FORBUILD

BALCONY CONNECTORS

Edition 1 / 2016

Dear Customers,

In this catalog we present you reinforcement connectors ebea KP / KPE, hereinafter referred to as the balcony connectors KP / KPE.

KP balcony connectors offered by Forbuild are an innovative and reliable solution, which will to a great extent eliminate the emergence of thermal bridges. Precise manufacture ensures structure reliability, at the same time allowing quick and simple assembly.
The large selection of balcony connectors allows us to pick, together with the Customer, the optimum solution adapted to most cases. Our technical advisers are available to You at every stage of the investment.

We are confident that providing You with this catalogue, we shall simplify Your decision process with regard to the best technical solution. We will be grateful for any and all remarks concerning both the content as well as the graphics and presentation style of the included information.

Choosing Forbuild, You choose a solid partner and satisfaction from a good investme

We supply the technology, experience and high quality.
Build with us ensures success.

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CONTENTS LIST

GENERAL INFORMATION

Thermal bridges emerge where the thermal insulation of an external partition has a leak, is discontinuous or where it changes thickness, thus describing an uninsulated space, i. e. a cold space. Temperature drops on the outside surface of the partition (it is required for it to be higher than the allowable value set forth in the relevant provisions of the law and Polish Standards). Otherwise, there arises a high risk of emergence of mildew and fungal growth. If the surface temperature drops below the dew point in its vicinity, water vapour condenses. To the dew point corresponds a temperature value, with respect to which air containing a particular volume of water vapour reaches a state of full saturation (relative humidity - 100%). It is worth noting that in case with a capillary and porous structure (i. e. gypsum, bricks), there exists the possibility of condensation of water vapour already at a relative air humidity equal to 80%. The dew point in a room with an air temperature of 20 °C and relative humidity of 50% amounts to approximately 9,5 °C. In the considered case, the minimum allowable temperature of the partition surface, allowing the ability of development of fungus, shall be approximately 12,5°C.

A very sensitive point causing much problems to investors is the connection between the ceiling and the balcony. This single component must do justice to structural and aesthetic requirements as well as high demands concerning thermal insulation.

In the recent years, the discussion concerning energy-saving buildings is becoming more and more intense. In the construction industry, due to the need of attaining a so-called low-energy level, thermal insulation processes were intensified. Today, houses are built as energy-efficient, meaning, utilising such solutions and materials, which minimise energy losses during use. Sadly, a house is like a chain - its energy requirements, reflected in the heating bills, depends on its weakest link. These spots are the nodes in the building structure (thermal bridges). Apart of increased energy exchange, they are often characterised by increased air penetrability as compared to full partitions. Uncontrolled infiltration of a stream of cold air to the inside of the building may decidedly influence the building's thermal requirement balance.

STRUCTURE OF THE KP REINFORCEMENT CONNECTORS

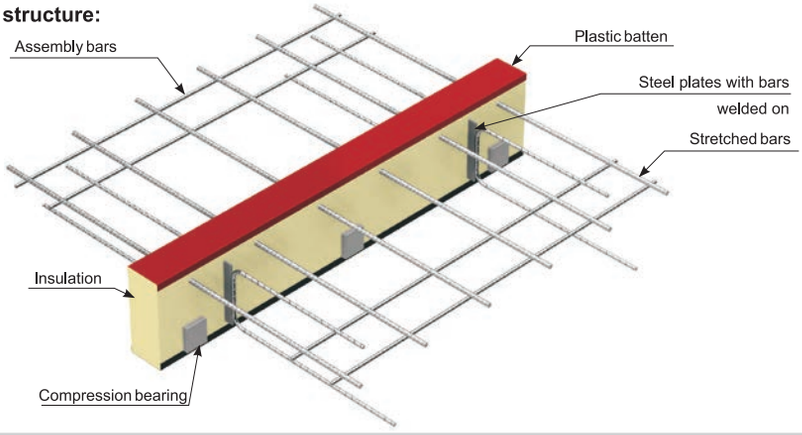
The structure of the KP/KPE reinforcement connectors allows freedom in the creation of a balcony's geometry, ensuring at the same time the required load bearing capacity and structure rigidity (deflection reduction). The load bearing base structure of the joints is made up of components transferring compressive forces (steel or reinforced concrete bearings) and shear forces, as well as of extended bars. The spaces between them are filled with insulating material - styrofoam or mineral wool with a low λ coefficient.

In addition, the joint bars work towards great reduction of thermal and contraction stress in the balcony slab. Such a solution allows the reduction of thermal bridges to a minimum, the heat from the inside of the space remains inside, and does not move to the interior of the balcony slab

As standard, they are manufactured with a length of one metre and in 20 cm and 30 cm modules, allowing almost unlimited design freedom.

KP/KPE reinforcement connectors	**Technical approval of the Polish Building Research Institute no. AT-15-9007/2013**
Component	**Material:**
- main reinforcement bars (extended)	Stainless steel (ferritic-austenitic duplex steel) or ordinary fire-galvanised carbon steel
- insulation material	Styrofoam with a thermal conduction coefficient of λ≤0,036 or mineral wool with a coefficient of λ≤0,040. Standard insulation width - 80 mm, options: 60 mm, 100 mm or 120 mm.
- compression bearings	Ferritic-austenitic duples stainless steel (for ceiling thickness values of 14 cm or 16 cm), concrete (for ceiling thickness values above 18 cm).
- components transferring shear forces	Stainless steel (ferritic-austenitic duplex steel)

Connector structure:



CONSTRUCTION DETAILS - ERRORS IN DESIGN AND EXECUTION

Thermal bridges emerge as a result of design and construction errors. Heat loss through thermal bridges causes the building's energy requirements to increase, and this is related to a great increase of heating expenses.

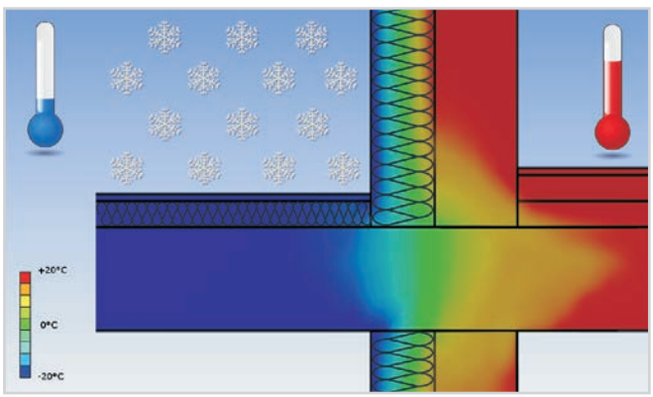
Already during the design phase, it is worth considering proper protection of spots sensitive to the emergence of thermal bridges, i. e. balconies, ledges, parapet walls, terraces, etc.

Reinforcement joints eliminate their risk, they reduce the threat of humidity as well as mildew and fungus, both of which are a health hazard. The solution offered by us means savings on time, money and energy.

The reinforcement joint is easy to install at the construction site, it is easily joined with reinforcement of the ceiling/balcony. Labour-intensive and costly thermal insulation of components from all sides become redundant. The construction work progresses much more quickly and much more efficiently.

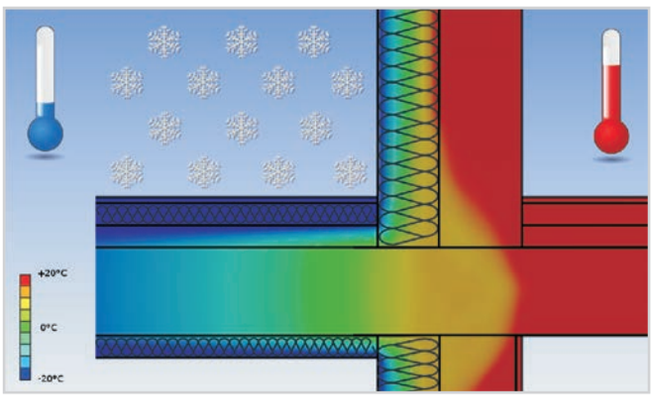
AN OVERVIEW OF THE MOST POPULAR SOLUTIONS

Thermal vision analyses of buildings have indicated that if the balcony is wide, thermal heat losses as a result of heat being diverted away by a badly insulated component are comparable to thermal heat losses caused by several square metres of uninsulated building external walls. The heat requirement for room heating can increase even by 20%. The above described solution, at today's heating costs, is unacceptable. Various methods are used in order to thermally separate the balcony plate from the inter-storey ceiling plate.



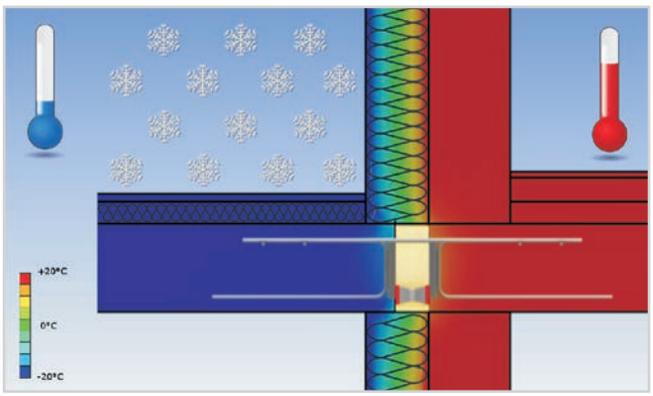
1. Balcony reinforced concrete slab - uninsulated balcony.

The most popular solution used in Poland is a supported reinforced concrete slab constituting an extension of the ceiling. Thermal vision research shows that as a result of discontinuity of the insulation, the component shall be a big thermal bridge, through which heat will very quickly escape from the building. There emerges the phenomenon of a geometric thermal bridge (the balcony slab forms a so-called cooling rib) and one of a material thermal bridge (high thermal conductivity of the reinforced concrete). Such a solution may lead to water vapour condensing over and under the ceiling, which in extreme cases may lead to the emergence of mildew and the grown of health-hazardous fungi.



2. The balcony slab, covered by insulation material from both sides.

In Poland, the reduction of the influence of a thermal bridge by covering the balcony with insulation material from all sides is very popular. An appropriate choice of thickness of the structural component and the thermal insulation layer may reduce the influence of the thermal bridge. However, such a solution does not guarantee protection in case of long-lasting low outside temperature levels.



3. Maintenance of insulation continuity - use of KP/KPE reinforcement connectors

One of the most effective methods of elimination of thermal bridges at the joint between the balcony and the ceiling are special KP/KPE reinforcement joints. They serve to interrupt the path of the thermal heat stream in the construction component (in most cases the balcony) through maintenance of continuity of thermal insulation, with simultaneous maintenance of continuity of structure and the transmission of the required cross-section forces. A broad product selection allows the use of joints in most constructional solutions and for various static concepts, both for balconies as well as for other components (i. e. parapet walls, terraces, ledges).

OTHER ADVANTAGES. DURABILITY.

Depending on the joint type, the reinforcement bars are made of ferritic-austenitic duplex stainless steel, or ordinary heat-galvanised carbon steel. The utilised stainless steel unites in itself the best qualities of chrome ferritic steel and chrome-nickel austenitic steel. It is characterised by very good mechanical properties: the yield strength, tensile strength and ductility as well as resistance to general, pitting and stress corrosion.

The zinc cladding, however, is applied pursuant to requirements of Polish Standard PN-EN ISO 14713 'Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Zinc and aluminium coatings. Requirements'. The durability of the utilised cladding is up to 120 years. Thus, all requirements concerning the usability period for structures, contained in PN-EN 1990 (Eurocode: Basis of structural design), are adhered to.

The solution proposed by us allows effective and durable protection of reinforcement bars against corrosion for decades.

It must be stressed, however, that the joint is protected on both sides by reinforced concrete slabs, finishing layers and insulation.

In such an arrangement, basically, there are no spots where humidity could pass through to the reinforcement bars.

Utilisation of coherent properties of stainless steel bars as well as fire-galvanised bars allows the avoidance of welding and joining two types of materials (i.e. when rebar steel bars are joined with stainless steel bars). Thus, there is no increased risk of emergence of corrosion in this area. A unified rebar steel type along the entire length of the bars ensures the same resistance properties in both joined components. Thus, one avoids additional stress, which could lead to vertical deformations of the supports.

SUPPLEMENTARY REINFORCEMENT (ADDED AT THE CONSTRUCTION SITE)

Bars of the KP/KPE reinforcement joint must be connected to the reinforcement of the ceiling and the balcony using tie wire. It is recommended for the plates to be additionally reinforced by the addition of:

- closing reinforcement (U-shaped shackles at the edges of the balcony - 8)

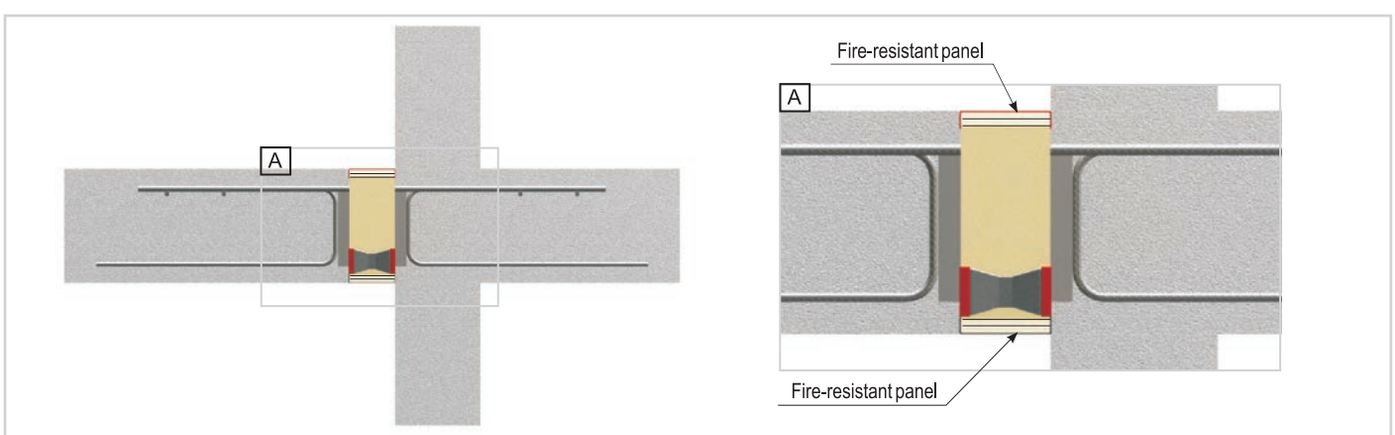
- horizontal crosswise edge reinforcement (straight bars - 10)

Detailed guidelines concerning the amount and type of reinforcement added at the construction site are found in the latter part of the catalogue (page nos. 11, 16, 18, 23, 25, 28, 37).

FIRE RESISTANCE

In particular circumstances, provisions of the law enforce an elevation of requirements concerning the fire resistance class of structural components. This is the case when the designed balcony is i. e. an evacuation route. Standing in front of necessity of permanent development and to provide optimal solutions adjusted to the most of design cases, company Forbuild conducted a tests confirming class of fire resistance R120 for part of its products.

In cases mentioned above, a component is designed with integrated fire-safe inlays. Their use guarantees fulfilment of fire resistance class requirements without the necessity of using additional safety devices.

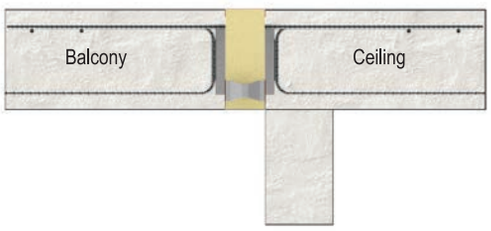


TECHNICAL APPROVALS AND CERTIFICATES

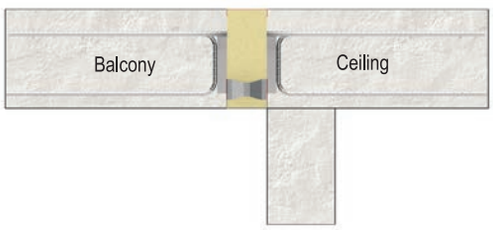
Technical agreement AT-15-9007/2012 issued by Building Research Institute in Warsaw

PRODUCT OVERVIEW

KP-100 connector used at the support joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (-) and V_{Rd} shear forces (±). Reinforcement bars of stainless steel.

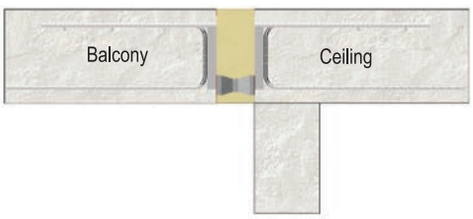


KPE-100 connector, used at corners, at the support joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (-) and V_{Rd} shear forces (±). Reinforcement bars of stainless steel.



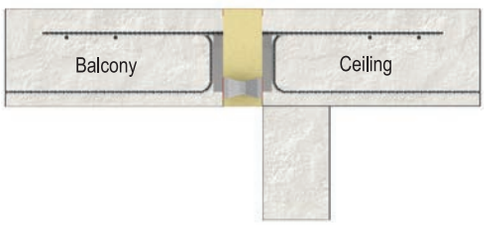
KP-200 connector, used at continuous joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (±) and V_{Rd} shear forces (±). Reinforcement bars of stainless steel.

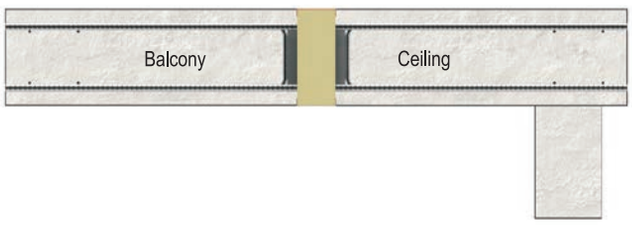
KP-300 connector, used at support joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (-) and V_{Rd} shear forces (±). Reinforcement bars of normal fire-galvanised carbon steel.



KPE-300 connector, used at corners, at support joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (-) and V_{Rd} shear forces (±). Reinforcement bars of normal fire-galvanised carbon steel.

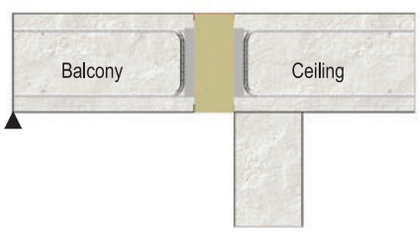
KP-400 connector, used at continuous joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (±) and V_{Rd} shear forces (±). Reinforcement bars of normal fire-galvanised carbon steel.

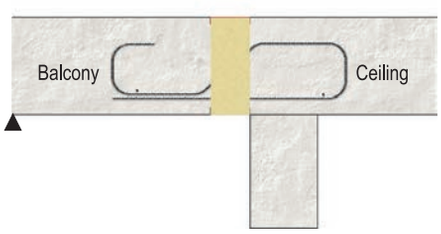




KP-500 connector, used at articulated joints of the balcony slab with the ceiling slab - transfer of V_{Rd} shear forces (±). Reinforcement bars of stainless steel.

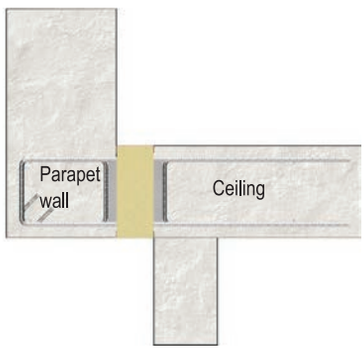
KP-600 connector, used at articulated joints of the balcony slab with the ceiling slab - transfer of V_{Rd} shear forces (+). Reinforcement bars of stainless steel.



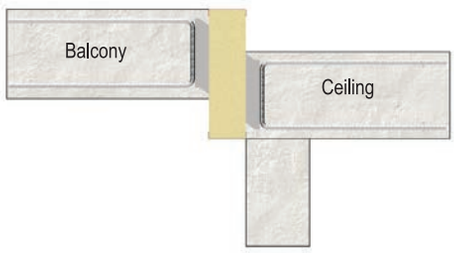


PRODUCT OVERVIEW

KP-700 connector, used at support joints of parapet walls, ledges and short supports with the ceiling (roof) slab - transfer of M_{Rd} bending moments (±) and V_{Rd} shear forces (±). Reinforcement bars of stainless steel.

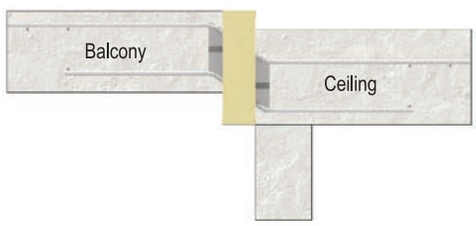


KP-800 connector, used at articulated joints of the balcony slab with the ceiling slab - transfer of V_{Rd} shear forces (±). Reinforcement bars of stainless steel.

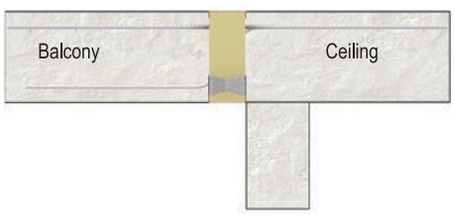


KP-900 connector, used at support joints of the balcony slab with the ceiling slab - transfer of V_{Rd} shear forces (±). Reinforcement bars of stainless steel.

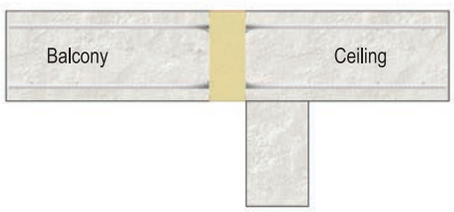
KP-1000 connector, used at support joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (±) and V_{Rd} shear forces (±). Reinforcement bars of stainless steel.



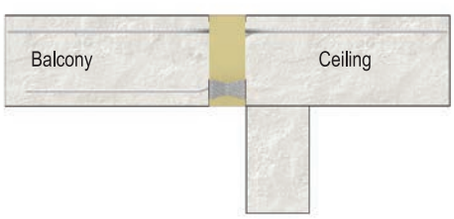
KP-1100 connector, used at support joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (-) and V_{Rd} shear forces (+). Reinforcement bars of stainless steel.



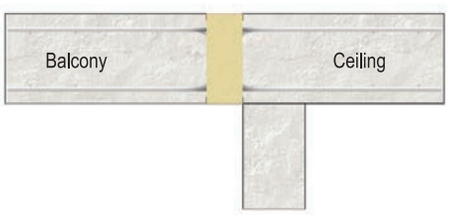
KP-1200 connector, used at continuous joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (±) and V_{Rd} shear forces (±). Reinforcement bars of stainless steel



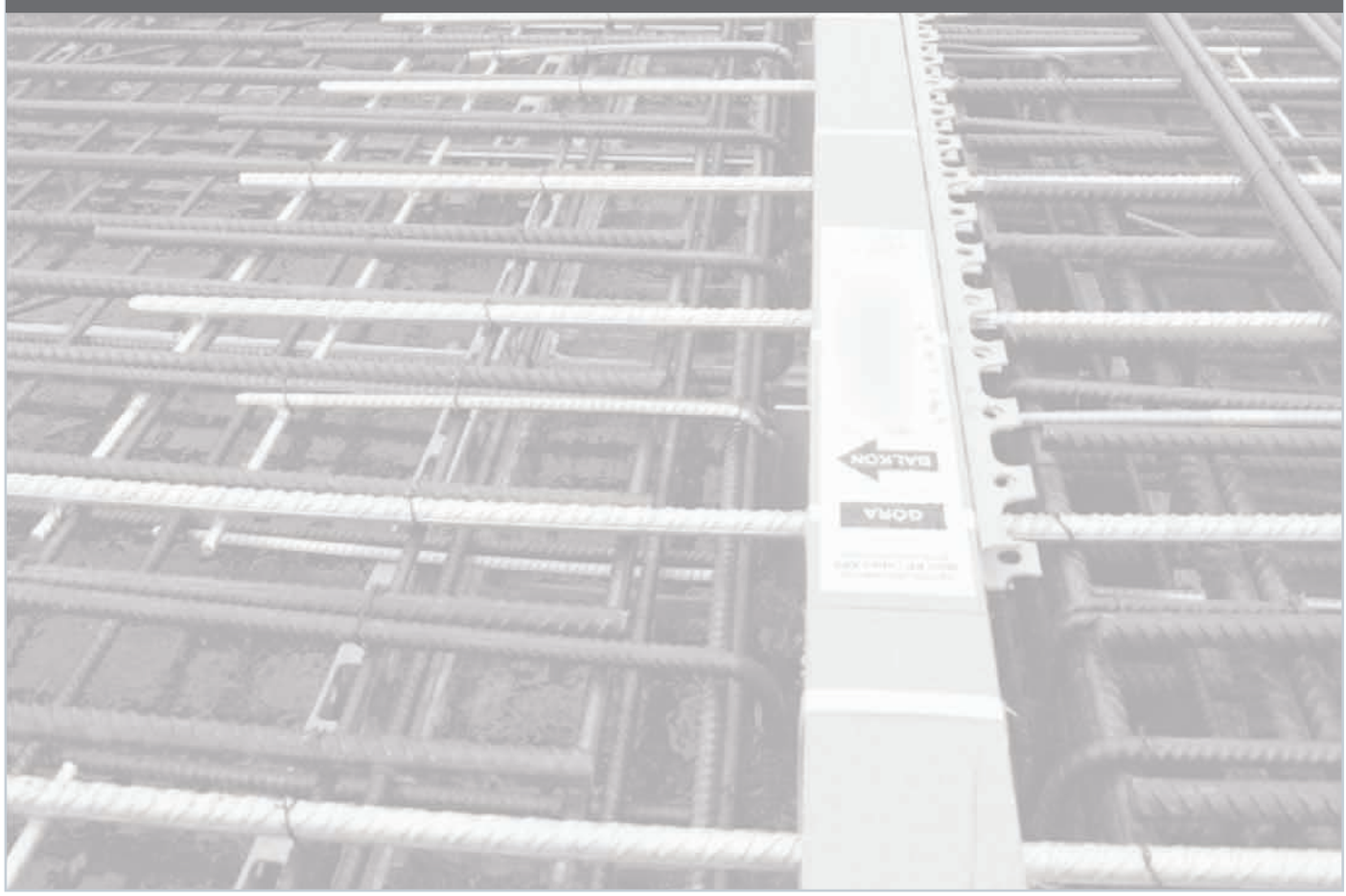
KP-1300 connector, used at support joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (-) and V_{Rd} shear forces (+). Reinforcement bars of normal fire-galvanised carbon steel.



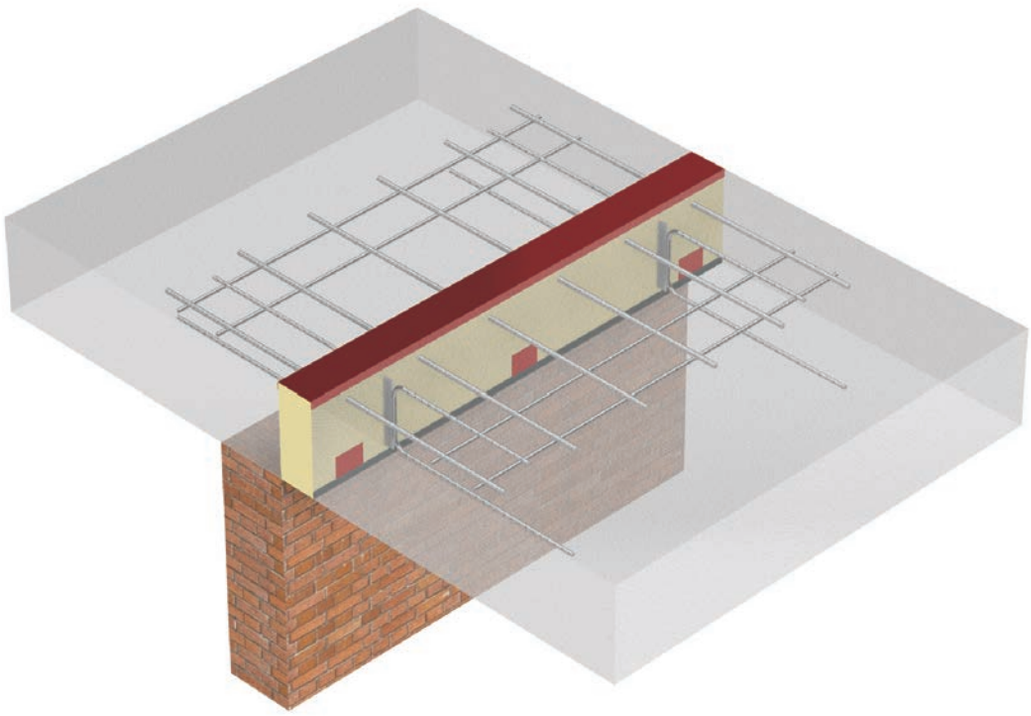
KP-1400 connector, used at continuous joints of the balcony slab with the ceiling slab - transfer of M_{Rd} bending moments (±) and V_{Rd} shear forces (±). Reinforcement bars of normal fire-galvanised carbon steel.



PRODUCTS



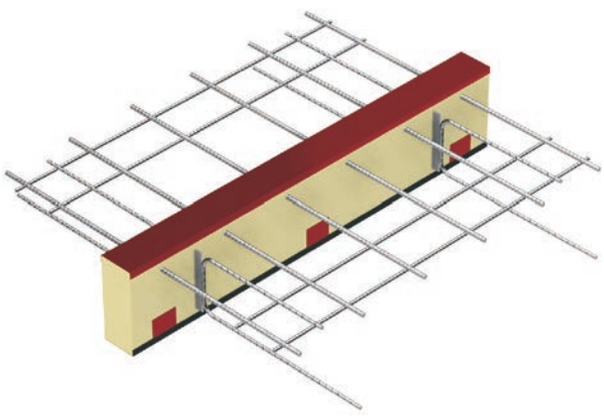
KP-100 BALCONY CONNECTOR FOR SUPPORT BALCONY SLABS



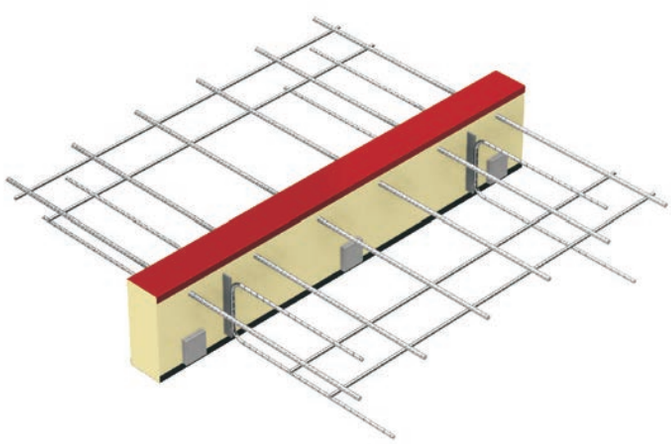
- standard elements for ceilings of thickness between 140 mm and 300 mm
- standard insulation thickness 80 mm; options: 60 mm, 100 mm, 120 mm
- insulation type: mineral wool (WM) or styrofoam (XPS)
- reinforcement bars of stainless steel
- steel plates of stainless steel
- stainless steel compression bearing (for 14 cm or 16 cm thick ceilings) or concrete compression bearing (for ceiling thickness values 18 cm and upwards)

Marking example:

KP - 104 (connector type) 6 (quantity of bars) x 10 (bar diameter) - 2 (quantity of steel plate) h=200 mm, XPS80, L=1000 mm



KP-104 balcony connector (6 x 10 - 2) with concrete compression bearings

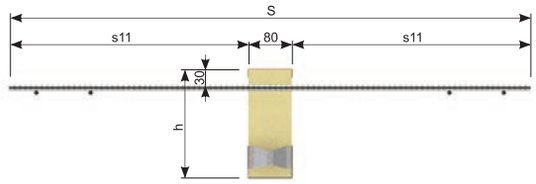


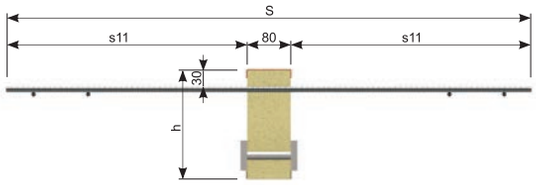
KP-104 balcony connector (6 x 10 - 2) with steel compression bearings

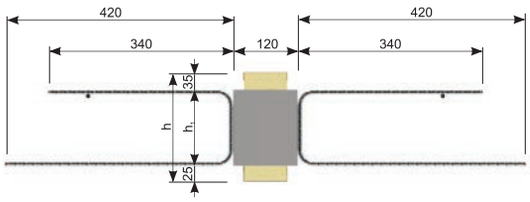
KP-100 BALCONY CONNECTOR - 20 cm module

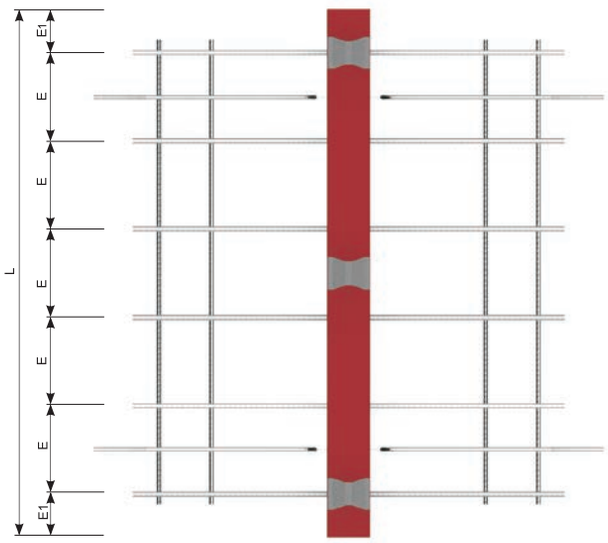
Concrete class: C25/30

Symbol	h [mm]	h_1 [mm]	Bar diameter ϕ [mm]	Quantity			M_{Rd} (-) [kNm]	Insulation 80 mm V_{Rd} (±) [kN]	Insulation 120 mm V_{Rd} (±) [kN]	RIgidity k [kNm/rad]	ψ [W/mK]	Dimension [mm]		
				Bars	Plate	Compression bearing						S	E	E1
KP-101 2x10-1 L=200 mm	140	80	10	2	1	1	6	22	16	318	0,060	960	100	50
	160	100	10	2	1	1	8	27	22	517	0,067	960	100	50
	180	120	10	2	1	1	10	33	27	765	0,073	960	100	50
	200	140	10	2	1	1	11	38	31	1 061	0,079	960	100	50
	220	160	10	2	1	1	13	44	35	1 405	0,085	960	100	50
	240	180	10	2	1	1	15	49	40	1 798	0,091	960	100	50
	260	200	10	2	1	1	17	55	45	2 239	0,096	960	100	50
	280	220	10	2	1	1	18	60	48	2 728	0,102	960	100	50
	300	240	10	2	1	1	20	65	53	3 266	0,108	960	100	50
KP-102 2x14-1 L=200 mm	140	80	14	2	1	2	12	22	16	450	0,083	1280	100	50
	160	100	14	2	1	2	15	27	22	742	0,089	1280	100	50
	180	120	14	2	1	2	19	33	27	1 106	0,095	1280	100	50
	200	140	14	2	1	2	22	38	31	1 542	0,100	1280	100	50
	220	160	14	2	1	2	26	44	35	2 051	0,105	1280	100	50
	240	180	14	2	1	2	29	49	40	2 632	0,111	1280	100	50
	260	200	14	2	1	2	32	55	45	3 286	0,116	1280	100	50
	280	220	14	2	1	2	36	60	48	4 012	0,122	1280	100	50
	300	240	14	2	1	2	39	65	53	4 811	0,127	1280	100	50









Additional bars installed at the construction site