Single shear dowels

Product description

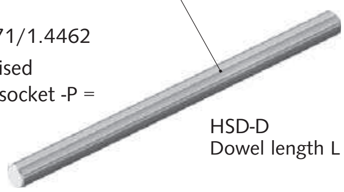
HALFEN Single shear dowels HSD allow sliding in the direction of the member axis. The dowels are normally used to transmit shear loads in any direction.

If lateral movements have to be taken into account, the HSD-SV sockets are used, which permit a sideways movement, i.e. the shear load will only be transmitted in one direction.

HALFEN Single shear dowels HSD-D require no official approval.

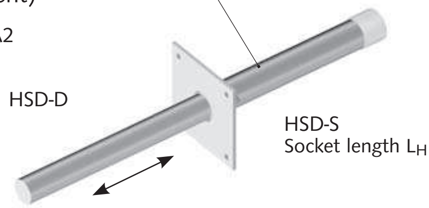
Single shear dowel HSD-D

Material / finish:
A4 = Stainless steel grade 1.4571/1.4462
FV = Steel S355, hot-dip galvanised (only in combination with socket -P = plastic)



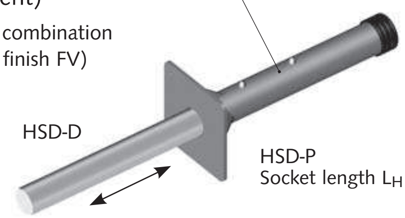
Socket HSD-S
(longitudinal movement)

Material: Stainless steel A2



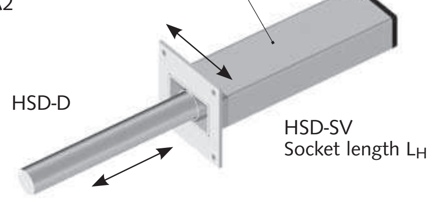
Socket HSD-P
(longitudinal movement)

Material: Plastic (only in combination with dowel in material / finish FV)



Socket HSD-SV
(longitudinal and transverse movement)

Material: Stainless steel A2



Dimensions of single shear dowels and sockets

Dowel type	Single shear dowel		Sliding sockets HSD-P, -S		Sliding sockets HSD-SV	
	Dowel diam. [mm]	Dowel length L [mm]	Socket length L_H [mm]	Nail plate width/height [mm]	Socket length L_H [mm]	Nail plate width/height [mm]
HSD-D 20	20	300	160	70/70	180	80/80
HSD-D 22	22	300	160	70/70	180	80/80
HSD-D 25	25	300	160	70/70	180	80/80
HSD-D 30	30	350	185	80/80	205	100/80

Ordering examples:

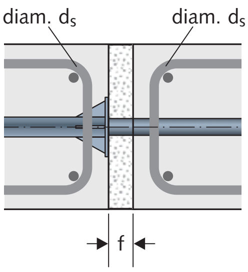
- Dowel: **HSD-D 22 -A4**
  HALFEN Shear dowel
  Diameter [mm]
  A4 = Stainless steel A4 material
- Sliding socket: **HSD-SV 22**
  HALFEN Sliding socket
  - S = Stainless steel A2
  - SV = ditto, transverse and longitudinal movement
  - P = Plastic
  for dowel diameter [mm]
- Set (Dowel + sliding socket) **HSD-SET 22 V -A4**
  HALFEN Shear dowel set
  with dowel diameter [mm]
  V = Socket transverse and longitudinal movement
  A4 = Dowel stainless steel A4, Socket S/SV = stainless steel A2

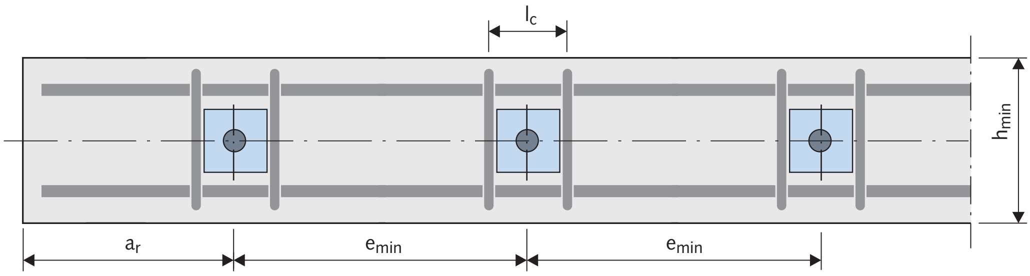
Single shear dowels

Dimensioning

Minimum spacing, Element thickness, Stirrup spacing						
Dowel diam. [mm]	Socket	Stirrup diam. d_s [mm]	Component thickness h_{min} [mm]	Stirrup spacing l_c [mm]	Required dowel spacing e_{min} [mm]	Edge distance a_r [mm]
20	HSD-S + HSD-P	10	160	60	310	160
22		10	160	60	350	175
25		12	175	70	410	200
30		14	210	90	560	240
20	HSD-SV	10	160	80	310	160
22		10	160	90	350	175
25		12	175	100	410	200
30		14	210	110	560	240

l_c = Distance between the first two stirrups
h_{min} = Minimum component thickness
e_{min} = Minimum centre spacing between the single dowels
a_r = Minimum edge distance





Dimensioning for non-reinforced concrete

Design resistances HSD-D in non-reinforced concrete according to volume 346, DAfStb (German association for reinforced concrete construction)

Steel load-bearing capacity: $V_{Rd,s} = f_\mu \cdot 1.25 \cdot (f_{yk}/\gamma_{MS}) \cdot W / (f + \text{diam.})$

Concrete load-bearing capacity: $V_{Rd,c} = 0.4 \cdot f_{ck} \cdot \text{diam.}^{2.1} / (333 + 12.2 \cdot f)$

$0.4 = (\alpha \cdot \gamma_{MW}) / 3$

where:

f_μ = 0.9 Reduction factor due to friction [-]
f_{yk} = yield strength [N/mm²]
f_{ck} = characteristic compressive cylinder strength of concrete [N/mm²]
f = Joint width [mm]
diam. = Shear dowel diameter [mm]
W = Section modulus [mm³]
γ_{MS} = Material safety factor for steel [-]

- HALFEN Single shear dowels HSD-D require no official approval.
- α = 0.85 (consideration of the long-term effects)
- γ_{MW} = 1.425 (average value from γ_G = 1.35 and γ_Q = 1.5)
- Minimum edge distance to the dowel axis a_r = 8 · diam. (in all directions)
- Minimum axial distance e = 16 · diam.

Dimensioning resistances VRd.s and VRd.c [kN] for non-reinforced concrete							
Dowel type	Concrete grade	Dowel-diam. [mm]	Minimum component thickness [mm]	Design resistances [kN] for joint width f [mm] 10	20	30	40
HSD-D 20	≥ C20/25	20	320	9.5	7.1	5.7	4.8
HSD-D 22		22	350	11.6	9.0	7.3	6.1
HSD-D 25		25	400	15.2	12.0	9.9	8.4
HSD-D 30		30	480	22.2	17.5	14.5	12.3

Dimensioning for reinforced concrete

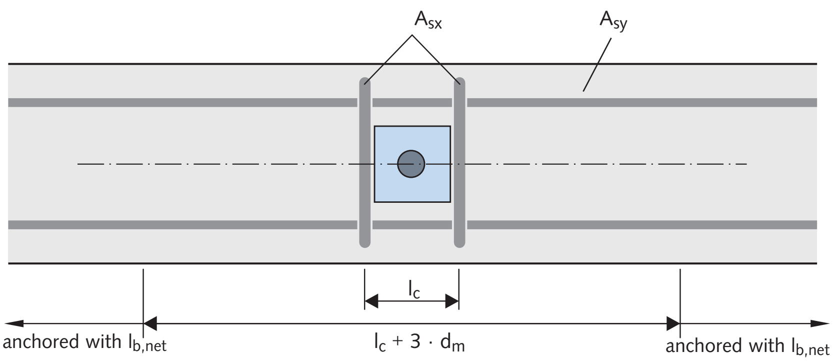
Design resistances HSD-D in reinforced concrete according to volume 346, DAfStb (German association for reinforced concrete construction)

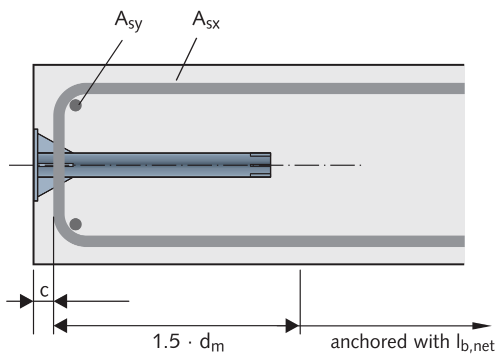
Required proofs:
Proof against punching failure $V_{Rd,ct}$
(acc. to DIN 1045-1)
Proof against concrete edge failure $V_{Rd,ce}$
(acc. to volume 346, DAfStb)
Proof of the steel load capacity $V_{Rd,s}$
Steel load-bearing capacity:
$V_{Rd,s} = f_\mu \cdot 1.25 \cdot (f_{yk}/\gamma_{MS}) \cdot W / (f + diam./2)$

$$V_{Rd} = \min(V_{Rd,s}; V_{Rd,c})$$

$V_{Rd,s}$ Dimensioning resistance of the steel load-bearing capacity
$V_{Rd,c}$ Dimensioning resistance of the concrete load-bearing capacity

where:
f_μ = Reduction factor due to friction [-]
f_{yk} = yield strength [N/mm²]
f = Joint width [mm]
diam. = Shear dowel diameter [mm]
W = Section modulus [mm³]
γ_{MS} = Material safety factor for steel [-]
d_m = effective depth of the cross section





Proof of the steel load-bearing capacity

Design resistances VRd,s for HSD-S and HSD-P - longitudinal movement - for reinforced concrete

Dowel type	concrete grade	Dowel-diam. [mm]	Design resistances $V_{Rd,s}$ [kN] for joint width f [mm]			
			10	20	30	40
HSD-D 20	≥ C20/25	20	14.3	9.5	7.1	5.7
HSD-D 22		22	18.1	12.2	9.3	7.4
HSD-D 25		25	24.8	17.1	13.1	10.6
HSD-D 30		30	38.5	27.5	21.4	17.5

taking account of friction (f_μ = 0.9)

Design resistances VRd,s for HSD-SV - longitudinal and transverse movement - for reinforced concrete

Dowel type	concrete grade	Dowel-diam. [mm]	Design resistances $V_{Rd,s}$ [kN] for joint width f [mm]			
			10	20	30	40
HSD-D 20	≥ C20/25	20	12.8	8.6	6.4	5.1
HSD-D 22		22	16.3	11.0	8.3	6.7
HSD-D 25		25	22.3	15.4	11.8	9.5
HSD-D 30		30	34.6	24.7	19.2	15.7

taking account of friction (f_μ = 0.81)

Dimensioning for reinforced concrete

Proof of the concrete load-bearing capacity

The design resistance for the concrete load-bearing capacity is the smallest dimensioning resistance from the concrete edge failure and punching failure proofs:

A_{sx} = Rear suspension reinforcement
A_{sy} = Longitudinal reinforcement
l_c = Distance between the first two stirrups

Dimensioning resistances VRd,c for HSD-S and HSD-P - longitudinal movement -

Dowel type	Component thickness h [mm]	c_{nom} [mm]	Design resistances $V_{Rd,c}$ [kN] ≥ C20/25	In-situ reinforcement A_{sx}	A_{sy}	Centre spacing l_c [mm]
HSD-D 20	≥160	30	14.2	2 diam. 10	2 diam. 10	60
	≥180		15.8			
HSD-D 22	≥160	30	14.2	2 diam. 10	2 diam. 10	60
	≥180		15.8			
	≥200		17.3			
	≥220		18.9			
	≥240		20.4			
HSD-D 25	≥180	30	20.5	2 diam.12	2 diam.12	70
	≥200		22.4			
	≥220		24.3			
	≥240		26.2			
	≥260		28.0			
HSD-D 30	≥220	30	29.3	2 diam. 14	2 diam. 14	90
	≥240		31.5			
	≥260		33.7			
	≥280		35.9			
	≥300		38.1			
	≥320		40.2			

taking account of friction (f_μ = 1.0)

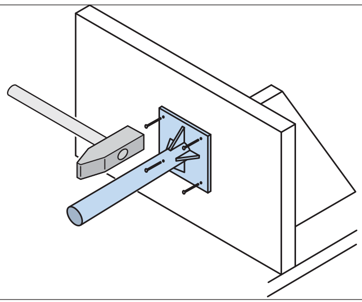
Dimensioning resistances VRd,c for HSD-SV - longitudinal and transverse movement-

Dowel type	Component thickness h [mm]	c_{nom} [mm]	Design resistances $V_{Rd,c}$ [kN] ≥ C20/25	In-situ reinforcement A_{sx}	A_{sy}	Centre spacing l_c [mm]
HSD-D 20	≥160	30	5)	2 diam. 10	2 diam. 10	80
	≥180		13.0			
HSD-D 22	≥160	30	5)	2 diam. 10	2 diam. 10	90
	≥180		12.5			
	≥200		13.9			
	≥220		15.3			
	≥240		16.7			
HSD-D 25	≥180	30	5)	2 diam.12	2 diam.12	100
	≥200		18.0			
	≥220		19.8			
	≥240		21.5			
	≥260		23.2			
HSD-D 30	≥220	30	24.6	2 diam. 14	2 diam. 14	110
	≥240		26.7			
	≥260		28.7			
	≥280		30.7			
	≥300		32.7			
	≥320		34.7			

taking account of friction (f_μ = 0.9)   5) No rear suspension stirrup in the break-out cone

Assembly instructions for HSD single shear dowels

1

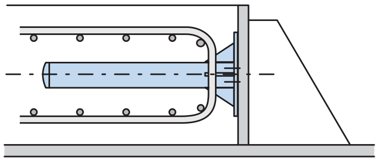


1. Fixing to the formwork

Nail the socket onto the formwork according to the specified position. Important: The socket must be aligned exactly in the direction of slide.

NOTE: Do not remove the label. This protects the socket from the penetration of fresh concrete.

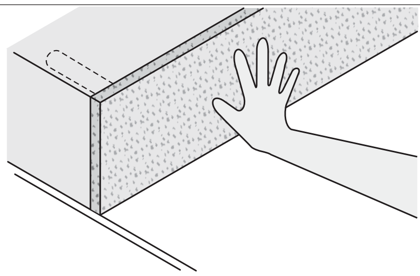
2



2. Reinforcement

Laying of the in-situ joint and rear suspension reinforcement, as well as the component reinforcement, in the 1st concreting-section.

3, 4



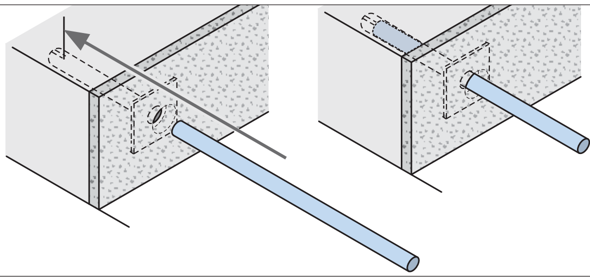
3. Protective label

The protective label can be removed from the socket after the concreting and the removal of the formwork.

4. Joint material

Application of the joint material. The positions of the shear dowel sockets are to be exactly marked where necessary.

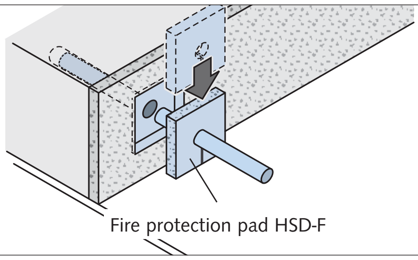
5a



5. a) Shear dowel

The dowel that matches the socket is now inserted through the joint material and is pushed into the socket up to the stop (safety plug).

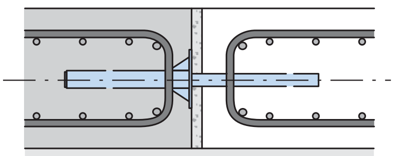
5b



5. b) Shear dowel

In the case of fire protection requirements according to DIN 4102, a recess is to be provided in the joint material for the HALFEN fire protection pad.

6



6. Concreting

Positioning of the reinforcement (by contractor) and concreting the 2nd concreting -section.