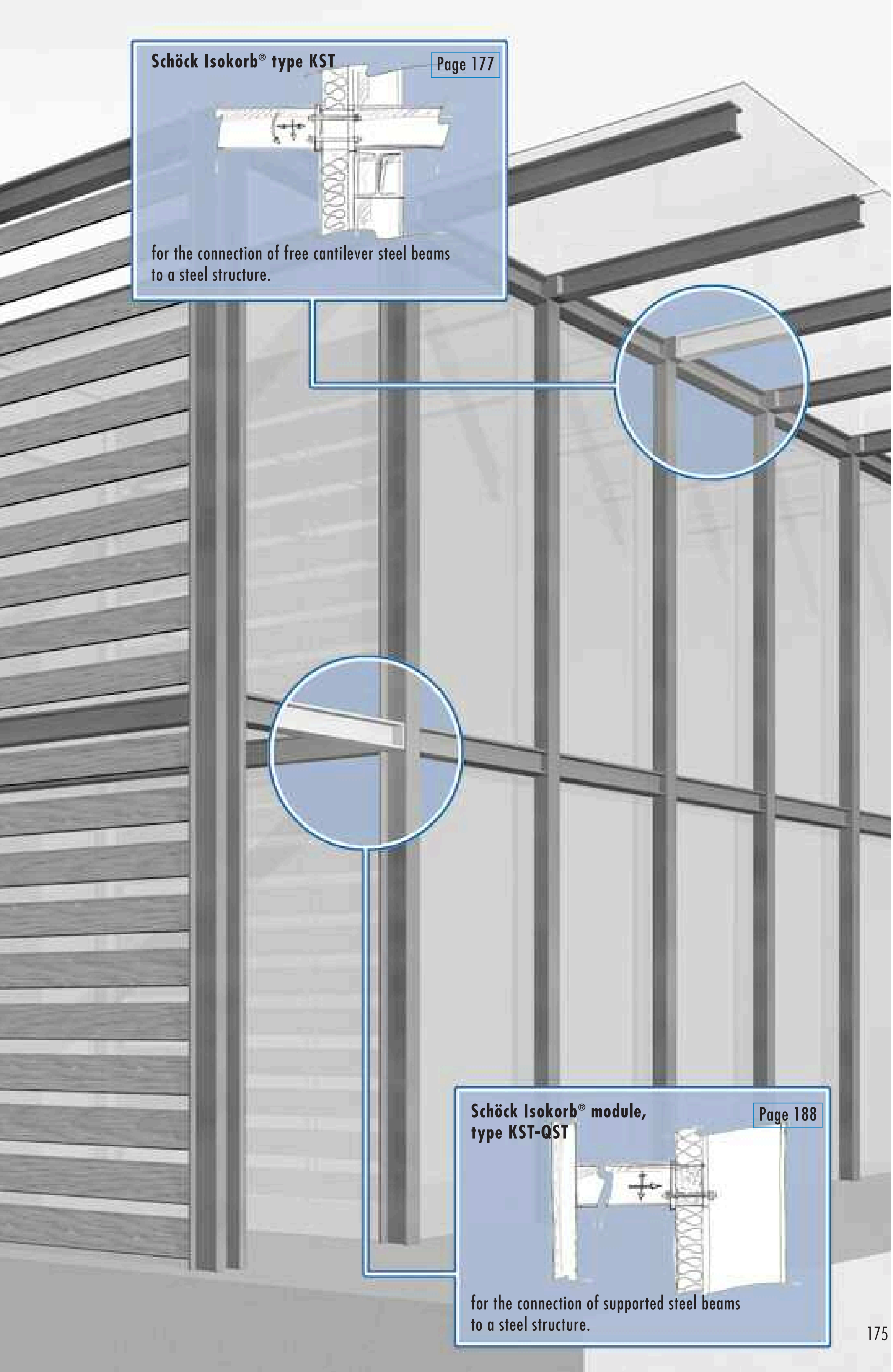


Schöck Isokorb® type KST Page 177

for the connection of free cantilever steel beams to a steel structure.

Schöck Isokorb® module, type KST-QST Page 188

for the connection of supported steel beams to a steel structure.

SCHÖCK ISOKORB® TYPE KST

Materials/Anti-corrosion protection/Fire protection

Schöck Isokorb® type KST - materials

Plates and sections

Chemical composition

Mo-Cr-Ni-austenitic stainless steel compliant with any of BS EN 10088 grades 1.4401, 1.4404 and 1.4571 (Choice of Grade at Manufacturer's Discretion).

Mechanical properties

In accordance with BS EN 10088 – except for the following components where Schöck only accept material with mechanical properties in excess of those required for compliance with BS EN 10088.

Component	Required minimum 0.2 % proof stress (N/mm²)	Required ultimate tensile stress (N/mm²)	Required minimum elongation after fracture (%)
Rectangular hollow section	355	600	30
12 mm pressure plate (QST module)	275	550	40

Threaded fasteners

Grade A4-70 to BS EN ISO 3506 (corrosion resistance equivalent to BS EN 10088 Grade 1.4401)
Grade A5-70 to BS EN ISO 3506 (corrosion resistance equivalent to BS EN 10088 Grade 1.4571)

Insulation material

Polystyrene hard foam (λ = 0,035 W/(m · K))

Anti-corrosion protection

- The stainless steel used for Schöck Isokorb® type KST corresponds to the material no.: 1.4401, 1.4404 or 1.4571.
  So the KST unit componenets will have a typical corrosion resistance expected for Mo-Cr-Ni austenitic stainless steels.
  This can be more accurately quantified by reference to specialist literature such as SCI Publication P291 – Structrural Design of Stainless Steel

- Bimetallic corrosion
  Using Schöck Isokorb® type KST in conjunction with a galvanised or paint treated front plate there is no concern regarding bimetallic corrosion. Since in this application the area of the galvanised steel is greater than the area of the stainless steel (bolts, washer and butt stop) bimetallic corrosion that could lead to failure can be excluded as far as this relates to the Schöck products.

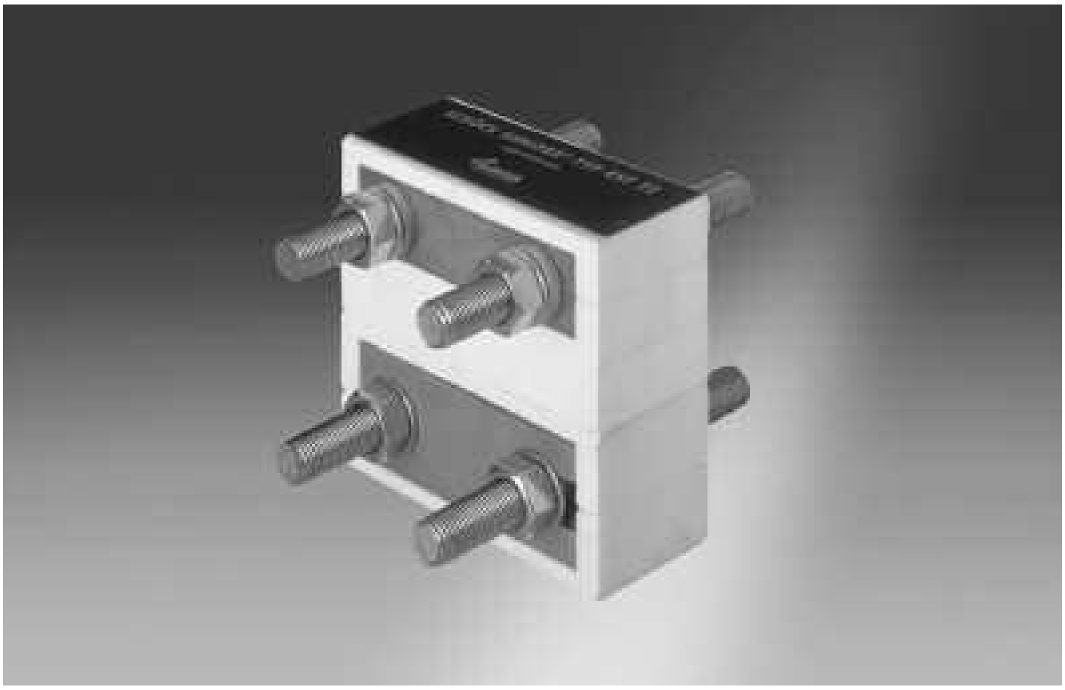
- Stress corrosion cracking
  An appropriate Schöck-protection needs to be provided in environments with a high chlorine content (e.g. inside indoor swimming pools,...). Further information about atmospheric application see Steel Construction Institute Publication P291 – Structural design of stainless steel, table 2.6. For more information please contact our design department telephone 059 915 1350.

Fire protection

The same on-site fire safety measures that apply to the overall load-bearing structure also apply to any freely accessible components of the Schöck Isokorb® type KST or to any components situated inside the insulating layer.
For more information please contact our design department telephone 059 915 1350.

SCHÖCK ISOKORB® TYPE KST

Schöck
build simply better
SCHÖCK ISOKORB®



Schöck Isokorb® type KST

Contents | **Page**

SCHÖCK ISOKORB® TYPE KST

Element arrangements/Connection layouts

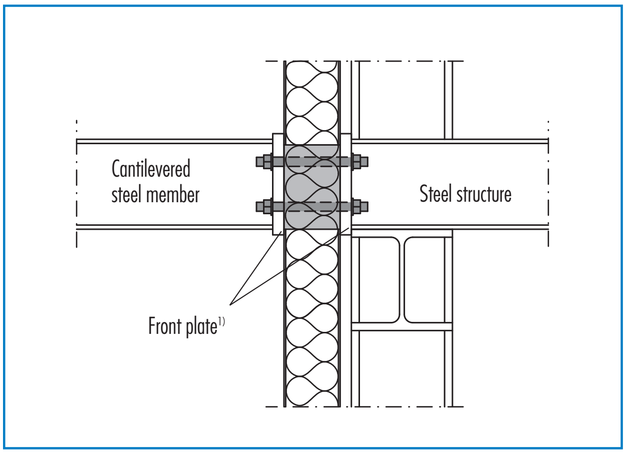


Figure 1: Schöck Isokorb® type KST for free cantilevered steel structures

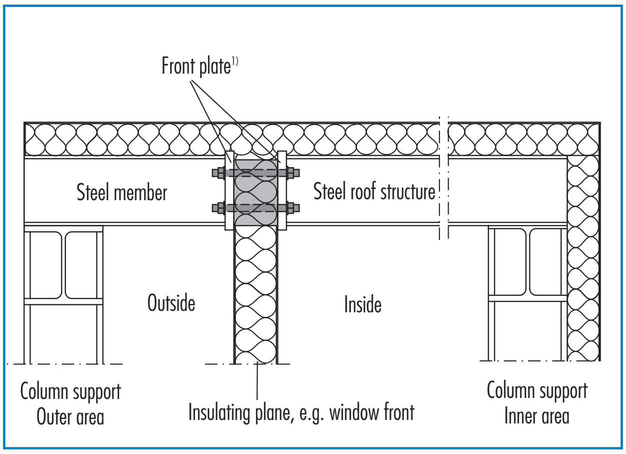


Figure 2: Schöck Isokorb® type KST for separation within the structural system

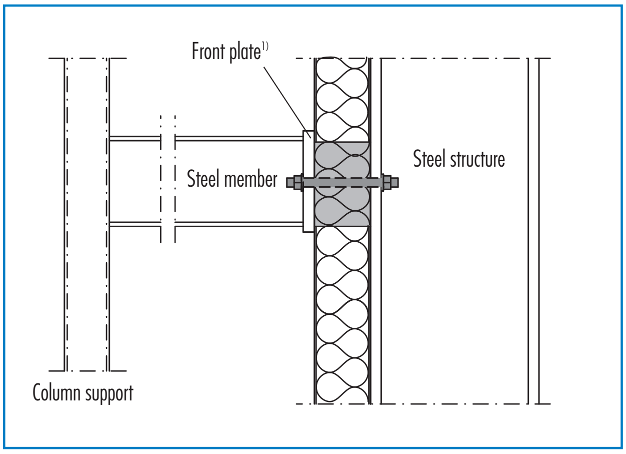


Figure 3: Schöck Isokorb® module, type KST-QST/KST-ZQST for supported steel structures

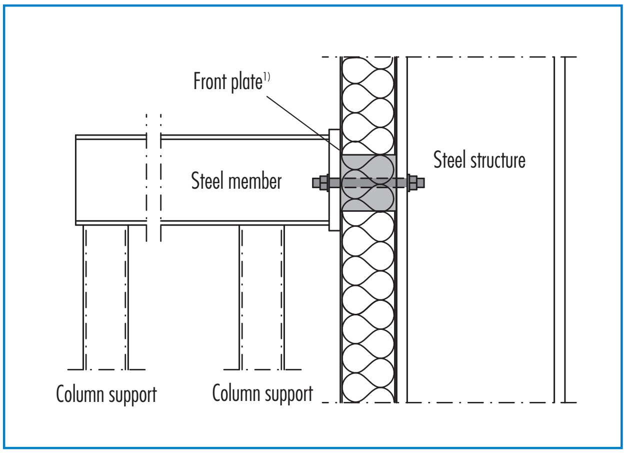


Figure 4: Schöck Isokorb® KST-ZST module for restrained steel structures

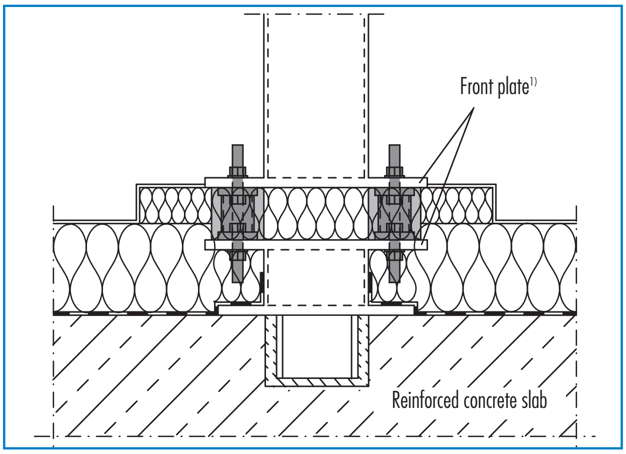


Figure 5: Schöck Isokorb® KST-QST module as insulated support base installation

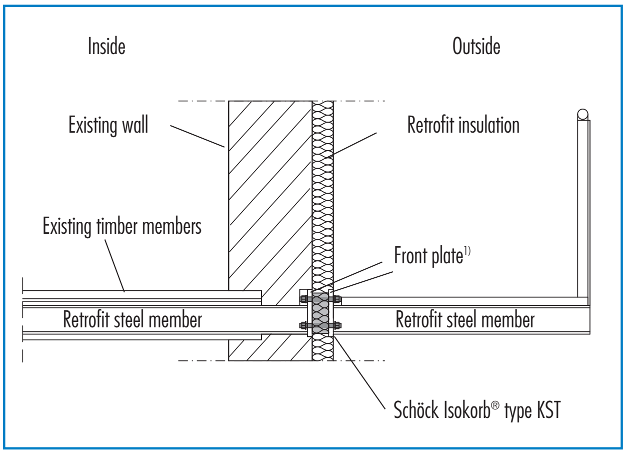
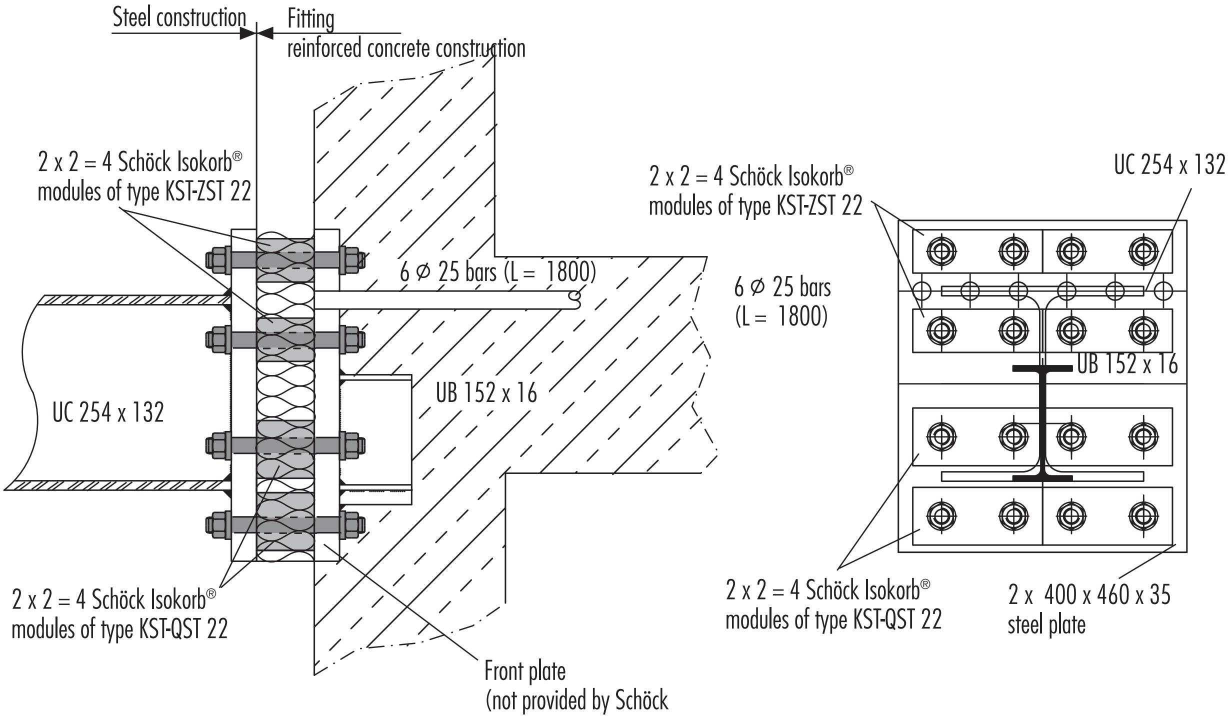


Figure 6: Schöck Isokorb® type KST for a renovation/retrofit balcony installation

1) Front plate not provided by Schöck

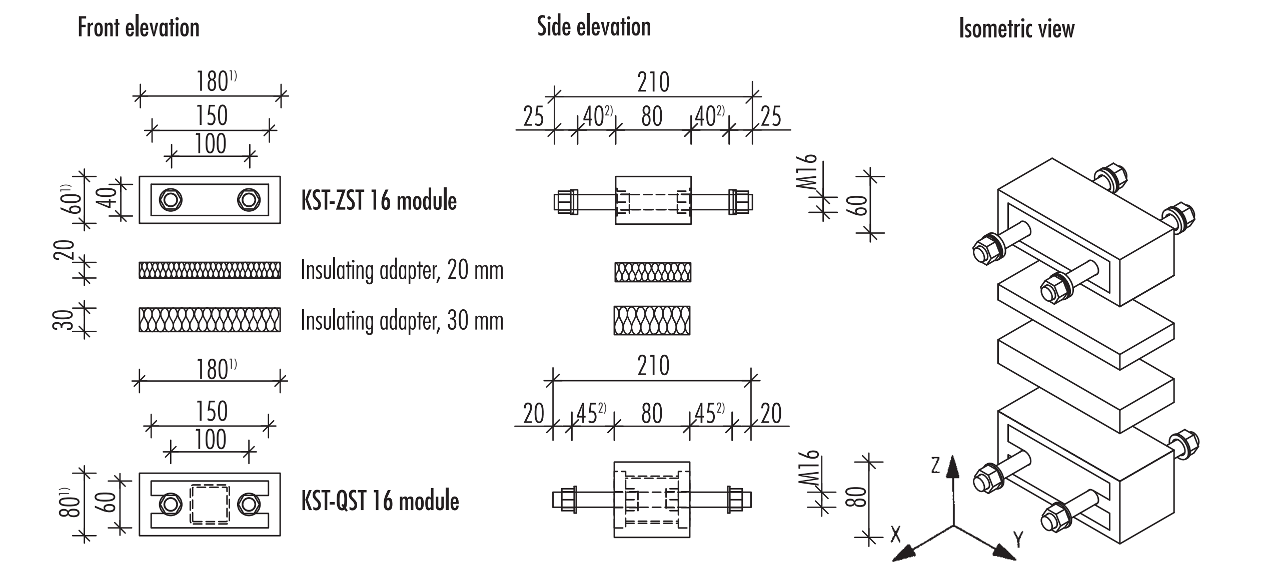


The KST type can also be used for connections between reinforced concrete and steel. This variant can be used if the member forces are too great for the Schöck Isokorb® type KS (refer to page 151).
However, it must be ensured that the forces in the steel member are reliably transferred into the concrete via the reinforcement bars which are welded on to the on-site front plate. The engineer responsible for the design of the load bearing structure shall ensure that this is satisfied.

Schöck Isokorb® type KST – basic type

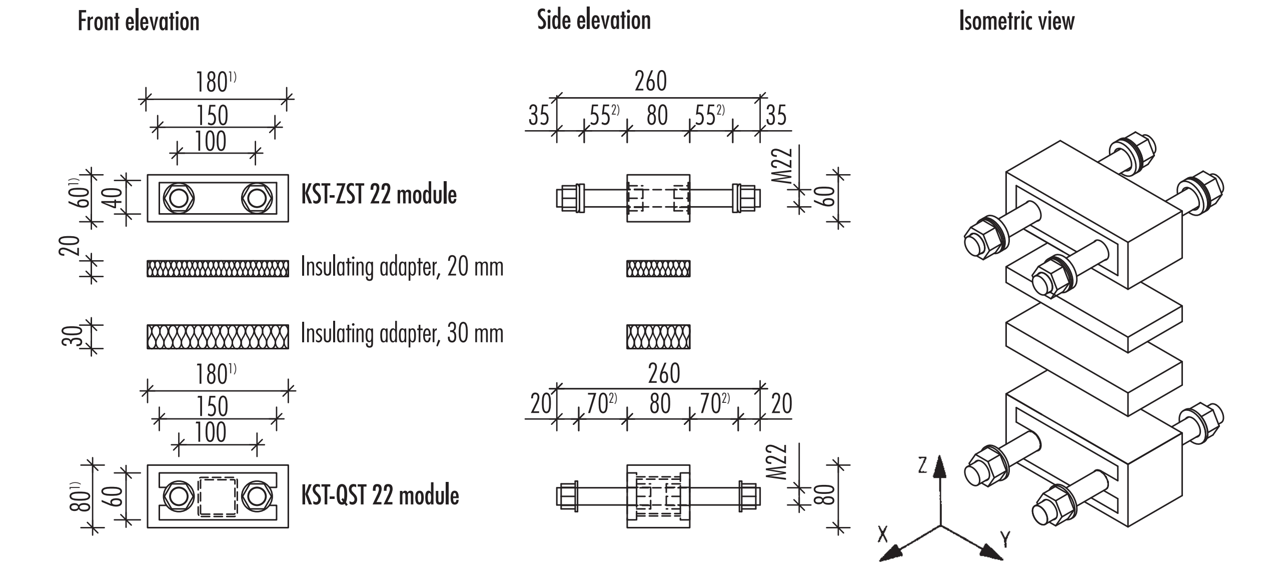
The basic KST type consists of one ZST module, one QST module, one insulating adapter with a thickness of 20 mm and one insulating adapter with a thickness of 30 mm. With these modules it is possible to achieve a vertical bolt separation of up to 120 mm (60/2 + 20 + 30 + 80/2). If your application requires a greater distance between the bolts, this can be achieved by inserting further insulating adapters or a corresponding insulating block. The main load on the basic KST type is a shear force in the z-direction and a moment around the y-axis.

Schöck Isokorb® type KST 16



Views - Schöck Isokorb® type KST 16

Schöck Isokorb® type KST 22



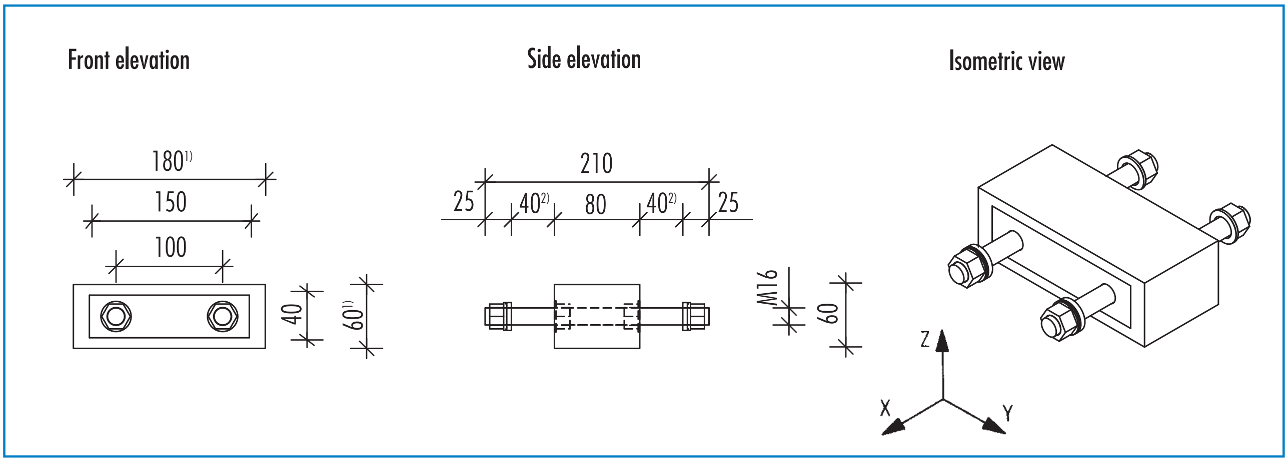
Views - Schöck Isokorb® type KST 22

[1)] If required, the insulating element can be cut off up to the steel plates (150 x 40 for the KST-ZST module, 150 x 60 for the KST-QST module and KST-ZQST module). The minimum distance is therefore 50 mm (40/2 + 60/2).
[2)] Available fixing length

Schöck Isokorb® module, type KST-ZST

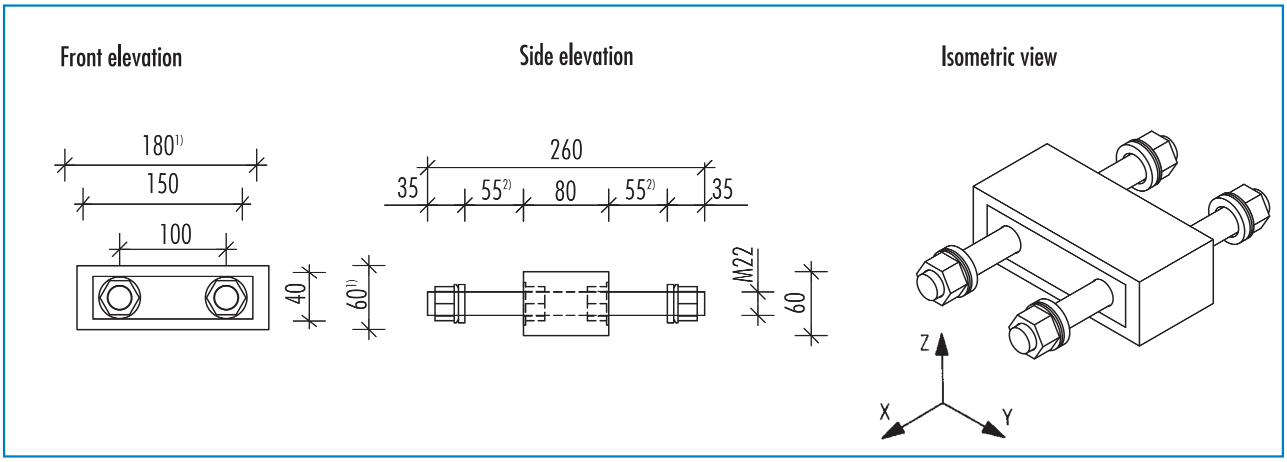
The KST-ZST module is used to absorb tensile forces. It comprises one insulating element (180/60/80 mm) and two stainless threaded rods with the corresponding nuts. The outer washers take the form of a ball socket and a conical disc. This offers advantages in terms of fatigue resistance. Refer also to the section about expansion joints on pages 186 - 187. In combination with a KST-QST module, it is also possible to absorb compressive forces, although this is limited to one third of the tensile force.

Schöck Isokorb® module, type KST-ZST 16



Views - Schöck Isokorb® module, type KST-ZST 16

Schöck Isokorb® module, type KST-ZST 22



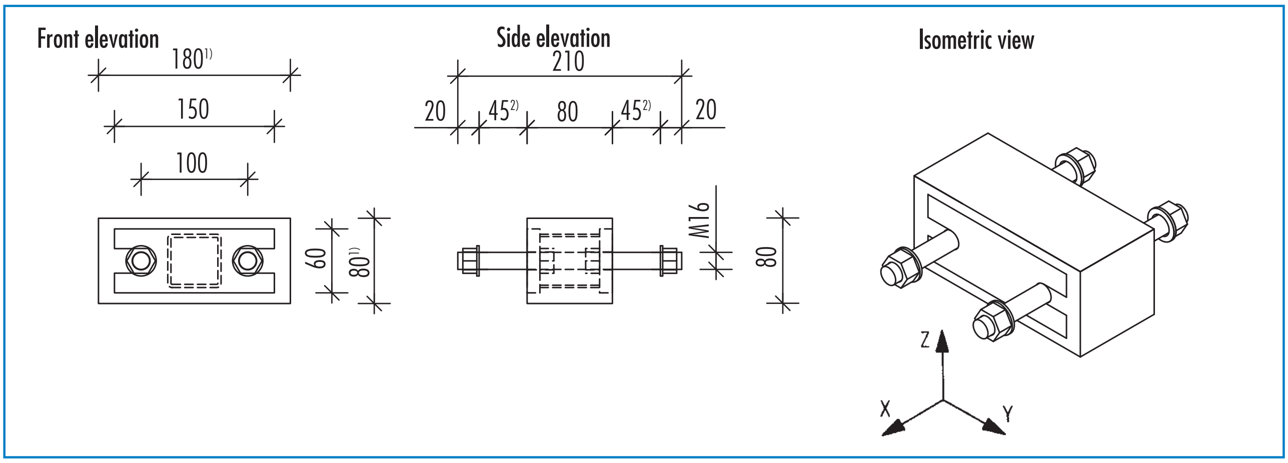
Views - Schöck Isokorb® module, type KST-ZST 22

[1] If required, the insulating element can be cut off up to the steel plates (150 x 40 for the KST-ZST module).
[2] Available fixing length

Schöck Isokorb® module, type KST-QST

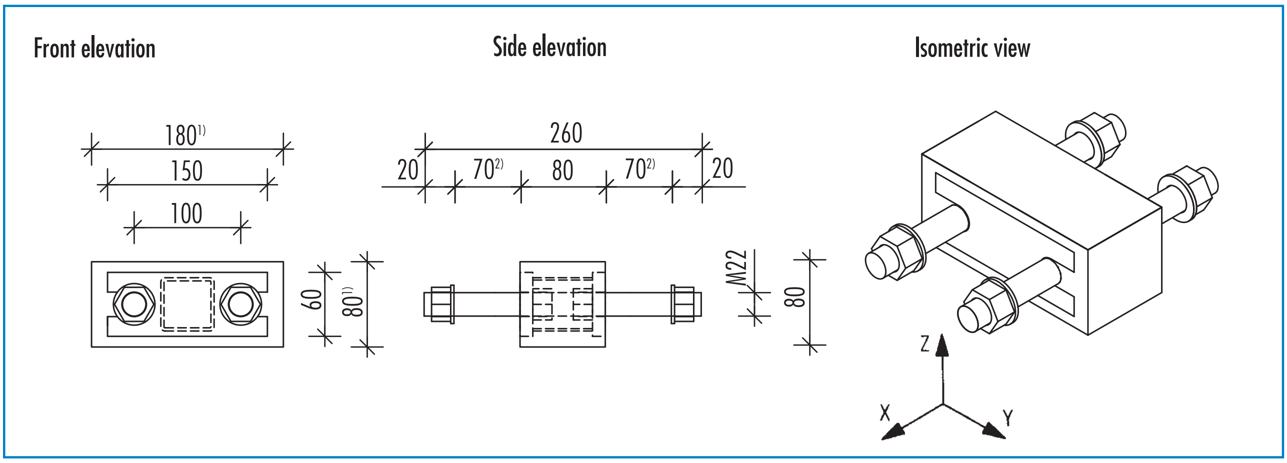
The KST-QST module is used to absorb compressive forces and shear forces. It consists of an insulating element (180/80/80 mm), two stainless threaded rods with corresponding nuts and a rectangular hollow section which is welded into the module. The rectangular hollow section transmits the shear forces. The element can transmit forces in the x, y and z-direction. Within a KST connection, the KST-QST module is located in the area in which pressure is exerted due to the own weight. Different load combinations, including tensile forces, within a KST connection, can be carried by the KST-QST module, although the interaction condition $3V_d + 2\ H_d + F_{t,d} = \max F_{t,d} \leq F_{t,Rd}$ must be satisfied.

Schöck Isokorb® module, type KST-QST 16



Views - Schöck Isokorb® module, type KST-QST 16

Schöck Isokorb® module, type KST-QST 22



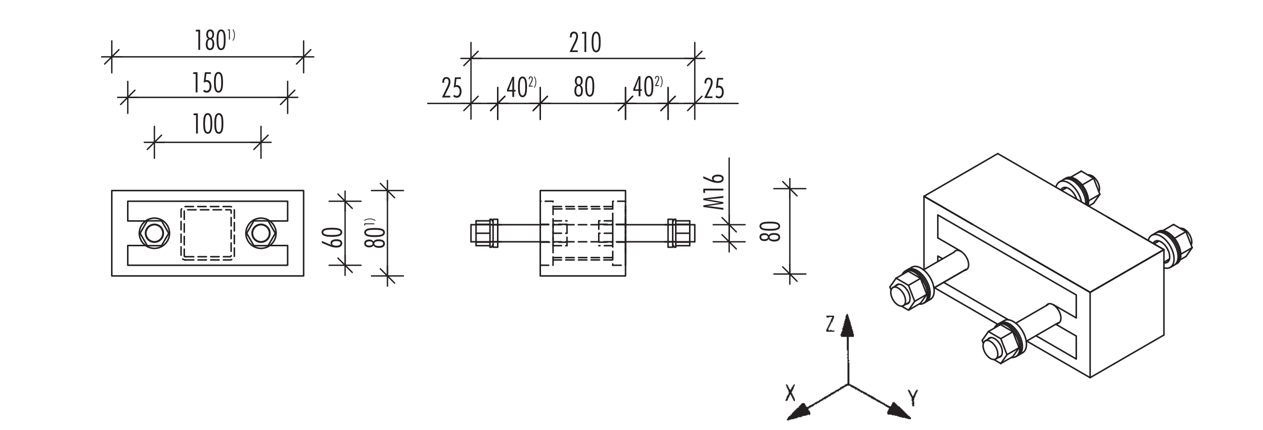
Views - Schöck Isokorb® module, type KST-QST 22

[1)] If required, the insulating element can be cut off up to the steel plates (150 x 60 for the KST-QST module and the KST-ZQST module).
[2)] Available fixing length

Schöck Isokorb® module, type KST-ZQST

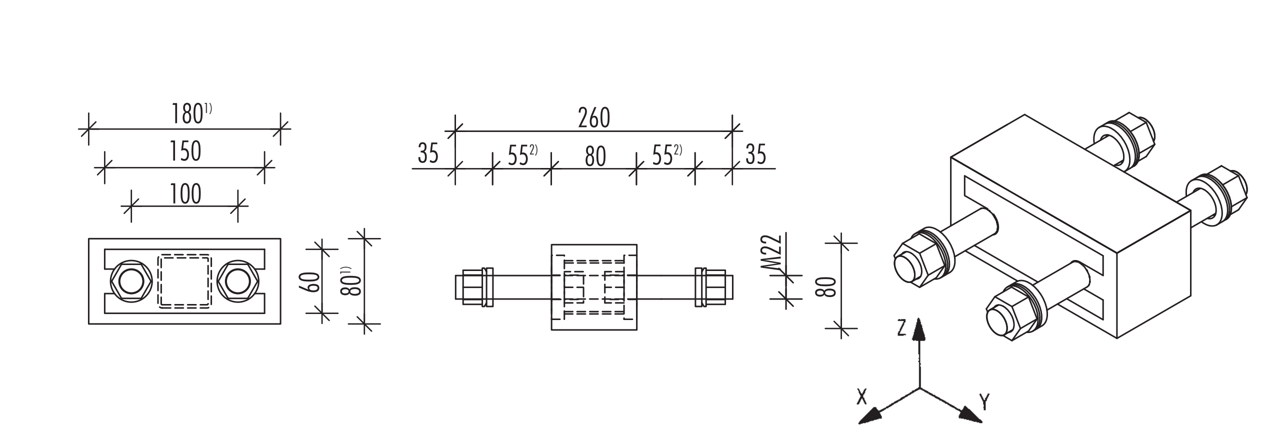
The KST-ZQST module combines the technical features of the KST-ZST module with those of the KST-QST module. It should be used for applications in which tensile forces are continuously transmitted and, at the same time, horizontal forces resulting from temperature deformations are transferred from the outer steel structure into the connection. Special two-part washers provide fatigue resistance.

Schöck Isokorb® module, type KST-ZQST 16



Views - Schöck Isokorb® module, type KST-ZQST 16

Schöck Isokorb® module, type KST-ZQST 22

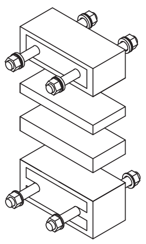
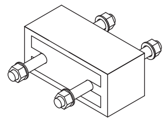
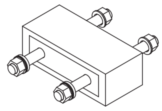


Views - Schöck Isokorb® module, type KST-ZQST 22

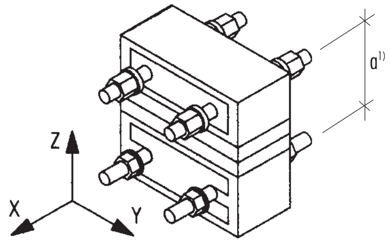
[1] If required, the insulating element can be cut off up to the steel plates (150 x 60 for the KST-QST module and the KST-ZQST module).
[2] Available fixing length

SCHÖCK ISOKORB® TYPE KST

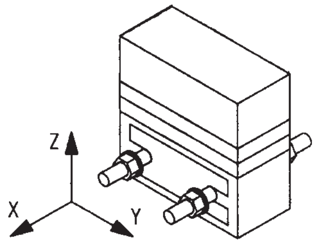
Design and calculation table

Schöck Isokorb® Type						
	KST 16	KST 22	KST-QST 16 module KST-ZQST 16 module	KST-QST 22 module KST-ZQST 22 module	KST-ZST 16 module	KST-ZST 22 module
$H_{y,Rd}$	±6 kN[5]	±6 kN[5]	±6 kN[3][5]	±6 kN[3][5]	0 kN	0 kN
$V_{z,Rd}$	30 kN	36 kN	30 kN[3]	36 kN[3]	0 kN	0 kN
$F_{x,t,Rd}$, $F_{x,c,Rd}$	116.8 kN[6]	225.4 kN[6]	116.8 kN[3]	225.4 kN[3]	F_t = 116.8 kN F_c = 0 kN	F_t = 225.4 kN F_c = 0 kN
$M_{y,Rd}$	$a \cdot F_{x,t,Rd}$[1]	$a \cdot F_{x,t,Rd}$[1]	0 kNm[4]	0 kNm[4]	0 kNm	0 kNm
$M_{z,Rd}$	[2][5]	[2][5]	[2][5]	[2][5]	0 kNm	0 kNm

F_{Rd}	resistance design [per module]
$F_{t,Rd}$	for the tensile loading capacity of the bolts
$F_{c,Rd}$	for the compression loading capacity of the bolts



Schöck Isokorb® type KST



Schöck Isokorb® module, type KST-QST/KST-ZQST

1) a = distance between the tension rods and compression bars of the Isokorb® element (inner lever arm), minimum possible axis separation between tension rods and compression bars = 50 mm (without insulating adapters after processing of the polystyrene – see pages 180 - 183[1]).

2) We recommend that you discuss the static system and calculations with our design department, tel. 059 915 1350.

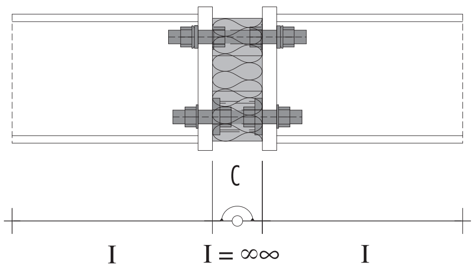
3) The interaction $3\ V_z + 2\ H_y + F_{x,t} = \max F_{x,t,d} \leq F_{x,t,Rd}$ needs to be taken into account in the event of simultaneous tensile force and shear force loads.

4) When using at least two modules arranged one above the other, it is possible to transfer both positive and negative forces (moments and shear forces) in accordance with the design variants on pages 189 - 200.

5) Please make sure that you read the notes on expansion joints/fatigue resistance on pages 186 - 187 below.

6) If the KST-ZST module is subjected to pressure loads within a KST connection (e.g. wind loads generating slight lift-off), then the KST-ZST module can absorb a maximum of 1/3 $F_{x,t,Rd}$ as a compressive force. The interaction (footnote 3) must also be noted in this load scenario.

Estimation of deformation variables due to M_K in the Schöck Isokorb® connection

Torsion spring strength/buckling angle resulting from bending moment			
Design variants	Torsion spring strength c [kNcm/rad]	Buckling angle φ [rad]	Static model for the estimation of flexural stiffness
No. 3 - see page 189	$3.175 \cdot a^2$	$\varphi = \frac{M_K}{C}$	
No. 4 - see page 190	$5.480 \cdot a^2$		
No. 5 - see page 192	$3.480 \cdot a^2$		
No. 6 - see page 192	$11.000 \cdot a^2$		
No. 7 - see page 193	$21.900 \cdot a^2$		
No. 8 - see page 194	$5.489 \cdot a^2$		
No. 9 - see page 196	$11.000 \cdot a^2$		
No. 10 - see page 198	$21.900 \cdot a^2$		

a [cm] = refer to the design variants on pages 189 - 200.
M_K = bending moment from characteristic values for the effects around the (existing M).
Deformations resulting from normal forces and shear forces can be ignored.
Values in table above assume average secant modulus of stainless steel under working load of 17900 kN/cm²

Possible modular combinations of the basic types are shown on the next pages.

Notes on calculations

- Basis:
  Type certification (LGA Nürnberg S-N 010415)

  The Schöck Isokorb® type KST has been classified by the DIBt (German Institute for Construction Technology) as the subject of structural standards with type certification. Approval is not required as it is a modular system.

  The design capacities of the Schöck Isokorb® type KST have been independently checked and approved as compliant to BS 5950:2000 in conjunction with SCI Publication P291 – Structural Design of Stainless Steel.

- Certification:
  The static calculations to Eurocode 3 for Schöck Isokorb type KST, when used in conjunction with BS 5950-1:2000 and Steel Construction Institute Publication P291, have been approved by the Flint & Neill Partnership, London.

- Front plate thickness:
  In the case of the connection of I-profiles in accordance with the design variants below, the indicated front plate thicknesses, using mild steel S235, can be adopted without further verification or proof. Smaller front plate thicknesses can be obtained with more accurate verification or proof.

  If the geometry is different then the front plates will need to be verified separately (e.g. connection of a U-profile, flat sheet metal, ...).

- Adjacent web thickness:
  If webs of adjacent girders are less than 3.5 mm or considered to be "slender" or "non-compact" classification to BS 5950, web to be checked for local compression effects induced by QST module.

- Dynamic loads:
  The Schöck Isokorb® type KST is only intended for use with primarily static loads.

SCHÖCK ISOKORB® TYPE KST

Expansion joints/Fatigue resistance

Changing temperatures cause changes in length of the steel members and thus cause fluctuating stresses to arise in the Isokorb® elements which are only passed on in part through the thermal separation.
Loads on the Isokorb® connections due to temperature deformations of the external steel construction should therefore generally be avoided.

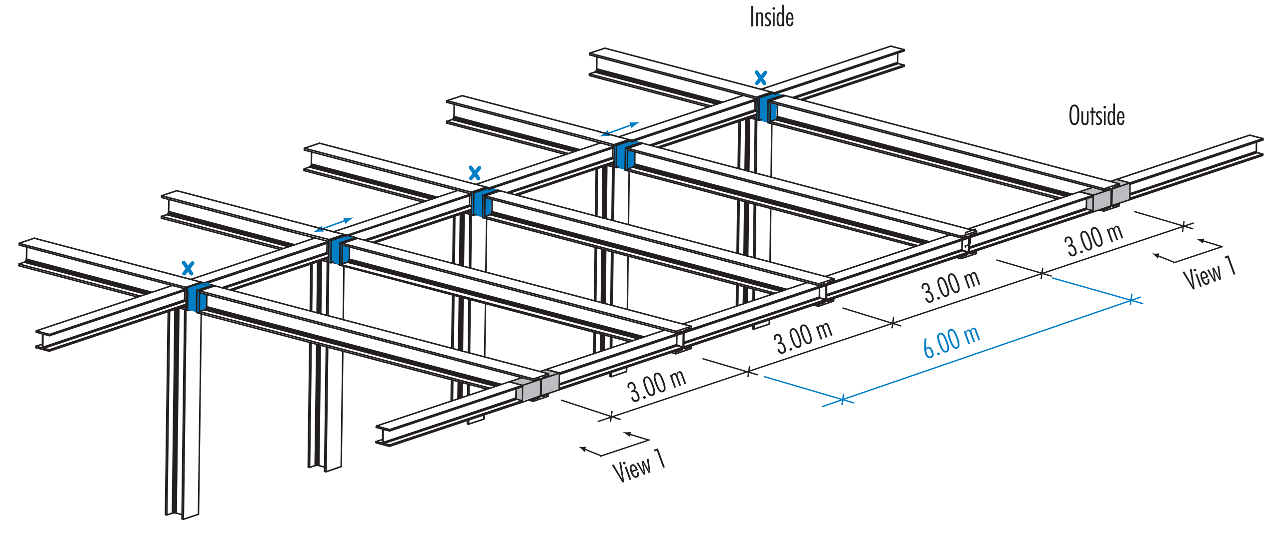
If, nonetheless, temperature deformations are assigned directly to the Isokorb® connection, then the Isokorb® type KST construction will be fatigue-resistant up to a construction length of 6 m by virtue of its special components (KST-QST module, KST-ZQST module: sliding film on the pressure plate; KST-ZST module, KST-ZQST module: 2-part special washer). At greater lengths an expansion joint should be positioned after no more than 6 m.

Horizontal slots are needed in the on-site front plate for the KST-QST module and KST-ZQST module used in the compression zone if horizontal temperature deformations are to be introduced. These must permit horizontal movements of ±2 mm. In this case, horizontal shear forces can only be absorbed non-structurally via friction.

Examples of the arrangement and design of expansion joints:

Key:

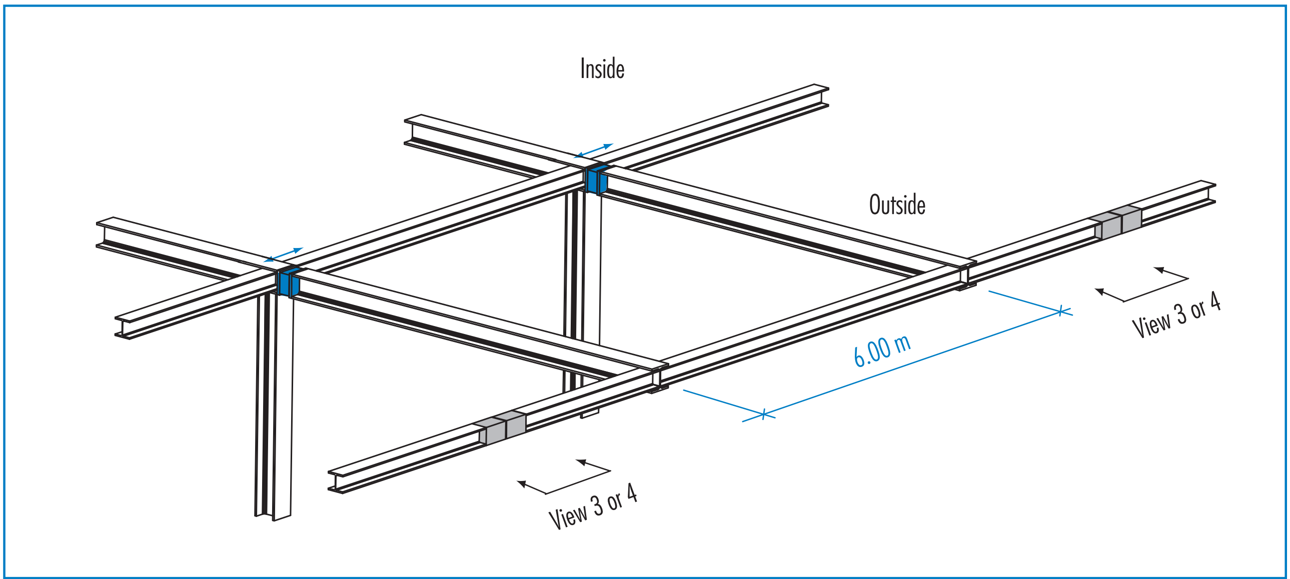
- ■ Isokorb®
- ■ Expansion joint
- × FIXED: No slots required
- ←→ MOVEABLE: Horizontal slots in the on-site front plate for KST-QST module, KST-ZQST module (compression zone)



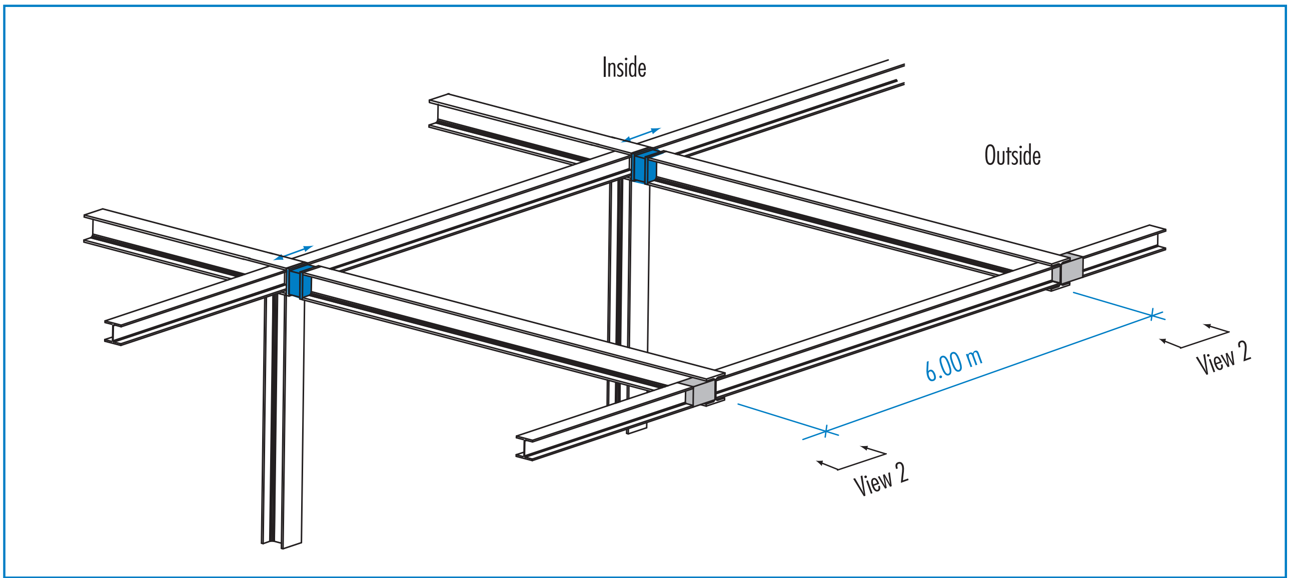
Example showing the arrangement of expansion joints, variant 1

KST

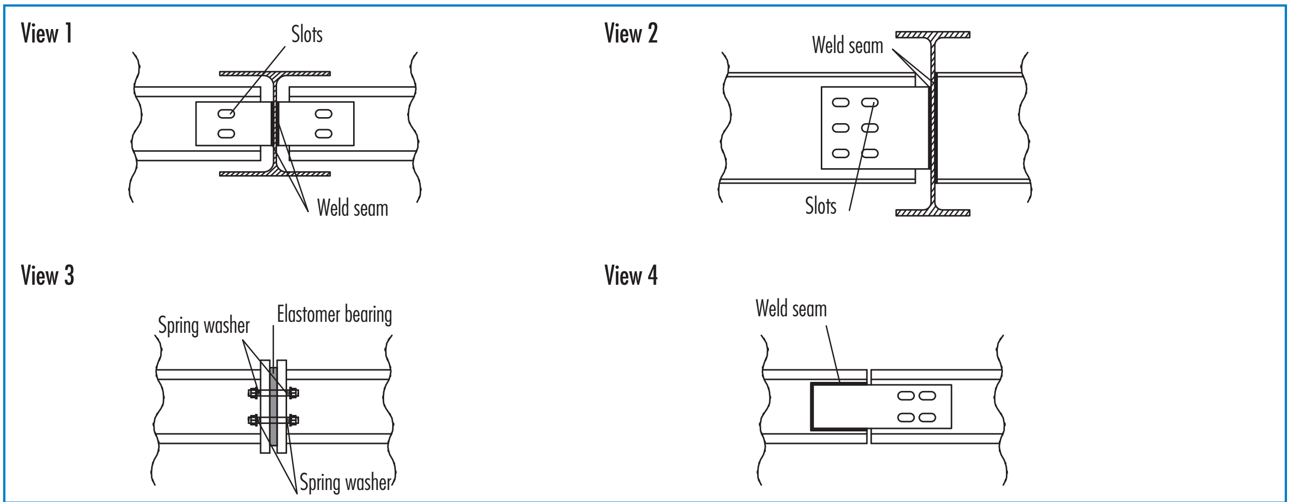
Steel-to-steel



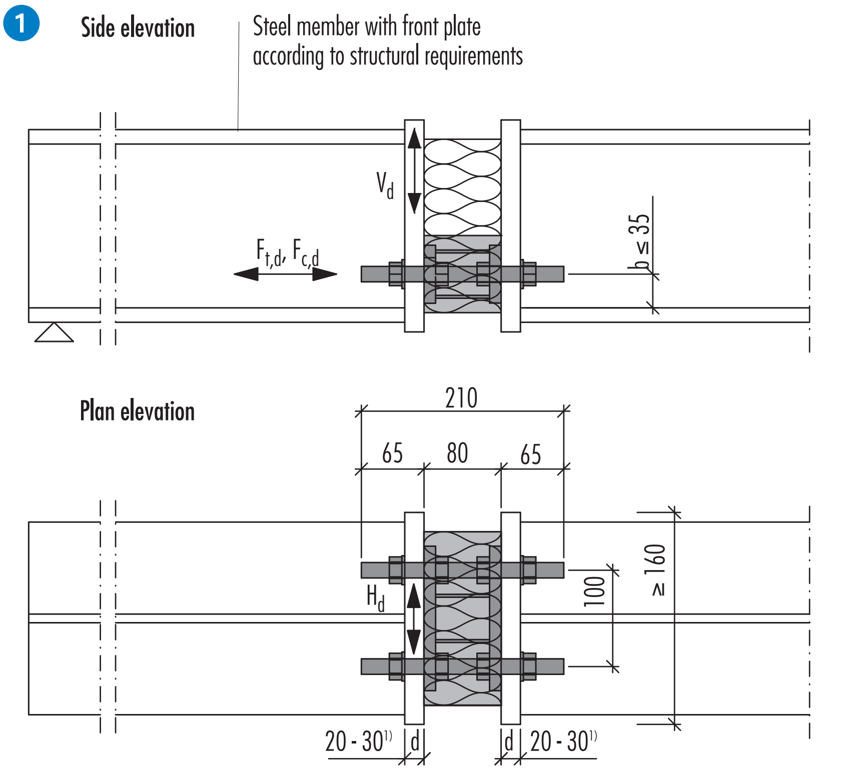
Example showing the arrangement of expansion joints, variant 2



Example showing the arrangement of expansion joints, variant 3



1



KST-QST 16 module, KST-ZQST 16[2)] module	
H_{Rd}	6 kN[3)]
V_{Rd}	30 kN
$F_{t,Rd}$, $F_{c,Rd}$	116.8 kN

Interaction between V_d, H_d, $F_{t,d}$:

$3\,V_d + 2\,H_d + F_{t,d} = \max F_{t,d} \leq F_{t,Rd}$

[1)] Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

$$\frac{\max. F_{t,d}}{F_{t,Rd}} = \frac{F_{c,d}}{F_{c,Rd}} \quad \begin{matrix} \leq 1.0 & : 30\text{ mm} \\ \leq 0.75 & : 25\text{ mm} \\ \leq 0.5 & : 20\text{ mm} \end{matrix}$$

[2)] The Schöck Isokorb® type KST-ZQST 16 module should be used for applications in which tensile forces need to be transferred continuously into the connection and in which, at the same time, horizontal forces resulting from temperature deformation of the external steel structure are transferred into the connection. Special two-part washers provide fatigue resistance.
Refer to pages 186 - 187 for the expansion joint spacings.

[3)] Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® modules, type KST-QST 16, KST-ZQST 16[2)]

KST

Example showing a supported connection of an UB 152 x 89 with a KST-QST 16 module

Loads: $V_{z,d} = 25$ kN $\quad H_d = \pm 3$ kN (from wind loads) $\quad F_{t,d} = 30$ kN or $F_{c,d} = 80$ kN

Verifications for KST-QST 16 module, for load case:

Shear force

$\frac{V_{z,d}}{V_{z,Rd}} < 1.0 \qquad \frac{H_d}{H_{Rd}} < 1.0$

$V_{z,d}/V_{z,Rd,QST16} = 25\text{ kN}/30\text{ kN} = 0.83 \quad < 1.0$

$H_d/H_{Rd,QST16} = 3\text{ kN}/\ 6\text{ kN} = 0.5 \quad < 1.0$

Compression

$\frac{F_{c,d}}{F_{c,Rd}} < 1.0$

$F_{cd}/F_{c,Rd,QST16} = 80\text{ kN}/116{,}8\text{ kN} = 0.68 \quad < 1.0$

Tensile force (see note on page 184)

Interaction condition: $3V_{z,d} + 2H_d + F_{t,d} = \max F_{t,d}$

$\frac{\max F_{t,d}}{F_{t,Rd}} < 1.0$

$\max F_{t,d} = 3V_{z,d} + 2H_d + F_{t,d} = 3 \times 25\text{ kN} + 2 \times 3\text{ kN} + 30\text{ kN} = 111\text{ kN}$

$\max F_{t,d}/F_{t,Rd,QST16} = 111\text{ kN}/116.8\text{ kN} = 0.95 < 1.0$

Minimum front plate thickness [d] without detailed verification, using mild steel S235: Distance b ≤ 35mm

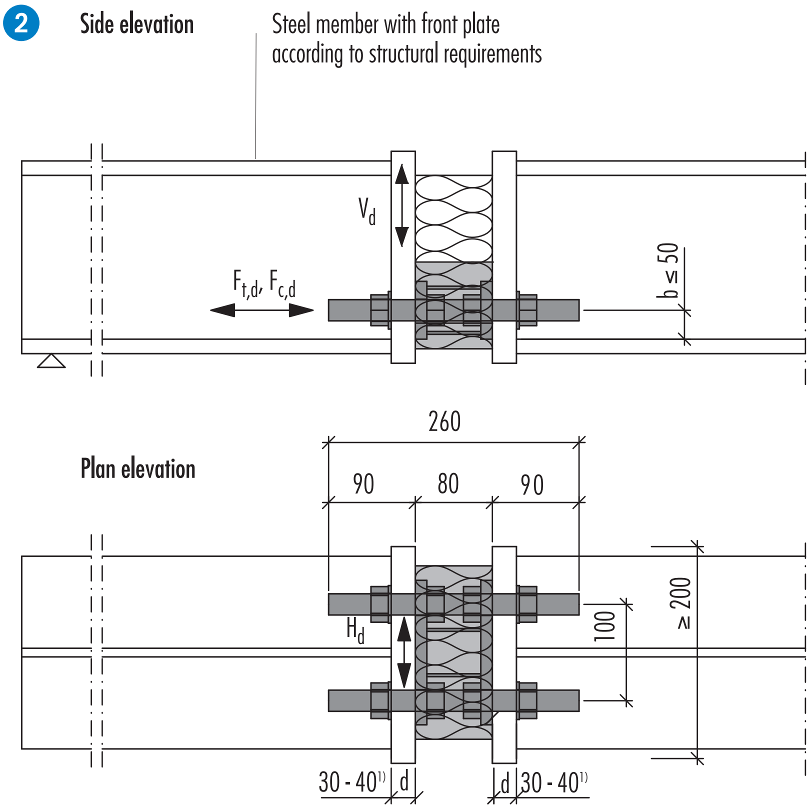
$$\frac{F_{c,d}}{F_{c,Rd,QST16}} \text{ or } \frac{\max F_{t,d}}{F_{t,Rd,QST16}} \begin{cases} \leq 1.0 & : 30\text{ mm} \\ \leq 0.75 & : 25\text{ mm} \\ \leq 0.5 & : 20\text{ mm} \end{cases}$$

$$\frac{\max F_{t,d}}{F_{t,Rd,QST16}} = 0{,}95 < 1{,}0 \rightarrow d = 30\text{ mm}$$

Steel-to-steel

Design configurations, type KST-QST 22 module and KST-ZQST 22 module, KST 16

2 Side elevation



KST-QST 22 module, KST-ZQST 22[2)] module	
H_{Rd}	6 kN[3)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

Interaction between V_d, H_d, $F_{t,d}$:

$$3\,V_d + 2\,H_d + F_{t,d} = \max F_{t,d} \leq F_{t,Rd}$$

1) Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

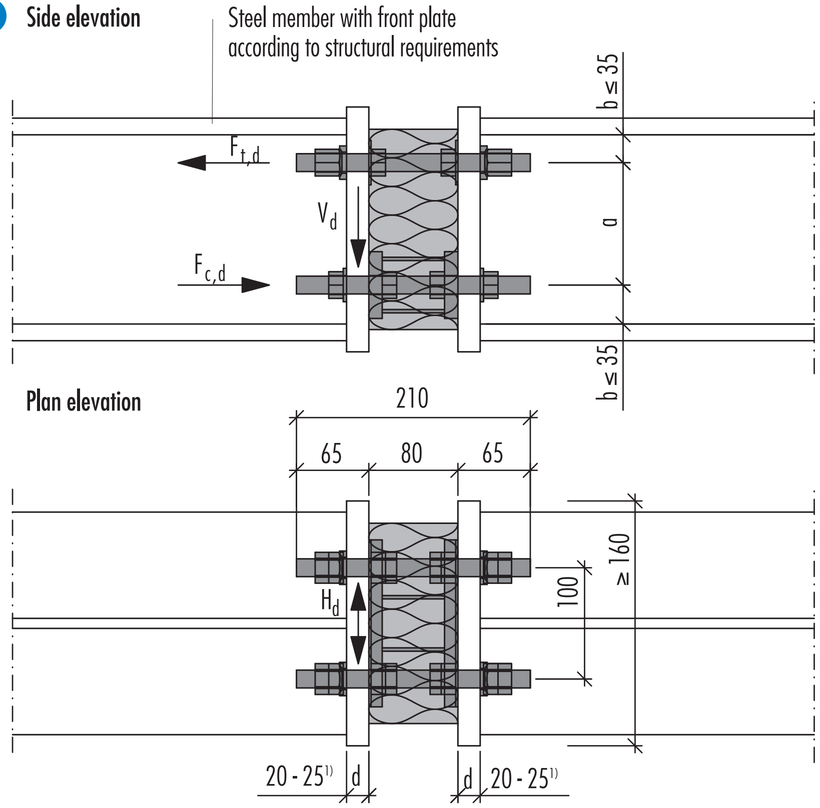
$$\frac{\max. F_{t,d}}{F_{t,Rd}} = \frac{F_{c,d}}{F_{c,Rd}} \quad \begin{matrix} \leq 1.0 : 40\text{ mm} \\ \leq 0.75 : 35\text{ mm} \\ \leq 0.5 : 30\text{ mm} \end{matrix}$$

2) The Schöck Isokorb® type KST-ZQST 22 module should be used for applications in which tensile forces need to be transferred continuously into the connection and in which, at the same time, horizontal forces resulting from temperature deformation of the external steel structure are transferred into the connection. Special two-part washers provide fatigue resistance. Refer to pages 186 - 187 for the expansion joint gaps.

3) Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® modules, type KST-QST 22, KST-ZQST 22[2)]

3 Side elevation



KST 16	
H_{Rd}	6 kN[2)]
V_{Rd}	30 kN
$F_{t,Rd}$, $F_{c,Rd}$	116.8 kN

1) Minimum front plate thicknesses [d] without more specific verification (Fkl.: S 235):

a ≤ 150: $\frac{F_{t,d}}{F_{t,Rd}}$ ≤ 1.0 : 25 mm; ≤ 0.9 : 20 mm

a < 150: 30 mm

2) Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

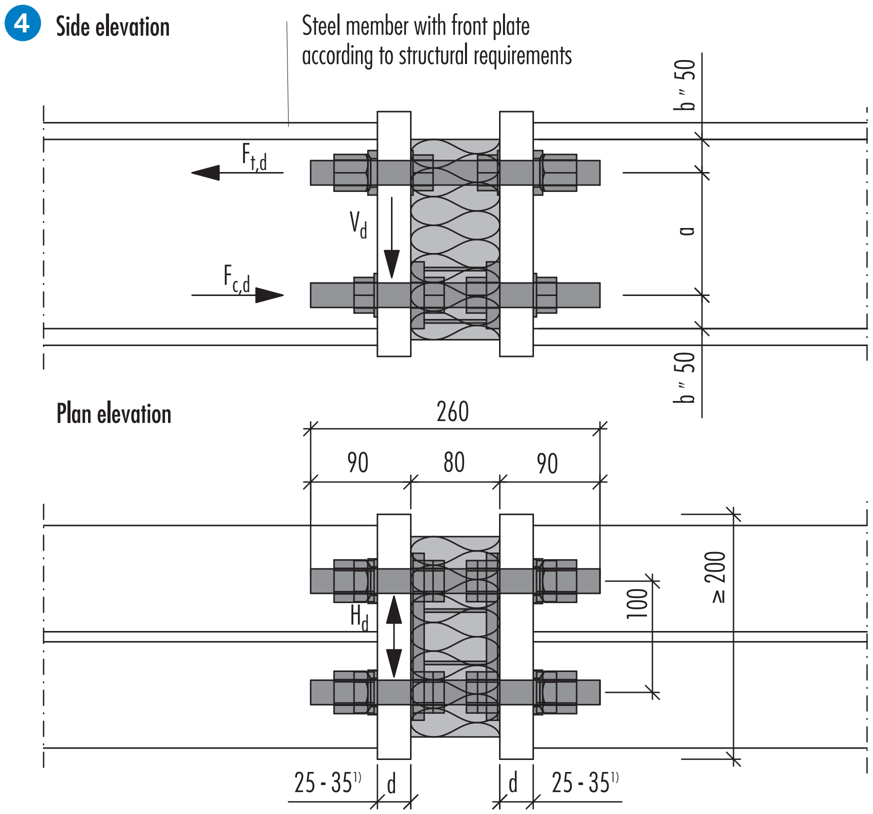
Schöck Isokorb® type KST 16

KST

Steel-to-steel

SCHÖCK ISOKORB® TYPE KST 22

Design configuration and example



KST 22	
H_{Rd}	6 kN[2)]
V_{Rd}	36 kN
Z_{Rd}, D_{Rd}	225.4 kN

[1)] Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

a ≤ 150: $\frac{F_{t,d}}{F_{t,Rd}}$ ≤ 1.0 : 35 mm; ≤ 0.8 : 30 mm; ≤ 0.5 : 25 mm

a < 150: 40 mm

[2)] Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® type KST 22

Example of moment connections for UB 203 x 23 with KST 22

Loads:	Load case 1:	$V_{z,d} = 32$ kN	$H_d = \pm 4$ kN	$M_{y,d} = -18$ kNm
	Load case 2:	$V_{z,d} = -16$ kN	$H_d = \pm 4$ kN	$M_{y,d} =$ 5 kNm
	a = 0.12 m			

Verifications for KST 22, for load case:

Shear force/horizontal force

$\frac{V_{z,d}}{V_{z,Rd}} < 1.0$ $\frac{H_d}{H_{Rd}} < 1.0$

$V_{z,d}/V_{z,Rd,QST22} = 32\ kN/36\ kN = 0.89 < 1.0$

$H_d/H_{Rd,QST22} = 4\ kN/\ 6\ kN = 0.67 < 1.0$

Positive moment

$\frac{F_{c,d}}{F_{c,Rd}} < 1,0$ $\frac{F_{t,d}}{F_{t,Rd}} < 1.0$

$F_{c,d} = F_{t,d} = M_{y,d}/a = 18\ kNm/0.12\ m = 150\ kN$

$F_{c,d}/F_{c,Rd,QST22} = 150\ kN/225.4\ kN = 0.67 < 1.0$

$F_{t,d}/F_{t,Rd,ZST22} = 150\ kN/225.4\ kN = 0.67 < 1.0$

Negatives moment (lifting off)

max $F_{t,d} < F_{t,Rd}$

$F_{c,d} = F_{t,d} = M_{y,d}/a = 5\ kNm/0.12\ m = 41.67\ kN$

max $F_{t,d} = 41.67\ kN < 225.4\ kN = F_{t,Rd,QST22}$

KST-ZST module under compressive load (see note on page 184)

max $F_{c,d} < F_{t,Rd}/3$

max $F_{c,d} = M_{y,d}/a = 5\ kNm/0.12\ m = 41.67\ kN$

$F_{t,Rd,ZST22}/3 = 225.4\ kN/3 = 75.13\ kN$

max $F_{c,d,ZST22} = 41.67\ kN < 75.13\ kN = F_{t,Rd,ZST22}/3$

KST-QST module under tensile load (see note on page 184)

Interaction condition:

$3V_{z,d} + 2H_d + F_{t,d} = \max F_{t,d}$

$\max F_{t,d} = 3V_{z,d} + 2H_d + F_{t,d} = 3 \cdot 16 + 2 \cdot 4 + 41.67 = 97.67$ kN

$$\frac{\max F_{t,d}}{F_{t,Rd}} < 1$$

$\max F_{t,d} / F_{t,Rd,ZST22} = 97.67/225.4 = 0.43 < 1$

Minimum front plate thickness [d] without detailed verfification, using mild steel S235: Distance b ≤ 50 mm

$$a \le 150: \quad \frac{F_{t,d}}{F_{t,Rd}} \begin{cases} \le 1.0 : 35 \text{ mm} \\ \le 0.8 : 30 \text{ mm} \\ \le 0.5 : 25 \text{ mm} \end{cases}$$

a > 150: 40 mm

$F_{t,d}/F_{t,Rd} = 150$ kN$/225.4$ kN $= 0.67$

$$a \le 150: \quad \frac{F_{t,d}}{F_{t,Rd}} = 0{,}67 < 0.8 \rightarrow d = 30 \text{ mm}$$

Deformation due to $M_{y,d}$ (see page 185)

Buckling angle

$$\varphi = \frac{M_K}{c} \text{ [rad]}$$

$c = 6000 \cdot a^2$ [cm]

$$\varphi = \frac{18/1{,}45^{1)} \cdot 100}{864000} = 1.4368 \cdot 10^{-3} \text{[rad]}$$

$c = 6000 \cdot 12^2 = 864000$ [KNcm/rad]

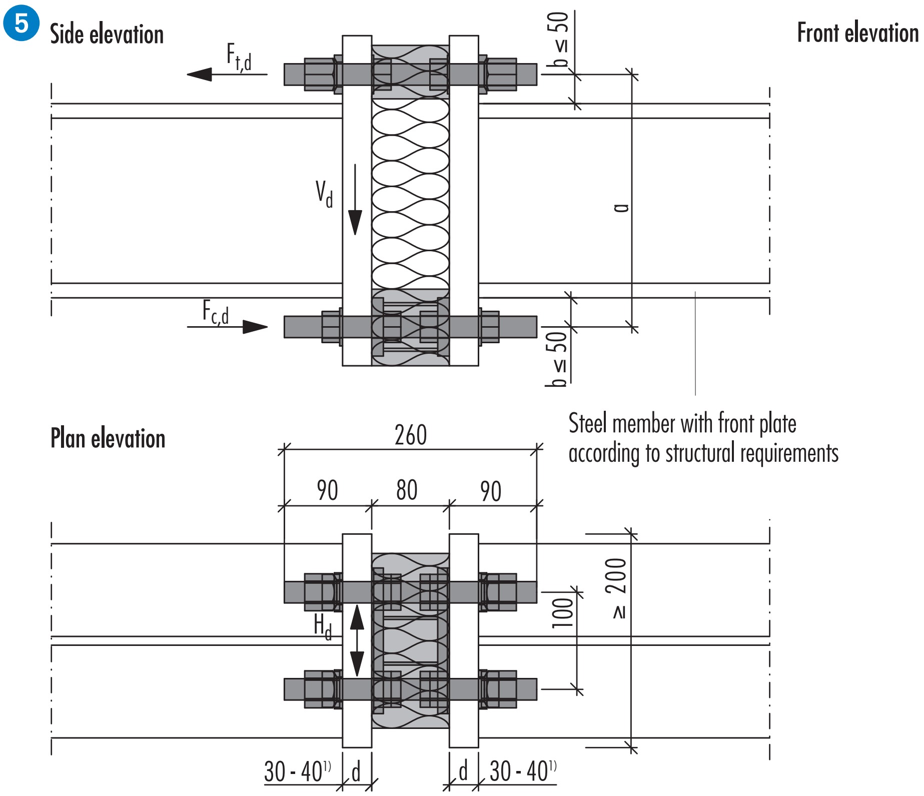
[1] Conversion of M_{yd} into M_K
(with global safety factor $\gamma_f = 1.45$)

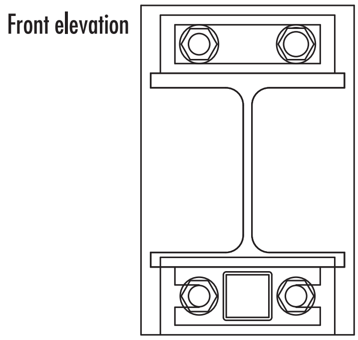
Notes on the example

- The information relating to the fatigue resistance of expansion joints on pages 186 - 187 must be followed.
- In the event of a short-term tensile load (e.g. from wind suction) a KST-QST module can be used instead of the KST-ZQST module in the lower connection, even if horizontal forces are introduced from temperature deformation H_d.
- The KST-ZST module can also be subjected to compressive loads of up to $1/3\ F_{t,Rd}$ (see footnote 6 on page 184). If $F_{c,d} > 1/3\ F_{t,Rd}$ then a KST-ZQST module must be used for the KST-ZST module.
- Greater stiffness can also be achieved with the arrangement no. 5.

SCHÖCK ISOKORB® TYPE KST 22

Design configurations





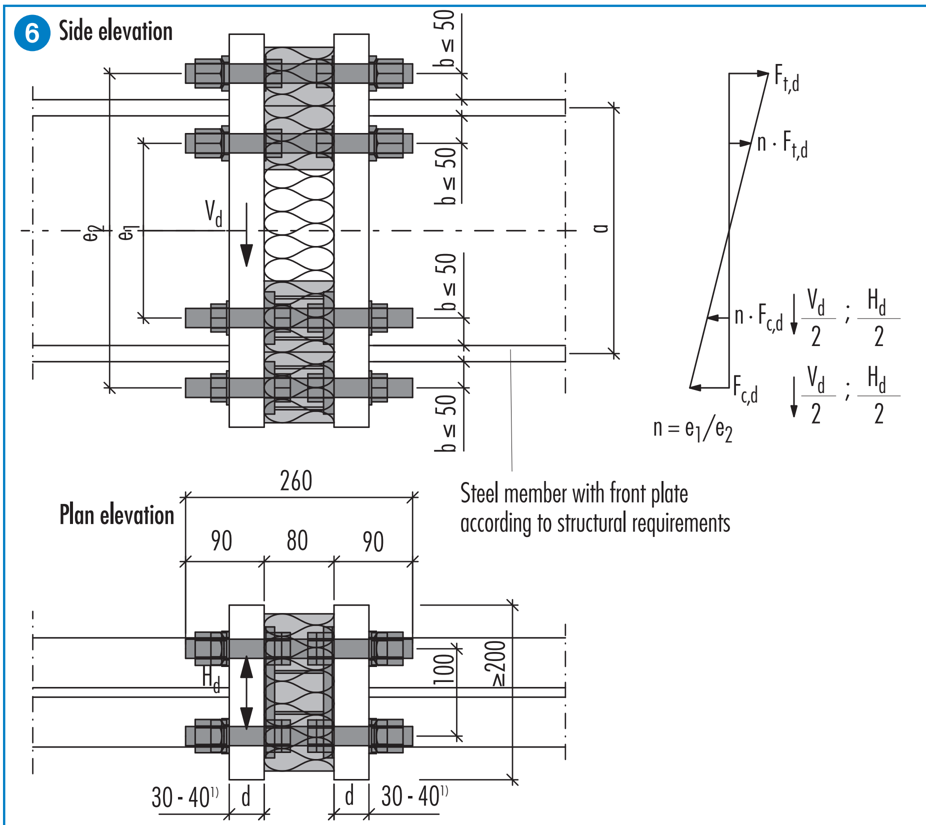
KST 22	
H_{Rd}	6 kN[2)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

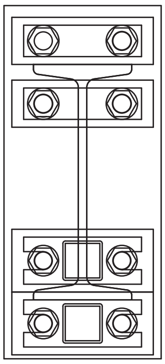
[1)] Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

$\frac{F_{t,d}}{F_{t,Rd}}$ ≤ 1.0 : 40 mm; ≤ 0.75 : 35 mm; ≤ 0.5 : 30 mm

[2)] Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® type KST 22





Load-bearing capacity of the individual module:

KST 22 per module	
H_{Rd}	6 kN[2)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

[1)] Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

$\frac{F_{t,d} \text{ per module}}{F_{t,Rd}}$ ≤ 1.0 : 40 mm; ≤ 0.75 : 35 mm; ≤ 0.5 : 30 mm

[2)] Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® for connection of members with 2 x KST 22 (2 tensile and 2 compressive shear force modules)

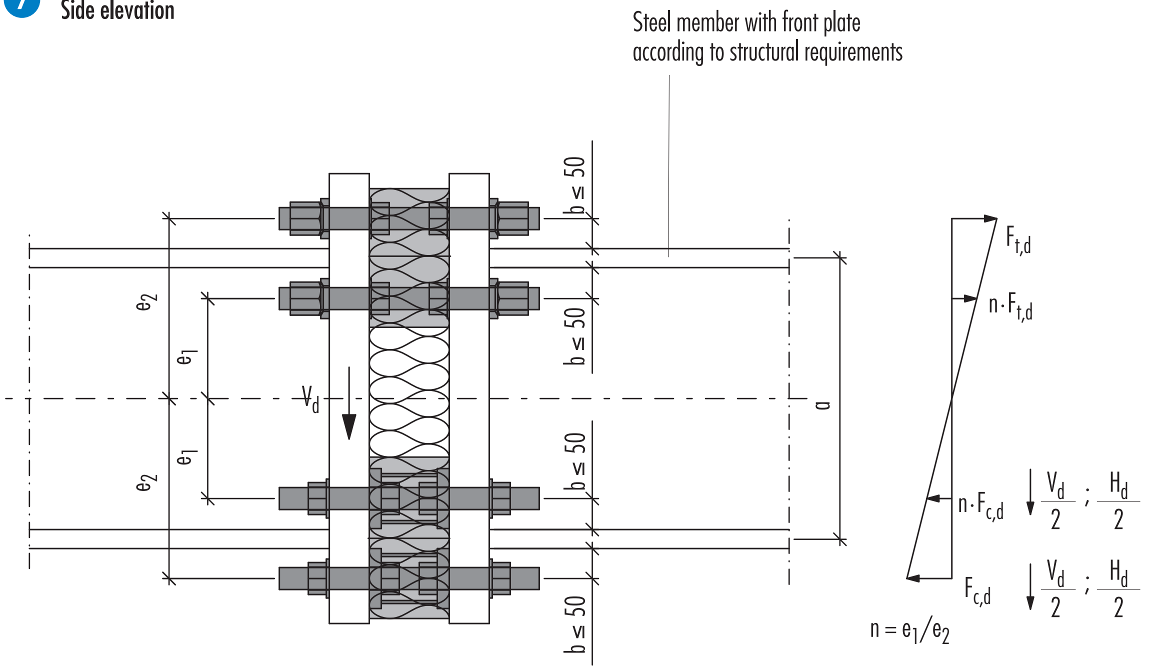
KST

Steel-to-steel

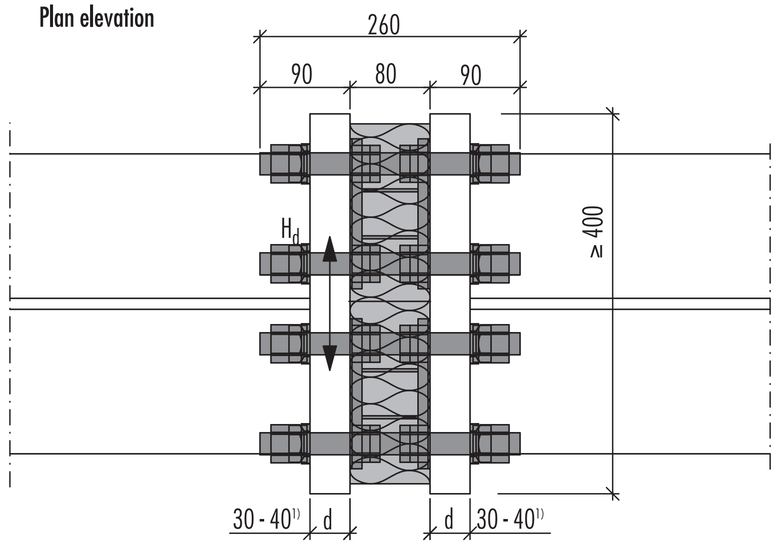
SCHÖCK ISOKORB® TYPE KST 22

Design configuration

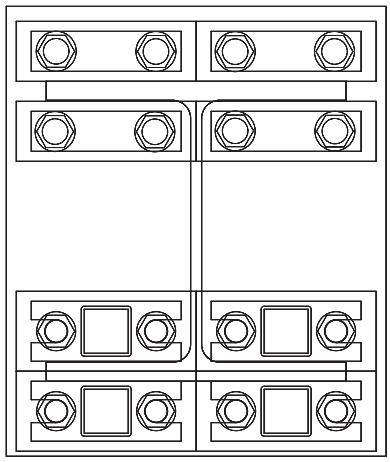
7 Side elevation



Plan elevation



Front elevation



1) Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

$$\frac{F_{t,d} \text{ per module}}{F_{t,Rd}} \quad \begin{array}{l} \leq 1.0 \;:\; 40 \text{ mm} \\ \leq 0.75 \;:\; 35 \text{ mm} \\ \leq 0.5 \;:\; 30 \text{ mm} \end{array}$$

2) Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Load-bearing capacity of the individual module:

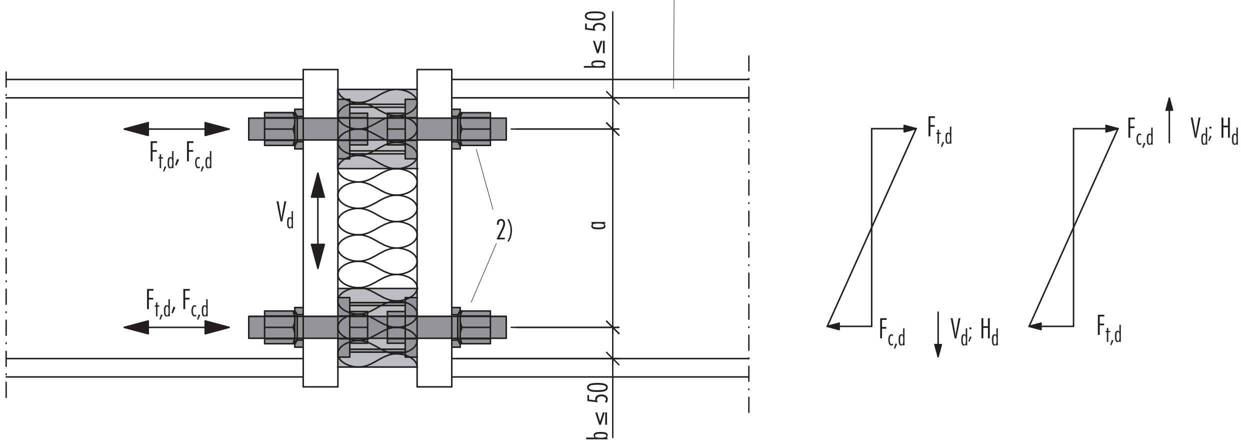
KST 22 per module	
H_{Rd}	6 kN 2)
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

Schöck Isokorb® for connection of members with 4 x KST 22 (4 tensile and 4 compressive shear force modules)

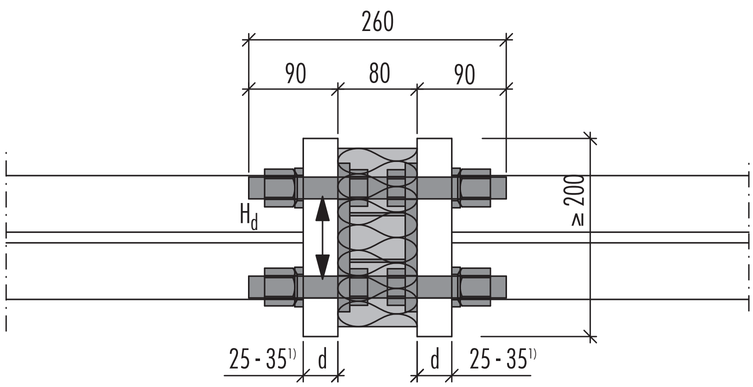
SCHÖCK ISOKORB® TYPE KST-QST 22 MODULE, KST-ZQST 22 MODULE

Design configuration

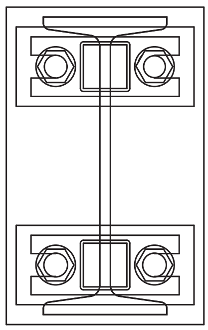
8 Side elevation



Plan elevation



Front elevation



Load-bearing capacity of the individual module:

KST-QST 22 module, KST-ZQST 22[2)] module	
H_{Rd}	6 kN[3)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

[1)] Minimum front plate thicknesses without detailed verification, using mild steel S235:

$\frac{F_{t,d} \text{ per module}}{F_{t,Rd}}$ ≤ 1.0 : 35 mm
≤ 0.8 : 30 mm
≤ 0.5 : 25 mm

[2)] This variant should be used if the system needs to absorb large forces which act on alternating sides (e.g. wind loads from below onto the cantilever). The KST-ZQST module should be used in accordance with page 183 wherever primarily tensile forces (resulting from permanent loads) are transferred. The element, which is subjected only temporarily to a tensile load, can be used as a KST-QST 22 module.

[3)] Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® for connection of members with 2 KST-QST 22 modules/KST-ZQST 22 modules[2)]

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Example of moment connections for UB 203 x 23 for lifting-off forces with 2 x KST-ZQST 22 modules

Loads:	Load case 1:	$V_{z,d} = 32$ kN	$H_d = \pm 5$ kN	$M_{y,d} = -18$ kNm
	Load case 2:	$V_{z,d} = -34$ kN	$H_d = \pm 5$ kN	$M_{y,d} = 20$ kNm
	a = 0.12 m			

Verifications for KST-ZQST 22 module, for load case:

Shear force/horizontal force

$\frac{V_{z,d}}{V_{z,Rd}} < 1.0 \qquad \frac{H_d}{H_{Rd}} < 1.0$

$V_{z,d}/V_{z,Rd,ZQST22} = 32\text{ kN}/36\text{ kN} = 0.89 < 1.0$

$H_d/H_{Rd,ZQST22} = 5\text{ kN}/\ 6\text{ kN} = 0.83 < 1.0$

Positive moment

$\frac{F_{c,d}}{F_{c,Rd}} < 1.0 \qquad \frac{F_{t,d}}{F_{t,Rd}} < 1.0$

$F_{c,d} = F_{t,d} = M_{y,d}/a = 18\text{ kNm}/0.12\text{ m} = 150\text{ kN}$

$F_{c,d}/F_{c,Rd,ZQST22} = 150\text{ kN}/225.4\text{ kN} = 0.67 < 1.0$

$F_{t,d}/F_{t,Rd,ZQST22} = 150\text{ kN}/225.4\text{ kN} = 0.67 < 1.0$

Negatives moment (lifting off)

$\frac{V_{z,d}}{V_{z,Rd}} < 1.0$

$\frac{F_{c,d}}{F_{c,Rd}} < 1.0 \qquad \frac{F_{t,d}}{F_{t,Rd}} < 1.0$

$V_{z,d}/V_{z,Rd,ZQST22} = 34\text{ kN}/36\text{ kN} = 0.94 < 1.0$

$F_{c,d} = F_{t,d} = M_{y,d}/a = 20\text{ kNm}/0.12\text{ m} = 166.67\text{ kN}$

$F_{c,d}/F_{c,Rd,ZQST22} = 166.67\text{ kN}/225.4\text{ kN} = 0.74 < 1.0$

$F_{t,d}/F_{t,Rd,ZQST22} = 166.67\text{ kN}/225.4\text{ kN} = 0.74 < 1.0$

Minimum front plate thickness [d] without detailed verification, using mild steel S235: Distance b ≤ 50 mm

$$\frac{\max F_{t,d}}{F_{t,Rd,QST22}} \begin{cases} < 1.0: 35\text{ mm} \\ < 0.8: 30\text{ mm} \\ < 0.5: 25\text{ mm} \end{cases}$$

$$\frac{F_{t,d}}{F_{t,Rd}} = 0{,}74 < 0{,}8 \rightarrow d = 30\text{ mm}$$

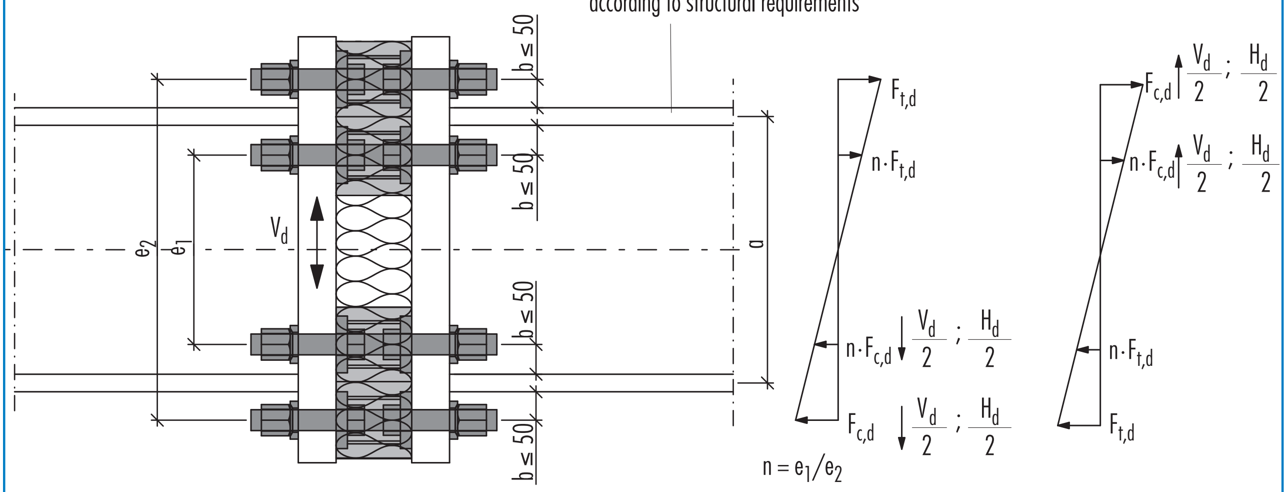
Deformation due to $M_{y,d}$ see page 185

Notes

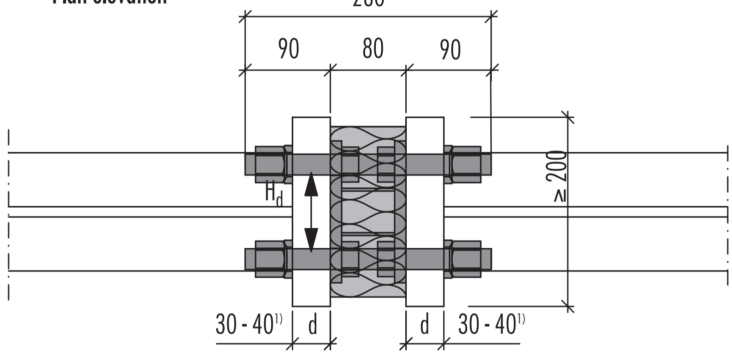
- As the compressive force for the KST-ZQST module will exceed 1/3 of the permitted tensile force, one KST-ZST 22 module in the up per tensile area structurally is not sufficient; furthermore, the interaction cannot be satisfied for the KST-QST module under tensile loads.
  $(F_{c,d} = 166.67 \geq \frac{225{,}4}{3} = F_{t,Rd})$
- In the lower area, tensile forces due to the wind will only occur for a limited time. Accordingly, a single KST-QST module would offer sufficient fatigue resistance. However, in order to prevent mix-ups, a symmetrical connection with 2 x KST-ZQST modules is recommended.
- As it cannot be ensured that the KST-QST modules/KST-ZQST modules establish a similarly large resistance to the dissipation of shear forces at the same time, only the module which is located in the compressive area must be used to dissipate shar forces.

Design configuration

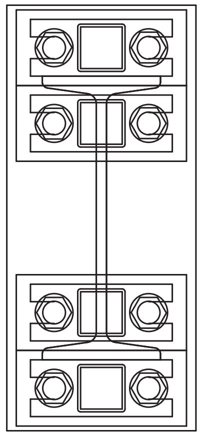
9 Side elevation



Plan elevation



Front elevation



Load-bearing capacity of the individual module:

per KST-QST 22 module, KST-ZQST 22[2] module	
H_{Rd}	6 kN[3]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

[1] Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

$\frac{F_{t,d} \text{ per module}}{F_{t,Rd}}$ ≤ 1.0 : 40 mm
≤ 0.75 : 35 mm
≤ 0.5 : 30 mm

[2] This variant should be used if the system needs to absorb large forces which act on alternating sides (e.g. wind loads from below onto the cantilever). The KST-ZQST module should be used in accordance with page 183 wherever primarily tensile forces (resulting from permanent loads) are transferred. The element, which is subjected only temporarily to a tensile load, can be used as a KST-QST 22 module.

[3] Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® for connection of members with 4 KST-QST 22 modules/KST-ZQST 22 modules[2]

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Example of moment connections for UB 356 x 33 for lifting-off forces with 4 x KST-ZQST 22 modules

Loads:	Load case 1:	$V_{z,d} = 55$ kN	$M_{y,d} = -130$ kNm	$e_1 = 0.25$ m
	Load case 2:	$V_{z,d} = -40$ kN	$M_{y,d} = 80$ kNm	$e_2 = 0{,}45$ m

Verifications for KST-ZQST 22 module, for load case:

Shear force

$$\frac{V_{z,d}}{V_{z,Rd}} < 1.0$$

$V_{z,Rd,ZQST22} = 2 \cdot 36$ kN 72 kN

$V_{z,d}/V_{z,Rd,ZQST22} = 55$ kN$/72$ kN $= 0.76 < 1.0$

Positive moment

$$F_{c,d} = F_{t,d} = M_{y,d}/e_2 + (\frac{e_1}{e_2} \cdot e_1)$$

$F_{c,d} = F_{t,d} = 130$ kNm$/(0.45$ m $+ (0.25$ m$/0.45$ m $\cdot 0.25$ m$))$

$F_{c,d} = F_{t,d} = 220.8$ kN

$$\frac{F_{c,d}}{F_{c,Rd}} < 1.0 \qquad \frac{F_{t,d}}{F_{t,Rd}} < 1.0$$

$F_{c,d}/F_{c,Rd,ZQST22} = 220.8$ kN$/225.4$ kN $= 0.98 < 1.0$

$F_t/F_{t,Rd,ZQST22} = 220.8$ kN$/225.4$ kN $= 0.98 < 1.0$

Negative moment (lifting off)

$$\frac{V_{z,d}}{V_{z,Rd}} < 1.0$$

$V_{z,Rd,ZQST22} = 2 \cdot 36$ kN 72 kN

$V_{z,d}/V_{z,Rd,ZQST22} = 40$ kN$/72$ kN $= 0.55 < 1.0$

$$F_{c,d} = F_{t,d} = M_{y,d}/e_2 + (\frac{e_1}{e_2} \cdot e_1)$$

$F_{c,d} = F_{t,d} = 80$ kNm$/(0.45$ m $+ (0.25$ m$/0.45$ m $\cdot 0.25$m$))$

$F_{c,d} = F_{t,d} = 135.8$ kN

$$\frac{F_{c,d}}{F_{c,Rd}} < 1.0 \qquad \frac{F_{t,d}}{F_{t,Rd}} < 1.0$$

$F_{c,d}/F_{c,Rd,ZQST22} = 135.8$ kN$/225.4$ kN $= 0.6 < 1.0$

$F_{t,d}/F_{t,Rd,ZQST22} = 135.8$ kN$/225.4$ kN $= 0.6 < 1.0$

Minimum front plate thickness [d] without detailed verification, using mild steel S235: Distance b ≤ 50 mm

$$\frac{\max F_{t,d}}{F_{t,Rd,QST22}} \begin{cases} < 1.0: 40 \text{ mm} \\ < 0.8: 35 \text{ mm} \\ < 0.5: 30 \text{ mm} \end{cases}$$

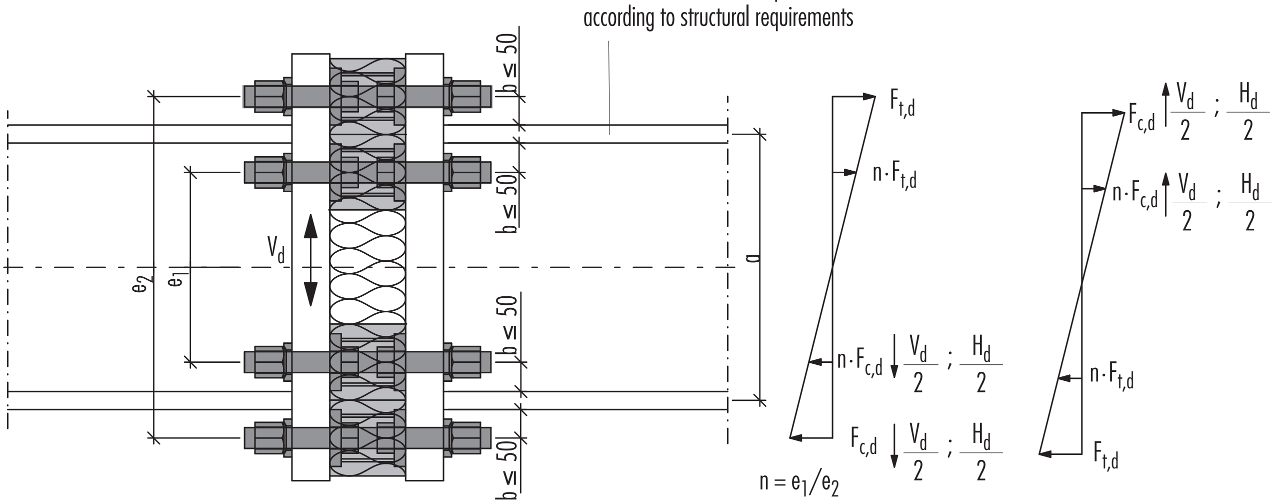
$$\frac{F_{t,d}}{F_{t,Rd}} = 0.98 \leq 1.0 \rightarrow d = 40 \text{ mm}$$

Deformation due to $M_{y,d}$ see page 185

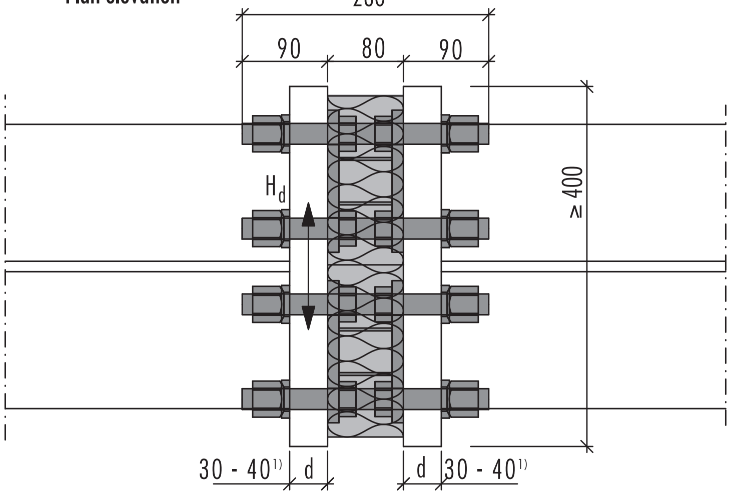
Notes

- As the compressive force for the KST-ZQST module will exceed 1/3 of the permitted tensile force, one KST-ZST 22 module in the upper tensile area structurally is not sufficient; furthermore, the interaction cannot be satisfied for the KST-QST module under tensile loads.
  $(F_{c,d} = 166.67 \geq \frac{225.4}{8} = F_{t,Rd})$
- In the lower area, tensile forces due to the wind will only occur for a limited time. Accordingly, a single KST-QST module would offer sufficient fatigue resistance. However, in order to prevent mix-ups, we recommend a symmetrical connection with 4 x KST-ZQST modules.
- As it cannot be ensured that the KST-QST modules/KST-ZQST modules establish a similarly large resistance to the dissipation of shear forces at the same time, only the module which is located in the compressive area must be used to dissipate shear forces.

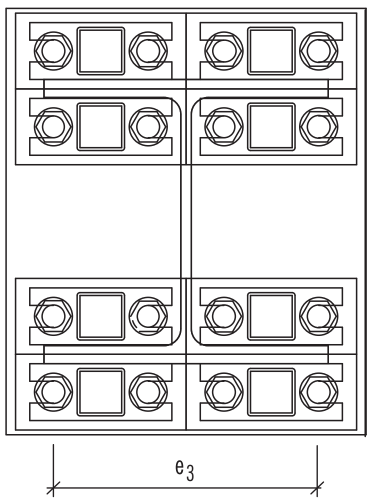
10 Side elevation



Plan elevation



Front elevation



Load-bearing capacity of the individual module:

per KST-QST 22 module, KST-ZQST 22[2] module	
H_{Rd}	6 kN[3]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

[1] Minimum front plate thicknesses [d] without detailed verification, using mild steel S235:

$\frac{F_{t,d} \text{ per module}}{F_{t,Rd}}$ ≤ 1.0 : 40 mm
≤ 0.75 : 35 mm
≤ 0.5 : 30 mm

[2] This variant should be used if the system needs to absorb large forces which act on alternating sides (e.g. wind loads from below onto the cantilever). The KST-ZQST module should be used in accordance with page 183 wherever primarily tensile forces (resulting from permanent loads) are transferred. The element, which is subjected only temporarily to a tensile load, can be used as a KST-QST 22 module.

[3] Always refer to the information about expansion joints/fatigue resistance on pages 186 - 187.

Schöck Isokorb® for connection of members with 8 KST-QST 22 modules/KST-ZQST 22 modules[2]

Example: Moment connection for HEA 360 with 4 x KST-ZQST 22 modules

Loads:
Load case 1 (status during usage): $V_{z,d} = 126$ kN $H_d = \pm 20$ kN $M_{y,d} = -236$ kNm
Load case 2 (assembly): $V_{z,d} = -96$ kN $M_{y,d} = 166$ kNm $M_{z,d} = \pm 22$ kNm $F_{x,c,d} = 160$ kNm

$e_1 = 0{,}215$ m
$e_2 = 0{,}450$ m
$e_3 = 0.280$ m (axis separation of the outer row of bolts)

Verification of the load case "status during usage":

Shear force/horizontal force

$$\frac{V_{z,d}}{V_{z,Rd}} < 1.0$$

$V_{z,Rd,QST22} = 4 \cdot 36 \text{ kN} = 144 \text{ kN}$
$V_{z,d}/V_{z,Rd,QST22} = 126 \text{ kN}/144 \text{ kN} = 0.88 < 1.0$

$H_{Rd,QST22} = 4 \cdot 6 \text{ kN} = 24 \text{ kN}$
$H_d/H_{Rd,QST22} = 20 \text{ kN}/24 \text{ kN} = 0.83 < 1.0$

Positive moment

$$M_{y,d} = 2 \cdot F_{t,Rd} \cdot e_2 + 2 \cdot \frac{e_1}{e_2} \cdot F_{t,Rd} \cdot a_1$$

$$F_{t,Rd,\,QST22} = \frac{M_{yd}}{2 \cdot e_2 + 2 \cdot \frac{e_1}{e_2} \quad e_1}$$

$$\frac{236 \text{ KNm}}{2 \cdot 0.45 \text{ m} + 2 \cdot \frac{0.215 \text{ m}}{0.45 \text{ m}} \cdot 0.215 \text{ m}} = 213.5 \text{ KN}$$

$$\frac{F_{c,d}}{F_{c,Rd}} < 1.0 \qquad \frac{F_{t,d}}{F_{t,Rd}} < 1.0$$

$F_{c,d}/F_{c,Rd,\,QST22} = 213.5 \text{ KN}/225.4 \text{ KN} = 0.95 < 1.0$
$F_{t,d}/F_{t,Rd,\,QST22} = 213.5 \text{ KN}/225.4 \text{ KN} = 0.95 < 1.0$

Minimum front plate thickness without detailed verification, using mild steel S235: Distance b ≤ 50mm

$$\frac{\max F_{t,d}}{F_{t,Rd,QST22}} \begin{cases} < 1.0: 40 \text{ mm} \\ < 0.8: 35 \text{ mm} \\ < 0.5: 30 \text{ mm} \end{cases}$$

$$\frac{F_{t,d}}{F_{t,Rd}} = 0.95 < 1.0 \rightarrow d = 40 \text{ mm}$$

Deformation due to $M_{y,d}$ (see page 185)

Buckling angle

$$\varphi = \frac{M_K}{C} \text{ [rad]} \qquad \varphi = \frac{236/1{,}45 \cdot 100}{25{,}5336^{06}} \text{ [rad]}$$

$$c = 24{,}000 \cdot a^2 \qquad c = 24{,}000 \cdot \left(\frac{(21.5 \text{ cm} + 45 \text{ cm})}{2}\right)^2 = 26.5335 \cdot 10^6 \text{ [KNcm/rad]}$$

Loading combination during assembly:

Shear force/horizontal force

$$\frac{V_{zd}}{V_{z,Rd}} < 1,0$$

$V_{z,Rd,QST22} = 4 \cdot 36\ \text{kN} = 144\ \text{kN}$

$V_{z,d}\ /\ V_{z,Rd,QST22} = 96\ \text{kN}\ /\ 144\ \text{kN} = 0.66 < 1.0$

Negative moment (lifting off)

$$M_{y,d} = 2 \cdot D_d \cdot e_2 + 2 \cdot \frac{e_1}{e_2} \cdot D_d \cdot e_1$$

$$M_{Zd} = 2 \cdot D_d \cdot e_3$$

Verification of the bolts under the highest loads for compressive loads from bi-axial bending[1)]

$$\frac{F_{c,d}}{F_{c,Rd}} < 1,0$$

$$F_{c,d} = \frac{M_{y,d}}{2 \cdot e_2 + 2 \cdot \frac{e_1}{e_2} \cdot e_1} + \frac{M_{z,d}}{2^{1)} \cdot e_3} + \frac{F_{c,d}}{8^{2)}}$$

$$F_{c,d} = \frac{166\ \text{KNm}}{2 \cdot 0.45\ \text{m} + 2 \cdot \frac{0.215\ \text{m}}{0.450\ \text{m}} \cdot 0.215\ \text{m}} + \frac{22\ \text{KNm}}{2 \cdot 0.28\ \text{m}} + \frac{160\ \text{KNm}}{8}$$

$$F_{c,d} = 150.17\ \text{KN} + 39.29\ \text{KN} + 20\ \text{KN}$$

$$F_{c,d}/F_{c,Rd,QST22} = 209.46\ \text{KN}/225.4\ \text{KN} = 0.93 < 1.0$$

KST

Steel-to-steel

[1)] Conserevatively, only the external bolts are considered as being load-bearing. The calculations are performed with just 2 bolts, as $F_{c,d}$ relates to 1 module.

[2)] Number of modules subjected to a compressive load due to normal force $F_{x,c,d}$.

Example - front plate protruding

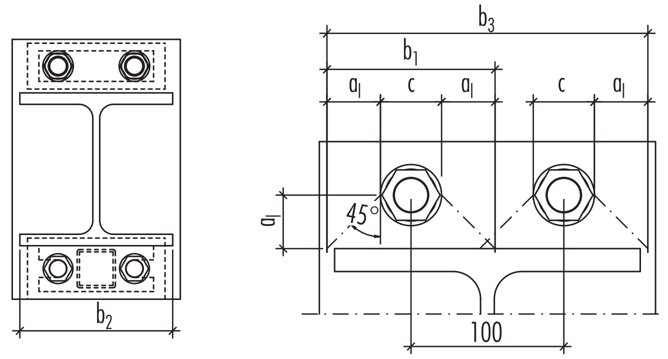
Calculation of max. bolt force: $\frac{F_{t,max,d}}{2} = F_{t,max,d}$ per bolt

Max. moment in the front plate:
$M_d = F_{t,\,max,d,bolt} \cdot a_l =$ [kNmm]
$W = d^2 \cdot b_{ef}/6 =$ [mm²] with

b_{ef} = min (b_1; $b_2/2$; $b_3/2$)
d = thickness of front plate
c = diameter of U-washer
c (KST 16) = 30 mm,
c (KST 22) = 39 mm

$b_1 = 2 \cdot a_l + c$ [mm]
b_2 = member width or width of front plate [mm]
$b_3 = 2 \cdot al + c + 100$ [mm]

$M_{R,d} = W \cdot f_{y,k}/1.1 =$ [kNmm]
$M_d/M_{R,d} = \leq 1.0$



Schöck Isokorb® type KST 22 dimensioning of the front plate

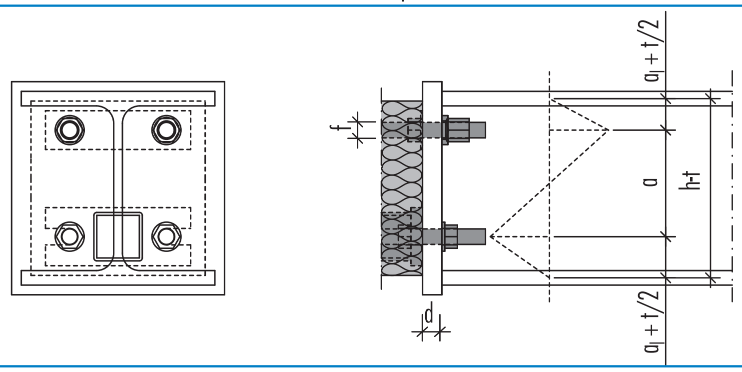
Example - front plate flush

Max. tensile or compressive force per module: $F_{t,d} = F_{c,d}$
Max. moment in the front plate: $M_d = F_{t,d} \cdot (a_l + \frac{t}{2})$

$W = d^2 \cdot b_{ef}/6$ with

$b_{ef} = b - 2 \cdot f$
d = thickness of front plate
f = diameter of bore
f (KST 16) = 18 mm
f (KST 22) = 24 mm
b = width of front plate

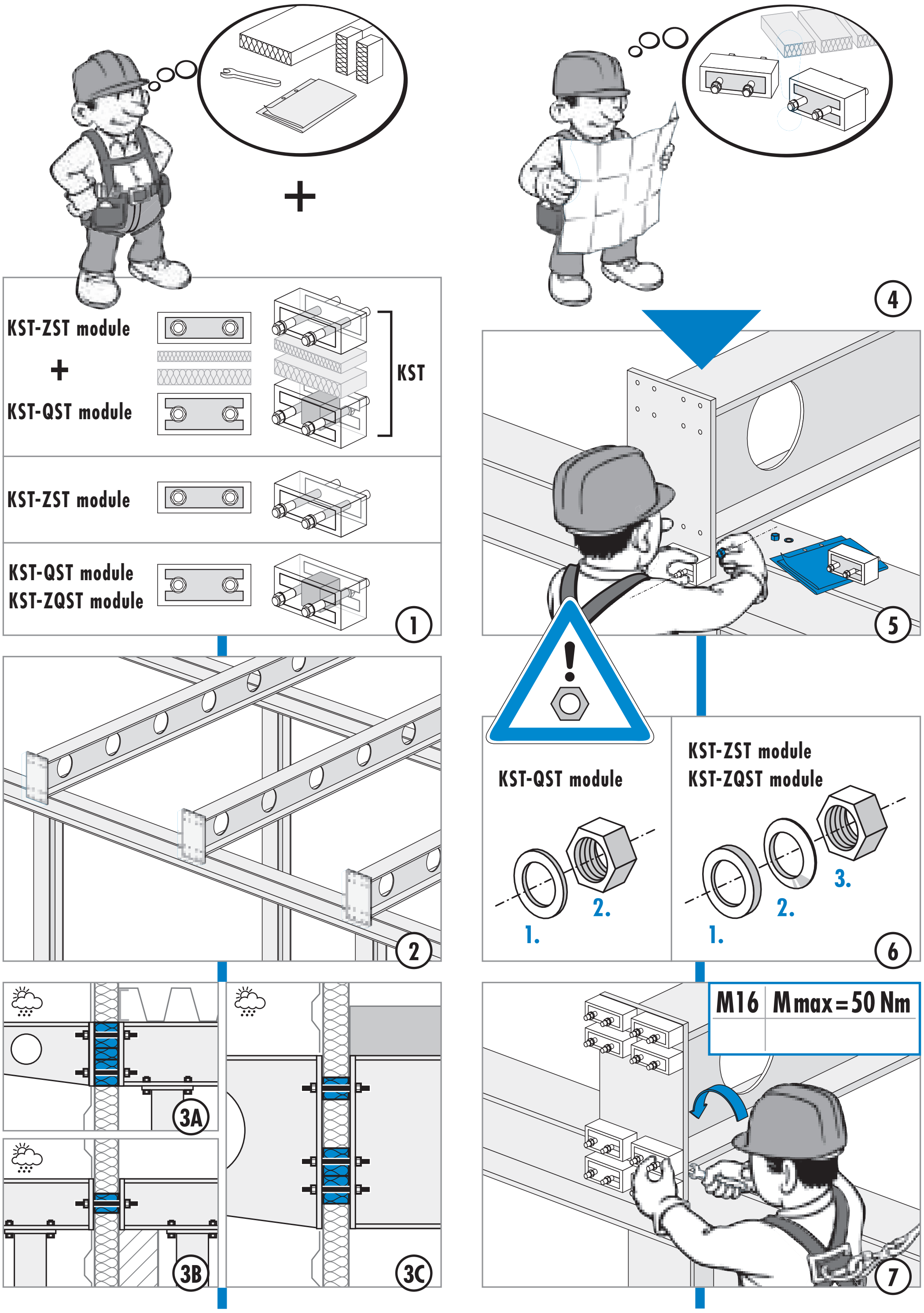
$M_{R,d} = W \cdot f_{y,k}/1.1$
$M_d/M_{R,d} = \leq 1.0$



Schöck Isokorb® type KST 16 dimensioning of the front plate

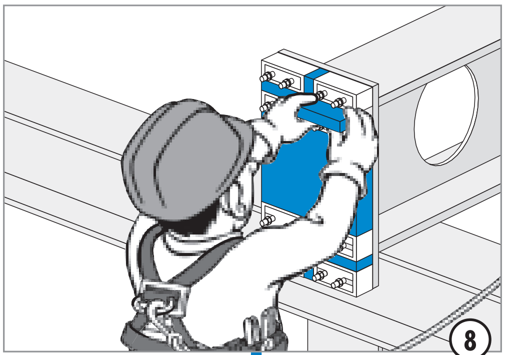
SCHÖCK ISOKORB® TYPE KST

Installation instructions



KST

Steel-to-steel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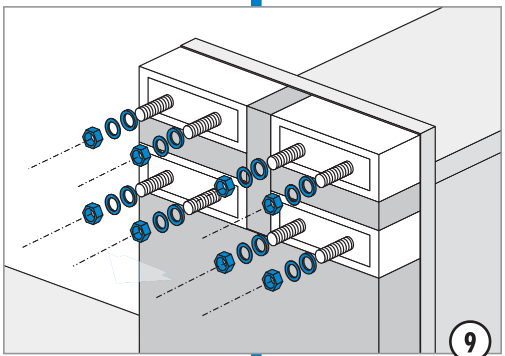
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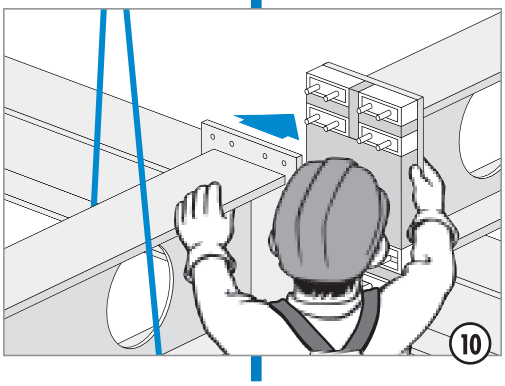
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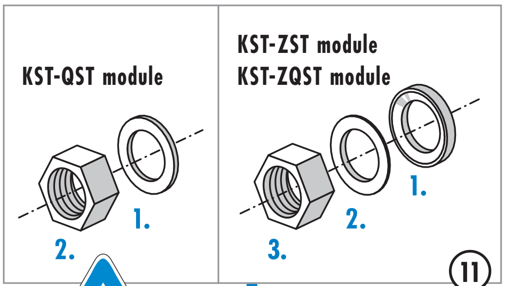
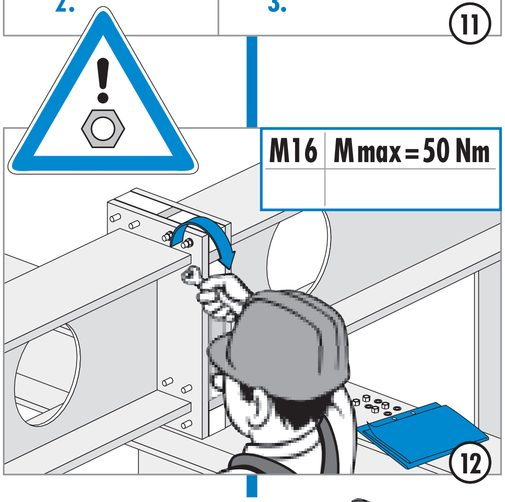
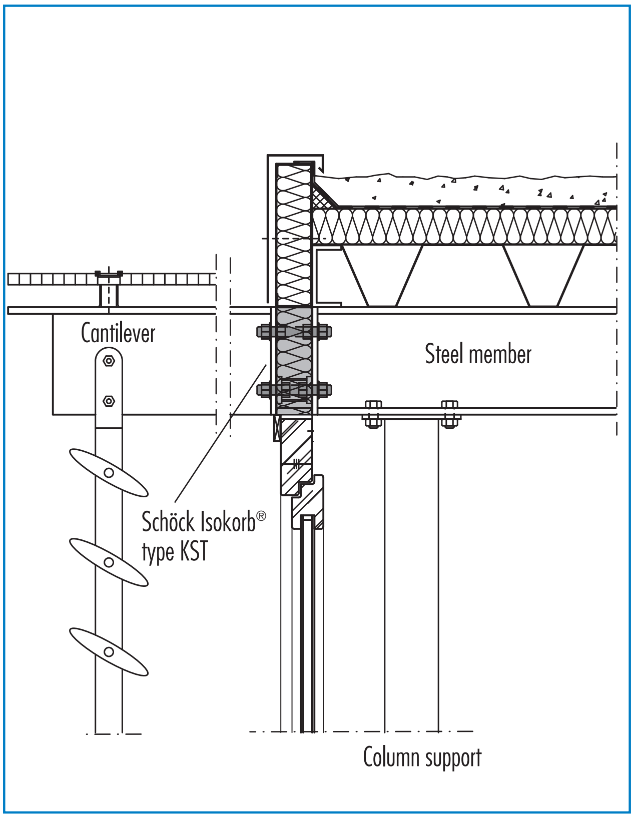

KST-QST module
1.
2.
KST-ZST module
KST-ZQST module
1.
2.
3.
11

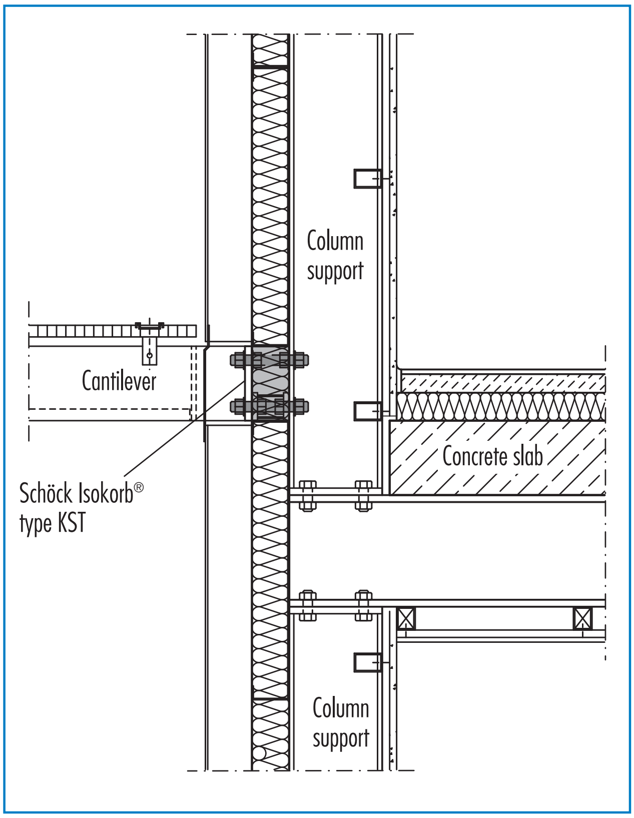

M16 | Mmax = 50 Nm
12

SCHÖCK ISOKORB® TYPE KST

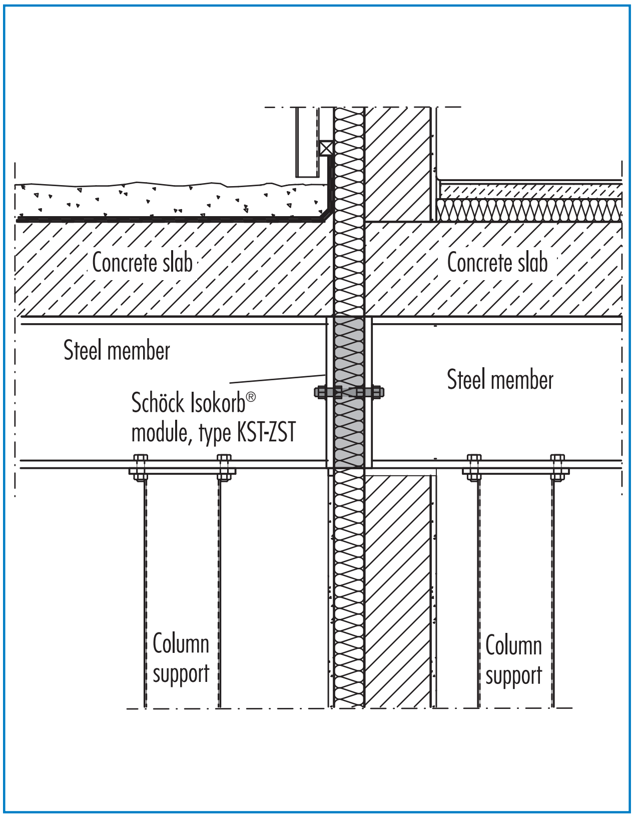
Constructions details



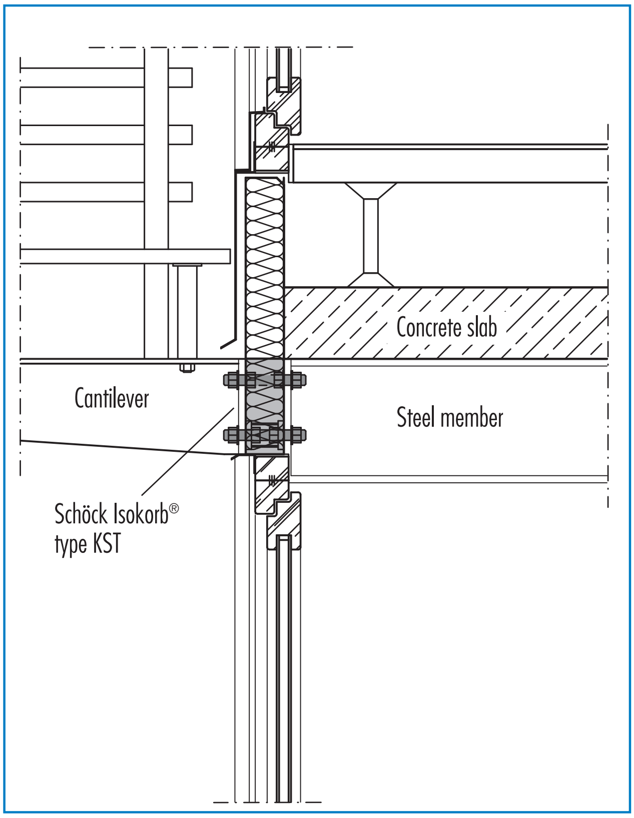
Provision of adjustable shading



Cantilevered canopy construction to column



Thermally insulated building transition



Façade balcony connection

Steel-to-steel

SCHÖCK ISOKORB® KST, QST, ZST, ZQST MODULE

Check list

- Have the member forces on the Isokorb® connection been determined at the design level? ☐

- Will the Isokorb® element be used under primarily static loads (see page 185)? ☐

- Are temperature deformations assigned directly to the Isokorb® connection? ☐
  Expansion joint spacing (see pages 186 - 187)?

- Will the Isokorb® connection be exposed to an environement with a high chlorine content (e.g. eg. inside indoor swimming pools) (see page 176)? ☐

- Is there a fire safety requirement for the overall load-bearing structure/Isokorb® (see page 176)? ☐

- Selection and calculation of the Isokorb® elements (refer also to pages 180 - 183 and the examples on pages 188 - 200)
  - Are the selected modules adequately dimensioned - refer to the "Design and calculation table" on page 184? ☐
  - Have wind loads with a slight lift-off effect been assigned to the KST connection (see page 184[6)])? ☐
  - Is the interaction relationship $3 \cdot V_z + 2 \cdot H_y + Z_x = \max Z_d \leq Z_{x,Rd}$ satisfied for the KST-QST module and KST-ZQST module under tensile loads with simultaneous shear loads (see page 184[3)])? ☐
  - Have the KST-QST modules and KST-ZQST modules been located in the compression area in order to transfer shear forces (refer to example 8 on pages 194 - 195)? ☐

- Front plate calculation without more detailed verification (see pages 188 - 198):
  Are the requirements in terms of maximum bolt distances to the flange and minimum head plate width satisfied (refer to examples 1 - 10 on pages 188 - 200)? ☐
  Front plate calculation with detailed verification: see page 201

- Did the deformation calculations for the overall structure take into account the deformation due to M_K in the Isokorb® connection (see page 185)? ☐

- Are the individual modules clearly marked in the implementation plan and works plan so that there is no risk of their being interchanged. ☐

- Have the tightening torques for the screwed connections been marked in the implementation plan (refer to page 202 - 203)? The nuts should be tightened finger-tight without planned preload; the following tightening torques apply: ☐
  KST 16 (bolt ⌀ 16): M_{max} 50 Nm
  KST 22 (bolt ⌀ 22): M_{max} 80 Nm