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Bautechnisches Prüfamt

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European Technical Assessment ETA-11/0105 of 28 June 2018

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General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	System Cocoon "Transformer"
Product family to which the construction product belongs	Metal frame building kit
Manufacturer	Cocoon System AG St. Johanns-Vorstadt 80 4056 Basel SCHWEIZ
Manufacturing plant	Herstellwerk 1 Cocoon System AG
This European Technical Assessment contains	35 pages including 30 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	ETAG 025, used as EAD according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.
This version replaces	ETA-11/0105 issued on 11 April 2011

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Specific Part

1 Technical description of the product

The system Cocoon "Transformer" consists of industrially prefabricated load-bearing room-separating wall and floor elements which are brought to the site as assembled elements of varying completion rates and mounted there to a metal frame building (see Annex 1).

The wall and floor elements consist of thin-walled, cold-formed U- respectively C-formed profiles made of steel with a double-sided sheathing of wood-based boards or gypsum fibre boards.

The prefabricated wall and floor elements as well as examples for essential details of construction including their joints are shown in Annex B.1 to this European Technical Assessment.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The system Cocoon "Transformer" is used for single-storey to at the most four-storey (ground floor and 3 upper floors) dwellings or buildings with comparable indoor climate and comparable use or for additions of stories on existing buildings (also for more than 4 entire floors). The intended use shall be assessed in the individual case depending on the climatic boundary conditions.

The performances given in section 3 are only valid if the system Cocoon "Transformer" is used in compliance with the specifications and conditions given in Annex A.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the system Cocoon "Transformer" of at least 50 years for the structure and for the not accessible building elements and materials, and 25 years for repairable or replaceable building components and building materials. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
characteristic values of resistance and section properties of the wall and lintel profiles	see Annex A, Table A.1
characteristic values of resistance and section properties of the floor profiles	see Annex A, Table A.2
characteristic values of resistance of the ballistic nails	see Annex A, Table A.3, A.4 and A.5
characteristic values of resistance of the screws	see Annex A, Table A.6 and A.7
seismic action	no performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	
steel profiles according to Annex A, section A.1.3.1 as well as the fasteners according to Annex A, section A.1.3.3 and the elements according to Annex A, section A.1.3.4 and A.1.3.5	Class A1
resin-bonded chipboards and OSB-boards according to Annex A, section A.1.3.2	Class D-s2, d0
cement-bonded chipboards according to Annex A, section A.1.3.2	Class B-s1, d0
gypsum fibre boards according to Annex A, section A.1.3.2	Class A2-s1, d0 respectively A1
mineral wool according to Annex A, section A.1.3.6	Class A1
Resistance to fire, external fire performance of the roof covering, fire compartmentation	no performance assessed

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Vapour permeability and moisture resistance, watertightness	no performance assessed
Release of dangerous substances	no performance assessed

3.4 Safety and accessibility in use (BWR 4)

Essential characteristic	Performance
Safety in use	no performance assessed

3.5 Protection against noise (BWR 5)

Essential characteristic	Performance
Protection against noise	no performance assessed

3.6 Energy economy and heat retention (BWR 6)

Essential characteristic	Performance
Energy economy and heat retention	no performance assessed

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with ETAG 025, the applicable European legal act is: 2003/728/EC.
The system to be applied is : 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 28 June 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Schult

Annex A

A.1 Characteristics of product

A.1.1 General

The dimensions, tolerances and material properties of the components which are not stated in the Annexes, shall be in accordance with the indication given in the technical documentation[1] to this European Technical Assessment.

A.1.2 Dimensions

The dimensions of the components of the system Cocoon "Transformer" shall correspond to the indications given in the Annexes to this European Technical Assessment.

A.1.3 Material properties

A.1.3.1 Profiles made of steel

For the manufacture of the wall and floor elements the cross-sections according to Annex B.2 shall be used. The cross-sections shall be made from thin-walled, cold-formed U- respectively C-formed steel profiles S320GD+Z or DX51D+Z275 according to EN 10346 with the following minimum values:

Yield strength: f_y = 320 N/mm^2
Tensile strength: R_m = 390 N/mm^2
Ultimate elongation: A_{80} = 17 %

A.1.3.2 Sheathing

For the sheathing of wall and floor elements the products according to Table A.3 may be used.

A.1.3.3 Fasteners

As fasteners screws and nails shall be used that are in accordance with indications given in Annexes B.8 and B.9 and in the technical documentation[1] to this European Technical Assessment.

A.1.3.4 Angle brackets and bracing elements

The angle brackets and bracing elements according to Annex B.3 shall be made of thin-walled, cold-formed steel profiles S250GD+Z according to EN 10346 with the following minimum values:

Yield strength: f_y = 250 N/mm^2
Tensile strength: R_m = 330 N/mm^2
Ultimate elongation: A_{80} = 19 %

A.1.3.5 Hat ceiling profiles/hat spring rails

The hat ceiling profiles/hat spring rails according to Annex B.5 shall be made of galvanized steel sheet according to EN 10346 with a minimum thickness of sheet of 0.6 mm and taking into account the indications of the technical documentation[1] to this European Technical Assessment.

A.1.3.6 Insulation material, steam brake/air tightness

As insulation material mineral wool according to EN 13162 is used. The thickness depends on the requirements concerning the building physics applicable to the structure.

As steam brake/air tightness PE foil according to EN 13984 is used according to the requirements concerning the building physics applicable to the structure.

[1] The technical documentation of this ETA is deposited with DIBt and, as far as this is important for the tasks of the body involved in the procedure of attestation of conformity, shall be handed over to the approved bodies.

A.1.4 Safety in case of fire

The steel profiles according to section A.1.3.1 as well as the fastening elements according to section A.1.3.3 and the elements according to section A.1.3.4 and A.1.3.5 satisfy the requirements of Class A1 of the reaction-to-fire performance appropriate to EN 13501-1.

The resin-bonded chipboards as well as the OSB-boards according to section A.1.3.2 satisfy the requirements of Class D-s2, d0 of the reaction-to-fire performance appropriate to EN 13501-1.

The cement-bonded chipboards according to section A.1.3.2 satisfy the requirements of Class B-s1, d0 of the reaction-to-fire performance appropriate to EN 13501-1.

The gypsum fibre boards according to section A.1.3.2 satisfy the requirements of Class A2-s1, d0 respectively A1 of the reaction-to-fire performance appropriate to EN 13501-1.

The mineral wool according to section A.1.3.6 satisfies the requirement of Class A1 of the reaction-to-fire performance appropriate to EN 13501-1.

The steam brake/air tightness according to section A.1.3.6 satisfies the requirement of Class E of the reaction-to-fire performance appropriate to EN 13501-1.

A.1.5 Corrosion protection

The provisions given in EN ISO 12944 respectively EN 10346, EN 1090-2 and EN 1995-1-1 apply.

A.1.6 Durability, serviceability and Identification

A.1.6.1 Aspects of durability

Durability of the kit is acceptable in relation to the intended use and performance related to sections 3.1, 3.2 and 3.3 of this European Technical Assessment.

For the corrosion protection section A.1.5 applies.

Concerning the wood-based boards EN 1995-1-1 respectively EN 13968 shall apply, as far as the gypsum fibre boards are concerned the relevant European Technical Assessment shall apply.

A.1.6.2 Aspects of serviceability

For the serviceability of the kit shall be ensured that suspended floors have sufficient stiffness to avoid unacceptable vibrations through normal use. The deflections of the wall and floor elements shall be limited in accordance with the requirements of the Member States.

A.1.6.3 Identification

The kit is identified with the CE marking. All individual components are identified in section 3 of this European Technical Assessment.

A.2 Assumptions concerning design

A.2.1 General

The design of the Cocoon "Transformer" system is carried out under the following conditions:

The loading is static or quasi-static according to EN 1990.

Dimensions, material properties and Minimum distances are observed.

The verification concept stated in EN 1990 as well as the characteristic values of resistance stated below are used for design.

The rules given in EN 1090-2 und EN ISO 12944 are taken into account.

Design is carried out by the designer of the structure experienced in the field of steel structures.

All building elements not specified in this European Technical Assessment (e.g. cladding, roof covering, windows, doors, stairs, surface covering, service installations, complementary structures (including substructure, foundation), etc.), which are required for a finished construction works are not part of this European Technical Assessment. This also applies to additional load-bearing components (e.g. beams or steel girders for concentrated loads/point loads) which are needed for each single construction works according to the static calculation.

A.2.2 Structural design

A.2.2.1 Design values and required verifications for wall and floor profiles

The characteristic values of load-bearing capacity and section properties of wall and lintel profiles should be taken from Table A.1 and of floor profiles from Table A.2. Design values result from characteristic values by dividing them by the partial safety factor γ_{M1}.

Table A.1: Characteristic values of resistance and section properties, wall and lintel profiles

Type	Profile	t_N	t_k	A_g	J_g	A_{eff}	W_{eff}	J_{eff}	M_{Rk}	$N_{b,Rk}$ in [kN] for s_k in [m]			V_{Rk}
		[mm]	[mm]	[cm²]	[cm⁴]	[cm²]	[cm³]	[cm⁴]	[kNm]	2.60	3.50	4.00	[kN]
Wall profiles	U 100/40/1.5	1.50	1.46	2.59	39.48	1.47	5.79	33.55	1.85	36.29	29.99	26.53	24.24
	U 100/40/2.0	2.00	1.96	3.45	52.15	2.48	8.57	47.69	2.74	57.29	45.27	39.12	35.50
	U 150/40/1.5	1.50	1.46	3.32	103.13	1.52	9.41	88.12	3.01	43.85	40.24	38.10	24.24
	U 150/40/2.0	2.00	1.96	4.43	136.80	2.62	15.45	126.76	4.94	73.12	65.75	61.39	43.69
	U 200/40/1.5	1.50	1.46	4.05	208.22	1.55	12.95	169.40	4.14	47.61	45.15	43.75	18.42
	U 200/40/2.0	2.00	1.96	5.41	276.84	2.68	21.63	256.02	6.92	80.62	75.68	72.82	43.69
	U 250/40/2.0	2.00	1.96	6.39	484.52	2.72	27.77	429.49	8.89	85.18	81.46	79.37	35.68
	U 300/40/2.0	2.00	1.96	7.37	772.09	2.75	33.97	654.08	10.87	88.00	85.34	83.68	29.69
	C 97/50/1.5	1.50	1.46	3.08	48.01	2.10	8.53	43.53	2.73	53.58	44.02	38.45	24.24
	C 96/50/2.0	2.00	1.96	4.08	61.63	3.26	11.74	57.69	3.76	79.17	62.27	53.20	34.05
	C 147/50/1.5	1.50	1.46	3.81	125.15	2.09	13.56	111.75	4.34	61.47	57.23	54.53	24.24
	C 146/50/2.0	2.00	1.96	5.06	162.63	3.31	20.10	151.17	6.43	95.45	87.56	82.47	43.69
	C 197/50/1.5	1.50	1.46	4.54	249.95	2.08	18.19	211.74	5.82	64.30	61.73	60.19	18.71
	C 196/50/2.0	2.00	1.96	6.04	326.87	3.31	27.81	300.53	8.90	101.14	96.48	93.65	43.69
Lintel profiles	S 100/175/1.5	1.50	1.46				18.64	193.48	5.97				
	S 100/175/2.0	2.00	1.96				25.75	274.70	8.24				
	S 150/175/1.5	1.50	1.46				18.82	197.80	6.02				
	S 150/175/2.0	2.00	1.96				26.13	284.35	8.36				
	S 200/175/1.5	1.50	1.46				18.90	199.90	6.05				
	S 200/175/2.0	2.00	1.96				26.30	288.96	8.42				

A_g = Gross cross section area
J_g = Moment of inertia
A_{eff} = Effective cross section area for axial compression force with f_{yb} = 320 N/mm²
W_{eff} = Section modulus for effective cross section area
J_{eff} = Effective moment of inertia for deformation calculation
M_{Rk} = Characteristic value of resistance to bending moment, $M_{Rk} = W_{eff} \cdot f_{yb}$
$N_{b,Rk}$ = Characteristic value of resistance to normal force in case of axial compression in dependence of buckling length s_k
V_{Rk} = Characteristic value of resistance to shear force (shear buckling)

Table A.2: Characteristic values of resistance and section properties, floor profiles

Profile	t_N [mm]	t_k [mm]	A_g [cm²]	J_g [cm⁴]	A_{eff} [cm²]	W_{eff} [cm³]	J_{eff} [cm⁴]	M_{Rk} [kNm]	$N_{b,Rk}$ [kN]
D1 C 146/50/2.0	2.00	1.96	5.06	162.6	3.31	20.10	151.2	6.43	82.47
DT1 C 146/50/2.0	2.00	1.96	10.12	325.3	6.62	40.20	302.3	12.86	164.93
D2 C 196/50/2.0	2.00	1.96	6.04	326.9	3.31	27.81	300.5	8.90	93.65
DT2 C 196/50/2.0	2.00	1.96	12.08	653.7	6.62	55.62	601.1	17.80	187.30
D3 U 246/50/2.0	2.00	1.96	6.70	523.5	2.76	28.18	441.8	9.02	81.06
DT3 U 246/50/2.0	2.00	1.96	13.40	1047.0	5.52	56.36	883.5	18.04	162.12
D4 U 296/50/2.0	2.00	1.96	7.68	830.6	2.79	34.53	673.2	11.05	85.28
DT4 U 296/50/2.0	2.00	1.96	15.36	1661.2	5.58	69.06	1346.4	22.10	170.57

			Single load or support load			Opposite transverse loads (pass through)			
Profile	t_N [mm]	t_k [mm]	$R_{A,Rk}$ [kN]	$R_{B,Rk,50}$ [kN]	$R_{B,Rk,150}$ [kN]	$R_{A,Rk}$ [kN]	$R_{B,Rk,50}$ [kN]	$R_{B,Rk,150}$ [kN]	V_{Rk} [kN]
D1 C 146/50/2.0	2.00	1.96	13.97	19.21	26.57	9.24	23.65	32.21	43.69
DT1 C 146/50/2.0	2.00	1.96	27.93	38.42	53.14	18.48	47.29	64.42	87.38
D2 C 196/50/2.0	2.00	1.96	13.97	19.21	26.57	9.24	23.65	32.21	43.69
DT2 C 196/50/2.0	2.00	1.96	27.93	38.42	53.14	18.48	47.29	64.42	87.38
D3 U 246/50/2.0	2.00	1.96	13.97	19.21	26.57	9.24	23.65	32.21	36.26
DT3 U 246/50/2.0	2.00	1.96	27.93	38.42	53.14	18.48	47.29	64.42	72.52
D4 U 296/50/2.0	2.00	1.96	13.97	19.21	26.57	9.24	23.65	32.21	30.10
DT4 U 296/50/2.0	2.00	1.96	27.93	38.42	53.14	18.48	47.29	64.42	60.20

A_g = Gross cross sectional area
J_g = Moment of inertia
A_{eff} = Effective cross sectional area for axial compression force with f_{yb} = 320 N/mm²
W_{eff} = Section modulus for effective cross section area
J_{eff} = Effective moment of inertia for deformation calculation
M_{Rk} = Characteristic value of resistance to bending moment, $M_{Rk} = W_{eff} \cdot f_{yb}$
$N_{b,Rk}$ = Characteristic value of resistance to normal forces in case of axial compression, buckling length s_k= 4.0 m
$R_{A,Rk}$ = Characteristic value of resistance to reaction force at end supports
$R_{B,Rk,50}$ = Characteristic value of resistance to reaction force at intermediate supports, width b_B = 50 mm
$R_{B,Rk,150}$ = Characteristic value of resistance to reaction force at intermediate supports, width b_B = 150 mm
V_{Rk} = Characteristic value of resistance to shear force (shear buckling)
Resistance terms $R_{A,Rk}$ and $R_{B,Rk}$ can also be used for verification of transferred forces from storeys above.

As partial safety factor γ_{M1} the value 1.1 is recommended. It should be used provided the value is not stated in the national provisions of the Member State where the system Cocoon "Transformer" will be used and/or in the National Annex to Eurocode 3.

The following verifications of wall, lintel and floor profiles are required:

A.2.2.1.1 For axial loads without horizontal loads the following applies:

$$\frac{N_{Ed}}{N_{b,Rk} / \gamma_{M1}} \leq 1$$

A.2.2.1.2 For floor profiles without axial force the following applies:

$$\frac{M_{Ed}}{M_{Rk} / \gamma_{M1}} \leq 1$$

A.2.2.1.3 For floor profiles with support reaction forces F_{Ed} (including transmitted forces from storeys above) the following applies:

$$\frac{F_{Ed}}{R_{Rk}/\gamma_{M1}} \leq 1$$

A.2.2.1.4 Combined loading from bending moment and axial force

For wall profiles with eccentric axial loading N_{Ed} or bending moments M_{Ed} due to wind loads or other horizontal forces as well as for floor profiles with axial forces due to diaphragm action the following shall be verified:

$$\left(\frac{N_{Ed}}{N_{b,Rk}/\gamma_{M1}}\right)^{0,8} + \left(\frac{N_{Ed}\cdot e + M_{Ed}}{M_{Rk}/\gamma_{M1}}\right)^{0,8} \leq 1$$

A.2.2.1.5 Combined loading from bending moment and support reaction

For floor profiles with combined loading from bending moment M_{Ed} and support reaction force F_{Ed} (including transferred forces from storeys above) the following shall be verified:

$$\frac{M_{Ed}}{M_{Rk}/\gamma_{M1}} + \frac{F_{Ed}}{R_{Rk}/\gamma_{M1}} \leq 1{,}25 \quad \text{and} \quad \frac{M_{Ed}}{M_{Rk}/\gamma_{M1}} \leq 1 \quad ; \quad \frac{F_{Ed}}{R_{Rk}/\gamma_{M1}} \leq 1$$

where:

γ_{M1} = 1.1 partial safety factor is recommended

$N_{b,Rk}$ = Characteristic value of resistance to axial compression forces of the wall profile in dependence of the buckling length according to Table A.1 and of the floor profile according to Table A.2 or on the basis of calculation according to EN 1993-1-3

M_{Rk} = Characteristic value of resistance to bending moments according to Tables A.1 and A.2

e = 0 in case of axial loads

= h_P / 2 in case of eccentric loads, h_P = height of wall or floor profile

R_{Rk} = Characteristic value of resistance of floor profiles for support forces according to Table A.2

A.1.4 Characteristic values and design values of resistance

The characteristic values of load-bearing capacity and section properties of ballistic nails should be taken from Table A.4 and of screws from Table A.6. Design values result from characteristic values by dividing them by the partial safety factor γ_M.

Table A.3: Sheathing material, minimum thicknesses and building material categories

Product	Technical regulation	Minimum thickness in [mm]		Building material category acc. to EN 13501	function
		Wall	Floor		
Resin-bonded chipboard P5 or P7	EN 13986	15	19	D-s2, d0	load-bearing
Cement-bonded chipboard	EN 13986	16	19	B-s1, d0	load-bearing
OSB/3 or OSB/4-board	EN 13986	15	22	D-s2, d0	load-bearing
Fermacell gypsum fibre board	ETA-03/0050	15	-	A2-s1, d0	load-bearing
Rigidur H gypsum fibre board	ETA-08/0147	15	-	A1	load-bearing
Vidiwall SK, VT gypsum fibre board	ETA-07/0086	15	-	A2-s1, d0	load-bearing

Table A.4: Characteristic values of load-bearing capacity per shear joint and ballistic nail $F_{f,Rk}$ in [N] for minimum sheathing thicknesses according to Table A.3

Component	Wall				Floor			
Thickness of profiled steel sheeting in [mm]	1.5		2.0		1.5		2.0	
Nail diameter in [mm]	2.2	2.8	2.2	2.8	2.2	2.8	2.2	2.8
Resin-bonded chipboard P5 or P7	730	-	-	950	892	-	-	1117
Cement-bonded chipboard	843	-	-	1087	958	-	-	1251
OSB/3 or OSB/4-board	730	-	-	950	940	-	-	1253
Gypsum fibre board[1]	597	-	-	878	-	-	-	-

[1] For Rigidur H gypsum fibre boards the verification of shear strength and buckling has to be carried out. For reasons of simplification the load bearing capacity referred to the length of the connection may be limited to F_{rk}/a_v = 9.3 N/mm instead.

Table A.5: Minimum distances of ballistic nails perpendicular to the edge of the sheathing in [mm]

Component	Wall profile and head rail		Sill	
Nail diameter in [mm]	2.2	2.8	2.2	2.8
Resin-bonded chipboard, OSB- and gypsum fibre board	10	12	15	20
Cement-bonded chipboard	33	42	33	42

Table A.6: Characteristic values of load-bearing capacity per shear joint and screw $F_{f,Rk}$ in [N] (perpendicular to screw axis) for minimum sheathing thicknesses according to Table A.3

Component	Type of screw	Wall		Floor	
Thickness of profiled steel sheeting t_n in [mm]		1.5 bzw. 2.0		1.5 bzw. 2.0	
Screw diameter d in [mm]		3.9	5.5	3.9	5.5
Resin-bonded chipboard	Self-drilling screw	769	853	998	1106
Cement-bonded chipboard	Drywall self-drilling screw	960	1102	1086	1354
OSB/3 or OSB/4-board	Self-drilling screw	769	853	1006	1299
Gypsum fibre board	Drywall self-drilling screw	723	-	-	-

Table A.7: Minimum distances of screws perpendicular to the edge of the sheathing in [mm] d = screw diameter in [mm]

Component	Wall profile and head rail	Sill or wall plate
Resin-bonded chipboard, OSB-board and gypsum fibre board	5d	7d
Cement-bonded chipboard	15d	15d

As partial safety factor γ_{M1} the value 1.3 is recommended. It should be used provided the value is not stated in the national provisions of the Member State where the system Cocoon "Transformer" will be used and/or in the National Annex to Eurocode 3.

For the design value of load-bearing capacity of the connection sheathing - steel profile $f_{p,Rd}$ the following applies:

$$f_{p,Rd} = \frac{F_{f,Rk} \cdot k_{mod}}{a_v \cdot \gamma_M}$$

where:

γ_M = 1.3 partial safety factor is recommended
$F_{f,Rk}$ Characteristic value of load-bearing capacity per shear joint and fastener in [N]
a_v Spacing between fasteners along the perimeter of each panel in [mm]
k_{mod} Modification factor according to EN 1995-1-1

A.2.2.3 Design and requirements for execution of floor diaphragms

Floor diaphragms (cf. Annex B.7) shall be surrounded by webs (steel profiles) and have several continuous inner webs, which are arranged with a unit spacing a_r and are parallel to the outer profiles. The edge webs of the diaphragms shall not be butted, or butt joints shall be designed rigidly. In this regard, butt joints are rigid, when the design value of load-bearing capacity of the joint is greater than 1.5 times the design value of the loading.

The sheathing panels are arranged in rows parallel or perpendicular to the continuous webs. In one direction, the sheathing panels shall always be jerked on webs. In the other direction, the panel edges are not connected or connected shear-resistant e.g. by butt plates.

The joint of sheathing and web is loaded along the web's axis by a shear force per unit length, which is to be assumed as locally constant for each web. Spacing a_v ($20\ d \le a_v \le 40\ d$) between fasteners is continuous at all panel edges on webs and possible butt plates.

For the design of floor diaphragms, which transfer their horizontal support reactions to Cocoon light weight construction wall diaphragms the support reactions of diaphragms that are continuous over several spans may be determined without exact verification and without considering the effect of continuity. The edge webs that are used as supporting should be designed to resist the support reactions. The transmission of the support reactions should be verified.

The regulations of EN 1995-1-1 apply accordingly. The verification of diaphragm deflection is not necessary, if the sheathing's lateral length is at least 1 m and the floor diaphragm's span is less than 4 b, where b is the floor diaphragm's width.

If, in contradiction to EN 1995-1-1, there are unconnected panel edges perpendicular to the inner webs, the load-bearing capacity $f_{p,Rk}$ (according to section A.2.2.2) shall be reduced by a third and within the range of the unconnected panel edges, the minimum edge spacing as for bottom sills mentioned in Table A.5 shall be taken into account. Glued key and slot joints without fishplate joint shall be considered as unconnected panel edges. In addition, the following requirements shall be observed:

- Panels are staggered by at least the unit spacing ar of the webs,
- the distance a_r between the webs is not exceeding 0.75-times the panel's length in direction of the webs,
- the panels are also connected with fastening elements at intervals of av to the webs on which the panels are not abutted,
- the diaphragm's span L is less than 12.5 m or there are not more than three rows of panels,
- the diaphragm's height h in direction of load is at least L/ 4 (L = effective span),
- the action's design value is not exceeding 5.0 kN/m.

The joint between single floor diaphragm elements as part of a floor diaphragm shall have at least the same load-bearing capacity as the connection of sheathing and edge webs.

The stresses of the diaphragms may be determined for reasons of simplification according to the technical beam theory. The upper and lower edge web should be designed as single-effective cords in order to resist the force resulting from the maximum bending moment. The sheathing has to be designed for shear flow resulting from the maximum shear force whereas the shear flow in the diaphragm may be assumed to be uniformly distributed over the width of the diaphragm. The effect of actions, occurring from loading perpendicular to the outer web, may be disregarded as long as the following is observed:

The effective height h of diaphragms with application of loading in direction of the continuous inner webs must not be larger than the span L.

If the structural behaviour is not exactly determined and the load application is not verified, the effective height h of diaphragms shall not be larger than L/2 when loads are acting on both edges and shall not be larger than L/4 for one-sided loads.

The verification of shear strength and buckling of the sheathing is not required.

A.3 Specification of the intended use

A.3.1 Local building regulations

A specification of relevant requirements concerning structural design, fire resistance and reaction to fire, sound insulation performance, thermal insulation performance and ventilation provisions shall be elaborated for each delivery as a basis for the production and dimensioning of a kit.

The design process (including the assessment of detailed plans, applications for planning permissions, building permits, etc.) shall comply with the procedures foreseen in the Member States in which the building is to be built. A European Technical Assessment for a metal frame building kit does not amend this process in any way.

A.3.2 Manufacturing

The manufacture of each kit shall be carried out on the basis of a specific structural design for the construction works and according to this European Technical Assessment. The structural design shall comply with the requirements and provisions applicable in the Member States where the building is to be erected.

The European Technical Assessment is issued for the kit on the basis of agreed data and information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data and information being incorrect, shall be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the European Technical Assessment and consequently the validity of the CE marking on the basis of the European Technical Assessment and if so whether further assessment or alterations to the European Technical Assessment shall be necessary.

A.3.3 Conceptual design

Each building is designed in accordance with the requirements of this European Technical Assessment and the requirements and provisions applicable in the Member States where the building is to be erected.

The columns of the building elements of the external wall respectively ceiling joists are arranged in a grid of a maximum of 62.5 cm.

The butt joints of the sheathing are arranged exclusively on the steel profiles.

Examples for the execution of detail areas are presented in Annexes B.10 to B.20.

A.3.4 Structural design

Unless otherwise specified in the European Technical Assessment, the verification of the load-bearing capacity and the serviceability of the system Cocoon "Transformer" (individual load-bearing components as well as the entire building) is verified in each single case on the basis of a structural design according to the requirements applicable in the Member States where the building is to be erected.

For the verification of the ultimate limit state the safety concept according to EN 1990 is used.

The necessary verifications of the load-bearing capacity of the wall, lintel and floor profiles, fasteners, floor and wall diaphragms are carried out in accordance with EN 1993-1-1, EN 1993-1-3 and EN 1995-1-1, taking into account the indications of this European Technical Assessment.

The deflections of the wall and floor elements are limited in accordance with the appropriate provisions of the Member States.

The loads are predominantly static.

The dimensions and material properties which are declared in this European Technical Assessment are observed.

The rules relating to corrosion protection given in EN 1090-2 and EN ISO 12944 respectively EN 10346 as well as EN 1995-1-1 are taken into account.

Furthermore, the rules relating to durability given in EN 1995-1-1 as well as EN 13986 are taken into account.

The verification of ultimate limit state is carried out by a structural engineer experienced in the field of steel and timber construction.

A.3.5 Substructure

This European Technical Assessment does not include the substructure of a building. The tolerances of the substructure´s surface are ± 5 mm. More indications to the dimensions, if necessary and the presentation of details (e.g. protective measures against ascending humidity etc.) for the manufacture of the substructure will be delivered by the manufacturer of the kit. The substructure shall be designed and carried out according to the requirements and provisions applicable in the Member States in which the construction work shall be erected. It shall be stable and capable to carry and to transmit the loads of the elements of the system Cocoon "Transformer".

With regard to the requirements for anchorage of the building elements of the external wall with the foundation or the substructure the provisions that apply in the Member States shall be respected accordingly.

A.3.6 Execution of works

The execution of works is carried out exclusively following the indications of the manufacturer by assembly personnel having undergone relevant instruction by specialists of firms experienced in this field. The manufacturer hands the assembling instructions that covers all important aspects related to the site work over to the executing company. It is indicated in the assembling instructions that all building elements of the system Cocoon "Transformer" have to be checked before installation for perfect quality and that damaged building elements may not be used.

The requirements in EN 1090-2 are taken into account where relevant.

The compatibility of the completed building with the provisions of the European Technical Assessment shall be confirmed by the executing company.

The completed building (the construction works) shall comply with the building regulations applicable in the Member States where the building is to be constructed.

A.3.7 Packaging, transport and storage

The instructions of the manufacturer shall be taken into account.

During transport and storage the wall and floor elements have to be protected from mechanical damage and detrimental moisture, e.g. from precipitations or moisture.

A.3.8 Use, maintenance, repair

Damaged building elements or components of the kit may not be used or installed. Damaged building elements or components shall be immediately exchanged and replaced by perfect ones.

With regard to the assumed working life a regular maintenance is required. The manufacturer shall add written documents to the kit which contain descriptions about type and frequency of the maintenance.

A.4 Indications to the manufacturer

The manufacturer shall ensure that the information on the specific conditions according to sections 1, 2 and 3 (including the Annexes referred to) is given to those who are concerned. This information may be given by reproduction of the European Technical Assessment.

In addition, all essential installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

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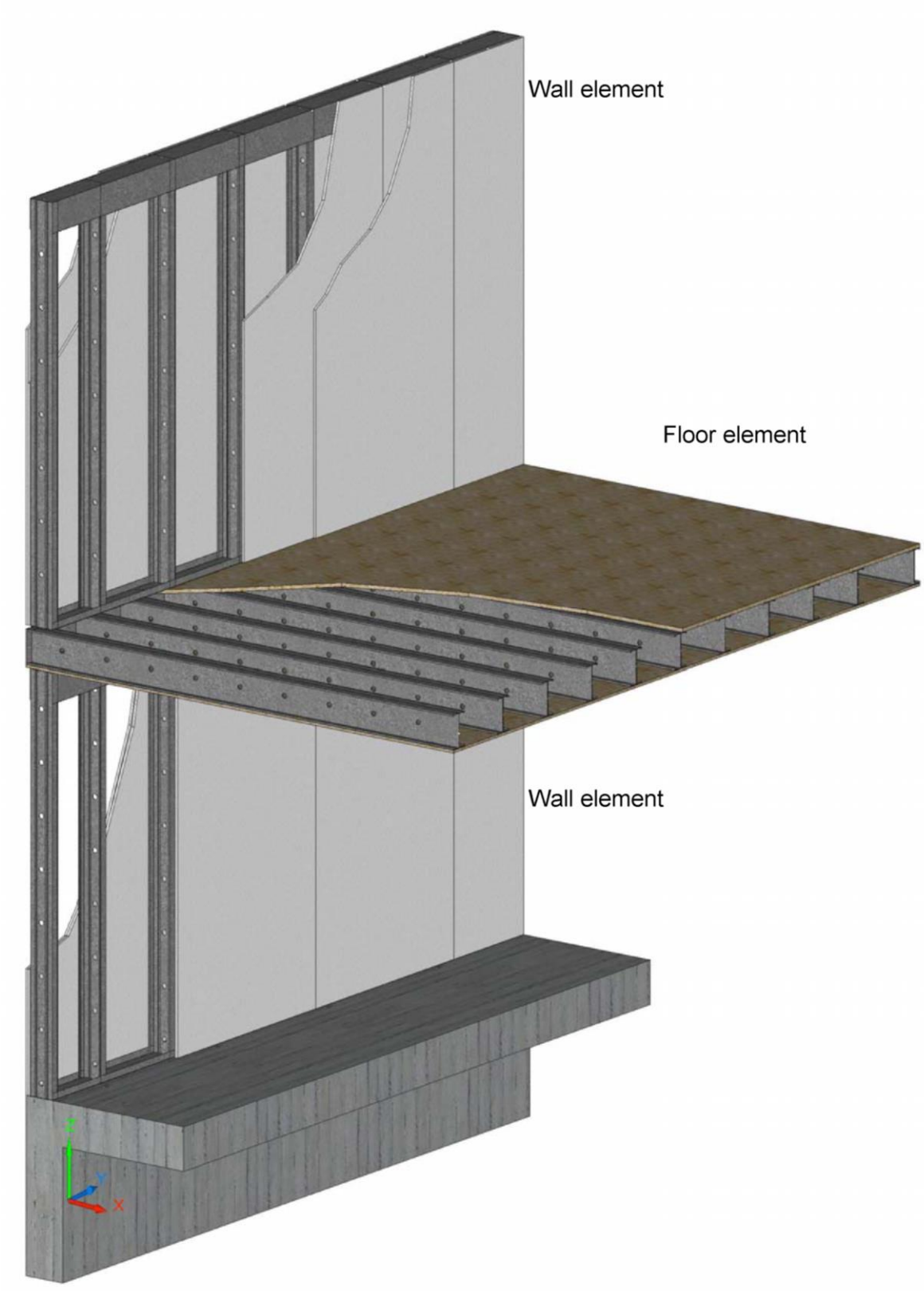
Annex B



System Cocoon "Transformer"	Annex B.1
Example	

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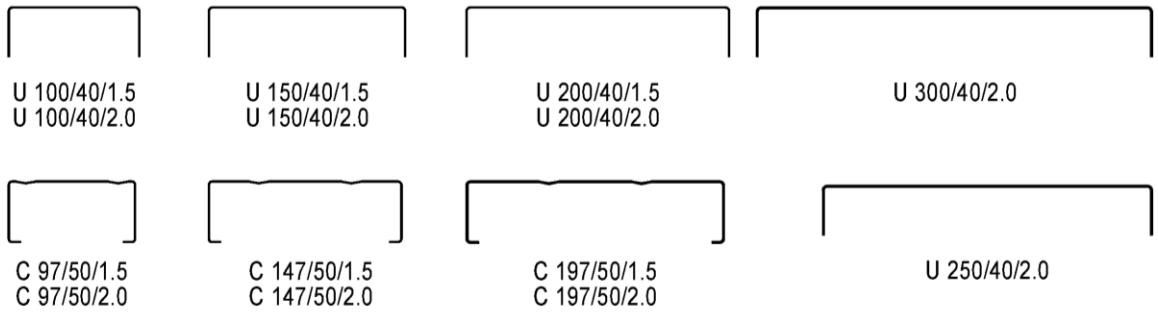
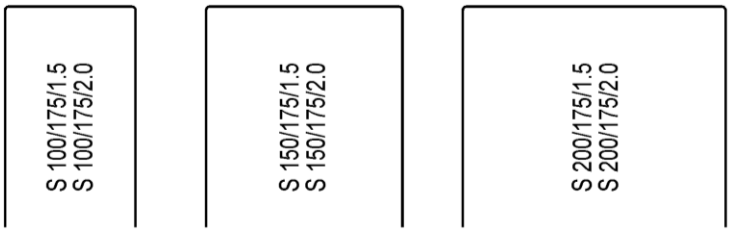
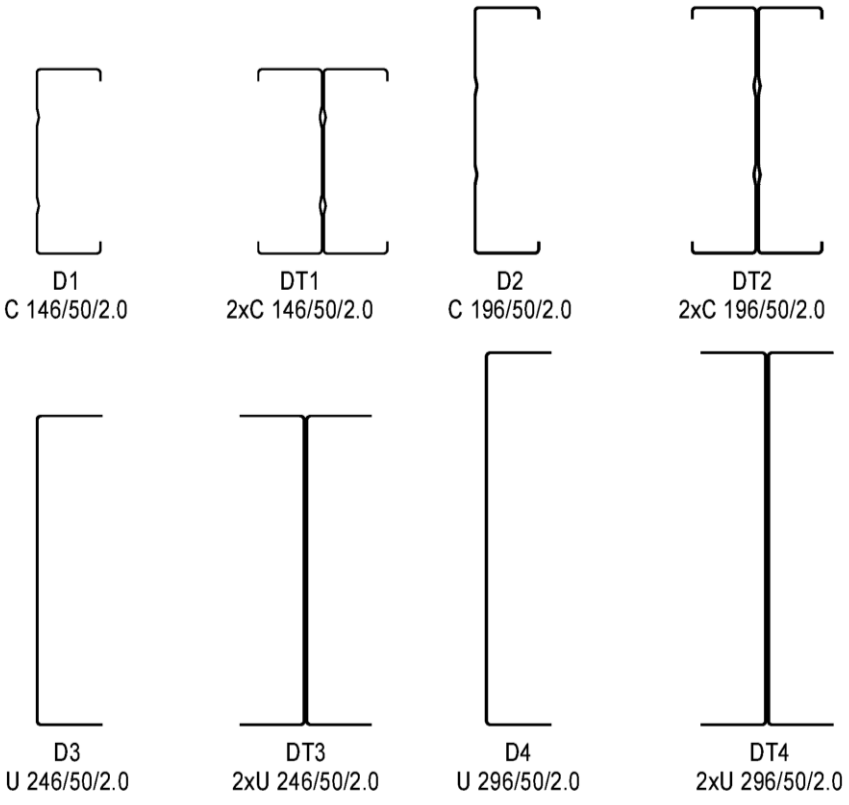
Wall profiles Cocoon Transformer



Lintel profiles Cocoon Transformer



Floor profiles Cocoon Transformer



System Cocoon "Transformer"	Annex B.2
Cross sections of profiles	

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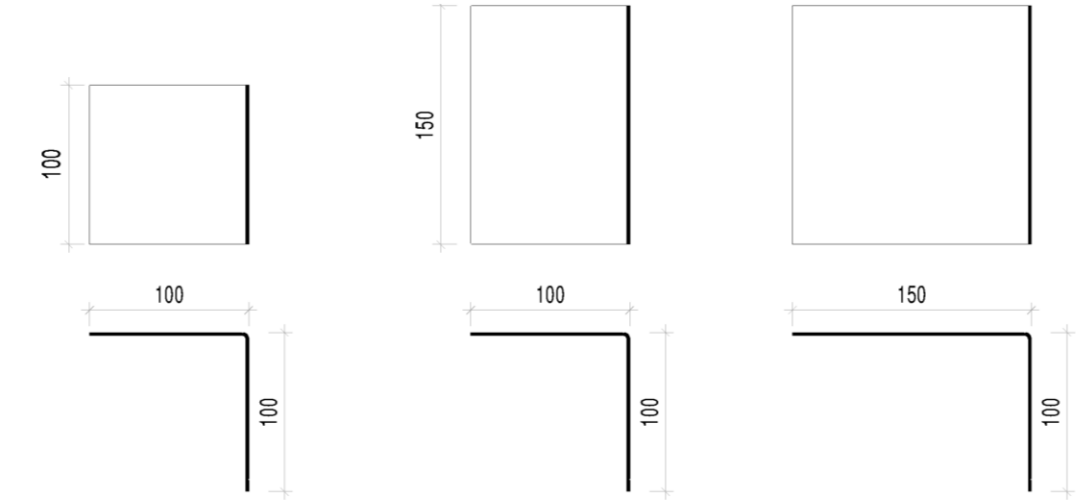
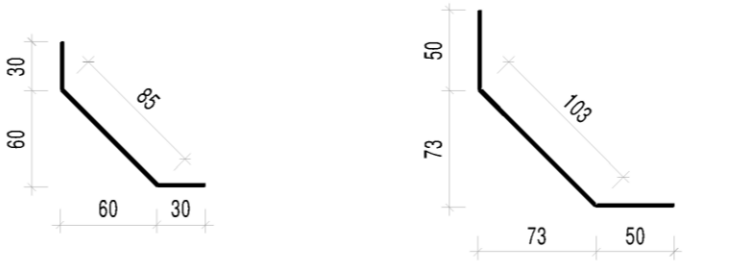
Angle brackets

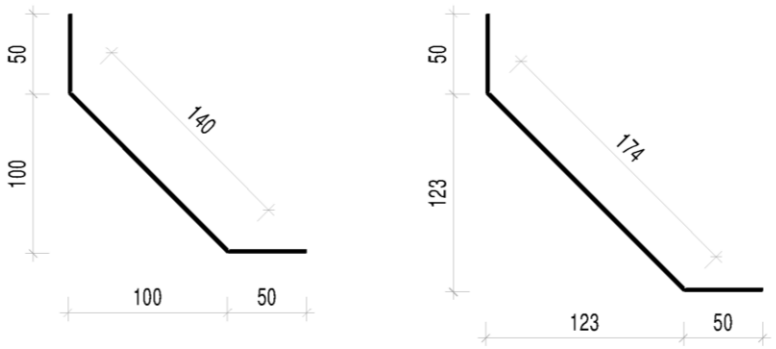


Angle bracket 100/100/100x2.0 | Angle bracket 150/100/100x2.0 | Angle bracket 150/150/100x2.0

Bracing elements



Bracing element 30/85/30x5.0 | Bracing element 50/103/50x5.0



Bracing element 50/140/50x5.0 | Bracing element 50/174/50x5.0

Dimensions in [mm]

System Cocoon "Transformer"	Annex B.3
Angle brackets and bracing elements	

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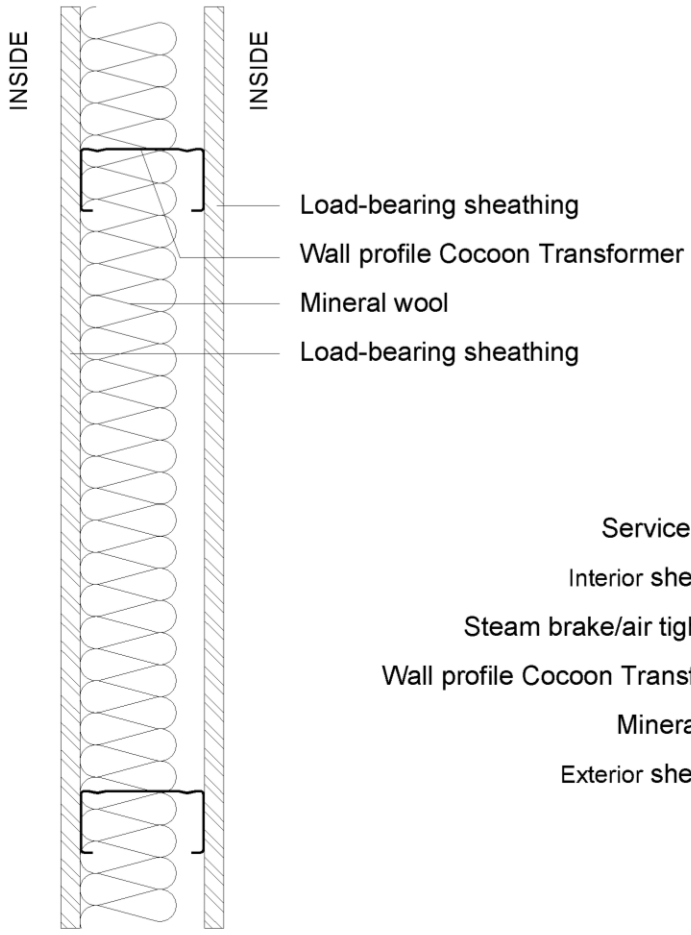
Assembly of wall elements

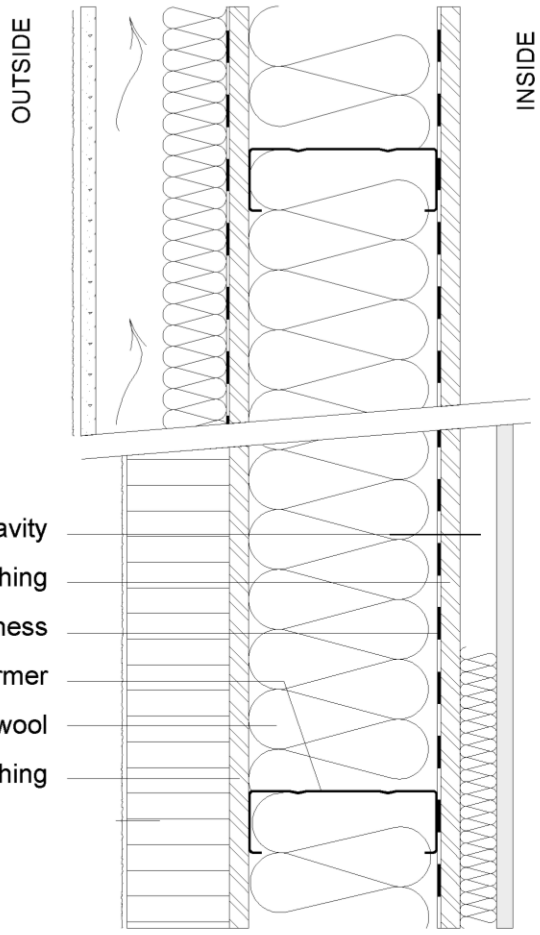
Interior wall

horizontal section



Exterior wall

horizontal section



The configuration and the choice of sheathing materials depend on the static and building-physics requirements of the structural element.

System Cocoon "Transformer"	Annex B.4
Assembly of wall elements	

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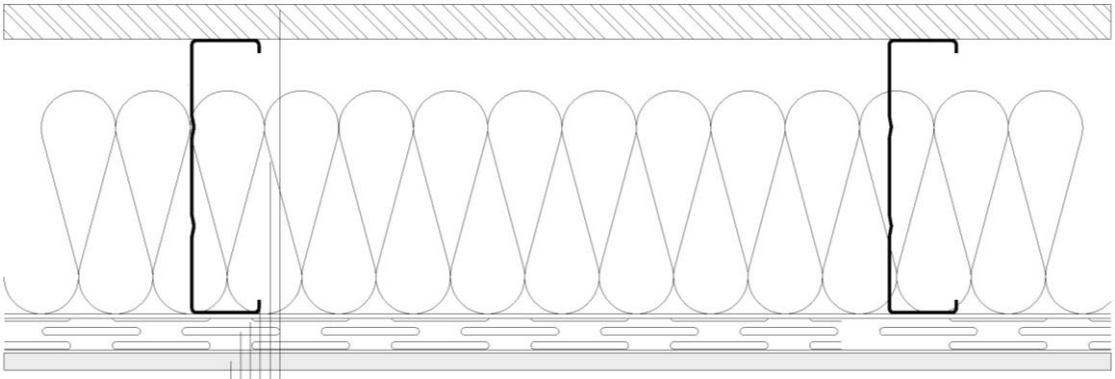
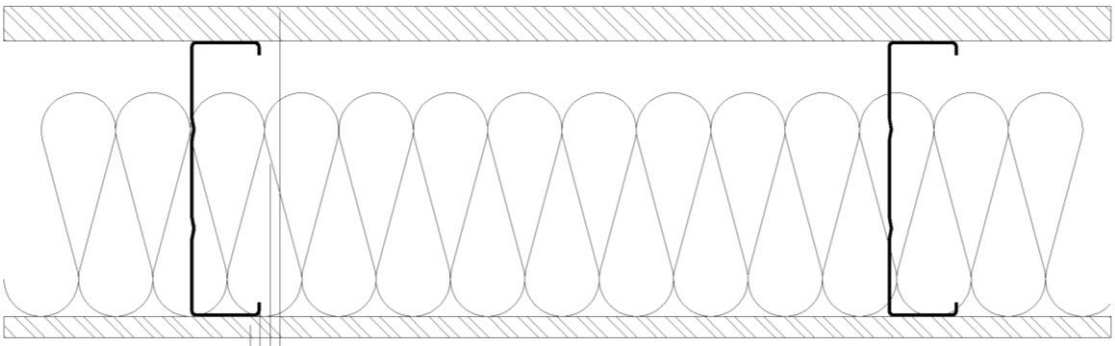
Assembly of floor elements

Vertical section



Upper sheathing
Mineral wool
Floor profile Cocoon Transformer (single or double profile)
Service cavity
Hat ceiling profile / hat spring rail according to Annex A, section A.1.3.5
Gypsum fiber board

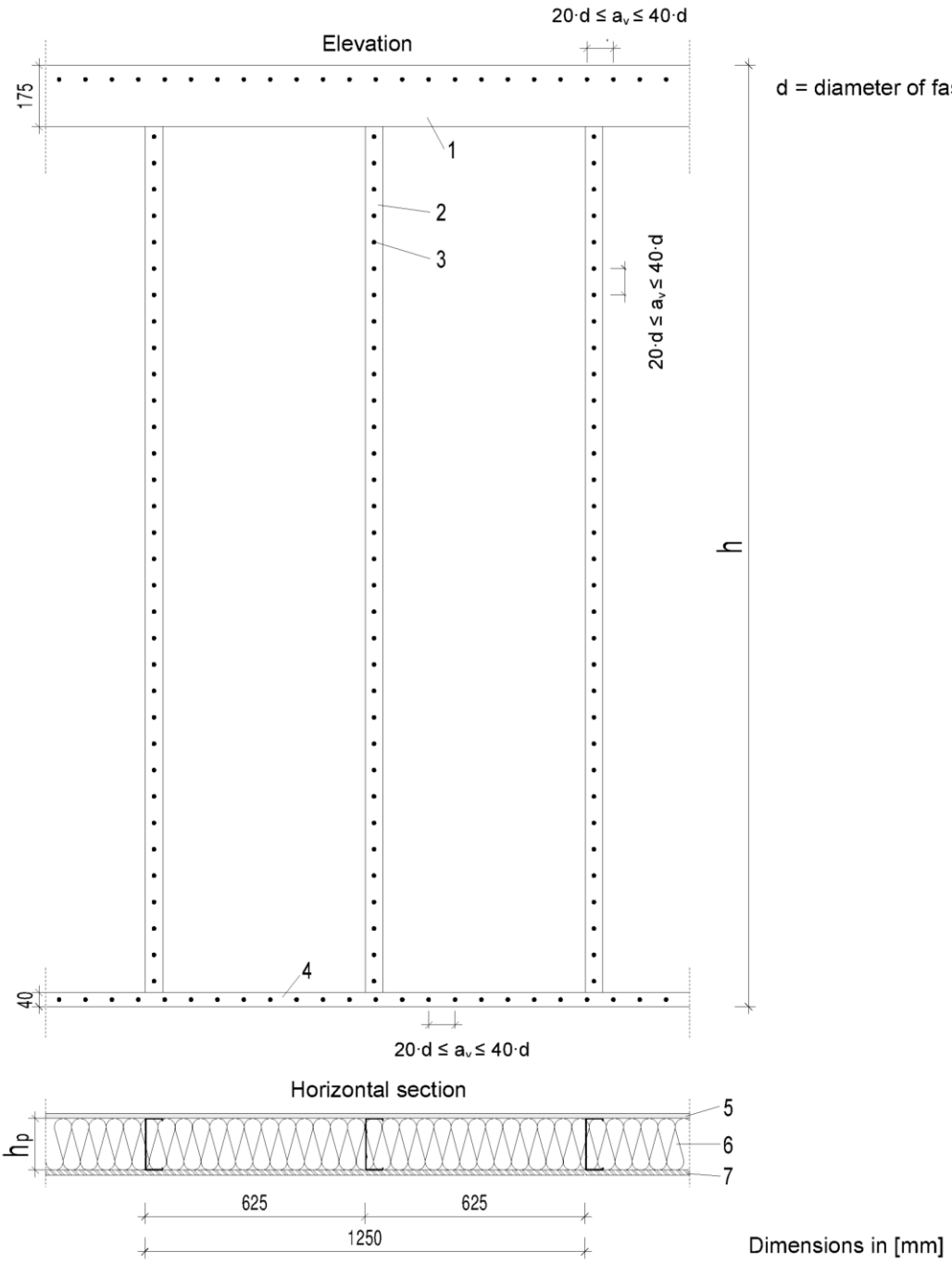
Vertical section



Upper sheathing
Mineral wool
Floor profile Cocoon Transformer (single or double profile)
Lower sheathing

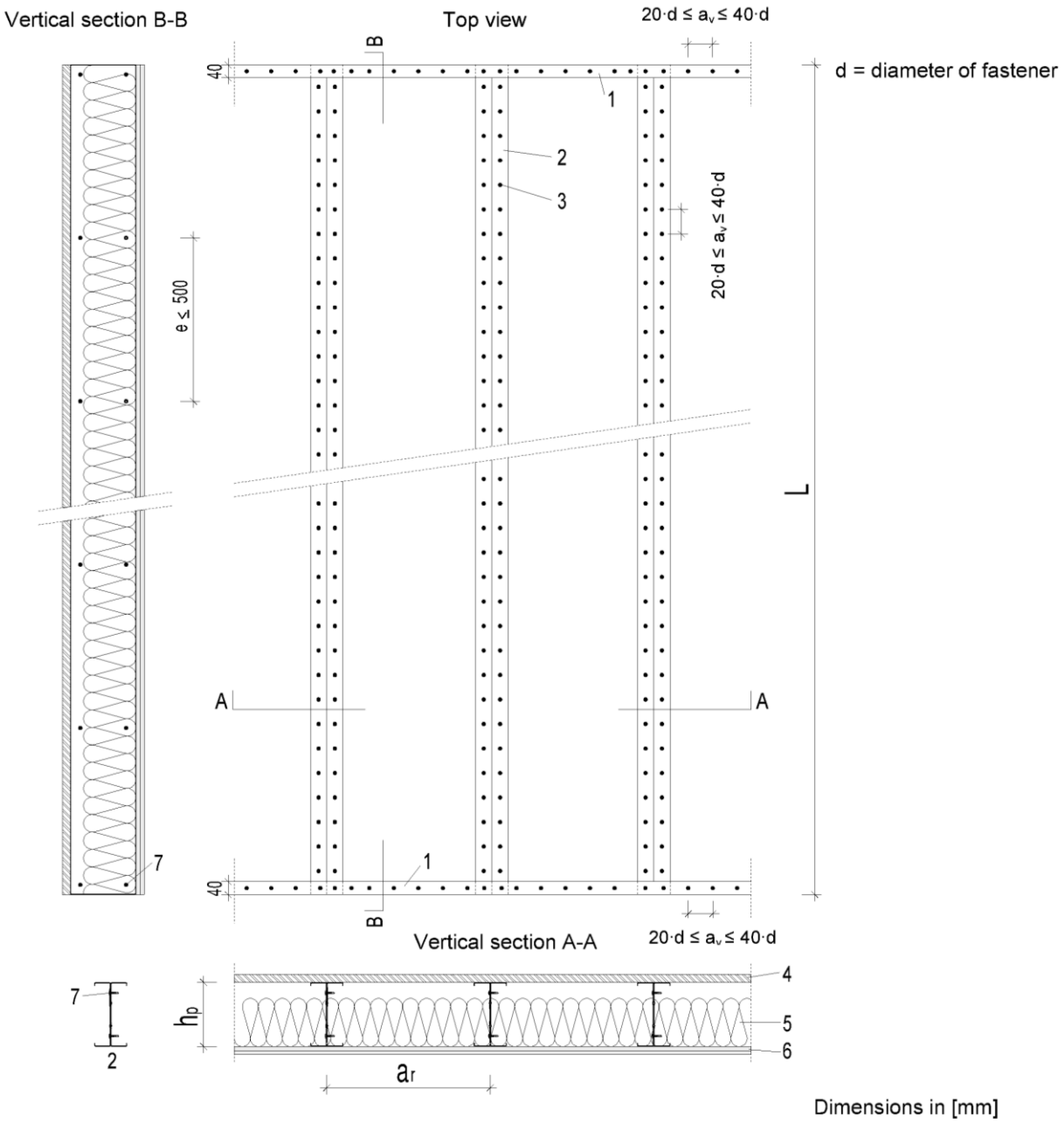
The configuration and the choice of sheathing materials depend on the static and building-physics requirements of the structural element.

System Cocoon "Transformer"	Annex B.5
Assembly of floor elements	



1 Lintel U-profile according to Annex B.2
2 Wall profile according to Annex B.2
3 Screws or ballistic nails according to Annex B.8. In case of walls used as diaphragm, the requirements concerning fastener distances according to Annex A, Table A.5 or Annex A, Table A.7 shall be considered.
4 U-profile (analogous wall profile according to Annex B.2)
5 Sheathing panel. Material, minimum thickness and building material category according to Annex A, Table A.3
6 Mineral wool
7 Sheathing panel. Material, minimum thickness and building material category according to Annex A, Table A.3

System Cocoon "Transformer"	Annex B.6
Execution of wall elements	



1 U-profile (analogous floor profile according to Annex B.2)
2 Floor profile according to Annex B.2
3 Screws or ballistic nails according to Annex B.8. In case of floors used as diaphragm, the requirements concerning fastener distances according to Annex A, Table A.5 or Annex A, Table A.7 shall be considered.
4 Load-bearing sheathing. Material, minimum thickness and building material category according to Annex A, Table A.3
5 Mineral wool
6 Suspended ceiling, e.g. gypsum fiber board on substructure made of metal or direct on floor profile. Characteristics depend on building-physics requirements
7 Connection of floor profiles e<500 mm. Edge distances according to Annex B.9.

System Cocoon "Transformer"	Annex B.7
Execution of floor elements	

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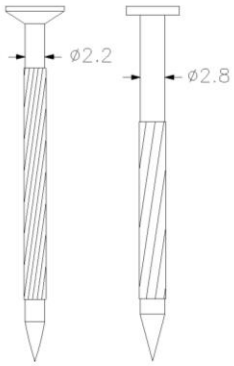
Drywall self drilling screw

Type:	Countersunk head, self-tapping screw thread, self-drilling tip for steel sheets of 0.70mm to 2.25mm according to technical documentation
Corrosion protection:	Phosphatising
Application:	Fastening of gypsum fibre boards on substructure made of steel

Self-drilling screw

Type:	Self-tapping screw thread, self-drilling tip for steel sheets of 1.5mm to 5mm according to technical documentation
Corrosion protection:	Galvanizing
Application:	Fastening of chip boards on substructure made of steel

Ballistic nail ITW



Type:	According to technical documentation
Corrosion protection:	Zinc-plated
Application:	Fastening of chip and gypsum boards on thin-walled steel profiles

Minimum distances perpendicular to the edge of the sheathing according to Annex A, Table A.5 or Annex A, Table A.7

System Cocoon "Transformer"	Annex B.8
Fasteners sheathing	

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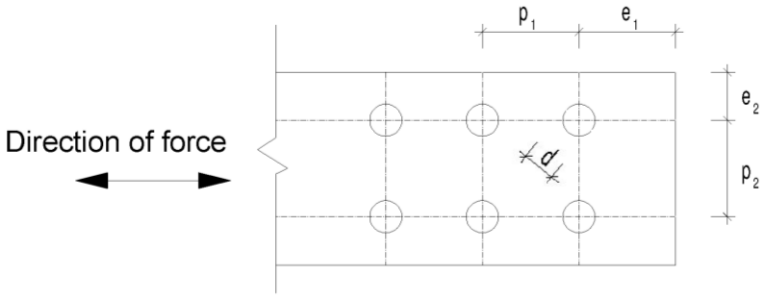
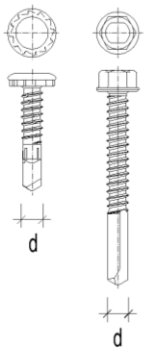
Edge distances and interspaces of fasteners according to EN 1993-1-3



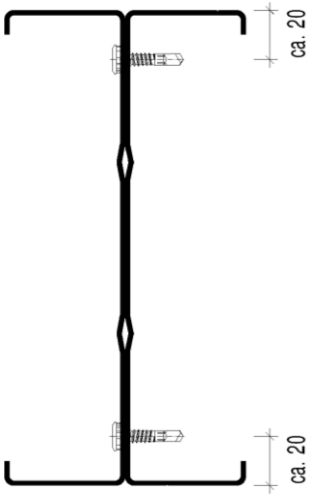
$e_1 > 3d$ $\quad p_1 > 3d$ $\quad$ d = nominal diameter of fastener

$e_2 > 1.5\ d$ $\quad p_2 > 3d$



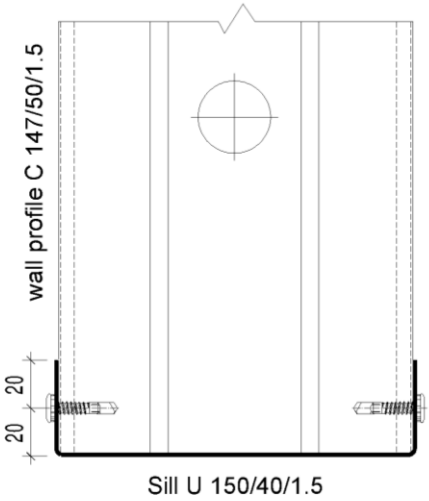
Fasteners with European Technical Assessment

Web joints



Dimensions in [mm]

Joint wall profile to bottom sill



System Cocoon "Transformer"	Annex B.9
Connection of steel profiles to each other	

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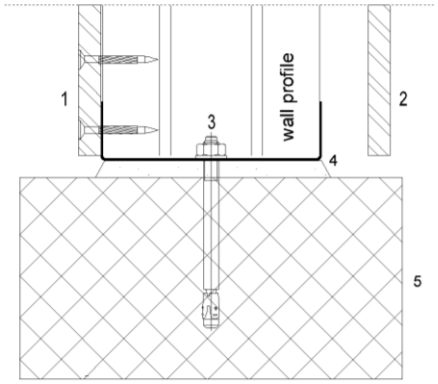
Continuous anchorage of sill profile to foundation

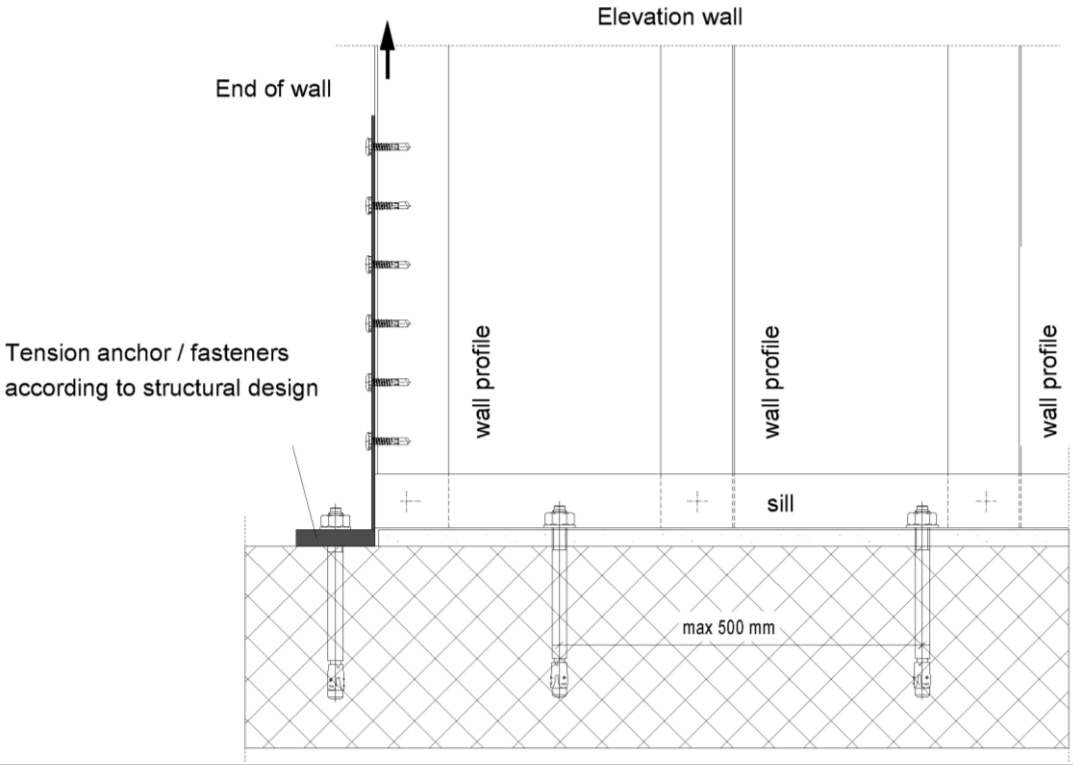
Vertical section



1 Factory-mounted panel (bracing sheathing)
2 Sheathing will be fixed at the building site after anchorage of wall
3 Anchor bolt according to structural design, maximum spacing to each other 500 mm
4 Force-fit shimming of sill e.g. using swelling mortar
5 Foundation

Tension anchor of wall diaphragms

Tension anchor in wall section. Tension plate of anchor is bolted together with the profile's web.
Tension anchor and number of fasteners according to structural design.



Fasteners sheathing, screwed joint of Cocoon profiles, insulation, steam brake, etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.10
Anchoring of factory-open or semi-open wall diaphragms	

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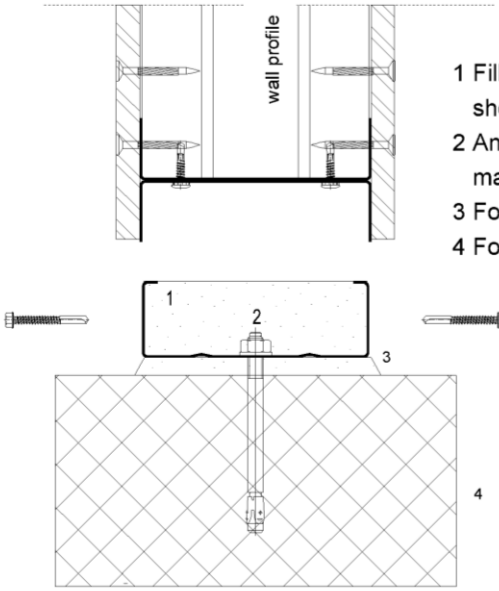
Continuous anchorage of sill profile to foundation

Option compound-filled sill

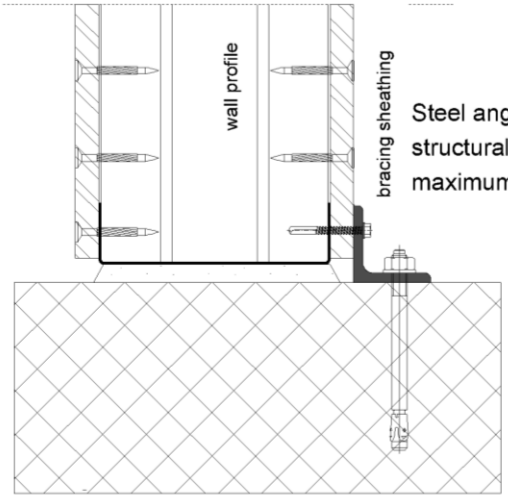
Vertical section



1 Filling with cement-bound, shrink-free grout shortly before erection of the wall!
2 Anchor bolt according to structural design, maximum spacing to each other 500 mm
3 Force-fit shimming of sill e.g. using swelling mortar
4 Foundation

Option steel angle bracket

Vertical section



Steel angle bracket/ anchor bolt according to structural design,
maximum spacing to each other 500 mm

Fasteners sheathing, screw joint of Cocoon profiles, insulation, steam brake, etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.11
Anchoring of factory-closed wall diaphragms	

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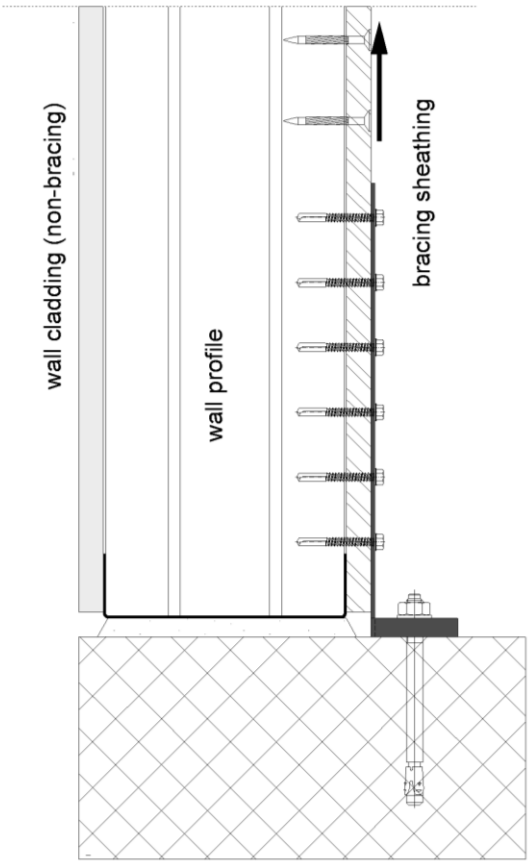
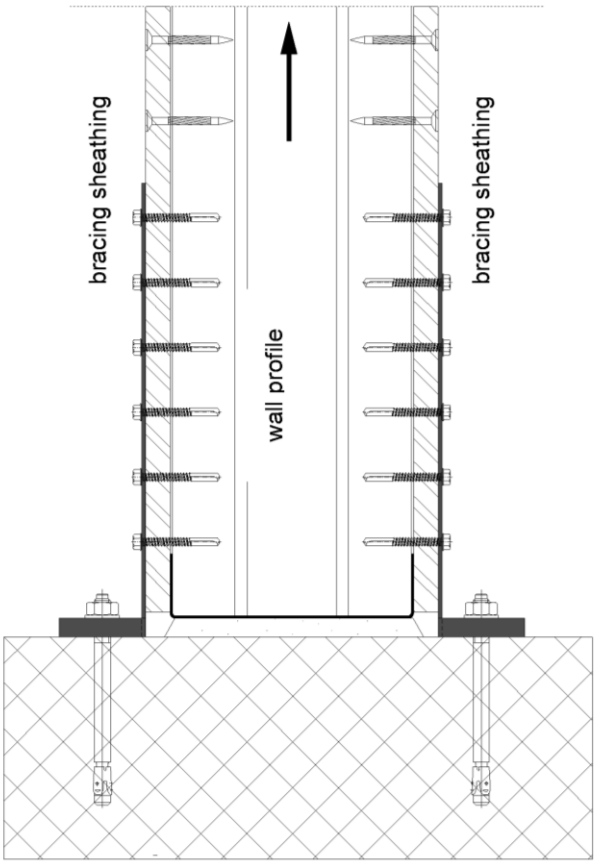
Tension anchor of factory-closed wall elements

Vertical section



Tension anchor of a one-sided braced wall

Vertical section



Tension anchor of a double-sided braced wall

Tension anchor and number of fasteners according to structural design

Fasteners sheathing, screw joint of Cocoon profiles, insulation, steam brake, etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.12
Tension anchor of factory-closed wall elements	

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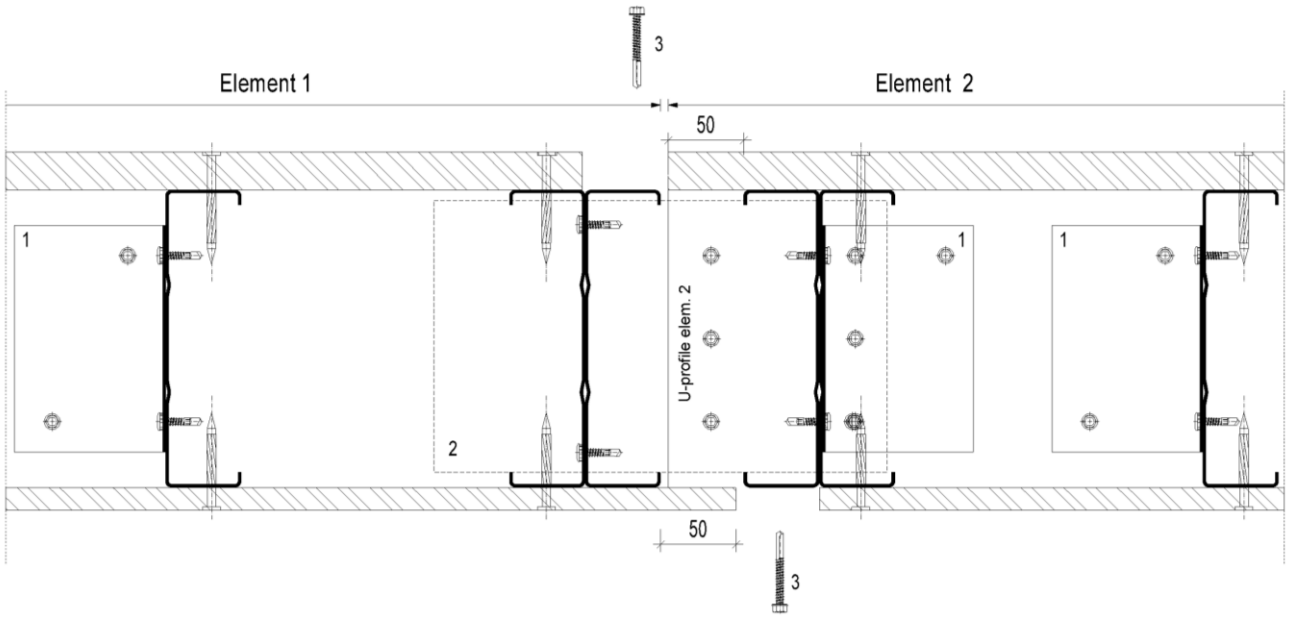
Connection of factory-closed floor elements

Vertical section



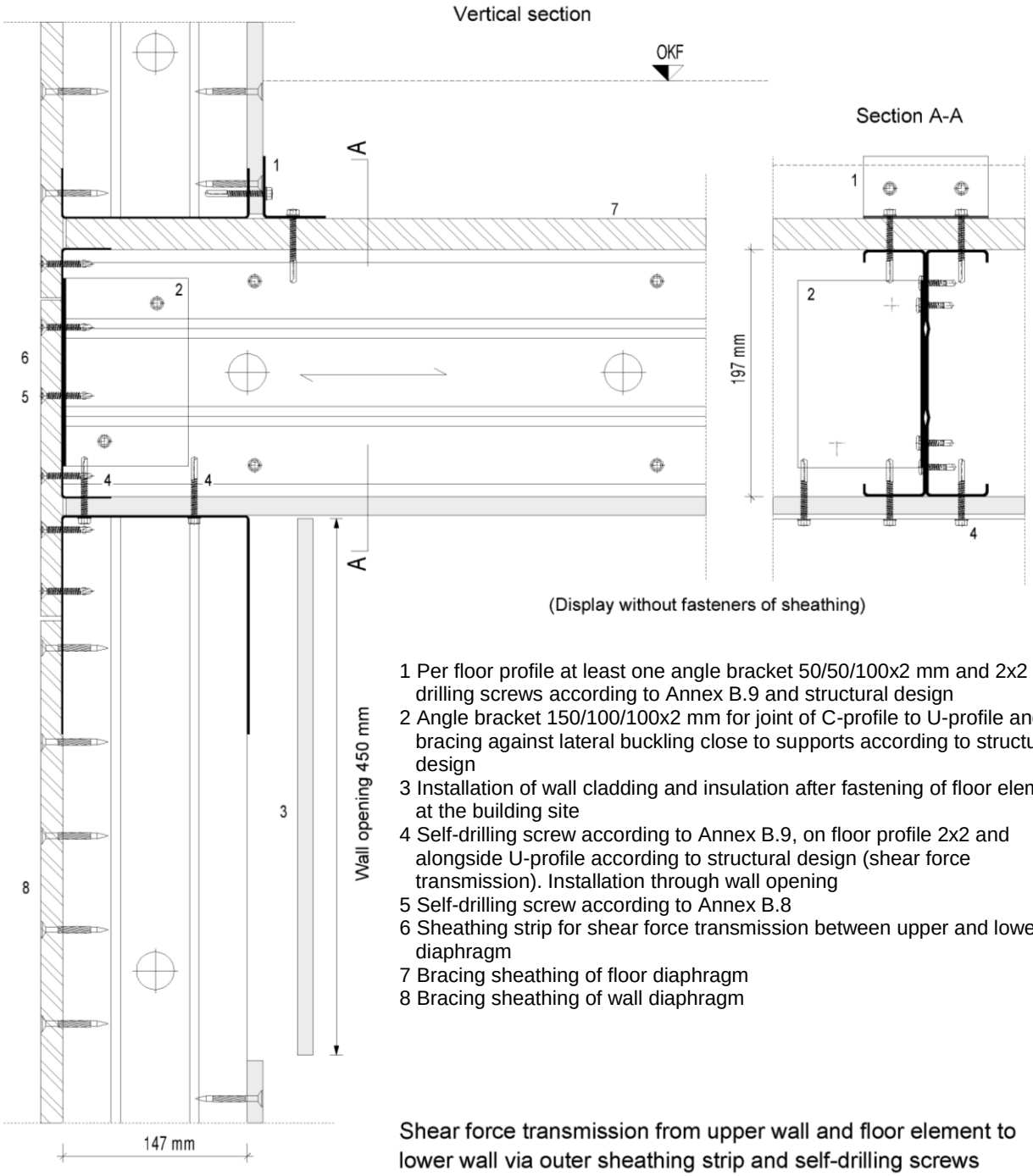
1 Angle bracket 150/100/100x2 mm for joint of C-profile to U-profile and as bracing against lateral buckling close to supports
2 Butt plate t = 2mm bolted to U-profiles. Dimensioning according to structural design
3 Fasteners according to Annex B.8. Distance according to structural design

Insulation, steam brake, etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.13
Connection of factory-closed floor elements	

Deutsches Institut für Bautechnik DIBt

Connection floor / Exterior wall outer sheathing, factory-closed elements



(Display without fasteners of sheathing)

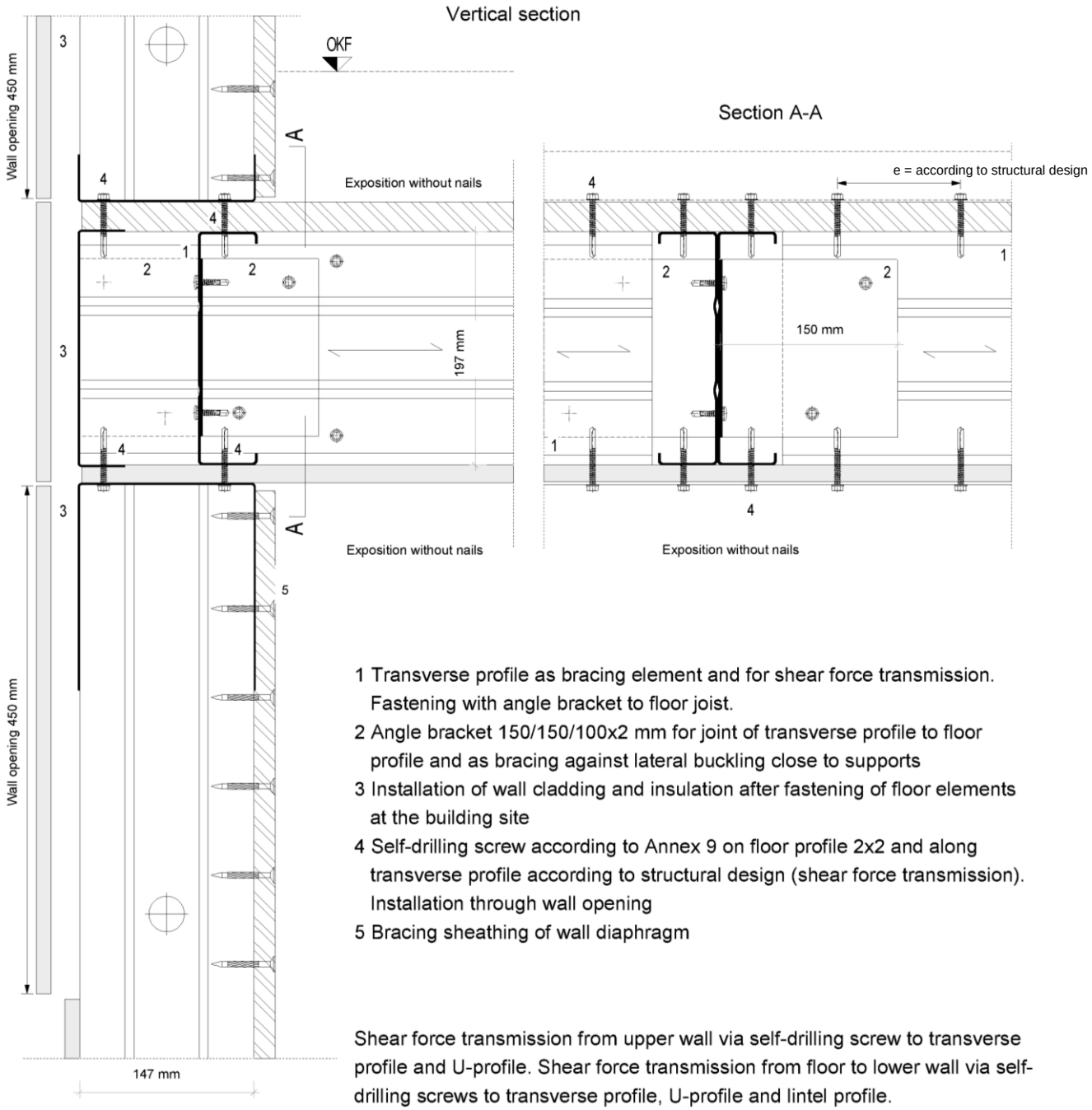
1 Per floor profile at least one angle bracket 50/50/100x2 mm and 2x2 self-drilling screws according to Annex B.9 and structural design
2 Angle bracket 150/100/100x2 mm for joint of C-profile to U-profile and as bracing against lateral buckling close to supports according to structural design
3 Installation of wall cladding and insulation after fastening of floor elements at the building site
4 Self-drilling screw according to Annex B.9, on floor profile 2x2 and alongside U-profile according to structural design (shear force transmission). Installation through wall opening
5 Self-drilling screw according to Annex B.8
6 Sheathing strip for shear force transmission between upper and lower wall diaphragm
7 Bracing sheathing of floor diaphragm
8 Bracing sheathing of wall diaphragm

Shear force transmission from upper wall and floor element to lower wall via outer sheathing strip and self-drilling screws

Insulation, steam brake, etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.14
Connection floor / exterior wall	

Connection floor / exterior wall
inner bracing sheathing, factory-closed elements



1 Transverse profile as bracing element and for shear force transmission. Fastening with angle bracket to floor joist.
2 Angle bracket 150/150/100x2 mm for joint of transverse profile to floor profile and as bracing against lateral buckling close to supports
3 Installation of wall cladding and insulation after fastening of floor elements at the building site
4 Self-drilling screw according to Annex 9 on floor profile 2x2 and along transverse profile according to structural design (shear force transmission). Installation through wall opening
5 Bracing sheathing of wall diaphragm

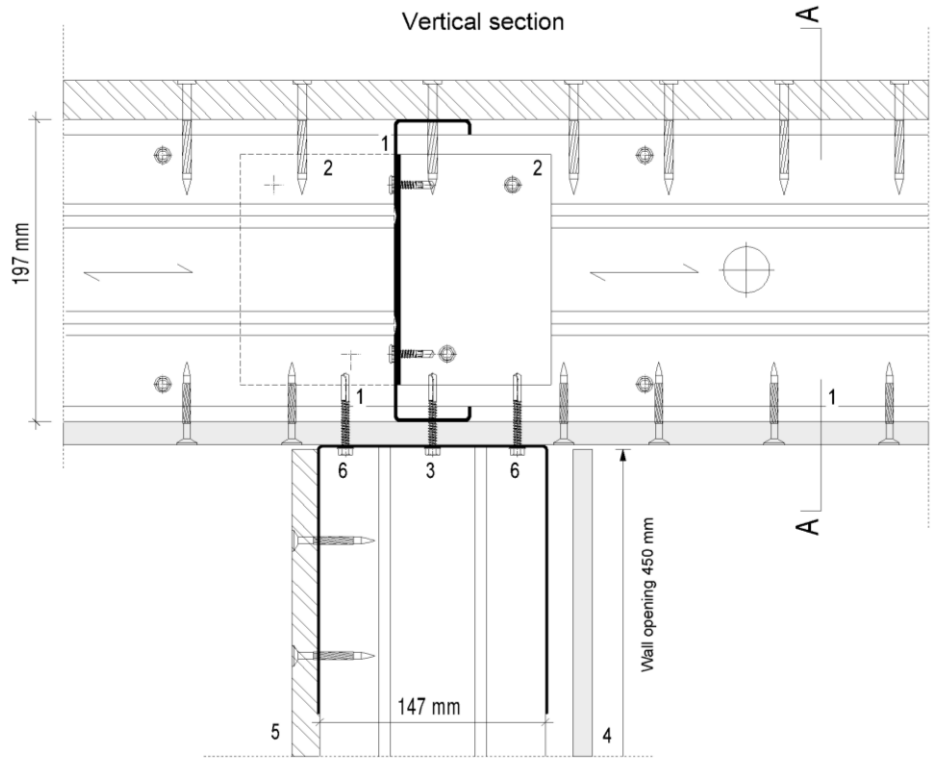
Shear force transmission from upper wall via self-drilling screw to transverse profile and U-profile. Shear force transmission from floor to lower wall via self-drilling screws to transverse profile, U-profile and lintel profile.

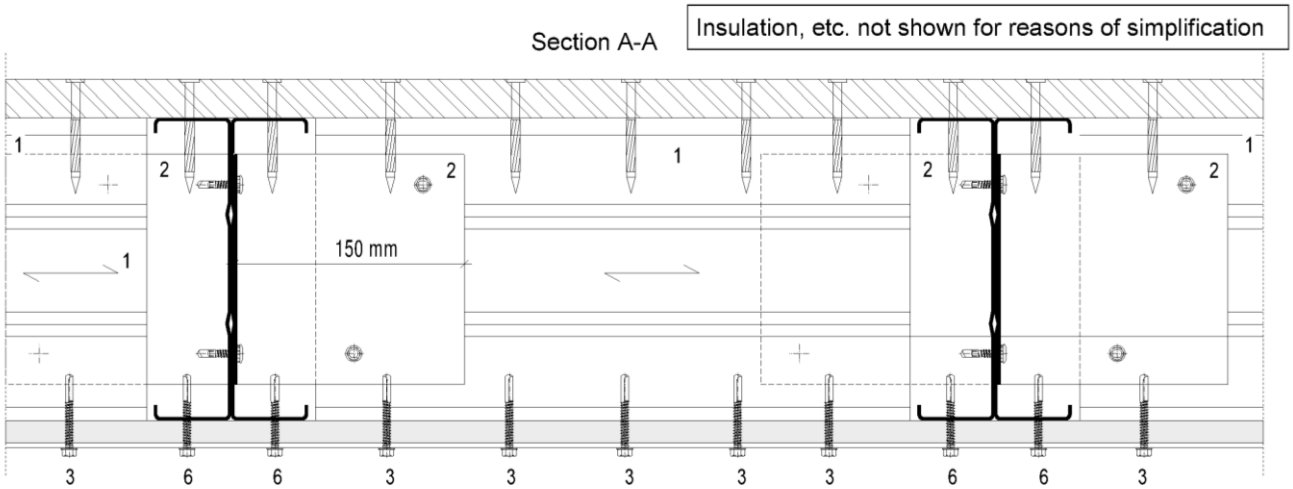
Insulation, steam brake, etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.15
Connection floor / exterior wall	

Deutsches Institut für Bautechnik DIBt

Connection load-bearing floor / load-bearing interior wall continuous floor profile





1 Stiffener in the range of supports and stiffening profile for shear force transmission. Fastening to floor profile via angle brackets. Single or double profile.
2 Angle bracket 150/150/100x2 mm for joint of C-profile to U-profile and for bracing against lateral buckling in the range of local supports according to structural design.
3 Self-drilling screw alongside bracing profile according to structural calculation (shear force transmission). Installation through wall opening.
4 Installation of sheathing or insulation after fastening of the floor elements on site
5 Bracing sheathing of wall diaphragm
6 Self-drilling screw according to Annex B.9 on floor joist 2x2 according to structural design

System Cocoon "Transformer"	Annex B.16
Connection load-bearing floor / load-bearing interior wall	

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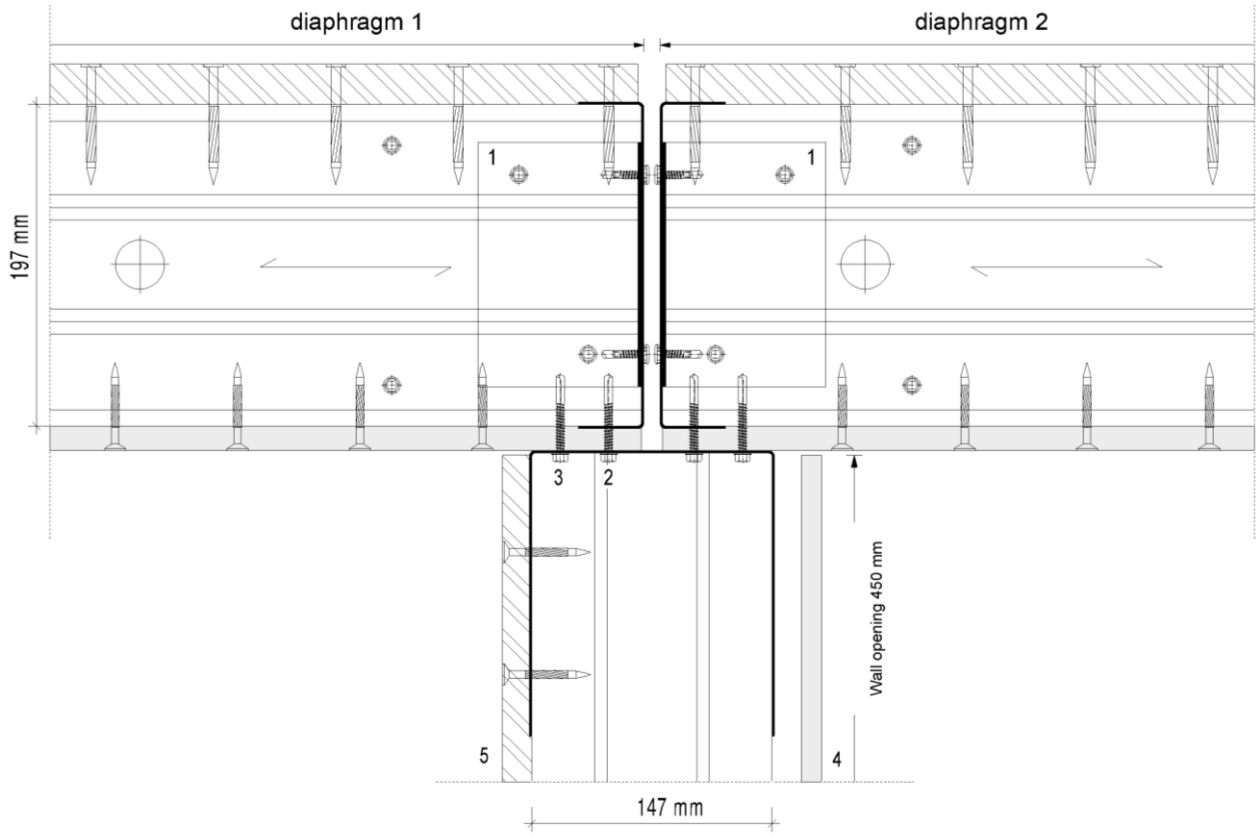
Connection load-bearing floor / load-bearing interior wall
Discontinuous floor profile, no shear transfer between floor diaphragms

Vertical section



1 Angle bracket 150/150/100x2 mm for connection C-profile to U-profile and as bracing against lateral buckling close to supports according to structural design
2 Self-drilling screw according to Annex B.9 alongside U-profile according to structural design (shear force transmission). Installation through wall opening.
3 Self-drilling screw according to Annex B.9 floor profile 2x2 according to structural design
4 Installation of sheathing or insulation after fastening of the floor elements on site
5 Stiffening sheathing of wall diaphragm

Both floor elements can be connected to transfer shear forces on demand. In this case, the connection of floor diaphragm shall be carried out and designed according to Annex B.13.

Insulation etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.17
Connection load-bearing floor / load-bearing interior wall Discontinuous floor profile	

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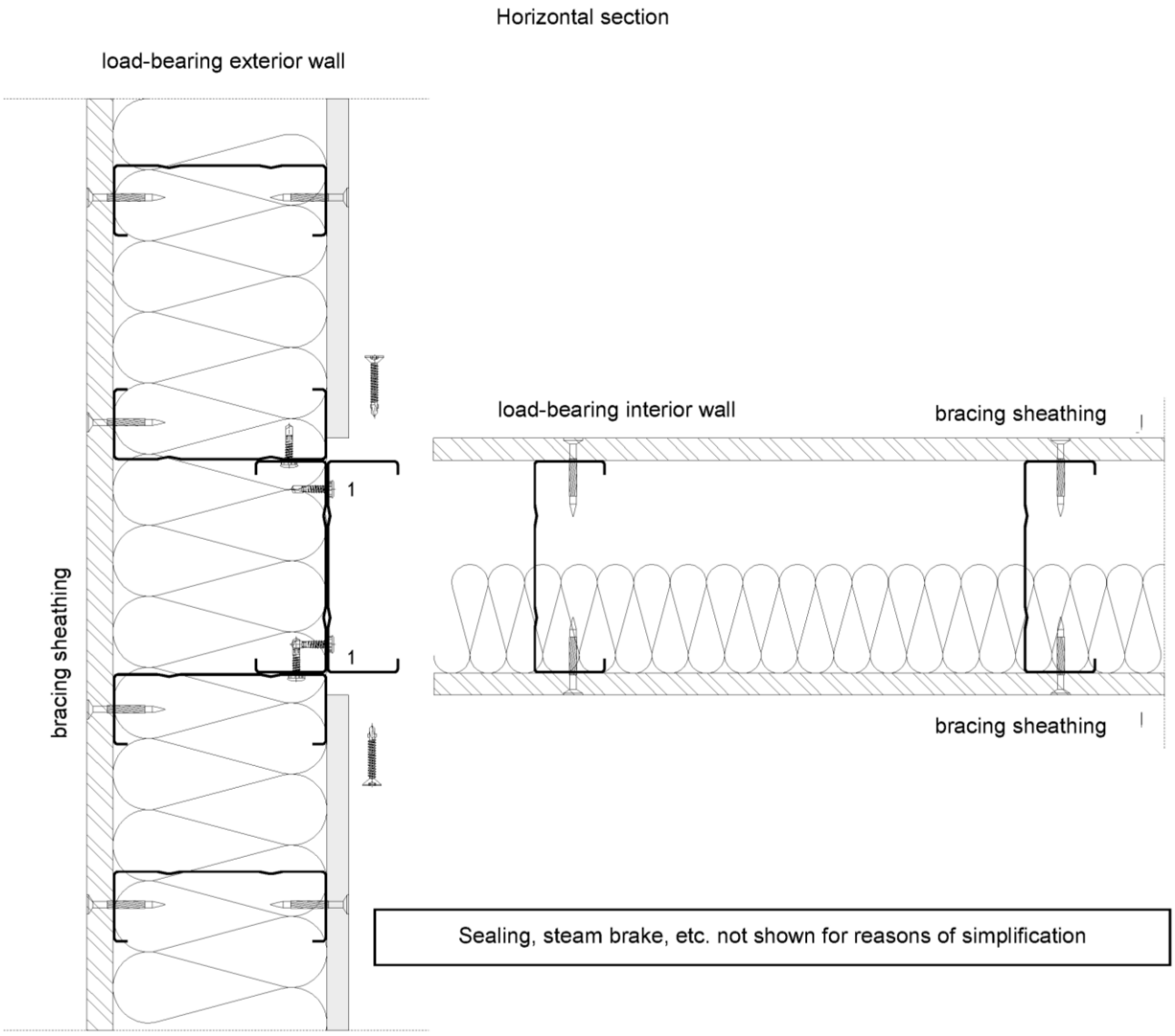
Connection load-bearing exterior wall / load-bearing interior wall



1 Self-drilling screw according to Annex B.9 along wall profile (C-profile) and structural design
2 Self-drilling screw according to Annex B.8 and structural design

System Cocoon "Transformer"	Annex B.18
Connection load-bearing exterior wall / load-bearing interior wall, horizontal section	

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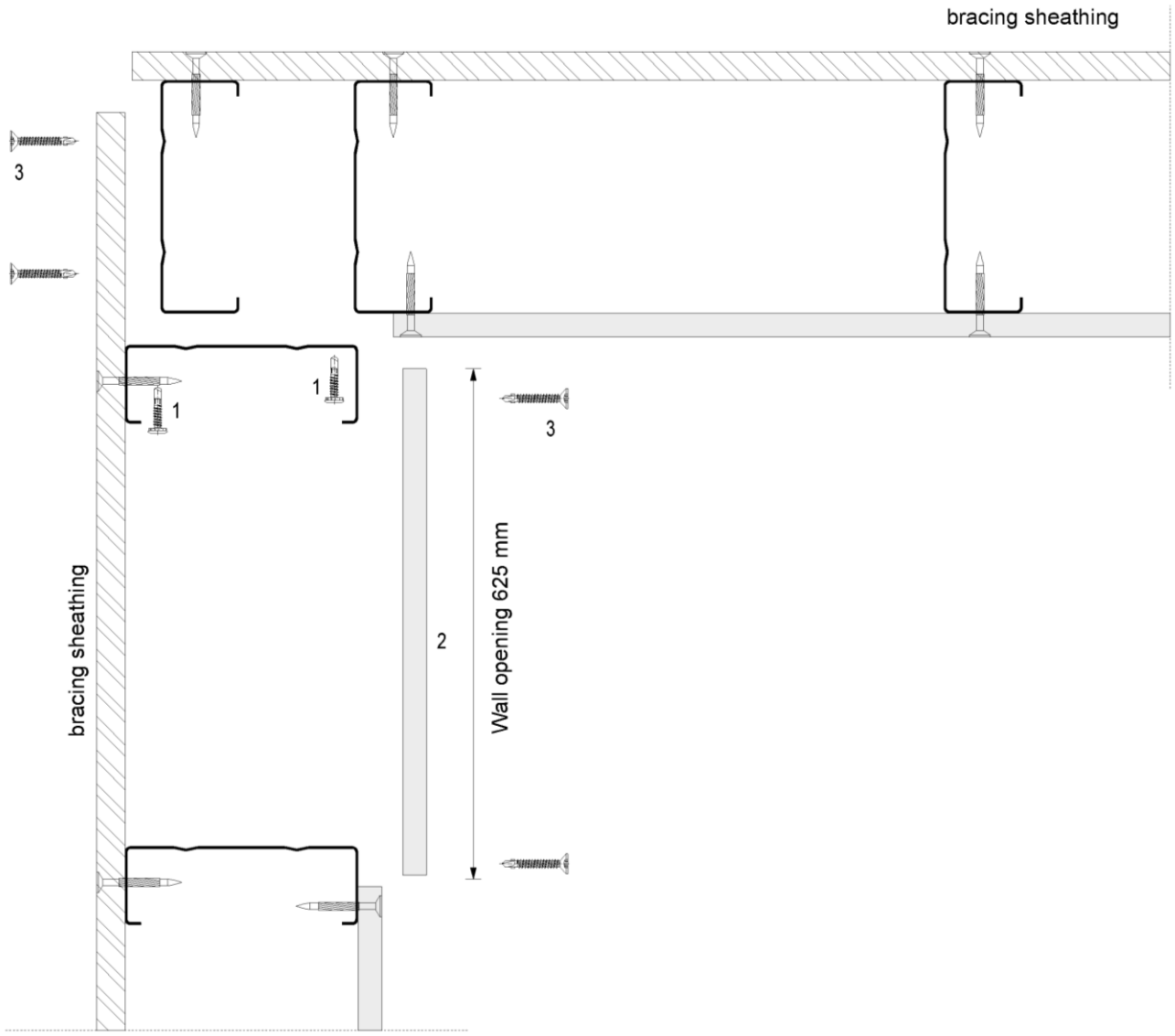
Corner connection of load-bearing exterior walls

Horizontal section



1 Self-drilling screw according to Annex B.9, installation through wall opening
2 Installation of sheathing or insulation after fastening of the floor elements on site
3 Self-drilling screw according to Annex B.8

Sealing, steam brake, etc. not shown for reasons of simplification

System Cocoon "Transformer"	Annex B.19
Corner connection of load-bearing exterior walls	

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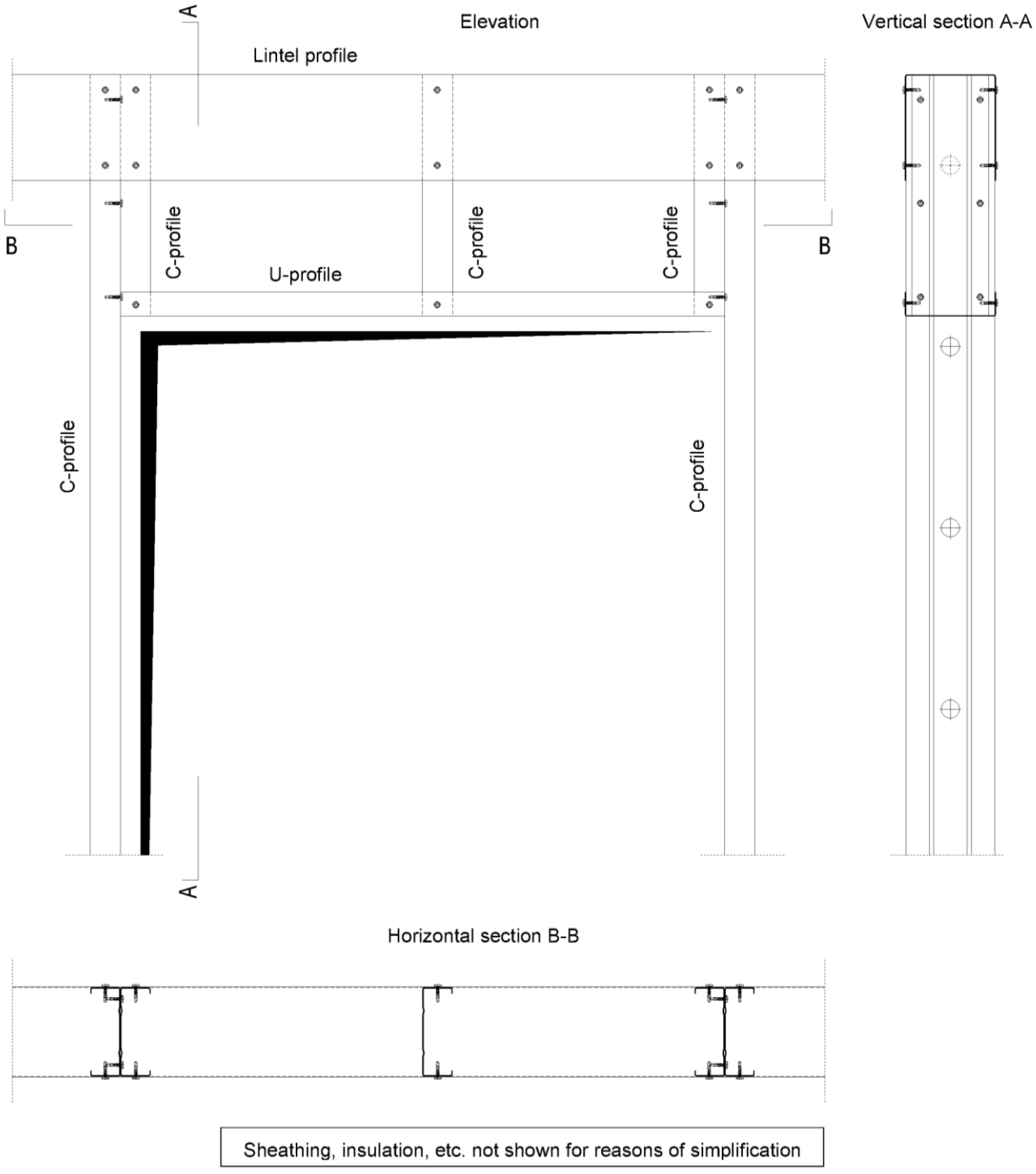
Door lintel



System Cocoon "Transformer"	Annex B.20
Door lintel	