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Surveyor comment

GS 1/12-14

Object

Benchmark in terms of performance in case of exposed to fire of Schöck Isokorb® type KST as connection element between steel components and a thermal barrier 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

Author:

M.Eng. Johannes Heimann

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 KST 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. It is constructed modular and consists out of the Isokorb® type KSTZ module and KSTQ module. The purpose of these elements is to isolate between steel constructions and prevent thermal bridges and the formation of condensation water.

This surveyor comment does only refer to the load bearing capacity of Isokorb® type KST 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 KST und QST 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 KST as shown in Figure 1 is a load bearing and thermal isolation connection element between two steel components. The connection is created with screws. They are screwed into a front plate attached to the steel components as shown in Figure 2. The dimension of the screws goes from M16 to M22, according to the type of Isokorb® used. All screws used must consist out of stainless steel. Further informations about the Isokorb® type KST 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 KST, KSTZ and KSTQ

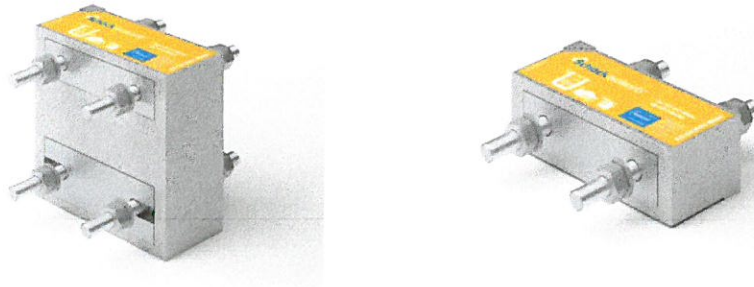


Figure 2: Construction scheme of Isokorb® type KST, KSTZ and KSTQ

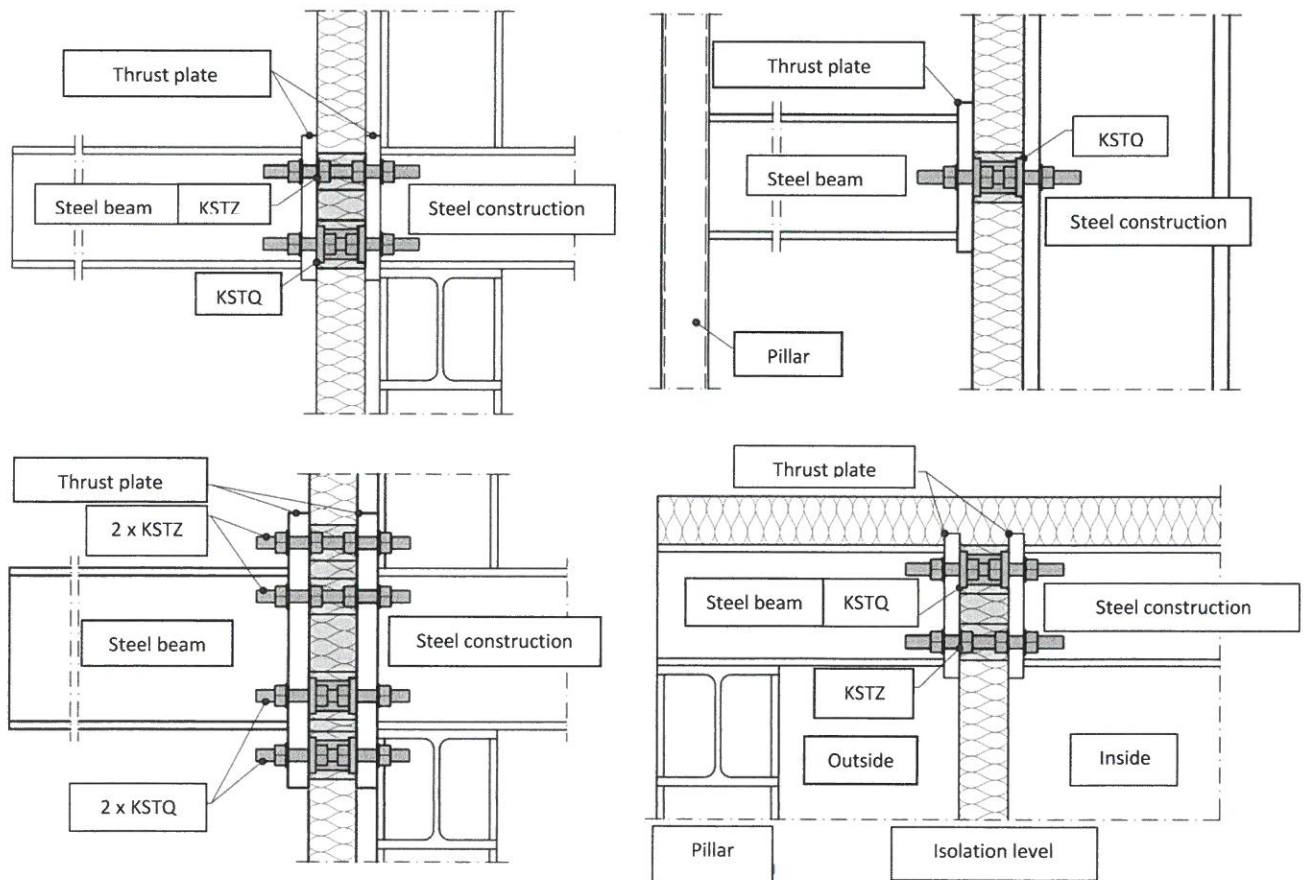
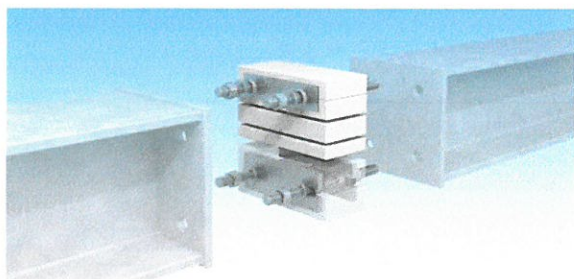
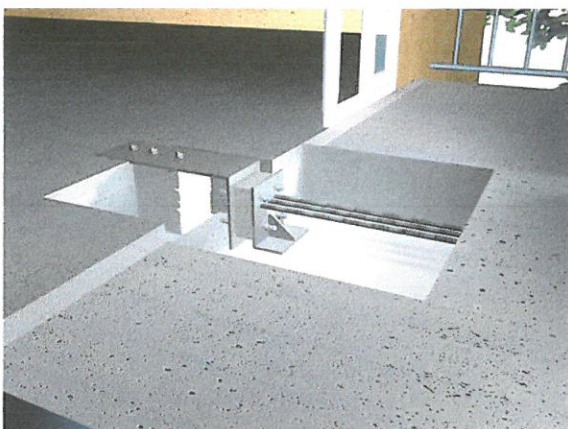
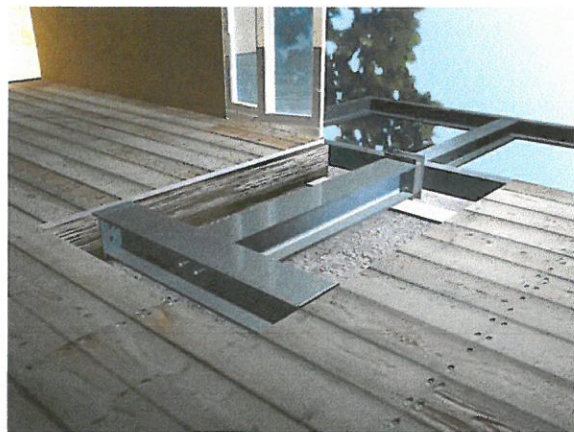
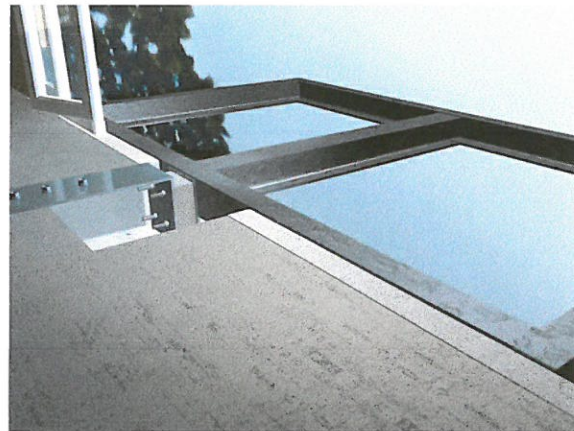
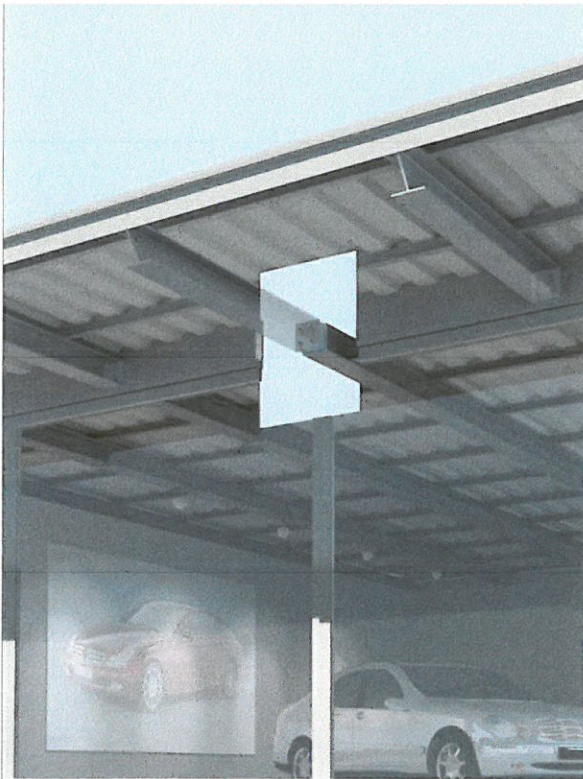
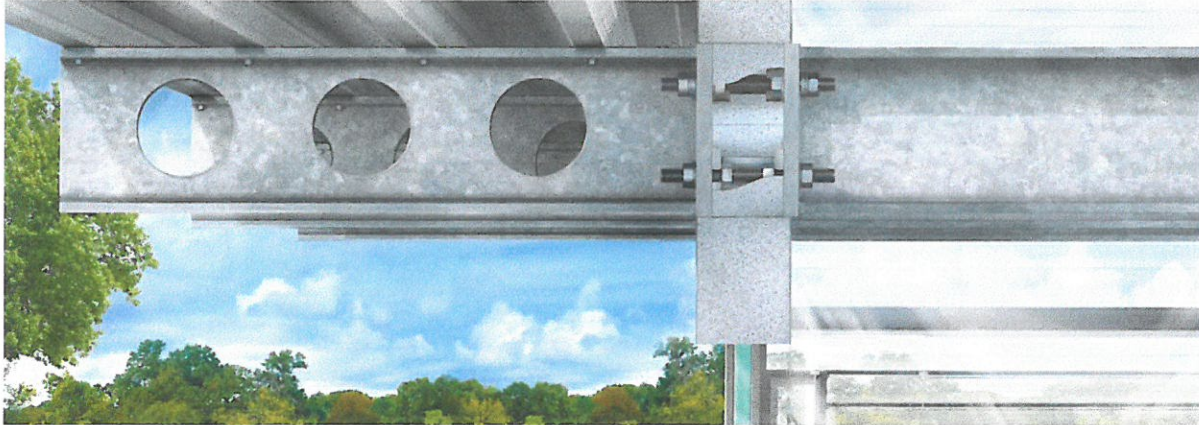


Figure 3: Examples for Isokorb® type KST applications



Building materials of Schöck Isokorb® type KST

Building material	Material / Quality
threaded rod:	strength class 70, 1.4404 (A4L), 1.4362 (-), 1.4571 (A5)
Rectangle hollow section	S 355
Stainless steel:	Material-Nr.: 1.4401, 1.4404, 1.4362, 1.4462 und 1.4571
Thrust plate (KSTQ)	S275
Thrust plate (KSTZ)	S235
Insulation:	EPS, Neopor® mit WLF 0,031 W/mK, Material class B1 (hardly inflammable)

4. Statement

The Isokorb® type KST 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 KST.

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 KST 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 KST fire protection is equal to or greater than the minimum value of the thermal resistance $(d_f / \lambda_f)_m$ of fire protection applied to any of the connected steel structure, where:
The value d_f is the thickness of the fire protecting material and λ_f is the effective thermal conductivity of the fire protection material.
- 2) The utilization (μ) of the threaded rod used in the Isokorb® type KST 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 KST 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/m ³]

The calculation for the required thickness of the fire protection plate to protect the Isokorb[®] type KST 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:

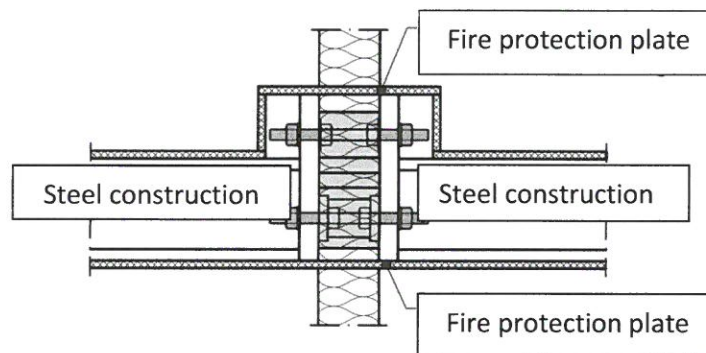
Fire endurance R [min]	Thickness of plate [mm]
30	15
60	20
90	25
120	30

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

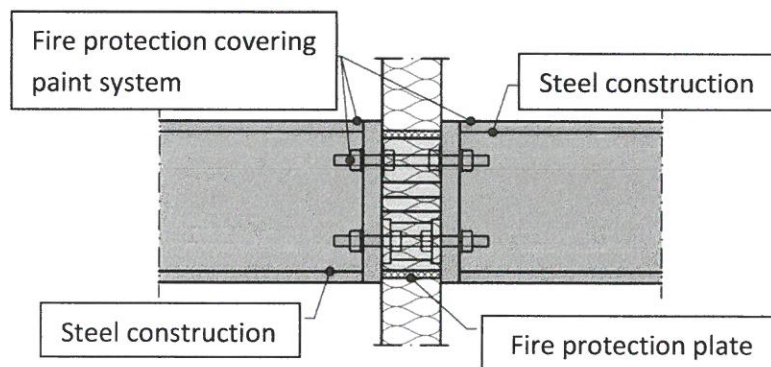
The Figure 4 and 5 shows examples for the construction design of fire protection provision with plates or covering paint

Figure 4 : Isokorb® Typen KST – Fire protection using fire protection plates



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 KST at least 30 mm. This is meant to avoid open gaps in case of a fire.

Figure 5: Isokorb® type KST - 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[®] KST 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[®] KST 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.

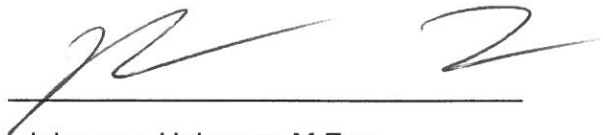
To reach a fire resistance of at least R30 the Isokorb type[®] KST always need to be protected by fire protection material. Without such actions the Isokorb type[®] KST count as it had no fire resistance (R0). This applies as well, if according to part 4.1 the surrounding structure would reach a fire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

Kaiserslautern, the 11th of August 2015



Prof. Dr.-Ing Dirk Lorenz

Head of department of fire protection



Johannes Heimann, M.Eng.

department of fire protection