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Surveyor comment

GS 2/12-14

Object	Benchmark in terms of performance in case of exposed to fire of Schöck Isokorb® type KS and QS as connection element with a thermal barrier between steel elements and reinforced concrete elements according to fire rating in DIN EN 13501-2
Client:	Schöck Bauteile GmbH Vimbucher Straße 3 D-76534 Baden-Baden
Date of order:	16.12.2014
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1. Motivation

The department of fire protection of the University of Kaiserslautern was ordered on 4th of December 2014 to carry out a surveyor comment to rate the Isokorb[®] type KS and QS elements according to the fire ratings in DIN EN 13501-2. The Isokorb[®] types KST is a load bearing, thermal isolation element between steel elements and reinforced concrete elements. The Isokorb[®] types KS and QS is a load bearing, thermal isolation element between steel elements and reinforced concrete elements. The purpose of these elements is to isolate between steel constructions and reinforced concrete structures and prevent thermal bridges and the formation of condensation water.

This surveyor comment does only refer to the load bearing capacity of Isokorb[®] type KS and QS elements in cases of fire impact. It is absolutely required, that the surrounding components and structure are adequate protected against fire impact. The surrounding components and structure are not rated

A survey about the structure on the whole is not part of this report.

2. Background

The following documents where used for this report:

- Covering letter of the Schöck company
- Duty checklist of the Schöck company
- Technical information (TI) Schöck Isokorb[®] / DE/ 2015.1/ January
- Statical calculations of the Isokorb KS und QS S/N 130346. Date of creation 17.12.2003
- Approval of renewal for statical calculations S/N 130346 (S-N 140141)
- Surveyor comment GS 3.2/09-110 from the MFPA Leipzig
- Surveyor comment GS 3.2/09-111 from the MFPA Leipzig
- EC 3-1-2, EC 3-1-8
- DIN 4102-4
- DIN EN 13501-2
- DIN EN 1993-1-2
- DIN EN 1993-1-8
- Brandschutz in Europa – Bemessung nach Eurocodes; Hosser, D.
- Fire Design of Steel Structures; Fransen, J.-M. ; Vila Real, P.
- General technical approval Z-14.4-518 about Schöck Isokorb Typ KST for connections in steel building
- Manufacturers informations about the components of the Schöck company

3. Description

The Isokorb® type KS and QS as shown in Figure 1 and 2 is a load bearing and thermal isolation connection element between steel- and reinforced concrete components. The connection to the steel components is created with screws. They are screwed into a front plate attached to the steel components as shown in Figure 1 and 2. The dimension of the screws goes from M16 to M22, according to the type of Isokorb® used. The connection to reinforced concrete components is created by setting the reinforcing steel of the Isokorb® in concrete of this element as shown in Figure 1 and 2. All screws and reinforcing steel used must consist out of stainless steel. Further informations about the Isokorb® type KS and QS are provided in the technical information (TI) Schöck Isokorb® / DE/ 2015.1/ January.

According to the requirements the connection has to withstand a fire impact between 30 and 120 minutes

Figure 1: Isokorb® type KS

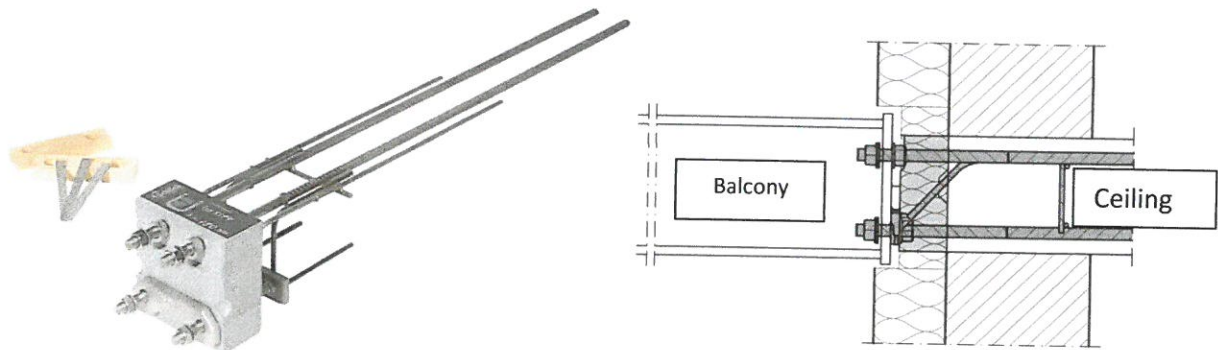


Figure 2: Isokorb® type QS

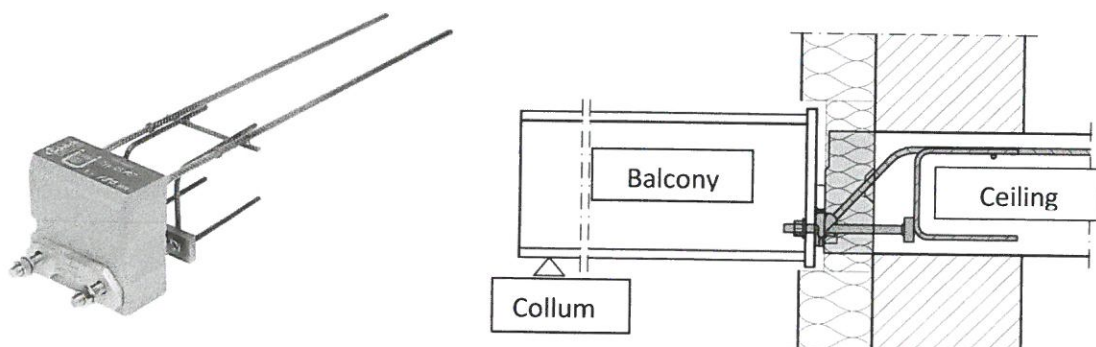
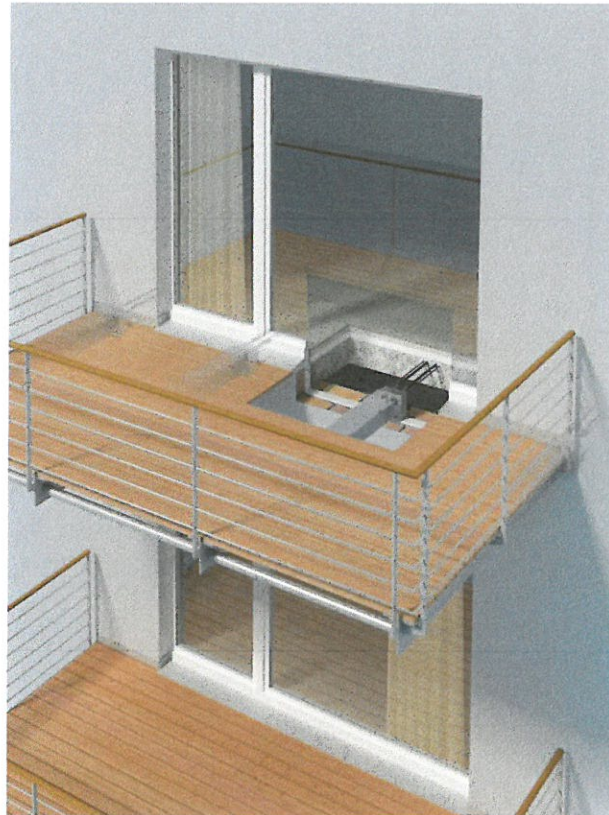


Figure 3: Example for the construction and use of Isokorb® Typ KS



Building materials of Schöck Isokorb® type KS and QS

Building material	Material / Quality
Reinforcing steel:	B500B according to DIN 488-1; BSt 500 NR according to general technical approval
Thrust block in concrete:	S 235 JRG2 according to DIN EN 10025-2 for the thrust block
Stainless steel:	Material-Nr.: 1.4401, 1.4404, 1.4362, 1.4462 und 1.4571, S460 according to approval Z-30.3-6 for all building elements and connections consisting of stainless steel or BSt 500 NR
Load bearing plate:	Material-Nr.: 1.4404, 1.4362 and 1.4571 or better than 1.4462
Distance plate:	Material-Nr.: 1.4401 S235, thickness 2 mm and 3 mm
Isolation:	EPS, Neopor® with WLF 0,031 W/mK, Material class B1 (hardly inflammable)

Recommendations for connected elements

Building material	Material / Quality
Concrete:	Standard concrete; strength category of concrete \geq C20/25
Concrete steel:	B500A or B500B according to DIN 488-1, or. DIN EN 1992-1-1 (EC2) and DIN EN 1991-1-1 NA
Structural steel:	At balcony side not less than S235; strength category, static proof and rust protection according to structural engineer

4. Stellungnahme

The Isokorb® type KS and QS shall reach the fire ratings R30, R60, R90 and R120 according to DIN EN 13501-2.

Other test criteria, like the integrity of the room (E) or the Isolation (I), do not apply for a punctual connection like the Isokorb® type KS and QS.

The criterion Isolation does not mean the quality in terms of building physics. It only means the Isolation (I) according to DIN EN 13501-2.

Proof of the fire ratings like required in DIN EN 13501-2 is given in two ways in 4.1 and 4.2.

4.1. Proof according to criteria

The specific fire endurance of Isokorb® type KS and QS can be esteemed as proven if the following criteria according to EC 3 are fulfilled:

- 1) The thermal resistance $(d_f / \lambda_f)_c$ of the Isokorb® type KS and QS fire protection is equal to or greater than the minimum value of the thermal resistance $(d_f / \lambda_f)_m$ of fire protection appliend to any oft he connected steel structure, where:

The value d_f ist he thickness oft he fire protecting meaterial and λ_f ist he effective thermal conductivity of the fire protection material.

- 2) The utilization (μ) of the threaded rod used in the Isokorb® type KS and QS is equal to or less than the maximum utilization of any of the connected members. Thereby the rated values according to the technical information of the Schöck Company and the General technical approval need to be considered.
- 3) The resistance of the Isokorb® type KS and QS at ambient temperature is calculated in accordance with the recommendations given in DIN EN 1993-1-8. According to the technical information of the Schöck Company the Isokorb® type KST is calculated according to EC 3. These requirements are fulfilled.

If the fire protection material is a covering paint system, the criteria found in part 5 "Special hints" apply.

4.2. Proof according to analysis

This proof was carried out according to EC3-1-2. The required conditions are the following:

- The screws used in the Isokorb® are heating in the same condition as the connected steel component.
- The connected steel component is a steel front plate.
- The front plate is covered with fire protection material having the same data as shown in table 1:

Table 1: Data of fire protection material

Data	Value
Thermal conductivity λ_p	0,11 [W/mK]
Specific Thermal conductivity c_p	950 [J/kgK]
Bulk density ρ	450 [kg/m³]

The calculation for the required thickness of the fire protection plate to protect the Isokorb® type KS and QS is done like described in EC3-1-2. The calculation does only apply for protection material with the values in table 1 or comparable values.

For very small front plates with a width from 160mm to 200mm and a thickness from 20mm to 30mm the following plate thicknesses are unproblematic according to EC 3:

Fire endurance R [min]	Thickness of plate [mm]
30	15
60	20
90	25
120	30

Front plates with a width over 200mm and a thickness over 30mm the following plate thicknesses can be assumed as unproblematic according to calculations referred to EC 3

Fire endurance R [min]	Thickness of plate [mm]
30	10
60	15
90	20
120	25

To prevent open gaps in cases of fire, it is necessary to take actions in the area of joints and overlaps. This can be done with swelling tape (like PROMASEAL or similar) or with a minimum anchoring depth according to the relevant fire endurance.

Fire endurance R [min]	Anchoring depth [mm]
30	10
60	15
90	20
120	25

In cases where the surrounding steel structure is protected by plates and the connections are in one level, the plates have to cover over the facing of the Isokorb® type KS and QS at least 30 mm. This is meant to avoid open gaps in case of a fire.

Figure 4 and 5 are showing examples for the design of fire protection with plates. Figure 6 and 7 are showing examples for the design of fire protection with covering paint systems.

Figure 4: Isokorb® type KS – Fire protection using fire protection plates

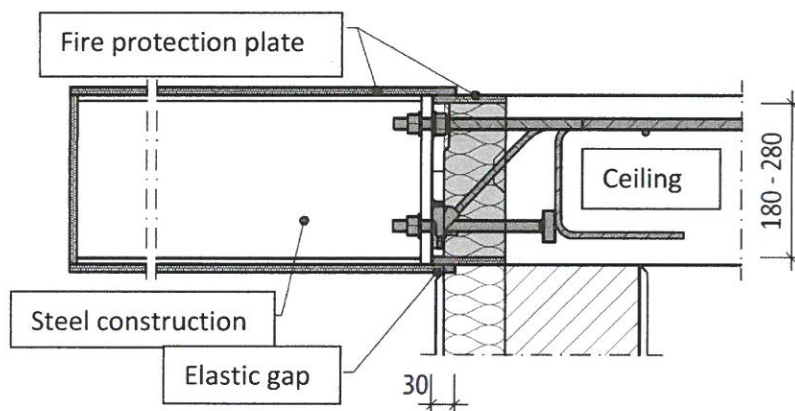


Figure 5: Isokorb® type KS - Fire protection using fire coating systems

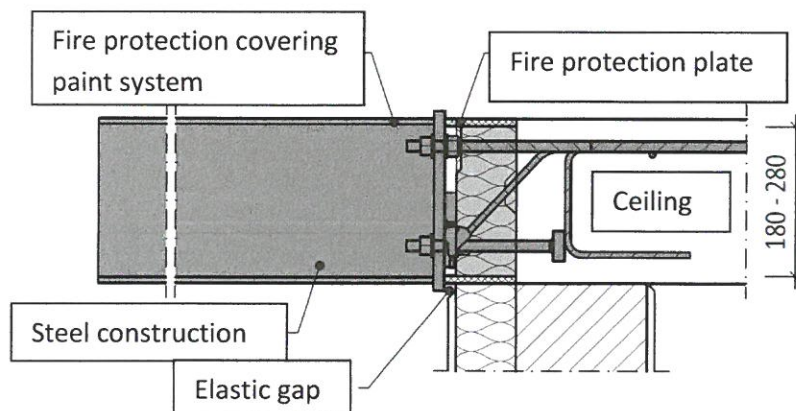


Figure 6: Isokorb® type QS - Fire protection using fire protection plates

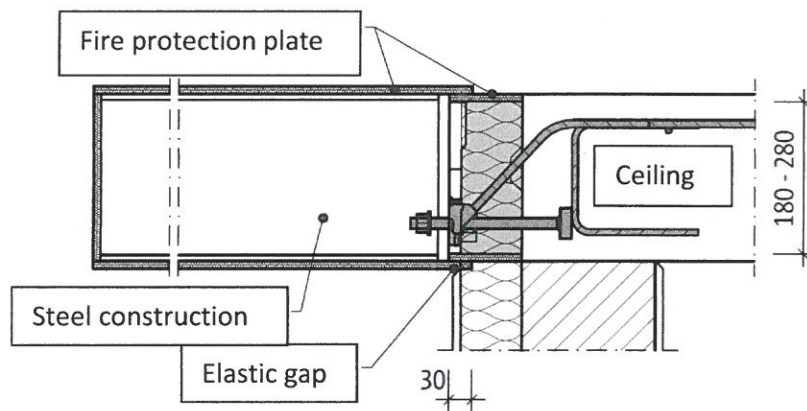
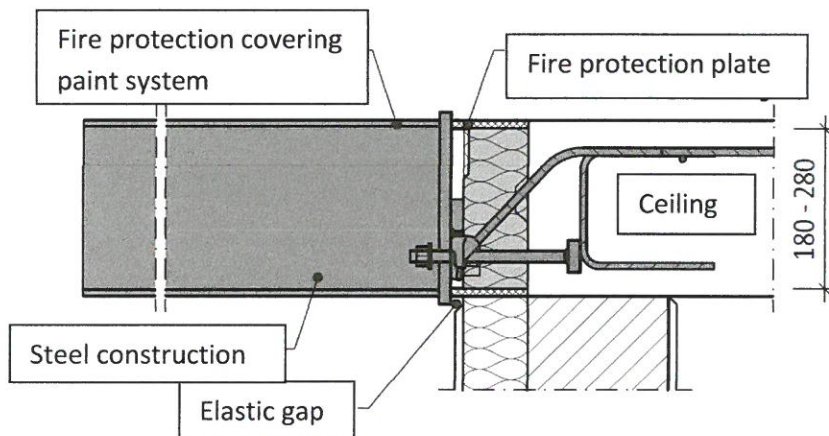


Figure 7: Isokorb® type QS - Fire protection using fire coating systems



5 Special hints

All statements of this surveyor comment are valid only if the surrounding structure is carried out properly according to the general technical approval and the technical information according to the Schöck Company and is supplied with an equivalent fire resistance. It is not possible to protect the Isokorb type[®] KS and QS with a covering paint system in the area of the thermal isolation. It is not possible to apply a covering paint system on a background like the thermal isolation. Out of this reason this situations can be assumed as if the surrounding structure was protected with fire protection plates. It is necessary that the plates used to protect the Isokorb type[®] KS and QS have the same proportion of $(d_f / \lambda_f)_c$ like the covering paint system to ensure equality in terms of fire resistance. The overlaying threaded rods can be protected with the same covering paint system as the connected structure. The threaded rods must get a paint layer as thick as the construction element with the highest fire resistance in the surrounding structure.

As covering paint systems and Fire protection plates only materials can be used which are approved with a general technical approval (abZ) or equivalent according to European and national law like ETA. All protection systems, both covering paint and protection plate systems, used to protect the Isokorb type[®] KST must be carried out properly according to the general technical approval and the technical information of the manufacturer.

To reach a fire resistance of at least R30 the Isokorb type[®] KST always need to be protected by fire protection material. Without such actions the Isokorb type[®] KST count as it had no fire resistance (R0). This applies as well, if according to part 4.1 the surrounding structure would reach a fire resistance class without fire protection.

This surveyor comment is only valid, if the fire protection of the Isokorb[®] type KS and QS fulfill an equivalent protection against fire as required for the surrounding structure. This applies also for the anchoring part of the Isokorb[®] type KS and QS.

Kaiserslautern, den 13.02.2015



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