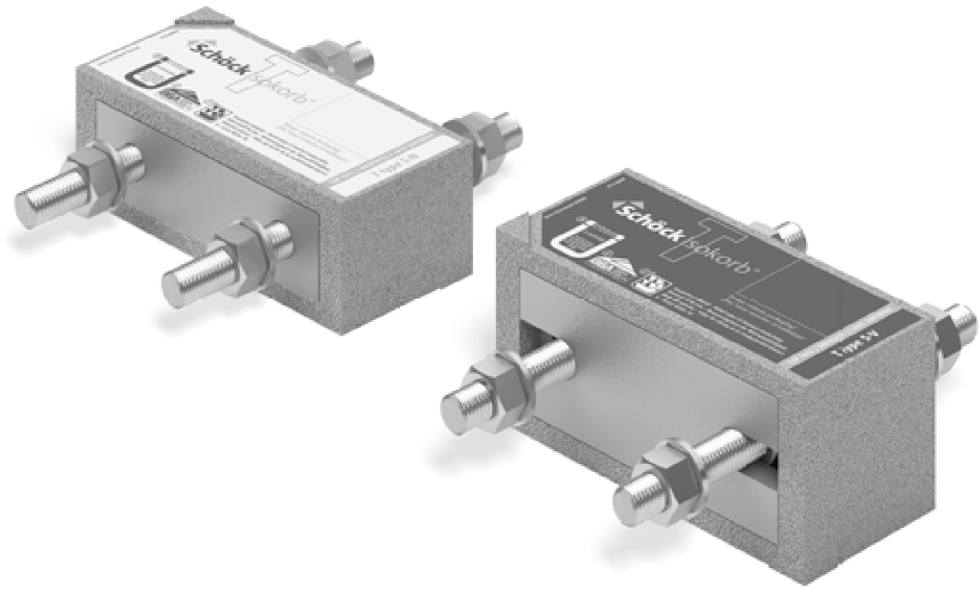
Schöck Isokorb® T type S



Schöck Isokorb® T type S

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Schöck Isokorb® T type S

Element arrangements/Connection layouts

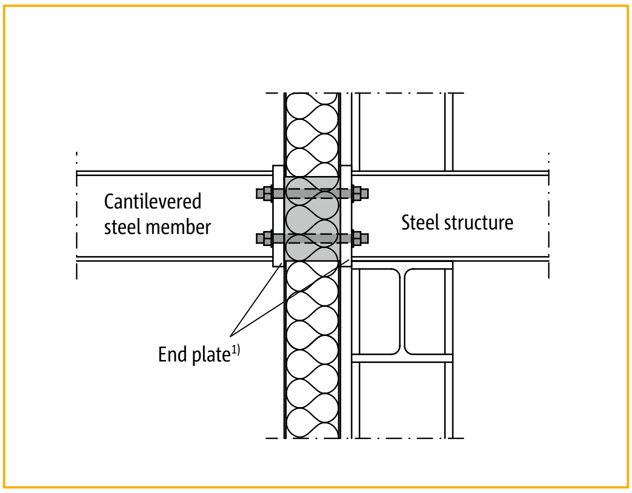


Figure 1: Schöck Isokorb® T type S for cantilevered steel structures

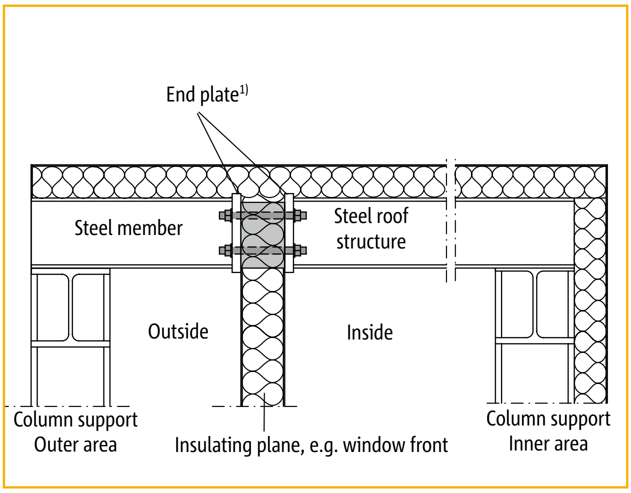


Figure 2: Schöck Isokorb®T type S for separation within the structural system

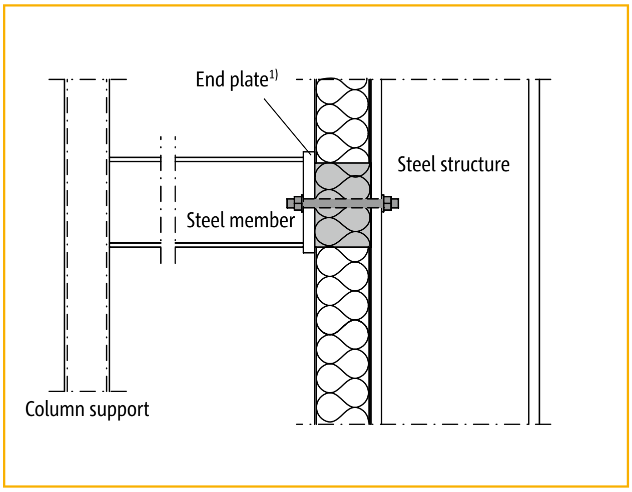


Figure 3: Schöck Isokorb® T type S-V for supported steel structures

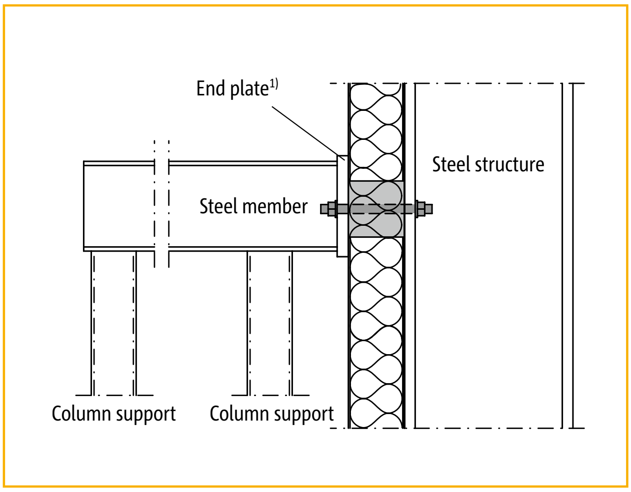


Figure 4: Schöck Isokorb® T type S-N for restrained steel structures

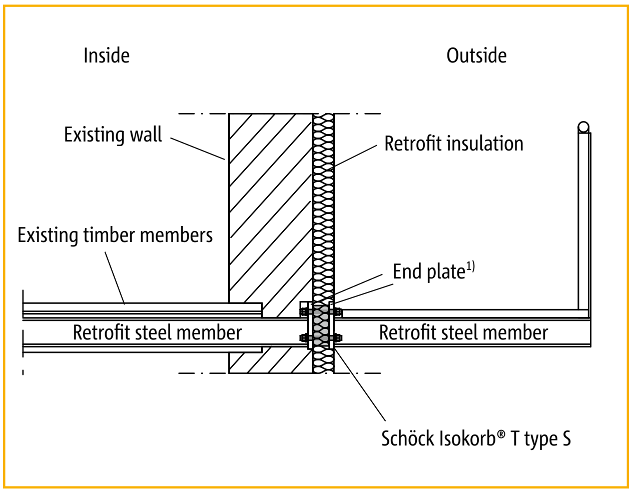
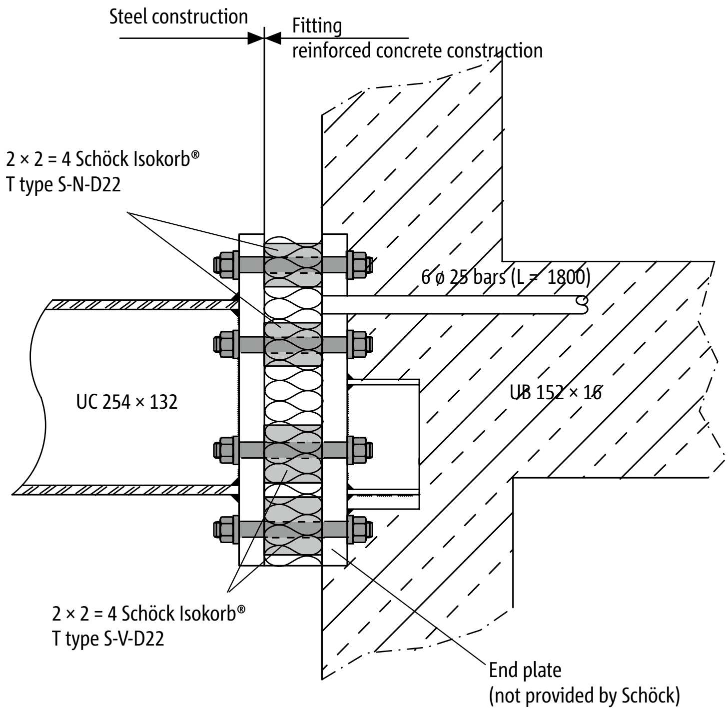


Figure 5: Schöck Isokorb® T type S for a renovation/retrofit balcony installation

[1] End plate not provided by Schöck

Schöck Isokorb® T type S
Element arrangements/Connection layout



The T type S 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® T type S.
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 end plate. The engineer responsible for the design of the load bearing structure shall ensure that this is satisfied.

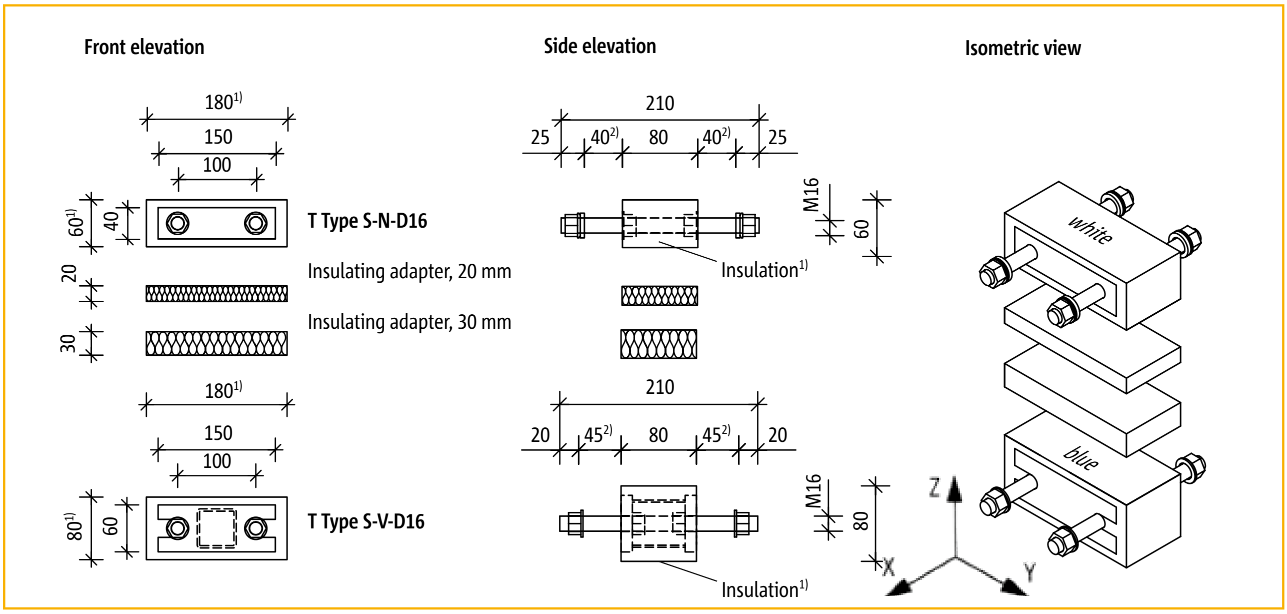
Schöck Isokorb® T type S

Views/Dimensions

Schöck Isokorb® T type S – basic type

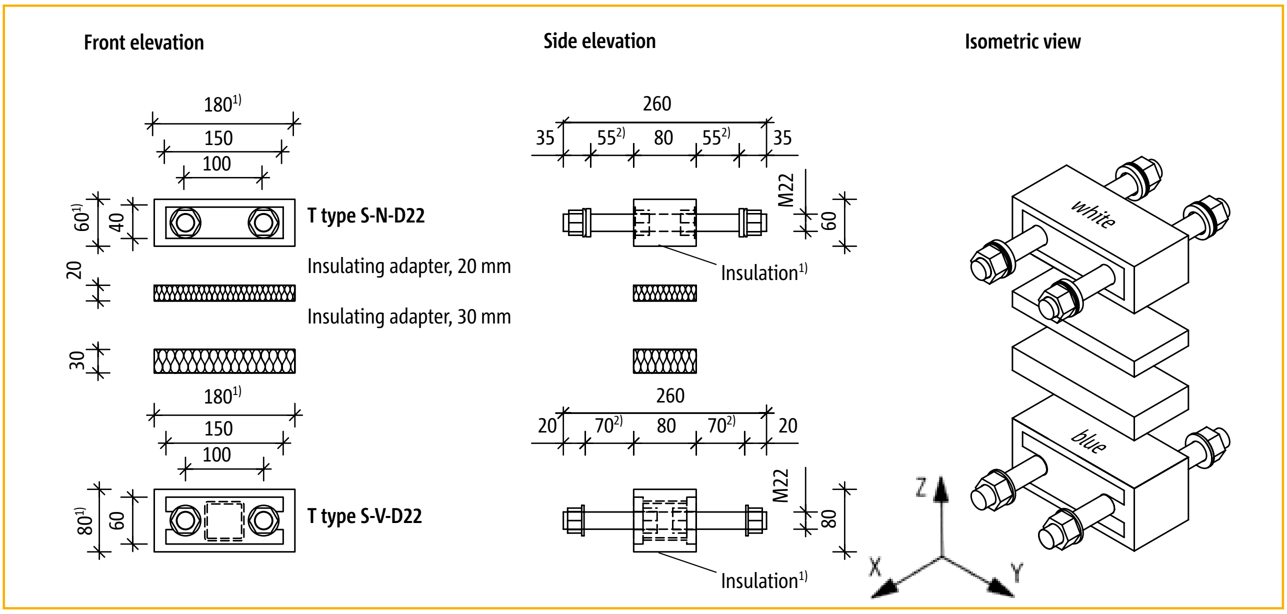
The basic T type S consists of one T type S-N, one T type S-V, one insulating adapter with a thickness of 20 mm and one insulating adapter with a thickness of 30 mm. With these modules it is possible to achieve a vertical bolt separation of up to 120 mm (60/2 + 20 + 30 + 80/2). If your application requires 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 T type S is a shear force in the z-direction and a moment around the y-axis.

Schöck Isokorb® T type S-D16



Views - Schöck Isokorb® T Type S-D16

Schöck Isokorb® T type S-D22



Views - Schöck Isokorb® T Type S-D22

[1)] If required, the insulating element can be cut off up to the steel plates (150 × 40 for the T type S-N, 150 × 60 for the T type S-V). The minimum distance is therefore 50 mm (40/2 + 60/2).
[2)] Available fixing length

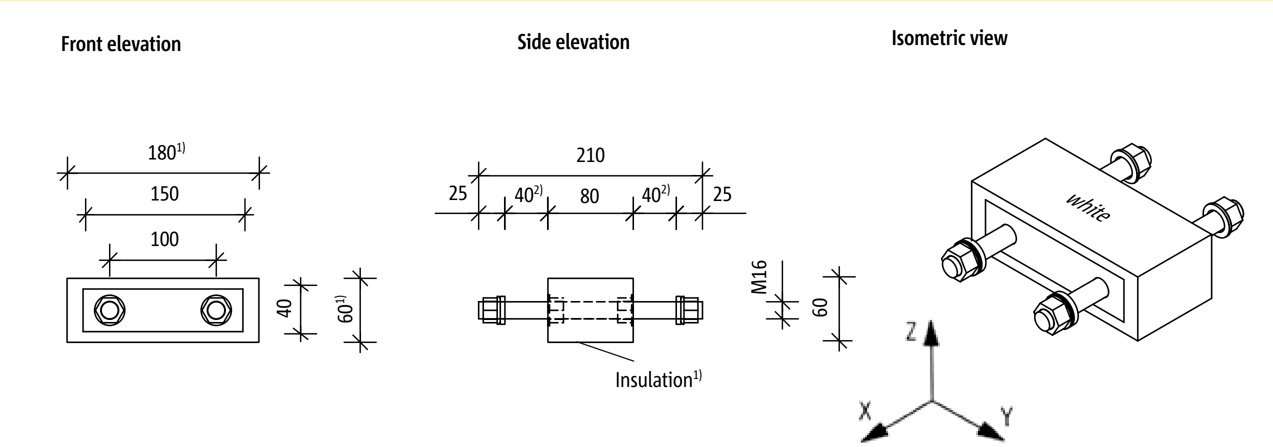
Schöck Isokorb® T type S

Views/Dimensions

Schöck Isokorb® T Type S-N

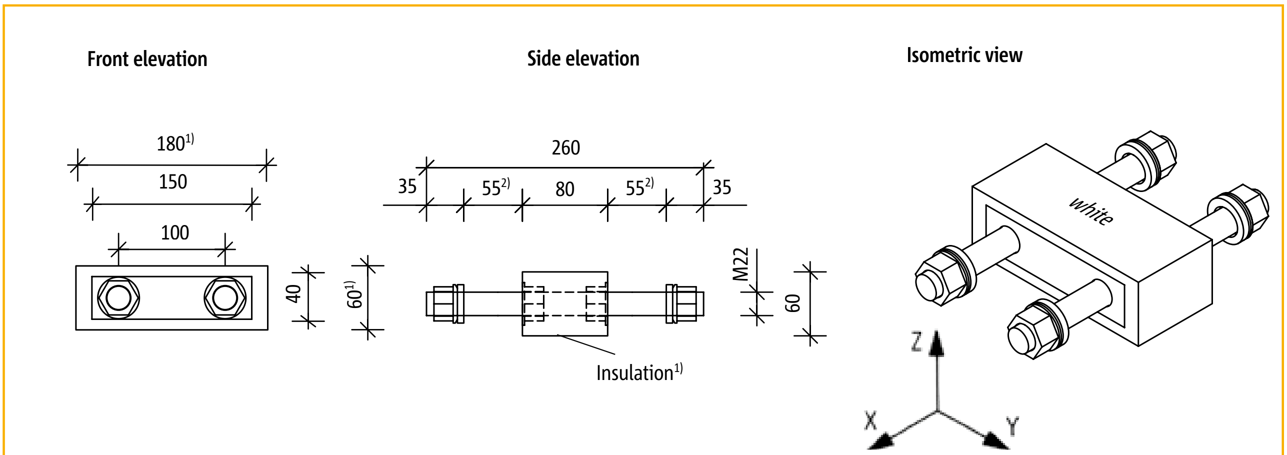
The T type S-N is used to absorb tensile forces. It comprises one insulating element (180/60/80 mm) and two stainless threaded bars with the corresponding nuts. The outer washers take the form of a ball socket and a conical disc. This offers advantages in terms of fatigue resistance. Refer also to the section about expansion joints on pages 80 - 81. In combination with a T type S-V, it is also possible to absorb compressive forces, although this is limited to one third of the tensile force.

Schöck Isokorb® T type S-N-D16



Views - Schöck Isokorb® T type S-N-D16

Schöck Isokorb® T type S-N-D22



Views - Schöck Isokorb® T type S-N-D22

T
type S

Steel – steel

[1)] If required, the insulating element can be cut off up to the steel plates (150 × 40 for the T type S-N).
[2)] Available fixing length

Schöck Isokorb® T type S
Views/Dimensions

Schöck Isokorb® T type S-V

The T type S-V is used to absorb compressive forces and shear forces. It consists of an insulating element (180/80/80 mm), two stainless threaded bars 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 T type S connection, the T type S-V is located in the area in which pressure is exerted due to the self weight. Different load combina-tions, including tensile forces, within a T type S connection, can be carried by the T type S-V, although the interaction condition $3V_d + 2\ H_d + F_{t,d} = \max F_{t,d} \leq F_{t,Rd}$ must be satisfied.

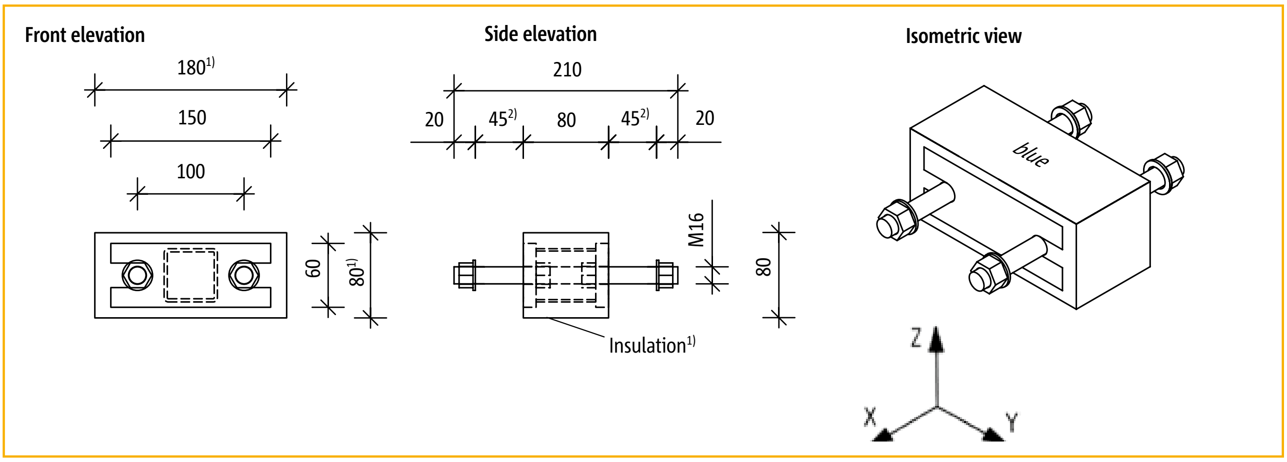
T type S

Steel – steel

[1] If required, the insulating element can be cut off up to the steel plates (150 × 60 for the T type S-V).
[2] Available fixing length

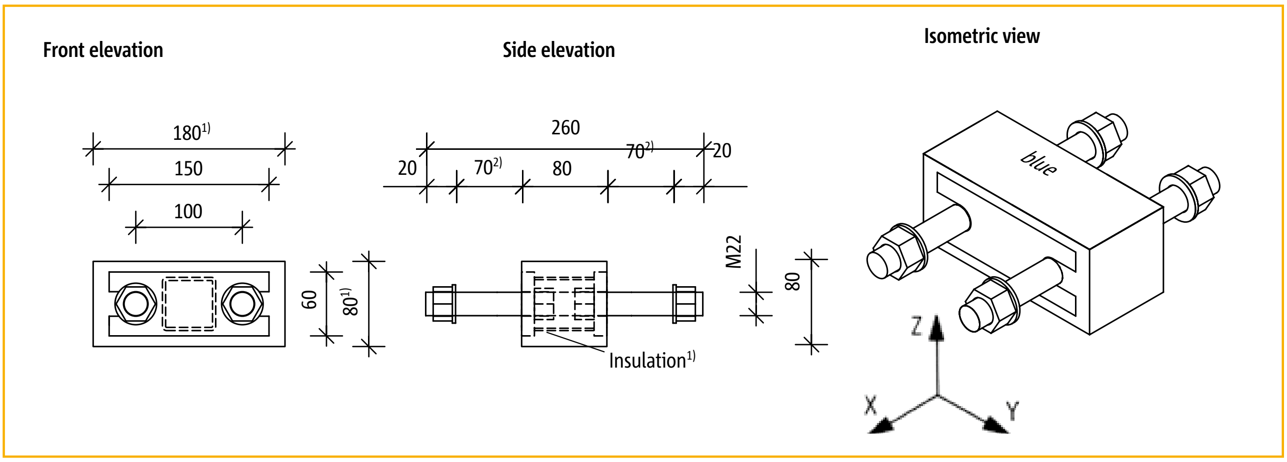
Schöck Isokorb® T type S
Views/Dimensions

Schöck Isokorb® T type S-V-D16



Views - Schöck Isokorb® T type S-V-D16

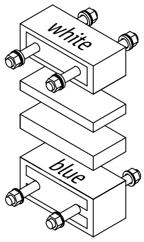
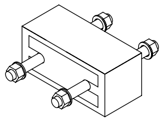
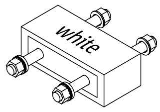
Schöck Isokorb® T type S-V-D22



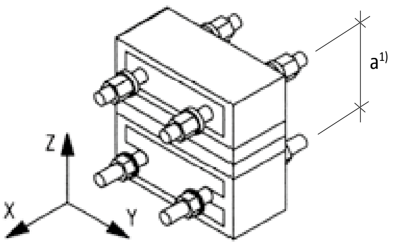
Views - Schöck Isokorb® module, T type S-V-D22

Schöck Isokorb® T type S

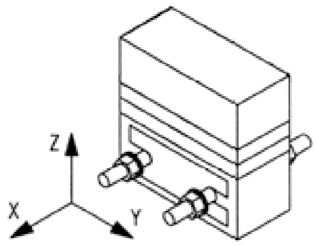
Design and capacity table

Schöck Isokorb® type			 T type S-V: blue			
	T type S-D16	**T type S-D22**	**T type S-V-D16**	**T type S-V-D22**	**T type S-N-D16**	**T Type S-N-D22**
$H_{y,Rd}$	±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
$M_{y,Rd}$	$a \times F_{x,t,Rd}$[1]	$a \times F_{x,t,Rd}$[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® T type S



Schöck Isokorb® T type S-V

1) a = distance between the tension bars and compression bars of the Isokorb® element (inner lever arm), minimum possible axis separation between tension bars and compression bars = 50 mm (without insulating adapters after processing of the polystyrene – see pages 74 - 77[1]).

2) We recommend that you discuss the static system and calculations with the Schöck design department, tel. 0845 241 3390.

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.

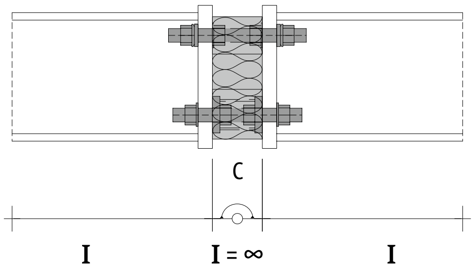
4) When using at least two modules arranged one above the other, it is possible to transfer both positive and negative forces (moments and shear forces) in accordance with the design variants on pages 83 - 94.

5) Please make sure that you read the notes on expansion joints/fatigue resistance on pages 80 - 81 below.

6) If the T type S-N module is subjected to pressure loads within a T type S connection (e.g. wind loads generating slight lift-off), then the T type S-N 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.

Schöck Isokorb® T type S
Torsion spring strength/Notes on calculations

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 83	3 700 × a²	$\varphi = \frac{M_K}{C}$	
No. 4 - see page 84	6 000 × a²		
No. 5 - see page 86	5 200 × a²		
No. 6 - see page 86	12 000 × a²		
No. 7 - see page 87	24 000 × a²		
No. 8 - see page 88	6 000 × a²		
No. 9 - see page 90	12 000 × a²		
No. 10 - see page 92	24 000 × a²		

a [cm] = refer to the design variants on pages 82 - 94.
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 17 900 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 T type S 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® T type S 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 T type S, when used in conjunction with BS 5950-1:2000 and Steel Construction Institute Publication P291, have been approved by the Flint & Neill Partnership, London.

- End plate thickness:
  In the case of the connection of I-profiles in accordance with the design variants below, the indicated end plate thicknesses, using mild steel S235, can be adopted without further verification or proof. Smaller end plate thicknesses can be obtained with more accurate verification or proof.
  If the geometry is different then the end 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 T type S-V.

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

Schöck Isokorb® T type S
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.

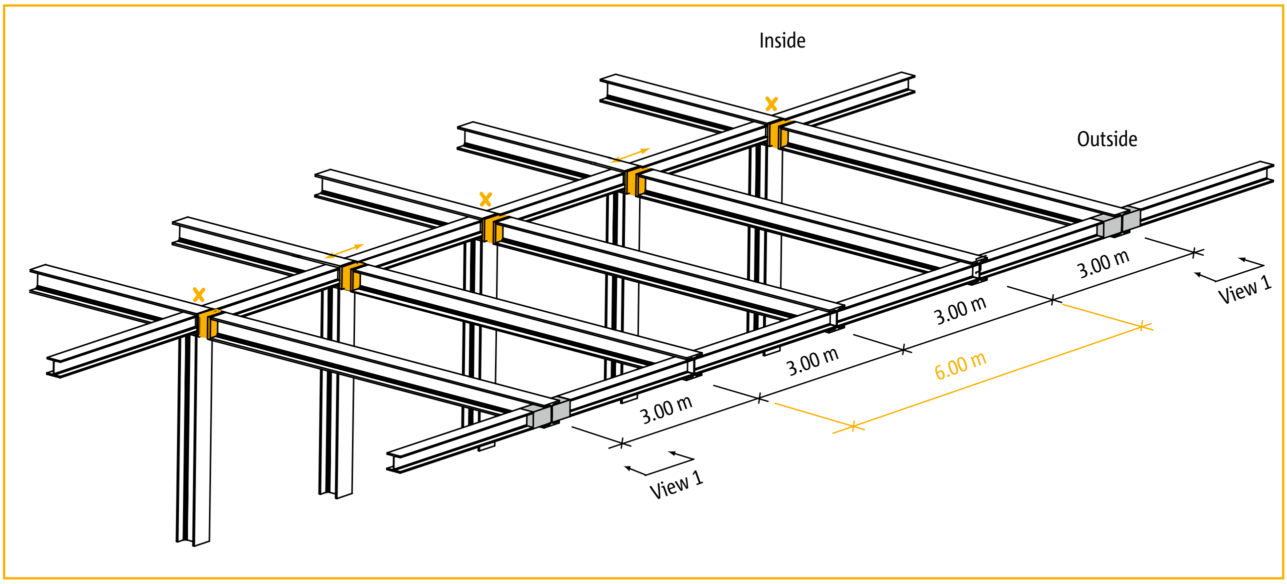
If, nonetheless, temperature deformations are assigned directly to the Isokorb® connection, then the Isokorb® T type S construction will be fatigue-resistant up to a construction length of 6 m by virtue of its special components (T type S-V: sliding film on the pressure plate; T type S-N). At greater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

Horizontal slots are needed in the on-site end plate for the T type S-V 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:

- Schöck Isokorb®
- Expansion joint
- FIXED: No slots required
- MOVEABLE: Horizontal slots in the on-site front plate for T type S-V (compression zone)

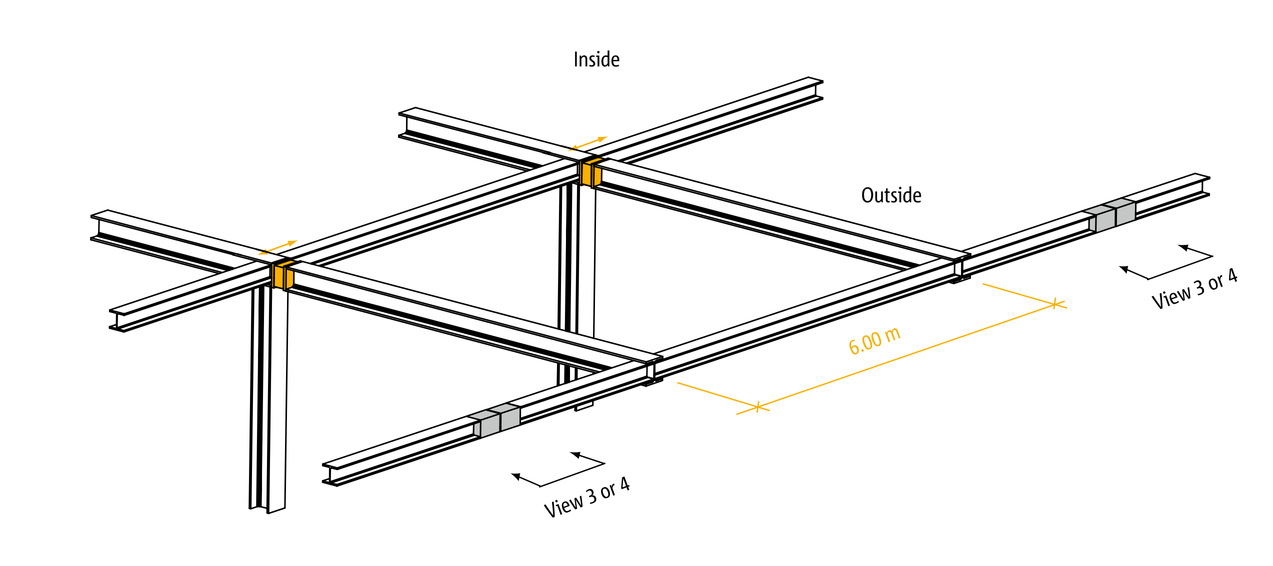


Example showing the arrangement of expansion joints, variant 1

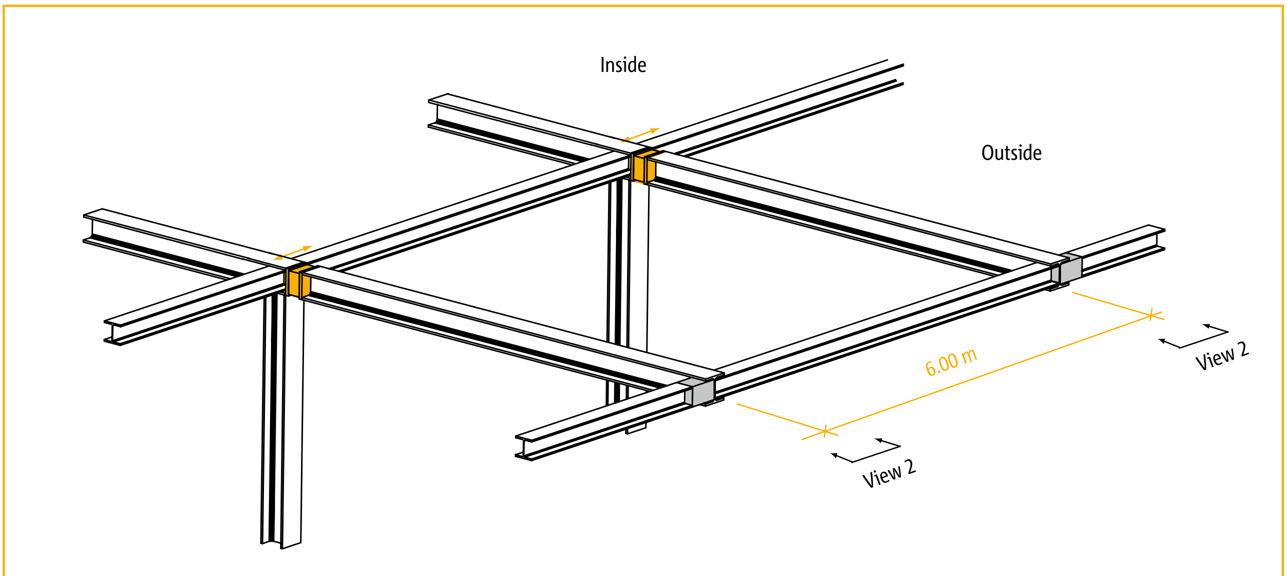
T type S

Steel – steel

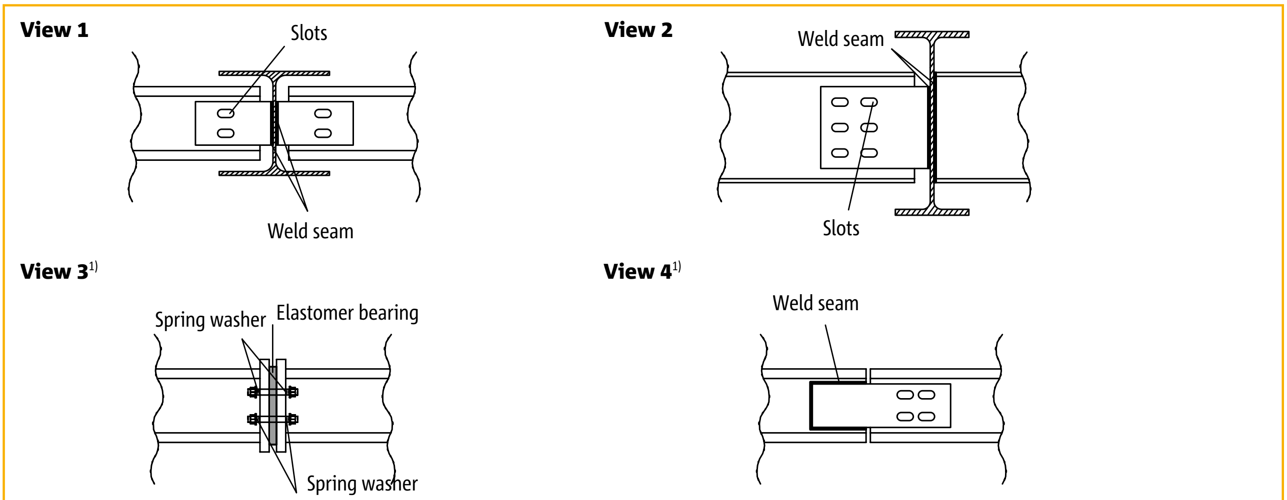
Schöck Isokorb® T type S
Expansion joints/Fatigue resistance



Example showing the arrangement of expansion joints, variant 2



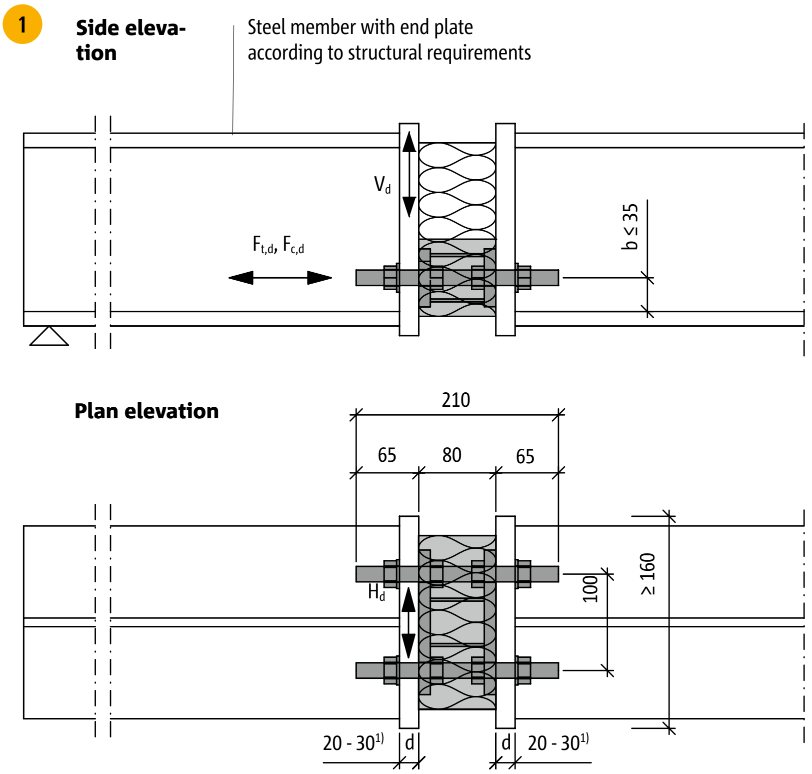
Example showing the arrangement of expansion joints, variant 3



[1)] Only partial moment transfer possible.

Schöck Isokorb® T type S-V-D16

Design configuration and example



T type S-V-D16	
H_{Rd}	6 kN[2)]
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 end plate thicknesses [d] without detailed verification, using mild steel S235:

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

2) Always refer to the information about expansion joints/fatigue resistance on pages 80 - 81.

Schöck Isokorb® T type S-V-D16

Example showing a supported connection of an UB 152 × 89 with a T type S-V-D16

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

Verifications for T type S-V-D16

Shear force

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

$V_{z,d}/V_{z,Rd,S\text{-}V\text{-}D16} = 25\text{ kN}/30\text{ kN} = 0.83 \quad < 1.0$

$H_d/H_{Rd,S\text{-}V\text{-}D16} = 3\text{ kN}/6\text{ kN} = 0.5 \quad < 1.0$

Compression

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

$F_{c,d}/F_{c,Rd,T\text{ type }S\text{-}V\text{-}D16} = 80\text{ kN}/116.8\text{ kN} = 0.68 < 1.0$

Tensile force (see note on page 78)

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

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

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

$\max F_{t,d}/F_{t,Rd,S\text{-}V\text{-}D16} = 111\text{ kN}/116.8\text{ kN} = 0.95 < 1.0$

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

$$\frac{F_{c,d}}{F_{c,Rd,S\text{-}V\text{-}D16}} \text{ or } \frac{\max F_{t,d}}{F_{t,Rd,S\text{-}V\text{-}D16}} \begin{cases} \leq 1.0 & : 30\text{ mm} \\ \leq 0.75 & : 25\text{ mm} \\ \leq 0.5 & : 20\text{ mm} \end{cases}$$

$\frac{\max F_{t,d}}{F_{t,Rd,S\text{-}V\text{-}D16}} = 0.95 < 1.0$ C d = 25 mm

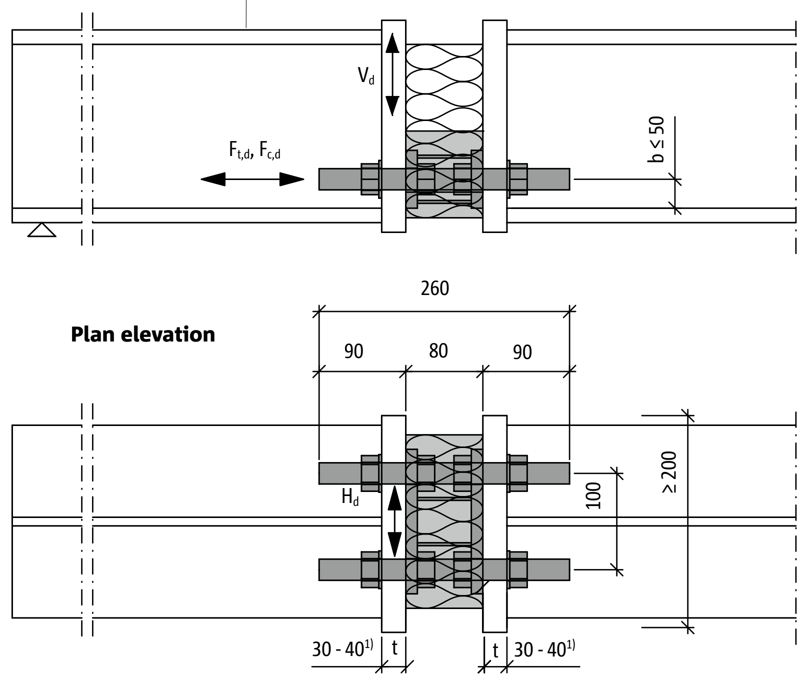
Schöck Isokorb®

Design configurations, T type S-V-D22, T type S-D16

2 **Side elevation**

Steel member with end plate according to structural requirements

Plan elevation



T type S-V-D22	
H_{Rd}	6 kN[2]
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 end plate thicknesses [d] without detailed verification, using mild steel S235:

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

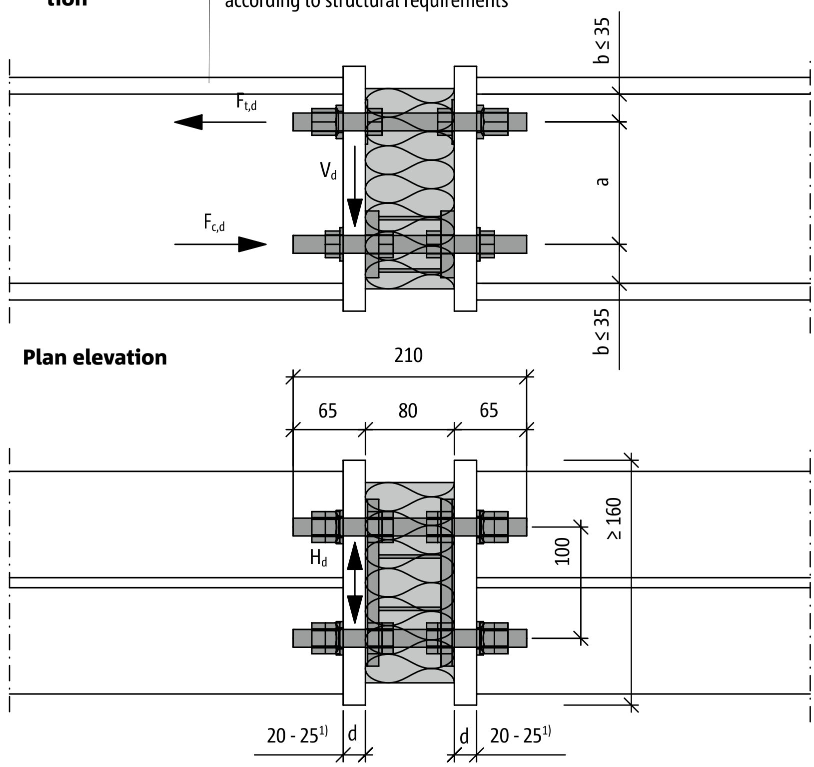
[2] Always refer to the information about expansion joints/fatigue resistance on pages 80 - 81.

Schöck Isokorb® T type S-V-D22

3 **Side elevation**

Steel member with end plate according to structural requirements

Plan elevation



T type S-D16	
H_{Rd}	6 kN[2]
V_{Rd}	30 kN
$F_{t,Rd}$, $F_{c,Rd}$	116.8 kN

[1] Minimum end 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

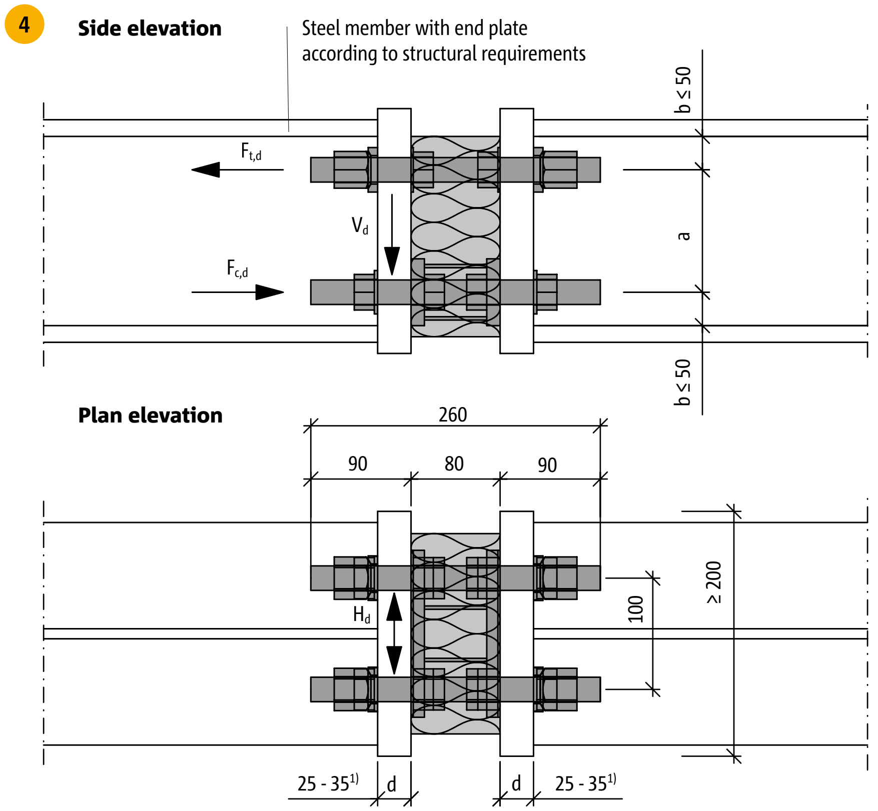
a < 150: 30 mm

[2] Always refer to the information about expansion joints/fatigue resistance on pages 80 - 81.

Schöck Isokorb® T type S-D16

Schöck Isokorb® T type S-D22

Design configuration and example



T type S-D22	
H_{Rd}	6 kN[2)]
V_{Rd}	36 kN
Z_{Rd}, D_{Rd}	225.4 kN

[1)] Minimum end 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 80 - 81.

Schöck Isokorb® T type S-D22

Example of moment connections for UB 203 × 23 with T type S-D22

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

Verifications for T type S

Shear force and horizontal force

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

$V_{z,d}/V_{z,Rd,S\text{-}V\text{-}D22}$ = 32 kN/36 kN = 0.89 < 1.0
$H_d/H_{Rd,S\text{-}V\text{-}D22}$ = 4 kN/6 kN = 0.67 < 1.0

Moment at load case 1

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

$F_{c,d} = F_{t,d} = M_{y,d}/a$ = 18 kNm/0.12 m = 150 kN
$F_{c,d}/F_{c,Rd,S\text{-}V\text{-}D22}$ = 150 kN/225.4 kN = 0.67 < 1.0
$F_{t,d}/F_{t,Rd,S\text{-}N\text{-}D22}$ = 150 kN/225.4 kN = 0.67 < 1.0

Moment at load case 2 (lifting off)

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

$F_{c,d} = F_{t,d} = M_{y,d}/a$ = 5 kNm/0.12 m = 41.67 kN
max $F_{t,d}$ = 41.67 kN < 225.4 kN = $F_{t,Rd,S\text{-}V\text{-}D22}$

T type S-N under compressive load
(see note on page 78)

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

max $F_{c,d} = M_{y,d}/a$ = 5 kNm/0.12 m = 41.67 kN
$F_{t,Rd,S\text{-}N\text{-}D22}/3$ = 225.4 kN/3 = 75.13 kN
max $F_{c,d,S\text{-}N\text{-}D22}$ = 41.67 kN < 75.13 kN = $F_{t,Rd,S\text{-}N\text{-}D22}/3$

Schöck Isokorb® T type S-D22
Example

T type S-V under tensile load (see note on page 78)
Interaction condition:
$3V_{z,d} + 2H_d + F_{t,d} = \max F_{t,d}$
$\max F_{t,d} = 3V_{z,d} + 2H_d + F_{t,d} = 3 \times 16 + 2 \times 4 + 41.67 = 97.67$ kN

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

$\max F_{t,d}/F_{t,Rd,S\text{-}N\text{-}D22} = 97.67/225.4 = 0.43 < 1.0$

Minimum end 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

$$a \le 150: \frac{F_{t,d}}{F_{t,Rd}} = 0.67 < 0.8 \text{ C } d = 30 \text{ mm}$$

Deformation due to $M_{y,d}$ (see page 79)
Buckling angle

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

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

$$\varphi = \frac{18/1.45^{1)} \times 100}{864000} = 1.4368 \times 10^{-3} \text{ [rad]}$$

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

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

Notes on the example

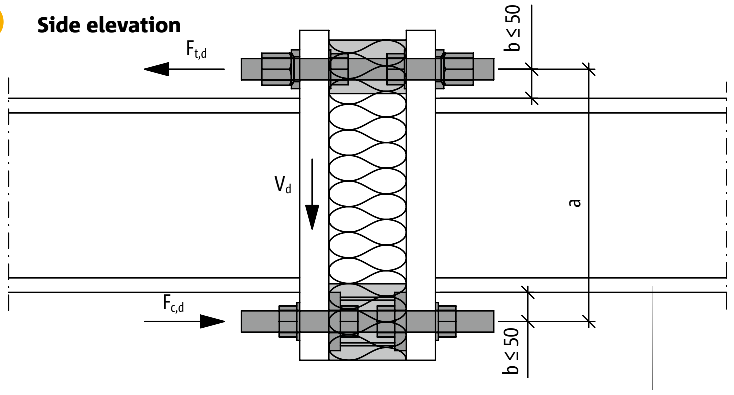
- The information relating to the fatigue resistance of expansion joints on pages 80 - 81 must be followed.
- In the event of a short-term tensile load (e.g. from wind suction) a T type S-V can be used, even if horizontal forces are introduced from temperature deformation H_d.
- The T type S-N can also be subjected to compressive loads of up to 1/3 $F_{t,Rd}$ (see footnote 6 on page 78).
- Greater stiffness can also be achieved with the arrangement no. 5.

Schöck Isokorb® T type S-D22

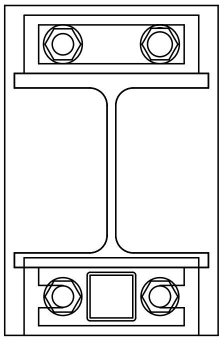
Design configurations

5

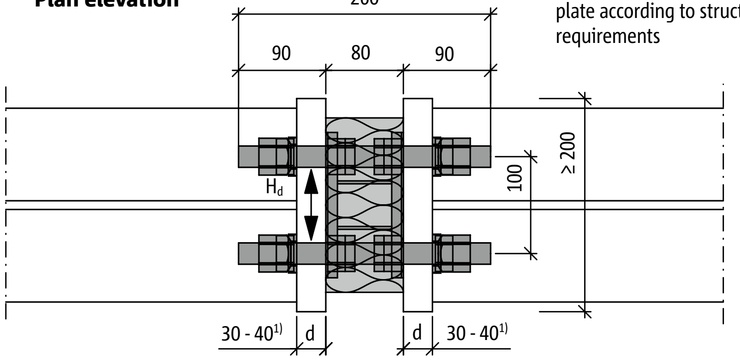
Side elevation



Front elevation



Plan elevation



Steel member with end plate according to structural requirements

T type S-D22	
H_{Rd}	6 kN[2)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

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

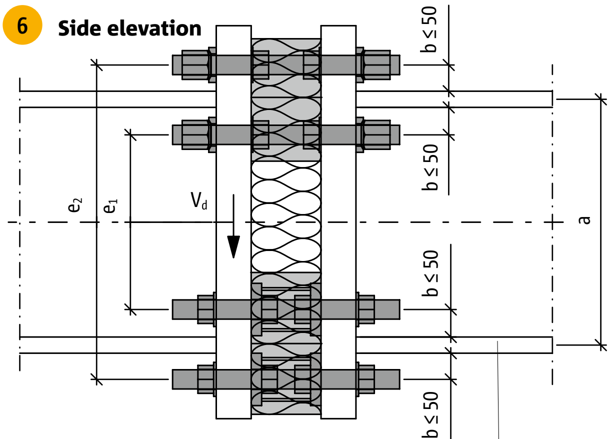
$\frac{F_{t,d}}{F_{t,Rd}}$ ≤ 1.0 : 40 mm
≤ 0.75 : 35 mm
≤ 0.5 : 30 mm

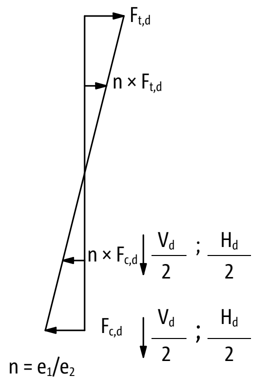
[2)] Always refer to the information about expansion joints/fatigue resistance on pages 80 - 81.

Schöck Isokorb® type KST 22

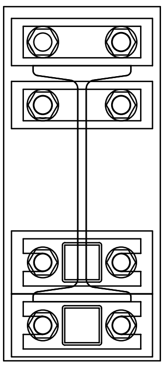
6

Side elevation

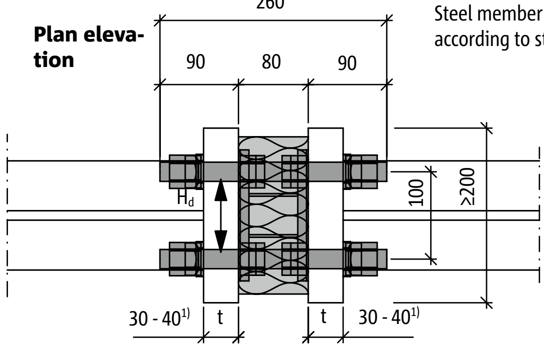




Front elevation



Plan elevation



Steel member with end plate according to structural requirements

Load-bearing capacity of the individual module:

T type S-D22	
H_{Rd}	6 kN[2)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

[1)] Minimum end 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

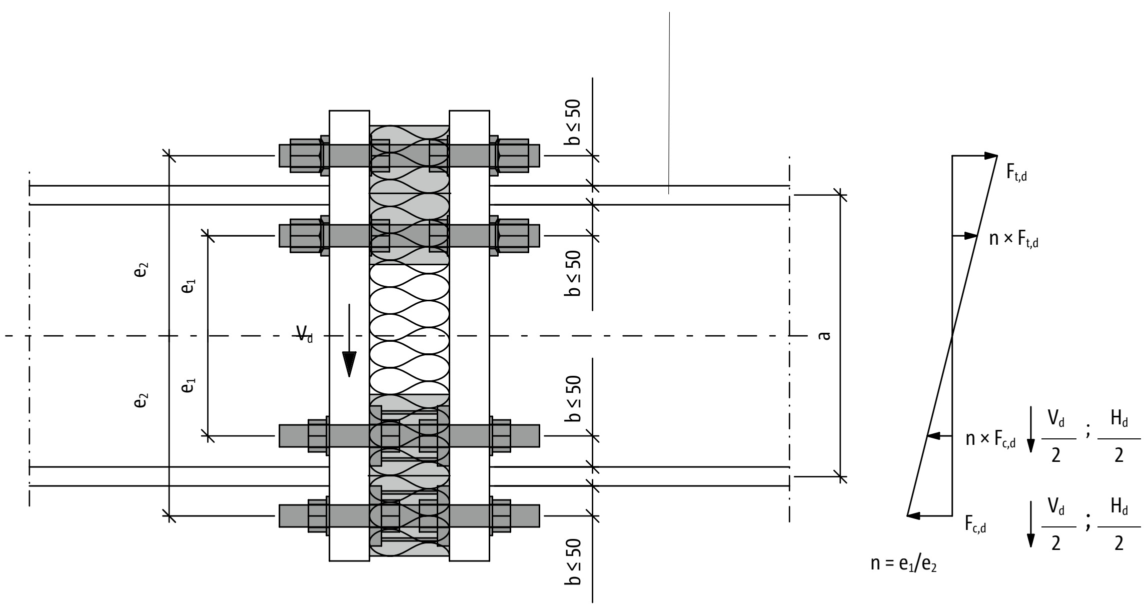
[2)] Always refer to the information about expansion joints/fatigue resistance on pages 80 - 81.

Schöck Isokorb® for connection of members with 2 × T type S-D22 (2 tensile and 2 compressive shear force modules)

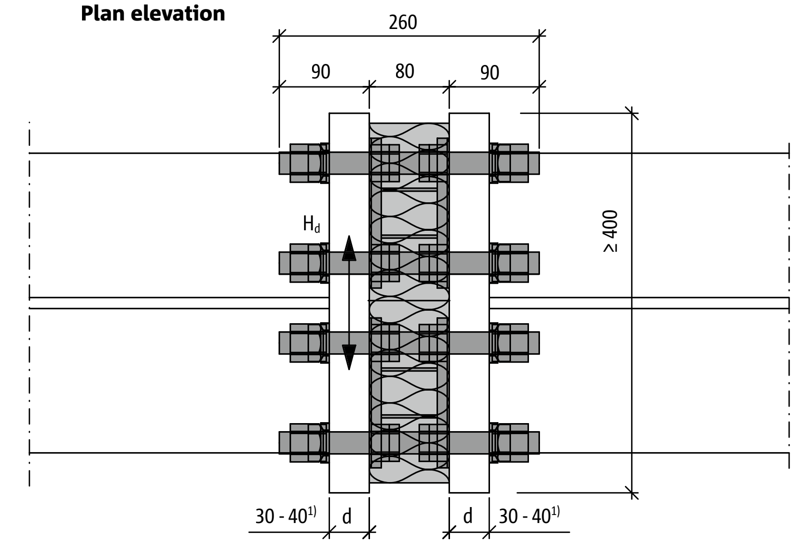
Schöck Isokorb® T type S-D22

Design configurations

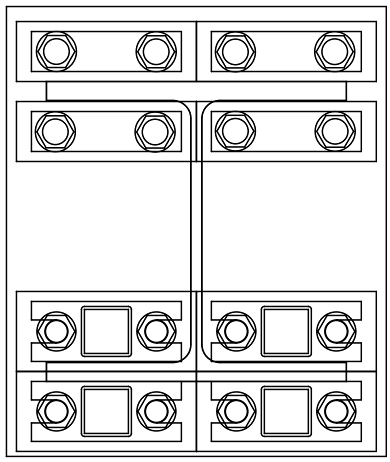
7 **Side elevation**



Plan elevation



Front elevation



[1] Minimum end 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 80 - 81.

Load-bearing capacity of the individual module:

T type S-D22	
H_{Rd}	6 kN[2]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

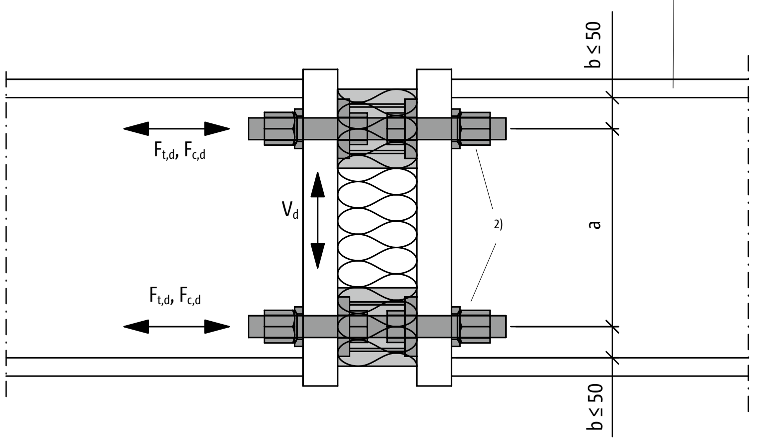
Schöck Isokorb® for connection of members with 4 × T type S-D22 (4 tensile and 4 compressive shear force modules)

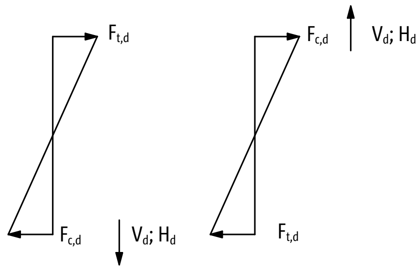
Schöck Isokorb® T type S-V-D22

Design configuration

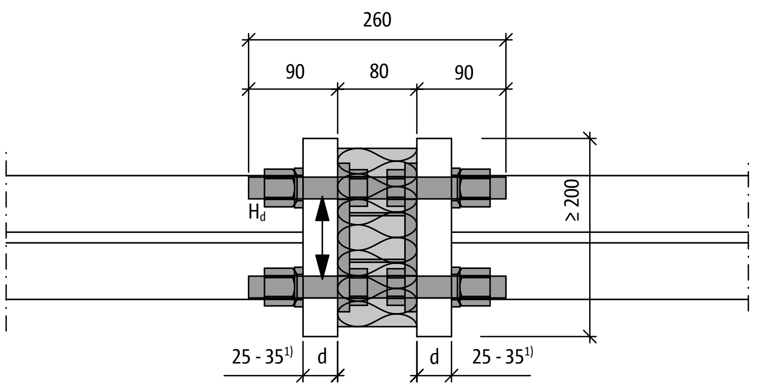
8 **Side elevation**

Steel member with end plate according to structural requirements

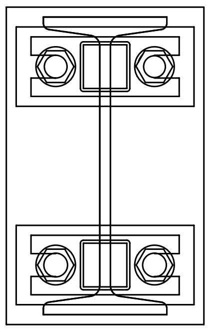




Plan elevation



Front elevation



Load-bearing capacity of the individual module:

T type S-V-D22	
H_{Rd}	6 kN[3)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

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

$$\frac{F_{t,d} \text{ per module}}{F_{t,Rd}} \quad \begin{array}{l} \leq 1.0 : 35 \text{ mm} \\ \leq 0.8 : 30 \text{ mm} \\ \leq 0.5 : 25 \text{ mm} \end{array}$$

[2)] Always refer to the information about expansion joints/fatigue resistance on pages 80 - 81.

Schöck Isokorb® for connection of members with 2 T type S-V-D22

Example: type T type S-V-D22

Example of moment connections for UB 203 × 23 for lifting-off forces with 2 × T type S-V-D22

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

Verifications for T type S-V-D22

Shear force and horizontal force

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

$V_{z,d}/V_{z,Rd,S\text{-}V\text{-}D22}$ = 32 kN/36 kN = 0.89 < 1.0
$H_d/H_{Rd,S\text{-}V\text{-}D22}$ = 5 kN/6 kN = 0.83 < 1.0

Moment at load case 1

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

$F_{c,d} = F_{t,d} = M_{y,d}/a$ = 18 kNm/0.12 m = 150 kN
$F_{c,d}/F_{c,Rd,S\text{-}V\text{-}D22}$ = 150 kN/225.4 kN = 0.67 < 1.0
$F_{t,d}/F_{t,Rd,S\text{-}V\text{-}D22}$ = 150 kN/225.4 kN = 0.67 < 1.0

Shear force and moment at load case 2 (lifting off)

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

$V_{z,d}/V_{z,Rd,S\text{-}V\text{-}D22}$ = 34 kN/36 kN = 0.94 < 1.0

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

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

$F_{c,d}/F_{c,Rd,S\text{-}V\text{-}D22}$ = 166.67 kN/225.4 kN = 0.74 < 1.0
$F_{t,d}/F_{t,Rd,S\text{-}V\text{-}D22}$ = 166.67 kN/225.4 kN = 0.74 < 1.0

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

$$\frac{\max F_{t,d}}{F_{t,Rd,S\text{-}V\text{-}D22}} \begin{cases} \leq 1.0 & : 35\text{ mm} \\ \leq 0.8 & : 30\text{ mm} \\ \leq 0.5 & : 25\text{ mm} \end{cases}$$

$$\frac{F_{t,d}}{F_{t,Rd}} = 0{,}74 < 0.8 \text{ C d} = 30\text{ mm}$$

Deformation due to $M_{y,d}$ see page 79

Notes

- One T type S-N-D22 in the upper tensile area structurally is not sufficient; furthermore, the interaction cannot be satisfied for the T type S-V under tensile loads.

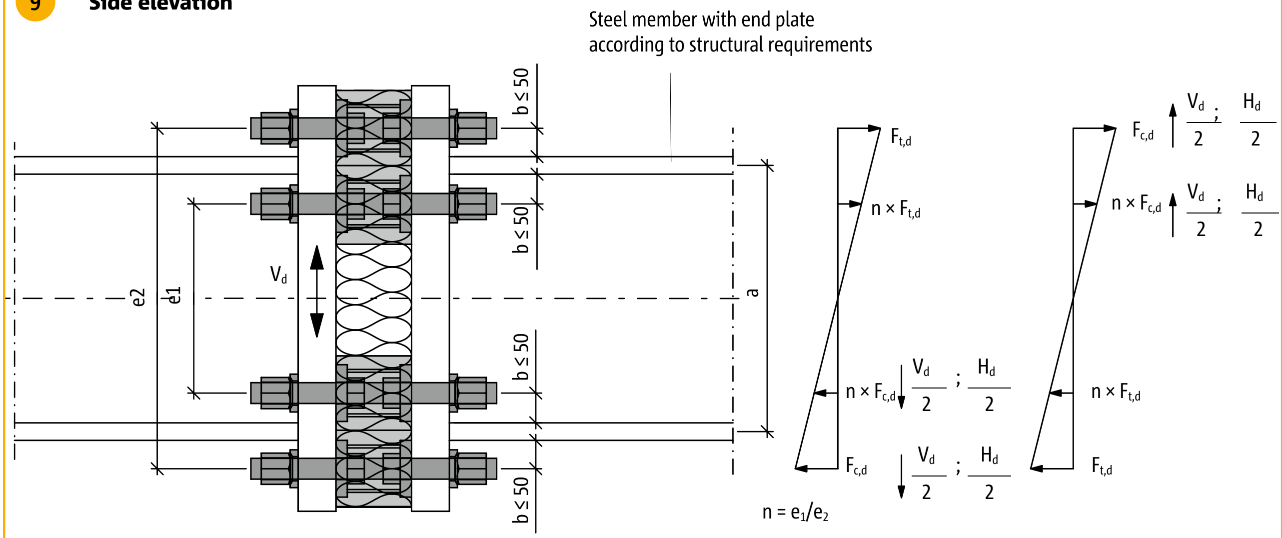
  $$(F_{c,d} = 166.67 \geq \frac{225.4}{3} = F_{t,Rd})$$

- In the lower area, tensile forces due to the wind will only occur for a limited time. Accordingly, a single T type S-V would offer sufficient fatigue resistance.
- As it cannot be ensured that the T type S-V 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.

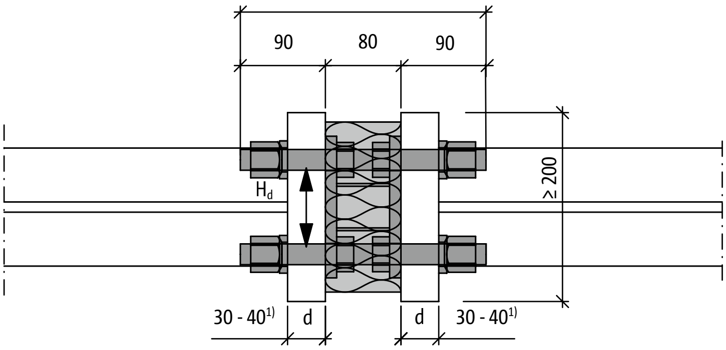
Schöck Isokorb® type T type S-V-D22

Design configuration

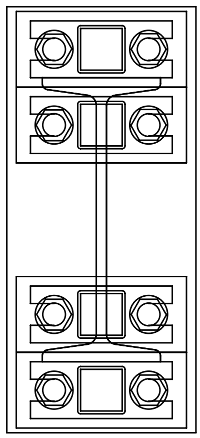
9 **Side elevation**



Plan elevation



Front elevation



Load-bearing capacity of the individual module:

T type S-V-D22	
H_{Rd}	6 kN[3]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

[1] Minimum end 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 80 - 81.

Schöck Isokorb® for connection of members with 4 T type S-V-D22

Schöck Isokorb®
Example: T type S-V-D22

Example of moment connections for UB 356 × 33 for lifting-off forces with 4 × T type S-V-D22

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 T type S-V-D22

Shear force

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

$V_{z,Rd,\ S\text{-}V\text{-}D22}$ = 2 × 36 kN = 72 kN
$V_{z,d}/V_{z,Rd,\ S\text{-}V\text{-}D22}$ = 55 kN/72 kN = 0.76 < 1.0

Moment at load case 1

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

$F_{c,d} = F_{t,d}$ = 130 kNm/(0.45 m + (0.25 m/0.45 m × 0.25m))
$F_{c,d} = F_{t,d}$ = 220.8 kN

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

$F_{c,d}/F_{c,Rd,\ S\text{-}V\text{-}D22}$ = 220.8 kN/225.4 kN = 0.98 < 1.0
$F_{t,d}/F_{t,Rd,\ S\text{-}V\text{-}D22}$ = 220.8 kN/225.4 kN = 0.98 < 1.0

Shear force and moment at load case 2 (lifting off)

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

$V_{z,Rd,\ S\text{-}V\text{-}D22}$ = 2 × 36 kN = 72 kN
$V_{z,d}/V_{z,Rd,\ S\text{-}V\text{-}D22}$ = 40 kN/72 kN = 0.55 < 1.0

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

$F_{c,d} = F_{t,d}$ = 80 kNm/(0.45 m + (0.25 m/0.45 m × 0.25m))
$F_{c,d} = F_{t,d}$ = 135.8 kN

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

$F_{c,d}/F_{c,Rd,\ S\text{-}V\text{-}D22}$ = 135.8 kN/225.4 kN = 0.6 < 1.0
$F_{t,d}/F_{t,Rd,\ S\text{-}V\text{-}D22}$ = 135.8 kN/225.4 kN = 0.6 < 1.0

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

$$\frac{\max F_{t,d}}{F_{t,Rd,\ S\text{-}V\text{-}D22}} \begin{cases} \le 1.0 & : 40 \text{ mm} \\ \le 0.8 & : 35 \text{ mm} \\ \le 0.5 & : 30 \text{ mm} \end{cases}$$

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

Deformation due to $M_{y,d}$ see page 79

Notes

- One T type S-N-D22 in the upper tensile area structurally is not sufficient; furthermore, the interaction cannot be satisfied for the T type S-V under tensile loads.

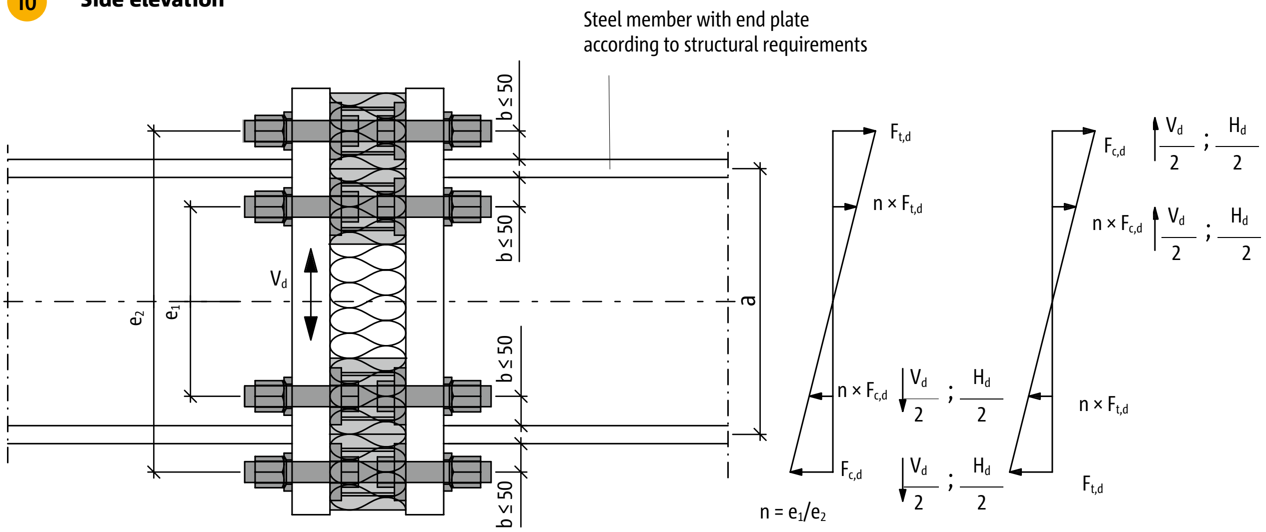
  $$\left(F_{c,d} = 166.67 \ge \frac{225.4}{8} = F_{t,Rd}\right)$$

- In the lower area, tensile forces due to the wind will only occur for a limited time. Accordingly, a single T type S-V would offer sufficient fatigue resistance.
- As it cannot be ensured that the T type S-V 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.

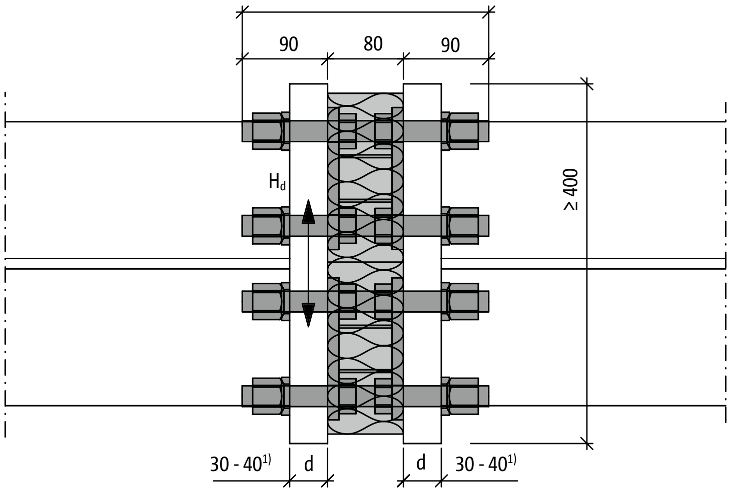
Schöck Isokorb® T type S-V-D22

Design configuration

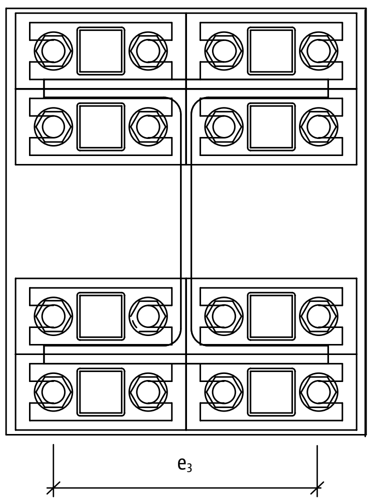
10 **Side elevation**



Plan elevation



Front elevation



Load-bearing capacity of the individual module:

T type S-V-D22	
H_{Rd}	6 kN[2)]
V_{Rd}	36 kN
$F_{t,Rd}$, $F_{c,Rd}$	225.4 kN

[1)] Minimum end 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 80 - 81.

Schöck Isokorb® for connection of members with 8 T type S-V-D22

Schöck Isokorb®
Example: T type S-V-D22

Example: Moment connection for HEA 360 with 4 × T type S-V-D22

Loads:
Load case 1 (status during usage): $V_{z,d}$ = 126 kN H_d = ±20 kN $M_{y,d}$ = –236 kNm
Load case 2 (assembly): $V_{z,d}$ = –96 kN $M_{y,d}$ = 166 kNm $M_{z,d}$ = ±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 and horizontal force at load case 1

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

$V_{z,Rd,T\ type\ S\text{-}V\text{-}D22}$ = 4 × 36 kN = 144 kN
$V_{z,d}/V_{z,Rd,T\ type\ S\text{-}V\text{-}D22}$ = 126 kN/144 kN = 0.88 < 1.0

$H_{Rd,S\text{-}V\text{-}D22}$ = 4 × 6 kN = 24 kN
$H_d/H_{Rd,T\ type\ S\text{-}V\text{-}D22}$ = 20 kN/24 kN = 0.83 < 1.0

Moment at load case 1

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

$$F_{t,Rd,S\text{-}V\text{-}D22} = \frac{M_{y,d}}{2 \times e_2 + 2 \times \frac{e_1}{e_2} e_1}$$

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

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

$F_{c,d}/F_{c,Rd,S\text{-}V\text{-}D22}$ = 213.5 KN/225.4 KN = 0.95 < 1.0
$F_{t,d}/F_{t,Rd,S\text{-}V\text{-}D22}$ = 213.5 KN/225.4 KN = 0.95 < 1.0

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

$$\frac{\max F_{t,d}}{F_{t,Rd,S\text{-}V\text{-}D22}} \begin{cases} \leq 1.0 & : 40\ \text{mm} \\ \leq 0.8 & : 35\ \text{mm} \\ \leq 0.5 & : 30\ \text{mm} \end{cases}$$

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

Deformation due to $M_{y,d}$ (see page 79)

Buckling angle

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

$$\varphi = \frac{236/1.45 \times 100}{25.5336^{06}}\ [\text{rad}]$$

$$c = 24\,000 \times a^2$$

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

Loading combination during assembly:

Shear force at load case 2

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

$V_{z,Rd,S\text{-}V\text{-}D22} = 4 \times 36\ kN = 144\ kN$

$V_{z,d}/V_{z,Rd,S\text{-}V\text{-}D22} = 96\ kN/144\ kN = 0.66 < 1.0$

Moment at load case 2 (lifting off)

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

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

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

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

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

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

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

$$F_{c,d}/F_{c,Rd,S\text{-}V\text{-}D22} = 209.46\ KN/225.4\ KN = 0.93 < 1.0$$

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 $F_{x,c,d}$.

Schöck Isokorb® T type S

End plate dimensioning

Example - end plate protruding

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

Max. moment in the end plate:

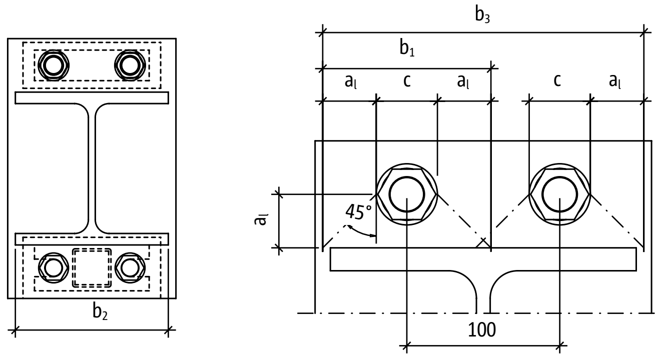
$M_d = F_{t,\,max,d,bolt} \times a_l = [\text{kNmm}]$

$W = d^2 \times b_{ef}/6 = [\text{mm}^2]$ with

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

$b_1 = 2 \times a_l + c$ [mm]
b_2 = member width or width of end plate [mm]
$b_3 = 2 \times a_l + c + 100$ [mm]

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



Schöck Isokorb® T type S-D22 dimensioning of the end plate

Example - end plate flush

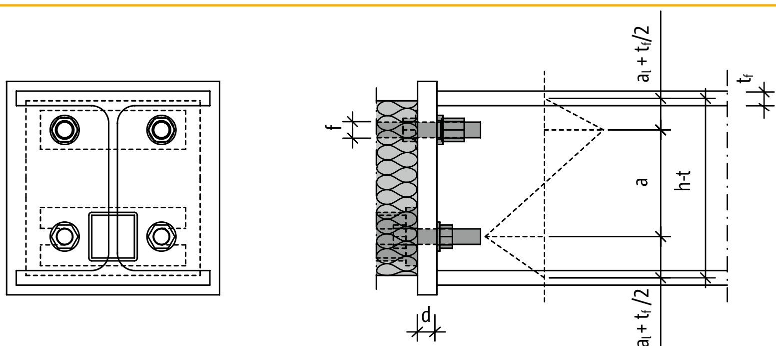
Max. tensile or compressive force per module: $F_{t,d} = F_{c,d}$

Max. moment in the end plate: $M_d = F_{t,d} \times (a_l + \frac{t}{2})$

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

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

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



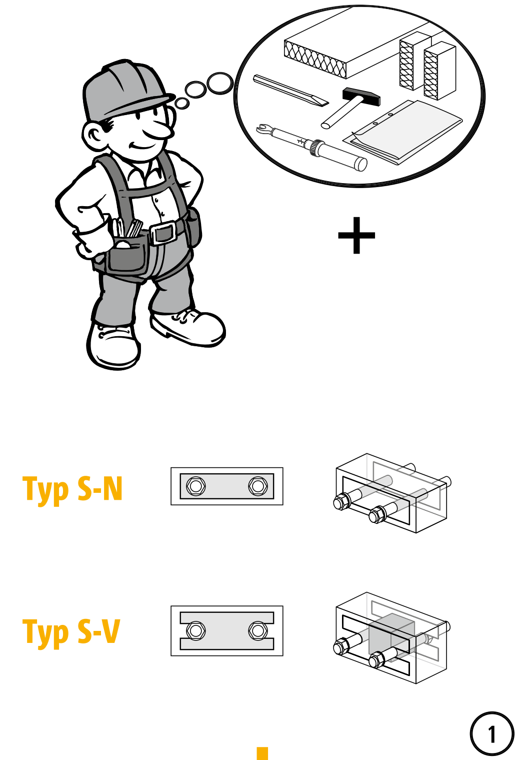
Schöck Isokorb® T type S-D16 dimensioning of the end plate

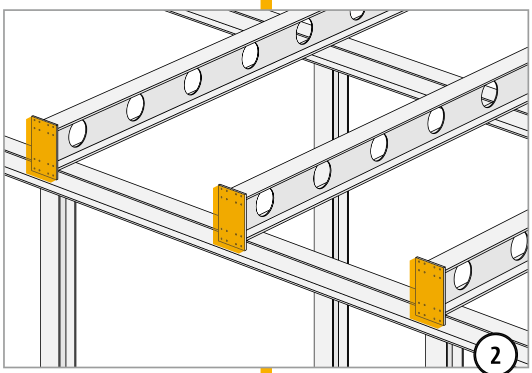
T
type S

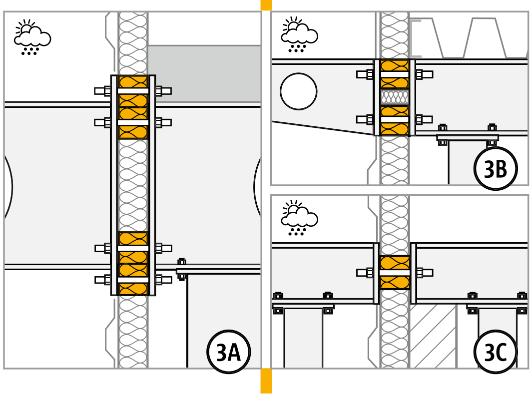
Steel – steel

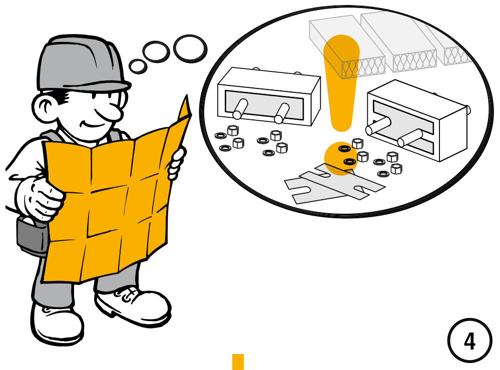
Schöck Isokorb® T type S

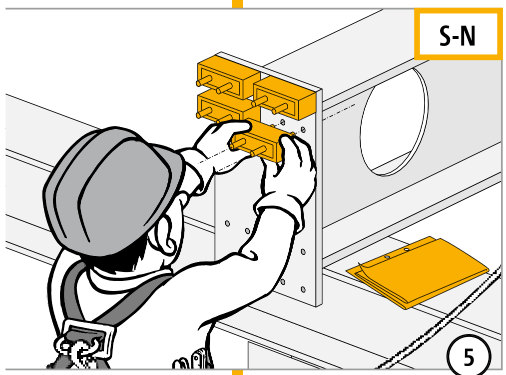
Method statement

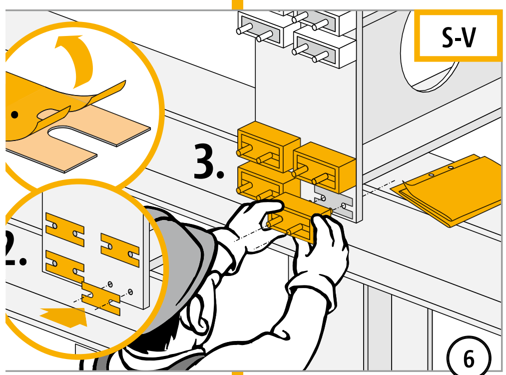


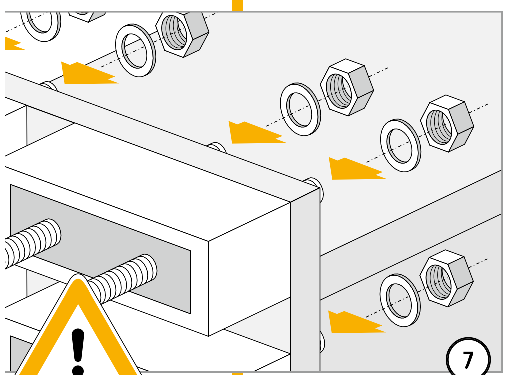


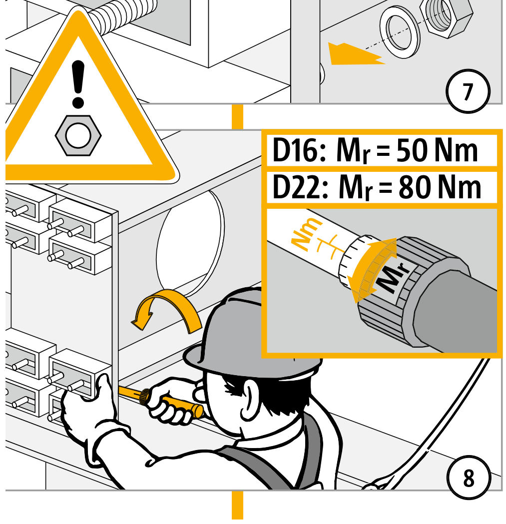




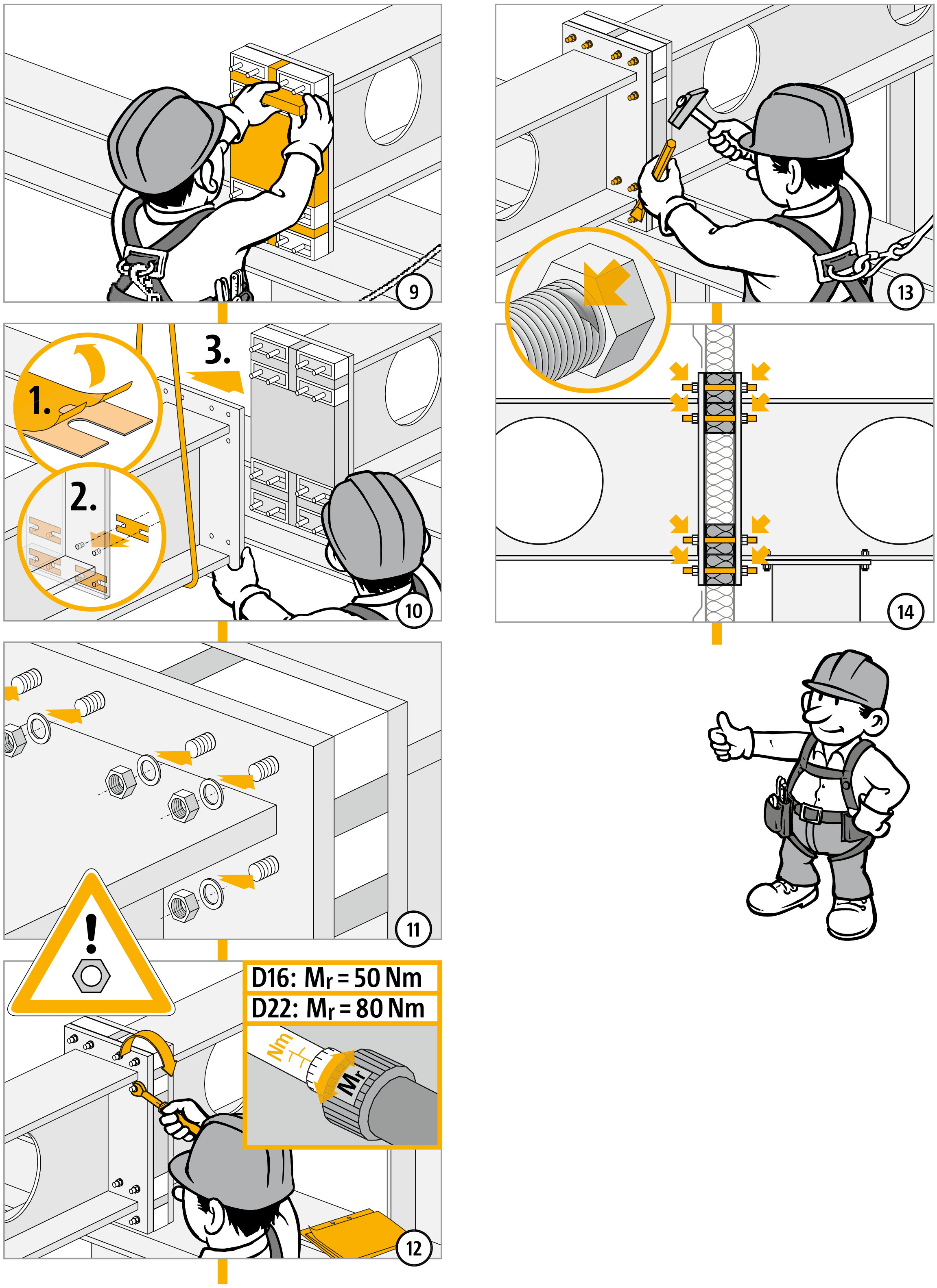




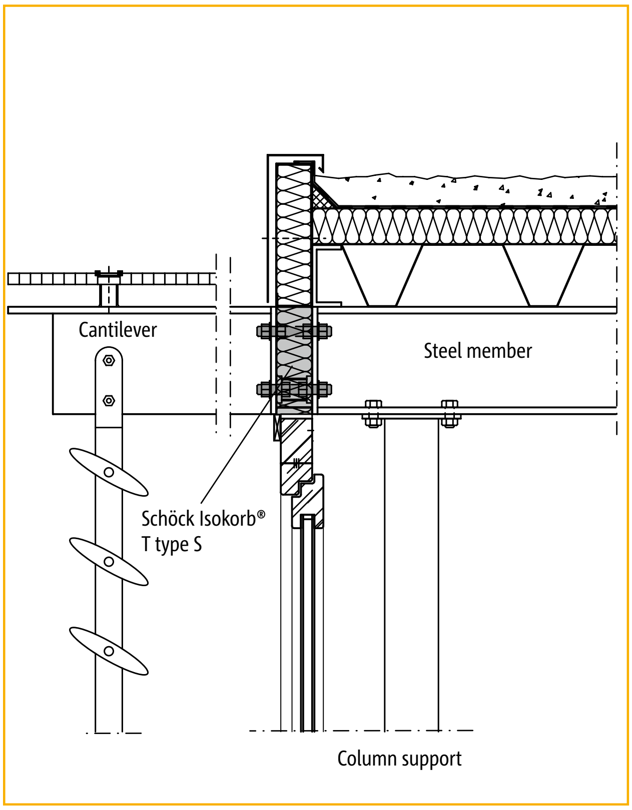




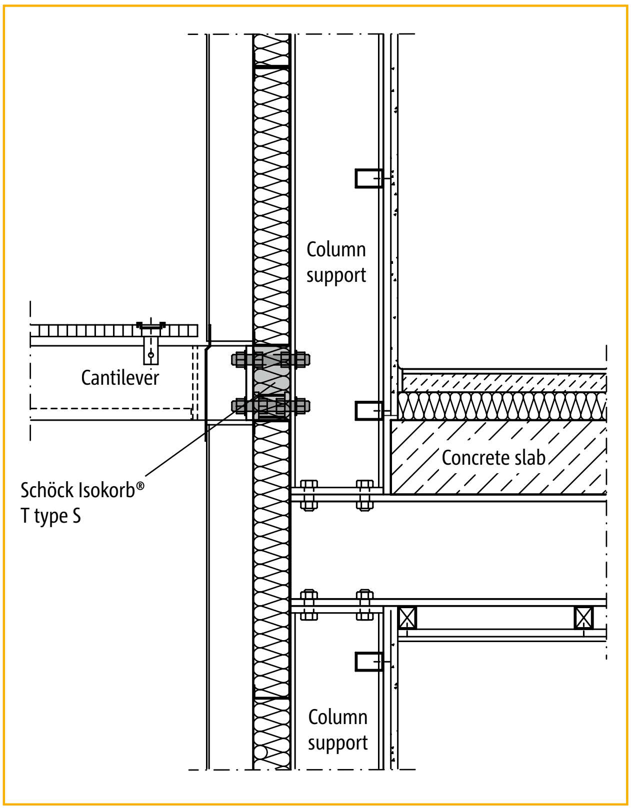
Schöck Isokorb® T type S
Method statement



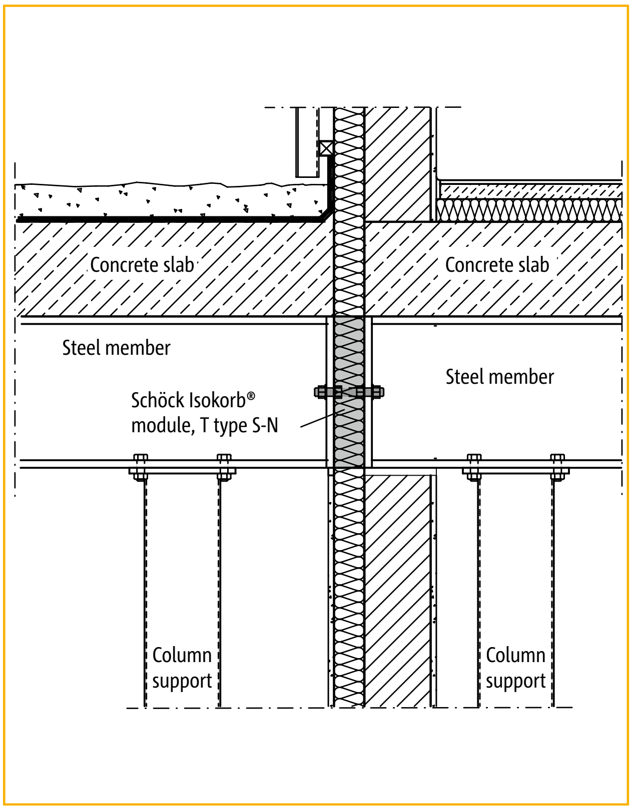
Schöck Isokorb® T type S
Constructions details



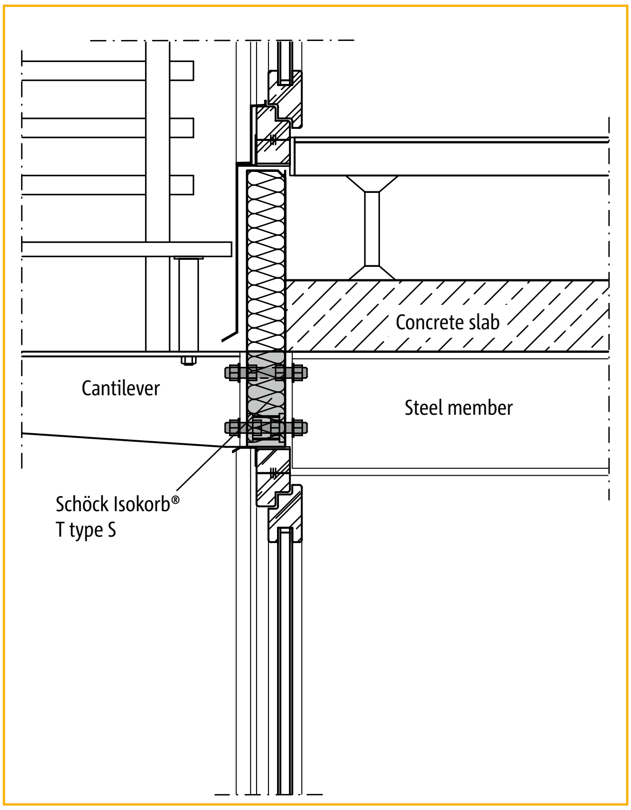
Provision of adjustable shading



Cantilevered canopy construction to column



Thermally insulated building transition



Façade balcony connection

Schöck Isokorb® T type S
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 79)?
- ☐ Are temperature deformations assigned directly to the Isokorb® connection? Expansion joint spacing (see pages 80 - 81)?
- ☐ Will the Isokorb® connection be exposed to an environement with a high chlorine content (e.g. inside indoor swimming pools) (see page 70)?
- ☐ Is there a fire safety requirement for the overall load-bearing structure/Isokorb® (see page 70)?
- ☐ Selection and calculation of the Isokorb® elements (refer also to pages 74 - 77 and the examples on pages 82 - 94)
  - Are the selected modules adequately dimensioned - refer to the “Design and calculation table” on page 78?
  - Have wind loads with a slight lift-off effect been assigned to the T type S connection (see page 78[6)])?
  - Is the interaction relationship $3 \times V_z + 2 \times H_y + Z_x = \max Z_d \leq Z_{x,Rd}$ satisfied for the T type S-V and under tensile loads with simultaneous shear loads (see page 78[3)])?
  - Have the T type S-V and been located in the compression area in order to transfer shear forces (refer to example 8 on pages 88 - 89)?
- ☐ End plate calculation without more detailed verification (see pages 82 - 92):
  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 82 - 94)?
  Front plate calculation with detailed verification: see page 95
- ☐ Did the deformation calculations for the overall structure take into account the deformation due to M_K in the Isokorb® connection (see page 79)?
- ☐ 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 96 - 97)? The nuts should be tightened spanner-tight without planned preload; the following tightening torques apply:

  T type S-D16 (bolt ø 16): M_r = 50 Nm
  T type S-D22 (bolt ø 22): M_r = 80 Nm