

Shear dowel HED

Technical information



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Shear dowel HED

Expansion joint anchoring for concrete components

The product

With the shear force dowel type HED, shear forces can be transmitted easily, safely and economically across expansion joints economically. It ensures displacement of the components in the longitudinal axis of the bar up to a joint width of 40 mm. The shear force dowels are available as steel grade S 355 in galvanized design, or as stainless steel of Mat.No. 1.4571 / 1.4362 (corrosion protection class 3). All types can be classified as F90 by means of a special fire protection collar.

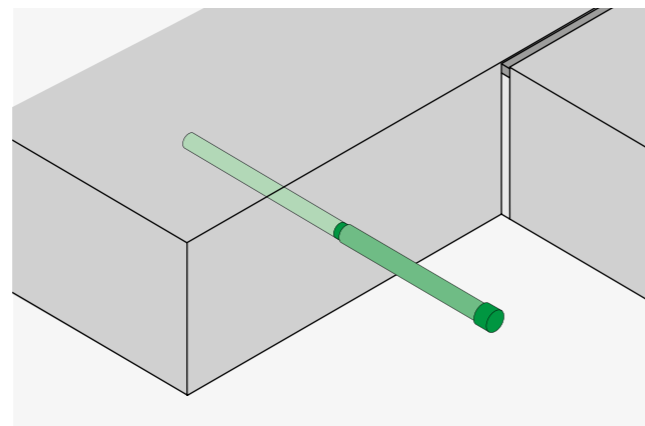
Range of application

Single shear force dowels type HED are used wherever shear forces have to be transmitted across structural joints, e.g. expansion joints between concrete slabs, in ceilings and walls, joints between columns and walls or beams and ceilings.



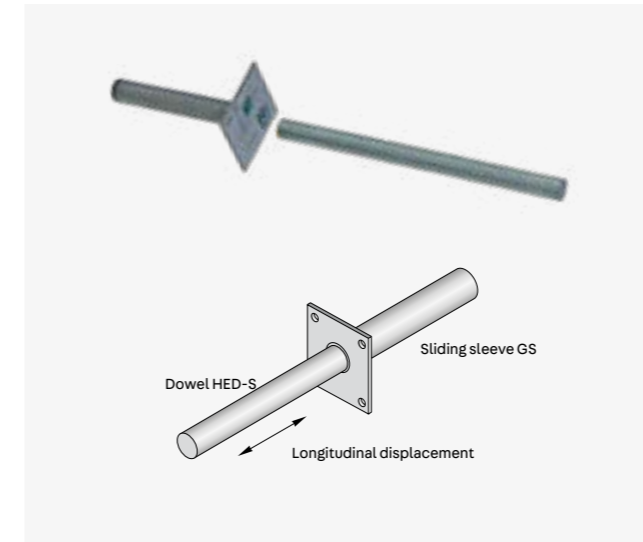
Advantages

- Avoidance of component offsets in the joint area
- Simple and precisely fitting assembly by means of a shear force mandrel sleeve on the formwork. A tear-resistant foil protects the sleeve from concrete penetration
- No drilling through the formwork or subsequent concrete drilling required when using sliding sleeves



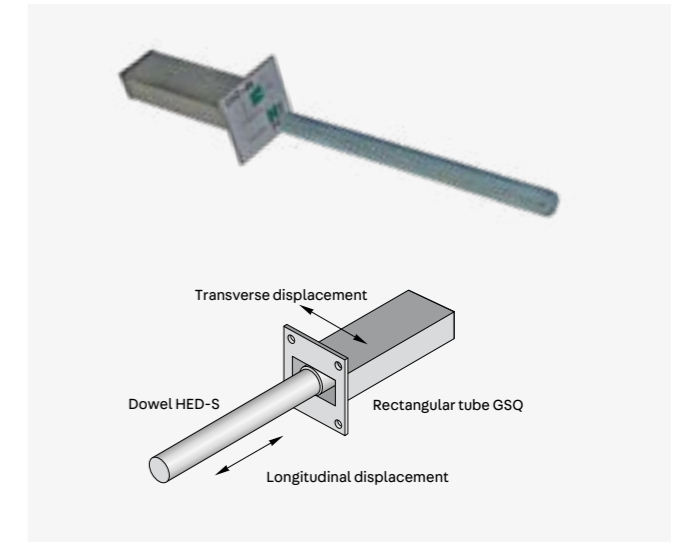
Types and dimensions

Types



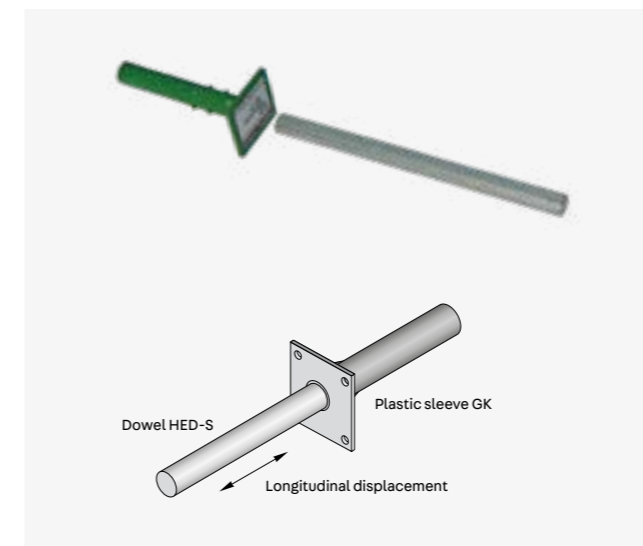
Shear dowel HED-S + GS sleeve

- Displacement perpendicular to the joint
- Transmission of shear forces vertically and parallel to the joint
- Stainless steel sliding sleeve and dowel



Shear dowel HED-S + GSQ sleeve

- Displacement perpendicular and parallel to the joint
- Transmission of shear forces vertical to the joint
- Stainless steel sliding sleeve and dowel



Shear dowel HED-S + GK sleeve

- Displacement perpendicular to the joint
- Transmission of shear forces vertically and parallel to the joint
- Sliding sleeve made of plastic, dowel made of S355 galvanized or stainless steel

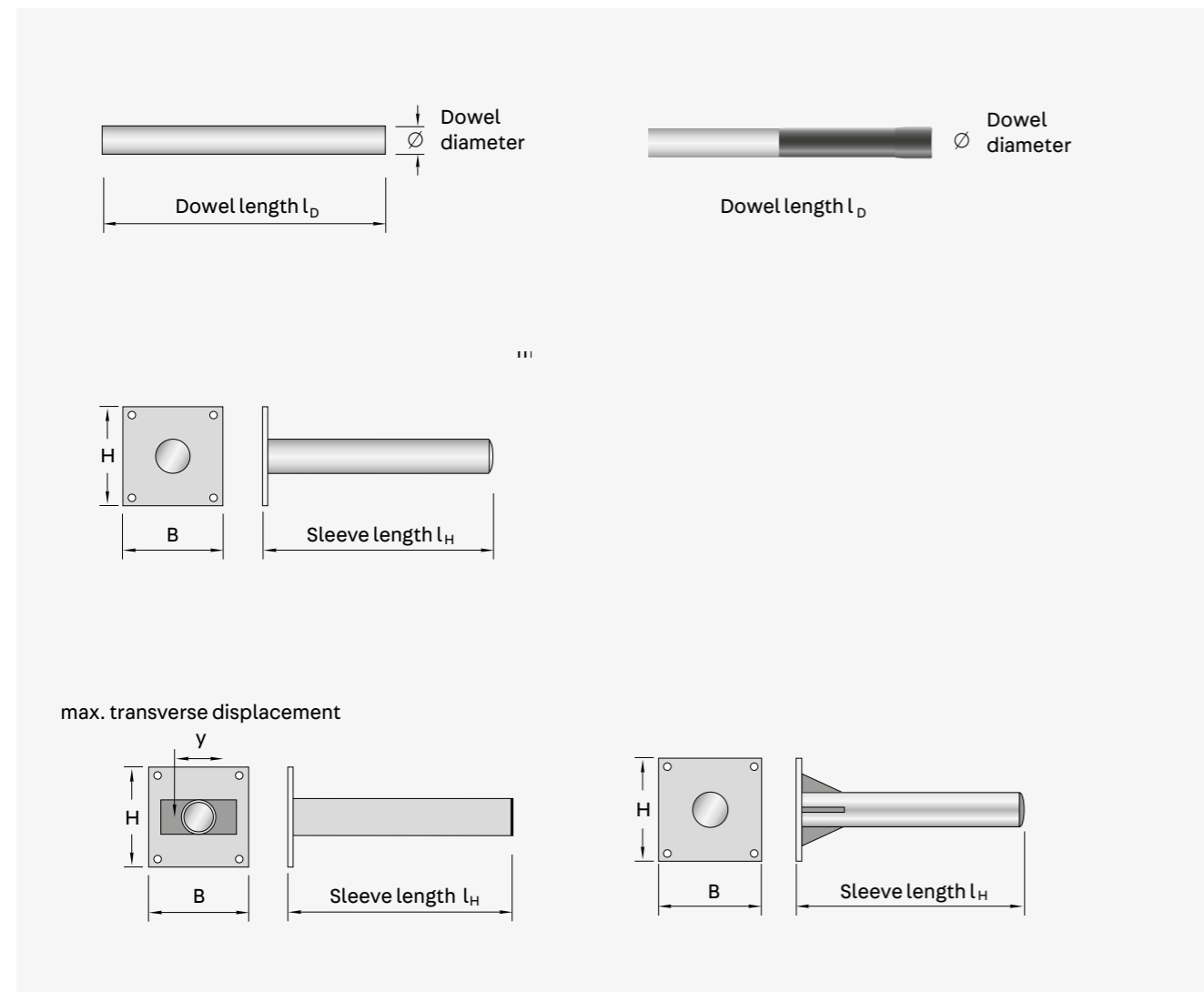


Shear dowel HED-P

- Displacement perpendicular to the joint
- Transmission of shear forces vertically and parallel to the joint
- With plasticized spring element
- Dowel made of S355 galvanized or stainless steel

Dimensions

Dowel type HED-S HED-P	Dowel element		Sleeves GS, GK		Sleeves GSQ		
	Dowel \emptyset mm	Dowel length l_D mm	Sleeve length l_H mm	Nail plate W/H mm	Sleeve length l_H mm	Nail plate W/H mm	Max. Transverse displacement y mm
20	20	300	160	70/70	180	80/80	± 11
22	22	300	160	70/70	180	80/80	± 10
25	25	300	160	70/70	180	80/80	± 14
30	30	350	185	80/80	205	100/80	± 21



Dimensioning

Reinforced concrete

The decisive resistance for the design is the smaller value of the steel load-bearing capacity and the concrete load-bearing capacity:

The decisive resistance for the concrete load-bearing capacity is the smaller value from the verifications of concrete edge failure and punching shear:

$$V_{Rd} = \min(V_{Rd,S}; V_{Rd,C})$$

$$V_{Rd,C} = \min(V_{Rd,ce}; V_{Rd,ct})$$

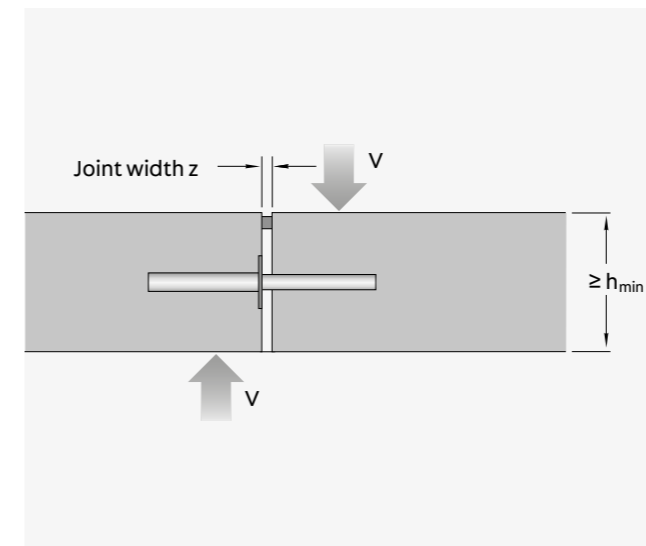
- $V_{Rd,S}$ Design resistance of the steel load-bearing capacity taking into account frictional forces ($f_{\mu} = 0.9$)
- $V_{Rd,C}$ Design resistance of the concrete bearing capacity
- $V_{Rd,ce}$ Design resistance of the concrete edge failure according to expert opinion of Prof. Elgehausen 2004
- $V_{Rd,ct}$ Design resistance against punching according to EC2

The dimensioning resistances for the steel load-bearing capacity are determined in accordance with booklet 346, DafStb as follows:

$$V_{Rd,S} = f_{\mu} \times 1,25 \times (f_{yk} / \gamma_{MS}) \times W / (z + \emptyset/2)$$

with:

- f_{μ} 0.9 Reduction factor friction
- f_{yk} Yield strength dowel [N/mm²]
- z Joint width [mm]
- \emptyset Diameter dowel [mm]
- W Resistance torque dowel [mm³]
- γ_{MS} Material safety factor for steel



Design resistances Concrete and steel load-bearing capacity in reinforced concrete

Dowel type HED-S HED-P	Design resistances Steel bearing capacity $V_{Rd,S}$ kN considering friction for joint width				Component thickness h mm	Design resistances Concrete bearing capacity* $V_{Rd,C}$ kN for C20/25
	z = 0-10 mm	z = 11-20 mm	z = 21-30 mm	z = 31-40 mm		
20	14,3	9,5	7,1	5,7	≥ 160	13,7
					≥ 180	14,3**
22	18,1	12,2	9,3	7,4	≥ 160	14,2
					≥ 180	15,8
					≥ 200	17,2
					≥ 220	18,0
					≥ 240	18,1**
25	24,8	17,1	13,1	10,6	≥ 180	20,5
					≥ 200	22,4
					≥ 220	23,6
					≥ 240	24,6
					≥ 260	24,8**
					≥ 220	29,2
30	38,5	27,5	21,4	17,5	≥ 240	31,5
					≥ 260	33,7
					≥ 280	35,8
					≥ 300	38,0
					≥ 320	38,5**

* taking into account reinforcement provided by the customer

** At these values, the design resistance of the steel load-bearing capacity is reached, taking into account frictional forces ($f_{\mu} = 0.9$).

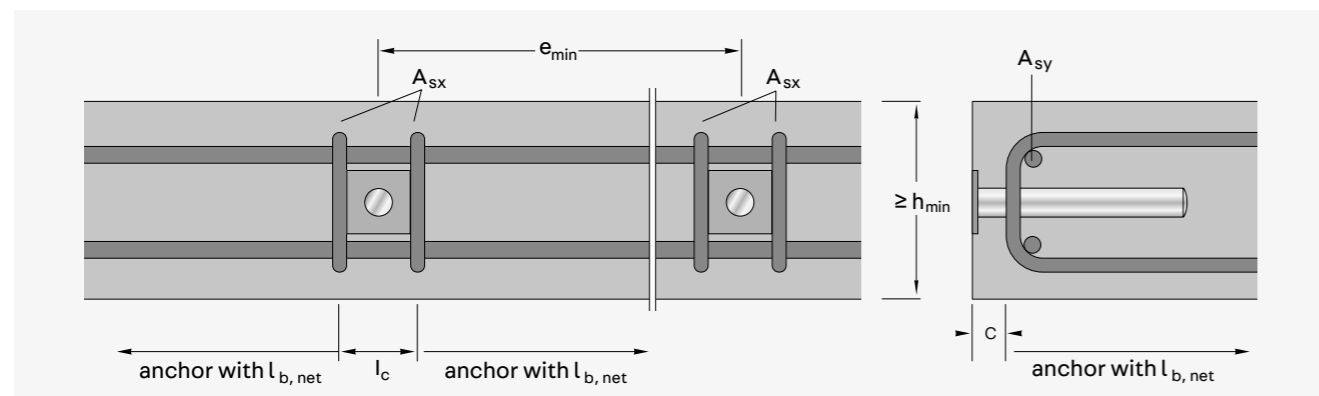
On-site reinforcement and minimum distances

Dowel type HED-S HED-P	Required dowel distance e_{min} mm	Edge distance a_r mm	Component thickness h_{min} mm	Stirrup spacing l_c mm	On-site reinforcement	
					A_{sx}	A_{sy}
20	310	155	160	60	2 Ø 10	2 Ø 10
22	350	175	160	60	2 Ø 10	2 Ø 10
25	410	205	180	70	2 Ø 12	2 Ø 12
30	560	280	220	90	2 Ø 14	2 Ø 14

e_{min} Mindestachsabstand zwischen den Einzeldornen
 a_r Mindestrandabstand

h_{min} Mindestbauteildicke
 l_c Abstand der ersten Steckbügel am Dorn

A_{sx} Steckbügel
 A_{sy} Längsbewehrung



Unreinforced concrete

The design resistances V_{Rd} of the individual shear force dowels HED for the steel and concrete load-bearing capacity are determined according to booklet 346, DafStb, taking into account:

Stahltragfähigkeit

$$V_{Rd,S} = f_{\mu} \times 1,25 \times (f_{yk} / \gamma_{MS}) \times W / (z + \phi/2)$$

Betontragfähigkeit

$$V_{Rd,C} = 0,4 \times f_{ck} \times \phi^{2,1} / (333 + 12,2 \times z)$$

$$0,4 = (\alpha \times \gamma_{MW}) / 3$$

with:

- f_{μ} 0.9 Reduction factor friction
- f_{yk} Yield strength dowel [N/mm²]
- f_{ck} Characteristic cylinder compressive strength of the concrete [N/mm²]
- z Joint width [mm]
- ϕ Diameter dowel [mm]
- W Resistive torque dowel [mm³]
- γ_{MS} Material safety factor for steel
- a 0,85 (Consideration of long-term effects on the compressive strength of the concrete)
- γ_{MW} 1,425 (Mean value between constant, $\gamma_{\phi} = 1,35$ and variable, $\gamma_{\phi} = 1,5$ Effect)

Dimensioning resistances in unreinforced concrete

Dowel type HED-S HED-P	Concrete grade	Dowel ϕ mm	Min. component thickness h_{min} mm	Dimensioning resistances kN Considering friction for joint width			
				z = 0-10 mm	z = 11-20 mm	z = 21-30 mm	z = 31-40 mm
20	≥ C 20/25	20	320	9,5	7,1	5,7	4,8
22		22	350	11,6	9,0	7,3	6,1
25		25	400	15,2	12,0	9,9	8,4
30		30	480	22,2	17,5	14,5	12,3



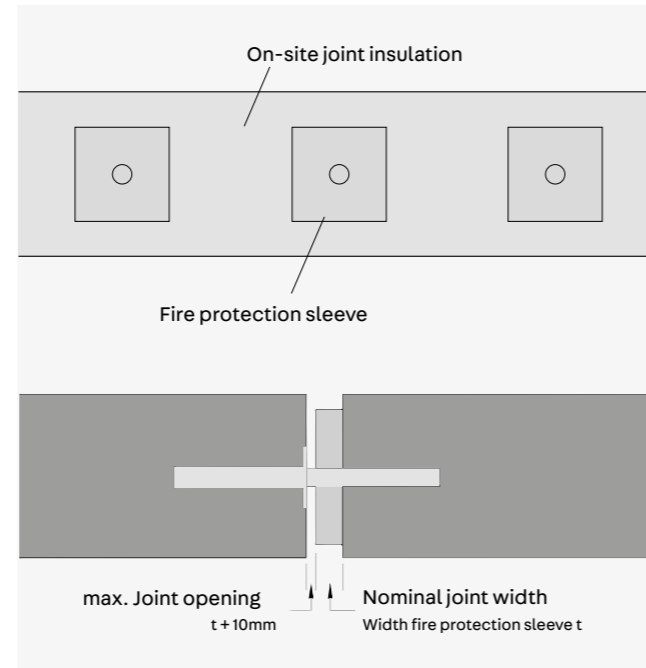
In relation to the dowel axis, an edge distance of $a_r \geq 8 \phi$ and a dowel distance of $e \geq 16 \phi$ must be maintained.

Fire protection

Fire protection sleeves BRM

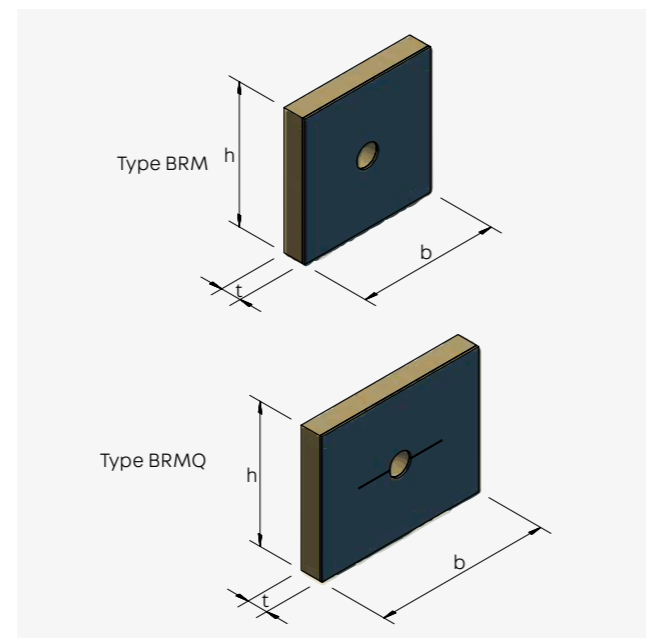
If fire protection requirements exist for components in accordance with DIN 4102 Part 2, the shear force dowels must be installed with fire protection collars. Only by sheathing the unprotected steel dowel with a fire protection collar in the joint can the classification F 90 can be achieved. The fire protection collar foams in the event of fire and the joint is completely sealed.

Nominal joint width mm	Fire protection sleeve t mm	max. joint opening mm
20	20	30
30	30	40
40	40	50
50	20 + 30	60



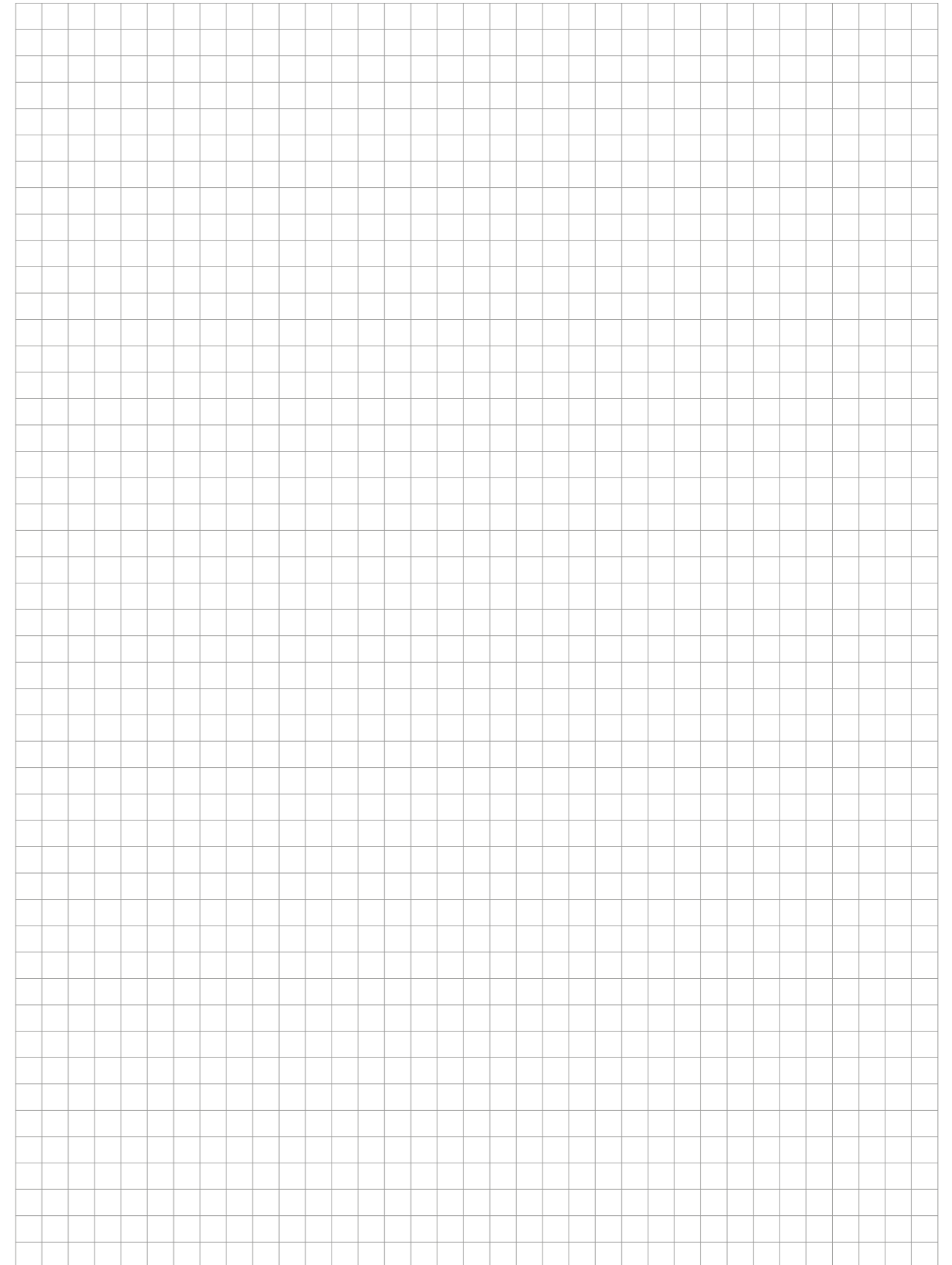
Dimensions of fire protection collars type BRM & BRMQ

Type	Dowel			Sleeve
	Ø mm	b mm	h mm	t mm
BRM 20	20	122	122	20, 30, 40
BRM 22	22	122	122	20, 30, 40
BRM 25	25	122	122	20, 30, 40
BRM 30	30	122	122	20, 30, 40
BRMQ 20	20	152	122	20, 30, 40
BRMQ 22	22	152	122	20, 30, 40
BRMQ 25	25	152	122	20, 30, 40
BRMQ 30	30	152	122	20, 30, 40



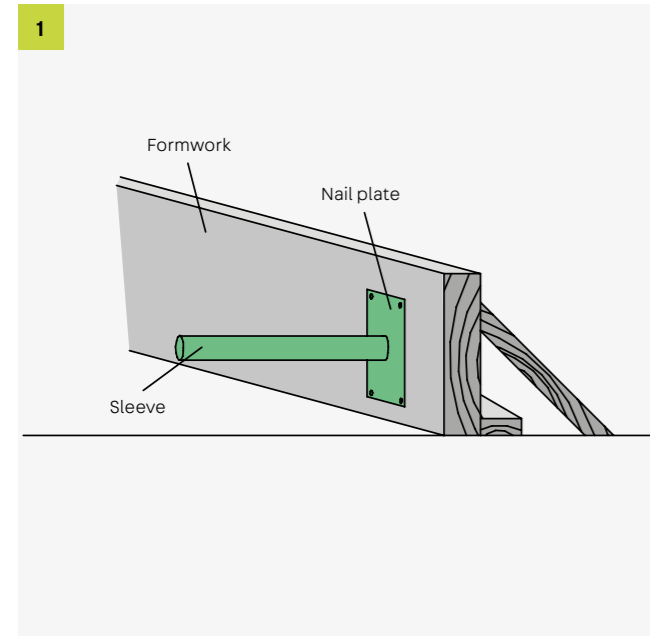
Ordering example

BRM-25-20
 — Nominal joint 20 mm
 — for shear dowel HED 25

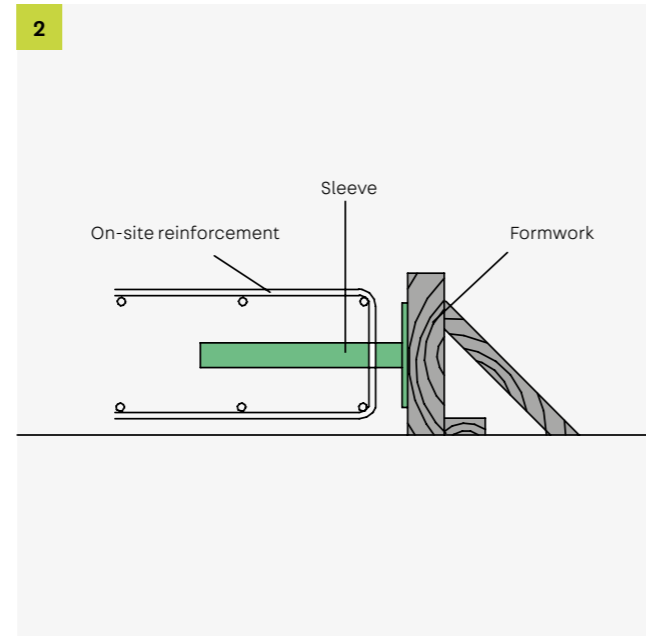


Installation instructions

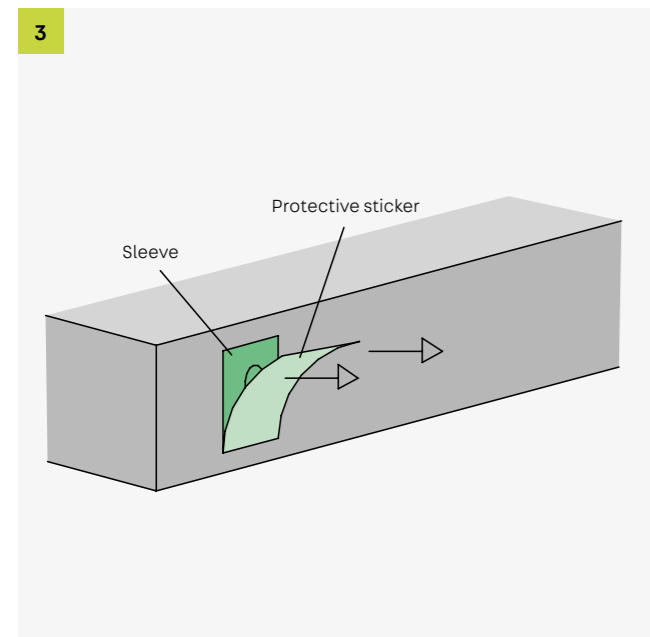
Shear force dowel HED-S + GK/GS Shear force dowel sleeve



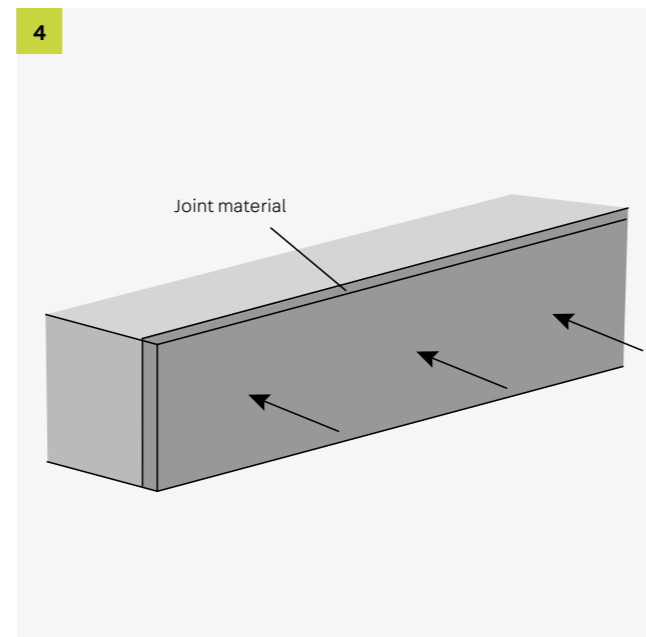
1 Nail the sleeve to the formwork
Do NOT remove protective sticker



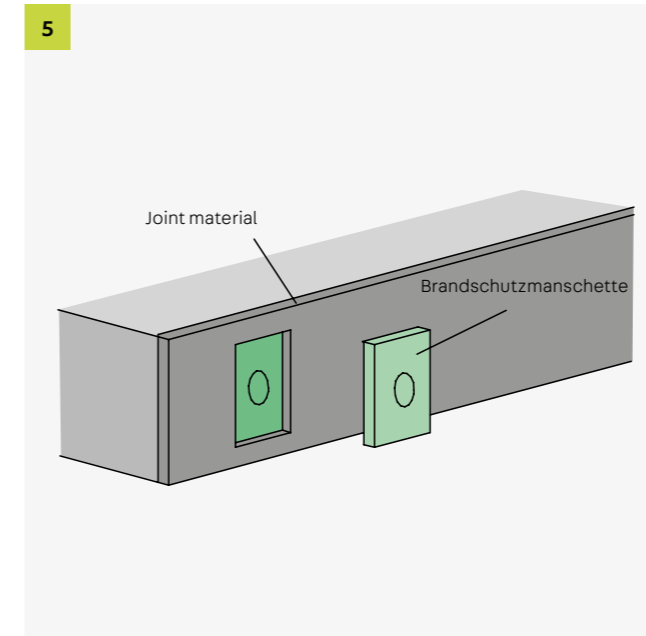
2 Lay reinforcement according to reinforcement plan
Concreting the first casting section



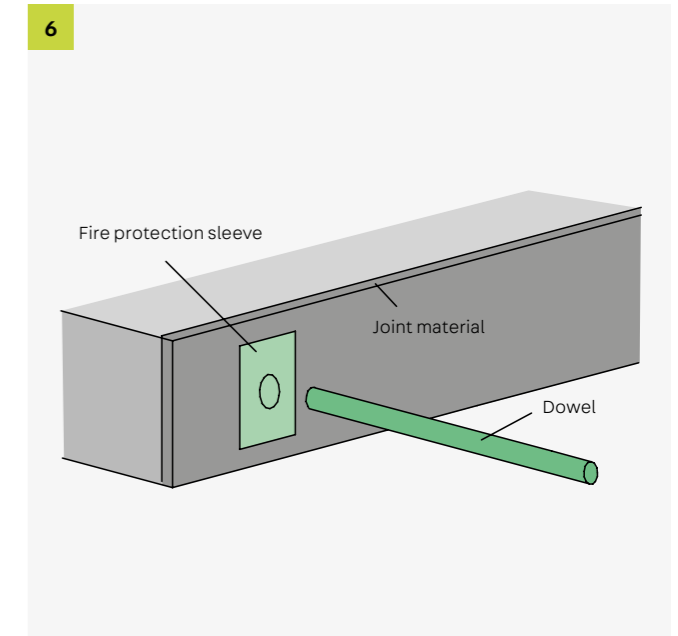
3 Stripping
Remove protective sticker



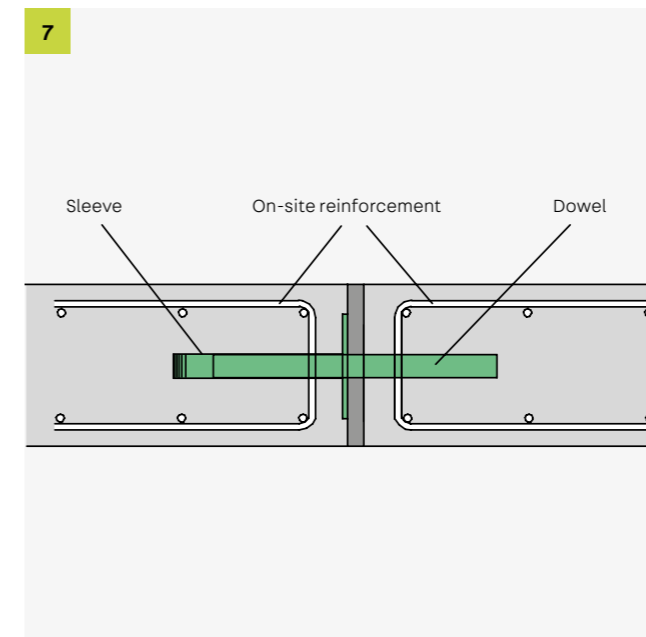
4 Apply joint material




5 Cut opening in joint material
Insert fire protection sleeve



6 Insert dowel into sleeve



7 Lay reinforcement according to reinforcement plan
Concreting the second casting section

 The GSQ sleeve is installed in the same way. Make sure that the GSQ sleeve is installed horizontally!



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