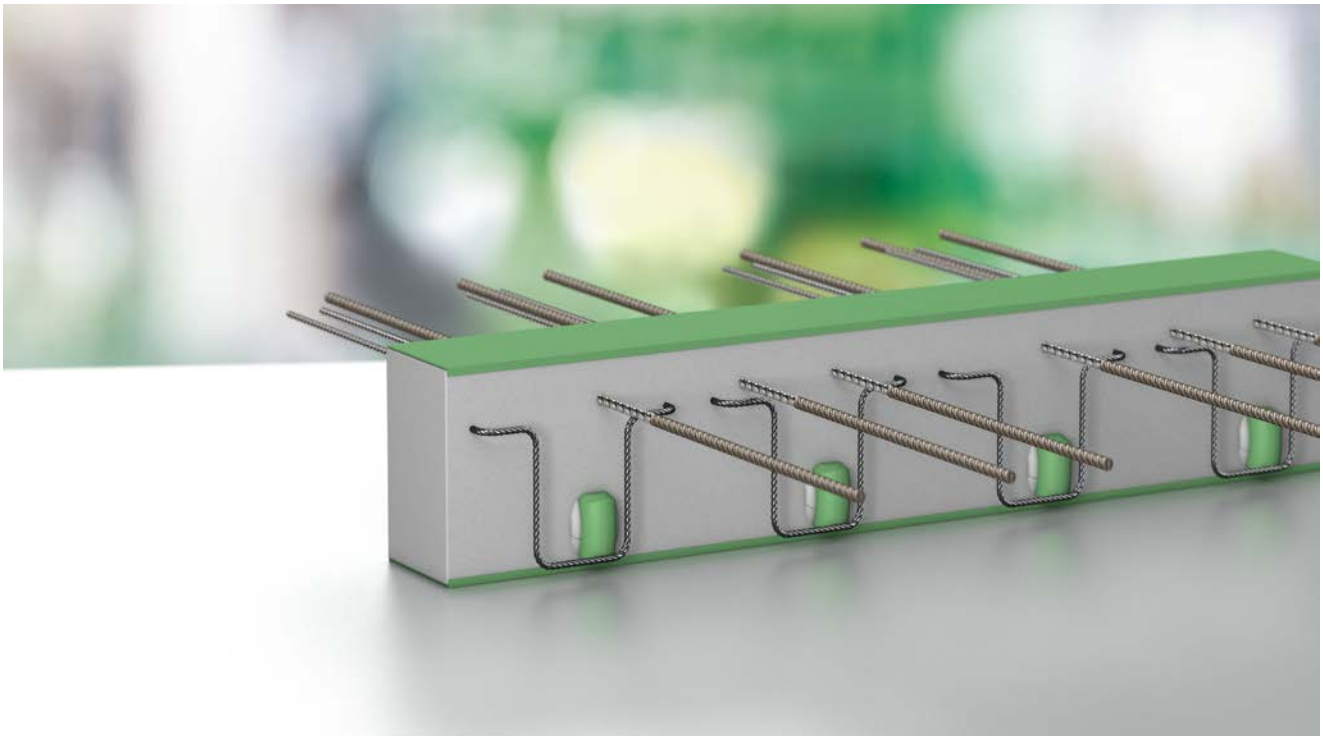
ISOPRO® 120

The load-bearing ISOPRO® 120 thermal insulation element creates a frictional connection to outdoor components. It consists of five main components, which are all designed to afford reliable force transmission coupled with minimal thermal conductivity. Thanks to the shear bars anchored in the compression bearings, the new ISOPRO® 120 element is easy to insert from above between the outdoor component and the floor.

Product categories for application in balconies

- Thermal insulation
- Fastening
- Connection
- Facade fastening

Product information



Product description

The ISOPRO® 120 series incorporates load-bearing thermal insulation elements for connecting outdoor components to buildings. With its 120 mm-thick insulating body, the ISOPRO® 120 affords optimal thermal insulation at the transition between the indoor and outdoor components. The elements are available in a variety of different load-bearing levels and element heights. ISOPRO® 120 is impressively easy to install in situ. In addition to our extensive product range, we now offer "priority" elements. These are popular items that we keep in stock. Additionally, for all special applications, PohlCons engineering department is available to assist you with creative custom solutions.

Advantages

- Effective thermal insulation through the use of optimised materials and cross sections
- Numerous different types and variants for all common applications
- Compression shear bearings make work on site easy
- Priority elements kept in stock for fast delivery
- Product range can be customised in close collaboration with our application engineers to cater for unusual applications
- Proprietary ISODESIGN software makes designing connections easy

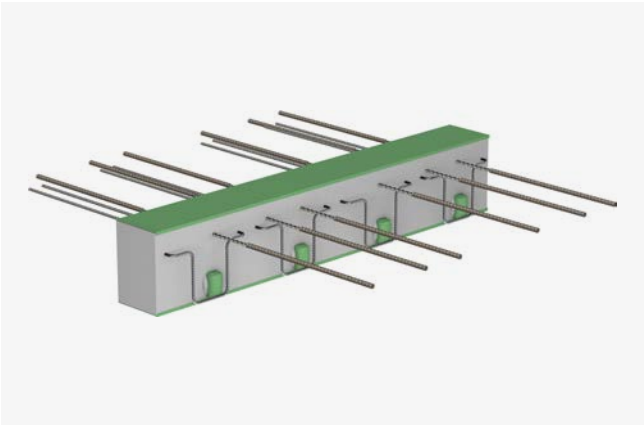
Scope of application

As a load-bearing thermal insulation element, the ISOPRO® 120 thermally separates reinforced concrete components to resolve structural problems at the transition between indoor and outdoor components and creates a frictional connection to reinforced concrete components across the insulating joint. Besides balcony connections, a great many other applications are possible with the ISOPRO® 120.

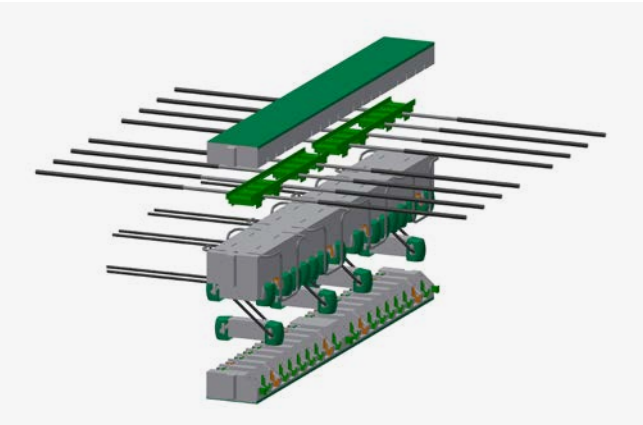
Technical approval

ISOPRO® 120: ETA-17/0466

Product components



ISOPRO® 120 M



ISOPRO® 120 Exploded view

Materials

Tie, shear, compression bar:	B500B reinforcing steel Ribbed stainless steel rebar 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 NEOPOR® is a registered trademark of BASF, Ludwigshafen (Germany)
Fireproof panels:	Fibre-cement board panels from building material class A1 with fire-resistant layer former

Materials of adjacent components

Concrete:	Standard concrete in accordance with DIN 1045-2 or DIN EN 206-1 with a bulk density of 2000 to 2600 kg/m³
Concrete strength classes:	Outdoor components ≥ C25/30 Indoor components ≥ C20/25
Reinforcing steel:	B500 in accordance with DIN 488-1 or DIN EN 1992-1-1 and DIN EN 1992-1-1 NA

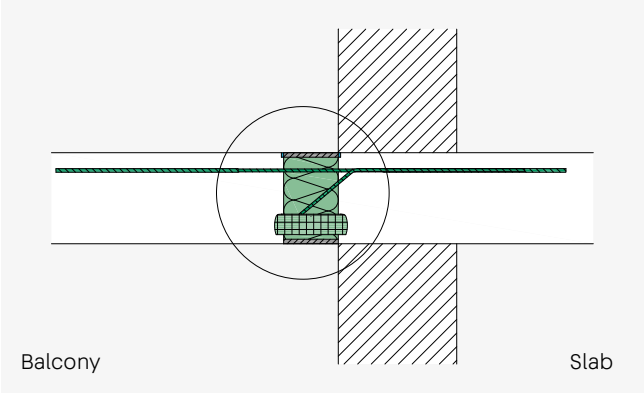
Fire protection

Fire resistance classes REI 90/REI 120

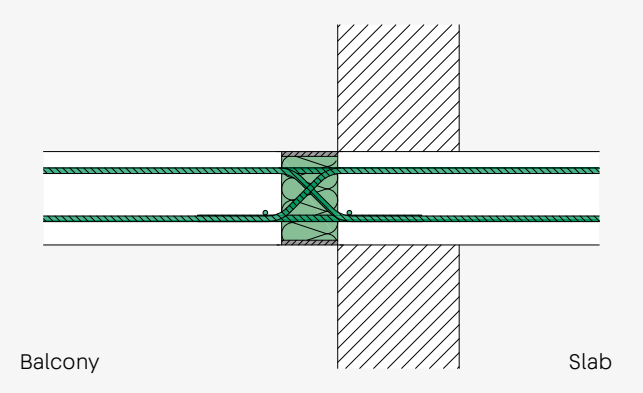
Where there are requirements regarding the fire resistance classification of building components, all ISOPRO® elements with compression bearings are available in fire resistance class REI 120 and all ISOPRO® elements with compression bars are available in fire resistance class REI 90 (fulfills REI 120 when planned with a reduction to 85% in ULS). These ISOPRO fire protection classes are defined according to the ETA-17/0466.

For this purpose, ISOPRO® elements are equipped with fire protection panels on the top and bottom in the factory. The short elements QS, QZ, QQS, A, F and O and the elements for beams and walls S and W are manufactured with all-round fire protection panels in the factory.

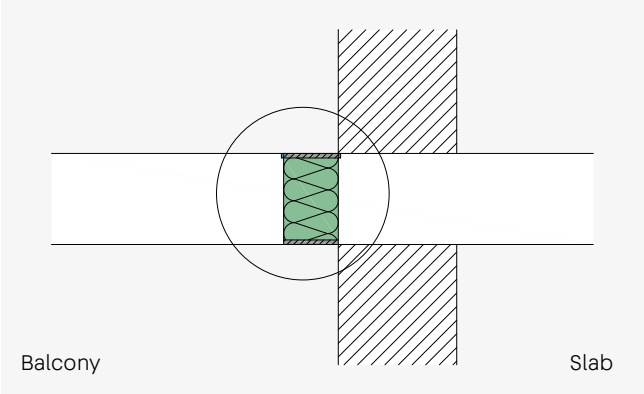
A prerequisite for classification as REI 90/REI 120 is that the adjacent building components meet the requirements for the respective fire resistance class. If a physical barrier (E) and thermal shielding (I) are also required in the event of fire, note that ISOPRO® 120 Z-ISO FP1 of type EI 120 must be used as intermediate insulation when ISOPRO® elements are used at specific points.



ISOPRO® 120 with compression bearings in REI 120.



ISOPRO® 120 with compression bars in REI 90.



ISOPRO® 120 with intermediate insulation in EI 120.

Fire resistance classes of the ISOPRO® 120 types with fire protection in accordance with DIN EN 13501

DIN EN 13501-2 describes the fire resistance classes of building components in accordance with the European standard. The performance criteria "R" (load-bearing capacity), "E" (room enclosure) and/or "I" (thermal insulation) must be maintained over a defined period of time in the event of fire. With REI 120, this applies to all three criteria for a period of at least 120 minutes.

The fire resistance classes of ISOPRO® are regulated in the ETA-17/0466.

Product and type	Fire protection type	Moments load-bearing level / Load-bearing level	Fire resistance classes (with fire separating function of the construction)
Cantilevered components			
IP120 M	REI 120	10 to 120	REI 120
IP120 M-P	REI 120	10 to 120	REI 120
IP120 M WU, WO, HV, UV	REI 120	10 to 40	REI 120
IP120 C	REI 90	10 to 20	REI 90 (REI 120 with ≤ 85% utilization ULS)
Supported components			
IP120 Q	REI 120	10 to 120	REI 120
IP120 QZ	REI 120	10 to 120	REI 120
IP120 QS	REI 120	10 to 90	REI 120
	REI 90	100 to 120	REI 90 (REI 120 with ≤ 85% utilization ULS)
IP120 QSZ	REI 120	10 to 120	REI 120
IP120 QQ	REI 120	10 to 120	REI 120
IP120 QQS	REI 120	10 to 90	REI 120
	REI 90	100 to 120	REI 90 (REI 120 with ≤ 85% utilization ULS)
Continuous elements			
IP120 D	REI 90	20 to 100	REI 90 (REI 120 with ≤ 85% utilization ULS)
Elements for special loads			
IP120 H	REI 120	X1, X2, X1Y1, X2Y2	REI 120
IP120 A	REI 90	1 and 2	REI 90 (REI 120 with ≤ 85% utilization ULS)
IP120 F	REI 90	–	REI 90 (REI 120 with ≤ 85% utilization ULS)
IP120 O	REI 120	1 and 2	REI 120
IP120 S	REI 90	1 to 4	REI 90 (REI 120 with ≤ 85% utilization ULS)
IP120 W	REI 90	1 to 4	REI 90 (REI 120 with ≤ 85% utilization ULS)
IP 120 Z ISO	FP 1	–	REI 90 / REI 120 – according to the ISOPRO load-bearing elements used

Notes

For the ISOPRO® with fire protection and steel compression bearings the fire protection class is REI 120 when the reaction coefficient η_{fi} (in accordance with EN 1992-1-2, section 2.4.2) is reduced to 0.6 – this corresponds to an utilization of ≤ 85% in ULS (ultimate limit state).

To satisfy fire protection requirements, it must be ensured that any insulation between individual ISOPRO® elements also meets the fire protection requirements. ISOPRO® Z ISO FP1 (EI 120) can be used for this purpose.

Structural design principles

General information

- The abutting reinforced concrete components are verified and reinforced by the structural engineer. For reinforcement, please note ability for concreting. This applies in particular to ISOPRO® 120 elements with significant reinforcement.
- 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 dimensioning.
- The specified design values apply to concrete grades ≥ C25/30.
- The table values specified for the on-site reinforcement apply to full utilisation of the ISOPRO® 120 elements. A reduction by m_{Ed}/m_{Rd} or v_{Ed}/v_{Rd} is permissible.
- The concrete covers are to be determined in accordance with EN 1992-1-1 and the corresponding national appendices for the components.
- The specified minimum heights depending on the shear force load-bearing level apply to concrete cover cv35. For cv50 these increase by 20 mm.
- Horizontal loads (wind or seismic design, stabilisation) can be transmitted by ISOPRO® 120 H.
- For cantilevered structures without an imposed load and with a planned moment from a load that does not increase the shear force, the ISOPRO® 120 M elements must be verified separately by our engineering department.

Load assumptions

g_k: Permanent loads (weight of structure itself + permanent loads fixed to structure)
q_k: Imposed load
V_k: Edge load (railings, balustrade, plinth, etc.)
M_k: Edge moment (due to horizontal load on railings, balustrade, etc.)

Procedure for FEM calculation

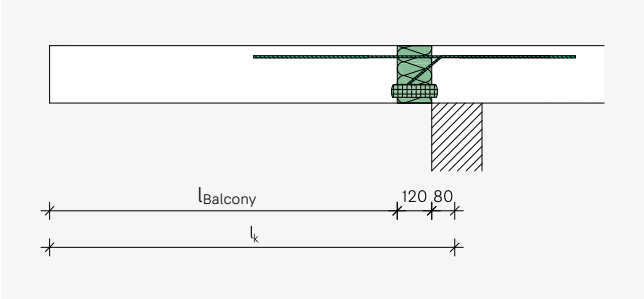
- Calculate the balcony slab as a system separate from the load-bearing structure of the building.
- Define supports in the connection area using the stiffness values mentioned on page 11.
- Determine the internal forces using linear elasticity.
- Select ISOPRO® 120 elements.
- Apply the internal forces determined as an edge load to the load-bearing structure of the building.

Notes

If the stiffness ratios vary greatly along the edge of the slab (e.g. columns along the edge of the slab and no continuous wall), the balcony slab should not be calculated as a system separate from the building. In this case, a joint line should be defined along the edge of the balcony slab with the stiffness values given on page 11. The ISOPRO® 120 elements can be determined by means of the joint forces.

System determination

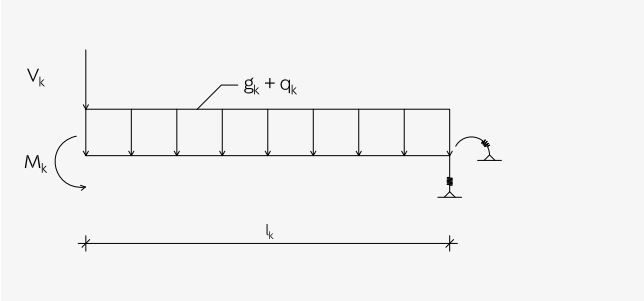
Cantilever



System

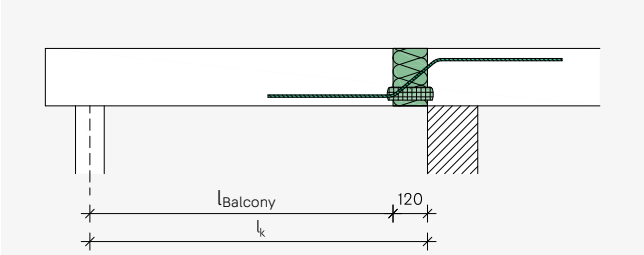
Manual calculation: Restrained

FEM calculation: Torsion spring 10,000 kNm/rad/m
Retractable spring 250,000 kN/m/m



Model

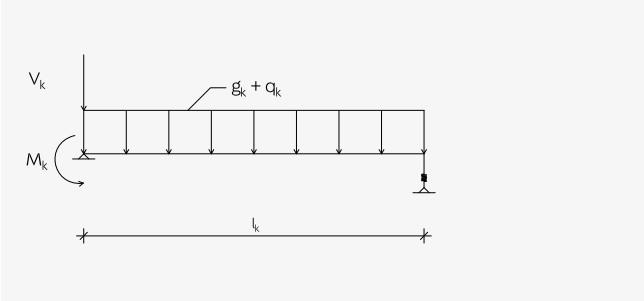
Supported



System

Manual calculation: Articulated

FEM calculation: Torsion spring –
Retractable spring 250,000 kN/m/m



Model

Proof of serviceability

Precamber

A cantilever slab under load deforms with the maximum deformation occurring at the cantilever end. If a cantilever slab is connected with an ISOPRO® 120 element, the proportion of deformation from the slab itself must be imposed on that of the ISOPRO® 120 element to determine the maximum deformation. In this case, the ISOPRO® 120 tie bars and compression components behave approximately similar to a spring system being stretched or compressed. The resulting angle of rotation is used to determine the maximum deformation of the ISOPRO® 120 element. We recommend performing verification in the serviceability limit state using the quasi-permanent combined load. To determine the required precamber of the cantilevered slab, the deformation should be rounded up or down according to the direction of the planned drainage.

To determine the deformation, see the individual chapters for the ISOPRO® 120 types.

Flexural aspect ratio

The flexural aspect ratio is defined as the ratio of the structural height d of the balcony slab to the cantilever length lk. The flexural aspect ratio of a slab has an effect on its vibration behaviour. Therefore, we recommend limiting the flexural aspect ratio. Limit values for the flexural aspect ratio are given on page 23.

Expansion joint spacing

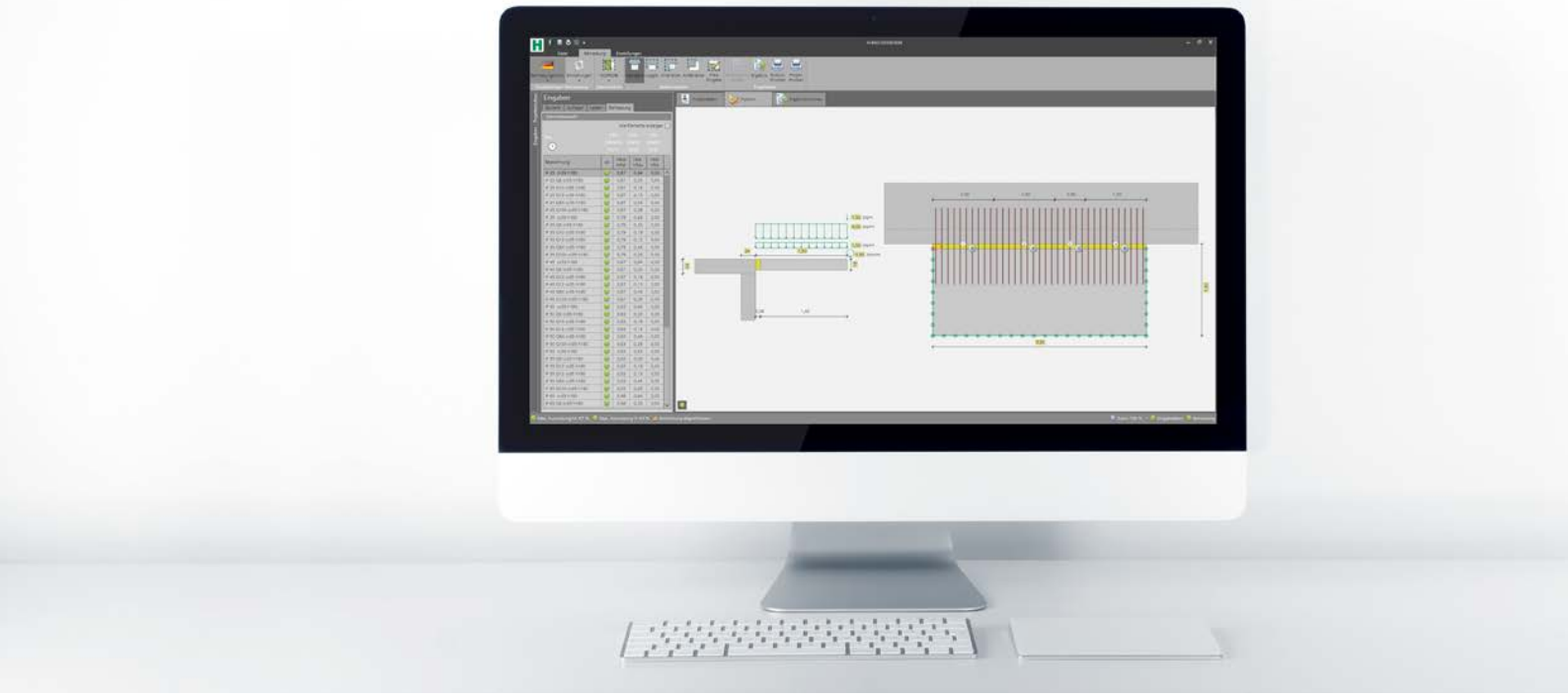
The effects of temperature on exterior building components such as balconies or canopies cause deformation of reinforced concrete components. These expand when heated and contract when they cool down. If the reinforced concrete components are thermally separated using ISOPRO® 120 elements, the ISOPRO® 120 components are deflected parallel to the insulating joint when the reinforced concrete slab deforms.

Very long reinforced concrete components must be separated by expansion joints to limit the stress on the ISOPRO® 120 elements due to temperature effects. The maximum permissible expansion joint spacing e is specified in the approval.

The expansion joint spacing e depends on the rebar diameter and thus on the ISOPRO® 120 type used (details can be found in the respective product information). Fixed points, such as supports that run around corners, or the use of ISOPRO® 120 H elements result in increased stress forces. This means that the maximum permissible expansion joint spacing must be reduced to e/2.

To prevent components separated by expansion joints from being unevenly compressed, they can be connected with longitudinally displaceable shear dowels of type HED.

ISODESIGN design software



Dimensioning the ISOPRO® 120

Our ISODESIGN design program makes our years of experience in designing ISOPRO® thermal insulation elements for the most common balcony systems available to you.

You can choose between the following balcony systems: cantilevered balcony, balcony on supports, loggia, inner corner balcony and outer corner balcony. Alternatively, you can enter unusual geometries in the free input fields. After entering the geometric data and the loads acting on the various components, you can select the corresponding ISOPRO® elements.

The feasibility of your layout and geometric characteristics of the ISOPRO® elements can be checked in floor plan and cross-section views. A structural analysis printout and a parts list are available for following work.

Benefits

- In addition to the standard balcony systems there is now also a "Custom input" option
- Calculation with FEM software
- Printout of log and verification

Consultation

Our Application Technology department will be happy to assist you with further solutions:

T +49 7742 9215-300
technik-hbau@pohlcon.com

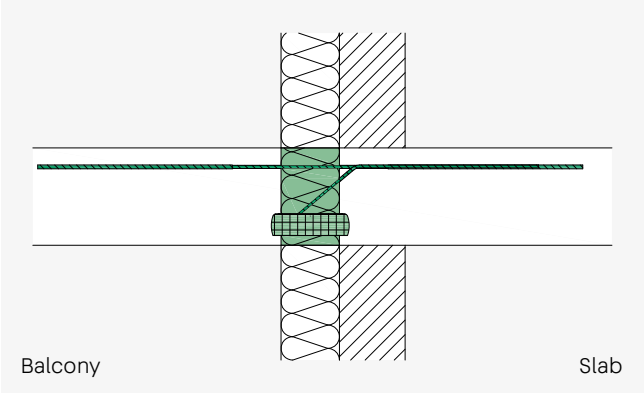
General installation information

Handling and installation on site

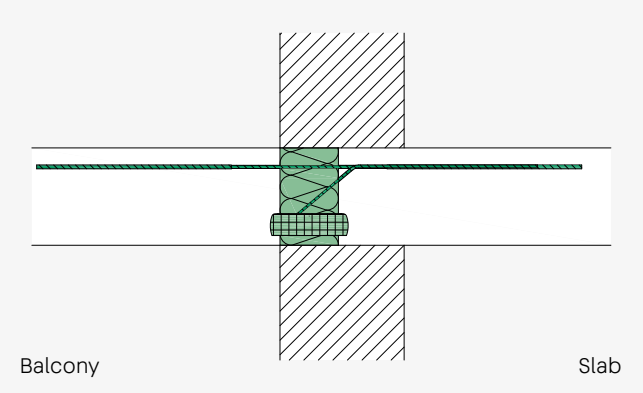
- When using ISOPRO® 120 elements with concrete compression bearings, ensure that a secure frictional connection between the compression bearing and the concrete of the component is created. When using element slabs, an in-situ concrete or grouting strip at least 100 mm wide must therefore be taken into account.
- When using ISOPRO® 120 elements with steel compression bars in floor element slabs, ensure that the width of the in-situ concrete strip is compatible with the length of the compression bars.
- When using ISOPRO® 120 elements with fire protection type REI 120, ensure that the fireproof panels are not damaged.
- Subsequent bending of the reinforcement bars on the construction site will render the approval and warranty by PohlCon GmbH void.
- The ISOPRO® 120 metre elements can be divided up on site. We recommend dividing the elements into 25 cm grids and filling any remaining lengths with ISOPRO® 120 Z-ISO intermediate insulation, and possibly with fire protection type FP1.
- In heavily reinforced components (e.g. joists), consider the possibility of laying the ISOPRO® 120 element before the in-situ reinforcement takes place.

Position in the building component

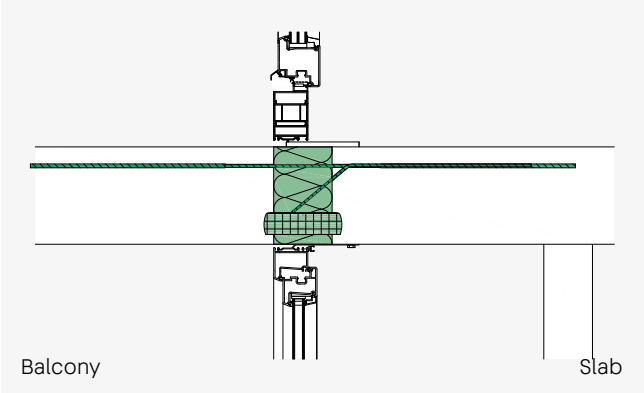
To reliably prevent thermal bridges, the ISOPRO® 120 elements are installed in the insulation level.



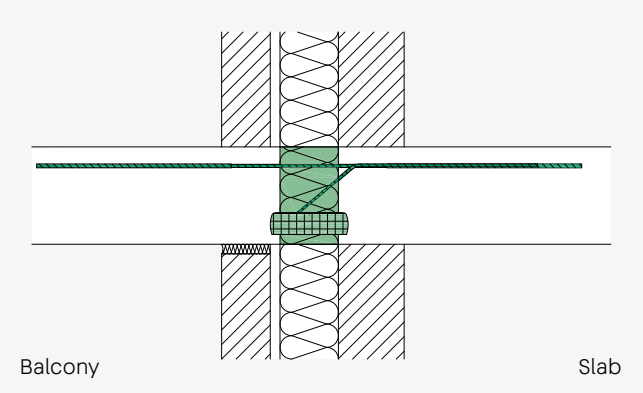
ISOPRO® 120 – installation cross section, thermal insulation composite system



ISOPRO® 120 – installation cross section, solid wall



ISOPRO® 120 – installation cross section, glass facade

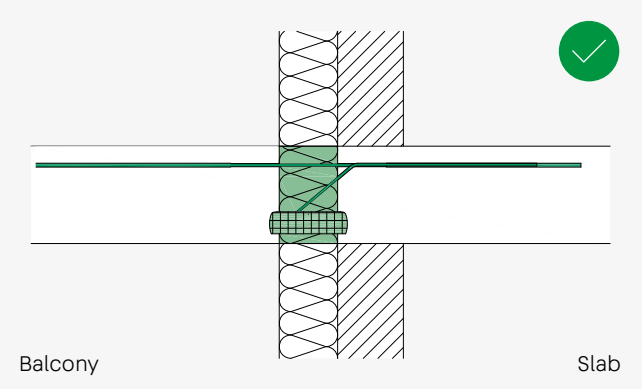


ISOPRO® 120 – installation cross section, cavity wall

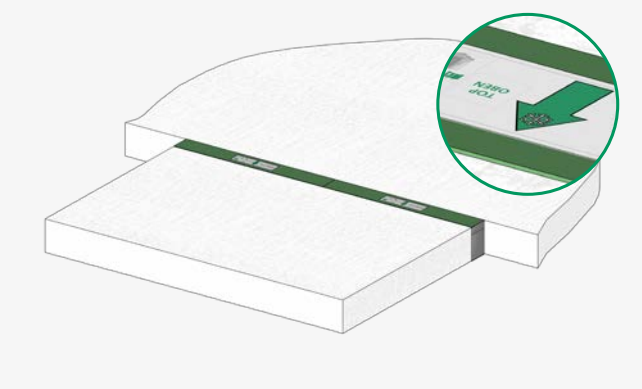
Installation direction

During installation, the correct installation direction for the balcony side/slab side and top/bottom must be observed. When installed correctly, the tie bars are at the top and the compression bearings/compression bars are at the bottom.

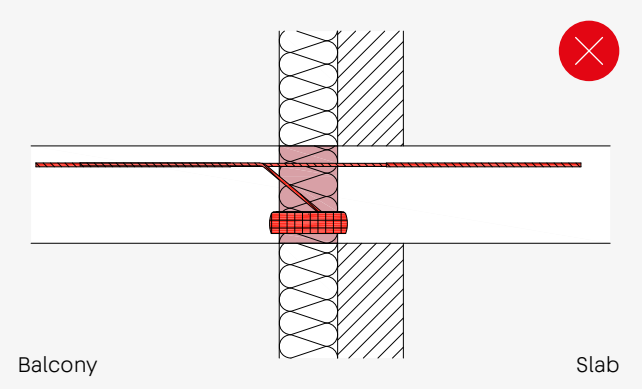
The shear bar runs diagonally through the ISOPRO® 120 element starting at the bottom on the balcony side and ends at the top on the slab side.



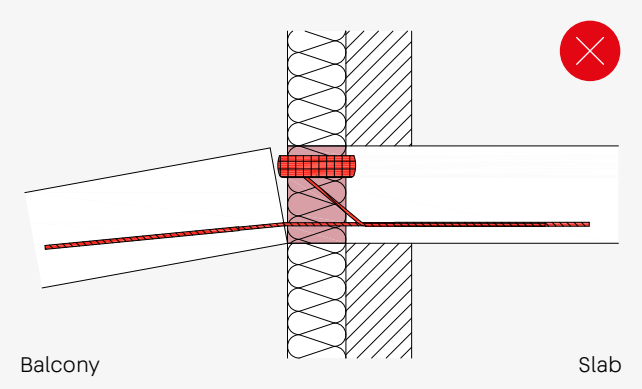
ISOPRO® 120 – Correct installation



ISOPRO® 120 – Installation direction



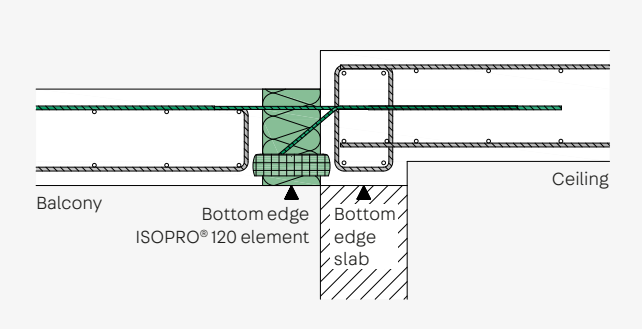
ISOPRO® 120 – Incorrect installation, shear bar must be on the slab side



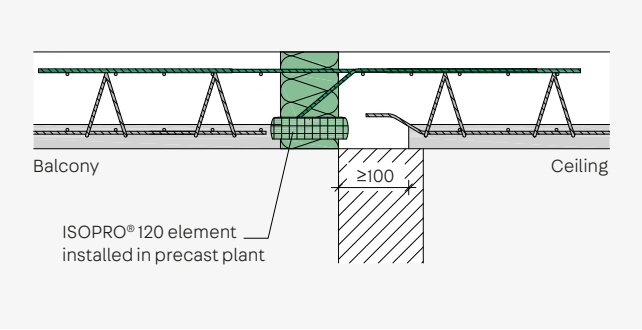
ISOPRO® 120 – Incorrect installation, tie bar must be at the top

Compression joint

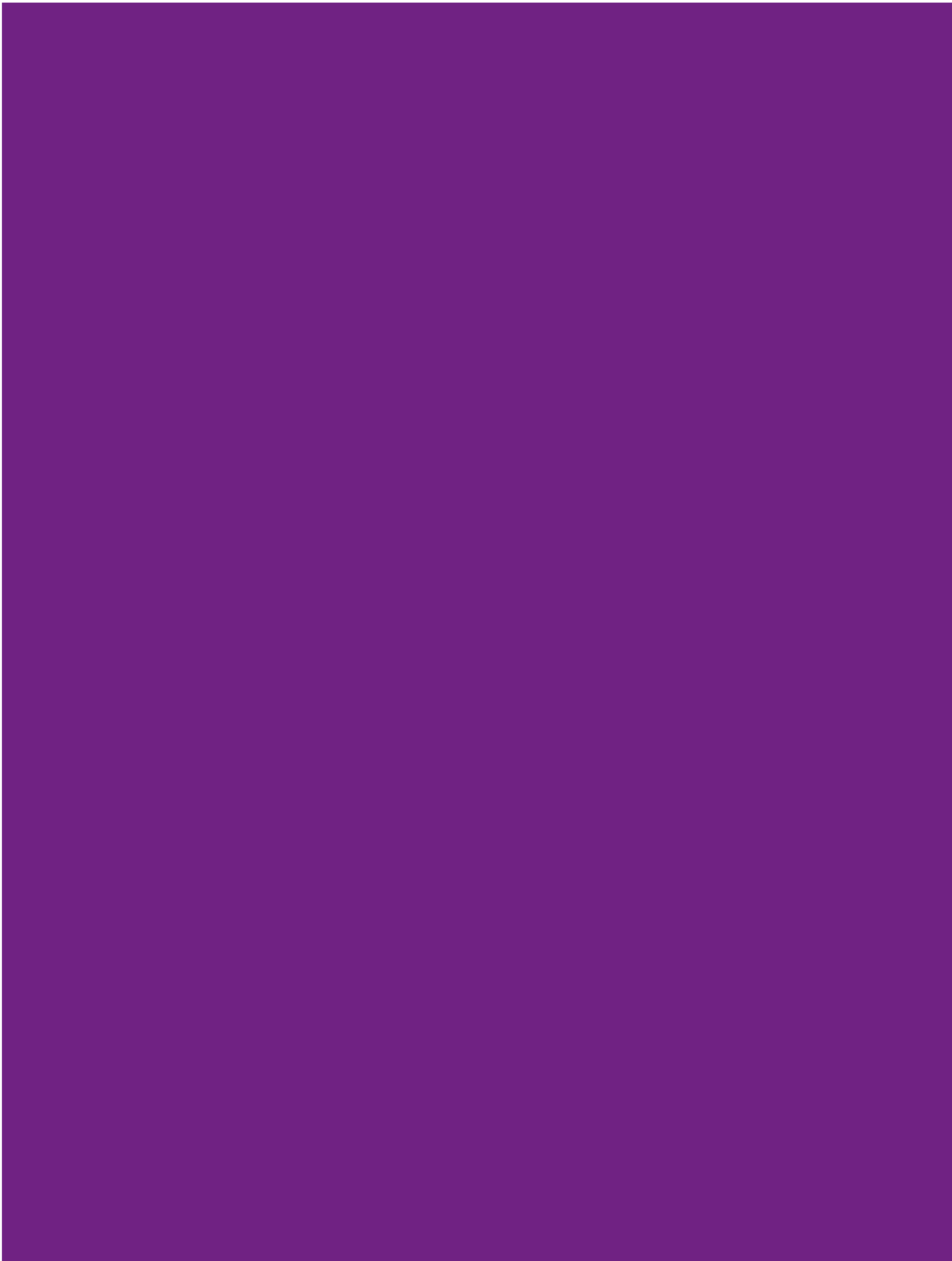
When installing the elements, ensure that a secure positive connection is created between the compression bearing and the fresh concrete. A compression joint of ≥ 100 mm must be provided for this purpose; the concreted section boundaries must be chosen accordingly. This applies especially when using prefabricated components and element slabs.



ISOPRO® 120 elements for in-situ concrete construction and vertically offset ceiling plates



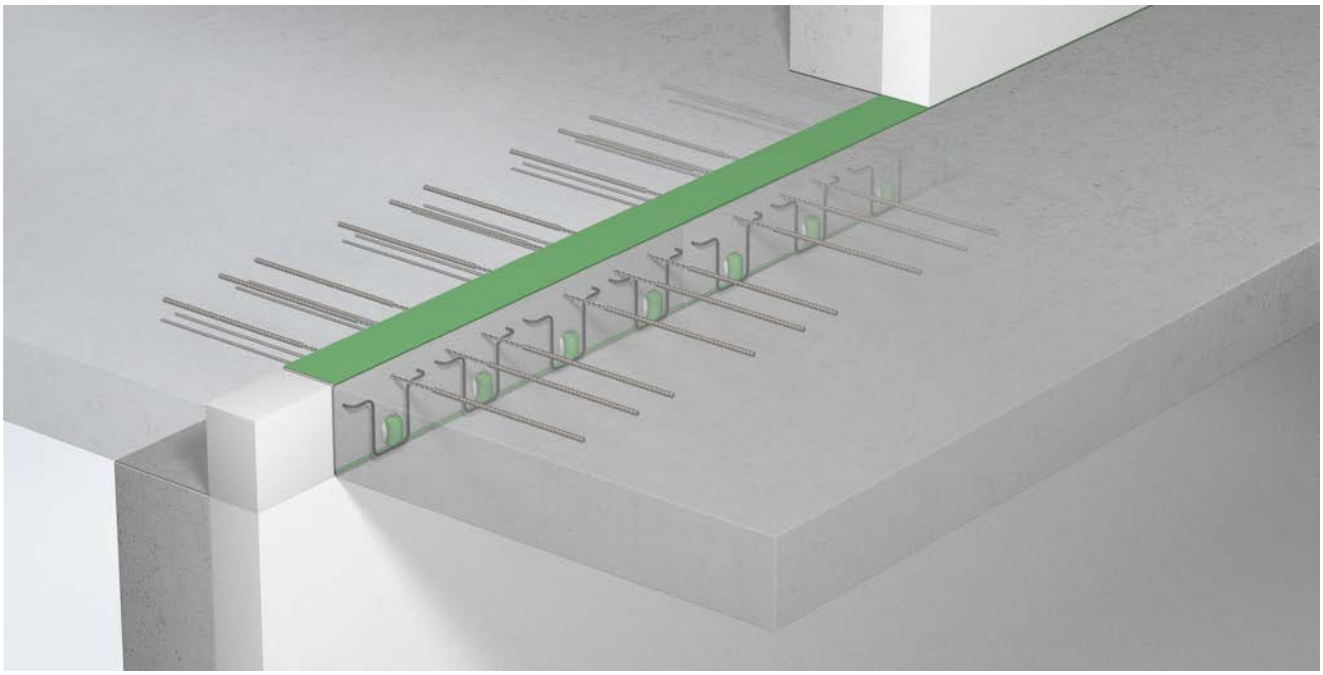
ISOPRO® 120 elements in conjunction with element slabs



Cantilevered components

IP 120 M

Elements for cantilevered balconies



IP 120 M

- For transferring moments and shear forces
- Load-bearing levels M 10 to M 120
- Shear force load-bearing levels Q4, Q6, Q8, Q4Q4, Q8Q4 and Q6Q6
- Concrete cover cv35 or cv50
- Element heights from 160 mm
- Fire resistance class REI 120 available
- Compression level with concrete compression bearings

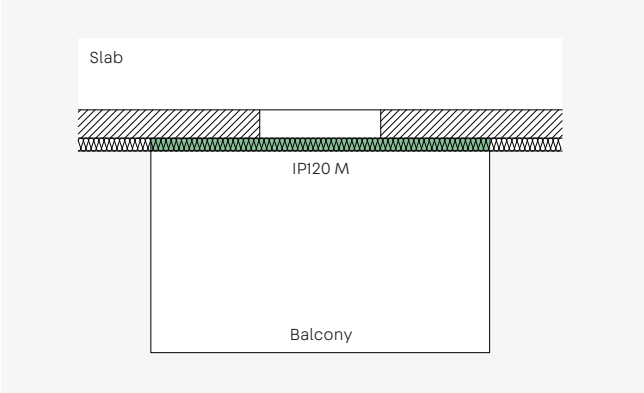
Type designation

IP 120 M 80 Q6 cv35 h200 REI 120

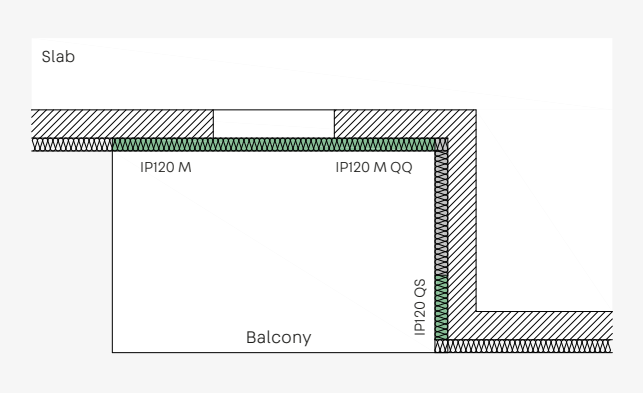
- REI 120 — Fire protection type
- h200 — Element height
- cv35 — Concrete cover
- Q6 — Shear force load-bearing level
- M 80 — Load-bearing level
- M — Type
- IP 120 — Abbreviation of product name

Application – Element arrangement

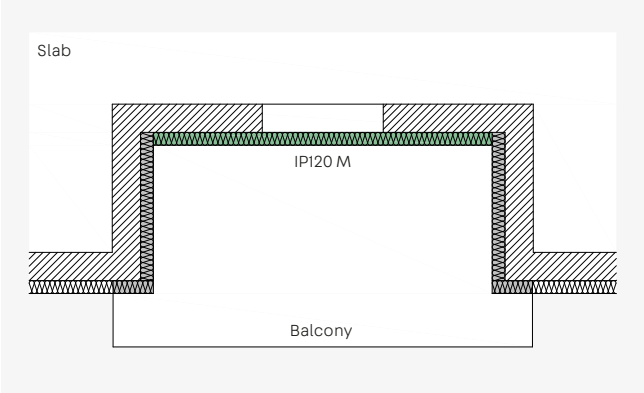
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



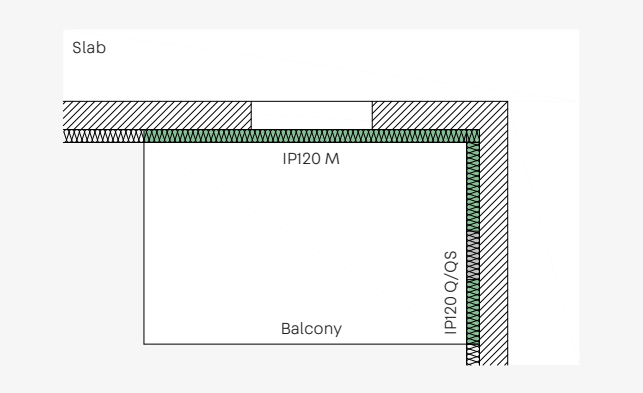
ISOPRO® 120 M – Cantilevered balconies



ISOPRO® 120 M – Cantilevered balconies in facade extensions



ISOPRO® 120 M – Cantilevered balconies in facade recesses



ISOPRO® 120 M in combination with Q and QS internal corner balconies

Measurement table for concrete ≥ C25/30

Rated values of the moments that can be transferred m_{Rd} in kNm/m

Element height mm		ISOPRO® 120 concrete ≥ C25/30					
cv 35	cv 50	M 10	M 20	M 30	M 40	M 50	M 60
160	-	9.6	15.1	22.4	24.3	25.8	29.0
-	180	10.3	16.2	23.9	25.9	27.4	30.8
170	-	10.9	17.1	25.3	27.4	29.0	32.6
-	190	11.6	18.2	26.9	29.0	30.6	34.5
180	-	12.2	19.1	28.3	30.5	32.2	36.3
-	200	12.9	20.2	29.8	32.2	33.9	38.1
190	-	13.5	21.1	31.2	33.7	35.5	39.9
-	210	14.2	22.2	32.7	35.4	37.1	41.7
200	-	14.8	23.2	34.1	36.9	38.7	43.5
-	220	15.5	24.3	35.5	38.6	40.3	45.3
210	-	16.1	25.2	37.0	40.2	41.9	47.2
-	230	16.9	26.3	38.4	41.9	43.5	49.0
220	-	17.5	27.3	39.8	43.4	45.1	50.8
-	240	18.3	28.4	41.2	45.2	46.7	52.6
230	-	18.9	29.4	42.6	46.7	48.4	54.4
-	250	19.6	30.6	44.0	48.5	50.0	56.2
240	-	20.3	31.5	45.4	50.0	51.6	58.0
250	-	21.7	33.7	48.2	53.4	54.8	61.7

Rated values of the shear force that can be transferred v_{Rd} in kN/m

ISOPRO® 120		M 10	M 20	M 30	M 40	M 50	M 60
Q	Q4	72.7	72.7	72.7	72.7	72.7	72.7
	Q6	109.0	109.0	109.0	109.0	109.0	109.0
	Q8	145.4	145.4	145.4	145.4	145.4	145.4
QQ	Q4Q4	72.7 / -72.7					
	Q8Q4	145.4 / -72.7					
	Q6Q6	109.0 / -109.0					

Dimensions and configuration

ISOPRO® 120		M 10	M 20	M 30	M 40	M 50	M 60
Tie bars*		5(6) Ø 8	8(9) Ø 8	12(13) Ø 8	13(14) Ø 8	10(10) Ø 10	11(11) Ø 10
Compression bearings		4	5	7	8	8	9
Q	Q4	4 DQ+	4 DQ+	4 DQ+	4 DQ+	4 DQ+	4 DQ+
	Q6	6 DQ+	6 DQ+	6 DQ+	6 DQ+	6 DQ+	6 DQ+
	Q8	8 DQ+	8 DQ+	8 DQ+	8 DQ+	8 DQ+	8 DQ+
QQ	Q4Q4	4 DQ+ / 4 DQ -					
	Q8Q4	8 DQ+ / 4 DQ-					
	Q6Q6	6 DQ+ / 6 DQ-					
Element length mm		1000	1000	1000	1000	1000	1000
Distance between expansion joints m		21.7	21.7	21.7	21.7	21.7	21.7

*The number of tie bars given in corbels corresponds to the QQ shear force versions.

Rated values of the moments that can be transferred m_{Rd} in kNm/m

Element height mm		ISOPRO® 120					
		Concrete ≥ C25/30					
cv 35	cv 50	M 70	M 80	M 90	M 100	M 110	M 120
160	-	34.3	37.0	39.8	44.4	48.4	56.3
-	180	36.5	39.5	42.5	47.4	51.6	60.0
170	-	38.7	41.8	45.0	50.2	54.7	63.6
-	190	41.0	44.3	47.7	53.2	57.9	67.4
180	-	43.2	46.7	50.2	56.0	61.0	70.9
-	200	45.5	49.2	52.9	59.1	64.3	74.8
190	-	47.7	51.5	55.4	61.9	67.4	78.4
-	210	50.0	54.1	58.1	65.0	70.7	82.2
200	-	52.2	56.4	60.6	67.8	73.8	85.8
-	220	54.6	59.0	63.4	70.9	77.2	89.7
210	-	56.8	61.4	65.9	73.8	80.3	93.3
-	230	59.2	64.0	68.7	76.9	83.7	97.2
220	-	61.4	66.3	71.3	79.7	86.8	100.8
-	240	63.8	69.0	74.1	82.9	90.2	104.5
230	-	66.0	71.3	76.6	85.8	93.3	108.1
-	250	68.5	74.0	79.5	89.0	96.8	111.7
240	-	70.7	76.3	82.0	91.8	99.9	115.3
250	-	75.4	81.4	87.4	97.9	106.5	122.6

Rated values of the shear force that can be transferred v_{Rd} in kN/m

ISOPRO® 120		M 70	M 80	M 90	M 100	M 110	M 120
Q	Q4	72.7	72.7	72.7	72.7	72.7	72.7
	Q6	109.0	109.0	109.0	109.0	109.0	109.0
	Q8	145.4	145.4	145.4	145.4	145.4	145.4
QQ	Q4Q4	72.7 / -72.7					
	Q8Q4	145.4 / -72.7					
	Q6Q6	109.0 / -109.0					

Dimensions and configuration

ISOPRO® 120		M 70	M 80	M 90	M 100	M 110	M 120
Tie bars*		12(13) Ø 10	13(14) Ø 10	14(15) Ø 10	11(12) Ø 12	12(13) Ø 12	14(15) Ø 12
Compression bearings		11	12	13	15	16	18
Q	Q4	4 DQ+	4 DQ+	4 DQ+	4 DQ+	4 DQ+	4 DQ+
	Q6	6 DQ+	6 DQ+	6 DQ+	6 DQ+	6 DQ+	6 DQ+
	Q8	8 DQ+	8 DQ+	8 DQ+	8 DQ+	8 DQ+	8 DQ+
QQ	Q4Q4	4 DQ+ / 4 DQ -					
	Q8Q4	8 DQ+ / 4 DQ-					
	Q6Q6	6 DQ+ / 6 DQ-					
Element length mm		1000	1000	1000	1000	1000	1000
Distance between expansion joints m		21.7	21.7	21.7	19.8	19.8	19.8

*The number of tie bars given in corbels corresponds to the QQ shear force versions.

Fitness for purpose

Deformation

During their creation, projecting reinforced concrete structures are elevated to take into account the anticipated deformation. If these structures are thermally separated with ISOPRO® 120 elements, when calculating the elevation, the deformation due to the ISOPRO® 120 element itself is superimposed with the deformation due to flexion of the slab in accordance with DIN EN 1992-1-1/NA. It must be ensured that the required elevation is rounded up or down, according to the planned drainage direction. If a drainage system is installed at the building facade, 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 limit state for the quasi-continuous load combination ($\gamma_G = 1.0$, $\gamma_Q = 1.0$, $\psi_2 = 0.3$). The tables below show the deformation factors tan α for calculating the deformation due to ISOPRO® 120.

Deformation due to the ISOPRO® 120 cantilever slab connection

w_1 = Deformation from thermal insulation element
w_2 = Deformation from slab deformation

$w_1 = \tan \alpha \cdot (m_{Ed}/m_{Rd}) \cdot l_k \cdot 10$

with

w_1	= Deformation at the end of the cantilever arm in mm due to the thermal insulation element
tan α	= Deformation factor, see table
m_{Ed}	= Bending moment for calculating the elevation as a result of the ISOPRO® 120 element The definitive load case combination in the suitability for use in the limit state is made by the planner.
m_{Rd}	= Moment of resistance of the ISOPRO® 120 element, see pages 20 – 21
l_k	= System length in m

Deformation factor tan α for concrete ≥ C25/30

ISOPRO® 120	Concrete cover cv mm	Height h mm									
		160	170	180	190	200	210	220	230	240	250
M 10 to M 40	35	1.4	1.3	1.2	1.0	1.0	0.9	0.8	0.8	0.7	0.7
	50	-	-	1.4	1.2	1.1	1.0	0.9	0.9	0.8	0.7
M 50 to M 90	35	1.7	1.5	1.3	1.2	1.1	1.0	1.0	0.9	0.8	0.8
	50	-	-	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9
M 100 to M 120	35	1.8	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.8
	50	-	-	1.7	1.5	1.3	1.2	1.1	1.0	1.0	0.9

Flexural aspect ratio

The flexural aspect ratio is defined as the ratio of the structural height d of the balcony slab to the cantilever length l_k. The flexural aspect ratio of a slab has an effect on its vibration behaviour. Therefore, it is advisable to limit the flexural aspect ratio for cantilevered reinforced concrete constructions.

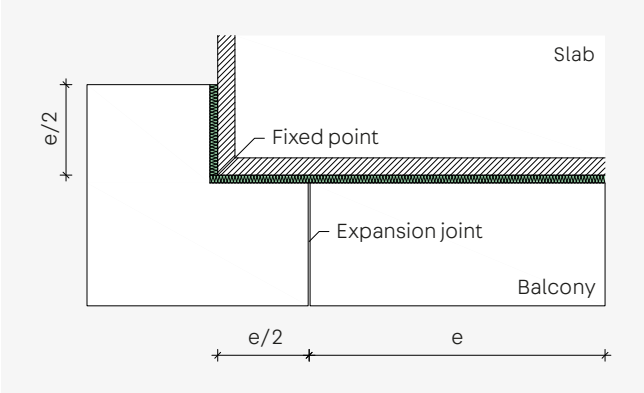
Recommended maximum cantilever length l_k in m

Concrete cover cv mm	Height h mm									
	160	**170**	**180**	**190**	**200**	**210**	**220**	**230**	**240**	**250**
35	1.68	1.82	1.96	2.10	2.24	2.38	2.52	2.66	2.80	2.94
50	1.47	1.61	1.75	1.89	2.03	2.17	2.31	2.45	2.59	2.73

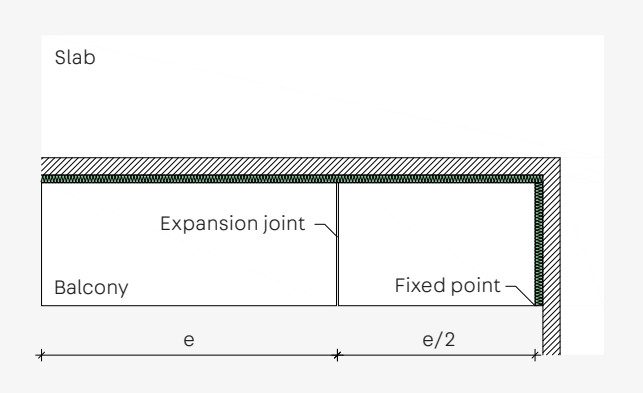
Expansion joint spacing

If the component dimensions exceed the maximum permissible expansion joint spacing, expansion joints must be aligned perpendicular to the insulation layer. The maximum permissible expansion joint spacing e depends on the maximum bar diameter across the expansion joint, and thus depends on the type.

Fixed points, such as supports that run around corners, or the use of ISOPRO® 120 H elements result in increased stress forces. This means that the maximum permissible expansion joint spacing must be reduced to e/2. Half the maximum expansion joint distance is always measured from the fixed point.



Expansion joint arrangement with fixed point at outside corner



Expansion joint arrangement with fixed point at inside corner

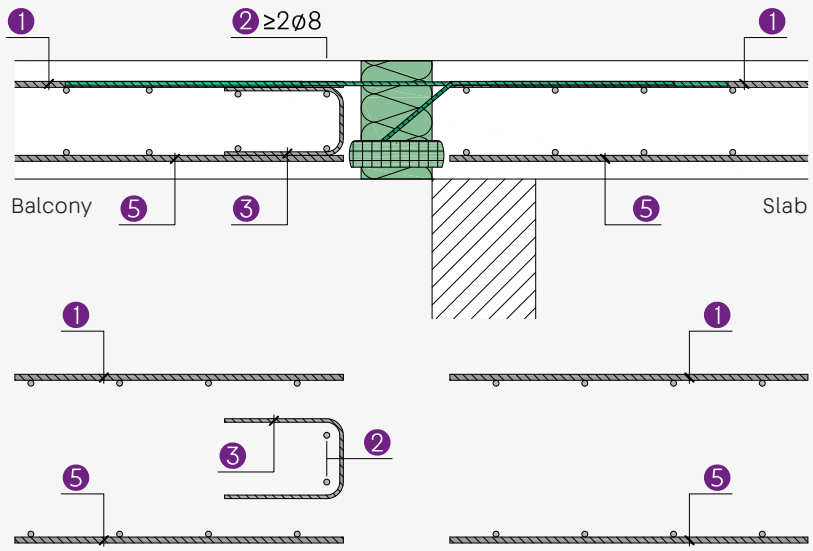
Notes

The values for the maximum permissible expansion joint spacing can be found in the measurement tables on pages 20 – 21.

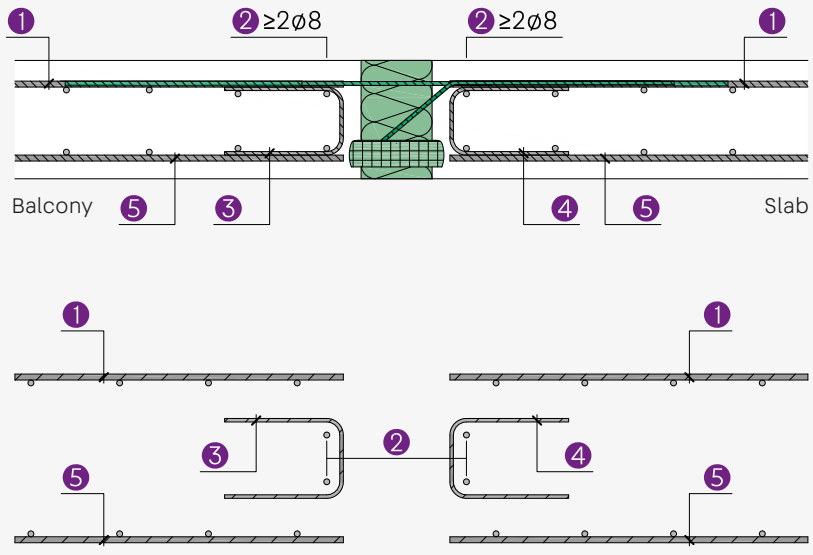
On-site reinforcement

M 10 to M 120

Direct support



Indirect support



Notes
For information on the required reinforcement diameters of the individual positions, see the table on page 25.

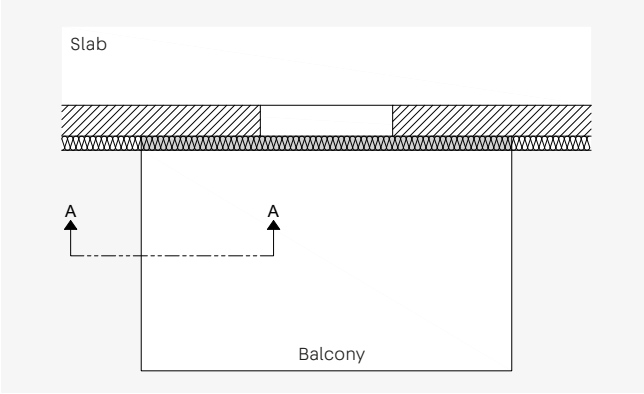
M 10 to M 60

$a_{s,erf}$		ISOPRO® 120					
		M 10	**M 20**	**M 30**	**M 40**	**M 50**	**M 60**
Pos. 1	**Connection reinforcement** cm²/m	2.97	4.60	6.49	7.28	7.42	8.34
Pos. 2	**Direct support**	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8
Pos. 3	**Q design**	≥ Ø 6/250					
	QQ design	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
Pos. 4	**Direct support Q**	-					
	Indirect support Q	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
	Direct support QQ						
	Indirect support QQ						
Pos. 5	**Component reinforcement**	As specified by the structural engineer					
Pos. 6	**Supplementary edge reinforcement**	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

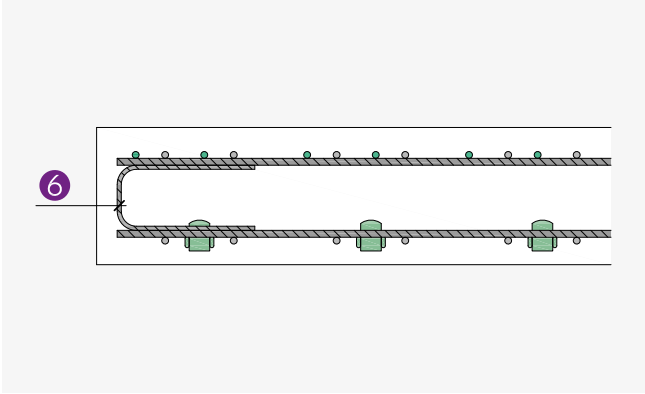
M 70 to M 120

$a_{s,erf}$		ISOPRO® 120					
		M 70	**M 80**	**M 90**	**M 100**	**M 110**	**M 120**
Pos. 1	**Connection reinforcement** cm²/m	10.20	11.12	11.95	13.46	14.63	16.68
Pos. 2	**Direct support**	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8
Pos. 3	**Q design**	≥ Ø 6/250					
	QQ design	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
Pos. 4	**Direct support Q**	-					
	Indirect support Q	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
	Direct support QQ						
	Indirect support QQ						
Pos. 5	**Component reinforcement**	As specified by the structural engineer					
Pos. 6	**Supplementary edge reinforcement**	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

Supplementary edge reinforcement



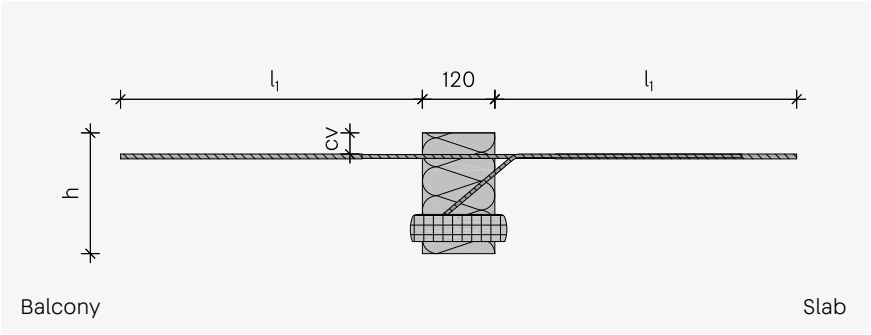
Top view balcony



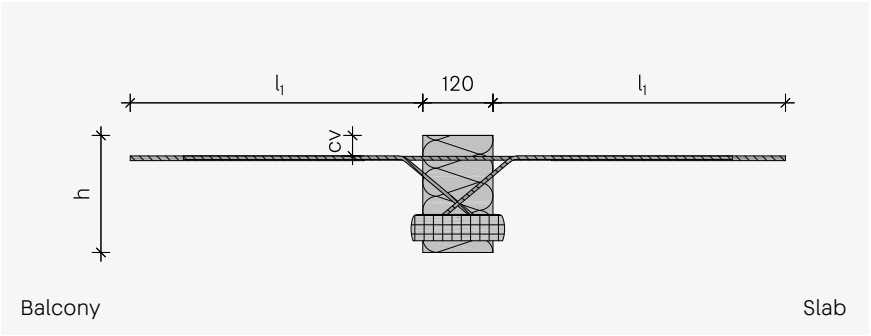
A-A cross-section

Element dimensions

M 10 to M 120 – Positive shear forces Q4, Q6, Q8



M 10 to M 120 – Positive and negative shear forces Q4Q4, Q8Q4, Q6Q6

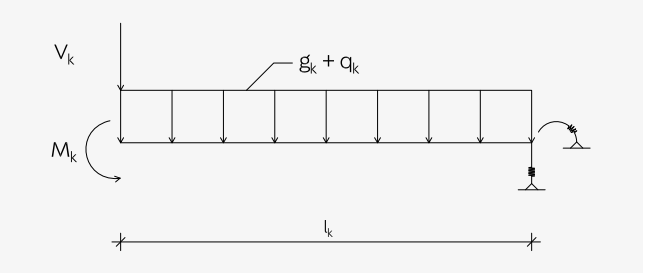


Dimensions in mm

ISOPRO® 120	M 10 to M 40	M 50 to M 90	M 100 to M 120
l_1	520	630	730
h	160-250		
cv	35/50		
Element length	1000		

Design example

Element selection, deformation and precamber



System:
Projecting cantilever
System length cantilever l_k = 2.12 m
Balcony slab thickness = 200 mm
Concrete cover cv35
Balcony and slab C25/30 concrete

Load assumptions:
Self weight g_k = 5.00 kN/m²
Surcharge/surface g_k = 1.50 kN/m²
Imposed load q_k = 4.00 kN/m²
Edge load V_k = 1.50 kN/m
Edge moment M_k = 0.00 kNm/m

Applied forces:
$m_{Ed} = (g_k \cdot 1.35 + q_k \cdot 1.5) \cdot l_k^2 / 2 + (G_k \cdot 1.35) \cdot l_k$
$v_{Ed} = (g_k \cdot 1.35 + q_k \cdot 1.5) \cdot l_k + (G_k \cdot 1.35)$
$m_{Ed} = (6.50 \cdot 1.35 + 4.00 \cdot 1.5) \cdot 2.12^2 / 2 + (1.50 \cdot 1.35) \cdot 2.12 =$ <u>-37.50 kNm/m</u>
$v_{Ed} = (6.50 \cdot 1.35 + 4.00 \cdot 1.5) \cdot 2.12 + (1.50 \cdot 1.35) =$ <u>33.30 kN/m</u>

Calculation:
Selected: M 50, Q4, cv35, h = 200 mm

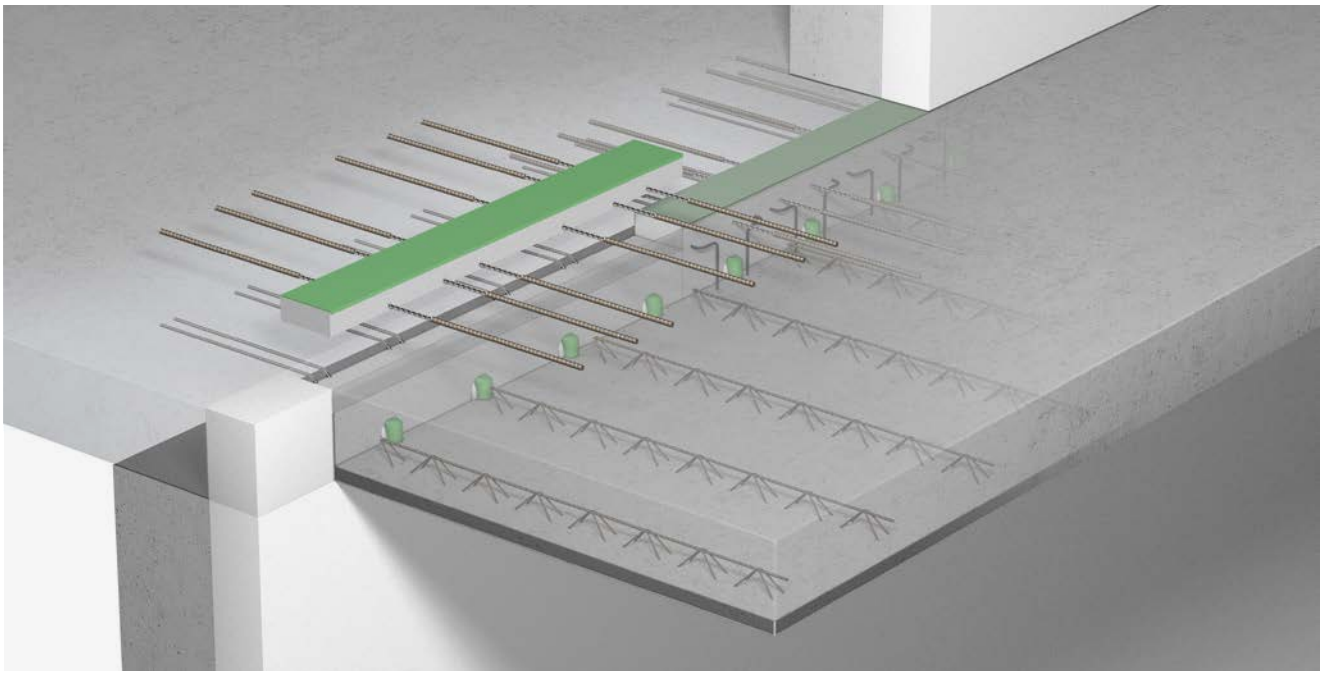
$m_{Rd} = |-38.70|$ kNm/m ≥ $|-37.50|$ kNm/m (see page 20)
v_{Rd} = 72.70 kN/m ≥ 33.30 kN/m

Recommendation for cantilever length:
Cantilever length l_k = 2.12 m
Balcony slab thickness h = 200 mm
Concrete cover cv35
Recommended maximum cantilever length l_k = 2.24 m ≥ 2.12 m

Deformation due to the thermal insulation element:
Quasi-permanent load combination almost constant $\Psi_2 = 0.30$, $\gamma_G = 1.00$, $\gamma_Q = 1.00$
$m_{Ed,perm} = m_{gk} + m_{qk} \cdot \Psi_2$
$m_{Ed,perm} = (g_k + q_k \cdot \Psi_2) \cdot l_k^2 / 2 + G_k \cdot l_K$
$m_{Ed,perm} = (6.50 + 4.00 \cdot 0.3) \cdot 2.12^2 / 2 + 1.50 \cdot 2.12 =$ <u>-20.50 kNm/m</u>
$w_1 = \tan \alpha \cdot (m_{Ed,perm} / m_{Rd}) \cdot l_k \cdot 10$
$\tan \alpha = 1.1$ (see page 28)
$w_1 = 1.1 \cdot (20.50 / 38.70) \cdot 2.12 \cdot 10 =$ <u>12.30 mm</u>

IP 120 M P

Two-part elements for cantilevered balconies



IP 120 M P

Two-part elements designed for installing the lower part of precast slabs in the precast concrete plant and fitting the upper section on the construction site.

- For transferring moments and shear forces
- Load-bearing levels M 10 to M 120
- Shear force load-bearing levels Q4, Q6, Q8, Q4Q4, Q8Q4 and Q6Q6
- Concrete cover cv35 or cv50
- Element heights from 160 mm
- Fire resistance class REI 120 available
- Compression level with concrete compression bearings

Type designation

IP 120 M 80 P Q4 cv35 h200 REI 120

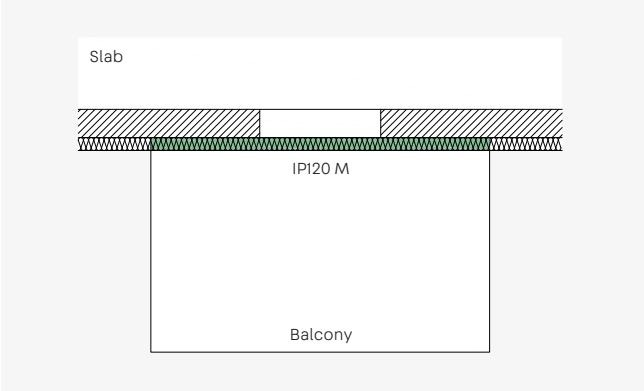
- REI 120 — Fire protection type
- h200 — Element height
- cv35 — Concrete cover
- Q4 — Shear force load-bearing level
- P — Two-part design for prefabricated parts factories
- 80 — Load-bearing level
- M — Type
- IP 120 — Abbreviation of product name

Application – Element arrangement

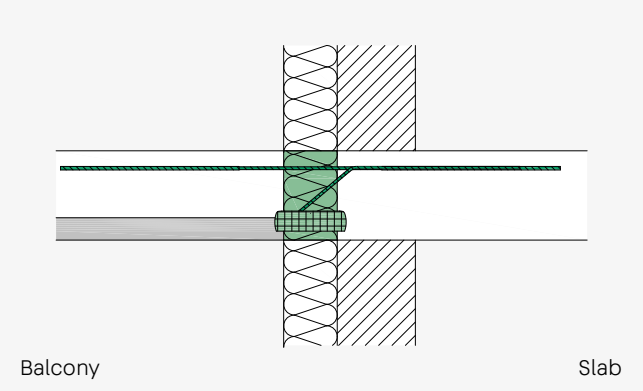
This chapter contains planning aids and specific information on elements in a split design for use with precast slabs in the precast concrete plant. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.

Note:

- Structural design principles, page 10 – 12
- Structural design tables, page 20 – 21
- Fitness for purpose, page 22 – 23
- Fire protection, page 8 – 9



ISOPRO® 120 M – Cantilevered balconies

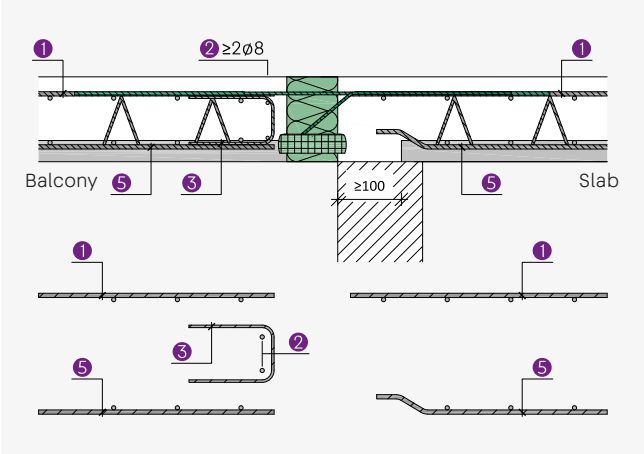


ISOPRO® 120 M P – Installation cross section of the thermal insulation composite system

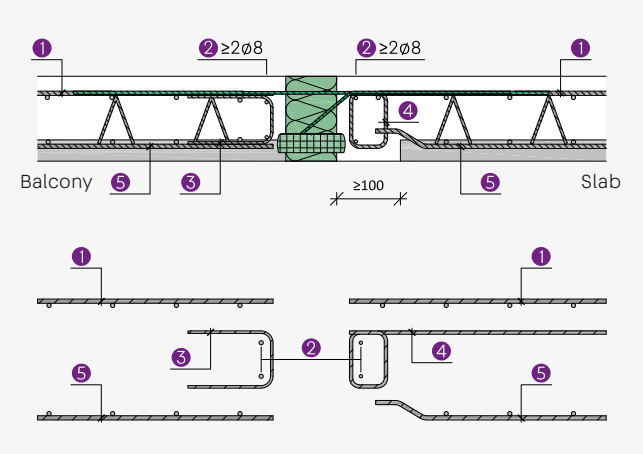
On-site reinforcement

M 10 P to M 120 P

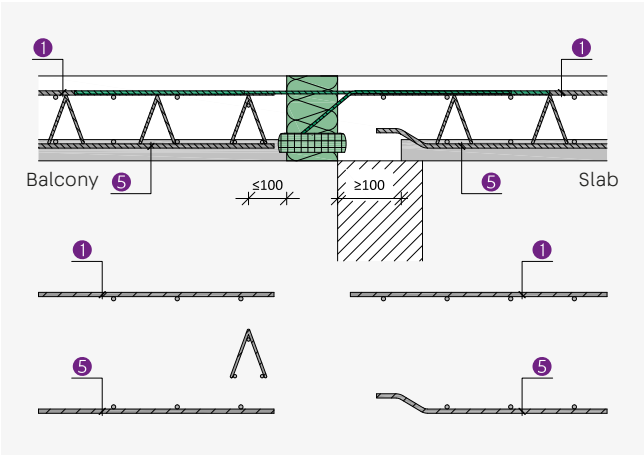
Direct support



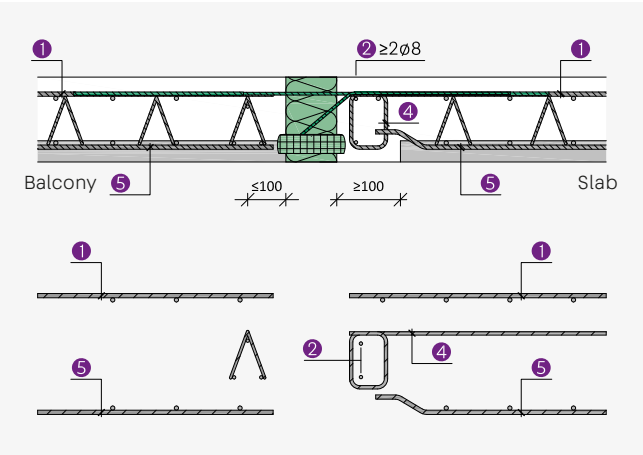
Indirect support



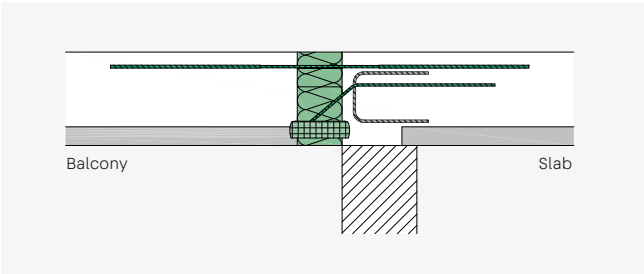
Braced girder close to the edge – direct support



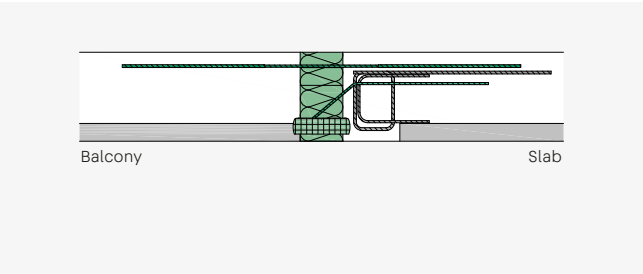
Braced girder close to the edge – indirect support



Direct support attachment reinforcement



Indirect support attachment reinforcement



If the clearance between the tie and shear bars is more than 24 mm on the ceiling, additional attachment reinforcement must be installed.

For information on the required reinforcement cross-sections for the individual items, see the table on page 31.

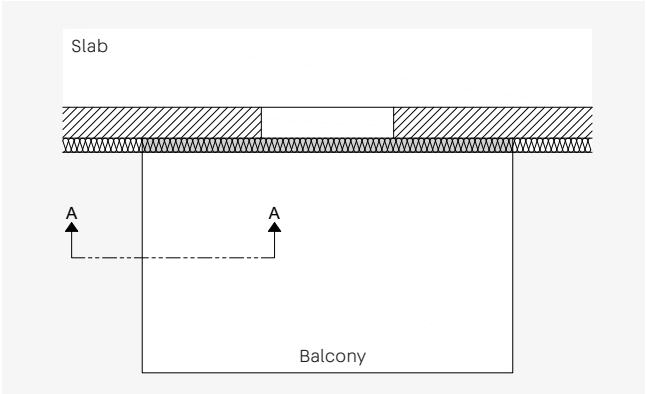
M 10 P to M 60 P

$a_{s,erf}$		ISOPRO® 120					
		M 10 P	M 20 P	M 30 P	M 40 P	M 50 P	M 60 P
Pos. 1	Connection reinforcement cm²/m	2.75	4.26	6.01	6.74	6.86	7.72
Pos. 2	Direct support	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8
Pos. 3	Q design	≥ Ø 6/250					
	QQ design	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
Pos. 4	Direct support Q	-					
	Indirect support Q	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
	Direct support QQ						
	Indirect support QQ						
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

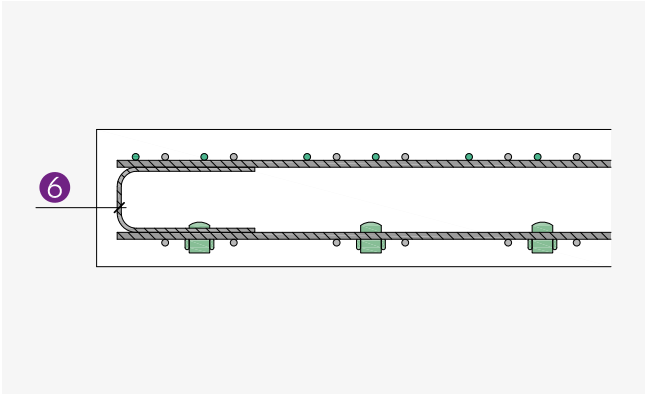
M 70 P to M 120 P

$a_{s,erf}$		ISOPRO® 120					
		M 70 P	M 80 P	M 90 P	M 100 P	M 110 P	M 120 P
Pos. 1	Connection reinforcement cm²/m	9.44	10.29	11.06	12.44	13.53	15.43
Pos. 2	Direct support	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8
Pos. 3	Q design	≥ Ø 6/250					
	QQ design	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
Pos. 4	Direct support Q	-					
	Indirect support Q	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250					
	Direct support QQ						
	Indirect support QQ						
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

Supplementary edge reinforcement

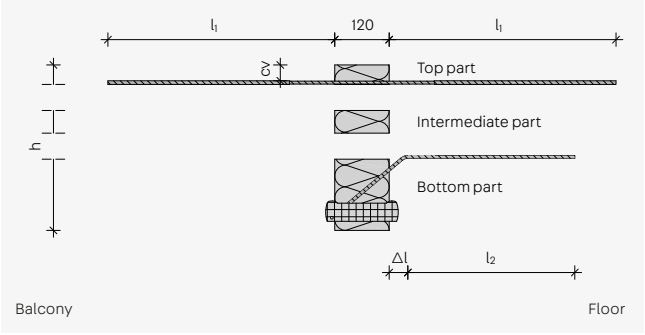


Top view balcony



A-A cross-section

Element dimensions in mm M 10 P to M 120 P



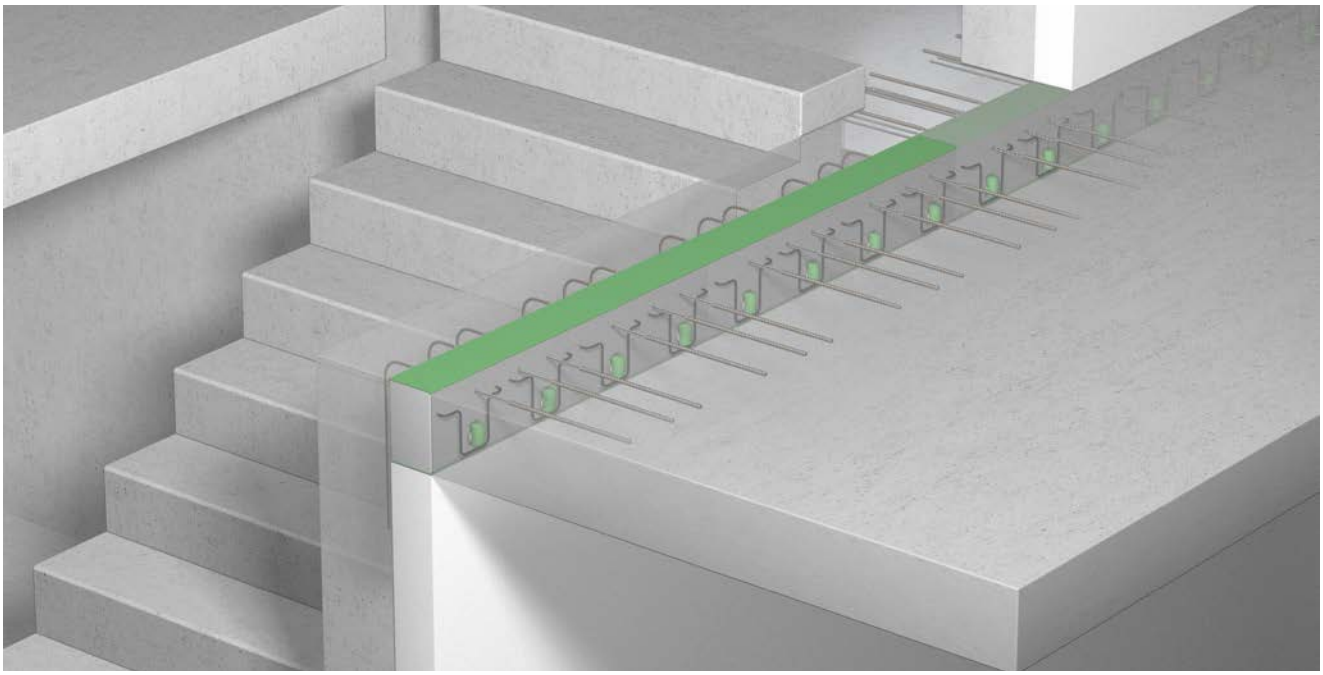
ISOPRO® 120	M 10 P to M 60 P	M 70 P to M 90 P	M 100 P to M 120 P
l_1	580	720	840
l_2	370		
Δl	(h-180) · 1.2 + 20 mm		
h	160-250		
cv	35/50		

Design of the two-part elements

- Dimensioning and configuration of the elements is identical to the corresponding one-part elements – pp. 20 to 21
- Elevation, bending slenderness and maximum permissible clearance between expansion joints – pp. 22 to 23
- Design of the insulating body comprising a bottom part and a top part
- Precast concrete plants have the option of ordering elements in standard heights and doubling them up to greater heights if necessary by inserting intermediate parts. The shear bar is designed for the originally selected element height and is not in the element's tension plane when doubled up. The ceiling side must be reinforced accordingly.
- The bottom part is concreted into the element slab in the precast concrete plant. The top part is installed on the construction site.
- Please make sure you use the right combination and installation direction (according to the label) on the construction site.
- Without the top part in place, the load-bearing capacity of the connection is not guaranteed.

IP 120 variants

Elements for cantilevered balconies



IP 120 M variants

Variant for connection situations where the concrete floor is not at the same level

- For transferring moments and shear forces
- Load-bearing levels M 10 to M 40
- Shear force load-bearing levels Q4 and Q6
- Concrete cover cv35 or cv50
- Element heights from 160 mm
- Fire resistance class REI 120 available
- Compression level with concrete compression bearings

Connection geometry

- WU – connection to a wall leading downwards
- WO – connection to a wall leading upwards
- HV – connection to a slab that is vertically offset upwards
- UV – connection to a slab that is vertically offset downwards

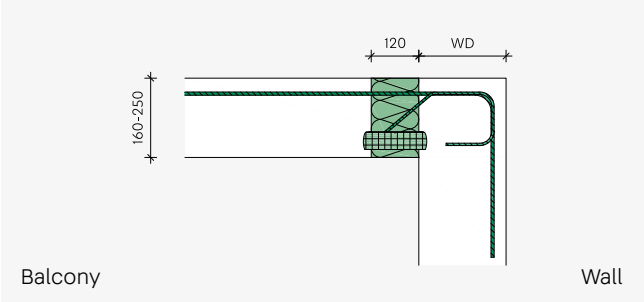
Type designation

IP 120 M 20 Q6 cv35 h200 WU WD 220

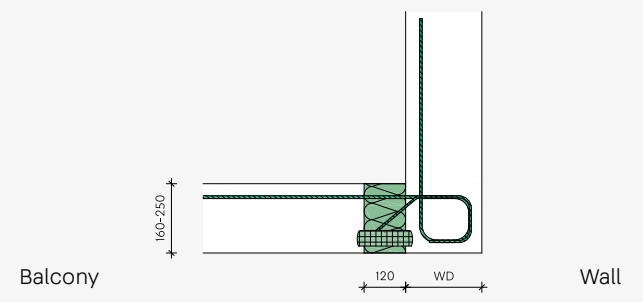
- WD 220 – Specification of the wall thickness: here, 220 mm
- WU – Connection geometry
- h200 – Element height
- cv35 – Concrete cover
- Q6 – Shear force load-bearing level
- M 20 – Load-bearing level
- M – Type
- IP 120 – Abbreviation of product name

Application – Element arrangement

Connection to a wall

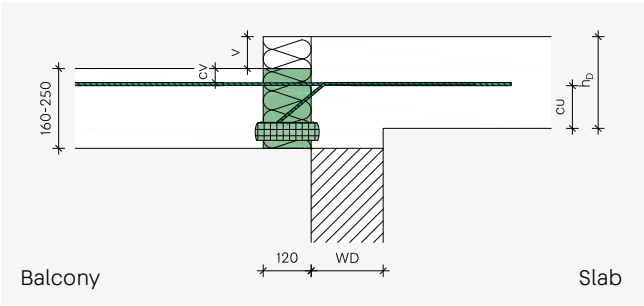


Wall connection downwards – ISOPRO® 120 M WU



Wall connection upwards – ISOPRO® 120 M WO

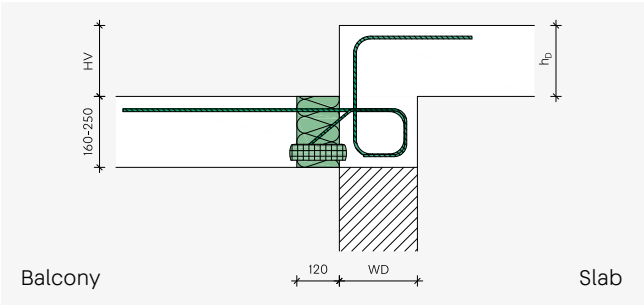
Connection to slab with a slight height offset with a standard ISOPRO® 120 element



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

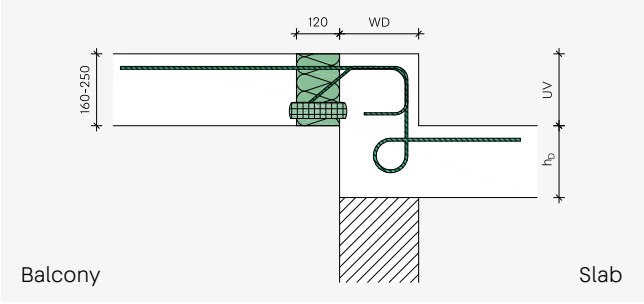
with
v – Height offset
h_D – Slab thickness
cv – Concrete cover of the tie bars of the ISOPRO® 120 elements
d_s – Diameter of the tie bars of the ISOPRO® 120 elements
cu – Concrete cover of the tie bars of the ISOPRO® 120 elements to the bottom edge of the slab

Connection to a slab with a height offset



Slab situated at a higher level – ISOPRO® 120 M HV

HV	Height offset mm
100	90–149
150	150–199
200	200–240



Slab situated at a lower level – ISOPRO® 120 M UV

UV	Height offset mm
80	80
90	81 to ≤ 90
100	91 to ≤ 100
110	101 to ≤ 110
120	111 to ≤ 120
130	121 to ≤ 130
140	131 to ≤ 140

UV	Height offset mm
150	141 to ≤ 150
160	151 to ≤ 160
170	161 to ≤ 170
180	171 to ≤ 180
190	181 to ≤ 190
200	191 to ≤ 200

Measurement table for concrete ≥ C25/30

Rated values of the moments that can be transferred m_{Rd} in kNm/m

Element height mm		ISOPRO® 120 WU, UV				ISOPRO® 120 WO, HV			
cv 35	cv 50	M 10	M 20	M 30	M 40	M 10	M 20	M 30	M 40
160	-	18.8	28.7	32.2	39.8	18.8	-	-	-
-	180	20.1	30.6	34.3	42.5	20.1	-	-	-
170	-	21.2	32.4	36.3	45.0	21.2	-	-	-
-	190	22.5	34.3	38.3	47.7	22.5	-	-	-
180	-	23.7	36.1	40.3	50.2	23.7	32.9	37.6	41.7
-	200	25.0	38.1	42.3	52.9	25.0	34.5	39.4	43.8
190	-	26.2	39.9	44.3	55.4	26.2	36.2	41.3	45.9
-	210	27.5	41.9	46.3	58.1	27.5	37.8	43.2	48.0
200	-	28.7	43.7	48.4	60.6	28.7	39.5	45.1	50.0
-	220	30.0	45.8	50.4	63.4	30.0	41.1	47.0	52.1
210	-	31.2	47.6	52.4	65.9	31.2	42.8	48.8	54.2
-	230	32.6	49.6	54.4	68.7	32.6	44.4	50.7	56.3
220	-	33.8	51.5	56.4	71.3	33.8	46.1	52.6	58.4
-	240	35.2	53.5	58.4	74.1	35.2	47.7	54.5	60.5
230	-	36.3	55.4	60.5	76.6	36.3	49.4	56.3	62.6
-	250	37.7	57.5	62.5	79.5	37.8	51.0	58.2	64.6
240	-	38.9	59.3	64.5	82.0	39.0	52.6	60.1	66.7
250	-	41.3	63.3	68.5	87.4	41.6	55.9	63.9	70.9

Rated values of the shear force that can be transferred v_{Rd} in kN/m

ISOPRO® 120 WU, WO, HV, UV	M 10	M 20	M 30	M 40
Q4				63.3
Q6				94.9

Dimensions and configuration

ISOPRO® 120	WU, UV				WO, HV			
	M 10	M 20	M 30	M 40	M 10	M 20	M 30	M 40
Tie bars	10 Ø 8	10 Ø 10	12 Ø 10	14 Ø 10	10 Ø 8	10 Ø 10	11 Ø 10	12 Ø 10
Compression bearings min.	6	10	10	13	8	14	16	18
Shear bars Q4	4 DQ+				4 DQ+			
Shear bars Q6	6 DQ+				6 DQ+			
Element length mm	1000				1000			
Distance between expansion joints m	21.7	19.8	19.8	19.8	21.7	19.8	19.8	19.8

Geometric boundary conditions for cv35*

ISOPRO® 120 WU, WO, HV, UV		M 10	M 20	M 30	M 40
WU	Minimum element height h	160	160	160	160
	Minimum wall thickness WD	175	200	200	200
WO	Minimum element height h	160	180	180	180
	Minimum wall thickness WD	≥ 175, ≥ h - 5 mm	> 200, ≥ h - 5 mm	> 200, ≥ h - 5 mm	> 200, ≥ h - 5 mm
HV	Minimum element height h	160	180	180	180
	Minimum wall thickness WD	≥ 175, ≥ h - 5 mm	> 200, ≥ h - 5 mm	> 200, ≥ h - 5 mm	> 200, ≥ h - 5 mm
UV	Minimum element height h	160	160	160	160
	Minimum wall thickness WD	175	200	200	200
	Minimum ceiling thickness h_D	160	160	160	160

*For cv50 concrete cover, the minimum element heights increase by 15 mm.

Fitness for purpose

Deformation

During their creation, projecting reinforced concrete structures are elevated to take into account the anticipated deformation. If these structures are thermally separated with ISOPRO® 120 elements, when calculating the elevation, the deformation due to the ISOPRO® 120 element itself is superimposed with the deformation due to flexion of the slab in accordance with DIN EN 1992-1-1/NA. It must be ensured that the required elevation is rounded up or down, according to the planned drainage direction. If a drainage system is installed at the building facade, 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 limit state for the quasi-continuous load combination ($\gamma_G = 1.0$, $\gamma_Q = 1.0$, $\psi_2 = 0.3$). The tables below show the deformation factors tan α for calculating the deformation due to ISOPRO® 120.

Deformation due to the ISOPRO® 120 cantilever slab connection

w_1 = Deformation from thermal insulation element
w_2 = Deformation from slab deformation

$w_1 = \tan \alpha \cdot (m_{Ed}/m_{Rd}) \cdot l_k \cdot 10$

with

w_1 = Deformation at the end of the cantilever arm in mm due to the thermal insulation element
$\tan \alpha$ = Deformation factor, see table
m_{Ed} = Bending moment for calculating the elevation as a result of the ISOPRO® 120 element
The definitive load case combination for the servicability limit state is made by the planner.
m_{Rd} = Moment of resistance of the ISOPRO® 120 element
l_k = System length in m

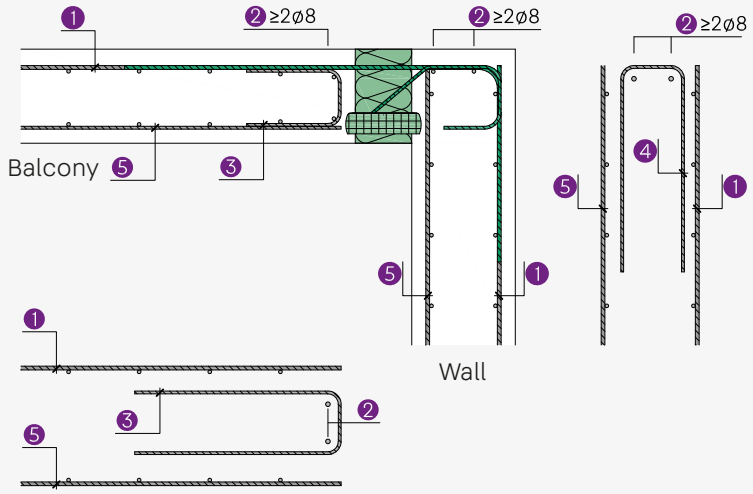
Deformation factor tan α for concrete ≥ C25/30

ISOPRO® 120 WU, WO, HV, UV	Concrete cover cv mm	Height h mm									
		160	170	180	190	200	210	220	230	240	250
M 10	35	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.5
	50	-	-	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6
M 20	35	1.2	1.1	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6
	50	-	-	1.2	1.0	0.9	0.9	0.8	0.7	0.7	0.6
M 30	35	1.3	1.1	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6
	50	-	-	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6
M 40	35	1.3	1.1	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6
	50	-	-	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6

On-site reinforcement

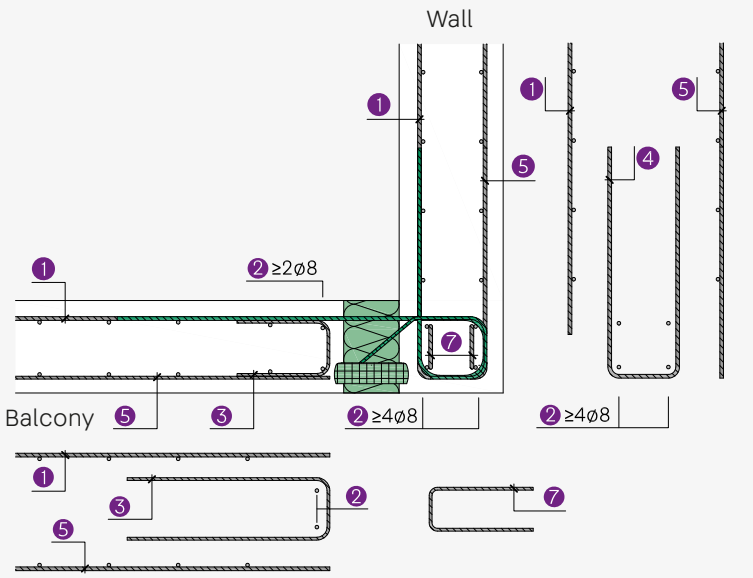
M 10 WU to M 40 WU

Connection to a wall leading downwards



M 10 WO to M 40 WO

Connection to a wall leading upwards



Notes
For information on the required reinforcement cross-sections for the individual items, see the table on page 39.

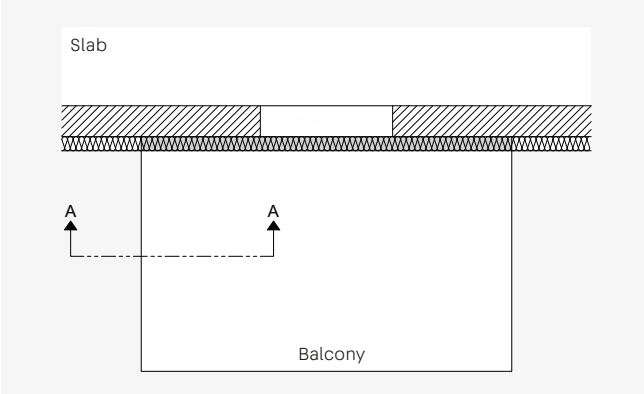
M 10 WU to M 40 WU

$a_{s,erf}$		ISOPRO® 120 WU			
		M 10 WU	M 20 WU	M 30 WU	M 40 WU
Pos. 1	Connection reinforcement cm²/m	as specified by the structural engineer, the tension rod must be fully overlapped			
		≥ 5.03	≥ 7.85	≥ 9.42	≥ 11.3
Pos. 2	Longitudinal reinforcement	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8
Pos. 3	Horizontal U-bar	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Vertical U-bar	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 5	Component reinforcement	As specified by the structural engineer			
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)			

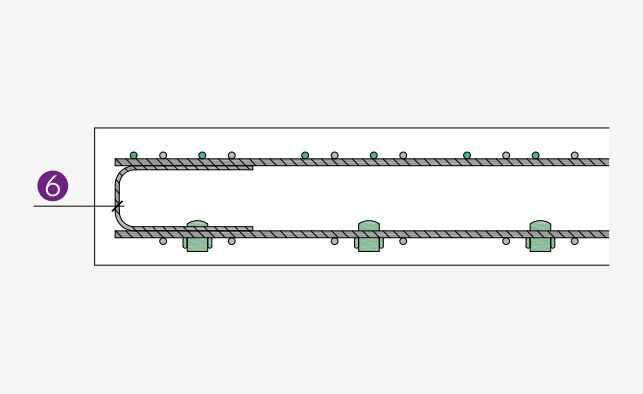
M 10 WO to M 40 WO

$a_{s,erf}$		ISOPRO® 120 WO			
		M 10 WO	M 20 WO	M 30 WO	M 40 WO
Pos. 1	Connection reinforcement cm²/m	as specified by the structural engineer, the tension rod must be fully overlapped			
		≥ 5.03	≥ 7.85	≥ 8.64	≥ 9.43
Pos. 2	Longitudinal reinforcement	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Supplementary edge reinforcement cm²/m	As specified by the structural engineer, ≥ 3.02 (≥ 6 Ø 8)			
Pos. 5	Component reinforcement	As specified by the structural engineer			
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)			
Pos. 7	Supplementary edge reinforcement cm²/m	2 Ø 6 (≥ 0.57)			

Supplementary edge reinforcement



Top view balcony

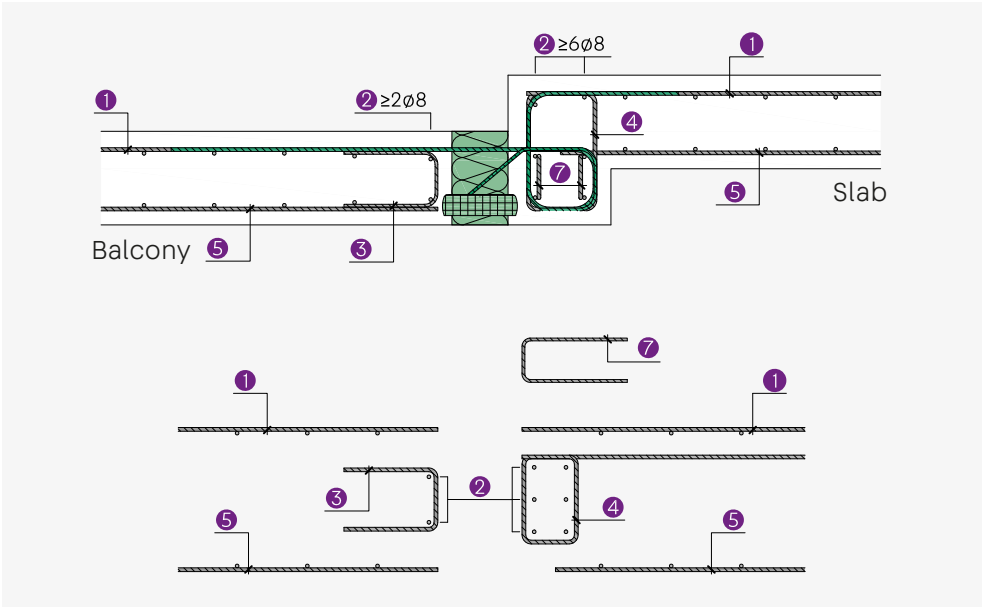


A-A cross-section

On-site reinforcement

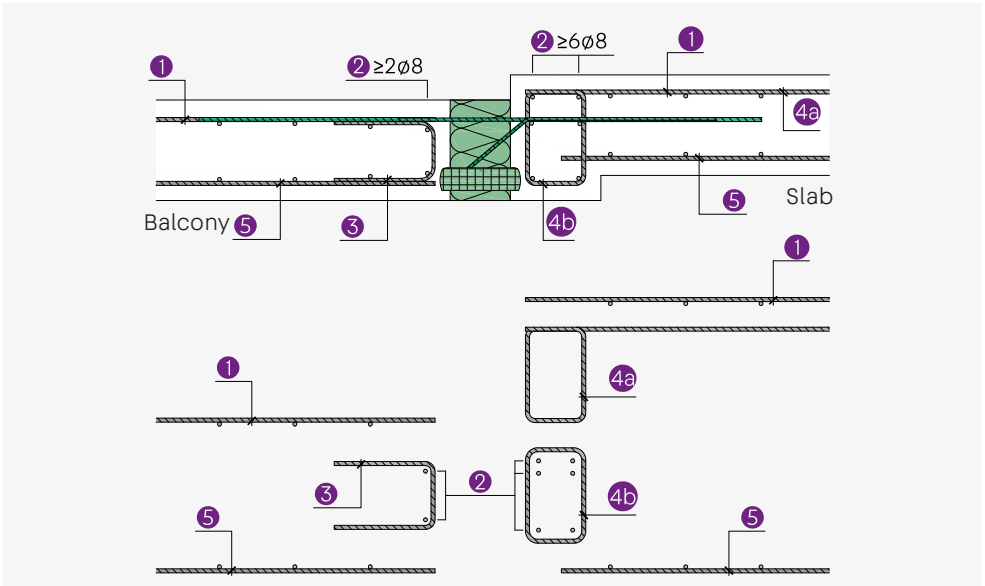
M 10 HV to M 40 HV

Connection to a slab with a height offset upwards



M 10 to M 120

Connection to a slab with a slight height offset upwards with a standard IP 120 element



Notes
For information on the required reinforcement cross-sections for the individual items, see the table on page 41.

M 10 HV to M 40 HV

$a_{s,erf}$		ISOPRO® 120 HV			
		M 10 HV	M 20 HV	M 30 HV	M 40 HV
Pos. 1	Connection reinforcement cm²/m	as specified by the structural engineer, the tension rod must be fully overlapped			
		≥ 5.03	≥ 7.85	≥ 8.64	≥ 9.43
Pos. 2	Longitudinal reinforcement	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Supplementary edge reinforcement cm²/m	As specified by the structural engineer, ≥ 3.02 (≥ 6 Ø 8)			
Pos. 5	Component reinforcement	As specified by the structural engineer			
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)			
Pos. 7	Supplementary edge reinforcement cm²/m	2 Ø 6 (≥ 0.57)	2 Ø 6 (≥ 0.57)	2 Ø 6 (≥ 0.57)	2 Ø 6 (≥ 0.57)

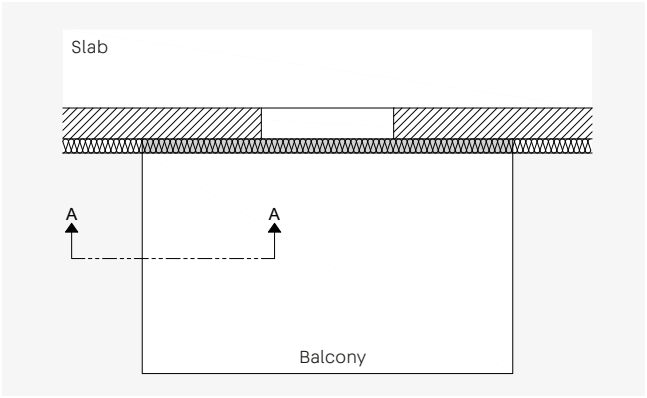
M 10 to M 120

$a_{s,erf}$		ISOPRO® 120					
		M 10	M 20	M 30	M 40	M 50	M 60
Pos. 2	Longitudinal reinforcement	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8
Pos. 4a	Joist reinforcement cm²/m	2.75	4.26	6.01	6.74	6.86	7.72
Pos. 4b	Joist reinforcement	Dimensioning for v_{Ed} and m_{Ed} by structural engineer					

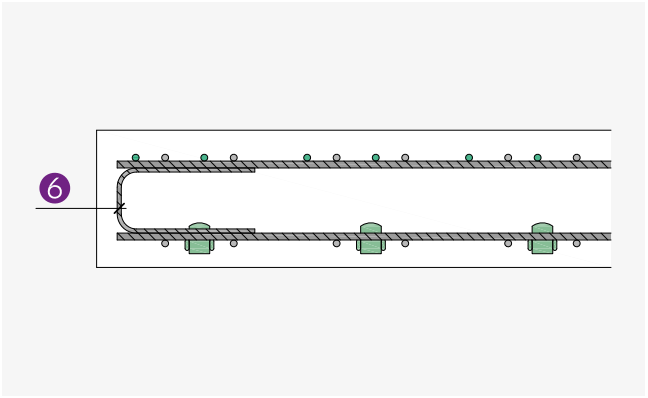
$a_{s,erf}$		ISOPRO® 120					
		M 70	M 80	M 90	M 100	M 110	M 120
Pos. 2	Longitudinal reinforcement	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8
Pos. 4a	Joist reinforcement cm²/m	9.44	10.29	11.06	12.44	13.53	15.43
Pos. 4b	Joist reinforcement	Dimensioning for v_{Ed} and m_{Ed} by structural engineer					

Notes
Reinforcement positions 1, 3 and 5-6 correspond to the information for standard elements on page 25.

Supplementary edge reinforcement



Top view balcony

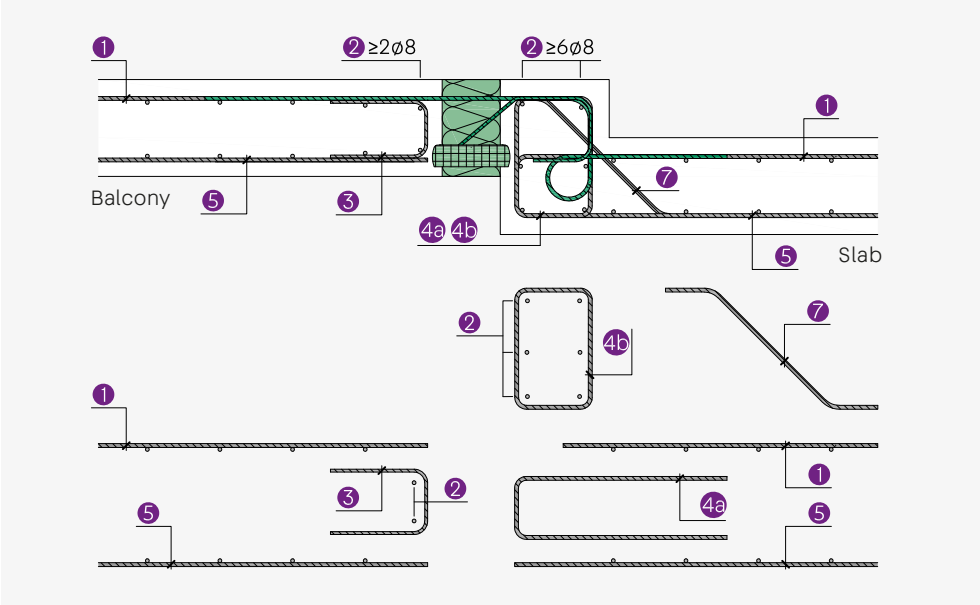


A-A cross-section

On-site reinforcement

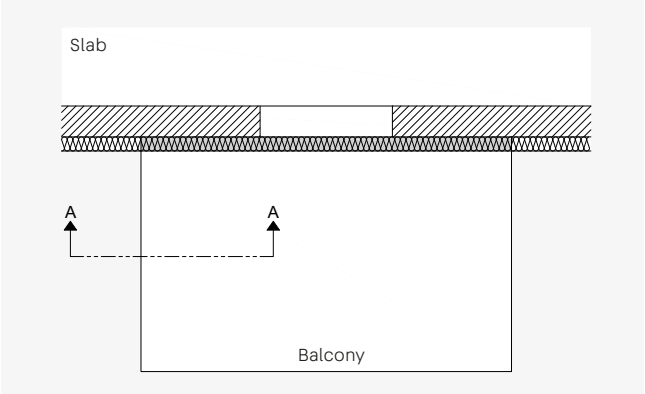
M 10 UV to M 40 UV

Connection to slab with a height offset downwards

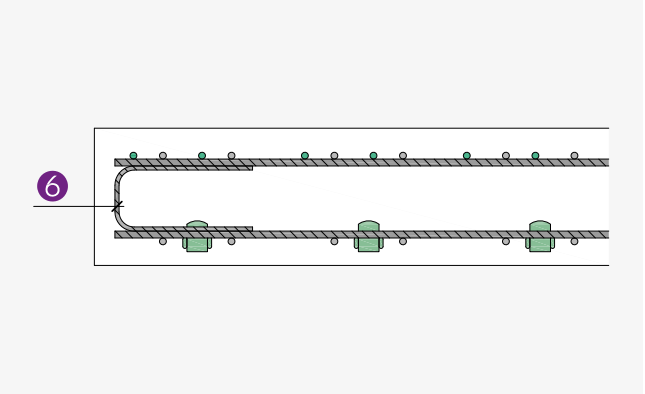


$a_{s,erf}$		ISOPRO® 120 UV			
		M 10 UV	M 20 UV	M 30 UV	M 40 UV
Pos. 1	Connection reinforcement cm²/m	as specified by the structural engineer, the tie rod must be fully overlapped			
		≥ 5.03	≥ 7.85	≥ 9.42	≥ 11.3
Pos. 2	Longitudinal reinforcement	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8	2 + 6 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4a	Stirrup	Connection reinforcement for absorbing the connection moment and for deflecting the tensile force in the beam into the upper tensile reinforcement of the slab in accordance with the structural engineer's specifications. The overlap length with the tensile reinforcement must be guaranteed.			
Pos. 4b	Stirrup				
Pos. 5	Component reinforcement	As specified by the structural engineer			
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)			
Pos. 7	Slope reinforcement	As specified by the structural engineer			

Supplementary edge reinforcement



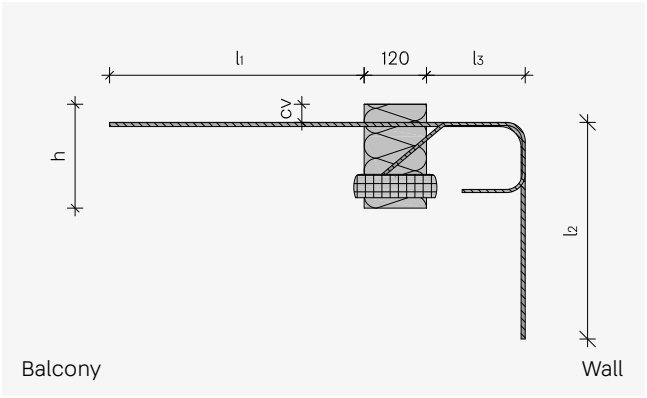
Top view balcony



A-A cross-section

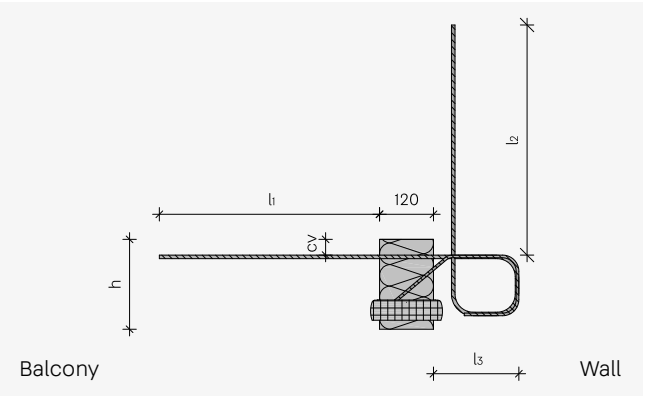
Element dimensions

M 10 WU to M 40 WU



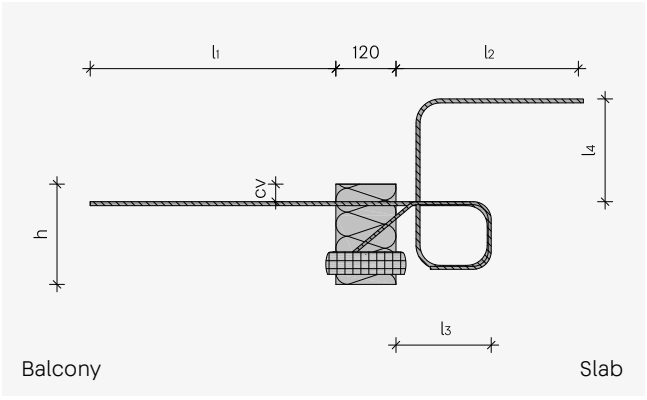
ISOPRO® 120 WU		M 10	M 20 M 30	M 40
l_1		≤ 645	≤ 760	≤ 880
l_2		637	854	1050
l_3	WD 175	150	-	-
	WD 200	170	170	170
	WD 220	190	190	190
	WD ≥ 240	210	210	210
h		160-250	160-250	160-250
cv		35/50	35/50	35/50

M 10 WO to M 40 WO



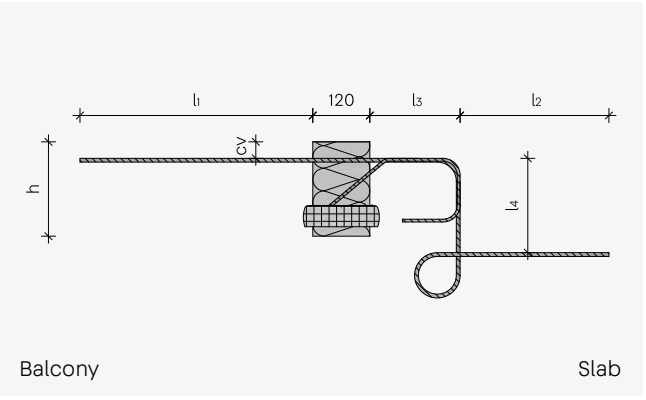
ISOPRO® 120 WO		M 10	M 20 M 30	M 40
l_1		580	720	840
l_2		482	616	730
l_3	WD 175	150	-	-
	WD 200	170	170	-
	WD 220	190	190	190
	WD ≥ 240	210	210	210
h		160-250	180-250	180-250
cv		35/50	35/50	35/50

M 10 HV to M 40 HV



ISOPRO® 120 HV		M 10	M 20 M 30	M 40
l_1		580	720	840
l_2		≤ 708	≤ 819	≤ 940
l_3	WD 175	150	-	-
	WD 200	170	170	170
	WD 220	190	190	190
	WD ≥ 240	210	210	210
l_4			100/150/200	
h		160-250	180-250	180-250
cv		35/50	35/50	35/50

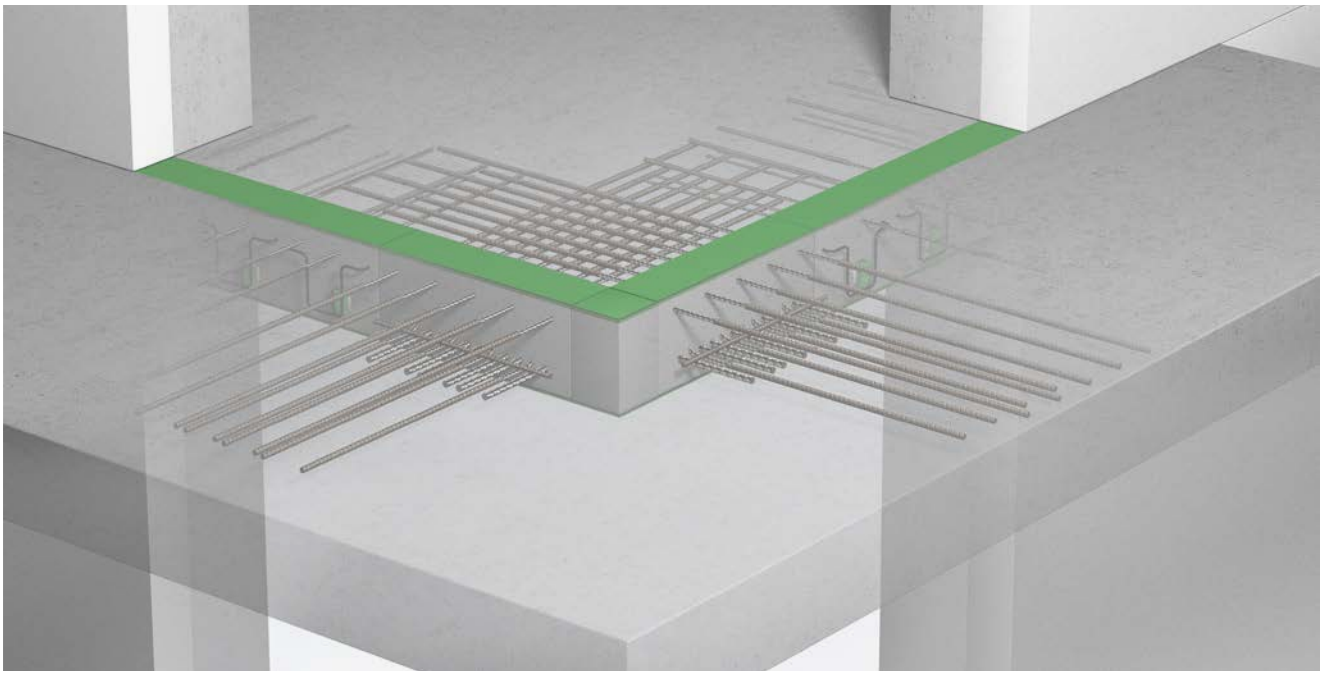
M 10 UV to M 40 UV



ISOPRO® 120 UV		M 10	M 20 M 30	M 40
l_1		≤ 645	≤ 760	≤ 870
l_2		≤ 584	≤ 705	≤ 856
l_3	WD 175	150	-	-
	WD 200	170	170	170
	WD 220	190	190	190
	WD ≥ 240	210	210	210
l_4		80-200	80-200	80-200
h		160-250	160-250	160-250
cv		35/50	35/50	35/50

IP 120 C

Elements for cantilevered corner balconies



IP 120 C

Complete corner elements for the easy connection of external corner balcony slabs. The offset in the cv dimension prevents the tie bars from clashing. Available as a complete structure (type "C") or as individual elements (type "CE").

- For transferring moments and shear forces
- Load-bearing levels C 10 and C 20
- Corner solution as a combination cv35/50, or individual elements cv35 or cv50
- Element heights from 180 mm
- Fire resistance class REI 90 (REI 120 with an utilization of ≤ 85% in ULS) available
- Compression level made from steel compression bars

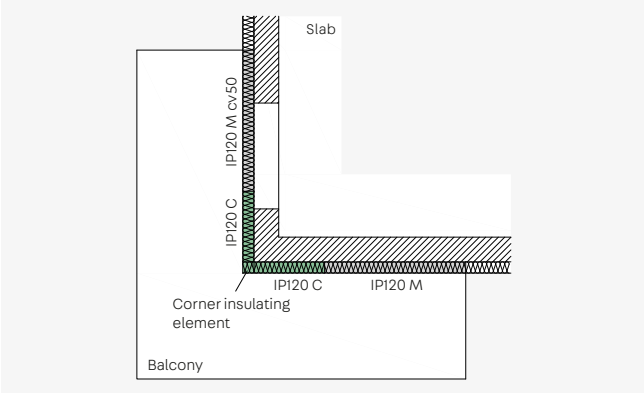
Type designation

IP 120 C 10 h200 REI 90

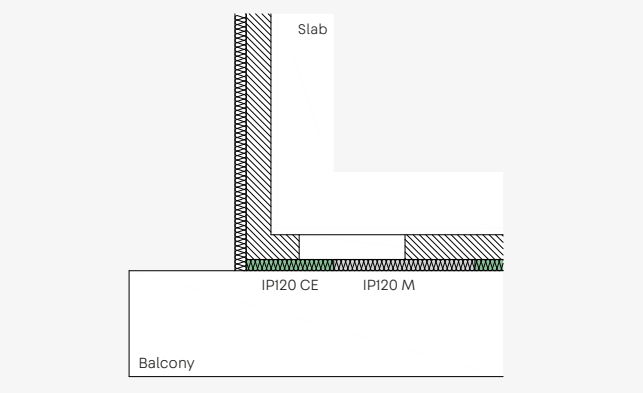
- REI 90 — Fire proof version
- h200 — Element height (cv dimension automatically 35+50 combined)
- C 10 — Load-bearing capacity
- C — Type
- IP 120 — Abbreviation of product name

Application – Element arrangement

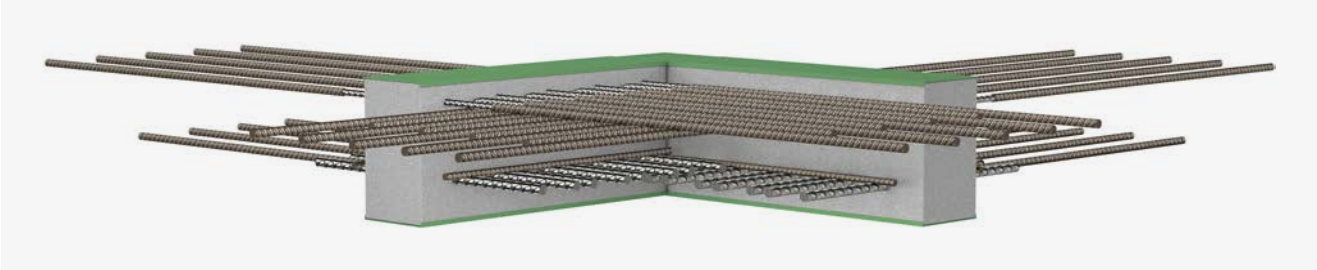
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



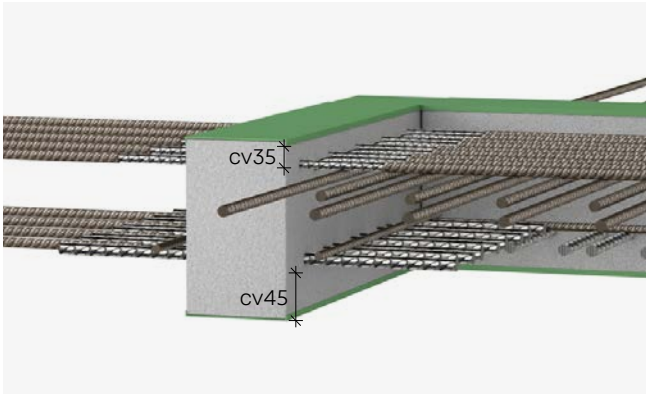
ISOPRO® 120 C – Cantilevered external corner balcony



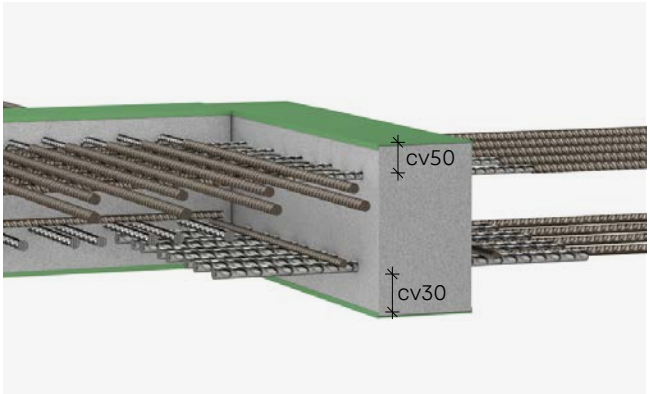
ISOPRO® 120 CE – Projecting balcony with slab protruding over the support



ISOPRO® 120 C– Ceiling side view



ISOPRO® 120 C– View 1st layer



ISOPRO® 120 C– View 2nd layer

Measurement table for concrete ≥ C25/30

Rated values of the moments that can be transferred m_{Rd} in kNm per element

Element height mm	ISOPRO® 120 cv 35/50			
	C 10	C 20	CE 10	CE 20
180	21.2	26.5	21.2	26.5
190	23.6	29.5	23.6	29.5
200	26.1	32.6	26.1	32.6
210	28.5	35.6	28.5	35.6
220	30.9	38.7	30.9	38.7
230	33.4	41.7	33.4	41.7
240	35.8	44.8	35.8	44.8
250	38.2	47.8	38.2	47.8

Rated values of the shear force that can be transferred v_{Rd} in kN

Load-bearing level	h_{min} mm	ISOPRO® 120			
		C 10	C 20	CE 10	CE 20
Q10	180-190	96.6			
Q12	200-280	139.2			

Dimensions and configuration

	ISOPRO® 120			
	C 10	C 20	CE 10	CE 20
Tension bars	2 x 5 Ø 12	2 x 5 Ø 14	5 Ø 12	5 Ø 14
Pressure rods	2 x 8 Ø 14	2 x 10 Ø 14	8 Ø 14	10 Ø 14
Shear bars Q10	2 x 4 Ø 10		4 Ø 10	
Shear bars Q12	2 x 4 Ø 12		4 Ø 12	
Element length mm	500+500		500	

Notes

- With small cantilever arm lengths, a combination of a standard ISOPRO® 120 M element in cv50 and an ISOPRO® 120 M element in cv35 can also be used instead of the ISOPRO® 120 C.
- An element C consists of one special unit CE with cv35, one special unit CE with cv50 and a filler directly in the corner.
- The CE elements can also be used individually as elements with a corresponding high load-bearing capacity.
- When using an ISOPRO® 120 C then an ISOPRO® 120 M in cv50 is required after the right element seen from the slab side. It is then possible to proceed in cv35 or cv50. Under certain conditions, the on-site reinforcement can be simplified by continuing in cv50.

Fitness for purpose

Deformation

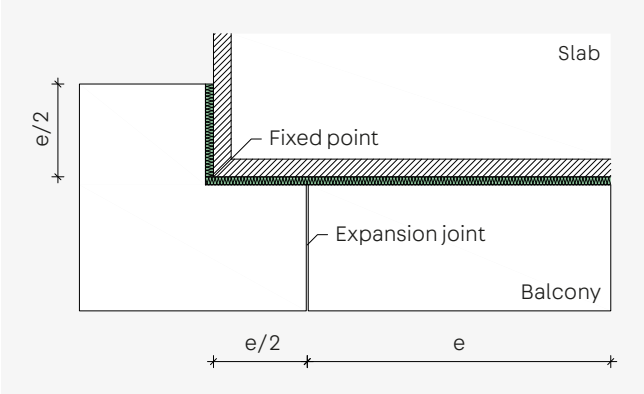
The required elevation of the reinforced concrete components is calculated in the same way as for the ISOPRO® 120 M on page 22 using the deformation factors below.

Deformation factor tan α for concrete ≥ C25/30

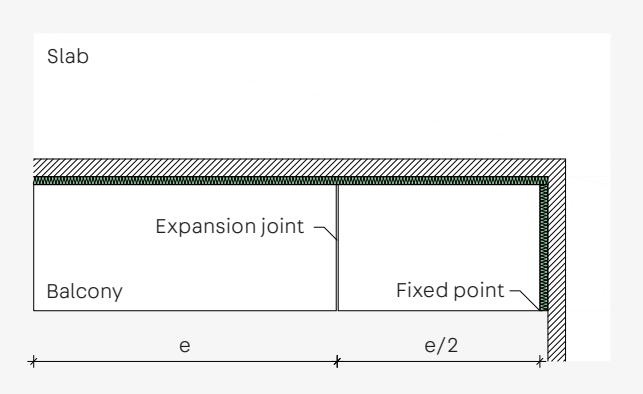
ISOPRO® 120	Concrete cover cv mm	Height h mm							
		180	190	200	210	220	230	240	250
C 10	35/50	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.9
C 20	35/50								
CE 10	35/50								
CE 20	35/50								

Expansion joint clearance

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



Expansion joint arrangement outside corner

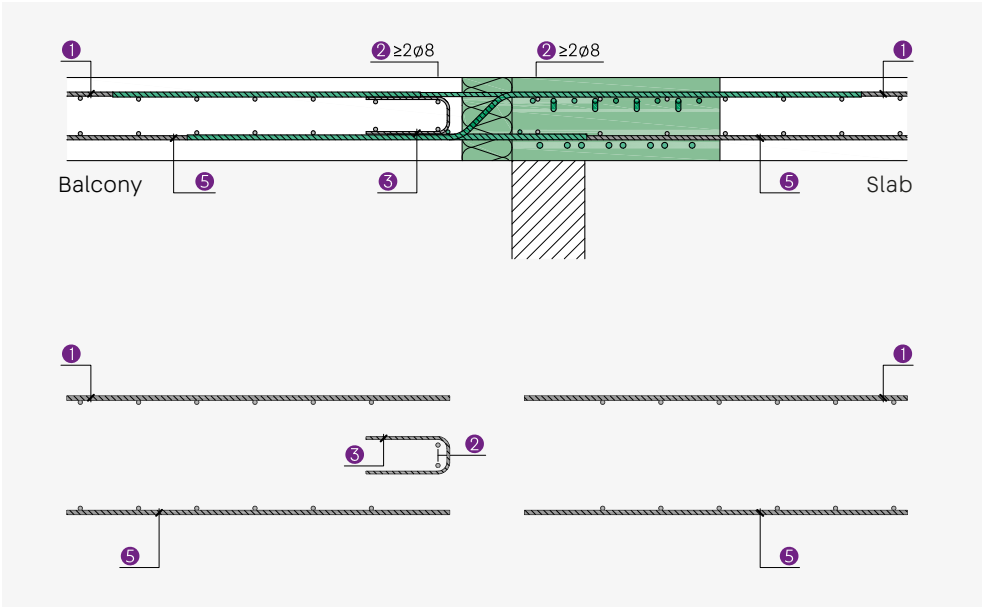


Expansion joint arrangement inside corner

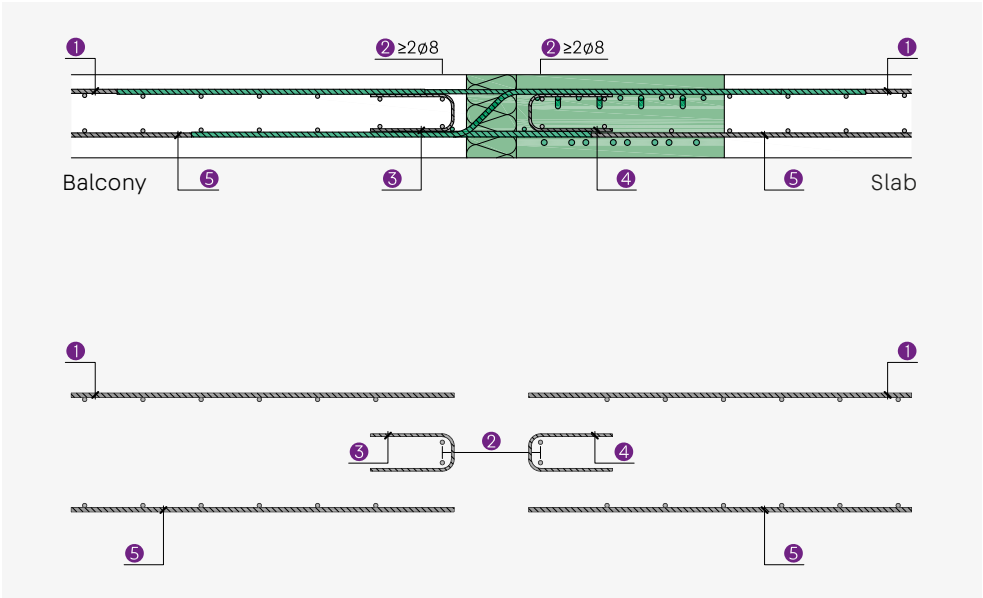
On-site reinforcement

C 10 to C 20

Direct support



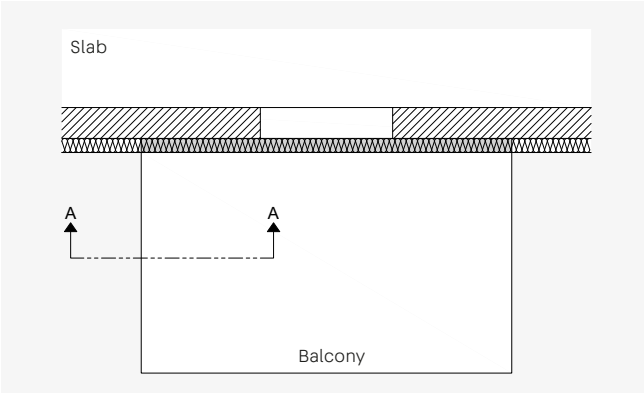
Indirect support



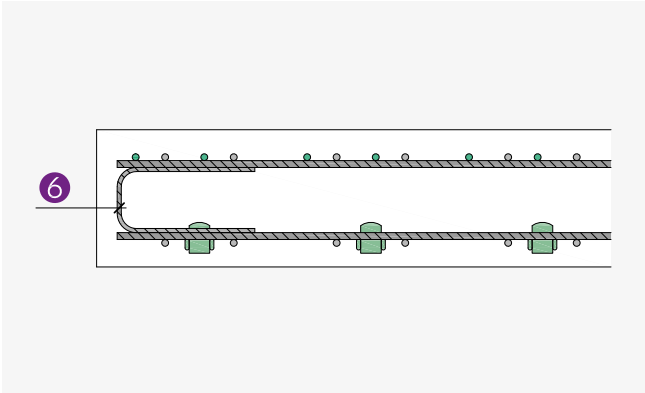
C 10 to C 20

$a_{s,erf}$		ISOPRO® 120 C			
		C 10	C 20	CE 10	CE 20
Pos. 1	Connection reinforcement cm²/m	5.65	7.70	5.65	7.70
Pos. 2	Direct support	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Direct support	-	-	-	-
	Indirect support	$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250		$a_{s,erf} = v_{Ed} / f_{yd} \geq$ Ø 6/250	
Pos. 5	Component reinforcement	As specified by the structural engineer		As specified by the structural engineer	
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)		in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)	

Supplementary edge reinforcement



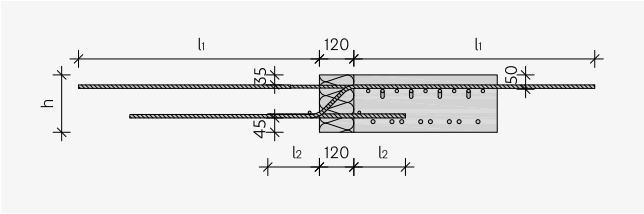
Top view balcony



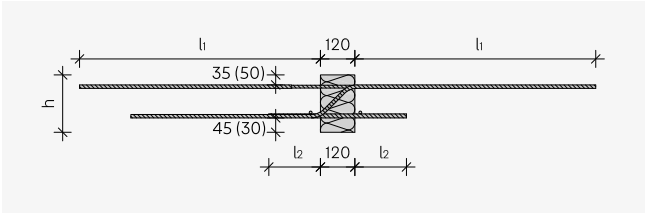
A-A cross-section

Element dimensions

C 10 to C 20

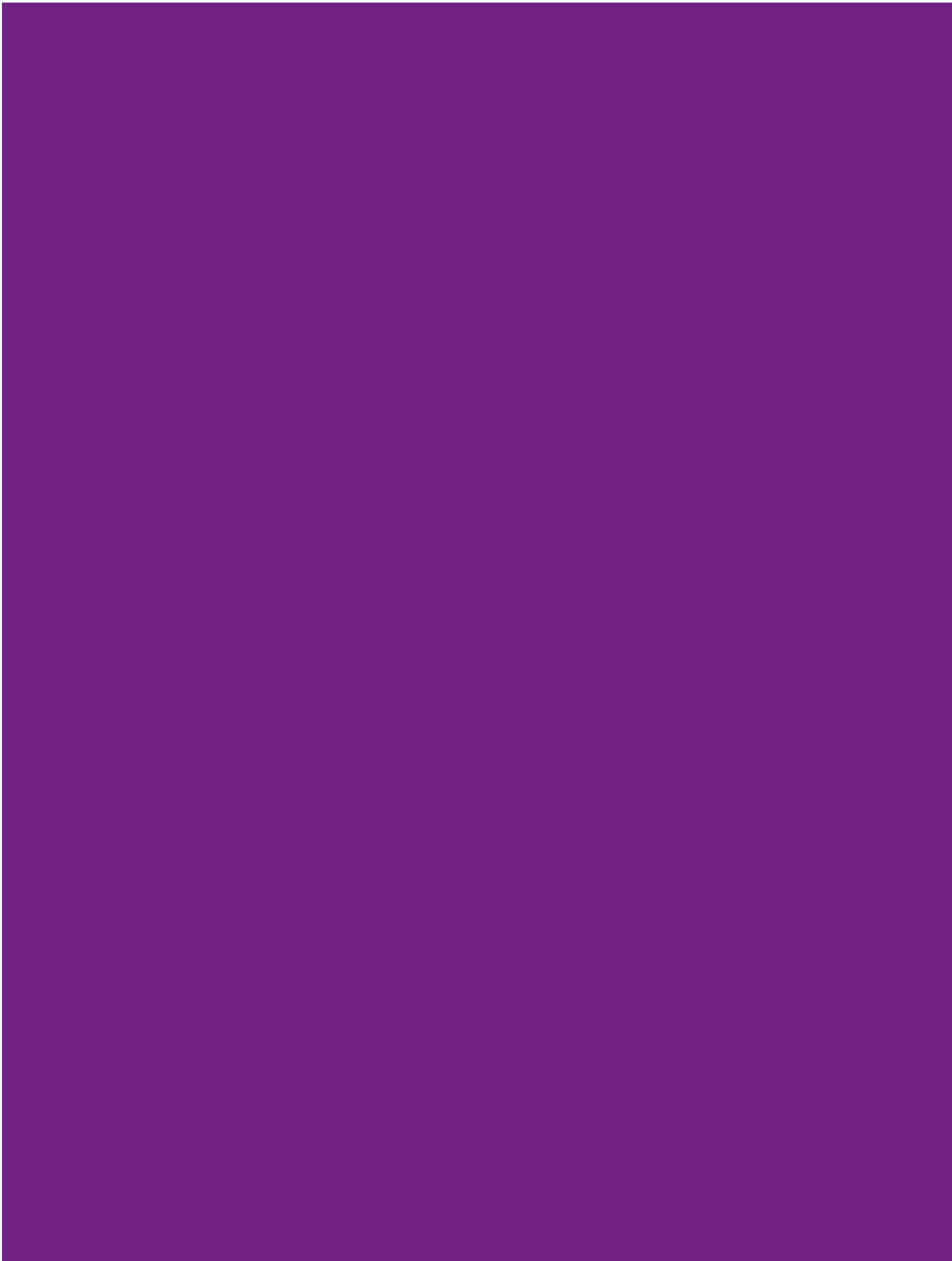


CE 10 to CE 20



Dimensions in mm

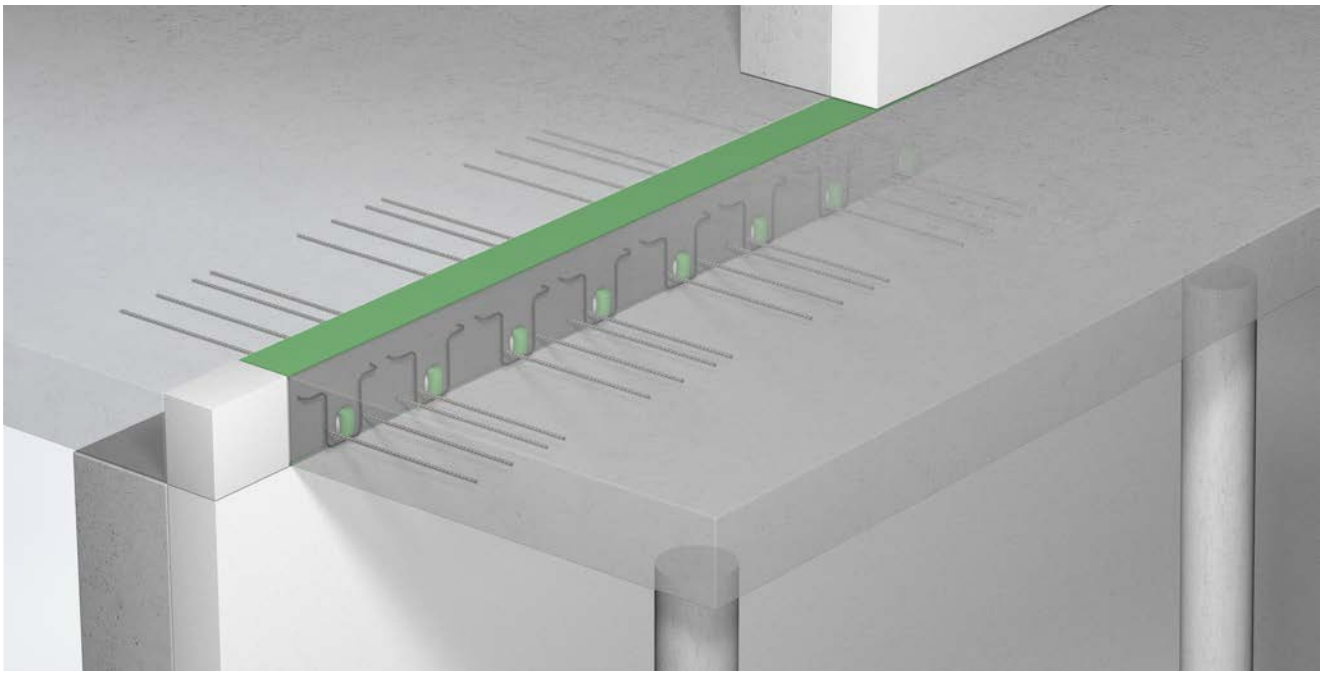
ISOPRO® 120	C 10	C 20	CE 10	CE 20
l_1	840	960	840	960
l_2	180	180	180	180
h	180-250	180-250	180-250	180-250
cv	-	-	35 (50) / 45 (30)	35 (50) / 45 (30)



Supported components

IP 120 Q, QZ, QS, QSZ

Elements for supported balconies



IP 120 Q, QZ

- For transferring shear forces
- Element length 1.0 m
- IP 120 Q compression level with concrete compression bearings
- IP 120 QZ without concrete compression bearings for support without pressure
- Element heights from 160 mm depending on the shear bar diameter
- Fire resistance class REI 120 available

IP 120 QS, QSZ

- Short elements for transferring shear forces at specific points
- Element length 0.3 m, 0.4 m or 0.5 m depending on the load-bearing level
- IP 120 QS compression level with concrete compression bearings or steel compression bars
- IP 120 QSZ without compression level for support without pressure
- Element heights from 160 mm depending on the shear bar diameter
- IP 120 QS: Fire resistance class REI 120 for load-bearing level 10 to 90 available
- IP 120 QS: Fire resistance class REI 90 for load-bearing-level 100 to 120 available (REI 120 with an utilization of ≤ 85% in ULS)
- IP 120 QSZ: Fire resistance class REI 120 available

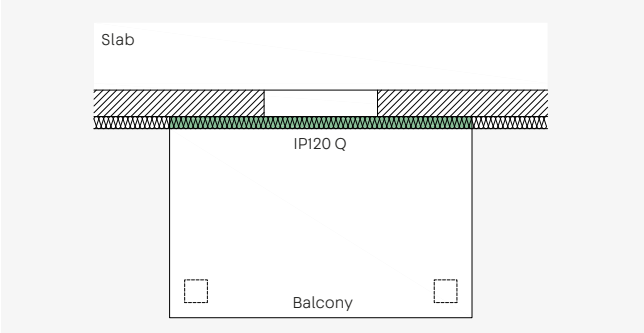
Type designation

IP 120 Q 20 h200 REI 120

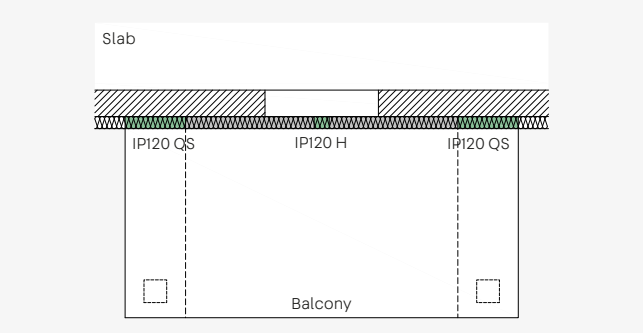
- REI 120 — Fire protection type
- h200 — Element height
- 20 — Load-bearing level
- Q — Type
- IP 120 — Abbreviation of product name

Application – Element arrangement

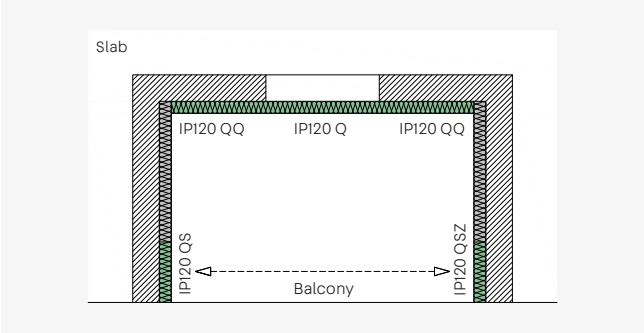
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



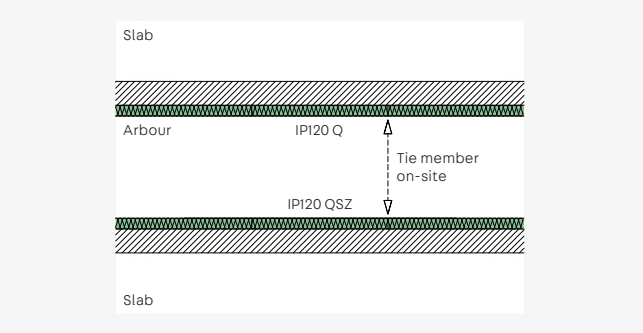
ISOPRO® 120 Q – Supported balconies



ISOPRO® 120 QS – Supported balconies with beams and columns at specific points



ISOPRO® 120 QS and QZ – Loggia balcony with load peaks at specific points and constraint-free support at the front



ISOPRO® 120 Q and QZ – Pergola with constraint-free support

For balconies connected with shear force elements, appropriate support must be ensured in all construction stages. Temporary supports may only be removed when the permanent supports that may be installed at a later date are sufficiently load-bearing and firmly connected to the balcony.

Measurement table for concrete ≥ C25/30

Q, QZ – Dimensioning values of absorbable shear force v_{Rd} in kN/m

ISOPRO® 120	Shear force v_{Rd} kN/m	Element height mm	Element length mm	Expansion joint clearance m	Configuration of shear bars	Configuration of compression bearings	
						Q	QZ
Q 10, QZ 10	31.6	≥ 160**	1000	21.7	4 Ø 6*	4	-
Q 20, QZ 20	47.4				6 Ø 6*		
Q 30, QZ 30	63.2				8 Ø 6*		
Q 40, QZ 40	79.1				10 Ø 6*		
Q 50, QZ 50	94.9				12 Ø 6*		
Q 60, QZ 60	98.4				7 Ø 8		
Q 70, QZ 70	112.4				8 Ø 8		
Q 80, QZ 80	135.3				10 Ø 8		
Q 90, QZ 90	175.7	≥ 170			8 Ø 10	6	
Q 100, QZ 100	202.9				10 Ø 10		
Q 110, QZ 110	253.0	≥ 180		19.8	8 Ø 12	8	
Q 120, QZ 120	270.5				9 Ø 12		

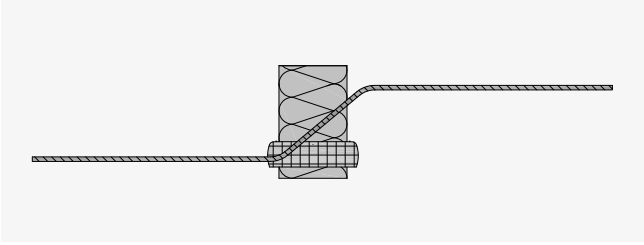
*Elements with shear bars Ø 6 have a looped rod on the ceiling.
**With shear bars Ø 6 and an element height of 160 mm, the distance between the bracket and the insulation is 155 mm (see l2, page 61). For all other elements, the shear bar on the ceiling side is straight (see also page 61).

QS, QSZ – Dimensioning values of absorbable shear force V_{Rd} in kN

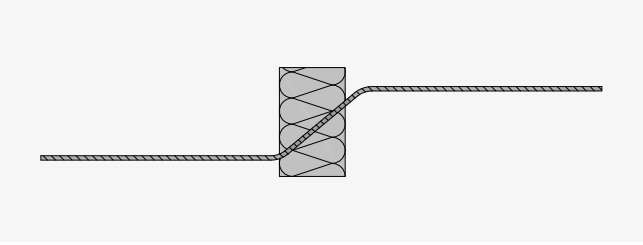
ISOPRO® 120	Shear force V_{Rd} kN	Element height mm	Element length mm	Expansion joint clearance m	Configuration of shear bars	Configuration of compression bearings	
						QS	QSZ
QS 10, QSZ 10	28.1	≥ 160	300	21.7	2 Ø 8	2	-
QS 20, QSZ 20	42.2		400		3 Ø 8		
QS 30, QSZ 30	56.2		500		4 Ø 8		
QS 40, QSZ 40	43.9	≥ 170	300		2 Ø 10		
QS 50, QSZ 50	65.9		400		3 Ø 10		
QS 60, QSZ 60	87.8		500		4 Ø 10	3	
QS 70, QSZ 70	63.2	≥ 180	300	19.8	2 Ø 12	2	
QS 80, QSZ 80	94.9		400		3 Ø 12	3	
QS 90, QSZ 90	126.5		500		4 Ø 12	4	
QS 100*, QSZ 100	84.0	≥ 200	300	17.0	2 Ø 14	3 Ø 14	
QS 110*, QSZ 110	140.0		400		3 Ø 14	5 Ø 14	
QS 120*, QSZ 120	167.9		500		4 Ø 14	6 Ø 14	

*Design with compression bars, fire protection REI 90

Notes
For the QS, QSZ 100 to QS, QSZ 120 with steel compression bars the fire resistance class is REI 90. The fire resistance class is REI 120 when the reaction coefficient η_{fi} (in accordance with EN 1992-1-2, section 2.4.2) is reduced to 0.6 – this corresponds to an utilization of ≤ 85% in ULS (ultimate limit state).



ISOPRO® 120 Q and QS



ISOPRO® 120 QZ and QSZ

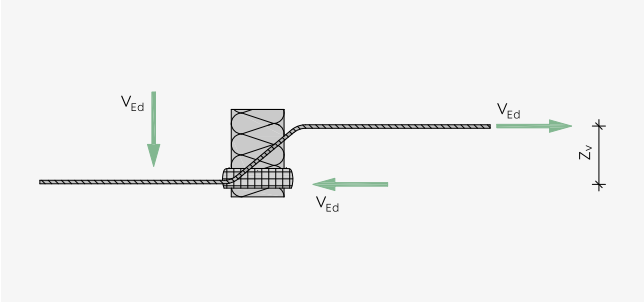
The QZ and QSZ elements have the same shear resistance as the corresponding Q and QS elements. Their design without a compression level enables constraint-free support of the components in inset constructions, but always requires a structural installation with a Q or QS design. Reinforcement information on pages 56 – 60.

Measurement table

Moment resulting from eccentric connections

When dimensioning the Supplementary reinforcement on the ceiling for the ISOPRO® 120 type Q – QZ shear elements, 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 elements are fully utilised.

$$\Delta M_{Ed} = \tan(\alpha)40° \cdot V_{Ed} \cdot z_v$$



Lever arm z_v for determining the offset moment

Q offset moments

ISOPRO® 120				Δm_{Ed} kNm/m
	h = 160-170 mm	h = 180-190 mm	h = 200-210 mm	h = 220-250 mm
Q 10	3.1	3.8	4.6	5.4
Q 20	4.6	5.8	6.9	8.0
Q 30	6.2	7.7	9.2	10.7
Q 40	7.7	9.6	11.5	13.4
Q 50	9.3	11.5	13.8	16.1
Q 60	9.5	11.8	14.2	16.5
Q 70	10.9	13.5	16.2	18.9
Q 80	13.1	16.3	19.5	22.7
Q 90	18.8	20.9	25.1	29.3
Q 100	21.8	24.2	29.0	33.9
Q 110	-	29.8	35.9	41.9
Q 120	-	31.9	38.4	44.8

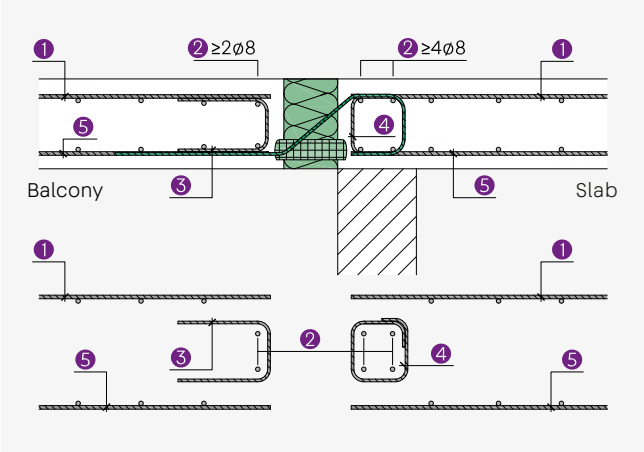
QS offset moments

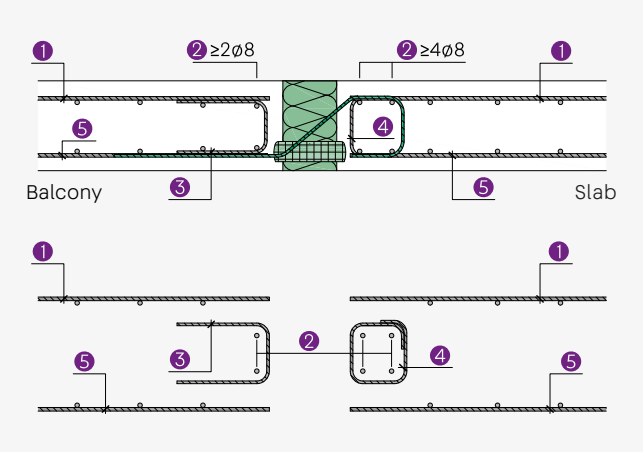
ISOPRO® 120				ΔM_{Ed} kNm
	h = 160-170 mm	h = 180-190 mm	h = 200-210 mm	h = 220-250 mm
QS 10	2.7	3.4	4.1	4.7
QS 20	4.1	5.1	6.1	7.1
QS 30	5.4	6.8	8.1	9.4
QS 40	4.7	5.2	6.3	7.3
QS 50	7.1	7.9	9.4	11.0
QS 60	9.4	10.5	12.6	14.7
QS 70	-	7.5	9.0	10.5
QS 80	-	11.2	13.5	15.7
QS 90	-	14.9	17.9	21.0
QS 100	-	-	12.1	14.1
QS 110	-	-	20.2	23.5
QS 120	-	-	24.2	28.2

On-site reinforcement

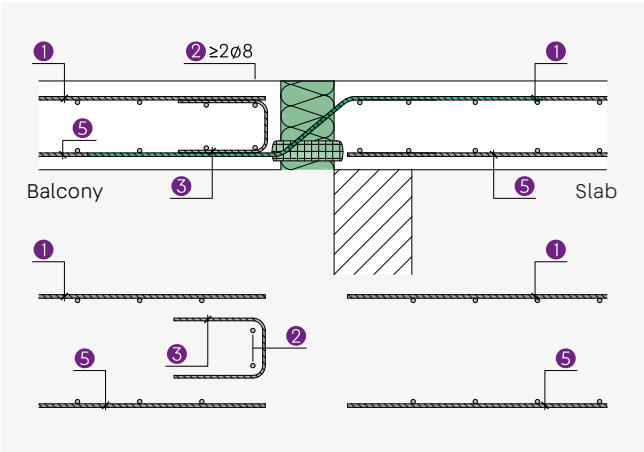
Q/QZ 10 to Q/QZ 120

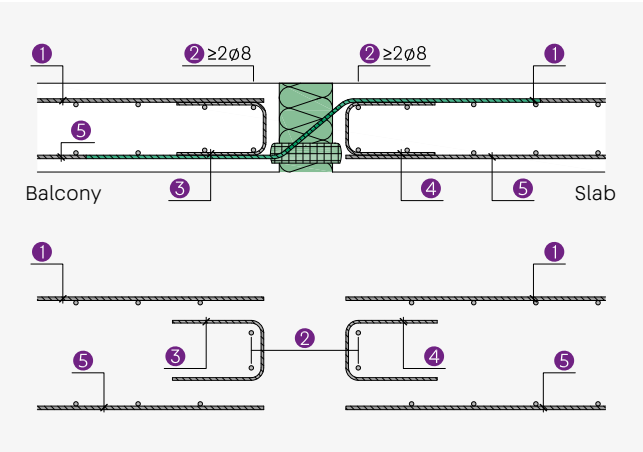
Shear bar Ø 6 looped on the slab side – direct and indirect support





Straight shear bar Ø 8-12 on the slab side - direct and indirect support





Notes

- For information on the required reinforcement cross-sections for the individual items, see the table on page 57.
- The representations are limited to the Q elements. The same reinforcement specifications apply to QZ.

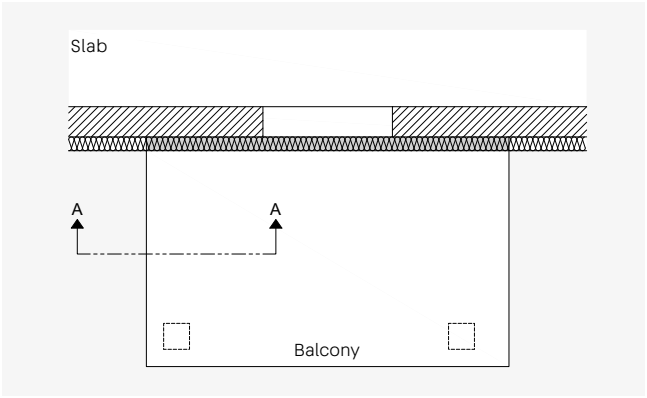
Q/QZ 10 to Q/QZ 60

$a_{s,erf}$		ISOPRO® 120					
		Q/QZ 10	Q/QZ 20	Q/QZ 30	Q/QZ 40	Q/QZ 50	Q/QZ 60
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Direct support	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 Ø 8
	Indirect support	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 2 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Direct support	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	-
	Indirect support cm²/m	1.13	1.13	1.45	1.82	2.18	2.26
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

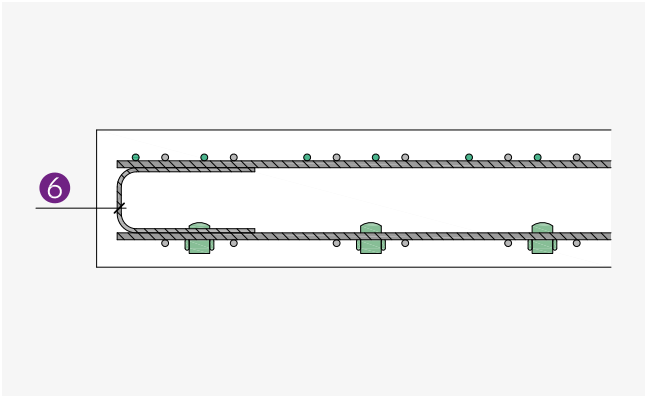
Q/QZ 70 to Q/QZ 120

$a_{s,erf}$		ISOPRO® 120					
		Q/QZ 70	Q/QZ 80	Q/QZ 90	Q/QZ 100	Q/QZ 110	Q/QZ 120
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Direct support	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Direct support	-	-	-	-	-	-
	Indirect support cm²/m	2.59	3.11	4.04	4.67	5.82	6.22
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

Supplementary edge reinforcement



Top view balcony

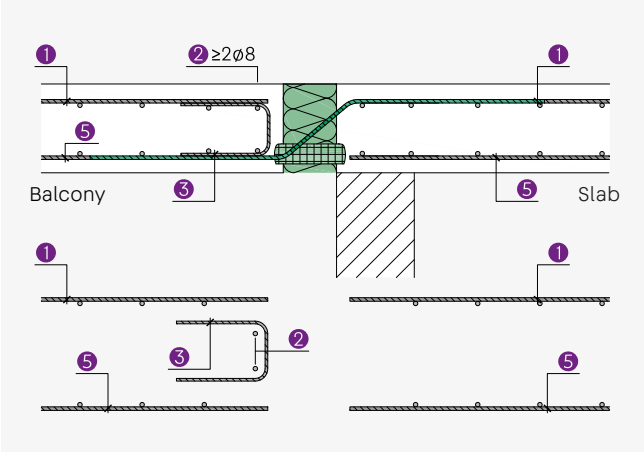


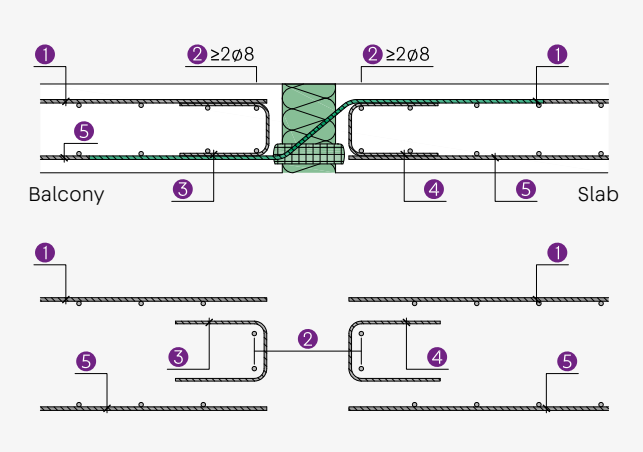
A-A cross-section

On-site reinforcement

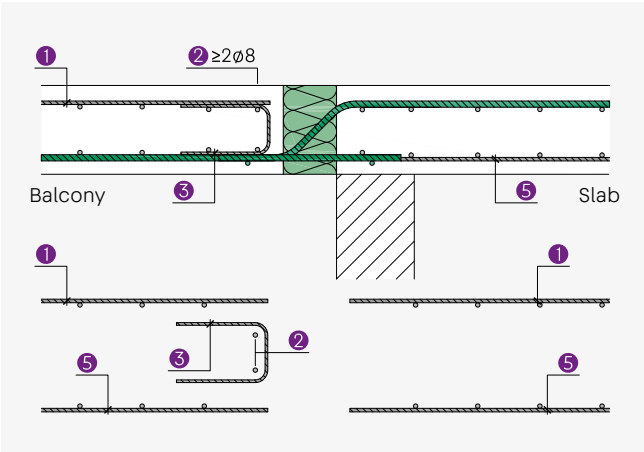
QS/QSZ 10 to QS/QSZ 120

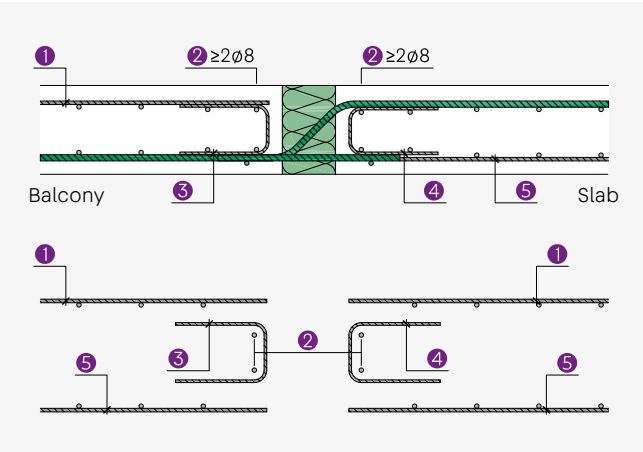
Straight shear bar Ø 8 -12 on the slab side – direct and indirect support





Straight shear bar Ø 14 on the slab side – direct and indirect support





Notes

- For information on the required reinforcement cross-sections for the individual items, see the table on page 59.
- The representations are limited to the QS elements. The same reinforcement specifications apply to QSZ.

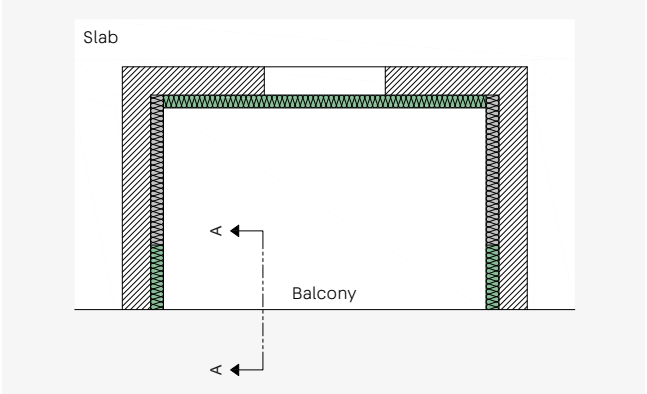
QS/QSZ 10 to QS/QSZ 60

$a_{s,erf}$		ISOPRO® 120					
		QS/QSZ 10	QS/QSZ 20	QS/QSZ 30	QS/QSZ 40	QS/QSZ 50	QS/QSZ 60
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Direct support	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Direct support	-	-	-	-	-	-
	Indirect support cm²	0.65	0.97	1.29	1.01	1.51	2.02
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

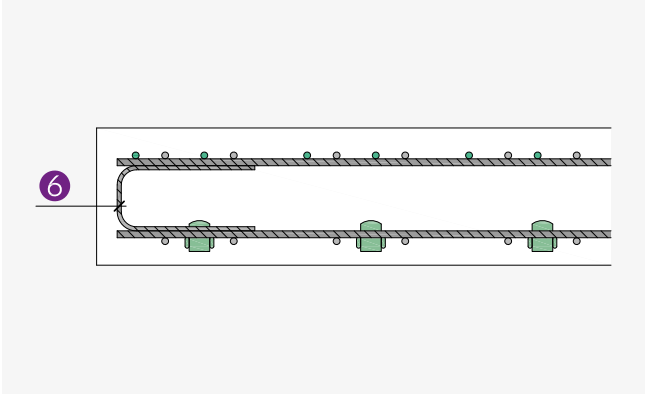
QS/QSZ 70 to QS/QSZ 120

$a_{s,erf}$		ISOPRO® 120					
		QS/QSZ 70	QS/QSZ 80	QS/QSZ 90	QS/QSZ 100	QS/QSZ 110	QS/QSZ 120
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Direct support	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8	2 Ø 8
	Indirect support	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8	2 + 2 Ø 8
Pos. 3	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250	≥ Ø 6/250
Pos. 4	Direct support	-	-	-	-	-	-
	Indirect support cm²	1.45	2.18	2.91	1.93	3.22	3.86
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

Supplementary edge reinforcement



Top view balcony

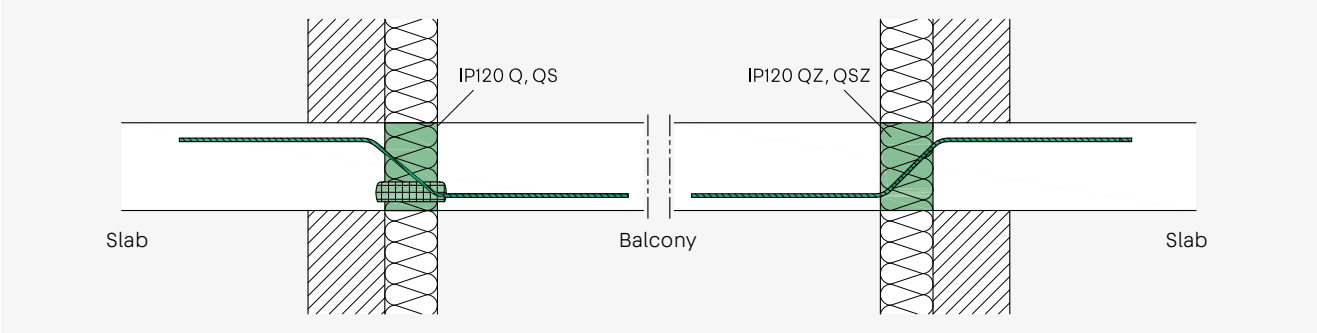


A-A cross-section

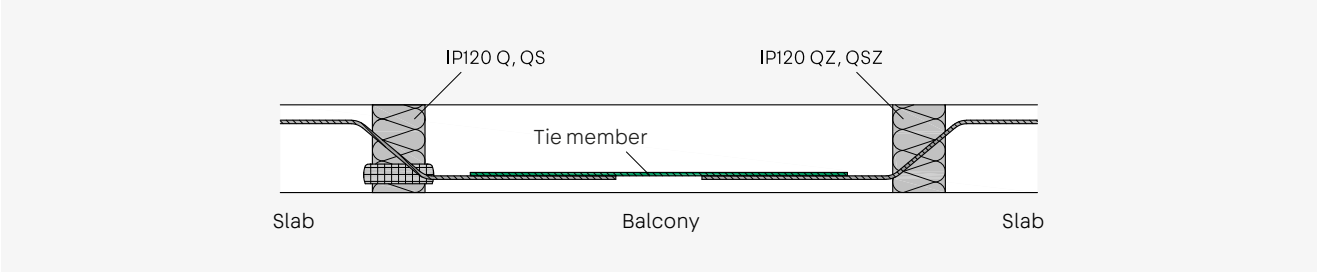
On-site reinforcement

QS/QSZ 10 to QS/QSZ 120

Tie bar design



ISOPRO® 120 Q/QZ, QS/QSZ – Installation cross-section with opposite types of the same load class



ISOPRO® 120 Q/QZ, QS/QSZ – On-site tie bar in the bottom layer of reinforcement

For constraint-free support with a ISOPRO® 120 QZ or QSZ, a corresponding Q element must be used on the opposing side. A tie bar must be installed between the two elements in accordance with the shear reinforcement of the ISOPRO® 120 elements.

QZ tie bar

ISOPRO® 120	Tie bar
QZ 10	4 Ø 6*
QZ 20	6 Ø 6*
QZ 30	8 Ø 6*
QZ 40	10 Ø 6*
QZ 50	12 Ø 6*
QZ 60	7 Ø 8
QZ 70	8 Ø 8
QZ 80	10 Ø 8
QZ 90	8 Ø 10
QZ 100	10 Ø 10
QZ 110	8 Ø 12
QZ 120	9 Ø 12

QSZ tie bar

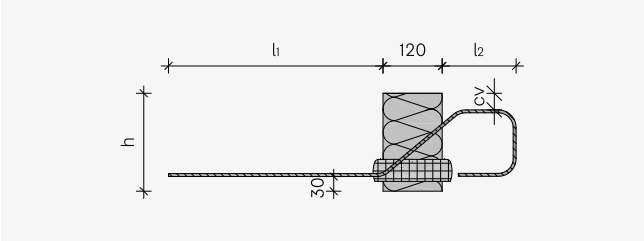
ISOPRO® 120	Tie bar
QSZ 10	2 Ø 8
QSZ 20	3 Ø 8
QSZ 30	4 Ø 8
QSZ 40	2 Ø 10
QSZ 50	3 Ø 10
QSZ 60	4 Ø 10
QSZ 70	2 Ø 12
QSZ 80	3 Ø 12
QSZ 90	4 Ø 12
QSZ 100	2 Ø 14
QSZ 110	3 Ø 14
QSZ 120	4 Ø 14

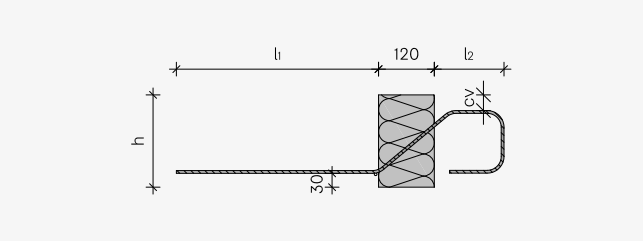
*Elements with shear bars Ø 6 have a looped bar on the slab side. For all other elements, the shear bar on the slab side is straight (see also page 61).

Element dimensions

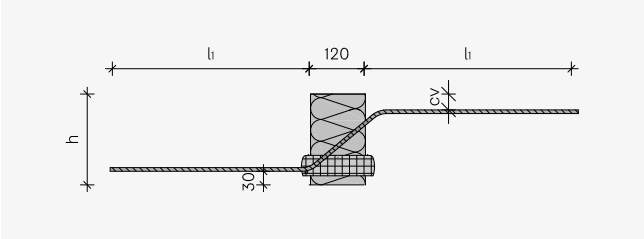
Q/QZ, QS/QSZ 10 to Q/QZ, QS/QSZ 120

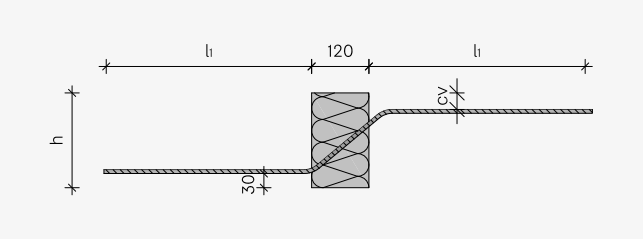
Shear bar Ø 6



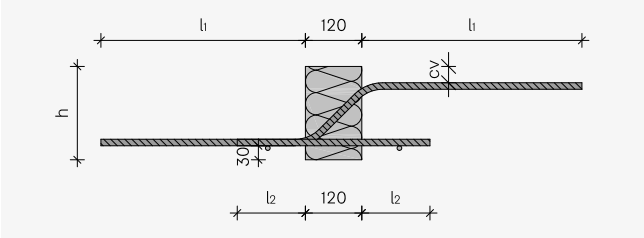


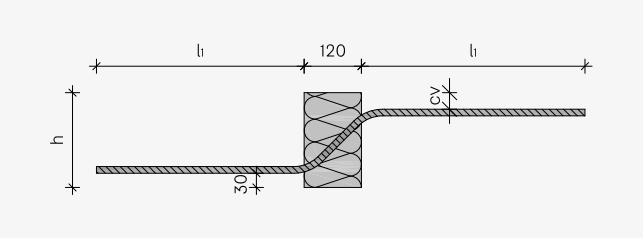
Shear bar Ø 8-12





Shear bar Ø 14





Dimensions in mm

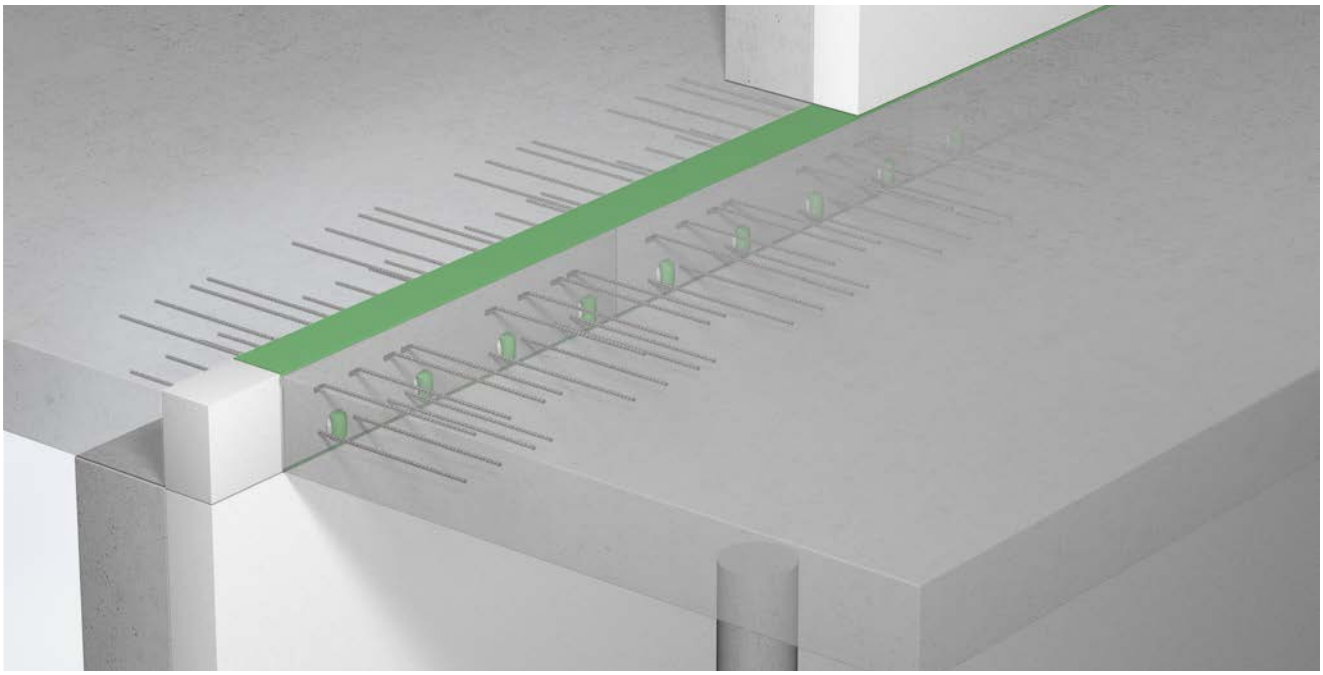
ISOPRO® 120	Q/QZ 10 – 50	Q/QZ 60 – 80 QS/QSZ 10 – 30	Q/QZ 90 – 100 QS/QSZ 40 – 60	Q/QZ 110 – 120 QS/QSZ 70 – 90	QS/QSZ 100 – 120
l_1	350	520	630	740	800
l_2	155	-	-	-	165
h	≥ 160	≥ 160	≥ 170	≥ 180	≥ 190

Concrete cover

Element height h mm	Concrete cover cv mm	Element height h mm	Concrete cover cv mm
160	35	210	45
170	45	220	35
180	35	230	45
190	45	240	55
200	35	250	65

IP 120 QQ, QQS

Elements for supported balconies with uplift loads



IP 120 QQ

- For transferring shear forces
- Element length 1.0 m
- Load-bearing levels QQ 10 to QQ 120
- Element heights from 160 mm
- Fire resistance class REI 120 available

IP 120 QQS

- For transferring shear forces
- Element length 0.3 m, 0.4 m or 0.5 m depending on the load-bearing level
- Load-bearing levels QQS 10 to QQS 120
- Element heights from 160 mm
- Fire resistance class REI 120 for load-bearing level 10 to 90 available
- Fire resistance class REI 90 for load-bearing-level 100 to 120 available (REI 120 with an utilization of ≤ 85% in ULS)

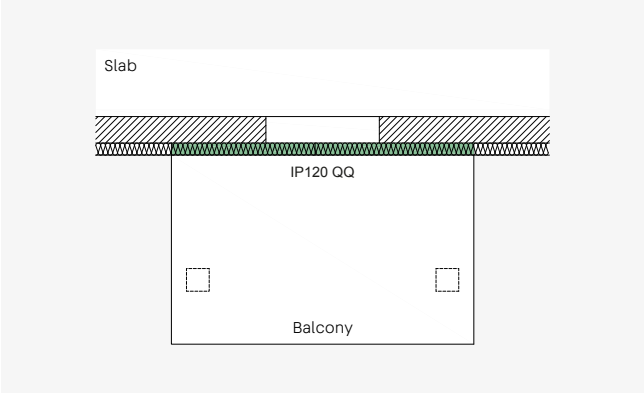
Type designation

IP 120 QQ 20 h200 REI 120

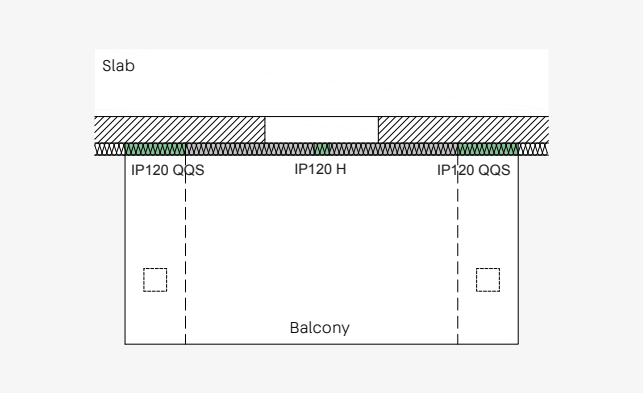
- REI 120 — Fire protection type
- h200 — Element height
- 20 — Load-bearing level
- QQ — Type
- IP 120 — Abbreviation of product name

Application – Element arrangement

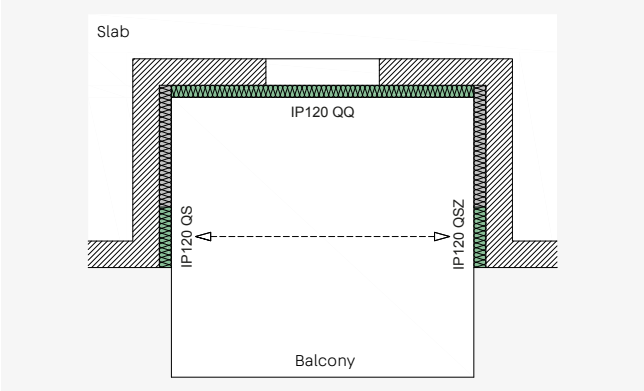
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



ISOPRO® 120 QQ – Supported balcony with inset columns position



ISOPRO® 120 QQS – Supported balcony with beams and columns at specific points with ISOPRO® 120 QQS elements



ISOPRO® 120 QQ, QS, QZ – Loggia balcony with load peaks at specific points at the front and uplifting loads in the rear corner area

For balconies connected with shear force elements, appropriate support must be ensured in all construction stages. Temporary supports may only be removed when the permanent supports that may be installed at a later date are sufficiently load-bearing and firmly connected to the balcony.

Measurement table for concrete ≥ C25/30

QQ – Dimensioning values of absorbable shear force v_{Rd} in kN/m

ISOPRO® 120	Shear force v_{Rd} kN/m	Element height mm	Element length mm	Expansion joint clearance m	Configuration Shear bars	Configuration Compression bearings
QQ 10	± 31.6	≥ 160	1000	21.7	2 x 4 Ø 6*	4
QQ 20	± 47.4				2 x 6 Ø 6*	4
QQ 30	± 63.2				2 x 8 Ø 6*	4
QQ 40	± 79.1				2 x 10 Ø 6*	4
QQ 50	± 94.9				2 x 12 Ø 6*	4
QQ 60	± 98.4				2 x 7 Ø 8	4
QQ 70	± 112.4				2 x 8 Ø 8	4
QQ 80	± 135.3				2 x 10 Ø 8	4
QQ 90	± 175.7	≥ 170			2 x 8 Ø 10	6
QQ 100	± 202.9				2 x 10 Ø 10	6
QQ 110	± 253.0	≥ 180		19.8	2 x 8 Ø 12	8
QQ 120	± 270.5				2 x 9 Ø 12	8

*Elements with shear bars Ø 6 have a looped rod on the slab side. For all other elements, the shear bar on the slab side is straight (see also page 70).

QQS – Dimensioning values of absorbable shear force V_{Rd} in kN

ISOPRO® 120	Shear force V_{Rd} kN	Element height mm	Element length mm	Expansion joint clearance m	Configuration Shear bars	Configuration Compression bearings
QQS 10	± 28.1	≥ 160	300	21.7	2 x 2 Ø 8	2
QQS 20	± 42.2		400		2 x 3 Ø 8	2
QQS 30	± 56.2		500		2 x 4 Ø 8	2
QQS 40	± 43.9	≥ 170	300		2 x 2 Ø 10	2
QQS 50	± 65.9		400		2 x 3 Ø 10	2
QQS 60	± 87.8		500		2 x 4 Ø 10	3
QQS 70	± 63.2	≥ 180	300	19.8	2 x 2 Ø 12	2
QQS 80	± 94.9		400		2 x 3 Ø 12	3
QQS 90	± 126.5		500		2 x 4 Ø 12	4
QQS 100*	± 84.0	≥ 200	300	17.0	2 x 2 Ø 14	3 Ø 14
QQS 110*	± 140.0		400		2 x 3 Ø 14	5 Ø 14
QQS 120*	± 167.9		500		2 x 4 Ø 14	6 Ø 14

*Design with steel compression bars, fire protection REI 90

Notes

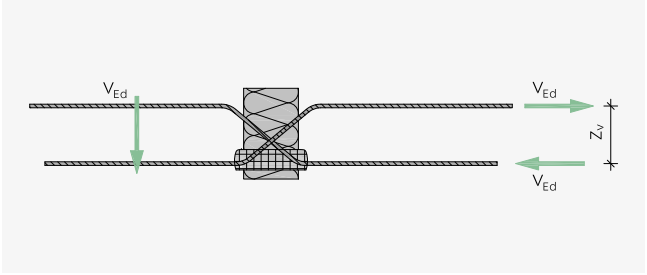
For the QQS 100 to QQS 120 with steel compression bars the fire protection class is REI 90. The fire protection class is REI 120 when the reaction coefficient η_{fi} (in accordance with EN 1992-1-2, section 2.4.2) is reduced to 0.6 – this corresponds to an utilization of ≤ 85% in ULS (ultimate limit state).

Measurement table

Moment resulting from eccentric connections

When dimensioning the Supplementary reinforcement on the ceiling for the ISOPRO® 120 type QQ and QQS shear elements, 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 elements are fully utilised.

$$\Delta M_{Ed} = \tan(\alpha)40° \cdot V_{Ed} \cdot z_v$$



Lever arm z_v for determining the offset moment

QQ offset moments

ISOPRO® 120				Δm_{Ed} kNm/m
	h = 160-170 mm	h = 180-190 mm	h = 200-210 mm	h = 220-250 mm
QQ 10	3.1	3.8	4.6	5.4
QQ 20	4.6	5.8	6.9	8.0
QQ 30	6.2	7.7	9.2	10.7
QQ 40	7.7	9.6	11.5	13.4
QQ 50	9.3	11.5	13.8	16.1
QQ 60	9.5	11.8	14.2	16.5
QQ 70	10.9	13.5	16.2	18.9
QQ 80	13.1	16.3	19.5	22.7
QQ 90	18.8	20.9	25.1	29.3
QQ 100	21.8	24.2	29.0	33.9
QQ 110	-	29.8	35.9	41.9
QQ 120	-	31.9	38.4	44.8

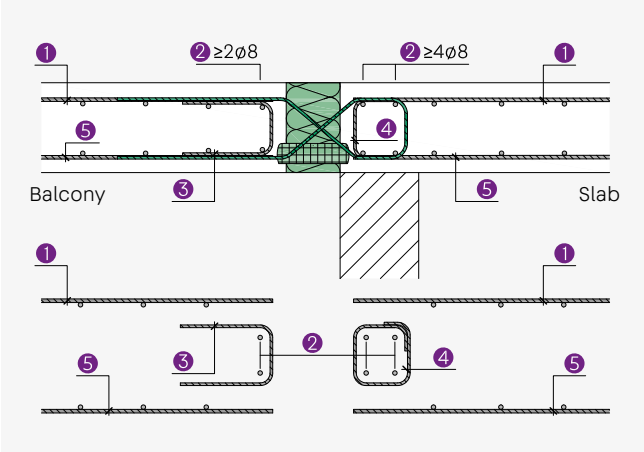
QQS offset moments

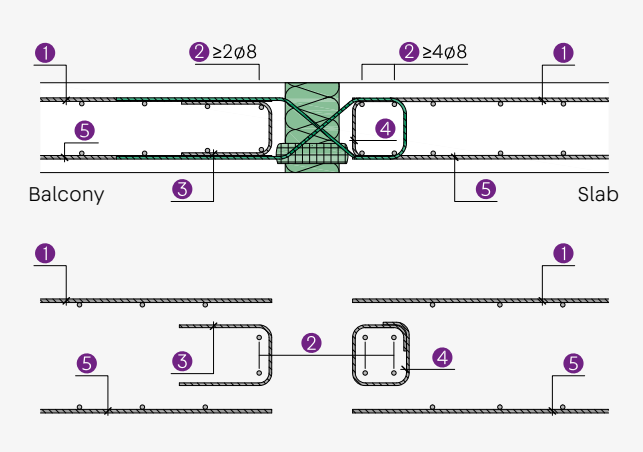
ISOPRO® 120				ΔM_{Ed} kNm
	h = 160-170 mm	h = 180-190 mm	h = 200-210 mm	h = 220-250 mm
QQS 10	2.7	3.4	4.1	4.7
QQS 20	4.1	5.1	6.1	7.1
QQS 30	5.4	6.8	8.1	9.4
QQS 40	4.7	5.2	6.3	7.3
QQS 50	7.1	7.9	9.4	11.0
QQS 60	9.4	10.5	12.6	14.7
QQS 70	-	7.5	9.0	10.5
QQS 80	-	11.2	13.5	15.7
QQS 90	-	14.9	17.9	21.0
QQS 100	-	-	12.1	14.1
QQS 110	-	-	20.2	23.5
QQS 120	-	-	24.2	28.2

On-site reinforcement

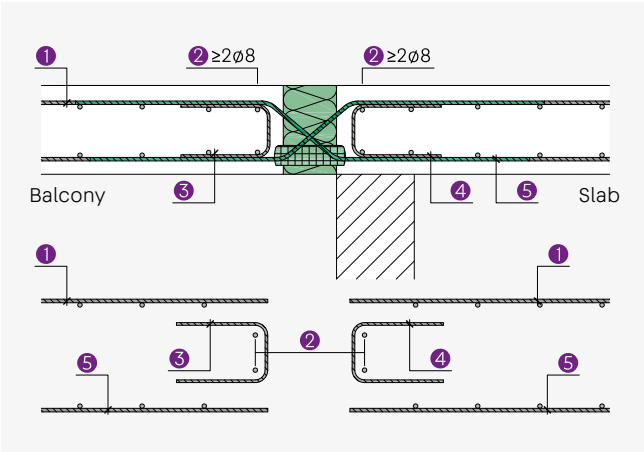
QQ 10 to QQ 120

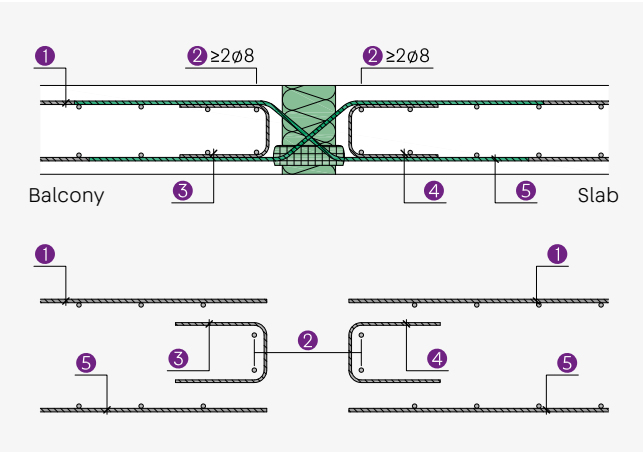
Shear bar Ø 6 looped on the slab side – direct and indirect support





Straight shear bar Ø 8 -12 on the slab side – direct and indirect support





Notes
For information on the required reinforcement cross-sections for the individual items, see the table on page 67.

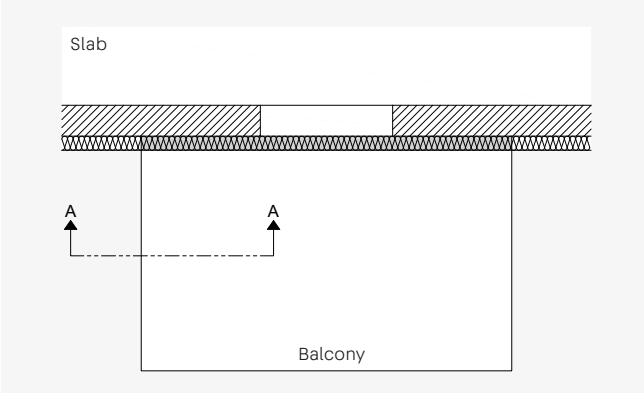
QQ 10 to QQ 60

$a_{s,erf}$		ISOPRO® 120					
		QQ 10	QQ 20	QQ 30	QQ 40	QQ 50	QQ 60
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Longitudinal reinforcement	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 4 Ø 8	2 + 2 Ø 8
Pos. 3	Supplementary edge reinforcement cm²/m	1.13	1.13	1.45	1.82	2.18	2.26
Pos. 4	Supplementary edge reinforcement cm²/m	1.13	1.13	1.45	1.82	2.18	2.26
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

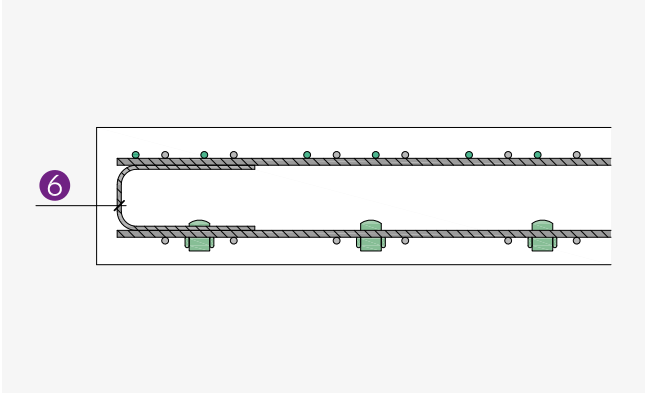
QQ 70 to QQ 120

$a_{s,erf}$		ISOPRO® 120					
		QQ 70	QQ 80	QQ 90	QQ 100	QQ 110	QQ 120
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Longitudinal reinforcement	2 + 2 Ø 8					
Pos. 3	Supplementary edge reinforcement cm²/m	2.59	3.11	4.04	4.67	5.82	6.22
Pos. 4	Supplementary edge reinforcement cm²/m	2.59	3.11	4.04	4.67	5.82	6.22
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

Supplementary edge reinforcement



Top view balcony

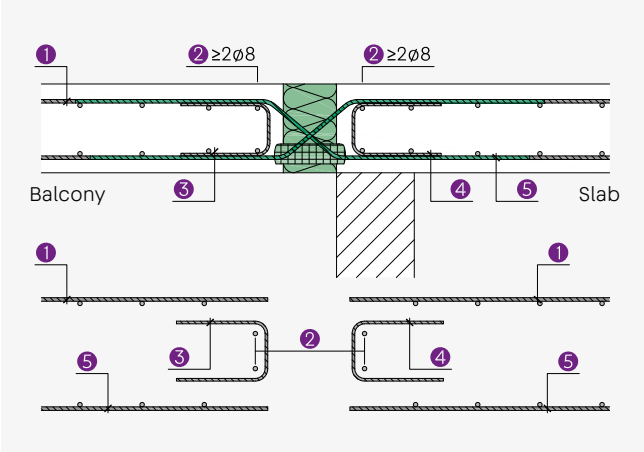


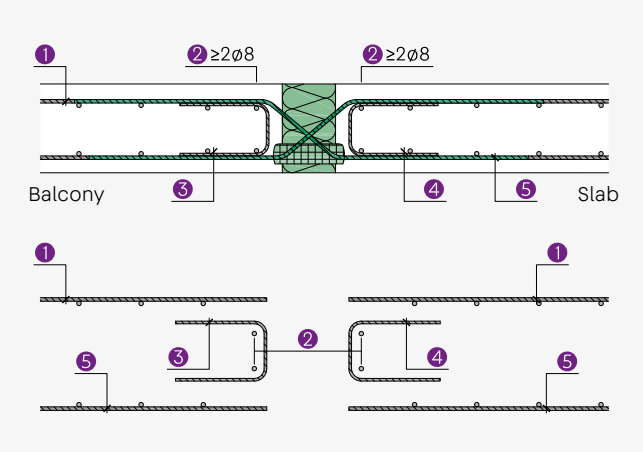
A-A cross-section

On-site reinforcement

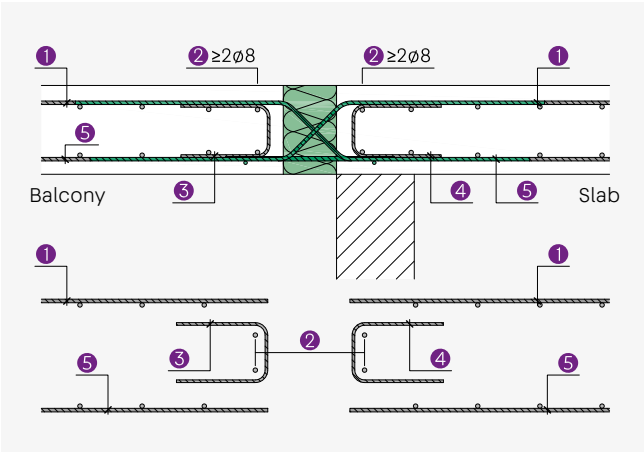
QQS 10 to QQS 120

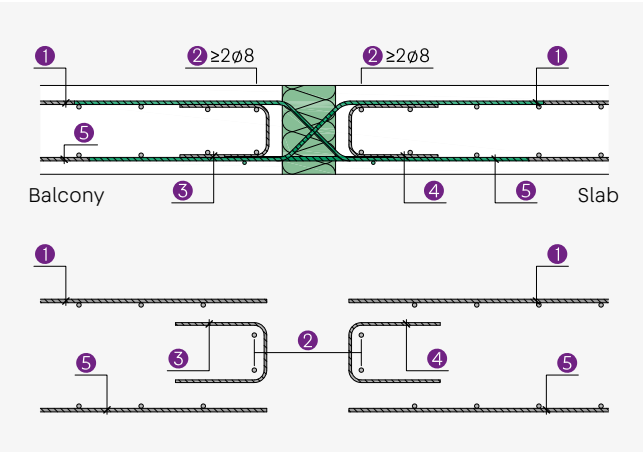
Straight shear bar Ø 8 -12 on the slab side – direct and indirect support





Straight shear bar Ø 14 on the slab side – direct and indirect support





Notes
For information on the required reinforcement cross-sections for the individual items, see the table on page 69.

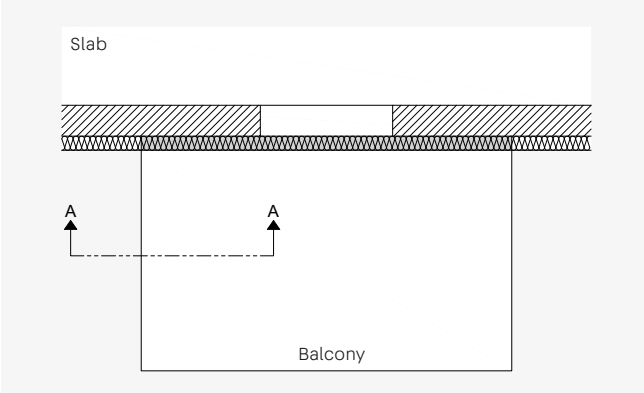
QQS 10 to QQS 60

$a_{s,erf}$		ISOPRO® 120					
		QQS 10	QQS 20	QQS 30	QQS 40	QQS 50	QQS 60
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Longitudinal reinforcement	2 + 2 Ø 8					
Pos. 3	Supplementary edge reinforcement cm²	0.65	0.97	1.29	1.01	1.51	2.02
Pos. 4	Supplementary edge reinforcement cm²	0.65	0.97	1.29	1.01	1.51	2.02
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

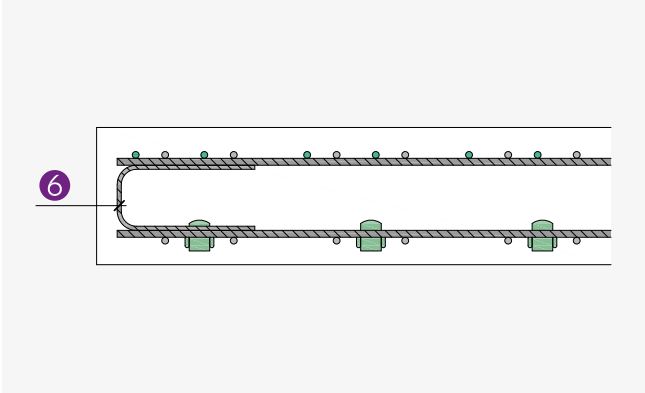
QQS 70 to QQS 120

$a_{s,erf}$		ISOPRO® 120					
		QQS 70	QQS 80	QQS 90	QQS 100	QQS 110	QQS 120
Pos. 1	Component reinforcement	As specified by the structural engineer					
Pos. 2	Longitudinal reinforcement	2 + 2 Ø 8					
Pos. 3	Supplementary edge reinforcement cm²	1.45	2.18	2.91	1.93	3.22	3.86
Pos. 4	Supplementary edge reinforcement cm²	1.45	2.18	2.91	1.93	3.22	3.86
Pos. 5	Component reinforcement	As specified by the structural engineer					
Pos. 6	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2)					

Supplementary edge reinforcement



Top view balcony

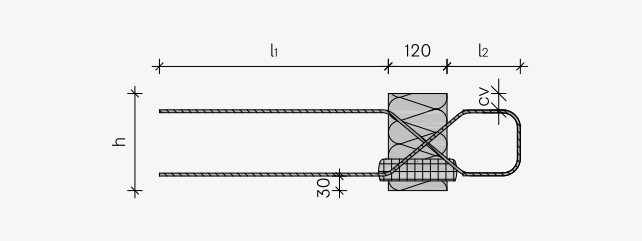


A-A cross-section

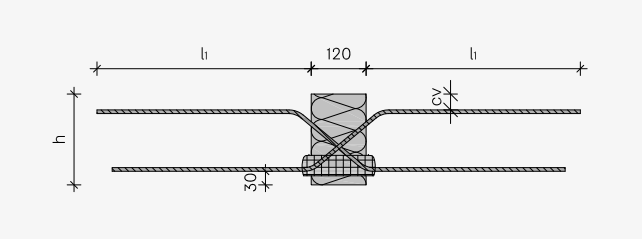
Element dimensions

QQ / QQS 10 to QQ / QQS 120

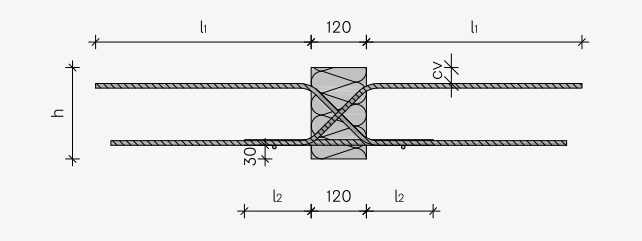
Shear bar Ø 6



Shear bar Ø 8-12



Shear bar Ø 14

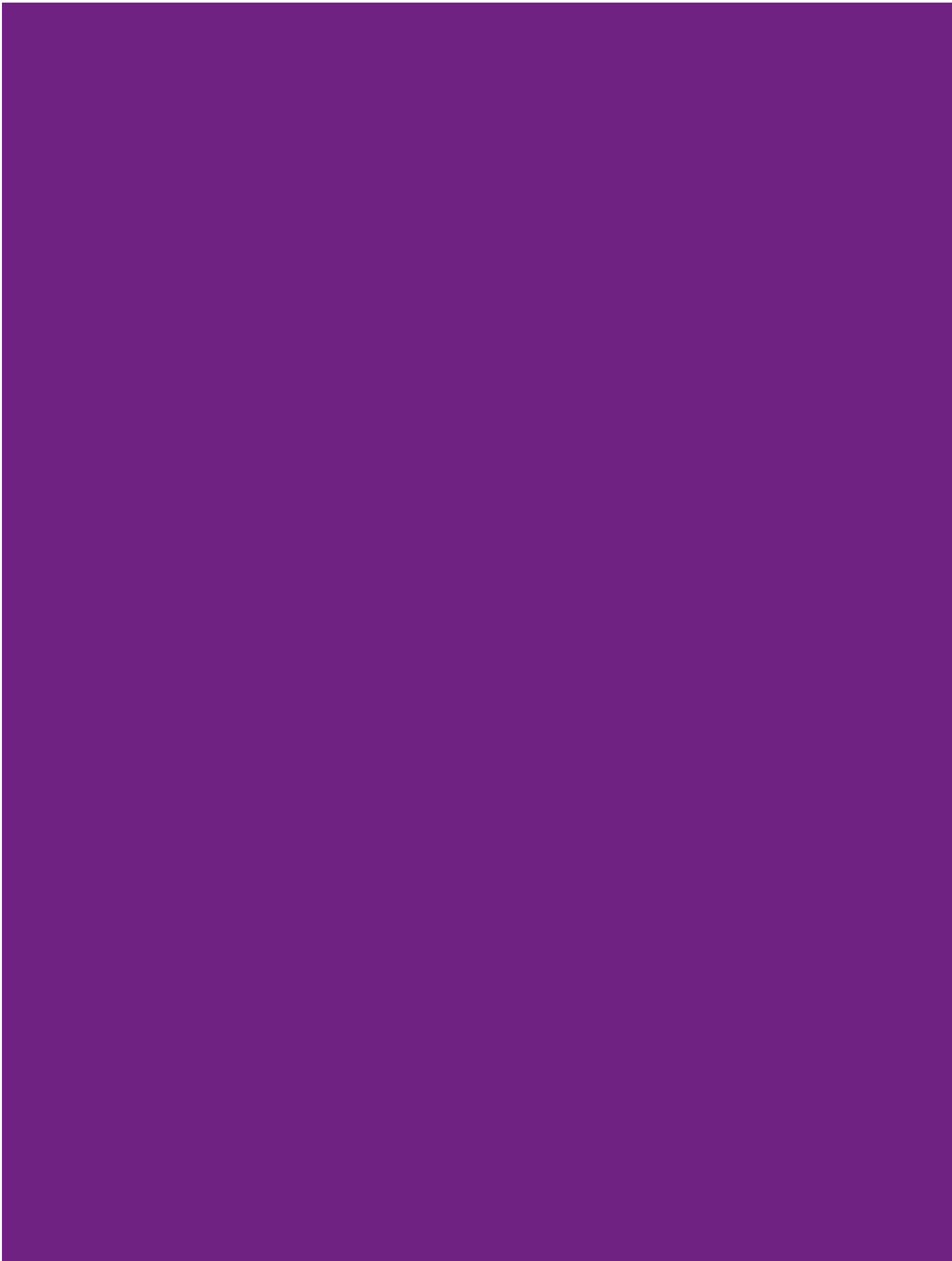


Dimensions in mm

ISOPRO® 120	QQ 10 – 50	QQ 60 – 80 QQS 10 – 30	QQ 90 – 100 QQS 40 – 60	QQ 110 – 120 QQS 70 – 90	QQS 100 – 120
l_1	350	470	590	700	800
l_2	155	-	-	-	165
h	≥ 160	≥ 160	≥ 170	≥ 180	≥ 200

Concrete cover

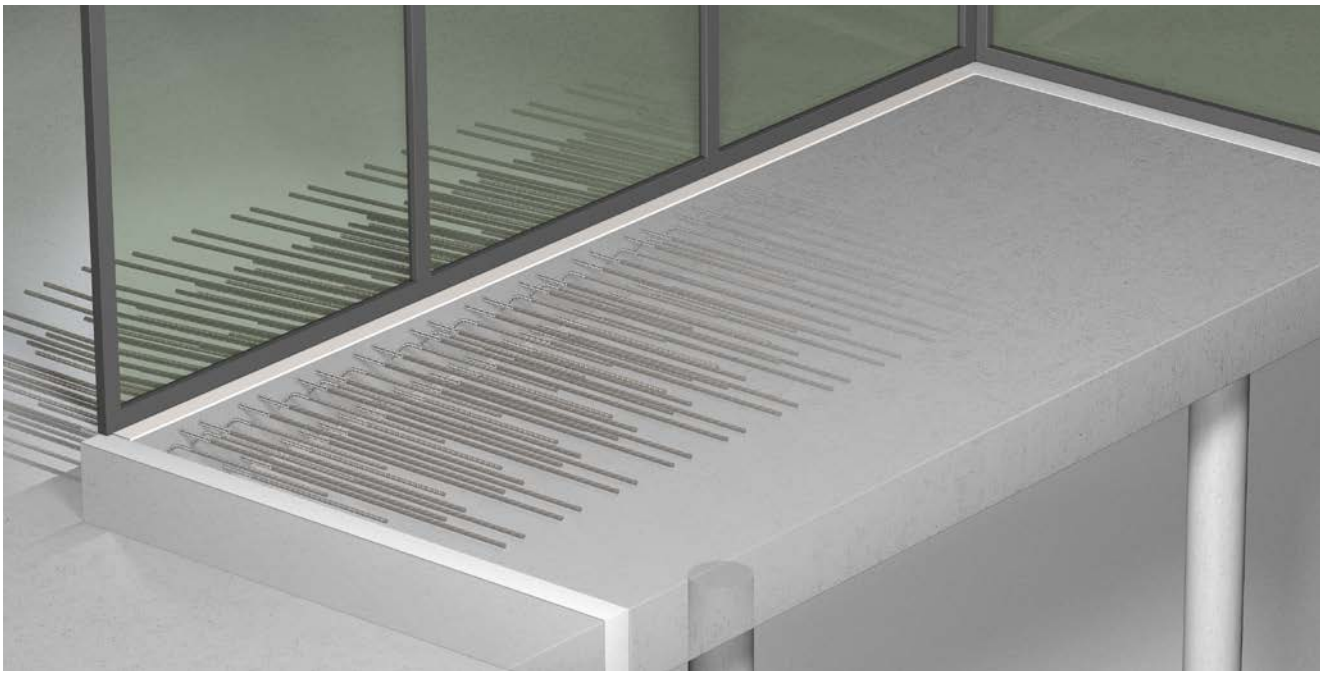
Element height h mm	Concrete cover cv mm	Element height h mm	Concrete cover cv mm
160	35	210	45
170	45	220	35
180	35	230	45
190	45	240	55
200	35	250	65



Continuous elements

IP 120 D

Elements for continuous slabs



IP 120 D

- For transferring moments and shear forces
- Load-bearing levels D 20 to D 100
- Shear force load-bearing levels Q8 and Q10
- Concrete cover of tie bars at the top, cv35 or cv50
- Concrete cover of compression rods at the bottom, 30 mm for cv35 and 50 mm for cv50
- Element heights from 160 mm depending on the shear force load-bearing level
- Fire resistance class REI 90 (REI 120 with an utilization of ≤ 85% in ULS) available
- Compression level with steel

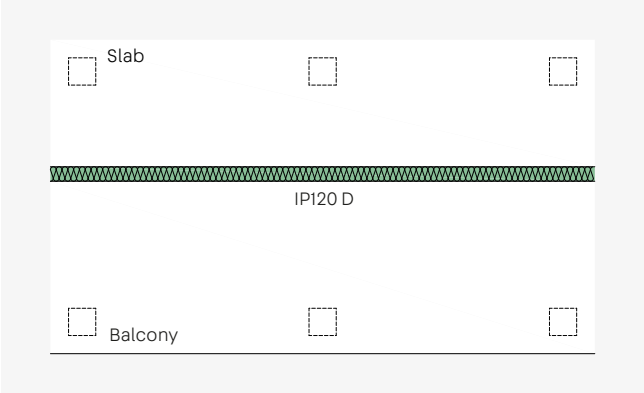
Type designation

IP 120 D 50 Q8 cv35 h200 REI 90

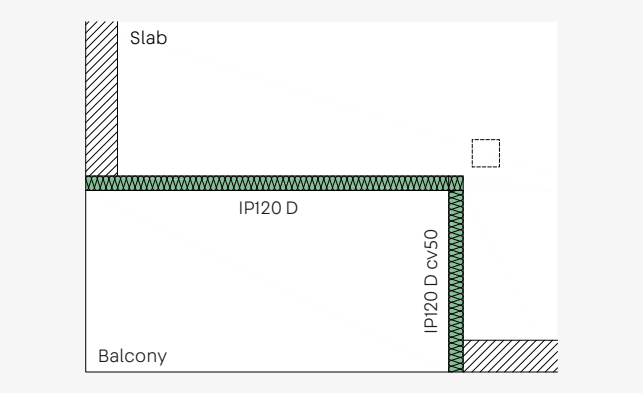
- REI 90 – Fire protection type
- h200 – Element height
- cv35 – Concrete cover
- Q8 – Shear force load-bearing level
- D 50 – Load-bearing level
- D – Type
- IP 120 – Abbreviation of product name

Application – Element arrangement

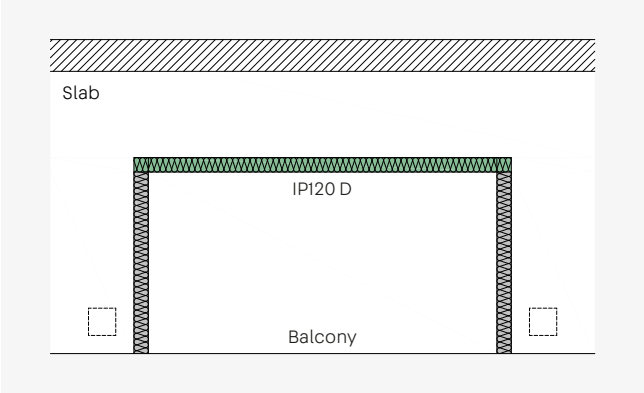
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



ISOPRO® 120 D – Continuous slab with a glass facade



ISOPRO® 120 D – Internal corner balcony with large dimensions and loads



ISOPRO® 120 D – Inset balcony with glass facade, without direct support

Notes on structural design

- The joint between the balcony and the ceiling slab must be factored in to calculations performed in the FEM software.
- ISOPRO® 120 D elements can only transmit bending moments perpendicular to the insulating joint.
- When determining the applied forces, the torsional spring stiffness of the D elements must be included in the calculation iteratively. First, the torsional spring stiffness of the thermal insulation elements is assumed.
  An element is then selected on the basis of the resulting internal forces. In the next step, the actual torsion spring stiffness of the selected element is factored in to the calculation. Another iterative step may be necessary to arrive at the final result.
- The elements can be combined with ISOPRO® 120 H to transmit perpendicular and parallel forces across the joint.

Measurement table for concrete ≥ C25/30

Rated values of the moments that can be transferred m_{Rd} in kNm/m

Element height mm **depending on cv** mm		ISOPRO® 120								
35	**50**	**D 20**			**D 30**			**D 50**		
		Q6	**Q8**	**Q10**	**Q6**	**Q8**	**Q10**	**Q6**	**Q8**	**Q10**
160	**-**	± 12.4	± 10.7	-	± 20.2	± 18.5	-	± 27.6	± 26.0	-
-	**200**	± 13.1	± 11.4	-	± 21.4	± 19.7	-	± 29.3	± 27.6	-
170	**-**	± 13.8	± 12.0	± 9.9	± 22.6	± 20.8	± 18.8	± 30.9	± 29.1	± 27.1
-	**210**	± 14.6	± 12.6	± 10.5	± 23.8	± 21.9	± 19.8	± 32.6	± 30.7	± 28.6
180	**-**	± 15.3	± 13.3	± 11.0	± 25.0	± 23.0	± 20.8	± 34.3	± 32.3	± 30.0
-	**220**	± 16.0	± 13.9	± 11.5	± 26.2	± 24.1	± 21.8	± 35.9	± 33.8	± 31.5
190	**-**	± 16.8	± 14.5	± 12.0	± 27.4	± 25.2	± 22.8	± 37.6	± 35.4	± 33.0
-	**230**	± 17.5	± 15.1	± 12.6	± 28.7	± 26.4	± 23.8	± 39.3	± 37.0	± 34.4
200	**-**	± 18.2	± 15.8	± 13.1	± 29.9	± 27.5	± 24.8	± 40.9	± 38.5	± 35.9
-	**240**	± 18.9	± 16.4	± 13.6	± 31.1	± 28.6	± 25.8	± 42.6	± 40.1	± 37.3
210	**-**	± 19.7	± 17.0	± 14.1	± 32.3	± 29.7	± 26.9	± 44.2	± 41.7	± 38.8
-	**250**	± 20.4	± 17.7	± 14.7	± 33.5	± 30.8	± 27.9	± 45.9	± 43.2	± 40.3
220	**-**	± 21.1	± 18.3	± 15.2	± 34.7	± 31.9	± 28.9	± 47.6	± 44.8	± 41.7
230	**-**	± 22.6	± 19.6	± 16.2	± 37.2	± 34.2	± 30.9	± 50.9	± 47.9	± 44.6
240	**-**	± 24.0	± 20.8	± 17.3	± 39.6	± 36.4	± 32.9	± 54.2	± 51.1	± 47.5
250	**-**	± 25.5	± 22.1	± 18.3	± 42.0	± 38.6	± 34.9	± 57.6	± 54.2	± 50.5

Rated values of the shear force that can be transferred v_{Rd} in kN/m

	ISOPRO® 120								
	D 20			**D 30**			**D 50**		
	Q6	**Q8**	**Q10**	**Q6**	**Q8**	**Q10**	**Q6**	**Q8**	**Q10**
Shear 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 configuration

	ISOPRO® 120								
	D 20			**D 30**			**D 50**		
	Q6	**Q8**	**Q10**	**Q6**	**Q8**	**Q10**	**Q6**	**Q8**	**Q10**
Tie/compression bars	6 Ø 10	6 Ø 10	6 Ø 10	6 Ø 12	6 Ø 12	6 Ø 12	8 Ø 12	8 Ø 12	8 Ø 12
Shear bars	2 x 4 dia. 8	2 x 6 dia. 8	2 x 6 dia. 10	2 x 4 dia. 8	2 x 6 dia. 8	2 x 6 dia. 10	2 x 4 dia. 8	2 x 6 dia. 8	2 x 6 dia. 10
Element length mm	500+500			500+500			500+500		
Expansion joint spacing m	21.7			19.8			19.8		

Rated values of the moments that can be transferred m_{Rd} in kNm/m

Element height mm
depending on cv mm

ISOPRO® 120

35	50	D 70			D 90			D 100		
		Q6	Q8	Q10	Q6	Q8	Q10	Q6	Q8	Q10
160	-	± 35.1	± 33.4	-	± 42.5	± 40.9	-	± 45.7	-	-
-	200	± 37.2	± 35.5	-	± 54.1	± 43.4	-	± 48.6	-	-
170	-	± 39.3	± 37.5	± 35.5	± 47.6	± 45.8	± 43.8	± 51.4	± 49.4	-
-	210	± 41.4	± 39.5	± 37.4	± 50.2	± 48.3	± 46.2	± 54.2	± 52.2	-
180	-	± 43.5	± 41.5	± 39.3	± 52.8	± 50.8	± 48.5	± 57.0	± 54.9	± 52.6
-	220	± 45.6	± 43.5	± 41.2	± 55.3	± 53.2	± 50.9	± 59.9	± 57.6	± 55.2
190	-	± 47.7	± 45.5	± 43.1	± 57.9	± 55.7	± 53.3	± 62.7	± 60.3	± 57.8
-	230	± 49.9	± 47.6	± 45.0	± 60.5	± 58.2	± 55.6	± 65.5	± 63.0	± 60.4
200	-	± 52.0	± 49.6	± 46.9	± 63.0	± 60.6	± 58.0	± 68.3	± 65.7	± 63.0
-	240	± 65.1	± 51.6	± 48.8	± 65.6	± 63.1	± 60.3	± 71.2	± 68.5	± 65.6
210	-	± 56.2	± 53.6	± 50.7	± 68.1	± 65.5	± 62.7	± 74.0	± 71.2	± 68.2
-	250	± 58.3	± 55.6	± 52.6	± 70.7	± 68.0	± 65.0	± 76.8	± 73.9	± 70.8
220	-	± 60.4	± 57.6	± 54.6	± 73.3	± 70.5	± 67.4	± 79.6	± 76.6	± 73.4
230	-	± 64.6	± 61.7	± 58.4	± 78.4	± 75.4	± 72.1	± 85.3	± 82.0	± 78.6
240	-	± 68.9	± 65.7	± 62.2	± 83.5	± 80.3	± 76.8	± 90.9	± 87.5	± 83.8
250	-	± 73.1	± 69.7	± 66.0	± 88.6	± 85.3	± 81.5	± 96.6	± 92.9	± 89.1

Rated values of the shear force that can be transferred v_{Rd} in kN/m

ISOPRO® 120

	D 70			D 90			D 100		
	Q6	Q8	Q10	Q6	Q8	Q10	Q6	Q8	Q10
Shear force V_{Rd} kN/m	± 53.0	± 92.0	± 135.0	± 53.0	± 92.0	± 135.0	± 92.0	± 135.0	± 180.0

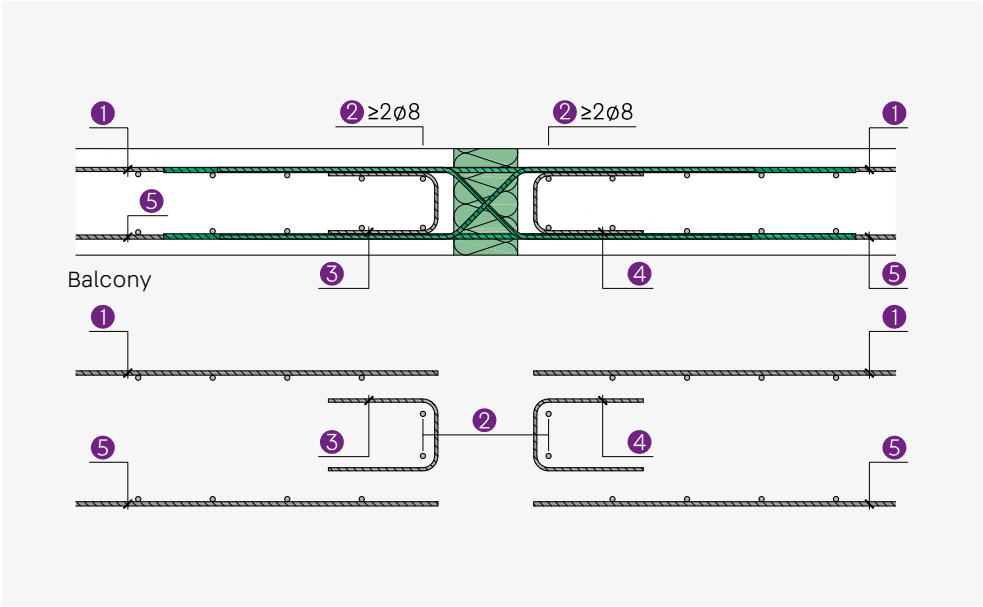
Dimensions and configuration

ISOPRO® 120

	D 70			D 90			D 100		
	Q6	Q8	Q10	Q6	Q8	Q10	Q6	Q8	Q10
Tie/compression bars	10 Ø 12	10 Ø 12	10 Ø 12	12 Ø 12	12 Ø 12	12 Ø 12	12 Ø 14	12 Ø 14	12 Ø 14
Shear bars	2 x 4 Ø 8	2 x 6 Ø 8	2 x 6 dia. 10	2 x 4 Ø 8	2 x 6 Ø 8	2 x 6 dia. 10	2 x 6 Ø 8	2 x 6 dia. 10	2 x 6 dia. 12
Element length mm	500+500			500+500			500+500		
Expansion joint spacing m	19.8			19.8			17.0		

On-site reinforcement

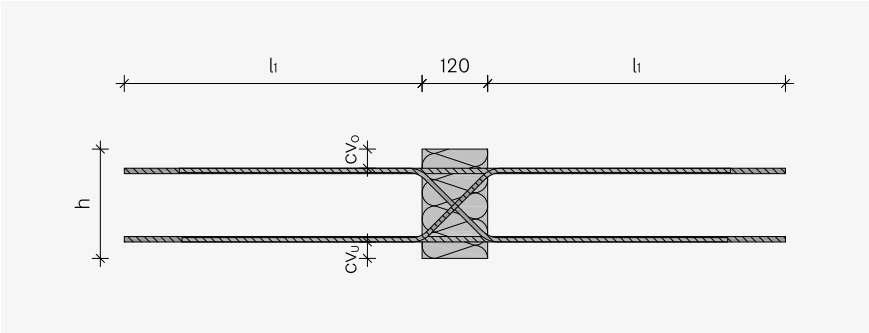
D 20 to D 100



$a_{s,erf}$		ISOPRO® 120					
		D 20	D 30	D 50	D 70	D 90	D 100
Pos. 1	Connection reinforcement cm²/m	4.71	6.79	9.05	11.30	13.56	18.48
Pos. 2	Longitudinal reinforcement	2 + 2 Ø 8					
Pos. 3	Attachment reinforcement	$a_{s,erf} = v_{Ed} / f_{yd} \geq Ø\ 6/250$					
Pos. 4	Attachment reinforcement	$a_{s,erf} = v_{Ed} / f_{yd} \geq Ø\ 6/250$					
Pos. 5	Supplementary reinforcement cm²/m	4.71	6.79	9.05	11.30	13.56	18.48

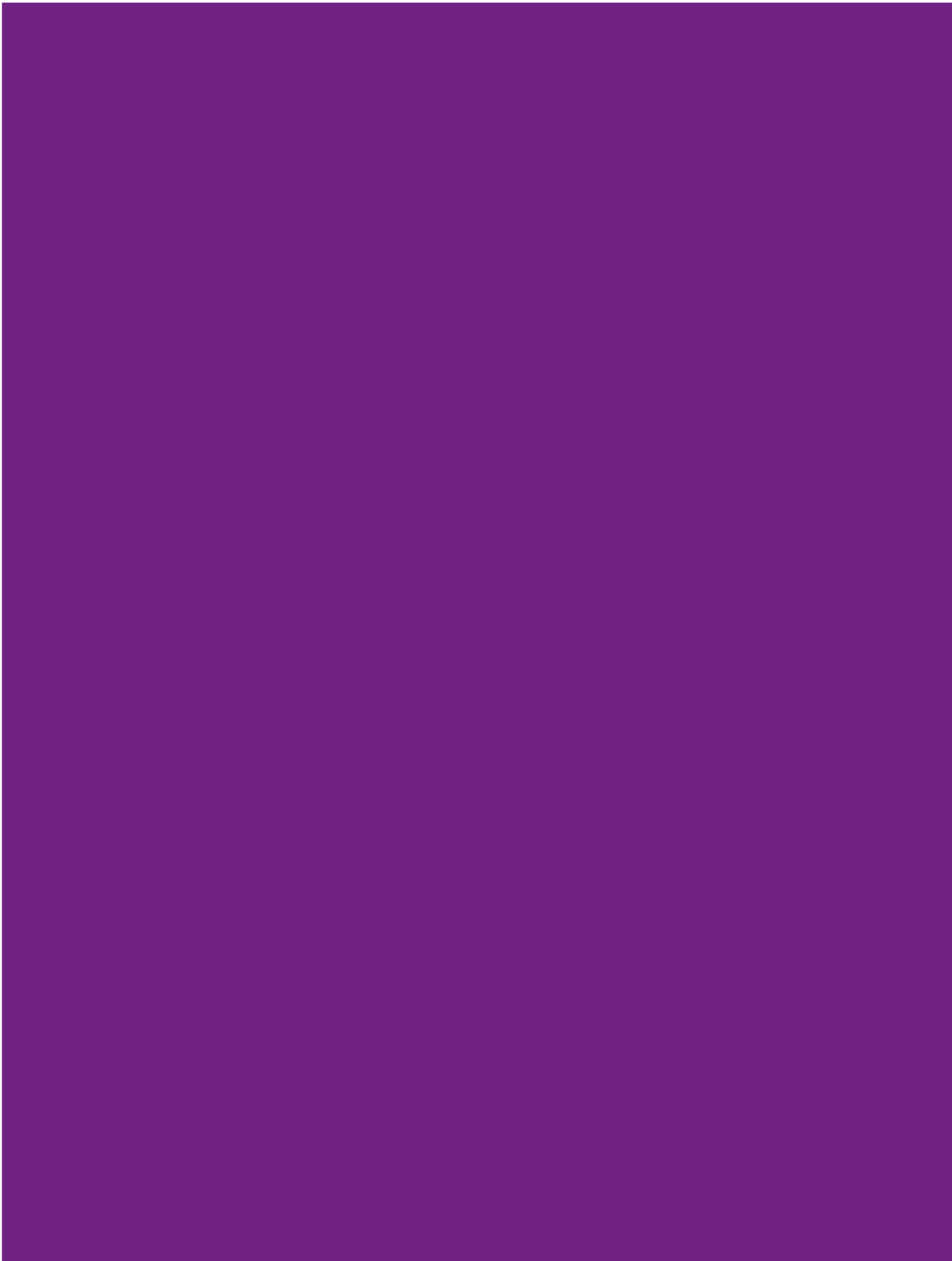
Element dimensions

D 20 to D 100



Dimensions in mm

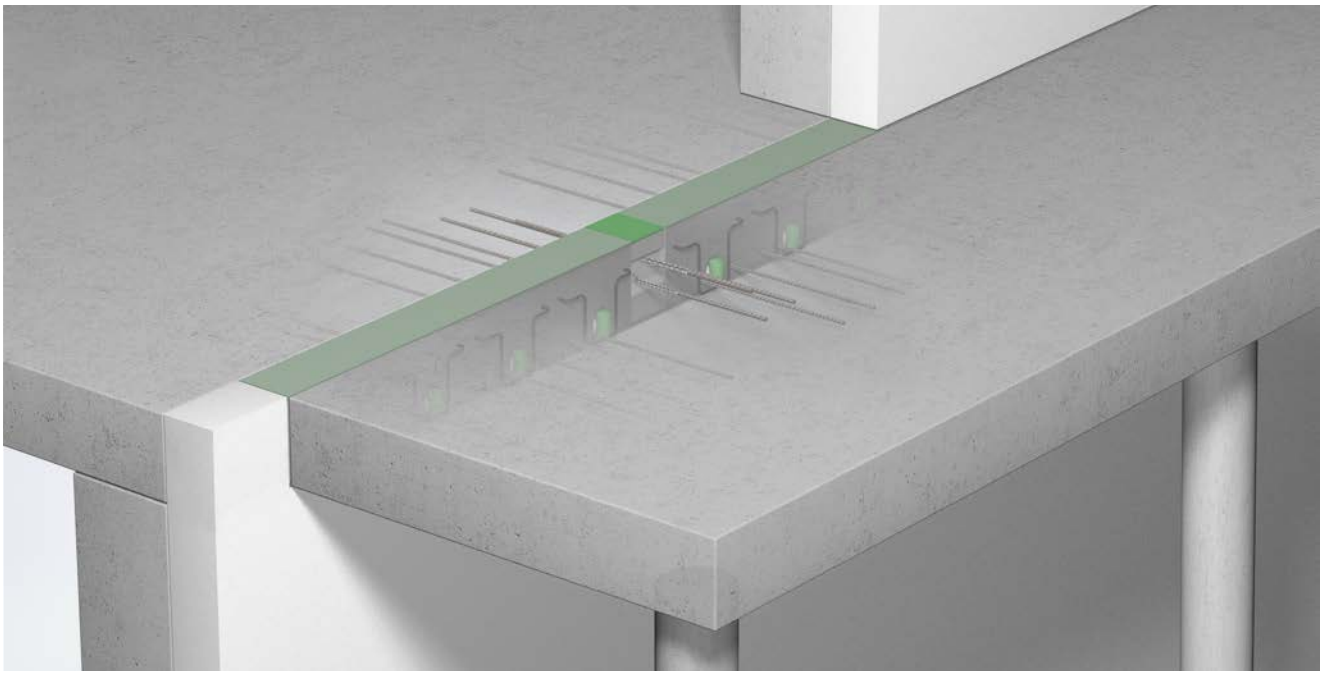
		ISOPRO® 120					
		D 20	D 30	D 50	D 70	D 90	D 100
l_1		720	840	840	840	840	960
cv_o		35/50					
cv_u		30/50					
h	Q6	160-250					
	Q8	160-250					
	Q10	180-250					
Element length		500+500					



Elements for special loads

IP 120 H

Elements for planned horizontal loads



IP 120 H

- ISOPRO® 120 H X for transferring horizontal forces perpendicular to the insulating joint
- ISOPRO® 120 H XY for transferring horizontal forces perpendicular to and parallel to the insulating joint
- Load-bearing levels X1, X2, X1Y1, X2Y2
- Clearly defined concrete cover – see product details
- Element heights from 180 mm
- Fire resistance class REI 120 available

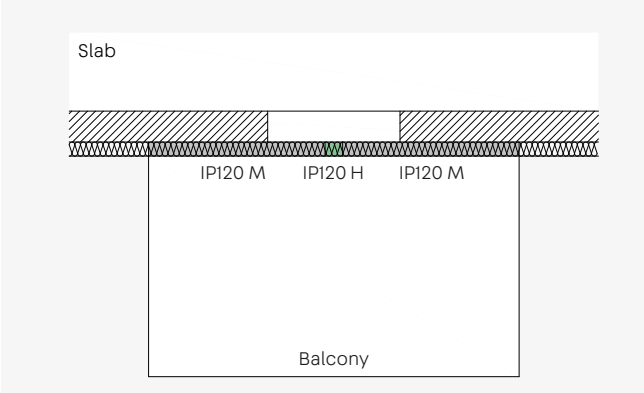
Type designation

IP 120 H X1 h200 REI 120

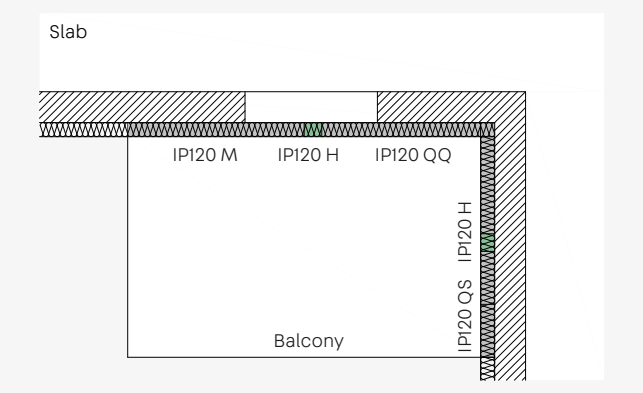
- REI 120 – Fire protection type
- h200 – Element height
- X1 – Load-bearing level
- H – Type
- IP 120 – Abbreviation of product name

Application – Element arrangement

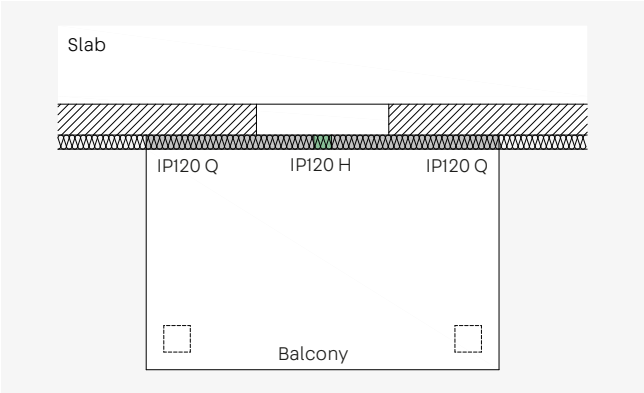
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 9 – 15 must also be taken into account.



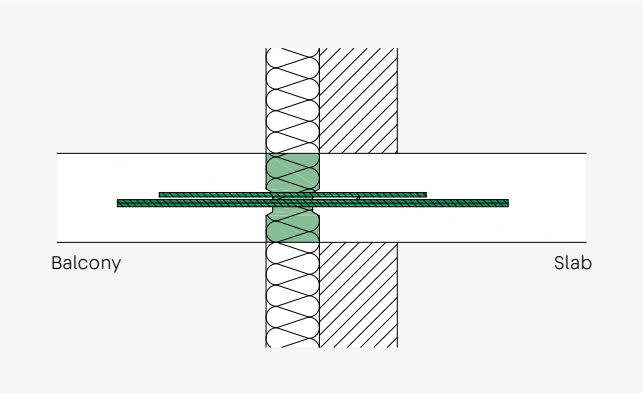
ISOPRO® 120 H – Cantilevered balcony with planned horizontal forces



ISOPRO® 120 H – Internal corner balcony with planned horizontal forces



ISOPRO® 120 H – Balcony on hinged supports with structurally anchored horizontal forces



ISOPRO® 120 H – Installation cross-section in the thermal insulation composite system

Measurement table for concrete ≥ C25/30

Dimensioning values of absorbable forces in kN

ISOPRO® 120	H X1	H X2	H X1Y1	H X2Y2
Shear force $v_{Rd,y}$	-	-	± 10.30	± 34.80
Normal force $N_{Rd,x}$	± 11.50	± 50.90	± 11.50	± 50.90

Dimensions and configuration

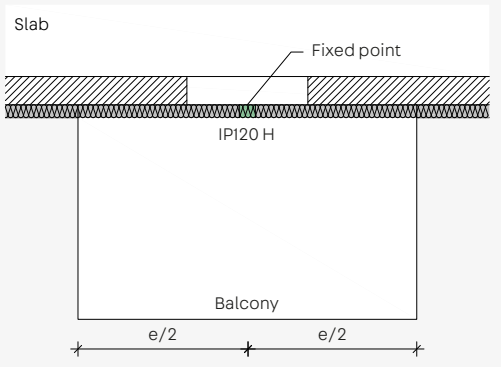
ISOPRO® 120	H X1	H X2	H X1Y1	H X2Y2
Tie/compression bars	1 Ø 10	1 Ø 14	1 Ø 10	1 Ø 14
Shear bars	-	-	2 x 1 Ø 10	2 x 1 Ø 12
Element length mm	150	150	150	150

Notes on structural design

- The quantity and position of the ISOPRO® 120 H are chosen in accordance with the structural engineer's specifications.
- When using ISOPRO® 120 H, 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 H elements used.
- Using ISOPRO® 120 H creates fixed points. This must be taken into account when selecting the maximum permissible expansion joint spacing.
- The bars of ISOPRO® 120 H are anchored on both sides of the insulating joint. No connection reinforcement is required for the H elements.

Expansion joint spacing

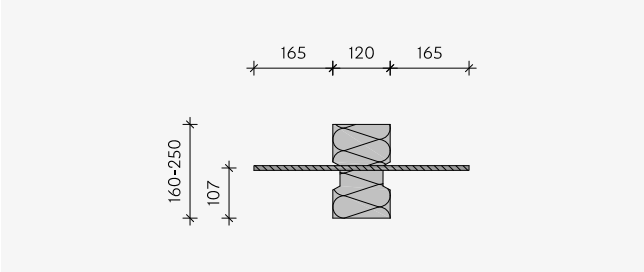
By using ISOPRO® 120 H, a fixed point is created, resulting in increased constraints. The maximum permissible expansion joint spacing is therefore reduced to e/2 when ISOPRO® 120 H is used. Half of the maximum expansion joint spacing is always measured from the fixed point.



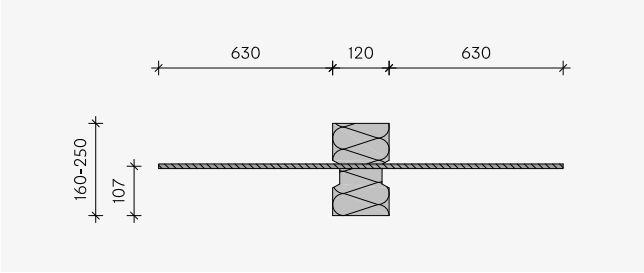
Element dimensions

H X1 - H X2Y2

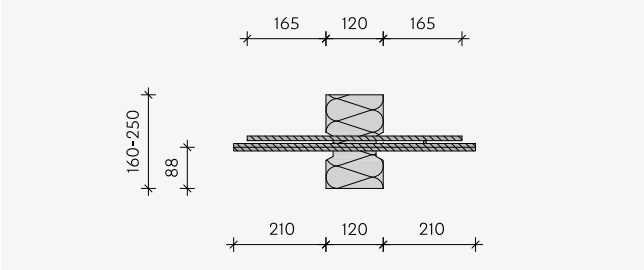
View



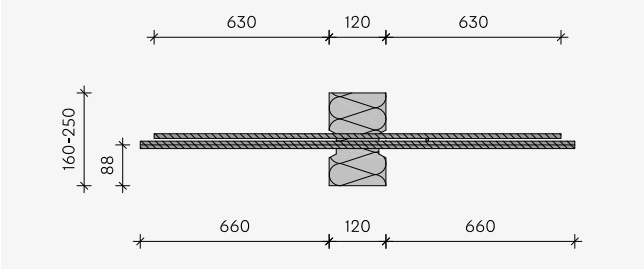
ISOPRO® 120 H X1



ISOPRO® 120 H X2

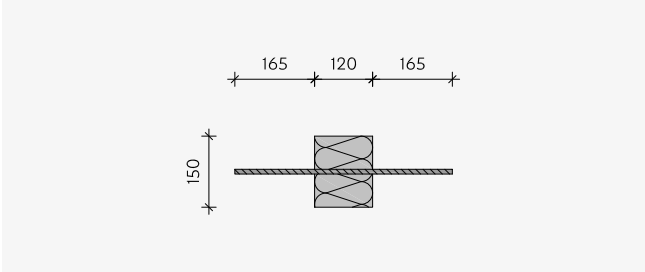


ISOPRO® 120 H X1Y1

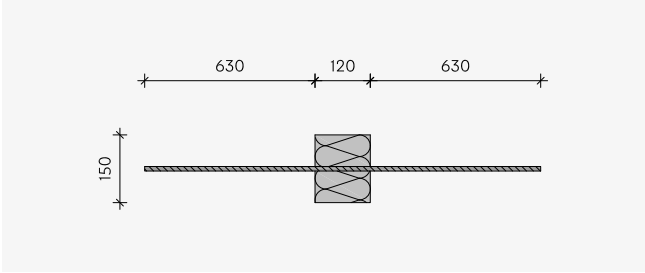


ISOPRO® 120 H X2Y2

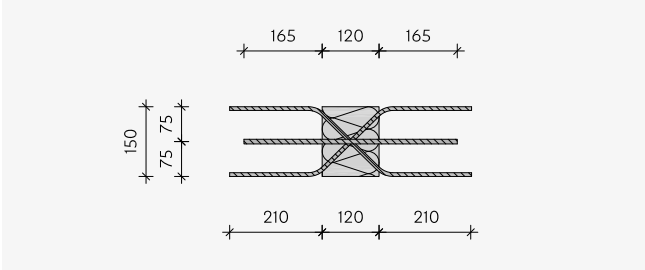
View from above



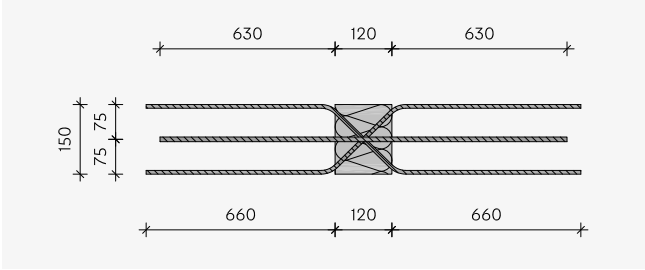
ISOPRO® 120 H X1



ISOPRO® 120 H X2



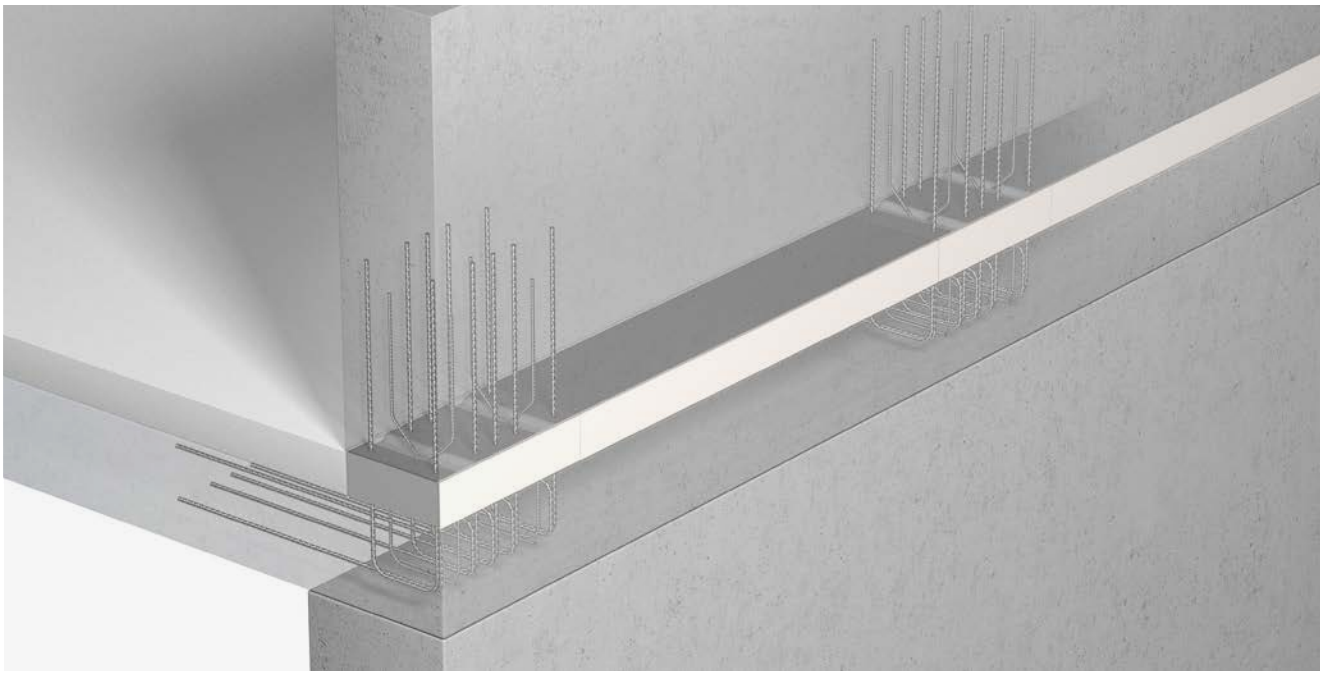
ISOPRO® 120 H X1Y1



ISOPRO® 120 H X2Y2

IP 120 A

Elements for parapets and parapet upstands



IP 120 A

- For transferring normal forces, moments and horizontal forces
- Load-bearing levels A1 and A2
- Element length 350 mm
- Parapet/parapet upstand widths from 150 to 250 mm
- Concrete cover varies depending on parapet thickness – see element structure
- Floor thicknesses from 160 mm
- Fire resistance class REI 90 (REI 120 with an utilization of ≤ 85% in ULS) available

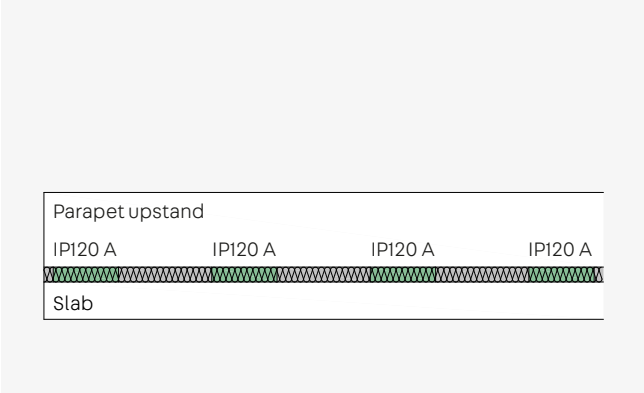
Type designation

IP 120 A 1 b200 REI 90

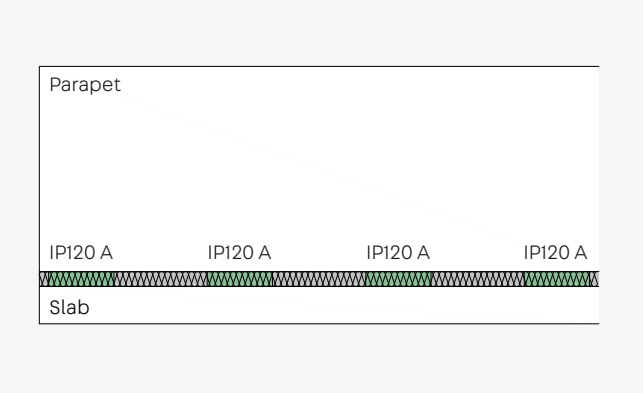
- REI 90 – Fire protection type
- b200 – Parapet/balustrade width
- A 1 – Load-bearing level
- A – Type
- IP 120 – Abbreviation of product name

Application – Element arrangement

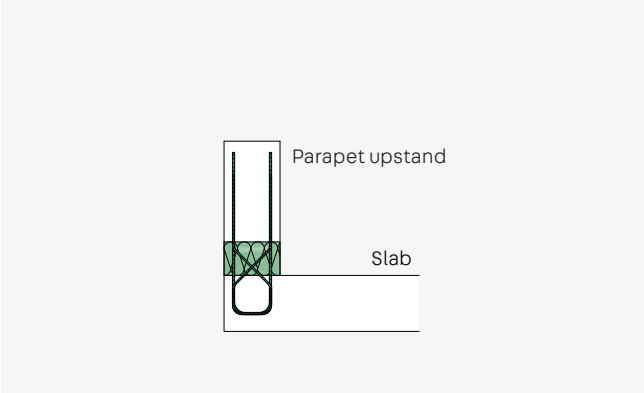
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



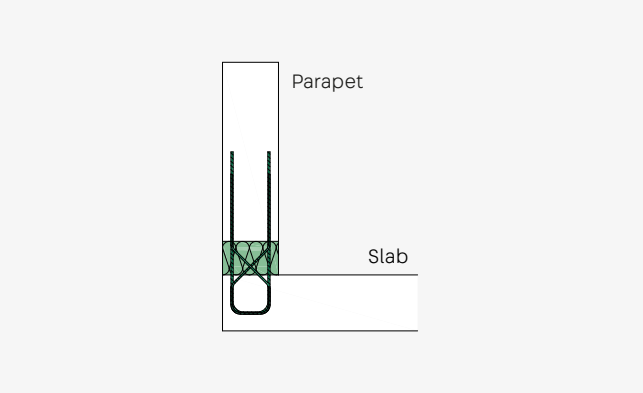
ISOPRO® 120 A – View of parapet connected to the horizontal face



ISOPRO® 120 A – View of parapet connected to the horizontal face



ISOPRO® 120 A – Installation cross-section of parapet upstand connected to the horizontal face



ISOPRO® 120 A – Installation cross-section of parapet connected to the horizontal face

Measurement table for concrete ≥ C25/30

A1 – Dimensioning values of absorbable forces

ISOPRO® 120		A1 – b < 200 mm	A1 – 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

A2 – Dimensioning values of absorbable forces

ISOPRO® 120		A2 – b < 200 mm	A2 – 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

- Only a compressive force can be transferred as the normal force.
- The normal force N_{Rd} specified in the table corresponds to the maximum transmissible compressive force depending on the type and concrete quality.
- The following edge clearances must be maintained at the slab and parapet edges and at expansion joints:
  - No edge clearence is required in the area of the parapet.
  - An edge clearance of 50 mm must be maintained in the slab area.

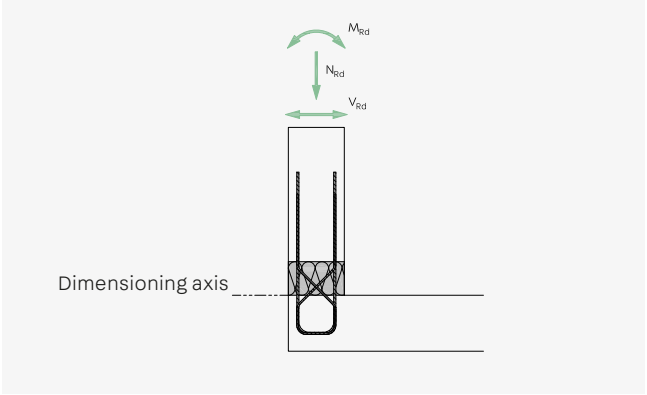
Concrete cover

Parapet/parapet upstand width b mm	Concrete cover cv mm
150	25
160	30
170	35
180	40
190	45
200	30
210	35
220	40
230	45
240	50
250	55

Dimensions and configuration

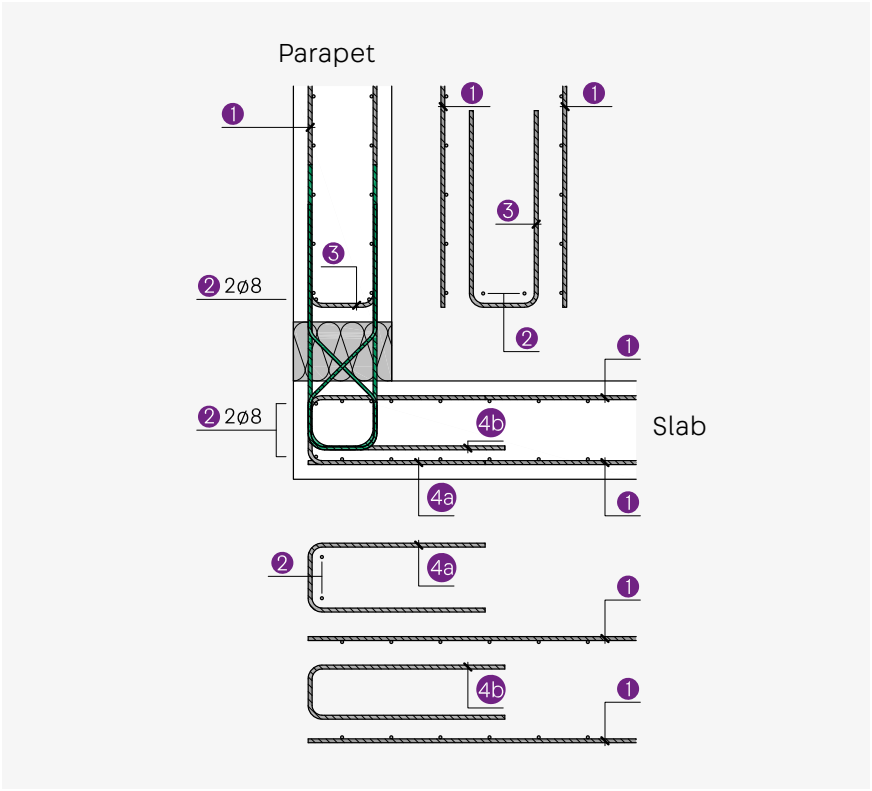
ISOPRO® 120	A1	A2
Parapet/parapet upstand width b mm	150 - 250	150 - 250
Tie/compression bars	2 Ø 8	5 Ø 8
Horizontal force bars	2 x 2 Ø 6	2 x 2 Ø 6
Element length mm	350	350
Expansion joint spacing m	21.7	21.7

Static system



On-site reinforcement

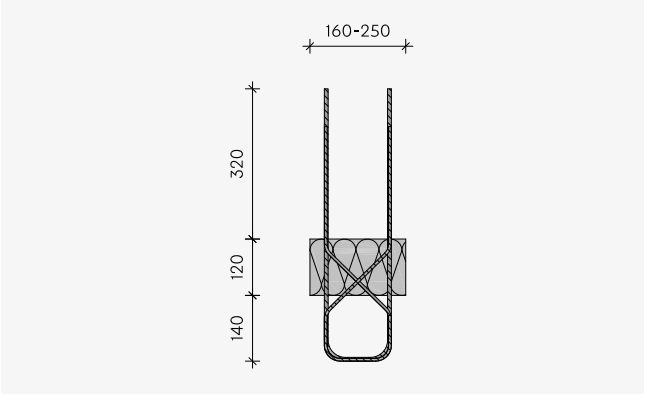
A1 to A2



$a_{s,erf}$		ISOPRO® 120	
		A1	A2
Pos. 1	Connection reinforcement	2 Ø 8	5 Ø 8
Pos. 2	Longitudinal reinforcement	2 + 2 Ø 8	2 + 2 Ø 8
Pos. 3	Attachment reinforcement	2 Ø 6	2 Ø 6
Pos. 4a	Supplementary edge reinforcement	≥ Ø 6/250	≥ Ø 6/250
Pos. 4b	Supplementary reinforcement*	2 Ø 8	5 Ø 8

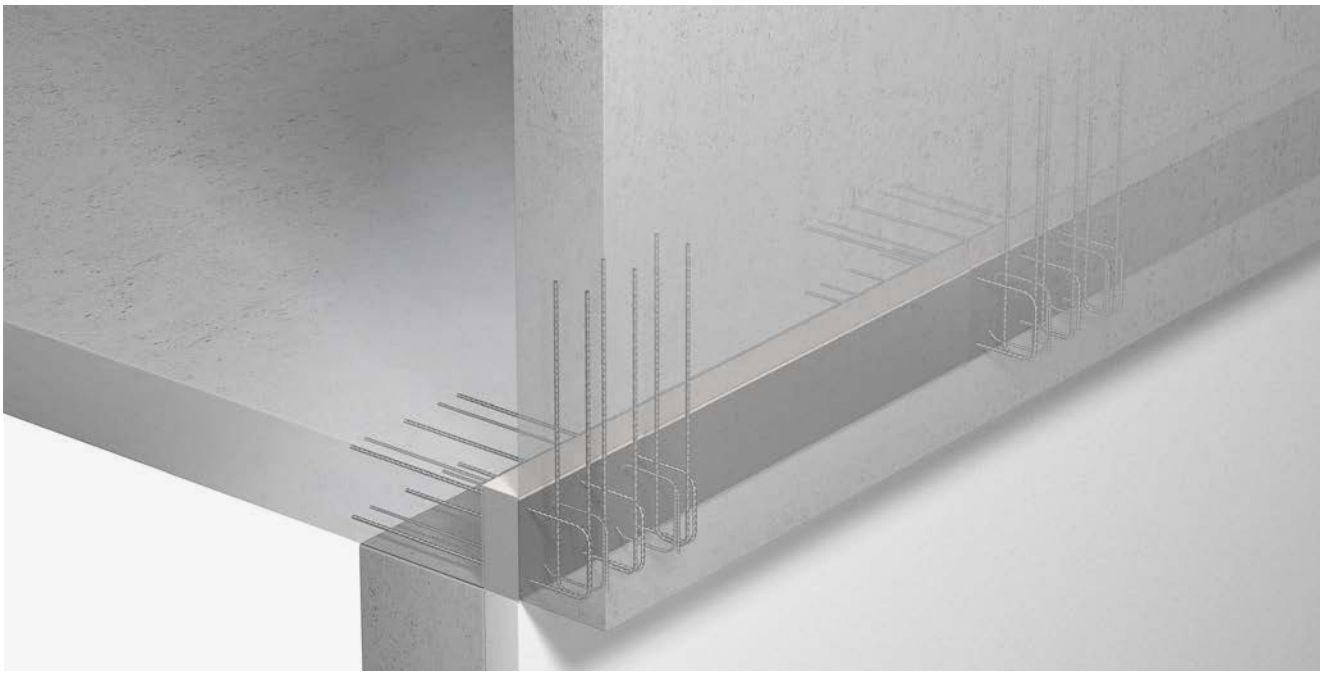
*supplied

Element dimensions



IP 120 F

Elements for parapets connected to the vertical face



IP 120 F

- For transferring shear forces, moments and horizontal forces
- Element length 350 mm
- Element heights from 160 to 250 mm
- Concrete cover varies depending on element height – see element structure
- Balustrade thicknesses from 150 mm
- Fire resistance class REI 90 (REI 120 with an utilization of ≤ 85% in ULS) available

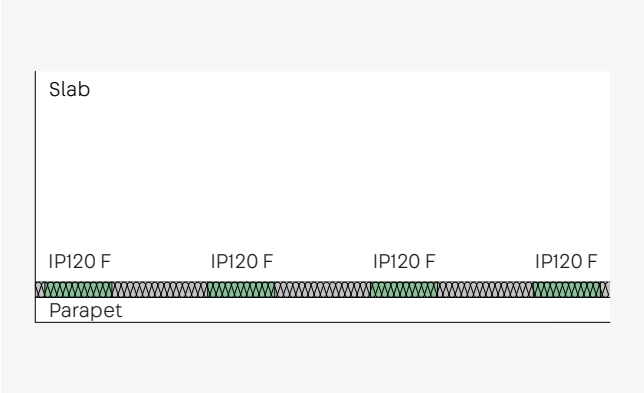
Type designation

IP 120 F h200 REI 90

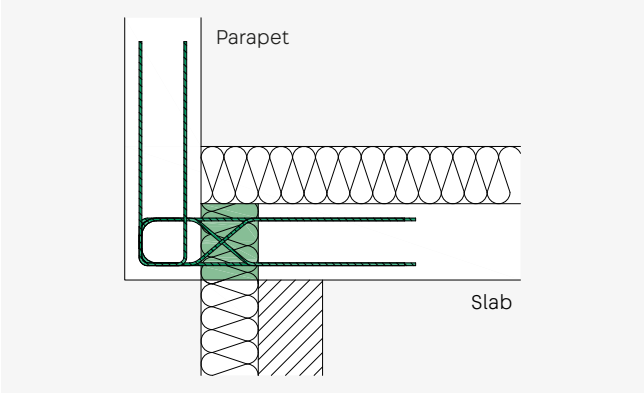
- REI 90 – Fire protection type
- h200 – Element height
- F – Type
- IP 120 – Abbreviation of product name

Application – Element arrangement

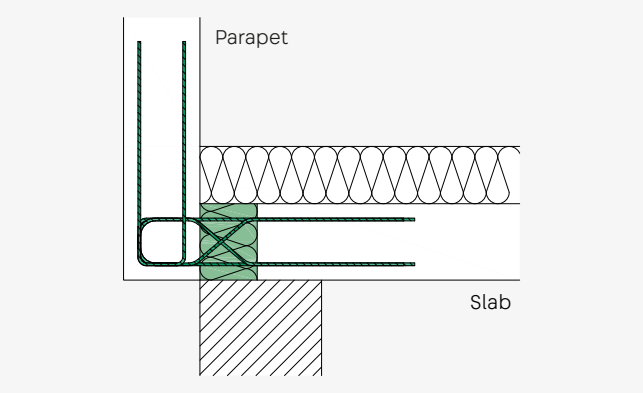
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 9 – 15 must also be taken into account.



ISOPRO® 120 F – Plan view of parapet connected to the vertical face



ISOPRO® 120 F – Installation cross-section of a parapet connected to the vertical face with a thermal insulation composite system



ISOPRO® 120 F – Installation cross-section of a parapet connected to the vertical face of a solid wall

Measurement table for concrete ≥ C25/30

Dimensioning values of absorbable forces

ISOPRO® 120	F – b < 200 mm	F – b ≥ 200 mm
Moment M_{Rd} kNm	± 2.1	± 3.0
Horizontal force N_{Rd} kN	± 3.5	± 3.5
Shear force V_{Rd} kN	± 12.0	± 12.0

Notes

The following edge clearances must be maintained at the slab and parapet edges and at expansion joints:

- An edge clearance of 50 mm must be maintained in the parapet area.
- No edge clearance is required for the slab.

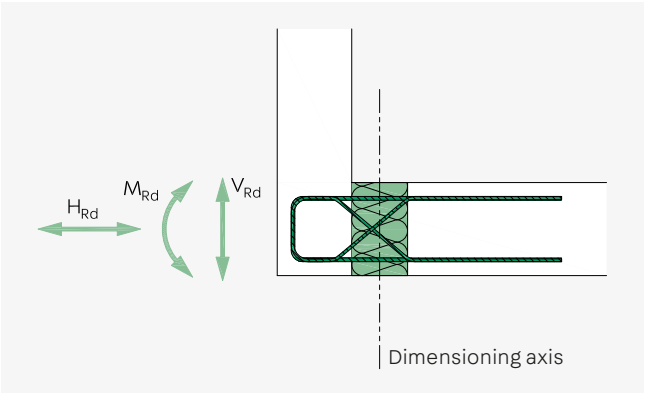
Concrete cover

Element height h mm	Concrete cover cv mm
160	30
170	35
180	40
190	45
200	30
210	35
220	40
230	45
240	50
250	55

Dimensions and configuration

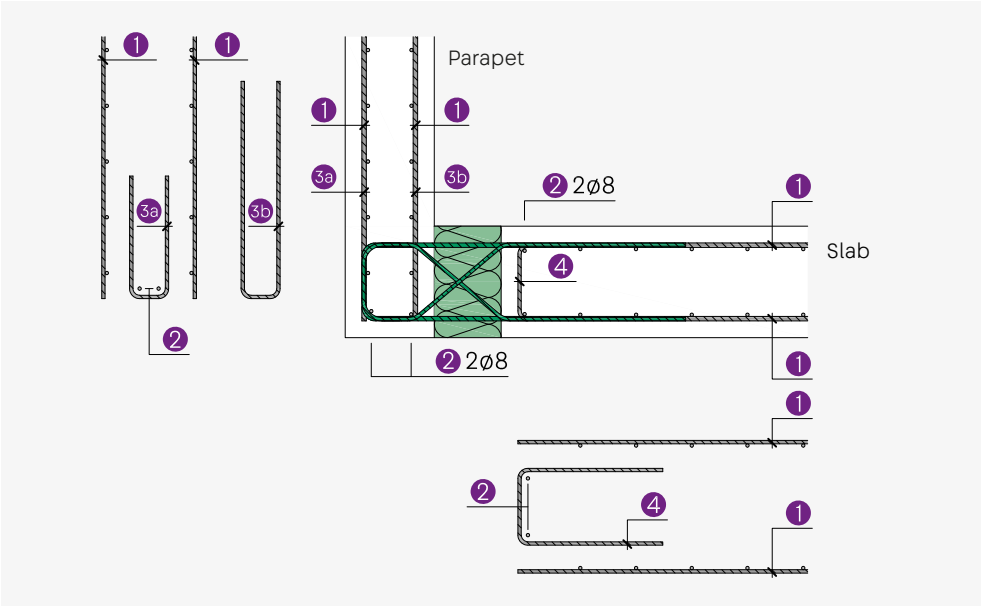
ISOPRO® 120	F
Parapet width b mm	160 - 250
Tie/compression bars	3 Ø 8
Horizontal force bars	2 x 2 Ø 6
Element length mm	350
Expansion joint spacing m	21.7

Static system



On-site reinforcement

IP 120 F



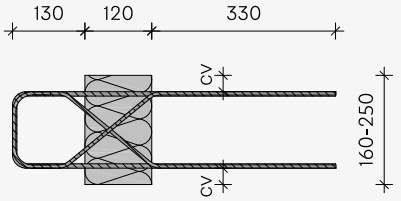
$a_{s,erf}$		ISOPRO® 120
		F
Pos. 1	Connection reinforcement	3 Ø 8
Pos. 2	Longitudinal reinforcement	2 + 2 Ø 8
Pos. 3a	Attachment reinforcement	3 Ø 8
Pos. 3b	Supplementary reinforcement*	≥ Ø 6/250
Pos. 4	Supplementary edge reinforcement	≥ Ø 6/250

*supplied

Notes

- When designing the reinforcement and selection of distances between the ISOPRO® 120 F elements, it is important to pay attention on the ability for processing the concrete.
- For ISOPRO® 120 F with parapet widths from 160 to 190 mm, pos. 3a can be omitted, as this is covered by pos. 3b.

Element dimensions



IP 120 O

Elements for corbels

IP 120 O

For corbels that are used to support masonry or precast elements

- For transferring shear forces, the resulting moments and horizontal forces
- Load-bearing levels O1 and O2
- Element length 250 mm
- Element heights from 180 to 250 mm
- Concrete cover varies depending on element height – see element structure
- Corbel widths O1 from 160 mm, O2 from 200 mm
- Insulation thickness 120 mm
- Fire resistance class REI 120 available

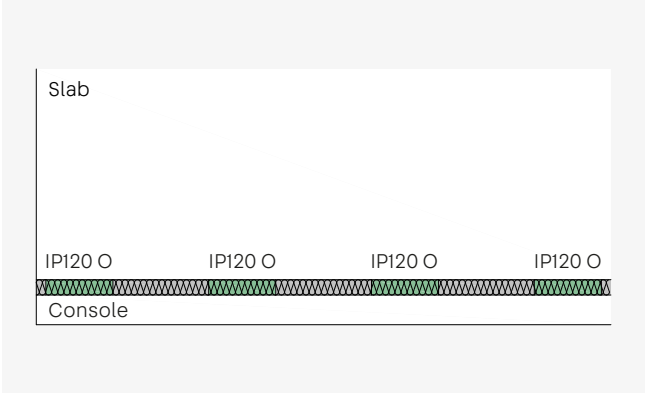
Type designation

IP 120 O 2 h200 REI 120

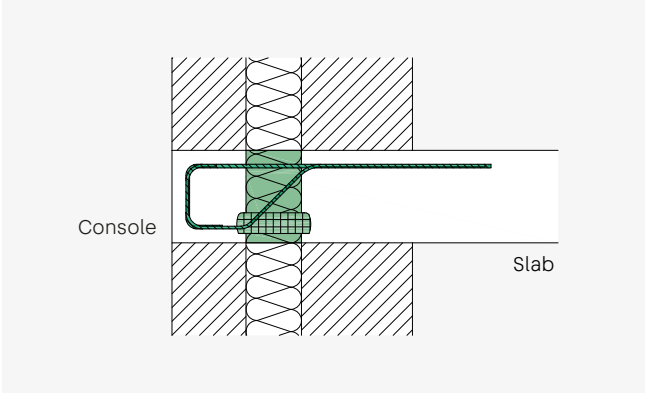
- REI 120 – Fire protection type
- h200 – Element height
- 2 – Load-bearing level
- O – Type
- IP 120 – Abbreviation of product name

Application – Element arrangement

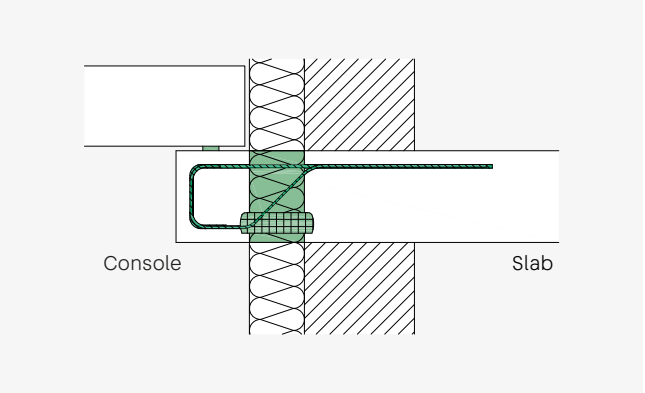
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



ISOPRO® 120 O – Plan view of corbel



ISOPRO® 120 O – Corbel with facing masonry



ISOPRO® 120 O – Corbel as support for a precast component, support with centring bearing

Measurement table for concrete ≥ C25/30

O1 – Dimensioning values of absorbable forces

ISOPRO® 120						O1
Load application point x mm		**≤ 60**	**≤ 75**	**≤ 85**	**≤ 95**	**≤ 105**
Shear force V_{Rd} kN depending on the **element height h** mm	**≥ 180**	24.2	24.2	24.2	23.8	19.5
	≥ 220	24.2	24.2	24.2	24.2	24.2
Horizontal force H_{Rd} kN		± 0.1 · V_{Ed}				

O2 – Dimensioning values of absorbable forces

ISOPRO® 120					O2
Load application point x mm		**≤ 115**	**≤ 125**	**≤ 135**	**≤ 145**
Shear force V_{Rd} kN depending on the **element height h** mm	**≥ 180**	24.6	20.8	17.6	14.7
	≥ 220	26.5	26.5	23.6	19.8
Horizontal force H_{Rd} kN		± 0.1 · V_{Ed}			

Notes

The values in the measurement table assume a load application area with a width of 115 mm. The following edge clearances must be maintained at the slab and corbel edges and at expansion joints:

- An edge clearance of 50 mm must be maintained in the area of the corbel.
- No edge clearance is required for the slab.

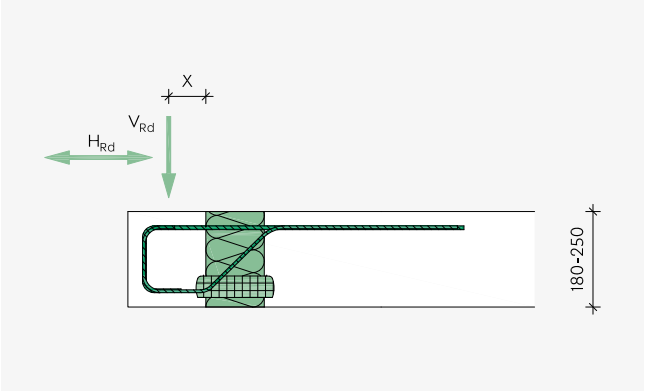
Concrete cover

Element height h mm	Concrete cover at the top cv_u mm	Concrete cover at the bottom cv_u mm
180	35	30
190	35	40
200	35	50
210	35	60
220	35	30
230	35	40
240	35	50
250	35	60

Dimensions and configuration

ISOPRO® 120	O1	O2
min. corbel widths mm	160	200
Element height h mm	180 - 250	180 - 250
Tie bars	2 Ø 8	2 Ø 8
Shear bars	3 Ø 8	3 Ø 8
Compression bearings	2	2
Element length mm	250	250
Distance between expansion joints m	21.7	21.7

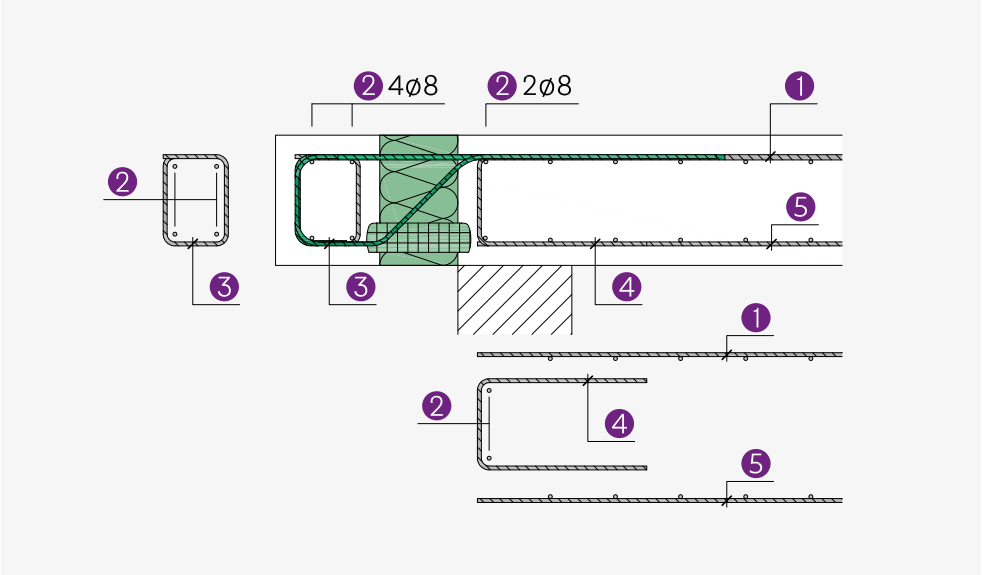
Static system



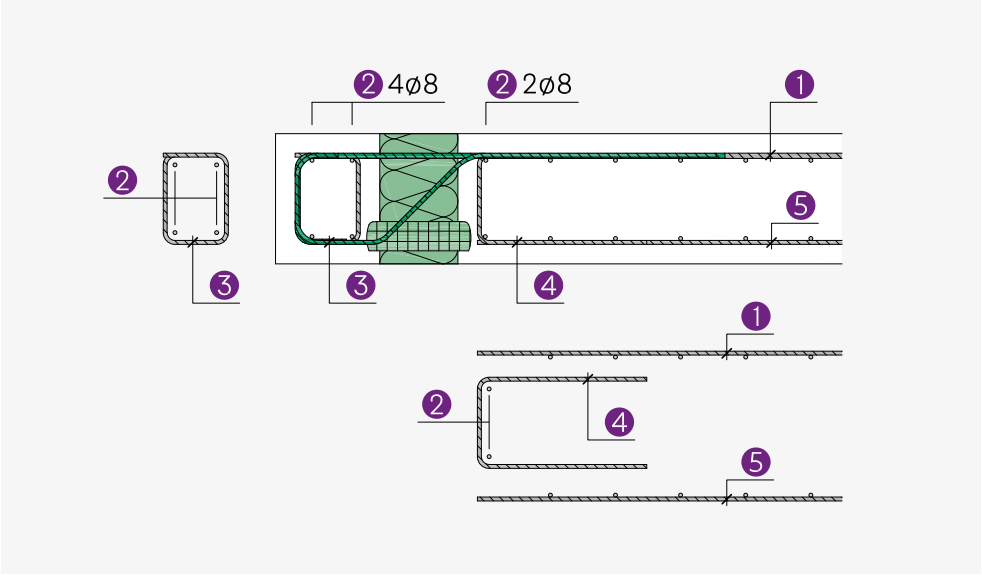
On-site reinforcement

O1 and O2

Direct support

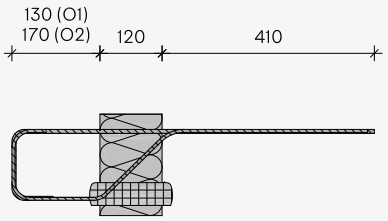


Indirect support



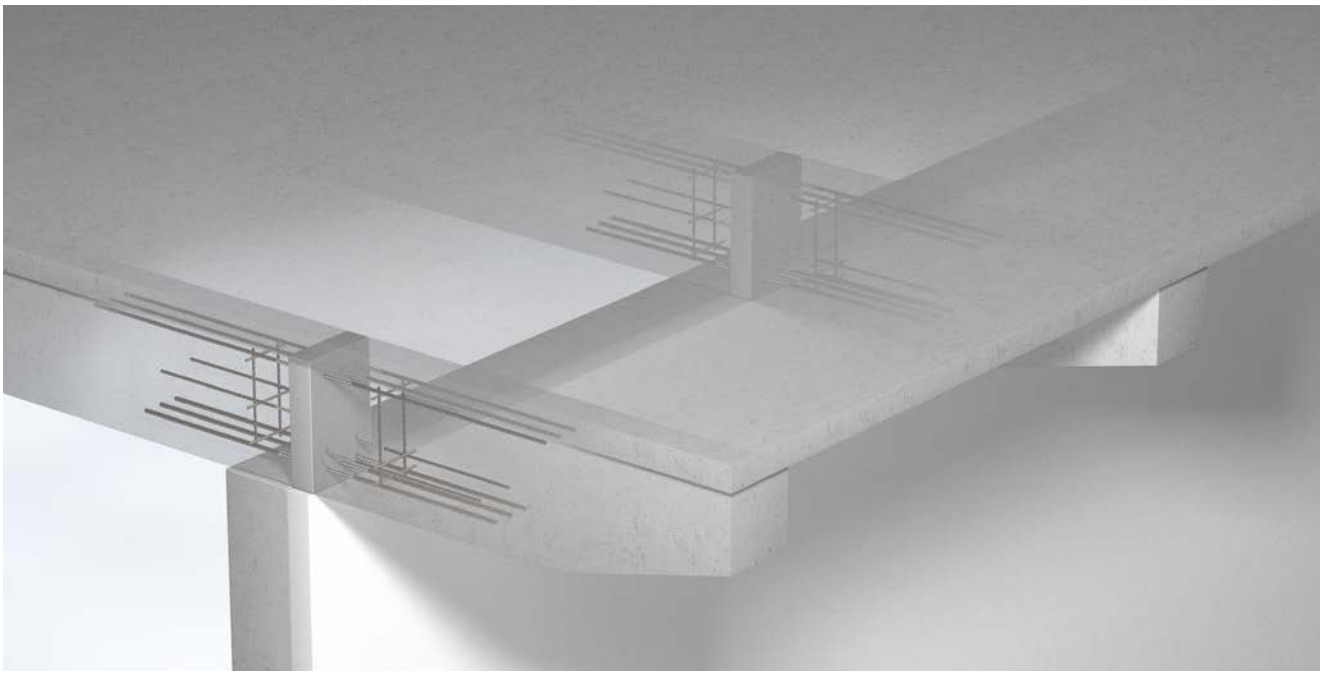
$a_{s,erf}$		ISOPRO® 120	
		O1	O2
Pos. 1	Connection reinforcement	4 Ø 8	4 Ø 8
Pos. 2	Longitudinal reinforcement	≥ 4 + 2 Ø 8	≥ 4 + 2 Ø 8
Pos. 3	Corbel reinforcement	As specified by the structural engineer	
Pos. 4	Direct support	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2) ≥ Ø 6/250	
	Indirect support cm²	≥ 0.64	≥ 0.64
Pos. 5	Component reinforcement	As specified by the structural engineer	

Element dimensions



IP 120 S

Elements for cantilevered joists



IP 120 S

- For transferring moments and shear forces
- Load-bearing levels S1 to S4
- Element widths from 220 to 300 mm
- Element heights from 300 to 600 mm
- Concrete cover cv50 at the top, bottom and side
- Fire resistance class REI 90 (REI 120 with an utilization of ≤ 85% in ULS) available

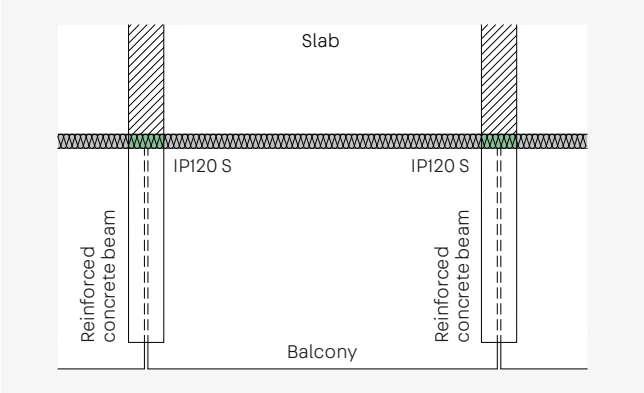
Type designation

IP 120 S 2 b/h = 220/400 REI 90

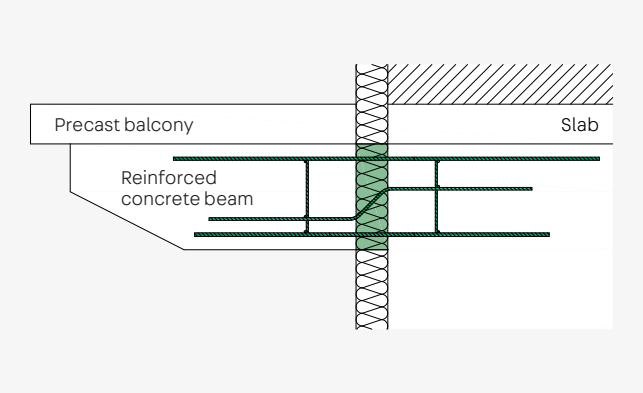
- REI 90 — Fire protection type
- b/h = 220/400 — Element dimensions
- S 2 — Load-bearing level
- S — Type
- IP 120 — Abbreviation of product name

Application – Element arrangement

This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 – 15 must also be taken into account.



ISOPRO® 120 S – Balcony construction with prefabricated slabs that are not structurally connected, and load-bearing reinforced concrete beams



ISOPRO® 120 S – Installation cross-section with prefabricated slabs

Measurement table for concrete ≥ C25/30

Rated values of the moments that can be transferred m_{Rd} in kNm

Element height mm	ISOPRO® 120			
	S1	S2	S3	S4
300	19.4	24.0	33.4	47.7
350	24.5	30.5	42.4	60.8
400	29.6	36.9	51.4	73.9
600	50.1	62.6	87.5	126.4

Rated values of the shear force that can be transferred v_{Rd} in kN

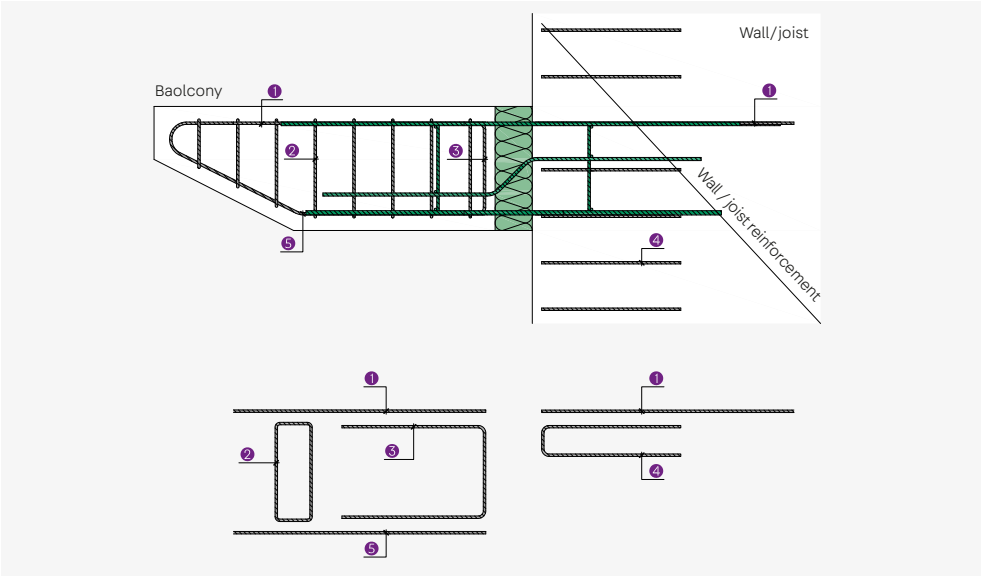
ISOPRO® 120	S1	S2	S3	S4
Shear force V_{Rd} kN	30.9	48.3	69.5	94.6

Dimensions and configuration

ISOPRO® 120	S1	S2	S3	S4
Tie bars	3 Ø 10	3 Ø 12	3 Ø 14	3 Ø 16
Shear bars	2 Ø 8	2 Ø 10	2 Ø 12	2 Ø 14
Pressure rods	3 Ø 12	3 Ø 14	3 Ø 14	3 Ø 20
Element width mm	220 - 300			
Element height mm	300 - 600			
Distance between expansion joints m	19.8	17.0	17.0	13.5

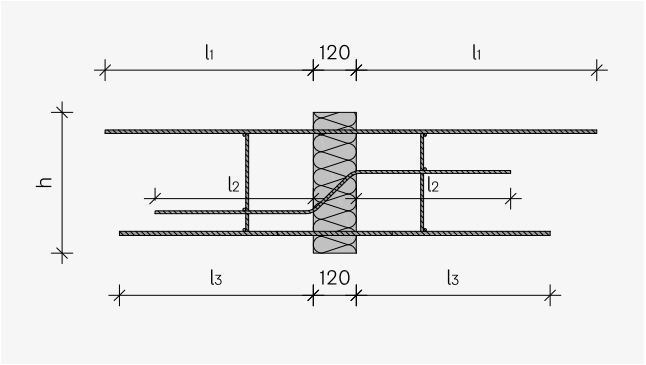
On-site reinforcement

S1 to S4

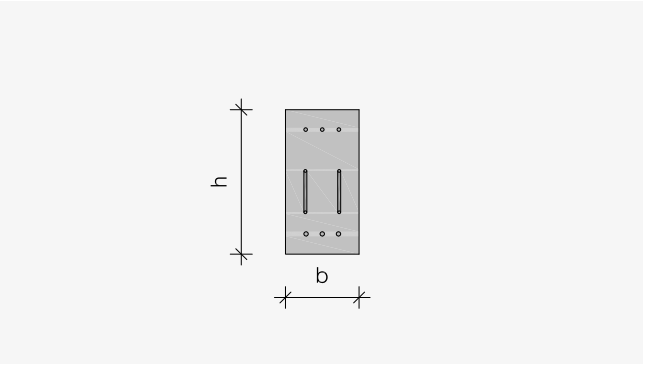


$a_{s,erf}$		ISOPRO® 120			
		S1	S2	S3	S4
Pos. 1	Connection reinforcement cm²	2.35	3.39	4.61	6.03
Pos. 2	Bracket reinforcement	As specified by the structural engineer			
Pos. 3	Attachment reinforcement cm²	0.71	1.11	1.59	2.17
Pos. 4	Supplementary edge reinforcement	in accordance with DIN EN 1992-1-1, 9.3.1.4 (EC2) ≥ Ø 6/250			
Pos. 5	Component reinforcement	As specified by the structural engineer			

Element dimensions



ISOPRO® 120 S – Lateral view



ISOPRO® 120 S – Front view

ISOPRO® 120	S1	S2	S3	S4
l_1*	840	1010	1160	1870
l_2	440	555	660	775
l_3	580	650	785	955
b	220-300			
h	300-600			

*The anchoring length of the tie bars is designed for "moderate connection conditions".

IP 120 W

Elements for cantilevered reinforced concrete walls

IP 120 W

- For transferring moments, shear and horizontal forces
- Load-bearing levels W1 to W4
- Element widths from 150 to 250 mm
- Element heights from 1500 to 3500 mm
- Concrete cover cv50 at the top and bottom, and cv25 to cv50 at the side, depending on the element width
- Fire resistance class REI 90 (REI 120 with an utilization of ≤ 85% in ULS) available
- Elements supplied in at least three sub-elements: bottom part with compression and shear bars, center part and top part with tie bars. For large element heights, additional center parts are added.

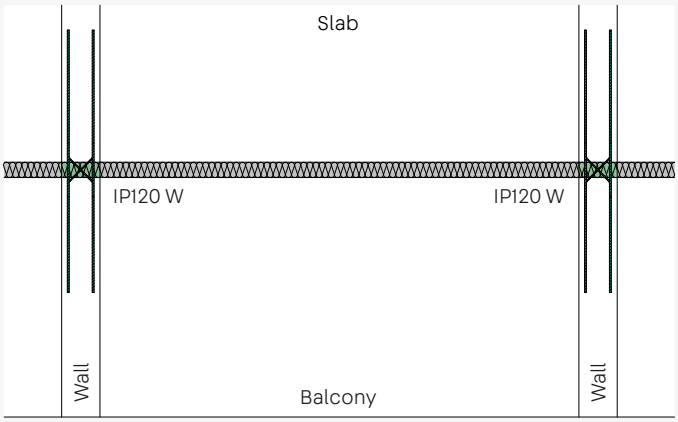
Type designation

IP 120 W 2 b/h = 220/2000 REI 90

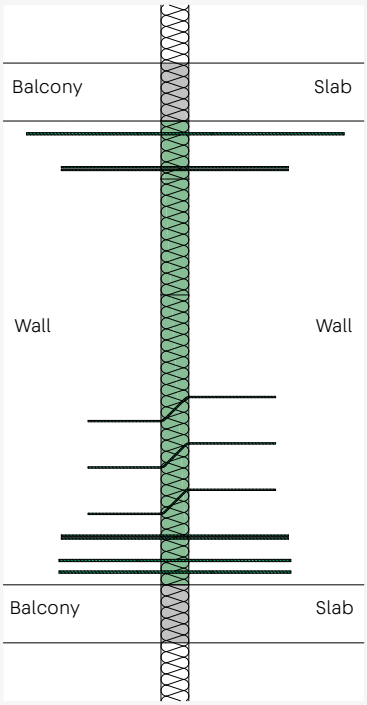
- REI 90 — Fire protection type
- b/h = 220/2000 — Element dimensions
- W 2 — Load-bearing level
- W — Type
- IP 120 — Abbreviation of product name

Application – Element arrangement

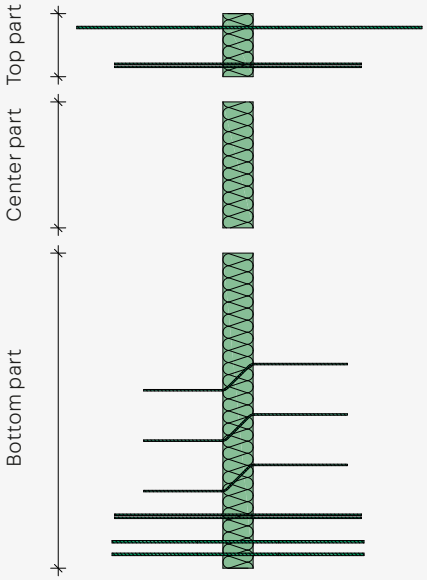
This chapter contains planning aids and specific information about this product. Moreover, the general information on materials, dimensioning, thermal insulation and fire protection, installation on the construction site, etc., on pages 4 - 15 must also be taken into account.



ISOPRO® 120 W – Arrangement of elements in the plan view in combination with a balcony slab



ISOPRO® 120 W – Installation cross-section with wall slab connected to the balcony slab monolithically



ISOPRO® 120 W – Element structure

Measurement table for concrete ≥ C25/30

Rated values of the moments that can be transferred m_{Rd} in kNm

Element height mm	ISOPRO® 120			
	W1	W2	W3	W4
≥ 1,500	64.7	127.0	178.7	178.7
≥ 1,750	76.6	150.7	212.7	212.7
≥ 2,000	88.4	174.4	246.8	246.8
≥ 2,250	100.3	198.1	280.8	280.8
≥ 2,500	112.1	221.8	314.8	314.8
≥ 2,750	124.0	245.5	348.8	348.8
≥ 3,000	135.8	269.2	382.9	382.9

Rated values of the shear force that can be transferred V_{Rd} in kN and horizontal forces H_{Rd} in kN

ISOPRO® 120	W1	W2	W3	W4
Shear force V_{Rd} kN	51.1	92.7	154.5	241.3
Horizontal force H_{Rd} kN	± 17.4	± 17.4	± 17.4	± 17.4

Dimensions and configuration

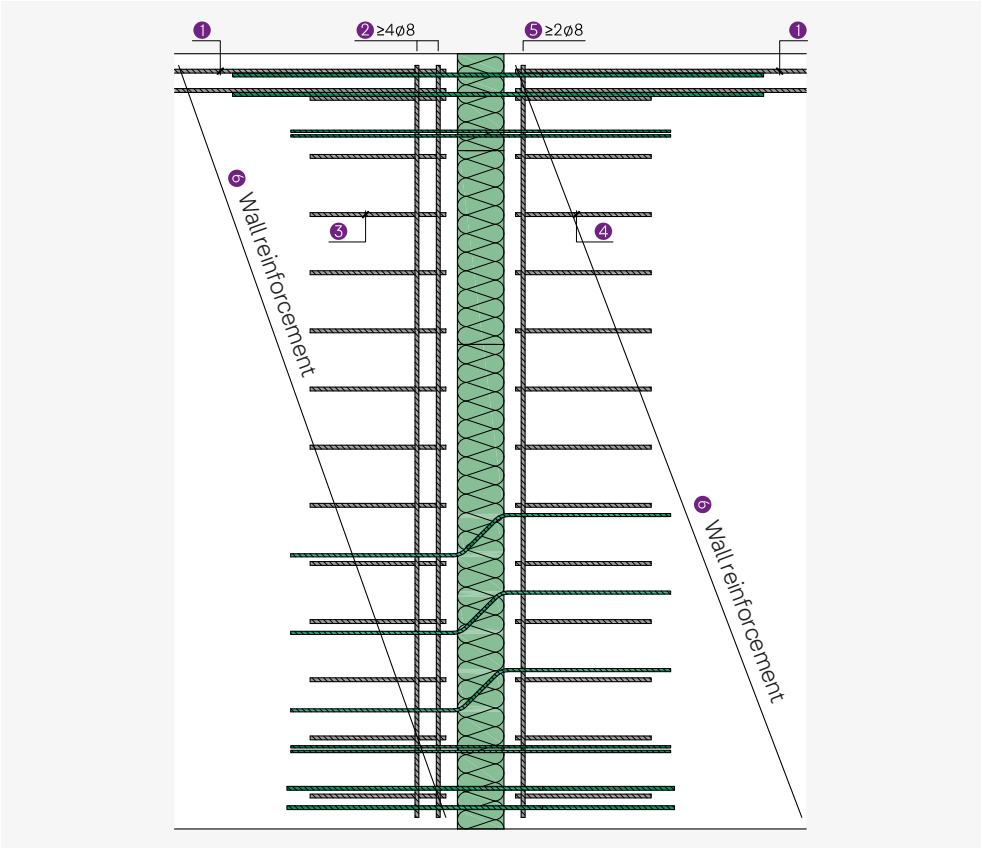
ISOPRO® 120	W1	W2	W3	W4
Tie bars	2 Ø 10	4 Ø 10	4 Ø 12	4 Ø 12
Shear bars	6 Ø 6	6 Ø 8	10 Ø 8	10 Ø 10
Horizontal rods	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8	2 x 2 Ø 8
Pressure rods	4 Ø 10	6 Ø 10	6 Ø 12	6 Ø 14
Element width mm	150 - 250			
Element height mm	1500 - 3500			
Distance between expansion joints m	21.7	21.7	19.8	17.0

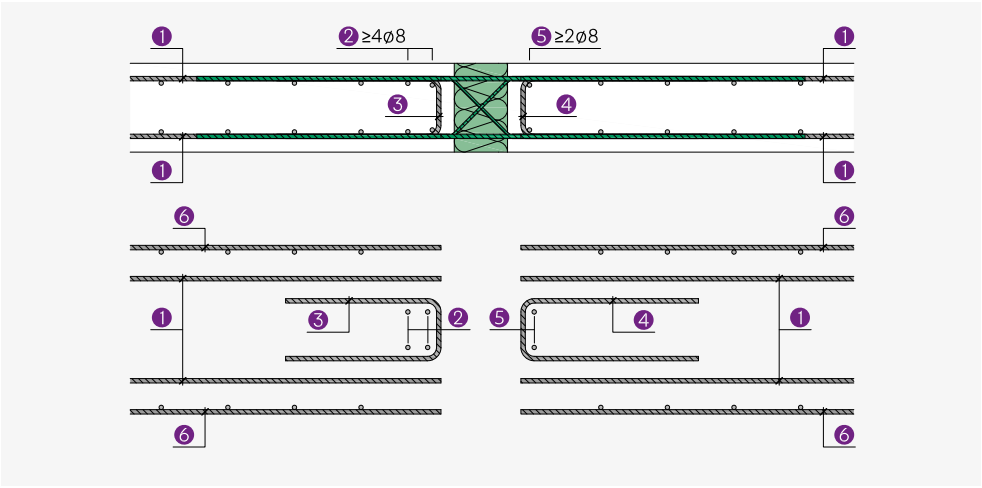
Notes on structural design

- Moments from wind loads perpendicular to the wall slab cannot be absorbed by the ISOPRO® 120 W element. These loads are transferred through the stiffening effect of the monolithically connected balcony slabs. If this is not possible, the ISOPRO® 120 W can be supplemented with an ISOPRO® 120 D. This then replaces the center part.

On-site reinforcement

W1 to W4

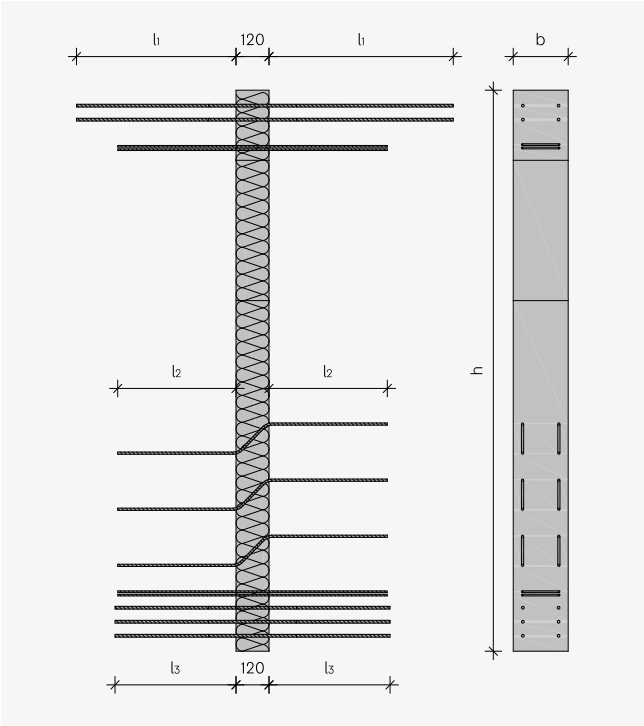




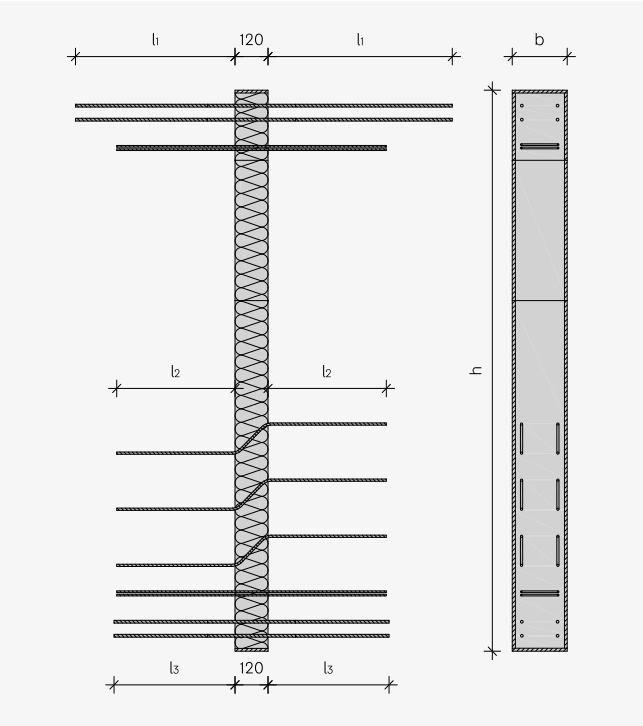
$a_{s,erf}$		ISOPRO® 120			
		W1	W2	W3	W4
Pos. 1	Connection reinforcement cm²	1.57	3.14	4.50	4.50
Pos. 2	Supplementary reinforcement cm²	1.19	2.13	3.55	5.54
Pos. 3	Supplementary edge reinforcement	As specified by the structural engineer ≥ Ø 6/250			
Pos. 4	Supplementary edge reinforcement	As specified by the structural engineer ≥ Ø 6/250			
Pos. 5	Attachment reinforcement	As specified by the structural engineer			
Pos. 6	Wall reinforcement	As specified by the structural engineer			

Element dimensions

W1 to W4



ISOPRO® 120 W

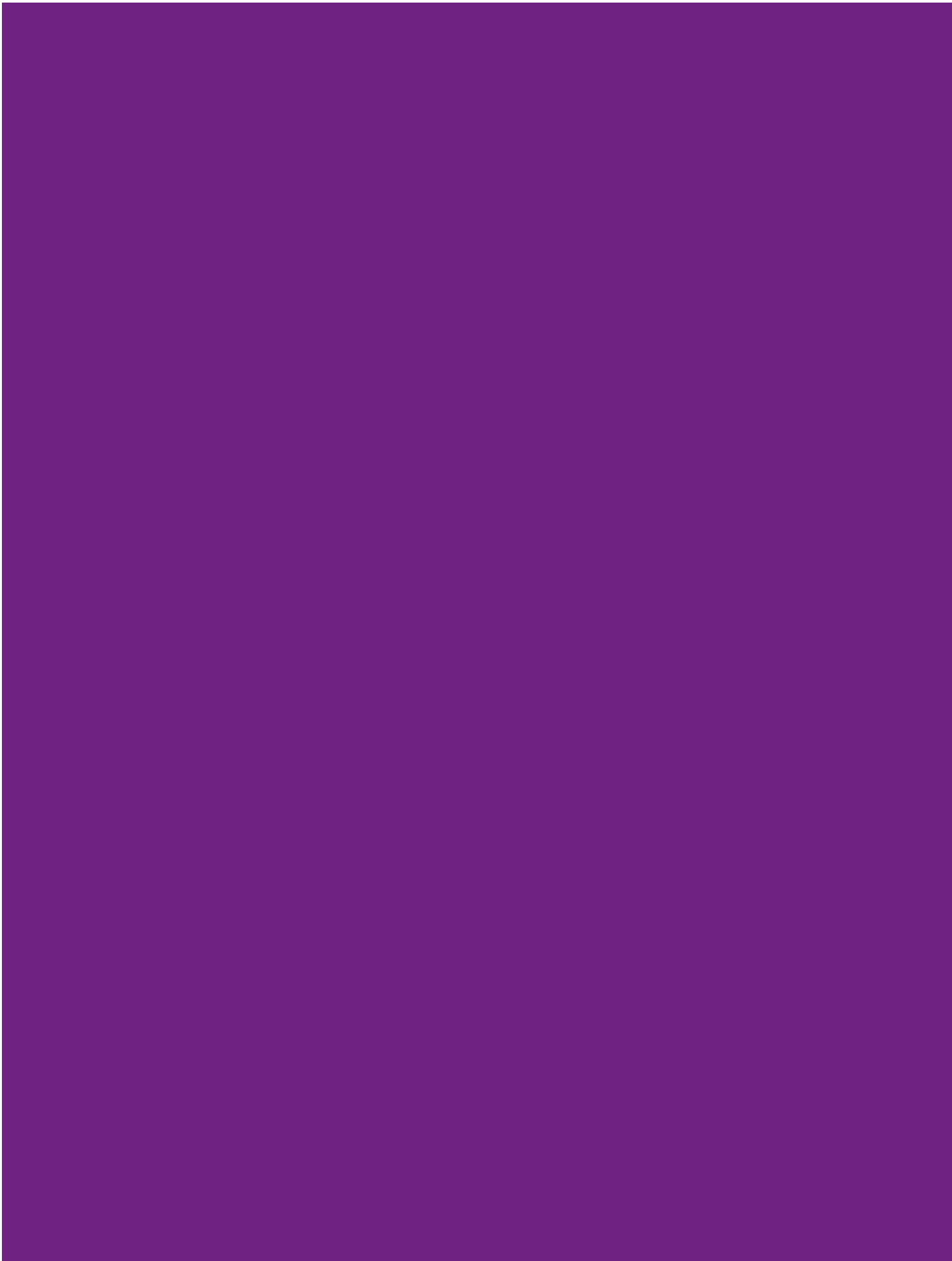


ISOPRO® 120 W REI 90 – Circumferential fireproof panels

Dimensions in mm

ISOPRO® 120	W1	W2	W3	W4
l_1*	740	740	860	860
l_2	330/390	440	440	555
l_3	480	480	570	650
b	150-250			
h	1.500-3.000			

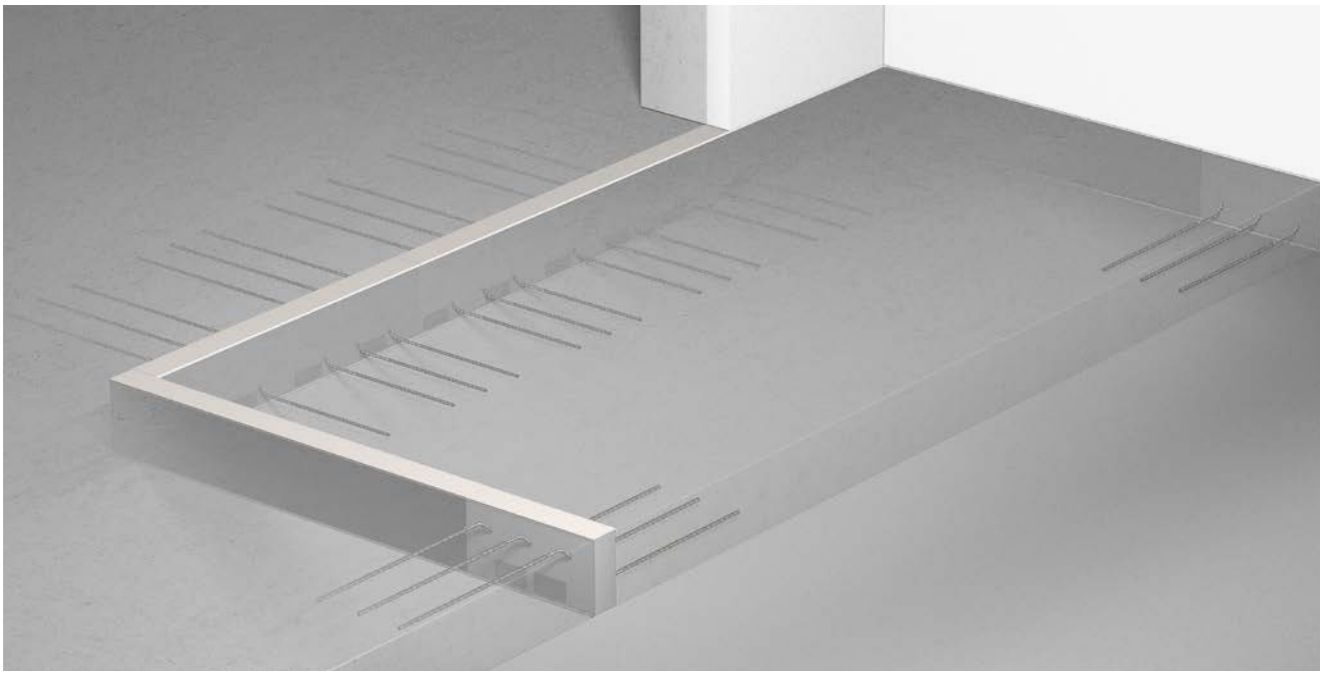
*The anchoring length of the tie bars is designed for "moderate bond conditions ".



Insulation elements without load-bearing function

IP 120 Z ISO

Elements as infill insulation



IP 120 Z ISO

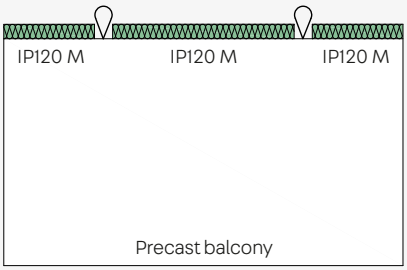
- Intermediate insulation without structural function
- Length: 1.0 m
- Element heights from 160 to 250 mm
- Short elements available on request
- Fire resistance class EI 120 (with fire protection type FP1) available

Type designation

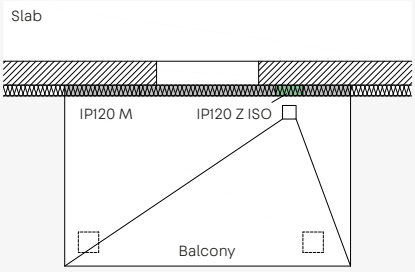
IP 120 Z ISO h200 FP1

- FP1 — Fire protection type
- h200 — Element height
- ISO — Load-bearing level
- Z — Type
- IP 120 — Abbreviation of product name

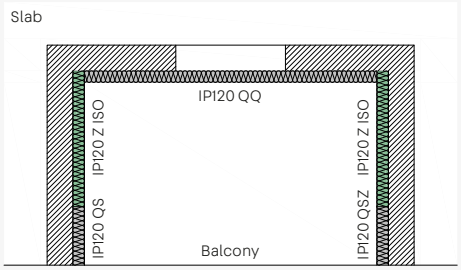
Application – Element arrangement



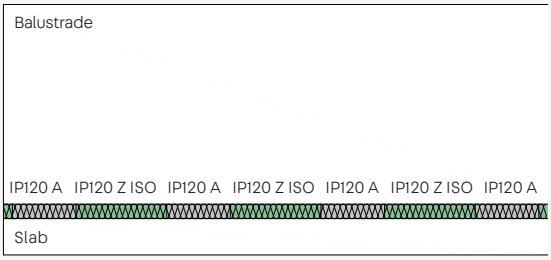
ISOPRO® 120 Z ISO – Balcony as precast component with transport anchors – Z-ISO elements are added on site



ISOPRO® 120 Z ISO – Balcony on supports – Z ISO elements in the drainage recess area

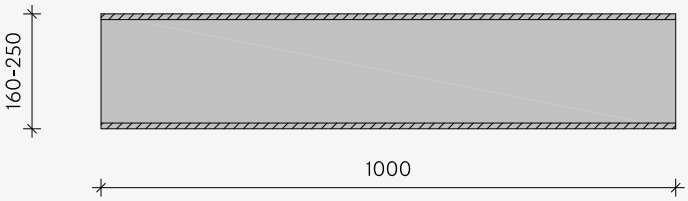


ISOPRO® 120 Z ISO – Loggia with support at specific points

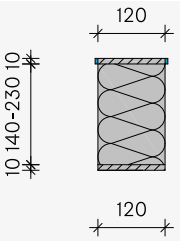


ISOPRO® 120 Z ISO – Use in a parapet

Element dimensions



ISOPRO® 120 Z ISO FP1 – View with fireproof panels at the top and bottom



ISOPRO® 120 Z ISO FP1 – Cross-section

Notes

- When using ISOPRO® 120 Z ISO, 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 length of the Z ISO elements (in percentage) in relation to the overall connection length.
- The fire resistance class of the Z-ISO element corresponds to the maximum fire resistance class of the structurally load-bearing ISOPRO® 120 elements used in the linear connection:
  - Z ISO in combination with ISOPRO® 120 elements with compression bearings – in total REI 120
  - Z ISO in combination with ISOPRO® 120 elements with compression bars – in total REI 90
    (REI 120 with a utilization of the structurally load-bearing ISOPRO 120 elements of ≤ 85% in ULS)

Our synergy concept for your benefit

With us, you benefit from the collective experience of three established manufacturers, who combine products and expertise in a comprehensive range. That is the PohlCon synergy concept.

Full-service consulting

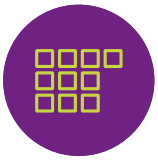
Our extensive network of consultants is available to answer all your questions about our products on site. From planning to use, you can enjoy personal support from our qualified employees.

Digital solutions

Our digital solutions provide targeted support in planning with our products. From tender texts to CAD details and BIM data, right through to modern software solutions, we offer customized support for your planning process.

7 fields of application

We think in terms of holistic solutions. This is why we have combined our products into seven fields of application, where you can benefit from their synergy and the overall PohlCon product range.



10 product categories

In order to find the right product in our extensive range even faster, we have divided our products into ten product categories. This way you can navigate clearly and precisely between our products.

Individual solutions

Is there no series product on the market that is suitable for your project? We realize unique construction projects and deal with exceptional challenges using the many years of expertise of the three manufacturing brands.

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