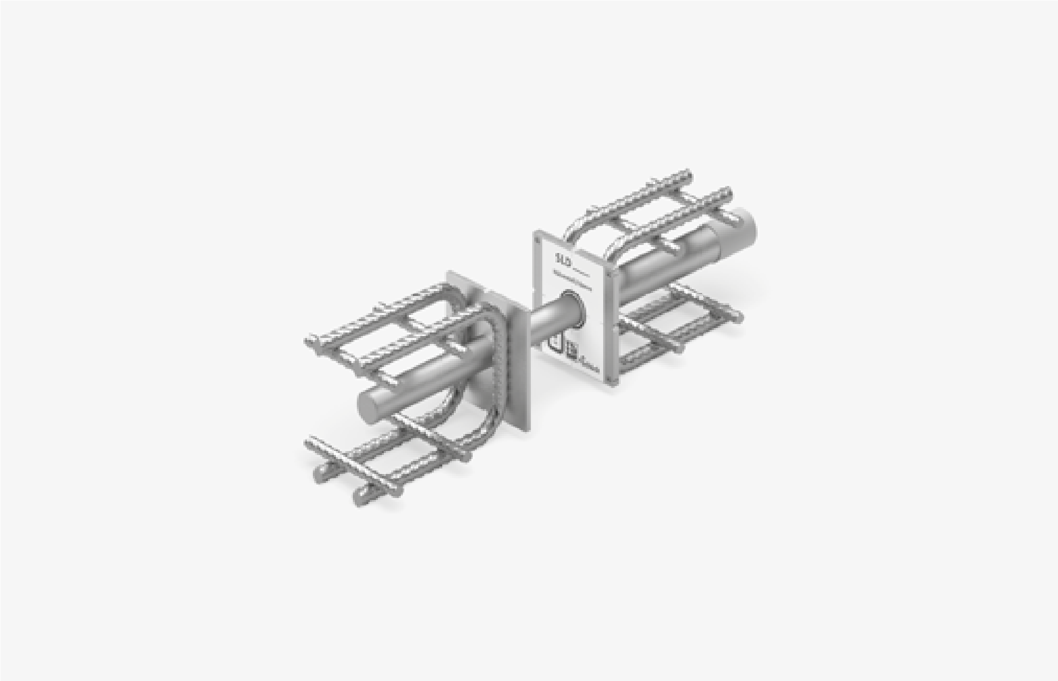
Schöck Dorn type SLD, SLD-Q

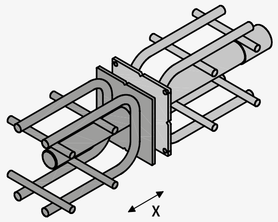


Schöck Dorn type SLD
Heavy duty dowel for the transmission of high transverse forces in expansion joints between thin concrete structural components with freedom of movement in the direction of the dowel axis.

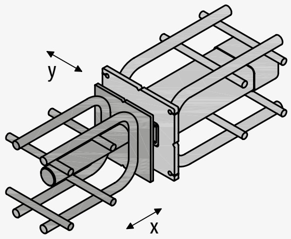
Schöck Dorn type SLD-Q
Heavy duty dowel for the transmission of high shear forces between thin concrete structural components with freedom of movement along and transverse to the dowel axis.

Type designations | Product characteristics | Application areas

Schöck Dorn type SLD



SLD
The heavy duty dowel serves the transmission of high shear forces in building joints and with this enables free movement in the direction of the dowel axis. Through the stiff anchoring body it is particularly suited for the connection of thin structural components.



SLD-Q
This heavy duty dowel serves the transmission of high shear forces in bulding joints and with this enables free movement in the longitudinal and transverse direction to the dowel axis. Through the stiff anchoring body it is particularly suited for the connection of thin structural components.

Type designations in planning documents

Dowel type
Sleeve movable transversely (optional)
Load-bearing level
SLD - Q - 60

Product characteristics

The Schöck Dorn type SLD (heavy duty dowel) consists of a sleeve part and a dowel part, which are concreted into the respective building components adjacent to the joint. The dowel transmits the loads from one structural component through bending in the sleeve and thus into the other structural component. With this, the welded-on stirrups and the face plate ensure an optimum anchoring of the concrete.
The sleeve of the Schöck Dorn type SLD is round and thus enables flexibility in the direction of the dowel axis, in order to prevent induced stresses due to structural component elongation. The forces can be transmitted perpendicularly and transversely to the dowel axis. Should a movement lateral to the dowel axis be required, the Schöck Dorn type SLD-Q can be used. The sleeve of this dowel is rectangular and thus enables displacement of ± 12 mm in the transverse direction.

Application areas

The Schöck Dorn type SLD has general building supervisory approval from the German Institute for Structural Engineering (DIBt) for the transmission of mainly dormant, statically relevant shear forces with expansion joints. Approval Z-15.7-236 regulates the design according to BS EN 1992-1-1 (EC2) for the concrete strength classes C20/25 to C50/60. The joint widths can vary between 10 and 60 mm. The Schöck Dorn type SLD is approved as form-fit connecting element between reinforced concrete structural components, which fulfil the conditions for the limitation of deflection in accordance with BS EN 1992-1-1 para. 7.4.2.
Dowel and sleeve consist of stainless steels of the material numbers 1.4362, 1.4571 as well as 1.4404 and thus meet the requirements of corrosion resistance class 3 in accordance with BS EN 1993-1-4.
All dimensions, reinforcement and geometry tables below apply according to BS EN 1992-1-1 (EC2). The concrete load-bearing resistance were determined with a concrete cover of 30 mm.

Minimum dowel spacing/component dimensions

Schöck Dorn type SLD	40	50	60	70	80	120	150
Minimum component dimensions	Dimension [mm]						
Slab thickness h_{min}	160	160	180	200	240	300	350
Wall thickness b_w	185	200	215	255	275	460 + c_{nom}	460 + c_{nom}
Beam width b_u	240	240	270	300	360	450	530
Minimum dowel spacing							
Horizontal $e_{h,min}$	240	240	270	300	360	450	530
Vertical $e_{v,min}$	120	120	140	160	200	215	235
Minimum edge distance							
Horizontal $e_{R,min}$	120	120	135	150	180	225	265

Schöck Dorn type SLD	Q 40	Q 50	Q 60	Q 70	Q 80	Q 120	Q 150
Minimum component dimensions	Dimension [mm]						
Slab thickness h_{min}	160	160	180	200	240	300	350
Wall thickness b_w	200	210	215	250	305 + c_{nom}	460 + c_{nom}	540 + c_{nom}
Beam width b_u	240	240	270	300	360	450	530
Minimum dowel spacing							
Horizontal $e_{h,min}$	240	240	270	300	360	450	530
Vertical $e_{v,min}$	120	120	140	160	200	215	235
Minimum edge distance							
Horizontal $e_{R,min}$	120	120	135	150	180	225	265

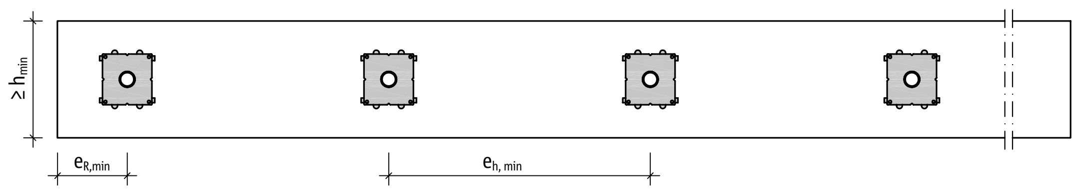


Fig. 23: Schöck Dorn type SLD: Minimum structural component dimensions and dowel spacings in a slab

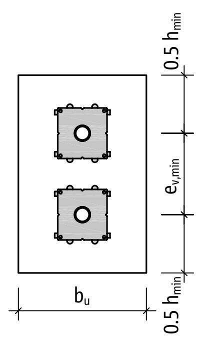


Fig. 24: Schöck Dorn type SLD: Minimum structural component dimensions and dowel spacings in the front face of a beam or wall

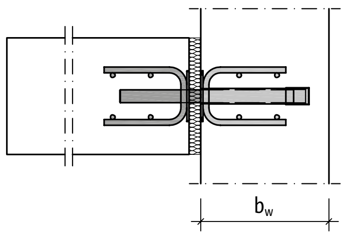


Fig. 25: Schöck Dorn type SLD: Minimum structural component thickness of a wall or column

SLD

Critical dowel spacings/edge distances

With the observation of the critical edge distances and dowel spacings no mutual influencing of the punching cone is to be taken in to account. The design tables onwards from page 24 are based on these spacings. Should these spacings be undercut an additional punching shear design taking into account the shortened perimeter is required.
The maximum dowel spacing is limited in the Product Standard ETAG 030 to 8 times the slab height.

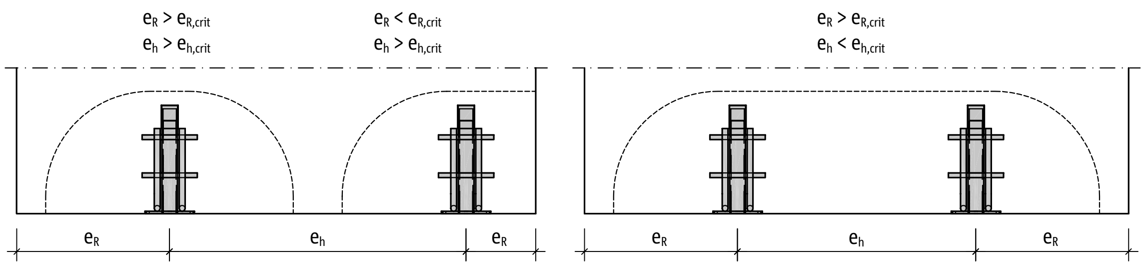


Fig. 26: Schöck Dorn type SLD: Circular cut depending on critical dowel spacing and edge separation

Schöck Dorn type SLD	40	50	60	70	80	120	150
Slab thickness [mm]	**Critical dowel spacings $e_{h,crit}$ [mm]**						
160	425	420	-	-	-	-	-
180	470	470	480	-	-	-	-
200	515	515	530	550	-	-	-
220	560	560	575	595	-	-	-
250	695	690	645	660	700	-	-
280	785	780	780	730	765	-	-
300	845	840	840	850	810	880	-
350	995	990	990	1000	925	1030	1035
Slab thickness [mm]	**Critical edge distances $e_{R,crit}$ [mm]**						
160	345	340	-	-	-	-	-
180	380	380	390	-	-	-	-
200	415	415	425	440	-	-	-
220	450	450	460	475	-	-	-
250	555	555	515	530	555	-	-
280	625	625	625	580	605	-	-
300	675	670	670	675	640	685	-
350	790	790	790	795	730	805	805

Critical dowel spacings/edge distances

Schöck Dorn type SLD	Q 40	Q 50	Q 60	Q 70	Q 80	Q 120	Q 150
Slab thickness [mm]	Critical dowel spacings $e_{h,crit}$ [mm]						
160	455	455	-	-	-	-	-
180	500	500	515	-	-	-	-
200	545	545	565	585	-	-	-
220	590	590	610	630	-	-	-
250	725	725	675	695	730	-	-
280	815	815	815	765	795	-	-
300	875	875	875	885	840	915	-
350	1025	1025	1025	1035	955	1065	1075
Slab thickness [mm]	Critical edge distances $e_{R,crit}$ [mm]						
160	360	360	-	-	-	-	-
180	395	395	405	-	-	-	-
200	430	430	445	455	-	-	-
220	465	465	480	495	-	-	-
250	570	570	530	545	570	-	-
280	640	640	640	600	620	-	-
300	690	690	690	695	655	705	-
350	805	805	805	815	745	825	825

Product description SLD 40-80

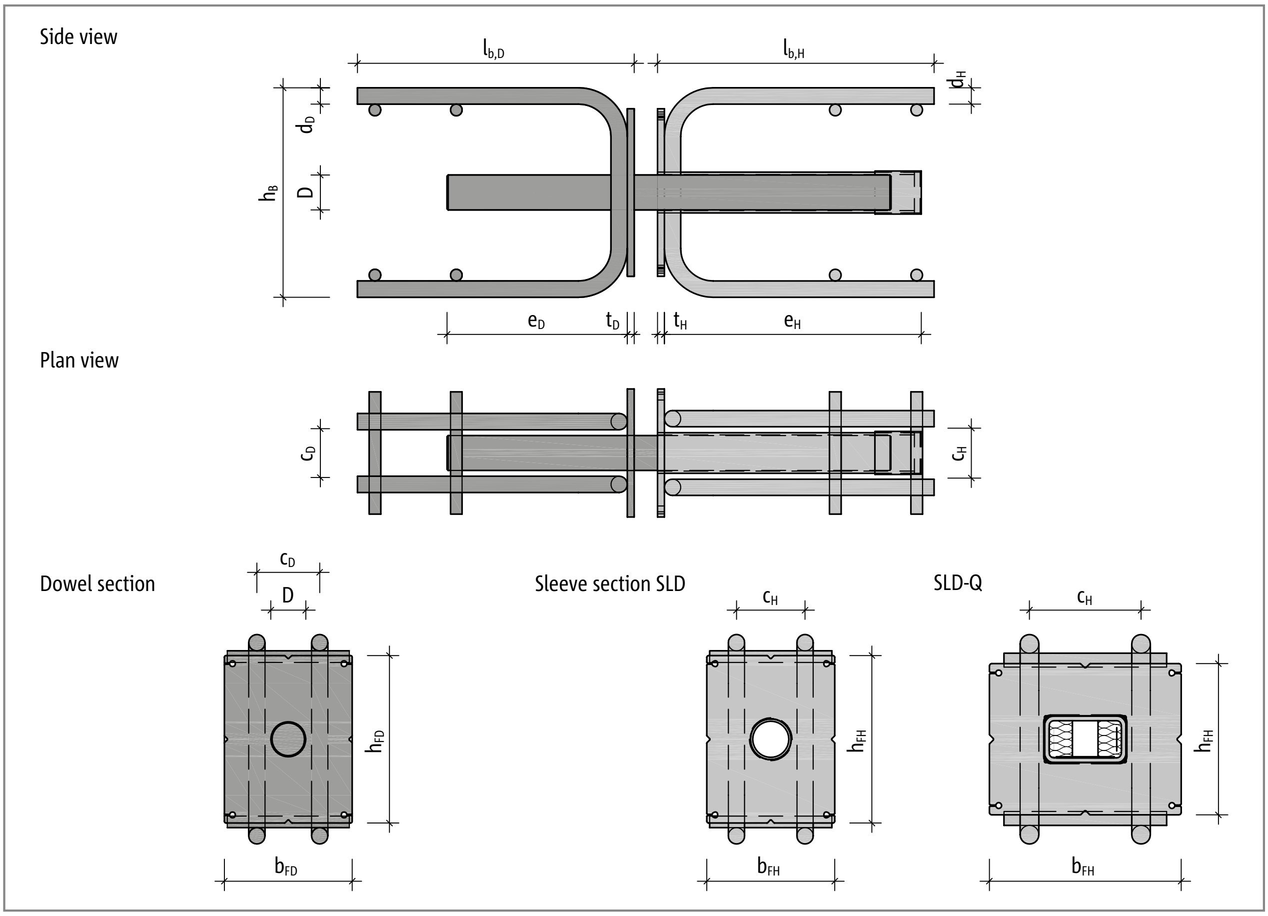


Fig. 27: Schöck Dorn type SLD 40 bis SLD 80: Dimensions

Schöck Dorn type SLD		40	Q 40	50	Q 50	60	Q 60	70	Q 70	80	Q 80
Dowel part		Dimensions [mm]									
Diameter dowel	D	22		22		24		27		30	
Dowel anchoring depth	e_D	100		115		130		145		155	
Diameter Stirrup	d_D	10		10		12		12		14	
Stirrup height	h_B	100		100		120		140		180	
Stirrup length	$l_{b,D}$	146		146		169		220		238	
Stirrup spacing	c_D	42		42		46		49		54	
Front plate thickness	t_D	4		4		4		5		6	
Front plate height	h_{FD}	85		87		117		129		144	
Front plate width	b_{FD}	65		85		85		95		110	
Sleeve part											
Sleeve length	e_H	165	165	180	180	195	195	211	211	221	221
Diameter Stirrup	d_H	10	10	10	12	12	12	12	14	14	16
Stirrup length	$l_{b,H}$	146	168	146	175	169	171	220	214	238	294
Stirrup spacing	c_H	43	76	43	78	46	82	50	86	59	96
Front plate thickness	t_H	4	5	4	6	4	6	5	8	6	8
Front plate height	h_{FH}	85	95	87	95	117	110	129	110	144	130
Front plate width	b_{FH}	65	105	85	110	85	120	95	130	110	165

SLD

Product description SLD 120-150

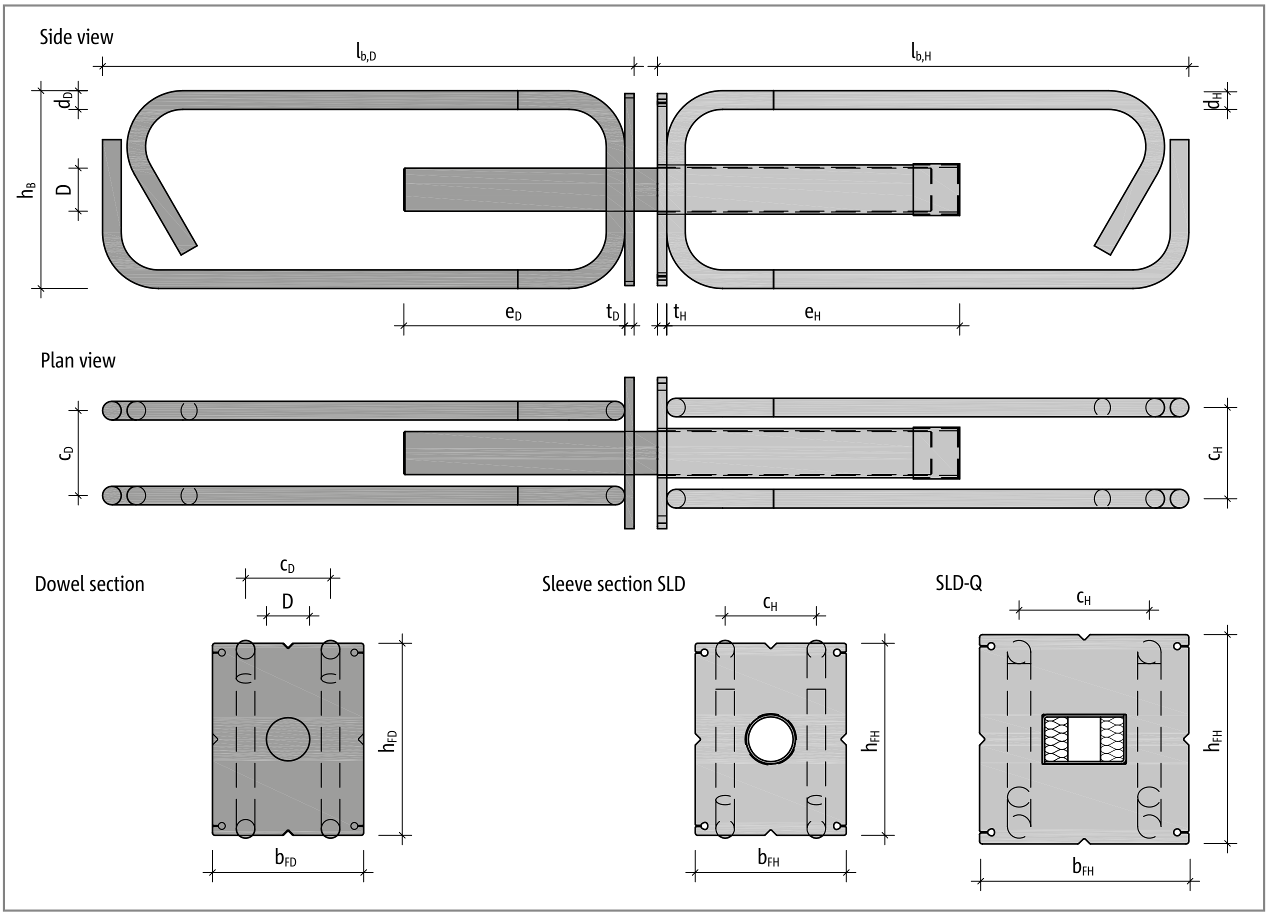


Fig. 28: Schöck Dorn type SLD 120, SLD 150: Dimensions

Schöck Dorn type SLD		120	Q 120	150	Q 150
Dowel part		Dimensions [mm]			
Diameter dowel	D	37		42	
Dowel anchoring depth	e_D	190		230	
Diameter Stirrup	d_D	16		20	
Stirrup height	h_B	170		210	
Stirrup length	$l_{b,D}$	457		458	
Stirrup spacing	c_D	73		82	
Front plate thickness	t_D	8		10	
Front plate height	h_{FD}	165		180	
Front plate width	b_{FD}	130		145	
Sleeve part					
Sleeve length	e_H	258	258	300	302
Diameter Stirrup	d_H	16	20	20	25
Stirrup length	$l_{b,H}$	457	448	458	536
Stirrup spacing	c_H	78	112	88	122
Front plate thickness	t_H	8	10	10	10
Front plate height	h_{FH}	165	180	180	210
Front plate width	b_{FH}	130	180	145	200

SLD

Design SLD C20/25

Design resistance V_{Rd} = min [steel load-bearing capacity $V_{Rd,s}$, concrete edge resistance $V_{Rd,c}$, punching shear resistance $V_{Rd,ct}$]

The following design values have been determined in accordance with BS EN 1992-1-1 (EC2) with a concrete cover of 30 mm. With higher concrete cover the load-bearing capacity for a correspondingly reduced slab height must be applied. The maximum load-bearing capacities listed here apply only in connections with a reinforcement arrangement in accordance with pages 30 or 31 and under observation of the critical dowel spacing or edge distance in accordance with page 20.

Schöck Dorn type		SLD 40	SLD 50	SLD 60	SLD 70	SLD 80	SLD 120	SLD 150
Slab thickness [mm]	Joint width [mm]	Design resistances V_{Rd}, Concrete strength class C20/25 [kN/dowel]						
160	20	35.8	46.7					
	30	35.8	46.7					
	40	35.8	46.7					
	50	30.1	40.1					
	60	25.1	33.4					
180	20	39.1	50.8	52.6				
	30	39.1	50.8	52.6				
	40	37.6	50.1	52.6				
	50	30.1	40.1	52.0				
	60	25.1	33.4	43.4				
200	20	55.4	54.7	66.9	73.1			
	30	50.2	54.7	66.9	73.1			
	40	37.6	50.1	65.0	73.1			
	50	30.1	40.1	52.0	73.1			
	60	25.1	33.4	43.4	61.7			
220	20	60.3	72.4	75.0	81.8			
	30	50.2	66.4	75.0	81.8			
	40	37.6	50.1	65.0	81.8			
	50	30.1	40.1	52.0	74.1			
	60	25.1	33.4	43.4	61.7			
250	20	67.5	85.6	87.6	95.1	125.9		
	30	50.2	66.4	84.8	95.1	125.9		
	40	37.6	50.1	65.0	92.6	125.9		
	50	30.1	40.1	52.0	74.1	101.6		
	60	25.1	33.4	43.4	61.7	84.7		
280	20	67.6	85.6	98.2	106.6	139.7		
	30	50.2	66.4	84.8	106.6	139.7		
	40	37.6	50.1	65.0	92.6	125.9		
	50	30.1	40.1	52.0	74.1	101.6		
	60	25.1	33.4	43.4	61.7	84.7		
300	20	67.6	85.6	103.9	126.5	149.1	167.6	
	30	50.2	66.4	84.8	116.1	149.1	167.6	
	40	37.6	50.1	65.0	92.6	125.9	167.6	
	50	30.1	40.1	52.0	74.1	101.6	167.6	
	60	25.1	33.4	43.4	61.7	84.7	158.9	
350	20	67.6	85.6	105.7	139.6	172.9	201.3	232.1
	30	50.2	66.4	84.8	116.1	152.0	201.3	232.1
	40	37.6	50.1	65.0	92.6	125.9	201.3	232.1
	50	30.1	40.1	52.0	74.1	101.6	189.4	232.1
	60	25.1	33.4	43.4	61.7	84.7	158.9	232.1

Design SLD C25/30

Design resistance V_{Rd} = min [steel load-bearing capacity $V_{Rd,s}$, concrete edge resistance $V_{Rd,c}$, punching shear resistance $V_{Rd,ct}$]

The following design values have been determined in accordance with BS EN 1992-1-1 (EC2) with a concrete cover of 30 mm. With higher concrete cover the load-bearing capacity for a correspondingly reduced slab height must be applied. The maximum load-bearing capacities listed here apply only in connections with a reinforcement arrangement in accordance with pages 30 or 31 and under observation of the critical dowel spacing or edge distance in accordance with page 20.

Schöck Dorn type		SLD 40	SLD 50	SLD 60	SLD 70	SLD 80	SLD 120	SLD 150
Slab thickness [mm]	Joint width [mm]	Design resistances V_{Rd}, Concrete strength class C25/30 [kN/dowel]						
160	20	40.4	52.3					
	30	40.4	52.3					
	40	37.6	50.1					
	50	30.1	40.1					
	60	25.1	33.4					
180	20	44.2	57.2	59.3				
	30	44.2	57.2	59.3				
	40	37.6	50.1	59.3				
	50	30.1	40.1	52.0				
	60	25.1	33.4	43.4				
200	20	62.5	61.8	72.0	78.8			
	30	50.2	61.8	72.0	78.8			
	40	37.6	50.1	65.0	78.8			
	50	30.1	40.1	52.0	74.1			
	60	25.1	33.4	43.4	61.7			
220	20	67.6	78.0	80.8	88.1			
	30	50.2	66.4	80.8	88.1			
	40	37.6	50.1	65.0	88.1			
	50	30.1	40.1	52.0	74.1			
	60	25.1	33.4	43.4	61.7			
250	20	67.6	85.6	94.4	102.4	135.6		
	30	50.2	66.4	84.8	102.4	135.6		
	40	37.6	50.1	65.0	92.6	125.9		
	50	30.1	40.1	52.0	74.1	101.6		
	60	25.1	33.4	43.4	61.7	84.7		
280	20	67.6	85.6	105.7	114.8	150.5		
	30	50.2	66.4	84.8	114.8	150.5		
	40	37.6	50.1	65.0	92.6	125.9		
	50	30.1	40.1	52.0	74.1	101.6		
	60	25.1	33.4	43.4	61.7	84.7		
300	20	67.6	85.6	105.7	136.3	160.6	180.5	
	30	50.2	66.4	84.8	116.1	152.0	180.5	
	40	37.6	50.1	65.0	92.6	125.9	180.5	
	50	30.1	40.1	52.0	74.1	101.6	180.5	
	60	25.1	33.4	43.4	61.7	84.7	158.9	
350	20	67.6	85.6	105.7	139.6	178.2	216.8	250.0
	30	50.2	66.4	84.8	116.1	152.0	216.8	250.0
	40	37.6	50.1	65.0	92.6	125.9	216.8	250.0
	50	30.1	40.1	52.0	74.1	101.6	189.4	250.0
	60	25.1	33.4	43.4	61.7	84.7	158.9	232.2

Design SLD C30/37 – C50/60

Design resistance V_{Rd} = min [steel load-bearing capacity $V_{Rd,s}$, concrete edge resistance $V_{Rd,c}$, punching shear resistance $V_{Rd,ct}$]

The following design values have been determined in accordance with BS EN 1992-1-1 (EC2) with a concrete cover of 30 mm. With higher concrete cover the load-bearing capacity for a correspondingly reduced slab height must be applied. The maximum load-bearing capacities listed here apply only in connections with a reinforcement arrangement in accordance with pages 30 or 31 and under observation of the critical dowel spacing or edge distance in accordance with page 20.

Schöck Dorn type		SLD 40	SLD 50	SLD 60	SLD 70	SLD 80	SLD 120	SLD 150
Slab thickness [mm]	Joint width [mm]	Design resistances V_{Rd}, Concrete strength class C30/37 [kN/dowel]						
160	20	44.6	55.6					
	30	44.6	55.6					
	40	37.6	50.1					
	50	30.1	40.1					
	60	25.1	33.4					
180	20	48.9	63.1	65.6				
	30	48.9	63.1	65.6				
	40	37.6	50.1	65.0				
	50	30.1	40.1	52.0				
	60	25.1	33.4	43.4				
200	20	67.6	68.3	76.5	83.7			
	30	50.2	66.4	76.5	83.7			
	40	37.6	50.1	65.0	83.7			
	50	30.1	40.1	52.0	74.1			
	60	25.1	33.4	43.4	61.7			
220	20	67.6	82.9	85.8	93.6			
	30	50.2	66.4	84.8	93.6			
	40	37.6	50.1	65.0	92.6			
	50	30.1	40.1	52.0	74.1			
	60	25.1	33.4	43.4	61.7			
250	20	67.6	85.6	100.3	108.9	144.1		
	30	50.2	66.4	84.8	108.9	144.1		
	40	37.6	50.1	65.0	92.6	125.9		
	50	30.1	40.1	52.0	74.1	101.6		
	60	25.1	33.4	43.4	61.7	84.7		
280	20	67.6	85.6	105.7	122.0	160.0		
	30	50.2	66.4	84.8	116.1	152.0		
	40	37.6	50.1	65.0	92.6	125.9		
	50	30.1	40.1	52.0	74.1	101.6		
	60	25.1	33.4	43.4	61.7	84.7		
300	20	67.6	85.6	105.7	139.6	170.7	191.8	
	30	50.2	66.4	84.8	116.1	152.0	191.8	
	40	37.6	50.1	65.0	92.6	125.9	191.8	
	50	30.1	40.1	52.0	74.1	101.6	189.4	
	60	25.1	33.4	43.4	61.7	84.7	158.9	
350	20	67.6	85.6	105.7	139.6	178.2	230.4	265.7
	30	50.2	66.4	84.8	116.1	152.0	230.4	265.7
	40	37.6	50.1	65.0	92.6	125.9	221.6	265.7
	50	30.1	40.1	52.0	74.1	101.6	189.4	265.7
	60	25.1	33.4	43.4	61.7	84.7	158.9	232.2

Design SLD Q C20/25

Design resistance V_{Rd} = min [steel load-bearing capacity $V_{Rd,s}$, concrete edge resistance $V_{Rd,c}$, punching shear resistance $V_{Rd,ct}$]

The following design values have been determined in accordance with BS EN 1992-1-1 (EC2) with a concrete cover of 30 mm. With higher concrete cover the load-bearing capacity for a correspondingly reduced slab height must be applied. The maximum load-bearing capacities listed here apply only in connections with a reinforcement arrangement in accordance with pages 30 or 31 and under observation of the critical dowel spacing or edge distance in accordance with page 21.

Schöck Dorn type		SLD Q 40	SLD Q 50	SLD Q 60	SLD Q 70	SLD Q 80	SLD Q 120	SLD Q 150
Slab thickness [mm]	Joint width [mm]	Design resistances V_{Rd}, Concrete strength class C20/25 [kN/dowel]						
160	20	28.6	36.8					
	30	28.6	36.8					
	40	28.6	36.8					
	50	27.1	36.1					
	60	22.6	30.1					
180	20	31.7	40.7	42.3				
	30	31.7	40.7	42.3				
	40	31.7	40.7	42.3				
	50	27.1	36.1	42.3				
	60	22.6	30.1	39.0				
200	20	34.7	44.4	46.1	63.0			
	30	34.7	44.4	46.1	63.0			
	40	33.9	44.4	46.1	63.0			
	50	27.1	36.1	46.1	63.0			
	60	22.6	30.1	39.0	55.6			
220	20	49.3	48.0	65.5	68.7			
	30	45.2	48.0	65.5	68.7			
	40	33.9	45.1	58.5	68.7			
	50	27.1	36.1	46.8	66.7			
	60	22.6	30.1	39.0	55.6			
250	20	56.0	71.2	73.7	77.0	124.2		
	30	45.2	59.8	73.7	77.0	124.2		
	40	33.9	45.1	58.5	77.0	113.3		
	50	27.1	36.1	46.8	66.7	91.5		
	60	22.6	30.1	39.0	55.6	76.2		
280	20	60.8	77.0	81.7	101.2	141.9		
	30	45.2	59.8	76.3	101.2	136.8		
	40	33.9	45.1	58.5	83.3	113.3		
	50	27.1	36.1	46.8	66.7	91.5		
	60	22.6	30.1	39.0	55.6	76.2		
300	20	60.8	77.0	87.0	108.4	151.3	157.9	
	30	45.2	59.8	76.3	104.5	136.8	157.9	
	40	33.9	45.1	58.5	83.3	113.3	157.9	
	50	27.1	36.1	46.8	66.7	91.5	157.9	
	60	22.6	30.1	39.0	55.6	76.2	143.0	
350	20	60.8	77.0	95.1	119.1	160.3	175.2	182.0
	30	45.2	59.8	76.3	104.5	136.8	175.2	182.0
	40	33.9	45.1	58.5	83.3	113.3	175.2	182.0
	50	27.1	36.1	46.8	66.7	91.5	170.5	182.0
	60	22.6	30.1	39.0	55.6	76.2	143.0	182.0

Design SLD Q C25/30

Design resistance V_{Rd} = min [steel load-bearing capacity $V_{Rd,s}$, concrete edge resistance $V_{Rd,c}$, punching shear resistance $V_{Rd,ct}$]

The following design values have been determined in accordance with BS EN 1992-1-1 (EC2) with a concrete cover of 30 mm. With higher concrete cover the load-bearing capacity for a correspondingly reduced slab height must be applied. The maximum load-bearing capacities listed here apply only in connections with a reinforcement arrangement in accordance with pages 30 or 31 and under observation of the critical dowel spacing or edge distance in accordance with page 21.

Schöck Dorn type		SLD Q 40	SLD Q 50	SLD Q 60	SLD Q 70	SLD Q 80	SLD Q 120	SLD Q 150
Slab thickness [mm]	Joint width [mm]	Design resistances V_{Rd}, Concrete strength class C25/30 [kN/dowel]						
160	20	32.2	41.3					
	30	32.2	41.3					
	40	32.2	41.3					
	50	27.1	36.1					
	60	22.6	30.1					
180	20	35.8	45.8	47.7				
	30	35.8	45.8	47.7				
	40	33.9	45.1	47.7				
	50	27.1	36.1	46.8				
	60	22.6	30.1	39.0				
200	20	39.3	50.1	52.0	71.1			
	30	39.3	50.1	52.0	71.1			
	40	33.9	45.1	52.0	71.1			
	50	27.1	36.1	46.8	66.7			
	60	22.6	30.1	39.0	55.6			
220	20	55.7	54.3	73.9	77.7			
	30	45.2	54.3	73.9	77.7			
	40	33.9	45.1	58.5	77.7			
	50	27.1	36.1	46.8	66.7			
	60	22.6	30.1	39.0	55.6			
250	20	60.8	77.0	83.4	87.2	137.9		
	30	45.2	59.8	76.3	87.2	136.8		
	40	33.9	45.1	58.5	83.3	113.3		
	50	27.1	36.1	46.8	66.7	91.5		
	60	22.6	30.1	39.0	55.6	76.2		
280	20	60.8	77.0	92.6	114.6	152.9		
	30	45.2	59.8	76.3	104.5	136.8		
	40	33.9	45.1	58.5	83.3	113.3		
	50	27.1	36.1	46.8	66.7	91.5		
	60	22.6	30.1	39.0	55.6	76.2		
300	20	60.8	77.0	95.1	122.9	160.3	178.3	
	30	45.2	59.8	76.3	104.5	136.8	178.3	
	40	33.9	45.1	58.5	83.3	113.3	178.3	
	50	27.1	36.1	46.8	66.7	91.5	170.5	
	60	22.6	30.1	39.0	55.6	76.2	143.0	
350	20	60.8	77.0	95.1	125.6	160.3	198.3	205.2
	30	45.2	59.8	76.3	104.5	136.8	198.3	205.2
	40	33.9	45.1	58.5	83.3	113.3	198.3	205.2
	50	27.1	36.1	46.8	66.7	91.5	170.5	205.2
	60	22.6	30.1	39.0	55.6	76.2	143.0	205.2

Design SLD Q C30/37 – C50/60

Design resistance V_{Rd} = min [steel load-bearing capacity $V_{Rd,s}$, concrete edge resistance $V_{Rd,c}$, punching shear resistance $V_{Rd,ct}$]

The following design values have been determined in accordance with BS EN 1992-1-1 (EC2) with a concrete cover of 30 mm. With higher concrete cover the load-bearing capacity for a correspondingly reduced slab height must be applied. The maximum load-bearing capacities listed here apply only in connections with a reinforcement arrangement in accordance with pages 30 or 31 and under observation of the critical dowel spacing or edge distance in accordance with page 21.

Schöck Dorn type		SLD Q 40	SLD Q 50	SLD Q 60	SLD Q 70	SLD Q 80	SLD Q 120	SLD Q 150
Slab thickness [mm]	Joint width [mm]	Design resistances V_{Rd}, Concrete strength class C30/37 [kN/dowel]						
160	20	35.5	45.4					
	30	35.5	45.4					
	40	33.9	45.1					
	50	27.1	36.1					
	60	22.6	30.1					
180	20	39.5	50.4	52.6				
	30	39.5	50.4	52.6				
	40	33.9	45.1	52.6				
	50	27.1	36.1	46.8				
	60	22.6	30.1	39.0				
200	20	43.4	55.3	57.5	78.4			
	30	43.4	55.3	57.5	78.4			
	40	33.9	45.1	57.5	78.4			
	50	27.1	36.1	46.8	66.7			
	60	22.6	30.1	39.0	55.6			
220	20	60.8	60.0	81.5	85.9			
	30	45.2	59.8	76.3	85.9			
	40	33.9	45.1	58.5	83.3			
	50	27.1	36.1	46.8	66.7			
	60	22.6	30.1	39.0	55.6			
250	20	60.8	77.0	92.3	96.6	146.5		
	30	45.2	59.8	76.3	96.6	136.8		
	40	33.9	45.1	58.5	83.3	113.3		
	50	27.1	36.1	46.8	66.7	91.5		
	60	22.6	30.1	39.0	55.6	76.2		
280	20	60.8	77.0	95.1	124.4	160.3		
	30	45.2	59.8	76.3	104.5	136.8		
	40	33.9	45.1	58.5	83.3	113.3		
	50	27.1	36.1	46.8	66.7	91.5		
	60	22.6	30.1	39.0	55.6	76.2		
300	20	60.8	77.0	95.1	125.6	160.3	195.7	
	30	45.2	59.8	76.3	104.5	136.8	195.7	
	40	33.9	45.1	58.5	83.3	113.3	195.7	
	50	27.1	36.1	46.8	66.7	91.5	170.5	
	60	22.6	30.1	39.0	55.6	76.2	143.0	
350	20	60.8	77.0	95.1	125.6	160.3	219.6	226.5
	30	45.2	59.8	76.3	104.5	136.8	219.6	226.5
	40	33.9	45.1	58.5	83.3	113.3	199.4	226.5
	50	27.1	36.1	46.8	66.7	91.5	170.5	226.5
	60	22.6	30.1	39.0	55.6	76.2	143.0	209.0

On-site reinforcement

Schöck Dorn type SLD / SLD Q	40	50	60	70	80
A_{sx} (right / left)	2 • 3 • H10	2 • 3 • H12	2 • 3 • H12	2 • 4 • H12	2 • 5 • H16
s_1 for slab thickness ≤ 300 mm	30	32	34	32	36
s_1 for slab thickness > 300 mm	50	50	50	50	50
s_i	50	50	50	50	50
A_{sy} (top / bottom)	2 • 3 • H12	2 • 3 • H12	2 • 3 • H12	2 • 3 • H12	2 • 3 • H16
Pos. 1	2 • H8	2 • H8	2 • H8	2 • H8	2 • H8
e_1	65	80	95	105	115
l_{c1} SLD	62	64	72	73	89
l_{c1} SLD Q	92	98	106	111	122

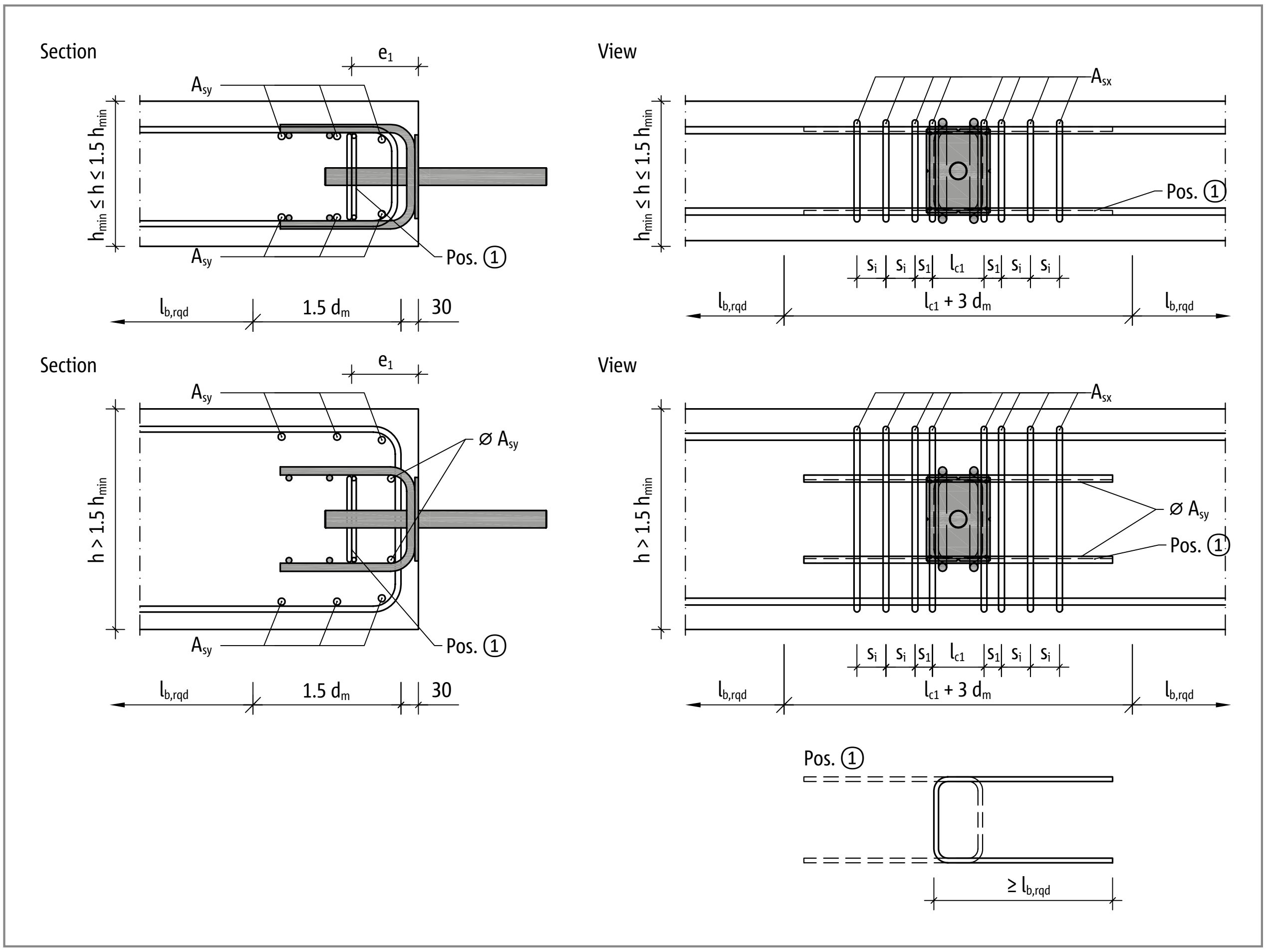


Fig. 29: Schöck Dorn type SLD 40 to SLD 80: On-site reinforcement

On-site reinforcement

Schöck Dorn type SLD / SLD Q	120	150
A_{sx} (right / left)	2 • 5 • H16	2 • 5 • H20
s_1	50	50
s_i	50	50
A_{sy} (top / bottom)	2 • 4 • H16	2 • 4 • H20
Pos. 1	2 • H10	2 • H12
e_1	150	185
l_{c1} SLD	114	131
l_{c1} SLD Q	151	171

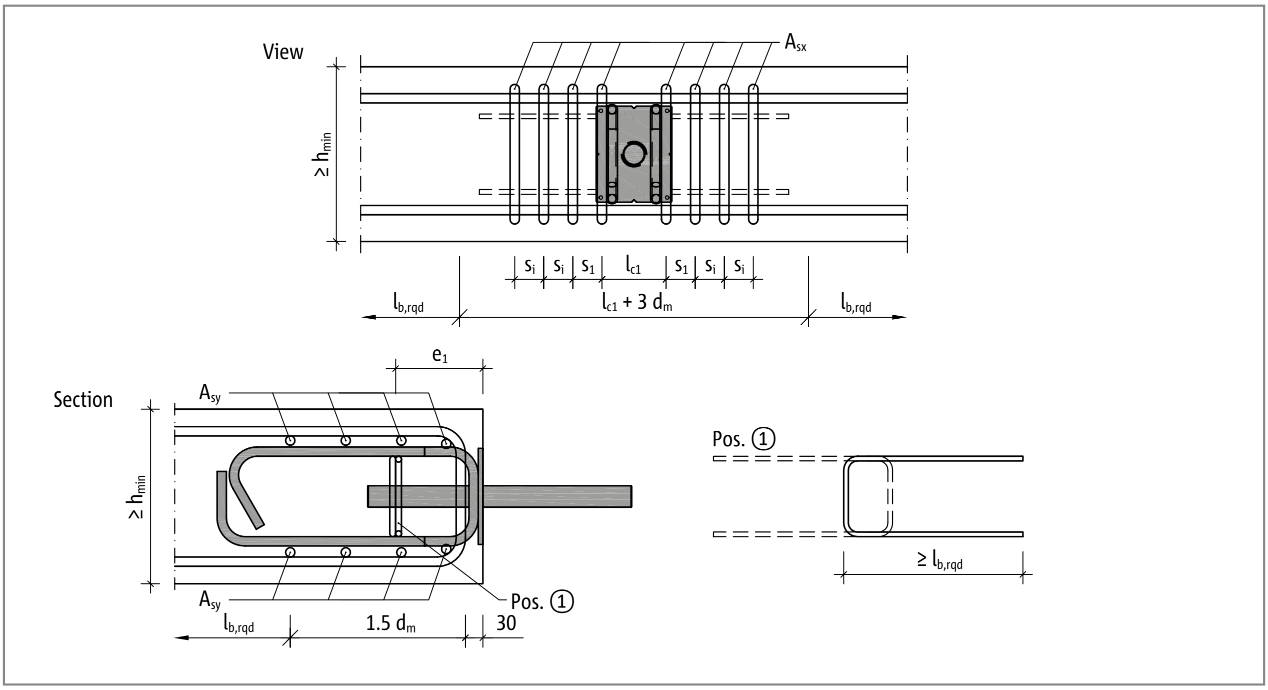


Fig. 30: Schöck Dorn type SLD 120, SLD 150: On-site reinforcement

On-site reinforcement

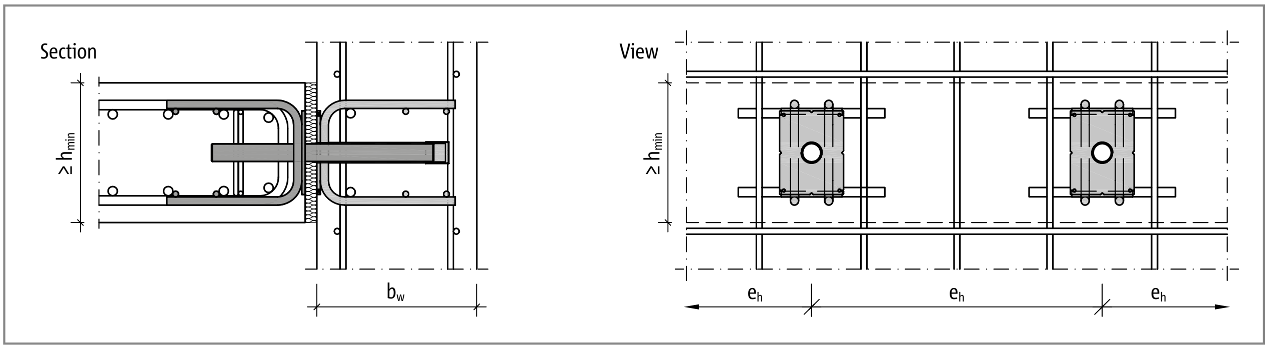


Fig. 31: Schöck Dorn type SLD: On-site reinforcement for floor-wall connection

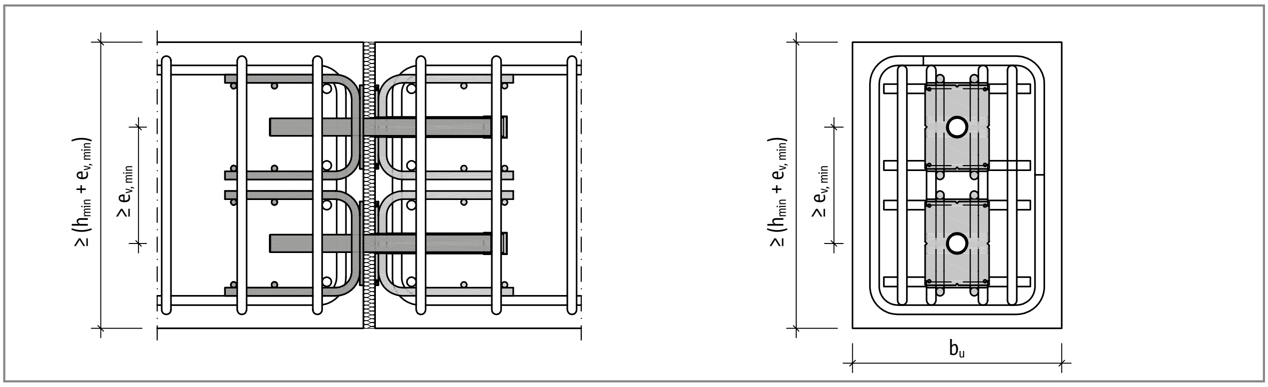


Fig. 32: Schöck Dorn type SLD: On-site reinforcement for beam connection

SLD

Verification of the load-bearing capacity | steel load-bearing capacity

Verification of the load-bearing capacity in accordance with approval document Z-15.7-236

The load-bearing capacity of an expansion joint connection using the Schöck Dorn type is determined as being the minimum verifiable resistance to punching through shear failure, concrete edge failure and steel load-bearing resistance.

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

with:

V_{Ed} - design value of the effective shear force
V_{Rd} - design resistance of the dowel connection
$V_{Rd,ct}$ - design resistance against punching shear failure
$V_{Rd,c}$ - design resistance against concrete edge failure
$V_{Rd,s}$ - design resistance against steel failures of the dowel

These verifications are necessary if the constraints for the design tables are not observed. The punching shear design must be conducted if the critical spacings according to page 20 are undercut or the on-site reinforcement according to page 30 has been modified. The load-bearing capacity of the concrete edge must, in addition, be checked if the on-site reinforcement deviates from the recommendations on page 30.

Steel load-bearing capacity in accordance with approval document Z-15.7-236

The steel load-bearing capacity of the Schöck Dorn type SLD is determined from the minimum of the load-bearing capacities of the welded-on stirrups, the welded seams, the front plate and the dowel. It is thus independent of the surrounding concrete. The load-bearing capacity is always relevant in structural components in which concrete edge and punching shear failure can be ruled out. This is the case, for example, in walls or columns.

Schöck Dorn type SLD	40	50	60	70	80	120	150
Joint width [mm]	Steel load-bearing capacity $V_{Rd,s}$ [kN]						
10	85.0	102.5	126.6	163.1	204.3	270.7	372.0
20	67.6	85.6	105.7	139.6	178.2	270.7	372.0
30	50.2	66.4	84.8	116.1	152.0	253.8	341.9
40	37.6	50.1	65.0	92.6	125.9	221.6	305.3
50	30.1	40.1	52.0	74.1	101.6	189.4	268.7
60	25.1	33.4	43.4	61.7	84.7	158.9	232.2

Schöck Dorn type SLD	Q 40	Q 50	Q 60	Q 70	Q 80	Q 120	Q 150
Joint width [mm]	Steel load-bearing capacity $V_{Rd,s}$ [kN]						
10	76.5	94.3	113.9	146.8	183.8	270.7	372.0
20	60.8	77.0	95.1	125.6	160.3	257.4	340.6
30	45.2	59.8	76.3	104.5	136.8	228.4	307.7
40	33.9	45.1	58.5	83.3	113.3	199.4	274.8
50	27.1	36.1	46.8	66.7	91.5	170.5	241.9
60	22.6	30.1	39.0	55.6	76.2	143.0	209.0

SLD

Punching shear design

Punching shear design in accordance with approval document Z-15.7-236

The punching shear design in accordance with approval document Z-15.7-236, in deviation from the standard BS EN 1992-1-1 (EC2), is carried out with a spacing of 1.5d. This verification management has proven itself over years and enables smaller, critical edge distances and dowel spacings compared with a punching shear design in a spacing of 2d in accordance with EC2.

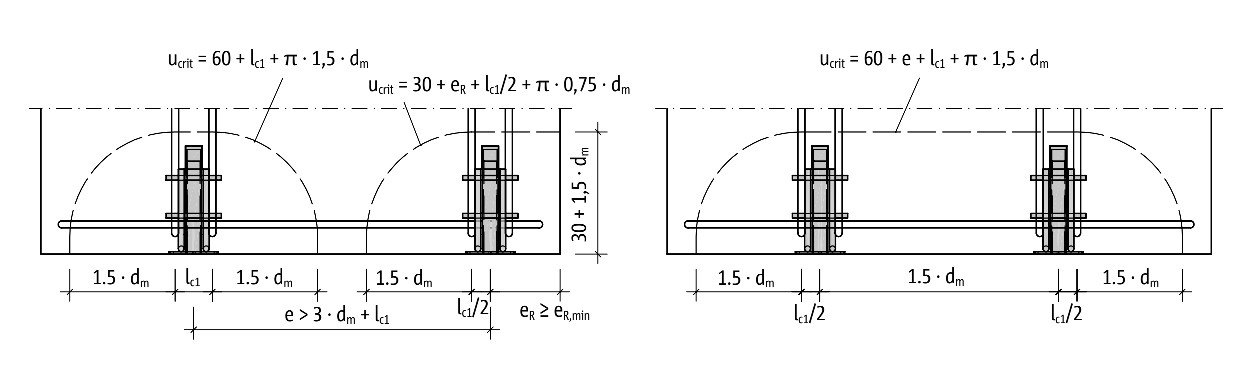


Fig. 33: Schöck Dorn type SLD: Lengths of the perimeter for the punching shear design dependent on the dowel spacings

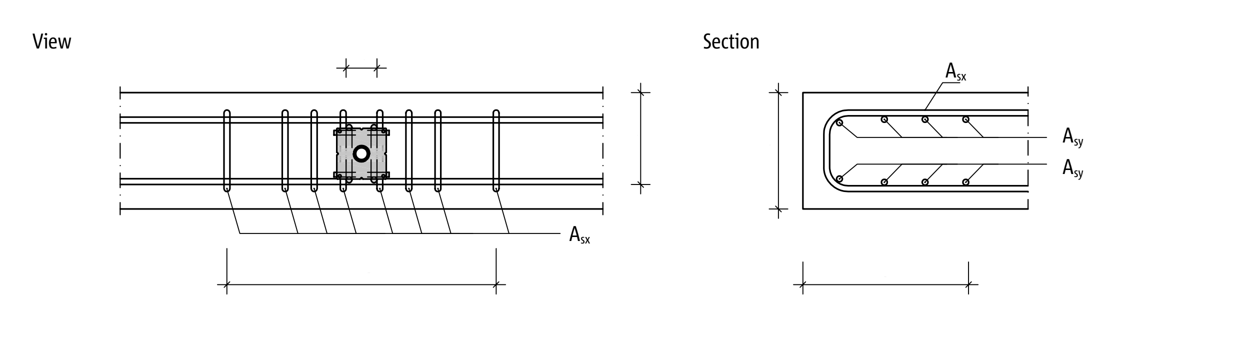


Fig. 34: Schöck Dorn type SLD: Dimensions of the punching area

Punching shear resistance:

$V_{Rd,ct}$ $= 0.14 \cdot \eta_1 \cdot \kappa \cdot (100 \cdot \rho_l \cdot f_{ck})^{1/3} \cdot d_m \cdot u_{crit}/\beta$

with:

η_1	$= 1.0$ for standard concrete
κ	$= 1 + (200 / d_m)^{1/2} \leq 2.0$
d_m	- mean static effective depth [mm] $d_m = (d_x + d_y) / 2$
ρ_l	- reinforcement ratio of longitudinal reinforcement within the perimeter $\rho_l = (\rho_x \cdot \rho_y)^{1/2} \leq 0.5 \cdot f_{cd} / f_{yd} \leq 0.02$ $\rho_x = A_{sx} / (d_x \cdot b_y)$ $\rho_y = A_{sy} / (d_y \cdot b_x)$
f_{ck}	- characteristic compression strength of the concrete
β	- coefficient for consideration of non-uniform load application; with dowels at the corners 1.5, otherwise 1.4
u_{crit}	- length of the critical perimeter (see diagram)

Concrete edge failure

Verification against concrete edge failure in accordance with approval document Z-15.7-236

The verification against concrete edge failure is a product-specific verification and is based on the evaluation of tests. For the verification, the load-bearing capacity is calculated with the aid of the suspended reinforcement on both sides of the dowel. However, only the legs of the suspended reinforcement may be taken into account, whose effective anchoring length (l'_i) in the breakout cone is greater than zero. Otherwise these legs are too far from the dowel and are thus ineffective.

$V_{Rd,ce} = (\Sigma V_{Rd,1,i} + \Sigma V_{Rd,2,i}) \cdot f_\mu \leq \Sigma A_{sx,i} \cdot f_{yd} \cdot f_\mu$

$f_\mu = 0.9$ for type SLD-Q, otherwise $f_\mu = 1.0$

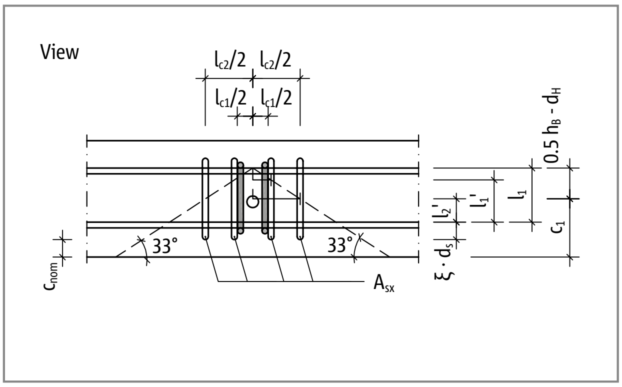


Fig. 35: Schöck Dorn type SLD: Dimensions of the breakout cone of the concrete edge

$V_{Rd,1,i}$ - hook load-bearing capacity of a stirrup alongside the dowel

$V_{Rd,1,i} = 0.357 \cdot \psi_i \cdot A_{sx,i} \cdot f_{yk} \cdot (f_{ck} / 30)^{1/2} / \gamma_c$

with:

- ψ_i - coefficient to take into account the spacing of the suspended reinforcement of the dowel
  $\psi_i = 1 - 0.2 \cdot (l_{ci} / 2) / c_1$
  $l_{ci}/2$ = distance $A_{sx,i}$ from dowel, of the suspended reinforcement considered
  l_{c1} - distance of the first stirrup row of the dowel, see page 30
  c_1 - edge separation starting from the dowel centre up to the free edge
- $A_{sx,i}$ - cross-section of a leg of the suspended reinforcement in the breakout cone
- f_{yk} - characteristic yield strength of the suspended reinforcement
- f_{ck} - characteristic compression strength of the concrete
- γ_c - $\gamma_c = 1.5$

$V_{Rd,2,i}$ - bond resistance of a stirrup alongside the dowel

$V_{Rd,2,i} = \pi \cdot d_s \cdot l'_i \cdot f_{bd}$

with:

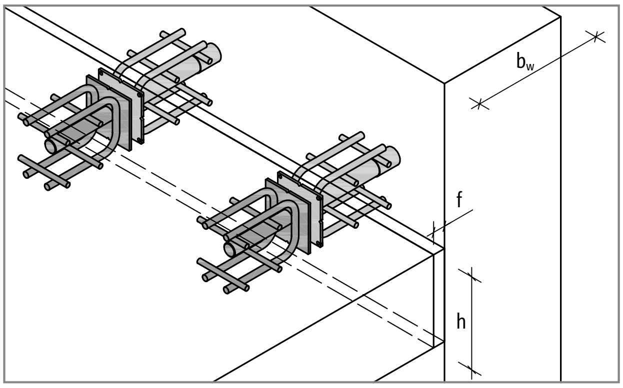
- d_s - diameter of the suspended reinforcement in [mm]
- l'_i - effective anchoring length of the suspended reinforcement in the breakout cone
  $l'_i = l_1 - (l_{ci} / 2) \cdot \tan 33°$
  $l_{ci}/2$ - distance $A_{sx,i}$ from dowel of the suspended reinforcement considered
  $l_1 = h / 2 + (0.5 \cdot h_b - d_h) - \xi \cdot d_s - c_{nom}$
  $\xi = 3$ for $d_s \leq 16$ mm
  $\xi = 4.5$ for $d_s > 16$ mm
  h_b, d_h - dimensions of the Schöck Dorn type SLD, see page 22 and 23
  c_{nom} - concrete cover of the suspended reinforcement
- f_{bd} - design value of the bond resistance between reinforcing steel and concrete in accordance with BS EN 1992-1-1 (EC2)

Design example

Connection of a floor slab to a wall

Concrete:	C25/30	
Slab thickness:	h	= 250 mm
Wall thickness:	b_w	= 300 mm
Concrete cover:	$c_{nom,u} = c_{nom,o}$	= 30 mm
Design value of the shear force:	v_{Ed}	= 100 kN/m
Joint length:	l_f	= 5.0 m
Joint width on installation:	f_E	= 20 mm
Maximum joint opening:	f	= 32 mm

The maximum joint opening to be expected is relevant for the design of the Schöck Dorn type SLD. This dimension can be determined through superimposition of the deformations from the shrinkage, loading and temperature changes which occur. Further information on the calculation of maximum joint width is given on page 12.
In accordance with approval document Z-15.7-236, for the design, the maximum joint opening to be expected must be rounded up to a full 10 mm. For this reason in the following design a maximum joint width of 40 mm is assumed.



Design example

Design Schöck Dorn type SLD

Determination of the design load for the dowel:

Maximum dowel spacing:	$e_{h,max}$	$= 8 \cdot h = 8 \cdot 250 = 2000$ mm = 2.0 m
Minimum possible number of dowels:	n_{Dorn}	$= l_f / e_{h,max} = 5.0 / 2.0 = 2.5 \approx 3$ dowels
Maximum possible dowel spacing:	e_h	$= l_f / n_{Dorn} = 5 / 3 = 1.6$ m
Loading per dowel:	$V_{Ed,SLD}$	$= e_h \cdot v_{Ed} = 1.6 \cdot 100 = 160$ kN

Selection of the dowel using the design table page 24:

Edge conditions:	Slab height = 250 mm and joint width = 40 mm	
	Selected: SLD 80	
Load-bearing capacity SLD 80:	$V_{Rd,SLD\ 80}$	$= 125.9$ kN $\leq V_{Ed,SLD} = 160$kN
	The dowel spacing must be reduced	

Determination of the optimum dowel spacing:

Maximum dowel spacing:	$e_{h,max,SLD\ 80}$	$= V_{Rd,SLD\ 80} / v_{Ed} = 125.9 / 100 \approx 1.25$ m
Number of dowels required:	n_{Dorn}	$= l_f / e_{h,max,SLD\ 80} = 5.0 / 1.25 = 4$ dowels
Loading per dowel:	$V_{Ed,SLD\ 80}$	$= e_{h,max,SLD\ 80} \cdot v_{Ed} = 1.25 \cdot 100 = 125$ kN

Checking of the minimum structural component measurements in accordance with page 19:

Minimum slab thickness:	h_{min}	$= 240$ mm $\leq h = 250$ mm
Minimum wall thickness:	$b_{w,min}$	$= 275$ mm $\leq b_w = 300$ mm

Checking of the critical dowel spacings and edge separations in accordance with page 20:

Critical dowel spacing:	$e_{h,crit}$	$= 700$ mm $\leq e_{h,max,SLD\ 80} = 1250$ mm
Critical edge distance:	$e_{R,crit}$	$= 555$ mm $\leq e_R = e_{h,max,SLD\ 80} / 2 = 1250 / 2 \approx 630$ mm

On-site reinforcement in accordance with page 30:

Longitudinal reinforcement:	A_{sy}	$= 2 \cdot 3 \cdot$ H16
Suspended reinforcement:	A_{sx}	$= 2 \cdot 5$ H16

Thus all the constraints for the application of the design tables are met and no further verification for the dowel connection is required. The reinforcement along the slab edge and in the slab must be certified as separated.
For information the detailed verifications of the dowel connection are listed below.

Steel load-bearing capacity

Load-bearing capacity:	$V_{Rd,s}$	= in accordance with table page 33 for SLD 80 with a joint width of 40 mm
	$V_{Rd,s}$	= 125.9 kN

SLD

Design example

Punching shear design

Load bearing capacity: $V_{Rd,ct} = 0.14 \cdot \eta_1 \cdot \kappa \cdot (100 \cdot \rho_l \cdot f_{ck})^{1/3} \cdot d_m \cdot u_{crit}/\beta$

with:

η_1 = 1.0 for standard concrete

$d_m = (d_x + d_y) / 2 = (212 + 193) / 2 = 202$ mm

$d_x = h - c_{nom} - \varnothing_{Asx} /2 = 250 - 30 - 16 / 2 = 212$ mm

$d_y = h / 2 + h_B /2 - d_D - \varnothing_{Asy} /2 = 250 / 2 + 180 / 2 - 14 - 16 / 2 = 193$ mm

h_B and d_D see page 22

$\kappa = 1 + (200 / d_m)^{1/2} = 1 + (200 / 202)^{1/2} = 2.0$

$\rho_l = (\rho_x \cdot \rho_y)^{1/2} = (0.0138 \cdot 0.00938)^{1/2} = 0.0113$

$\rho_x = A_{sx} / (d_x \cdot b_y) = 10 \cdot 201 / (212 \cdot 695) = 0.0136$

$\rho_y = A_{sy} / (d_y \cdot b_x) = 3 \cdot 201 / (193 \cdot 333) = 0.00938$

$b_y = 3 \cdot d_m + l_{c1} = 3 \cdot 202 + 89 = 695$ mm

$b_x = 1.5 \cdot d_m + 30 = 1.5 \cdot 202 + 30 = 333$ mm

$l_{c1} = 89$ mm see page 30

$f_{ck} = 25$ N/mm²

β = 1.4 - Dowel in the edge area

$u_{crit} = 60 + l_{c1} + 1.5 \cdot d_m \cdot \pi = 60 + 89 + 1.5 \cdot 202 \cdot \pi = 1100$ mm

Load-bearing capacity: $V_{Rd,ct} = 0.14 \cdot \eta_1 \cdot \kappa \cdot (100 \cdot \rho_l \cdot f_{ck})^{1/3} \cdot d_m \cdot u_{crit}/\beta$

$= 0.14 \cdot 1.0 \cdot 2.0 \cdot (100 \cdot 0.0113 \cdot 25)^{1/3} \cdot 202 \cdot 1100 / 1.4 = 135.3$ kN

Concrete edge fracture

Load-bearing capacity: $V_{Rd,ce} = (\Sigma V_{Rd,1,i} + \Sigma V_{Rd,2,i}) \cdot f_\mu \leq \Sigma A_{sx,i} \cdot f_{yd} \cdot f_\mu$

Hook load-bearing capacity: $V_{Rd,1,i} = 0.357 \cdot \psi_i \cdot A_{sx,i} \cdot f_{yk} \cdot (f_{ck} / 30)^{1/2} / \gamma_c$

with:

$A_{sx,i} = 201$ mm² (⌀ 16)

$f_{yk} = 500$ N/mm² (B500)

$f_{ck} = 25$ N/mm²

$\gamma_c = 1.5$

$c_1 = h / 2 = 250 / 2 = 125$ mm

$\psi_i = 1 - 0.2 \cdot (l_{ci} / 2) / c_1$

1. Stirrup alongside the dowel

$l_{c1} = 89$ mm see page 30

$\psi_1 = 1 - 0.2 \cdot (89 / 2) / 125$ mm $= 0.93$

$V_{Rd,1,1} = 0.357 \cdot 0.93 \cdot 201 \cdot 500 \cdot (25 / 30)^{1/2} / 1.5 = 20.3$ kN

2. Stirrup alongside the dowel

$l_{c2} = l_{c1} + 2 \cdot s_1 = 89 + 2 \cdot 36 = 161$ mm see page 30

$\psi_2 = 1 - 0.2 \cdot (161 / 2) / 125 = 0.87$

$V_{Rd,1,2} = 0.357 \cdot 0.87 \cdot 201 \cdot 500 \cdot (25 / 30)^{1/2} / 1.5 = 19.0$ kN

3. Stirrup alongside the dowel

$l_{c3} = l_{c2} + 2 \cdot s_i = 161 + 2 \cdot 50 = 261$ mm see page 30

$\psi_3 = 1 - 0.2 \cdot (261 / 2) / 125 = 0.79$

$V_{Rd,1,3} = 0.357 \cdot 0.79 \cdot 201 \cdot 500 \cdot (25 / 30)^{1/2} / 1.5 = 17.3$ kN

4. Stirrup alongside the dowel

$l_{c4} = l_{c3} + 2 \cdot s_i = 261 + 2 \cdot 50 = 361$ mm see page 30

$\psi_4 = 1 - 0.2 \cdot (361 / 2) / 125 = 0.71$

$V_{Rd,1,4} = 0.357 \cdot 0.71 \cdot 201 \cdot 500 \cdot (25 / 30)^{1/2} / 1.5 = 15.5$ kN

Design example

Bond resistance $V_{Rd,2,i} = \pi \cdot d_s \cdot l'_i \cdot f_{bd}$

with:

$d_s = 16$ mm

$h_b = 180$ mm see page 22

$d_h = 14$ mm see page 22

$\xi = 3$ for $d_s \leq 16$ mm

$c_{nom} = 30$ mm

$f_{bd} = 2.7\ N/mm^2$

$l_1 = h / 2 + (0.5 \cdot h_b - d_h) - \xi \cdot d_s - c_{nom}$

$= 250 / 2 + (0.5 \cdot 180 - 14) - 3 \cdot 16 - 30 = 123$ mm

$l'_i = l_1 - (l_{ci} / 2) \cdot \tan 33°$

1. Stirrup alongside the dowel

$l_{c1} = 89$ mm see page 30

$l'_1 = 123 - (89 / 2) \cdot \tan 33° = 94$ mm

$V_{Rd,2,1} = \pi \cdot 16 \cdot 94 \cdot 2.7 = 12.8$ kN

2. Stirrup alongside the dowel

$l_{c2} = l_{c1} + 2 \cdot s_1 = 89 + 2 \cdot 36 = 161$ mm

$l'_2 = 123 - (161 / 2) \cdot \tan 33° = 71$ mm

$V_{Rd,2,2} = \pi \cdot 16 \cdot 71 \cdot 2.7 = 9.6$ kN

3. Stirrup alongside the dowel

$l_{c3} = l_{c2} + 2 \cdot s_i = 161 + 2 \cdot 50 = 261$ mm

$l'_3 = 123 - (261 / 2) \cdot \tan 33° = 38$ mm

$V_{Rd,2,3} = \pi \cdot 16 \cdot 38 \cdot 2.7 = 5.2$ kN

4. Stirrup alongside the dowel

$l_{c4} = l_{c3} + 2 \cdot s_i = 261 + 2 \cdot 50 = 361$ mm

$l'_4 = 123 - (361 / 2) \cdot \tan 33° = 6$ mm

$V_{Rd,2,4} = \pi \cdot 16 \cdot 6 \cdot 2.7 = 0.8$ kN

A maximum of 4 stirrups per side of the dowel can be taken into account.

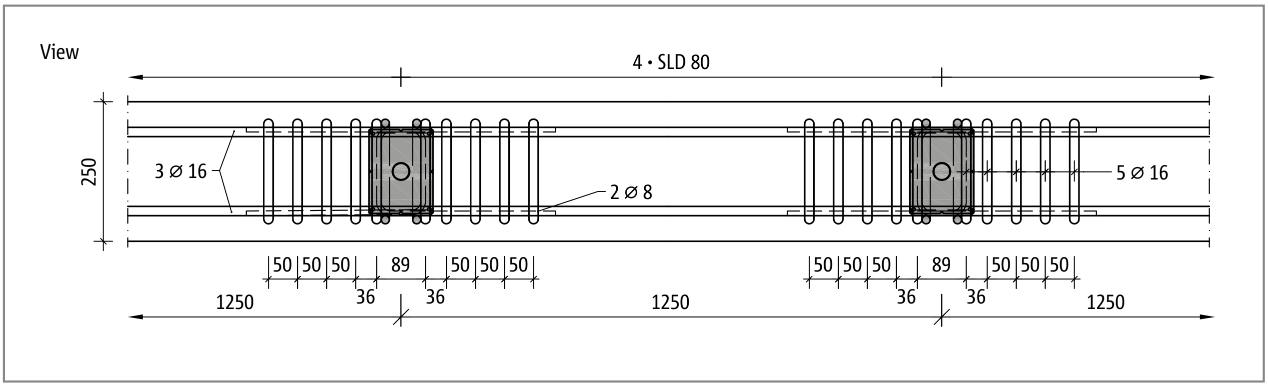
Load-bearing capacity: $V_{Rd,ce} = (\Sigma V_{Rd,1,i} + \Sigma V_{Rd,2,i}) \cdot f_\mu \leq \Sigma A_{sx,i} \cdot f_{yd} \cdot f_\mu$

$= [2 \cdot (20.3 + 19.0 + 17.3 + 15.5) + 2 \cdot (12.8 + 9.6 + 5.2 + 0.8)] \cdot 1.0$

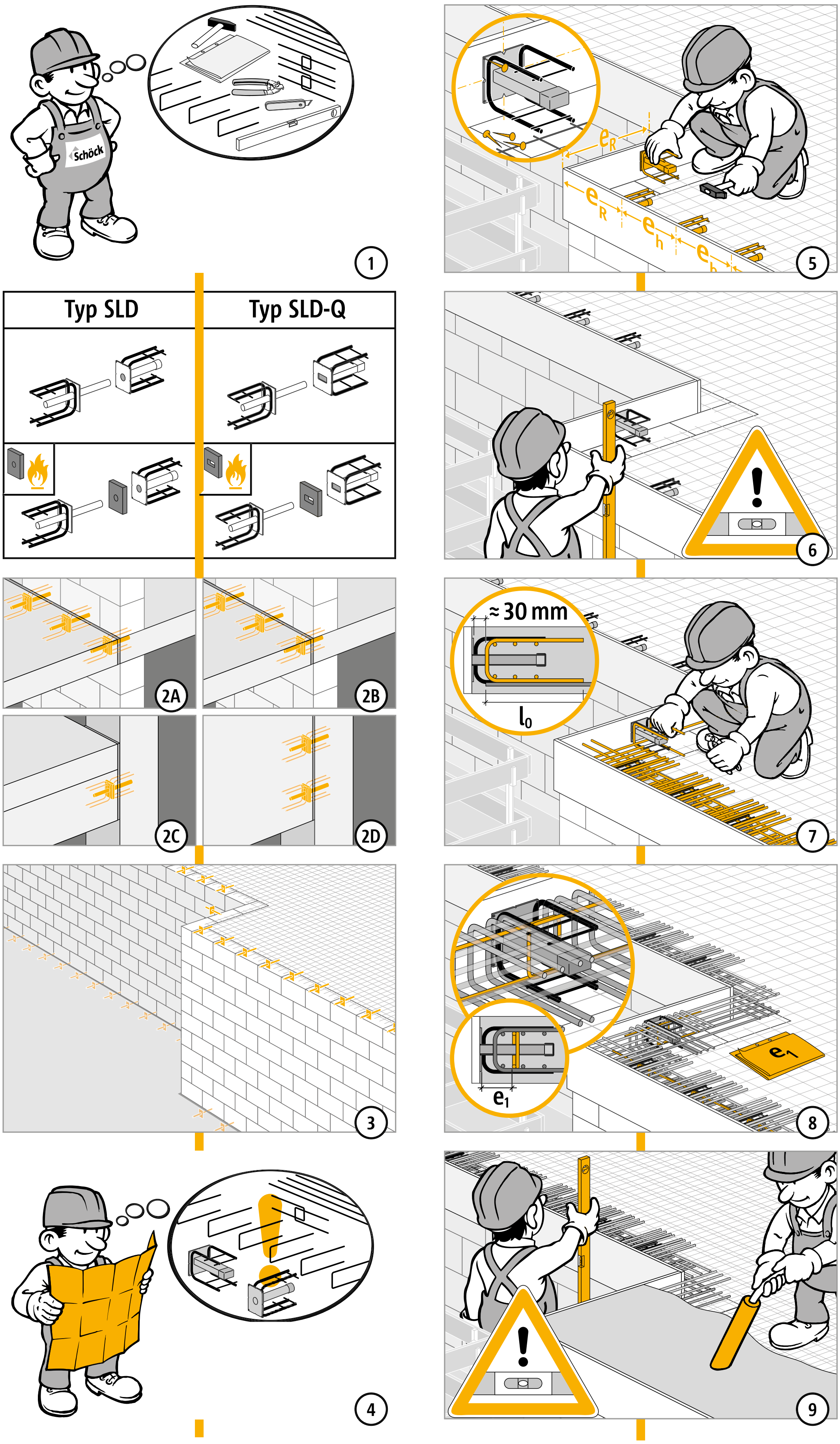
$= 201.0$ kN $\leq 8 \cdot 201 \cdot 43.5 = 699.7$ kN

Verification

Punching force:	$V_{Rd,ct} = 125.9$ kN	$\geq V_{Ed,SLD\ 80} = 125$ kN
Concrete edge fracture:	$V_{Rd,ce} = 201.0$ kN	$\geq V_{Ed,SLD\ 80} = 125$ kN
Steel failure:	$V_{Rd,s} = 125.9$ kN	$\geq V_{Ed,SLD\ 80} = 125$ kN



Installation instructions



Installation instructions