BUILDING
COMMON GROUND

MAX FRANK®

Egcobox® FST

Thermal separation of
steel structures

Edition International

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Egcobox® FST

Thermal separation of steel structures

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Thermal separation of steel structures

Steel structures are a well established component of modern architecture. As an elegant, transparent construction they offer excellent opportunities when combined with other materials such as glass, concrete or wood and provide the building with a certain lightness, predominantly in industrial and residential construction. Steel structures frequently impress through their flexibility of use and column-free zones, creating spacious and impressive large span areas.

Where steel construction is concerned, particular attention needs to be paid in the detailing of components that penetrate through the exterior shell of a building. With conventional construction methods, thermal bridges are created at the transition from the building to the projecting component. These lead to increased energy consumption, risk of condensation formation and the associated growth of mould. Thermal bridges impair, not only the quality and value of the building, but also the room climate.

According to current building regulations, thermal bridges should be reduced. The Egcobox® FST offers the ideal solution for the thermal isolation of steel structures without restricting the structural effectiveness of the support system.

Features of the Egcobox® FST

- reduced thermal bridging
- high structural functionality and corrosion resistance
- CE marking according to EN 1090
- type tested
- tailored manufacturing - specific to connection and project
- insulation: polystyrene (standard) or rock wool on request (A1)

CE

Egcobox® FST composition

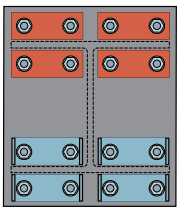
The Egcobox® FST is manufactured to precisely fit the specific project on the basis of the existing installation geometry and the structural requirements.

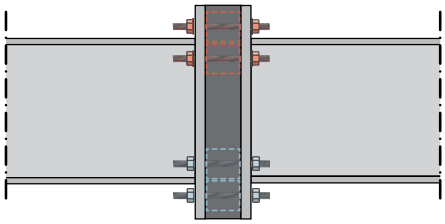
With the Egcobox® FST, distinction is made between components for tensile force stresses as well as normal or shear force stresses. A component consists of threaded rods, with a diameter of 16 mm or 22 mm, arranged in pairs.

Thanks to the customized manufacturing process, onsite modification or assembly of the Egcobox® FST is unnecessary.

Egcobox® FST type determination

FZST
FVST





Example: **Egcobox® type FST 16 – 4 / 4**

Type	Load-bearing capacity (Ø thread) [mm]	Number of FZST Components for tensile force stress [pc.]	Number of FVST Components for normal and shear force stresses [pc.]	Insulating material
FST	**16**	0	0	–
	22	1	1	**Polystyrene**
		2	2	SW Rock wool
		4	**4**	

The type designation does not provide information about the dimensions of the Egcobox® FST. The Egcobox® FST is adapted in the factory to the existing installation geometry.

The data required for the manufacture can be easily created with the help of the design forms (see pages 10/11).

Example 1:
Egcobox® type FST16–1/1 or FST22–1/1

consisting of:
1x FZST16 component or 1x FZST22 component
and
1x FVST16 component or 1x FVST22 component

Example 2:
Egcobox® type FST16–0/2 or FST22–0/2

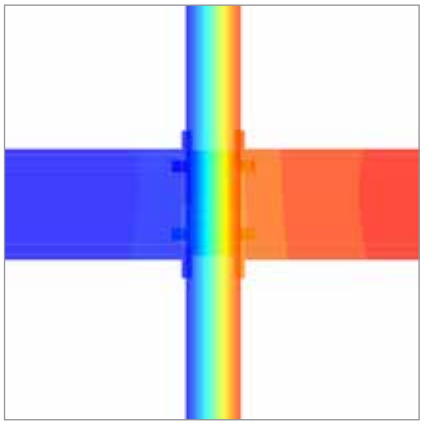
consisting of:
2x FVST16 component or 2x FVST22 component

Only threaded rods of the same diameter (Ø16 or Ø22) may be used in one Egcobox® FST.

Thermal insulation

Apart from the legal regulations, the owners' demands on thermal insulation are also continually increasing. The focus here is not just on environmental protection and the saving of heating costs, but also on a healthy room climate and thus on the prevention of condensation and the formation of mould.

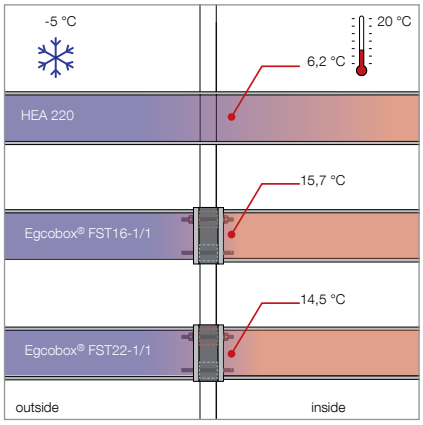
By means of the thermal separation of steel structures, the Egcobox® FST reduces thermal bridges and fulfils the requirements according to DIN 4108 supplementary sheet 2. The Egcobox® FST makes general considerations in the thermal calculation achievable.



Thermal bridges – comparison

The detailed thermal bridge verification clearly shows the improvement due to the use of the Egcobox® FST in comparison with continuous beams.

Steel structure	Continuous steel beam HEA 220	Egcobox® FST16-1/1	Egcobox® FST22-1/1
Temperature factor f_{rsi}	0.45	0.83	0.78
Indoor surface temperature $\Theta_{si,min}$ [°C]	6.2	15.7	14.5
Point thermal transmittance χ [W/K]	0.86	0.24	0.32



Fire protection

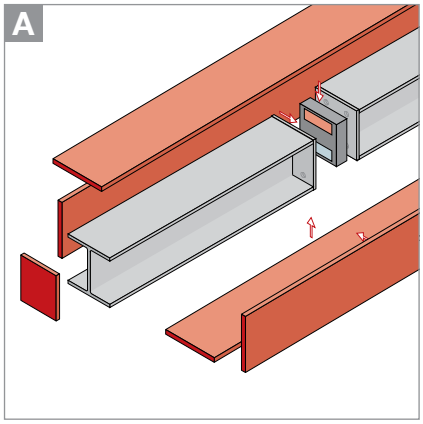
If there are requirements for fire protection, the entire steel structure, including the Egcobox® FST, must be protected against the effects of fire. In terms of planning, the same fire protection measures that are necessary for the entire steel support structure must also be taken into account for the Egcobox® FST.

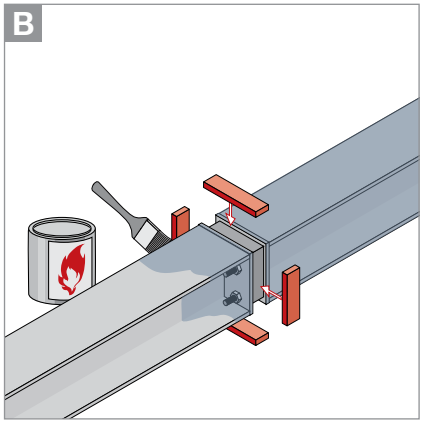
In the standard version, the Egcobox® FST is manufactured with polystyrene as the insulating material. At the customer's request, however, the Egcobox® FST can be manufactured completely from components of building material class A1 according to EN 13501 (rock wool insulation). The use of alternative insulation material rock wool depends on the geometry of the connection and should be checked according to project requirements by MAX FRANK.

Fire protection measures are not implemented in the factory and must therefore be carried out on site. The responsible specialist planner carries out the planning and ensures that the fire protection requirements are met.

Fire protection variants

- Cladding with fire protection plates (A)
  The entire structure, including the Egcobox® FST, is to be clad on site on all sides with fire protection plates.
- Fire protection through coating (B)
  The entire steel structure including the protruding threaded rods and nuts are to be provided with a fire protection coating. The insulation level of the Egcobox® FST must additionally be protected all round by fire protection plates.

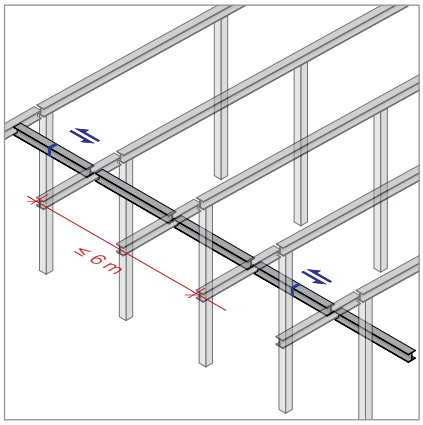




Movement joints

Components in the steel support structures are to be designed so that the deformations that occur do not impair the stability.

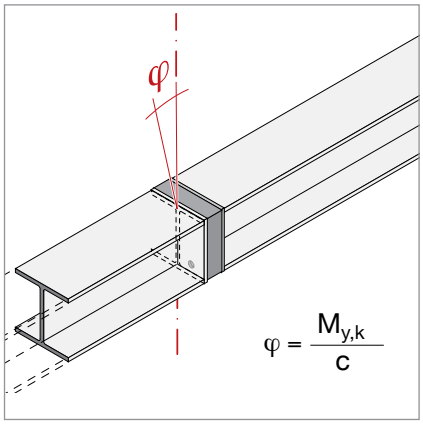
Structural damage often occurs as a result of inadequate detailed planning. Amongst other things, different temperature expansions can lead to stresses in the steel structure. The maximum distance between Egcobox® FST elements that are not interrupted by a movement joint must therefore be limited to 6.0 m.



Deformation / rotation

Through the use of an Egcobox® FST, a cantilever beam, for example, is interrupted or the steel cross-section is reduced in the joint area. A different rigidity must be applied for the Egcobox® FST than for the steel beam. On account of the moment action with cantilever beams, the associated torsion from the Egcobox® FST is to be taken into account. The rotation of the Egcobox® FST can be stated with:

φ	[rad]	Rotation angle / kink angle
$M_{y,k}$	[kN*cm]	Characteristic moment
c	[kN*cm/rad]	Rotation rigidity
z	[cm]	Lever arm
n	[pc.]	Number of threaded rods per connection

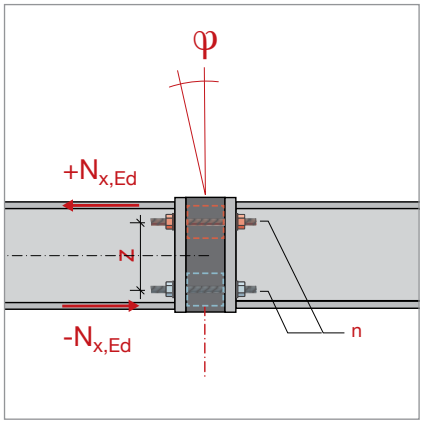


Torsion spring stiffness per threaded rod c [kN*cm/rad]

Egcobox® FST16	Egcobox® FST22
$c = n * 1/2 * 1779.33 * z^2$	$c = n * 1/2 * 3030 * z^2$

The following factors must be considered when assessing the rotation:

- Only the torsion spring stiffness is calculated, the vertical spring can be neglected.
- The end plate is regarded as infinitely rigid.
- Deformations can additionally occur in the adjoining structures.
- Torsional forces cannot be absorbed by the individual Egcobox® FST components and must therefore be compensated by the complete structure.

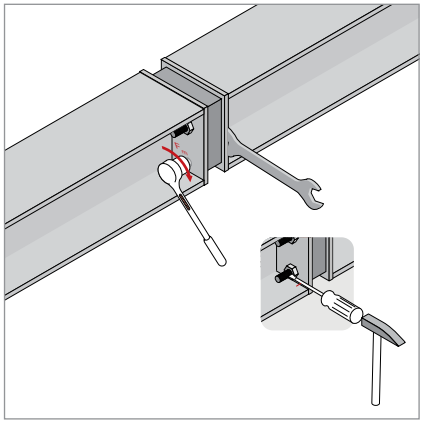


Fixing information

The following tightening torques are recommended to secure the steel connection:

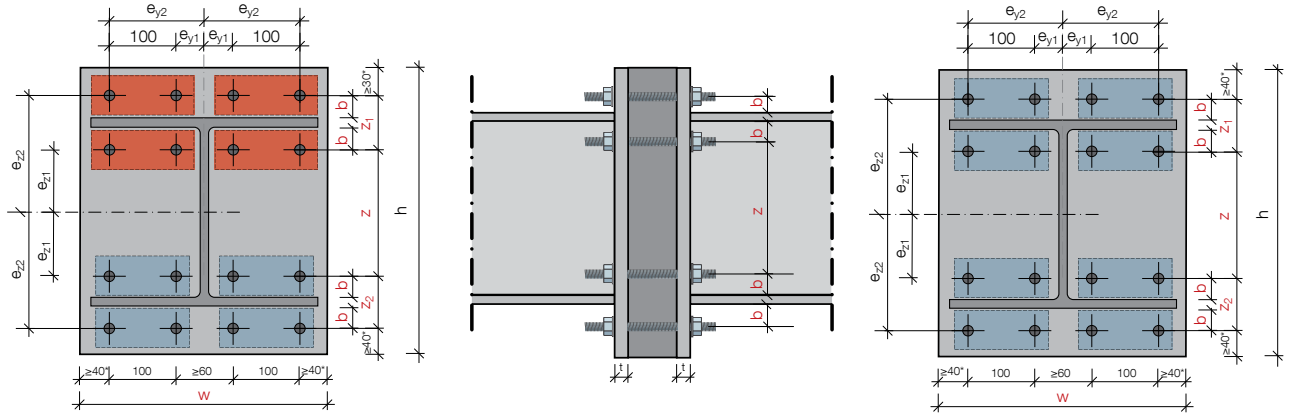
Egcobox® FST16	Egcobox® FST22
50 Nm	80 Nm

The threaded rods must subsequently be caulked. Further notes on installation on page 12.



Boundary conditions: Minimum thickness of Egcobox® FST end plate

Geometrical boundary conditions need to be observed in the planning of the Egcobox® FST. These include minimum distances between the components for tensile or normal and shear force stresses as well as the minimum thicknesses of the on-site end plates. In addition, only the use of the threaded rods with the same diameters (ø16 or ø22), as well as a symmetrical layout of the components, is permitted.



* The edge distance is related to the minimum size of the insulation of the Egcobox® FST. The complete size may differ from this.

			FST16 1/0 0/1	FST16 1/1 2/2 4/4	FST16 0/2 0/4 0/8	FST22 1/0 0/1	FST22 1/1 2/2 4/4	FST22 0/2 0/4 0/8
			Boundary conditions – component layout					
Distance to the flange of the steel beam:		**b**	25 ≤ b ≤ 35 mm [2]			30 ≤ b ≤ 50 mm [2]		
minimum lever arm:		**z**	≥ 55 mm [1]	≥ 65 mm [1]		≥ 55 mm [1]	≥ 65 mm [1]	
with 2-row layout		z_1	≥ 40 mm [1]	≥ 65 mm [1]		≥ 40 mm [1]	≥ 65 mm [1]	
with 2-row layout		z_2	≥ 65 mm [1]	≥ 65 mm [1]		≥ 65 mm [1]	≥ 65 mm [1]	
			Minimum width of the end plates (w)					
		w	≥ 160 mm			≥ 200 mm		
			Minimum thickness of the end plates (t) [4]					
$N_{x,Ed}/N_{X,Rd}$ [3]	≤ 1.00	**t**	≥ 29 mm (grade S235) ≥ 24 mm (grade S355)			≥ 45 mm (grade S235) ≥ 36 mm (grade S355)		
	≤ 0,75	**t**	≥ 25 mm (grade S235) ≥ 20 mm (grade S355)			≥ 39 mm (grade S235) ≥ 32 mm (grade S355)		
	≤ 0,60	**t**	≥ 22 mm (grade S235) ≥ 18 mm (grade S355)			≥ 35 mm (grade S235) ≥ 28 mm (grade S355)		
	≤ 0,45	**t**	≥ 19 mm (grade S235) ≥ 16 mm (grade S355)			≥ 30 mm (grade S235) ≥ 24 mm (grade S355)		
	≤ 0,25	**t**	≥ 15 mm (grade S235) ≥ 12 mm (grade S355)			≥ 22 mm (grade S235) ≥ 18 mm (grade S355)		

The end plates are to be manufactured with a nominal hole clearance of Δ 2 mm

1) Maintaining the distance to the flange of the steel beam **(b)**

2) A greater distance between the threaded rods of the Egcobox® FST and the flange constitutes a deviation from the type test. In this case the end plate must be separately verified by the structural engineer.

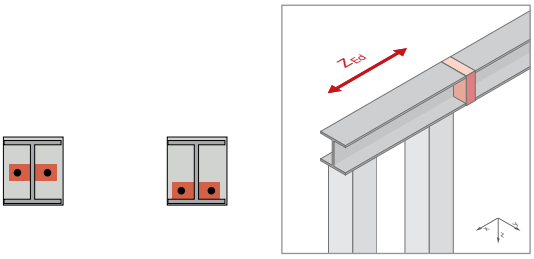
3) Tensile force of the threaded rod that is under the highest stress.

4) The minimum thickness of the end plate **(t)** is determined on the basis of the minimum width of the end plate **(w),** maintaining the distance to the flange of the steel beam **(b)** without more precise verification.

Type overview

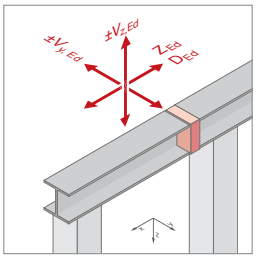
Egcobox® type FST16–1/0, FST22–1/0

Components for the transfer of tensile forces



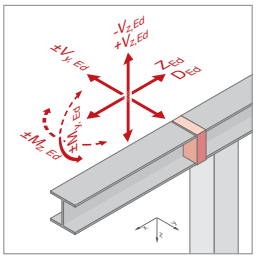
Egcobox® type FST16–0/1, FST22–0/1

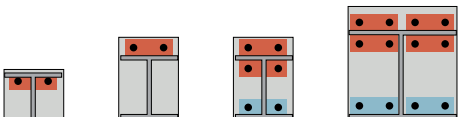
Components for the transfer of normal and shear forces



Egcobox® type FST16–n/n, FST22–n/n

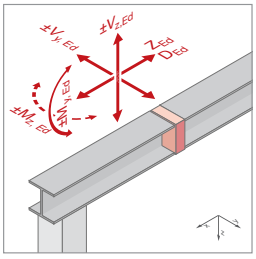
Egcobox® for the transfer of moment, normal and shear forces

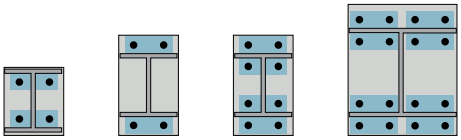




Egcobox® type FST16–0/n, FST22–0/n

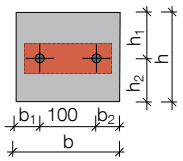
Egcobox® for the transfer of alternating moment, normal and shear forces





Egcobox® FST-1/0

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐

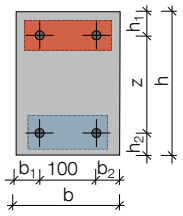


		h	h_1	h_2	b	b_1	b_2
Selected	[mm]	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 60	≥ 30	≥ 30	≥ 180	≥ 40	≥ 40
Dimensions rock wool	[mm]	≥ 80	≥ 40	≥ 40	≥ 200	≥ 50	≥ 50

..... **Quantity**

Egcobox® FST-1/1

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐



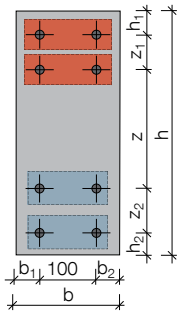
		h	h_1	h_2	b	b_1	b_2
Selected	[mm]	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 125	≥ 30	≥ 40	≥ 180	≥ 40	≥ 40
Dimensions rock wool	[mm]	≥ 145	≥ 40	≥ 50	≥ 200	≥ 50	≥ 50

		z
Selected	[mm]	.....
Dimensions polystyrene	[mm]	≥ 55
Dimensions rock wool	[mm]	≥ 55

..... **Quantity**

Egcobox® FST-2/2

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐



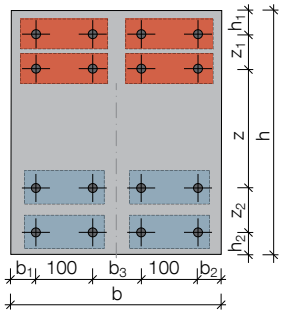
		h	h_1	h_2	b	b_1	b_2
Selected	[mm]	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 230	≥ 30	≥ 40	≥ 180	≥ 40	≥ 40
Dimensions rock wool	[mm]	≥ 270	≥ 40	≥ 50	≥ 200	≥ 50	≥ 50

		z	z_1	z_2
Selected	[mm]	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 55	≥ 40	≥ 65
Dimensions rock wool	[mm]	≥ 75	≥ 40	≥ 65

..... **Quantity**

Egcobox® FST-4/4

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐



		h	h_1	h_2	b	b_1	b_2	b_3
Selected	[mm]	.....	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 230	≥ 30	≥ 40	≥ 340	≥ 40	≥ 40	≥ 60
Dimensions rock wool	[mm]	≥ 270	≥ 40	≥ 50	≥ 380	≥ 50	≥ 50	≥ 80

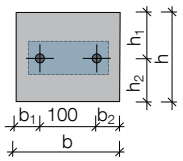
		z	z_1	z_2
Selected	[mm]	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 55	≥ 40	≥ 65
Dimensions rock wool	[mm]	≥ 75	≥ 40	≥ 65

..... **Quantity**

Pay attention to the maximum axis distances between the components and the steel beam flange as well as the recommended end plate thicknesses (see page 8)
Custom solutions can be created in cooperation with the support of our technical advice.

Egcobox® FST-0/1

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐

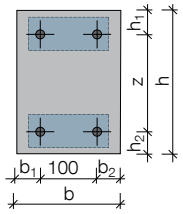


		h	h_1	h_2	b	b_1	b_2
Selected	[mm]	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 80	≥ 40	≥ 40	≥ 180	≥ 40	≥ 40
Dimensions rock wool	[mm]	≥ 100	≥ 50	≥ 50	≥ 200	≥ 50	≥ 50

..... **Quantity**

Egcobox® FST-0/2

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐



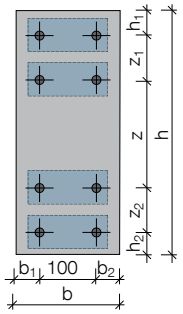
		h	h_1	h_2	b	b_1	b_2
Selected	[mm]	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 145	≥ 40	≥ 40	≥ 180	≥ 40	≥ 40
Dimensions rock wool	[mm]	≥ 165	≥ 50	≥ 50	≥ 200	≥ 50	≥ 50

		z
Selected	[mm]	.....
Dimensions polystyrene	[mm]	≥ 65
Dimensions rock wool	[mm]	≥ 65

..... **Quantity**

Egcobox® FST-0/4

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐



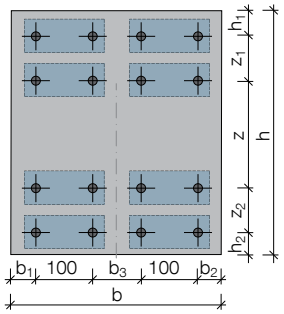
		h	h_1	h_2	b	b_1	b_2
Selected	[mm]	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 275	≥ 40	≥ 40	≥ 180	≥ 40	≥ 40
Dimensions rock wool	[mm]	≥ 315	≥ 50	≥ 50	≥ 200	≥ 50	≥ 50

		z	z_1	z_2
Selected	[mm]	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 65	≥ 65	≥ 65
Dimensions rock wool	[mm]	≥ 85	≥ 65	≥ 65

..... **Quantity**

Egcobox® FST-0/8

Ø 16 mm ☐ Ø 22 mm ☐ Polystyrene ☐ Rock wool ☐



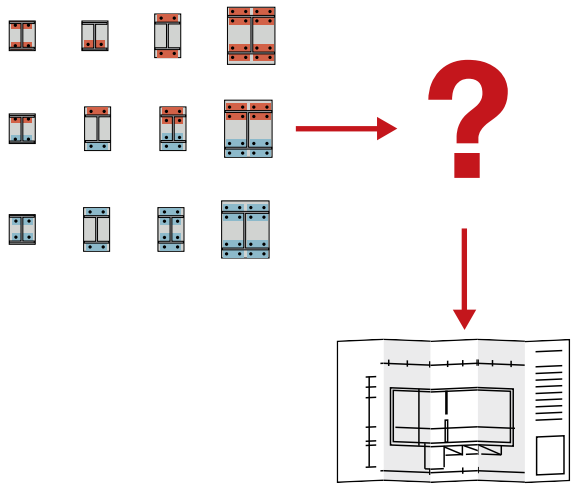
		h	h_1	h_2	b	b_1	b_2	b_3
Selected	[mm]	.....	.....	.....	.....	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 275	≥ 40	≥ 40	≥ 340	≥ 40	≥ 40	≥ 60
Dimensions rock wool	[mm]	≥ 315	≥ 50	≥ 50	≥ 380	≥ 50	≥ 50	≥ 80

		z	z_1	z_2
Selected	[mm]	.....	.....	.....
Dimensions polystyrene	[mm]	≥ 65	≥ 65	≥ 65
Dimensions rock wool	[mm]	≥ 85	≥ 65	≥ 65

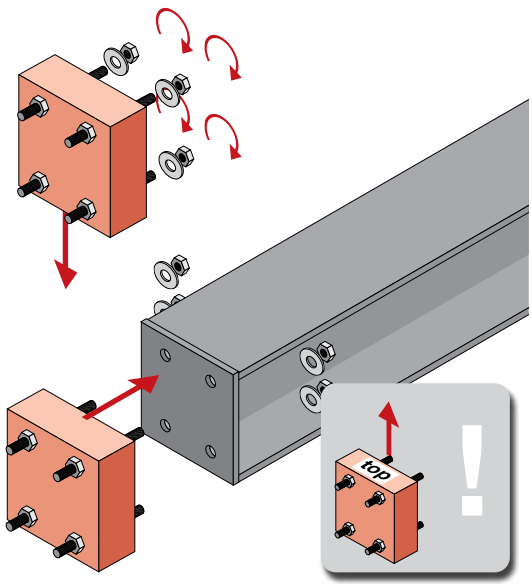
..... **Quantity**

Pay attention to the maximum axis distances between the components and the steel beam flange as well as the recommended end plate thicknesses (see page 8)
Custom solutions can be created in cooperation with the support of our technical advice.

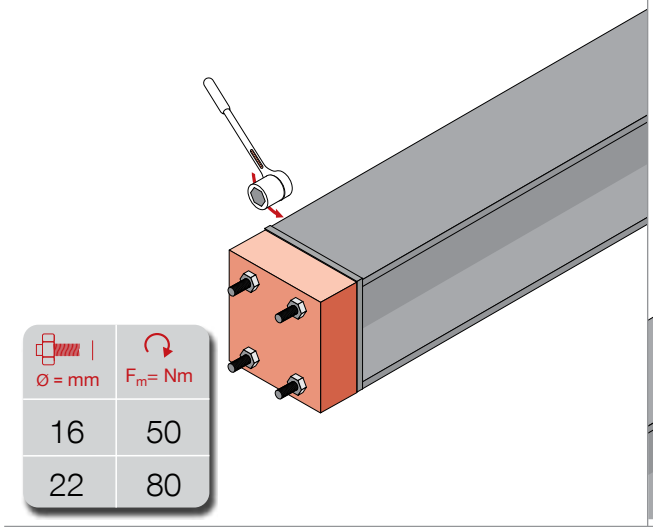
1



2

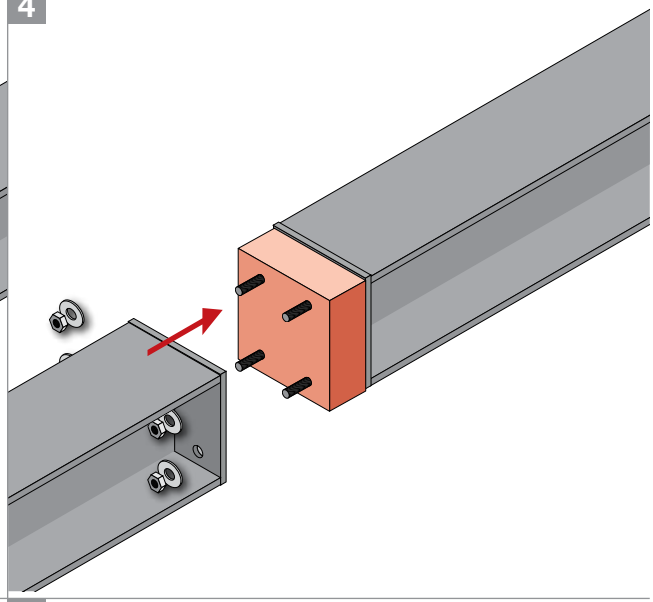


3

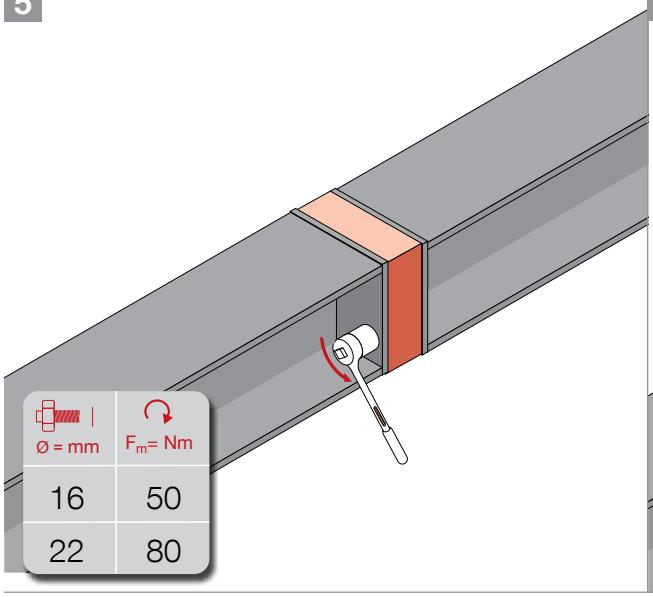


Ø = mm	F_m= Nm
16	50
22	80

4

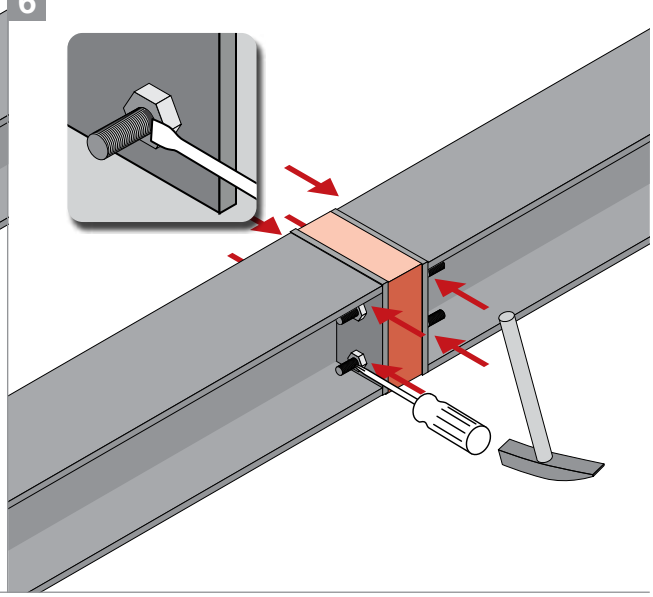


5



Ø = mm	F_m= Nm
16	50
22	80

6



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