



# SCHÖCK SPECIFIERS HANDBOOK 2007

THERMAL BRIDGING SOLUTIONS IN CONCRETE AND STEEL CONSTRUCTION



## THE PURPOSE OF THIS GUIDE



The purpose of this guide is to provide guidance for architects, structural engineers and other building professionals on the impact of thermal bridges due to cantilever building elements and how they can meet compliance with the far-reaching Part L of the Building Regulations, through the energy efficient design and construction of cantilevered balconies and other similar construction elements.

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### A LEADING EUROPEAN SUPPLIER

Today, still on the original site, we have grown to become one of Europe's leading suppliers of innovative thermal energy insulation, noise impact suppression and reinforcement technology solutions. In addition to our headquarters at Baden-Baden, we have a production plant in Halle/Saale and further subsidiaries have been established in England, Austria, Netherlands, Switzerland and Hungary. A network of highly qualified distributors provide expert sales and technical support in many countries including the Czech Republic, France, Belgium, Luxembourg, Poland and Ireland...

OVER **9** MILLION UNITS OF SCHÖCK ISOKORB® INSTALLED IN EUROPE SINCE ITS INTRODUCTION MORE THAN 20 YEARS AGO.

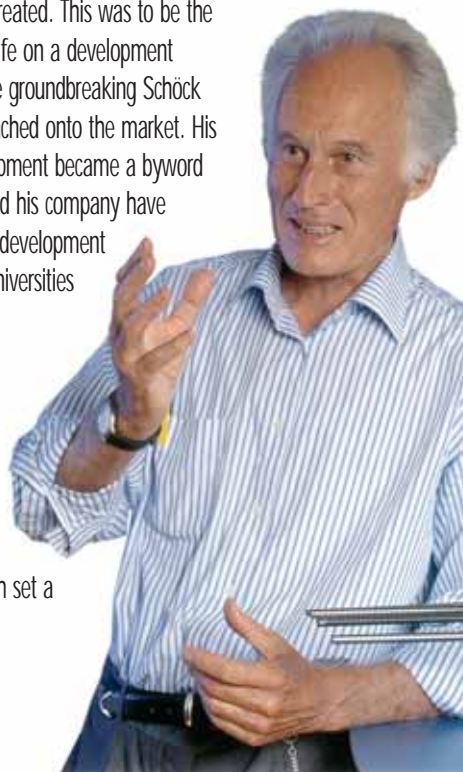
# INNOVATIVE THINKING IN PRACTICE



▶ In 1962, as a young structural engineer, Eberhard Schöck founded a specialist construction company at Baden-Baden, in southern Germany. His vision was to develop innovative construction solutions that would allow more effective and efficient processes on the building site. He dedicated his working time to considering every aspect of building physics and technologies, constantly looking for ways to improve construction techniques. ◀◀

Ironically, it was while on a skiing holiday in 1979 that he made the dramatic discovery that was to have so much impact on thermally efficient building design. Eberhard Schöck noticed that where conventional structural connections were used to join balconies and slabs in the buildings in which he was staying, condensation was forming in the walls and ceilings. He investigated this further and discovered that where balconies penetrate the building insulation envelope, an effect known as a "thermal bridge" is created. This was to be the catalyst for him to spend four years of his life on a development programme which resulted, in 1983, in the groundbreaking Schöck Isokorb® thermal break element being launched onto the market. His dedication to technical research and development became a byword and from that point on Eberhard Schöck and his company have continued to invest heavily in research and development programmes, working closely with many universities and research institutes.

Inevitably, other innovations followed, most notably in noise suppression and reinforcement technology. The Schöck Tronsole®, an impact noise suppressor for stairways, helping to create a quieter living environment and the Schöck BOLE® punching-shear reinforcement system, which set a benchmark in reinforcement technology.



## THE BALCONY – SPACIOUS, BUT DEMANDING



▶ A balcony is an important part of a modern building. It offers a feeling of freedom and spaciousness and has so many different uses – an outside meal, sunbathing, drying clothes, talking to the neighbours – not significant events, but important in terms of lifestyle and relaxation. Unfortunately, incorporating a balcony may not be so relaxing for the architect or structural engineer. Cantilever balcony connections and other similar construction elements which project through the building envelope, breaking the insulation layer in the process, are well known for creating thermal bridges, resulting in significant heat and energy loss. Moreover, if there is sustained exposure to condensation, plaster and paintwork will be subject to serious deterioration and mould growth. ◀





## COMBAT CLIMATE CHANGE

In the UK, Building Regulation Approved Document Part L1 (ADL1) and Part 2 (ADL) cites BRE IP1/06 for guidance, for requirements in terms of thermal bridges

- ▶ Relating to minimum surface temperature
- ▶ In terms of thermal losses came into force in April 2002. It places an obligation on everyone, particularly architects, designers, contractors and subcontractors, to contribute to the control and reduction of energy consumption by encouraging the industrywide adoption of energy efficient practices, in both building design and construction and help fulfil the UK's commitments to the Kyoto Protocol and the reduction of greenhouse gas emissions.

The future of building is more than ever linked to environmental considerations, placing greater pressure on the industry to provide thermally efficient, energy saving construction technologies to satisfy the demand for sustainable buildings. Schöck is a specialist dedicated to meeting the expectations of the professionals involved in delivering such technologies.

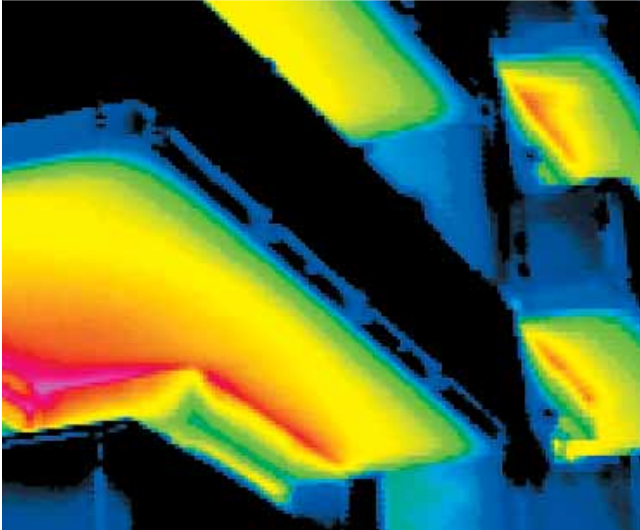


## PART L PARAGRAPH 1.30 READS:

*“The building fabric should be constructed so that there are no significant thermal bridges or gaps in the insulation layer(s) within the various elements of the fabric. . .”*



# THE STRUCTURAL THERMAL BRIDGE



## WHERE THERMAL BRIDGING OCCURS

Conventional balcony connections are a breeding ground for the conditions which create geometrical thermal bridges (the "Cooling fin" effect) and tangible thermal bridges (reinforced concrete slabs with a high thermal conductivity factor), thus causing a dramatic thermal outflow. Energy costs soar, as more and more warmth is lost and a drastic drop in surface temperature in these "cold spots" leads to various types of damage to the building.

## THE EFFECTS OF THE THERMAL BRIDGE

Energy consumption can increase by up to one third.

If there is sustained exposure to condensation, plaster and paintwork will be subject to serious deterioration.

Mould growth is not only an aesthetic disaster, it is hazardous to health and well known for being a major source of respiratory conditions, such as asthma.

## MINIMUM SURFACE TEMPERATURE REQUIREMENTS

Requirements relating to minimum surface temperature are stated in the Building Regulation Approved Document Part L1 (ADL1) and Part L2 (ADL2). The critical temperature factor ( $f_{CRSi}$ ) is introduced as a means of avoiding mould growth on absorbent surfaces and limiting the risk of surface condensation.

Type of building	$f_{CRSi}$
Dwellings, residential buildings, public buildings	0.75

## ENERGY LOSSES DUE TO THERMAL BRIDGING

ADL1 (Dwellings) uses the Government Standard Assessment Procedure SAP 2005 to determine overall carbon dioxide emissions from the building. Heat losses through non-repeating thermal bridges ( $H_{TB}$ ) is calculated using different methods.

To describe the energy performance of the thermal bridge the values  $\psi$  and  $\chi$  are used. If those specific values are not known, a default value has to be applied. This correction leads to a loss of approx. 40 % of the calculated energy performance of the building.

Using Accredited Construction Details the calculated energy loss is reduced from 40 % to 20 %.

If numerical modeling with  $\psi$  and  $\chi$  values is applied the calculated energy loss is only 5 %, eight times less than the calculation with not known specific values.

# THE STRUCTURAL THERMAL BRIDGE



## BETTER INSULATED HOUSES CUT CARBON DIOXIDE EMISSION AND HEATING COSTS

Architects and specifiers must reduce carbon dioxide and greenhouse gas emissions by building more energy efficient buildings. It is well documented that better thermal insulation is a good means of tackling the issue of global warming, and the Schöck thermal break system helps compliance with both the regulations and public expectation.

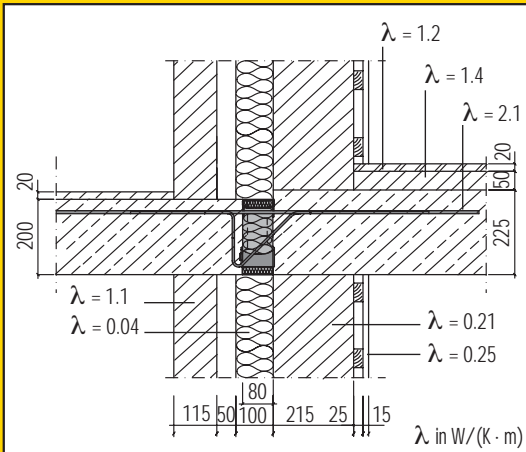
### CHARACTERISTICS VALUES FOR BALCONY CONNECTIONS USING THE SCHÖCK ISOKORB®

The  $\psi$  and  $\chi$  values depend on the type of construction used for the thermal bridge. To calculate them the thermal performance of the materials used and the equivalent thermal insulation value  $\lambda_{eq}$  of the thermal break are required.

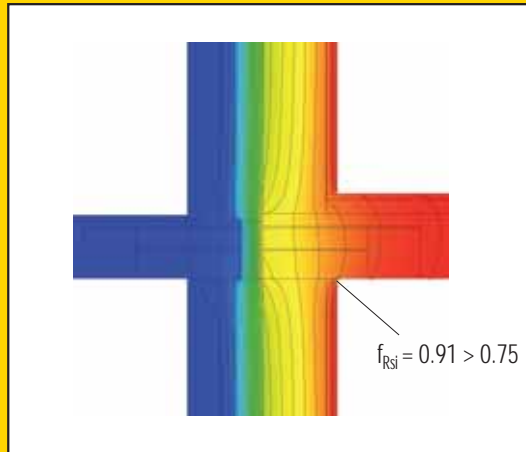
Characteristic thermal bridge values resulting from typical construction types, along with different Isokorb® types are shown in the table below. The underlying construction types and the isothermals are shown on page 8. Other thermal bridge construction types which do not match the ones shown here will have different values.

Schöck Isokorb® Type	K50	KS 14	KST 16 <sup>1)</sup>
Equivalent thermal conductivity (3-dim.) $\lambda_{eq}$ in $W/(m \cdot K)$	$\lambda_{eq} = 0.19$	$\lambda_{eq} = 0.31$	$\lambda_{eq} = 0.70$
Thermal transmission coefficient $\psi$ in $W/(m \cdot K)$ (in relation to external dimensions) or $\chi$ in $W/K$	$\psi = 0.21$	$\chi = 0.097$	$\chi = 0.26$
Temperature factor $f_{Rsi}$	$f_{Rsi} = 0.91$	$f_{Rsi} = 0.93$	$f_{Rsi} = 0.82$

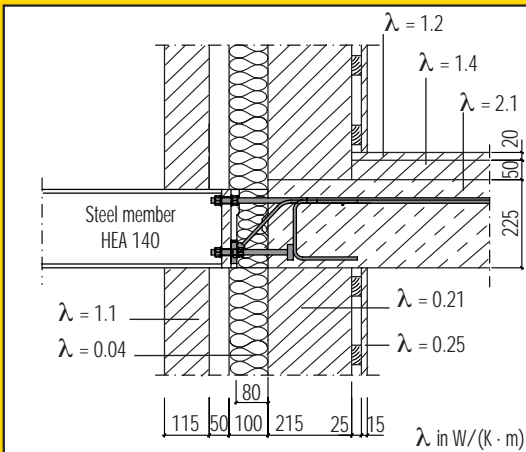
# NOTE THE EFFECTIVENESS



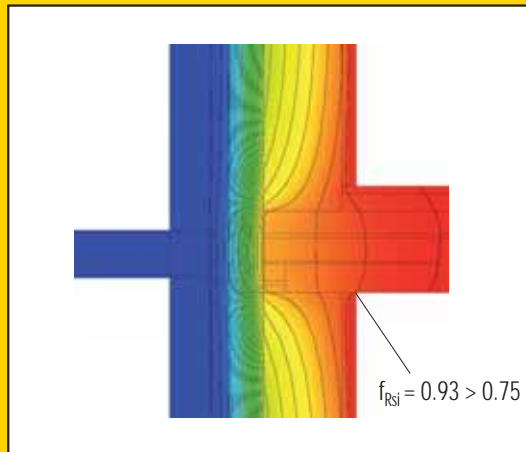
Balcony slab connection with Schöck Isokorb® type K50-CV30 and a composite thermal insulation system



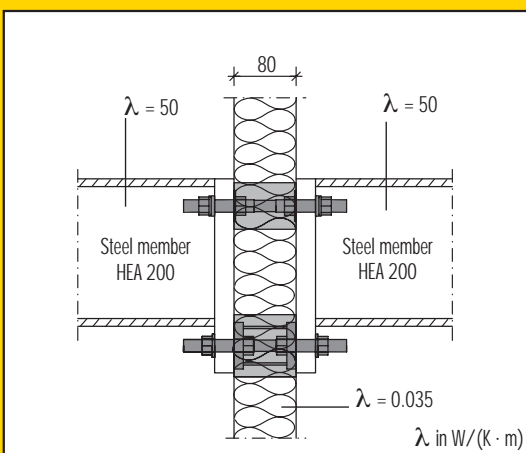
Isothermals for connection on the left side



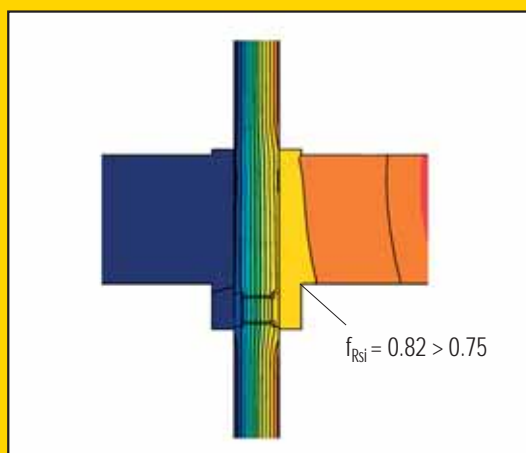
Connection of steel member HEA 140 with Schöck Isokorb® type KS14 and a composite thermal insulation system



Isothermals for connection on the left side



Connection of steel member HEA 200 with Schöck Isokorb® type KST16

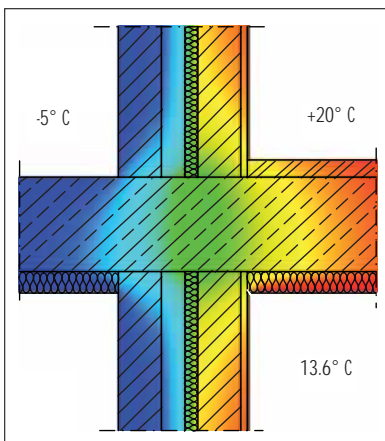


Isothermals for connection on the left side

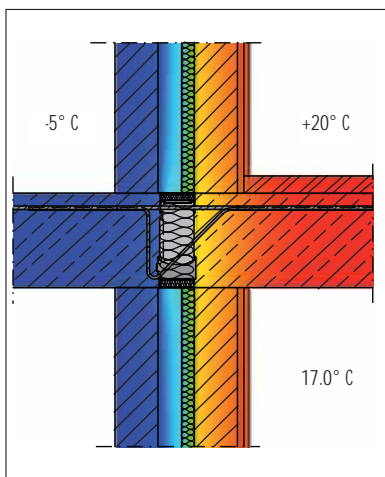
# SCHÖCK HAS A UNIQUE SOLUTION



The Schöck thermal elements are for use in concrete-to-concrete, concrete-to-steel and steel-to-steel construction and form a thermal break, whilst transferring load and maintaining full structural integrity. Known throughout Europe as the Schöck Isokorb® it has remained the most advanced, high performance thermal break element with over 9 million units installed since its introduction more than twenty years ago.



Balcony connection without thermal break.  
Insulation under balcony and ceiling.



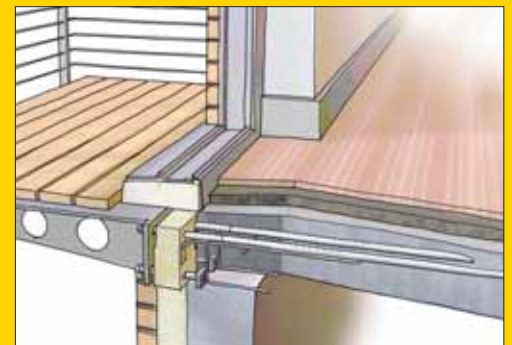
Balcony connection with Schöck Isokorb® K30.

THE ISOKORB® THERMAL BREAK ELEMENT IS THE ONLY PRODUCT OF ITS TYPE THAT ALLOWS THERMALLY EFFICIENT LOAD BEARING CONNECTIONS BETWEEN

## CONCRETE-TO-CONCRETE



## CONCRETE-TO-STEEL



## STEEL-TO-STEEL



# CONCRETE-TO-CONCRETE



The Schöck thermal break element, the Isokorb®, with its simple "drop-in" installation, low thermal conductivity and integral load bearing capacity offers the ideal insulation solution to this problem. It is manufactured from state-of-the-art materials – stainless steel and high density microfibre reinforced concrete – which guarantee the highest quality thermal partitioning of balconies and floor slabs. The dramatically reduced thermal outflow means higher surface temperatures inside, eliminating the risk of extra condensation, damage and mould growth.

## SETTING A NEW BENCHMARK

Using the latest generation of micro stainless steel fibre reinforced concrete pressure-bearing blocks, the Schöck Isokorb® range sets a new benchmark in thermal break technology. The Schöck Isokorb® type K with HTE-pressure-bearing module provides the best thermal performance achievable with thermal breaks today. At the same time this technique simplifies the installation on-site and thus reduces the installation time dramatically.

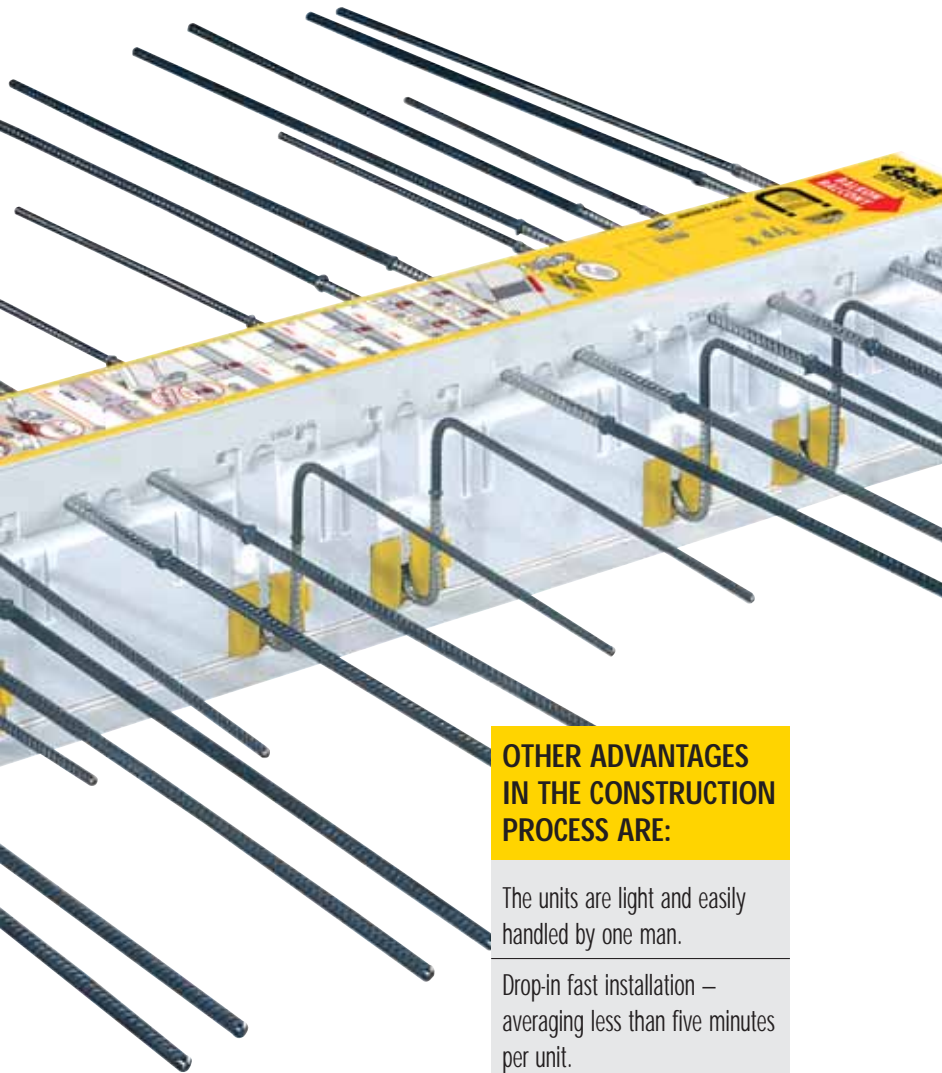
Examples of the average thermal conductivity with a balcony slab thickness of 220 mm

Schöck Isokorb® type	$\lambda_{eq} = (W/K \cdot m)$
K10	0,081
K20/KF20	0,101
K30/KF30	0,131
K40	0,141
K50	0,164



**HTE**  
MODULE





**OTHER ADVANTAGES  
IN THE CONSTRUCTION  
PROCESS ARE:**

The units are light and easily handled by one man.

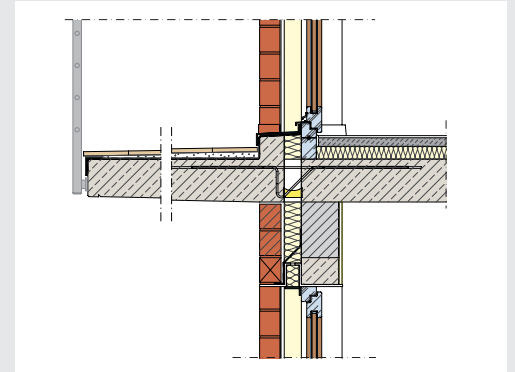
Drop-in fast installation – averaging less than five minutes per unit.

The product has a uniquely low thermal conductivity\*.

The first and therefore unique thermal break element with certification, No. 05/4277.

*\*One of the reasons why the Schöck Isokorb® was certified to be the best thermal break element by the "Fraunhofer Institute for Building Physics".*

**CONSTRUCTION DETAILS  
SCHÖCK ISOKORB® TYPE K**



**Construction materials Schöck Isokorb® type K**

On-site concrete	Minimum density class C25 (at component junctions)
Pressure bearing pad	PE-HD synthetic cloaking
Reinforcement steel	Bst 500S and Bst 500 M
Steel construction	S235 JRG1
Stainless steel	Construction material nr. 1.4571 hardening level S460 Reinforcement ribs Bst 500 NR
Fire protection plates	Lightweight building boards, materials class A1, cement-bound fire safety boards, mineral wool: $\rho \geq 150 \text{ kg/m}^3$ Melting point $T \geq 1000 \text{ °C}$ with integrated fire protection strips
Insulation Material	Polystyrene hard foam

**On-site installation**



**Installation in precast balcony**



# CONCRETE-TO-STEEL



The Schöck Isokorb® type KS enables a thermally insulated, loadbearing connection to be made between reinforced concrete and steel construction components. Fine tuning and adjustment to optimize fitting tolerance is possible.



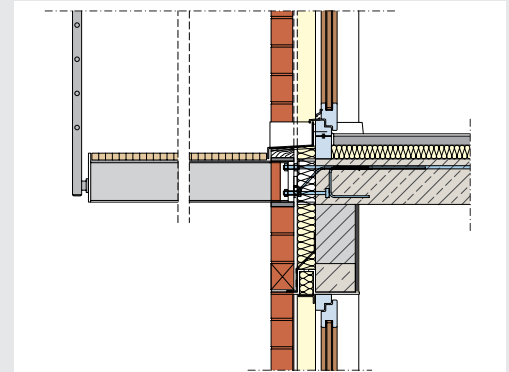
## ON-SITE:

Cuts down on operation time.

Ensures corrosion protection with its stainless steel finish.

Different types ensure the transmission of shear, bending moment and tension, as well as compression.

## CONSTRUCTION DETAILS SCHÖCK ISOKORB® TYPE KS



### Construction materials Schöck Isokorb® type KS

Reinforcing steel	B 500 B acc. to BS 4449, and BSt 500 NR
Pressure bearing	S 355 JO
Nonrusting steel and 1. 4571	Material no.: 1.4401, 1.4404 and 1. 4571
Pressure plate	Grade A4-70 to BS EN
Spacer shims	ISO 3506
Threaded fasteners	
Insulation material	Polystyrene hard foam

### Installation on-site



## STEEL-TO-STEEL



Free cantilever or canopies, balconies or walkways, the Isokorb® type KST offers complete freedom of design when it comes to steel construction. The unit is able to withstand extremely demanding loads and is effective against bending moment and shear force. Its stainless steel components mean that the unit is completely protected from corrosion.



### ON-SITE:

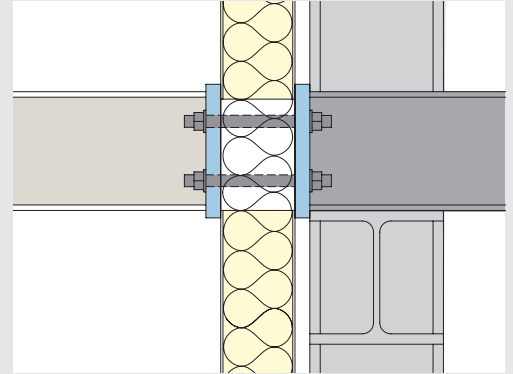
It is easy to fit with regular end plate connections.

All available steel profiles can be bolted on.

Specific load situations controlled by modular use of components.

Designed to suit loading conditions in residential and commercial buildings.

## CONSTRUCTION DETAILS SCHÖCK ISOKORB® TYPE KST



### Construction materials Schöck Isokorb® type KST

Nonrusting steel	Material no.: 1.4401, 1.4404 and 1. 4571
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Pressure plate	Grade A4-70 to BS EN
Rectangular hollow section	ISO 3506

Threaded fasteners	
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Insulation material	Polystyrene hard foam
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### Installation by the steel fabricator



# A COMPREHENSIVE RANGE FOR EVERY APPLICATION



## Schöck Isokorb® type K

Load bearing element for cantilever balconies. Transfers shear force and bending moment stress. With integrated hanging and edge reinforcement fitted as standard, makes the (normally required) on-site adding of extra stirrups and reinforcement redundant.

## Schöck Isokorb® type KF

For cantilever hanging slabs as precast elements. Partitioned model specially for the requirements of prefabricating plants. The on-site hanging reinforcement is integrated as standard.

## Schöck Isokorb® type K-corner

Produced as a supplement to types K and KF, Schöck Isokorb® type K-corner is used to form balconies with outside corners. The on-site hanging reinforcement is integrated as standard.

## Schöck Isokorb® type K-HV, K-BH, K-WO, K-WU

For stepped cantilever balconies, i.e. where slabs and balconies have to be set at different heights. The on-site hanging reinforcement is integrated as standard.

## Schöck Isokorb® type V

For insulation of balcony slabs with flexible joints, podiums and column supported balconies. Ideal for shear force transfer.

## Schöck Isokorb® type Q

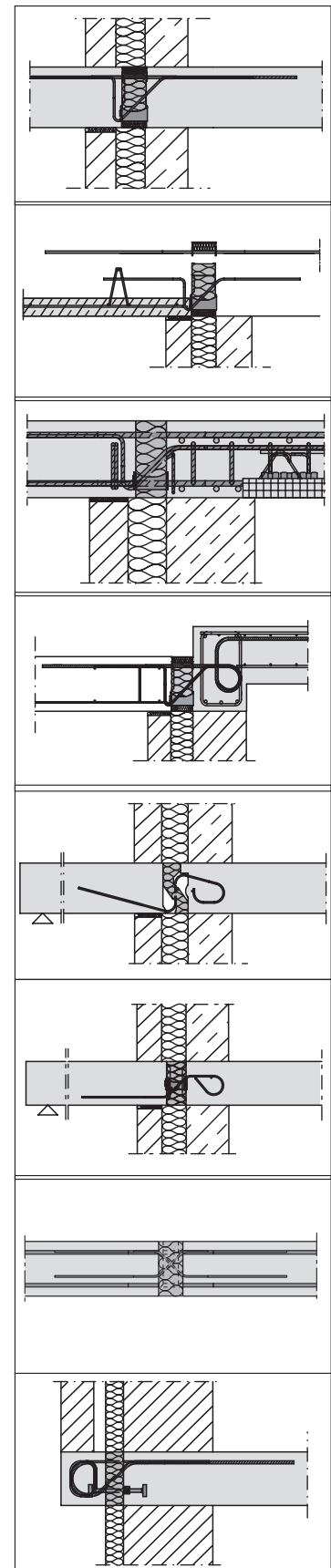
For shear and lateral force transfer, also where height and stress points are critical.

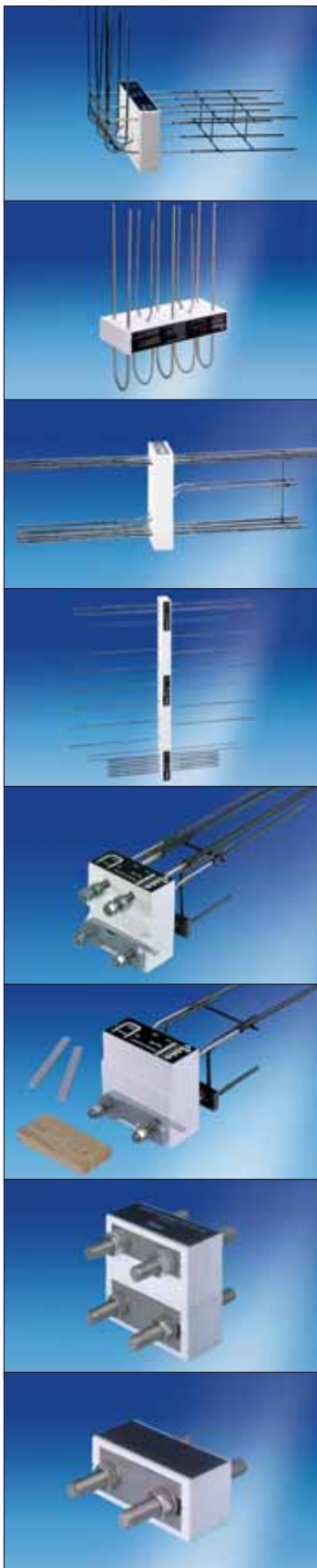
## Schöck Isokorb® type D

For insulation of balcony slabs where they appear within the floor slab field. Carries not only positive and negative bending moment stress but also shear forces.

## Schöck Isokorb® type O

For insulation of corbelled facing consoles. Point installation according to design requirement spacing.





### Schöck Isokorb® type F

For insulation between protruding balustrades. Point installation according to design requirements regarding spacing.

### Schöck Isokorb® type A

For insulation between parapets and floor slabs. Point installation according to design requirements regarding spacing.

### Schöck Isokorb® type S

For insulation at cantilever beams. Carries bending moment and shear force stress at exact point of origin. It is designed and manufactured according to the spacing requirements.

### Schöck Isokorb® type W

For insulation at floor/storey level wall height. Carries bending moment and shear forces both vertically and horizontally. It is designed and manufactured according to the spacing requirements.

### Schöck Isokorb® type KS

The thermal insulation connection element for cantilever steel construction connected to concrete slab.

### Schöck Isokorb® type QS

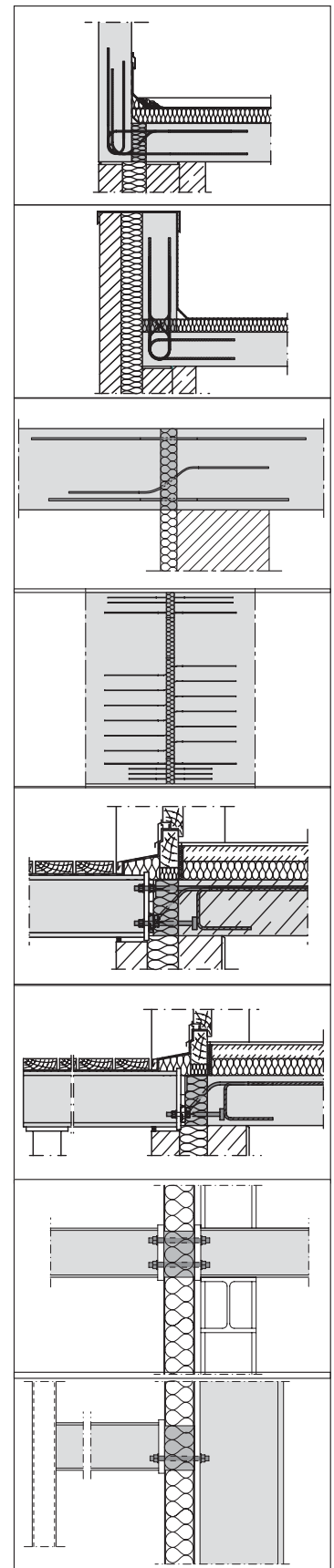
The thermal insulation element for steel construction connected to concrete slab, for shear forces only.

### Schöck Isokorb® type KST

The thermal insulation element for use where a "steel on steel" cantilever construction is planned.

### Schöck Isokorb® type QST

The thermal insulation element for shear forces in "steel on steel" construction.



## SCHÖCK COUNTERS THERMAL BRIDGING AT 417 RIVERSIDE...



► Whether or not London had been successful in its bid for the 2012 Olympics, Stratford and neighbouring areas in East London were still poised to take on a new strategic importance over the next few years. As part of the Thames Gateway regeneration project, enormous investment is planned for housing, employment, retail and general urban community development. The new Eurostar International Station is due to open in 2007, as indeed is a new "Bluewater" style shopping centre covering around one and a half million square feet – and many of the currently neglected open spaces in the area will take on a new lease of life as well. Greens, commons and pathways developed for walkers and cyclists, naturalisation of the riverbanks through ecological corridors and habitat creation and over 100 bridges are to be built throughout the lower Lea Valley as a whole. ◀



## BALCONIES – OFTEN A PROBLEM CHILD

One development that embodies the burgeoning social change in the area can be found at Fish Island, just off Wick Lane in Bow. Completed in late 2005, it is on the banks of the River Lea and known formally as 417 Riverside. Consisting of eight office units and seventy-two apartments in four inter-connecting blocks, the development, created by Henley Homes, is designed to provide an elegant, contemporary living and working environment. The apartments feature attractive balconies, but however appealing they may be to the residents, balconies are so often a problem child in the construction process. Cantilever balcony connections and other similar construction elements which project through the building envelope, breaking the insulation layer in the process, are well known for their tendency to create thermal bridges, resulting in significant heat and energy loss. Also, if there is sustained exposure to condensation it is probable that plaster and paintwork will be subject to serious deterioration and mould

growth – one of the major sources of respiratory allergies such as asthma. At 417 Riverside, the balconies feature a unique solution to thermal bridging problems – the Schöck structural thermal break system. The specific unit used at Wick Lane is the Schöck Isokorb® type K, which incorporates a concrete pressure bearing block (the HTE-module).

It has set new levels of performance in thermal break technology and features latest generation compression modules, made from microstainless steel fibre reinforced concrete for increased heat insulation. There is no requirement for an overhanging thrust bolt, so less tensile bars are needed to provide the same load bearing capacity and at the same time permit efficient cassette type installation.



**“I was very impressed with the Schöck products, their technical and thermal efficiency, cost saving installation times and Design Office involvement from beginning to end. I will definitely be specifying these products for future projects”.**

*Phil Hudson, Price and Myers Consulting Engineer*

## . . . AND IN SOUTHAMPTON – OCEANA BOULEVARD



Barratt is Britain's leading housebuilder and recently won a CABA Award (Commission for Architecture and the Built Environment) for the design of a modular steel frame house. The Government advisory body described them as the only housebuilder – "whose forward-thinking and motivation has led to better buildings and public spaces" – and the award citation itself said: "The last year has seen Barratt employ some top quality architects and explore new design solutions, suggesting a growing appetite for innovation in the business".

This commitment to innovation, coupled with the highest standards of design, quality of construction and demand for thermal efficiency is welcomed by Schöck Ltd, who once again have the opportunity to demonstrate their Isokorb® thermal break units at the stylish new Barratt Oceana Boulevard development alongside Southampton Water, at Dock Gate 4. The complex consists of studio, one and two bedroom flats and for the ultimate view across the estuary, a selection of Penthouse Suites. Another Barratt development, West Point at nearby Portsmouth, already successfully incorporates the units.

These BBA certified thermal break modules prevent thermal bridging and energy loss by forming a thermal break between cantilever structures and the internal floor, whilst transferring load and maintaining full structural integrity.



Cantilever balconies, canopies and other similar construction elements – which project through the building envelope and break the insulation layer in the process – are renowned for creating thermal bridges and conventional balcony connections are a breeding ground for these conditions.

Energy costs soar, as more and more warmth is lost and a drastic drop-in surface temperature in these "cold spots" leads to various types of damage to the building.

The first of three phases of the Oceana Boulevard development has just been completed and the entire project will eventually use nearly three hundred type KS Schöck modules. The KS enables a thermally insulated, load bearing connection

to be made between reinforced concrete and steel construction components. It can be fitted easily by one man in a matter of minutes and fine-tuning, with adjustment to optimise fitting tolerance, is possible on site. The units are made from stainless steel components to ensure corrosion protection and to minimise thermal conductivity.

There are more than two hundred and fifty standard solutions available in the Schöck range and modules can be tailored to suit practically any application, with different types enabling the transmission of shear, bending moment and tension, as well as compression.

**"The KS 14 provides a unique thermal and structural connection that offers verifiable thermal values and gives the architect a "clean" and unobtrusive connection detail between the balcony and the brick or rendered façade".**

*Graham Lealan, Consulting Civil and Structural Engineers  
Reuby & Stagg*



# CUSTOMER SERVICES



▶▶ Our engineers in the Technical Design Support department are ready to help you with your design and construction queries by providing general advice, along with detailed plans, project solutions and calculations where necessary. ◀◀

Please send your design, requirements, etc and the proposed site address to:

Schöck Ltd · Barford Road · Bloxham · Banbury OX15 4FF · United Kingdom

Telephone: 0845 241 3390 · Fax: 0845 241 3391

E-mail: [design@schoeck.co.uk](mailto:design@schoeck.co.uk) · Web: [www.schoeck.co.uk](http://www.schoeck.co.uk)

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