8.2 Vertical Wall Constructions

8.2.1 Scope of Application

According to the background information provided here, the CETRIS® boards can be applied in the following types of vertical wall constructions:

- Non-load-bearing walls and partitions up to a height of 9.50 metres and a fire resistance in the range EI 15 - EI 180 minutes, with and without mineral filling (with an air gap).
- Shaft or separate advanced wall – with one-sided cladding of a wall construction with a fire resistance of EI 15 – EI 45.
- Wall on a wooden framework – as a load-bearing wall with a maximum height of 3 metres, and as non-load-bearing (filling) walls with a maximum height of 4 metres.

As stated in the protocols it is also necessary to comply with the technology of the wall assembly and all assembly procedures used and tested in the context of preparation of the samples. This means that the proposed connecting elements, their spacing and layout on the construction and other details are binding and must be complied with for the above attests to be applicable. In addition this variant solutions are recommended for applications and elements which cannot be tested because of the methodologies used or the spatial arrangement of the kilns. These solutions have also been professionally assessed and tested by expert assessments of PAVUS Praha or Fires Batizovce.

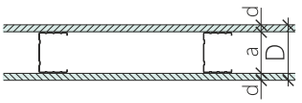
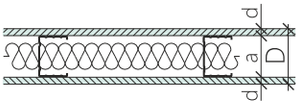
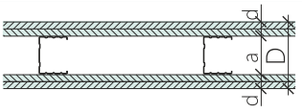
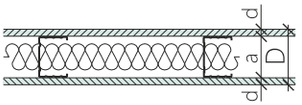
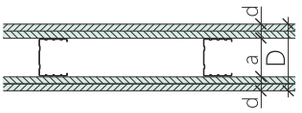
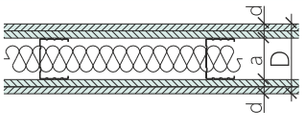
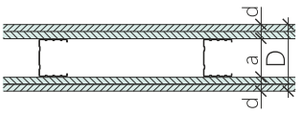
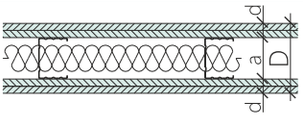
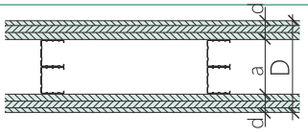
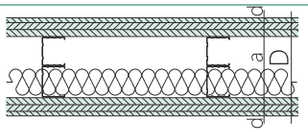
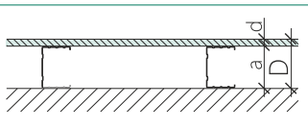
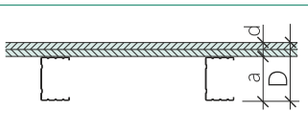
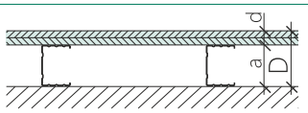
Important notice: The results of fire resistance tests and the tables following from them only assess the issue of the technical properties of the constructions in relation to their resistance to actual fire. For this reason, the axial distances and types of CW profiles / wooden pillars, which comply with the tests are stated. It is however necessary to consider them as the absolute minimum limit values. It is necessary to emphatically draw attention to the fact that when dimensioning the firewalls, the structural static requirements must also be assessed according to the real stress.

Assembly of fire constructions may only be carried out by trained staff – see Chap. 8.8. Training of assembly companies for CETRIS® board applications.

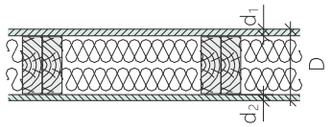
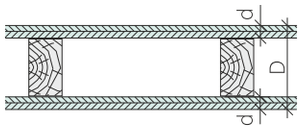
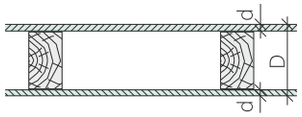
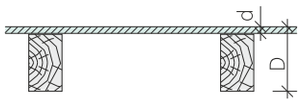
Description of the construction
The vertical fire partitions – walls and partition walls – with CETRIS® cement-bonded particleboard cladding can be designed on the basis of the fire resistance tests and extended applications of their results through theoretical calculations in several basic variants with different values of fire resistance pursuant to the following table.

Survey of wall constructions

See table on the next page.

Type / Marking	Scheme	Size			Weight (kg/m²)	Max. wall height (m)	Mineral wool		Fire Resistance	Thermal resistance (m^2K/W^1)	Weighted sound transmission loss (dB)
		a (mm)	d (mm)	D (mm)			Thickness (mm)	Density (kg/m^3)			
WS 01		75	16	107	45	4,50			EI 30	0,15	44
WS 02		75	12	99	38	3,60	60	50	EI 45	1,61	52
		100		124		4,00			EI 45		
		2x75		174		7,80			EI 15		
WS 03		75	10+10	115	56	4,00			EI 45	0,19	-
WS 04		75	16	107	49	3,60	60	75	EI 60	1,65	
		100		132		4,00					
WS 05		75	12+12	123	67	4,00			EI 60	0,23	50
						5,50			EI 45		
						7,30			EI 30		
WS 06		75	12+12	123	72	4,00	60	75	EI 90	1,73	56
WS 07		75	16+18	143	95	4,00			EI 90	0,32	
WS 08		75	16+18	143	95	4,00	60	75	EI 120	1,80	
WS 09		2x75	18+12+12	234	118	4,00			EI 120	0,40	
WS 10		2x75	18+12+12	234	122	4,90	60	75	EI 180	1,90	61
						6,40			EI 120		
						9,50			EI 90		
WS 11		75	16	91	22	4,00			EI 15[3])	0,08	
WS 12		75	12+12	99	34	4,00			EI 30[2])	0,11	
WS 13		75	16+16	107	48	4,00	60	50	EI 45[3])	1,67	

Supplementary classification according to ČSN 73 0810: 2010 – all walls with steel load-bearing structures with DP 1 classification.

Type / Marking	Scheme	Size			Weight (kg/m²)	Max. wall height (m)	Mineral wool		Fire Resistance	Thermal resistance (m²K/W¹)	Weighted sound transmission loss (dB)
		Supporting structure	d (mm)	D (mm)			Thickness (mm)	Density (kg/m³)			
WW 01		wooden lath 120x100 mm axially 625 mm	d1=14 CETRIS® BASIC d2=12,5 Knauf RED	146,5	43	3,00	120	40	REI / REW 60 DP3	0,08	
						3,00			REI / REW 15 DP2		
						4,00			EI 60 DP3		
WW 02		wooden lath 100x60 mm axially 625 mm	12+12	148	74	3,00			REI 60 DP3	0,32	
						3,00			REI 45 DP2		
						4,00			EI 60 DP3		
WW 03			14	128	45	3,00			REI 30 DP3	0,15	
						3,00			REI 15 DP2		
						4,00			EI 30 DP3		
WW 04			14	114	27	3,00			REI 15 DP2	0,08	
						4,00			EI 15 DP2		

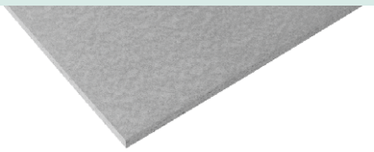
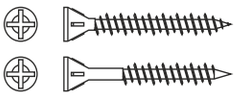
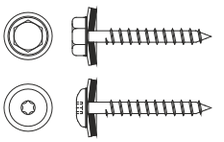
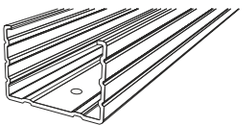
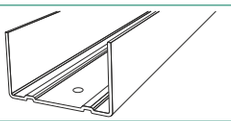
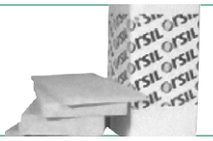
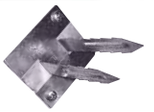
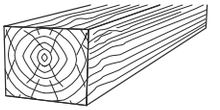
Notes to the table:

1) Informative thermal resistance value

2) Fire resistance value for exposition to fire on the CETRIS® board (full cladding) side as well as on the profile (hollow) side

3) The fire resistance value applies only to the fire stress on the CETRIS® boards

Materials for assembly of the firewall constructions – specifications

Description	Visualisation	Note
CETRIS® BASIC boardCement bonded particleboard, smooth surface, cement grey. Basic format 1,250x3,350 mm. Volume mass 1320±70 kgm^{-3}		Thickness according to the fire resistance requirements
Screw 4.2x25, 35, 45, 55 mm Counter-sunk, self-tapping screws		Screw type according to the thickness of cladding and type of load-bearing construction. Anchoring in the interior, or exterior under the warm cladding system (ETICS)
Screw 4.2 – 4.8 x 38, 45, 55 mm Stainless steel or galvanised screws with half-round or hex head with thrust water-tight washer		Screw type according to the thickness of the cladding and type of load-bearing construction. Anchoring on the exterior – it is necessary to pre-drill the board (hole diameter 8(10) mm)
CW profile 75, 100 (vertical) Galvanised sheet metal profile 75x50x0.6 mm 100x50x0.6 mm		Dimensions according to the fire resistance and wall height requirements. Alternatively, it is possible to use steel profiles with a cross-section area that minimally equivalent to the CW profiles.
UW profile 75, 100 (horizontal) Galvanised sheet metal profile 75x40x0.6 mm 100x40x0.6 mm		
Steel dowels For profile anchoring to masonry (concrete) walls)		Dimensions (diameter and length) by weight of structure, type of substrate and anchored material
Fireproof sealant White matter for filling the joints and looping the screw heads		DEXAFLAMM-R putty (manufactured by Tora Spytihněv), or fire-resistant DenBraven (acrylic, silicone) putty
Heat-insulation Mineral or rock wool (Isover, Rock wool, Knauf Insulation ...)		It is necessary to keep the thickness and volume mass according to the specification in the composition. Reaction to fire class A1
Adhesive pins		For stabilisation of position of the insulation boards in the frame construction.
Wooden post Spruce timber of minimum class SII, max. Humidity 18%.		Alternatively glued timber may be used; cross-section according to the specifications in the composition
FIBERFRAX DurafeltAluminium-silicon fibre mats/paper		For profile lining on the bottom side, interruption of thermal bridges, as insulation for temperatures up to 1,260° C
KNAUF GKF / RED board KNAUF plasterboard of thickness 12.5 mm. Basic size 1,250 × 2,000 (2,500) mm		Processing, anchoring, filler applications, surface finish of boards pursuant to the instructions of KNAUF Praha spol. s r.o.
KNAUF Uniflott Plasterboard joint filler.		Cannot be used for CETRIS® board joint filling!!!
Screw TN 35 Quick screw (4.0 × 35 mm) for plasterboard anchoring		Cannot be used for CETRIS® board anchoring!!!

8.2.2.1 Load-bearing Construction

The load-bearing construction is a frame consisting of steel zinc-coated profiles CW (vertical posts) and UW (horizontal profiles). For specification of the CW profile dimension in relation to the height and total thickness of the wall, the ratio of the wall height hs and thickness d should always be lower than 40. The hs/d > 40 ratio represents slenderness ratio L/i circa 140.

The peripheral profiles are anchored into the frame (masonry) with steel dowels with a spacing of 625 mm, the joint between the profiles and the masonry is filled with fire-resistant filler. The axial distance of the vertical interior profiles does not exceed 625 mm.

8.2.2.2 Construction Composition

The construction is symmetrically or asymmetrically cladded on one or both sides with one or more layers of CETRIS® cement bonded particleboards. The thickness and the number of the CETRIS® boards, and the mineral wool insertion represent the decisive elements of fire resistance (see the dimension tables for the particular specified construction types). The horizontal displacement of the boards is min. 400 mm.

For multi-layer cladding, the gaps between the boards mutually overlap – in the vertical direction by the profile (625 mm), in the horizontal direction min. 400 mm.

For CETRIS® board anchoring to the sheet metal profiles self-tapping screws with sunken heads are used; the screw heads are equipped with blades for countersinking in the board and the screw size is 4.2 × 25 or 35, 45, 55 mm. The screw length must always be at least 10 mm longer than the thickness of the screwed board (in the case of multilayer coating at least 10 mm longer than the total thickness of all anchored layers). In the exterior (the boards form a visible cladding) anchoring must be done via the pre-drilled holes using the screws with a visible head and water-tight washer. Gaps of minimum width 5 mm are left between the boards. The joint fill, the wall perimeter filling and coverage of the screw heads is done using fire-resistant filler.

Dimensions of partition walls with heights up to 4 m

(a steel framework of CW profiles, two-sided, clad with one- or a multi-layer coat of CETRIS® boards with or without interior heat insulation on mineral/rock wool basis)

Fire Resistance	Structure of the double-sided cladding made of CETRIS® boards						
	with an air gap			with thermal insulation (mineral or rock wool with resistance to fire class A1)			
	Cladding	Min. air gap thickness	Cladding	Cladding	Insulation thickness	Density	Cladding
EI 30	16	50	16	-	-	-	-
EI 45	10+10	50	10+10	12	60	50	12
EI 60	12+12	50	12+12	16	60	75	16
EI 90	18+16	50	18+16	12+12	60	75	12+12
EI 120	18+12+12	50	18+12+12	16+16	60	75	16+16
EI 180	-	-	-	18+12+12	60	75	18+12+12

Sizes of partition walls taller than 4 m

(a steel framework of CW profiles, two-sided, clad with one-or a multi-layer coat of CETRIS® boards with or without interior heat insulation on mineral/rock wool basis)

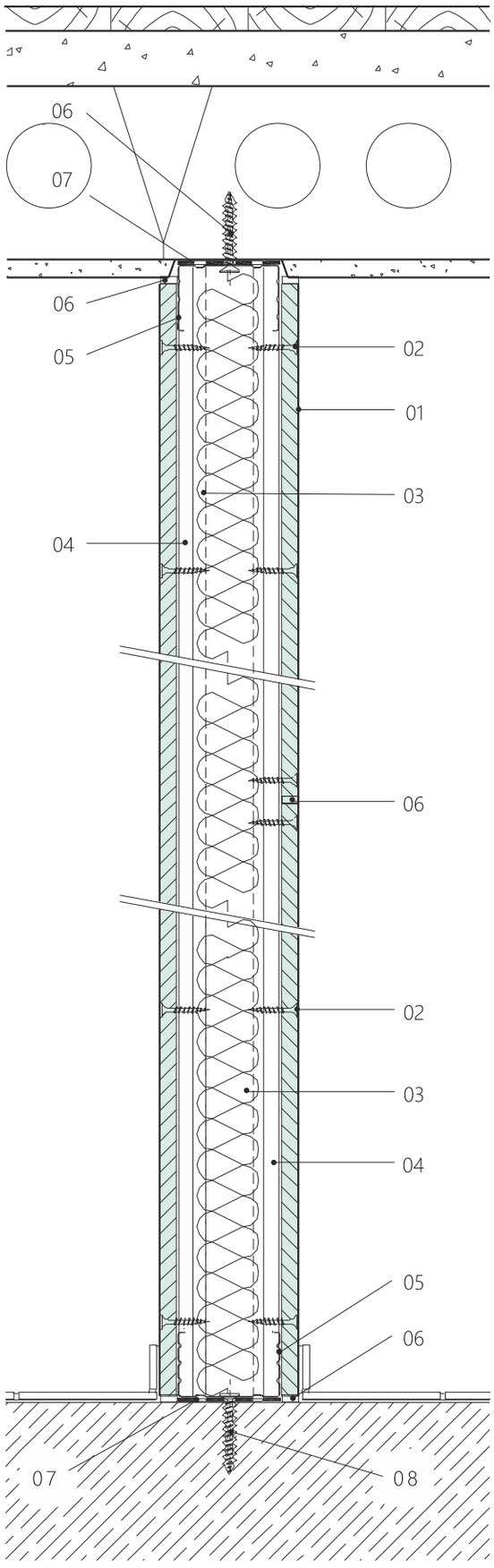
Fire resistance[1]	Structure of the double-sided cladding made of CETRIS® boards				Maximum height (m)
	Cladding	Insulation thickness[3])	Density	Cladding	
EI 15	12	60	50	12	7,8
EI 30 [2)4)5)]	16	-	-	16	4,5
EI 30 [2)4)]	12+12	-	-	12+12	7,3
EI 45 [2)4)]	12+12	-	-	12+12	5,5
EI 90	18+12+12	60	75	18+12+12	9,5
EI 120					6,4
EI 180					4,9

Supplementary classification according to ČSN 73 0810: 2010 – all walls with steel load-bearing structures with DP 1 classification.

Notes to the table:

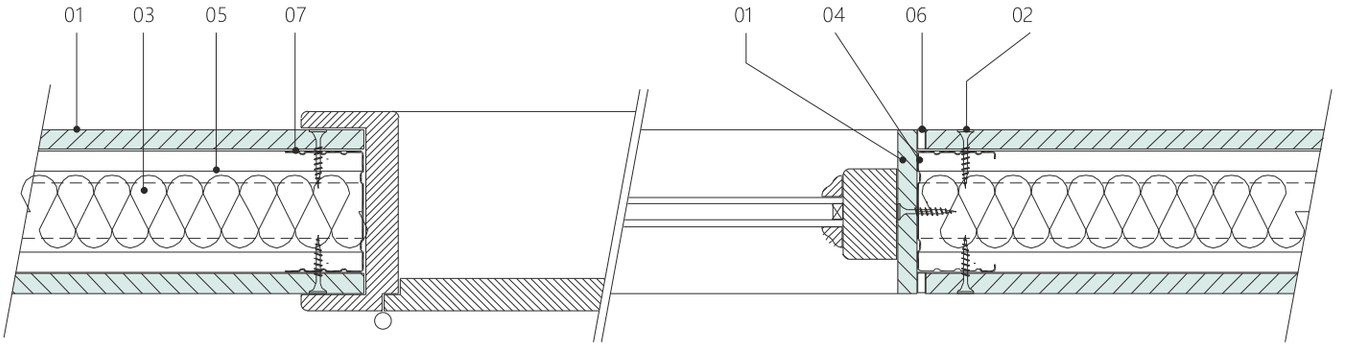
1) *Classification of limit conditions of fire resistance is performed pursuant to EOTA TR 35*
2) *The air gap width is 75 mm*
3) *Mineral or rock wool insulation (e.g. Isover, Rock wool Knauf Insulation ...) with a prescribed density and thickness, reaction to fire class of min. A2. If we are not filling the entire joint, it is necessary to secure the position of the insulation – e.g. with adhesive pins.*
4) *For partitions with a height above 4 m, it is necessary to consider a higher weight of the construction and the higher the stress in the steel cross-section, which causes a drop in the critical temperature of the steel. For this reason, in the case of higher partitions, the steel framework needs better protection – unless filled with mineral wool in the points of contact between the steel CW profiles and the boards, the coating needs to be padded with a strip of CETRIS® board with the minimum thickness of 12 mm for the strip to overlap the width of the CW profile at least by 60 mm on each side.*
5) *The upper base U profile must have a minimum height of 100 mm at the point of the CW post.*

Vertical section



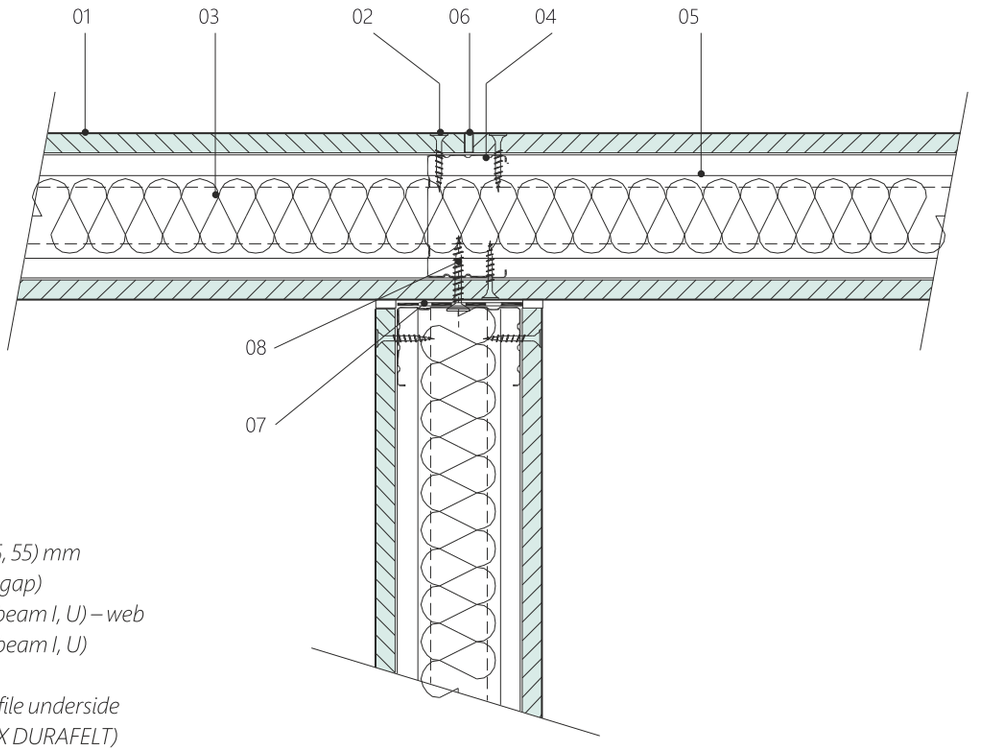
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 DEXAFLAMM-R filler
07 sealing of the profile underside (FIBERFRAX DURAFELT paper)
08 dowel

Hole in the wall - Horizontal section



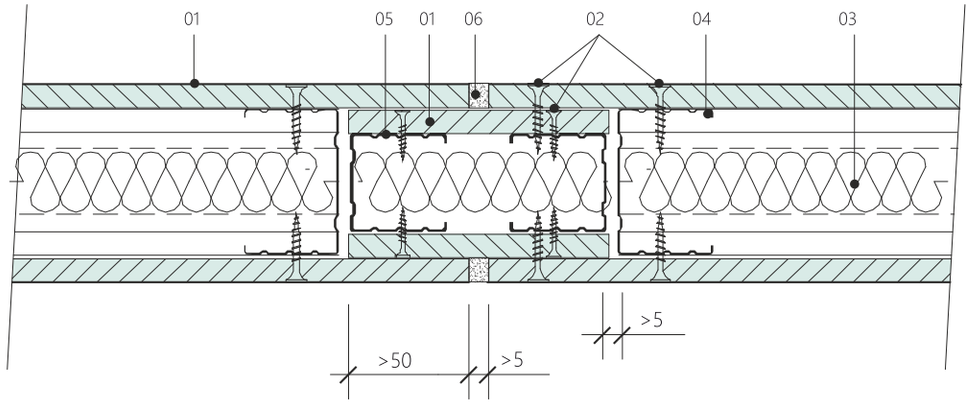
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 UA profile

T-joint - Horizontal section



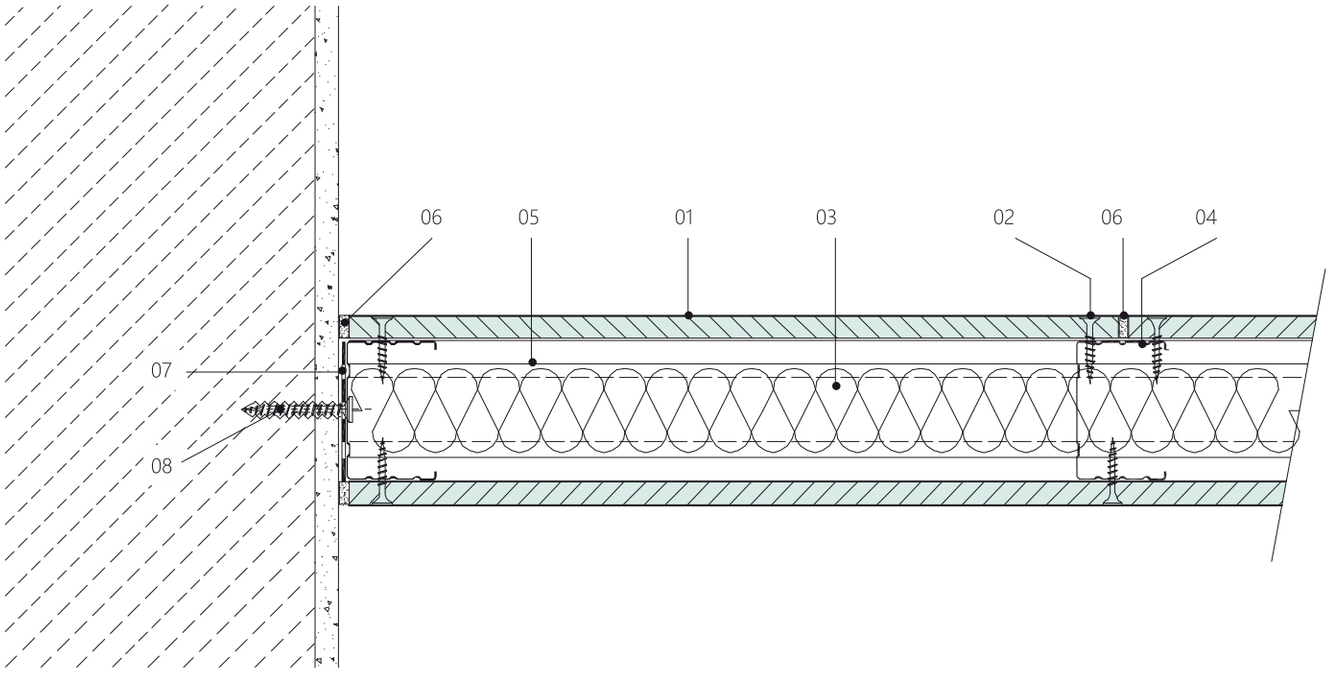
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing of the profile underside (paper FIBERFRAX DURAFELT)
08 dowel

Joint detail – EI > 60 min - Horizontal section



01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile 75
05 UW profile 50
06 fire resistant filler.

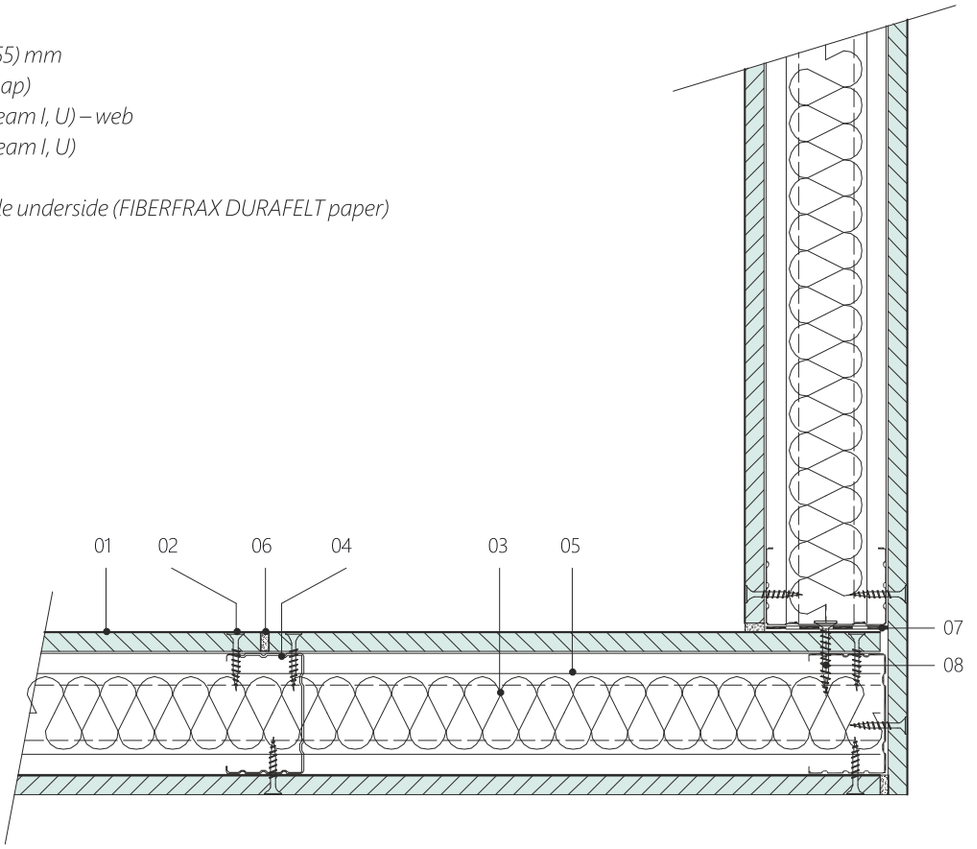
Connection at the wall - Horizontal section



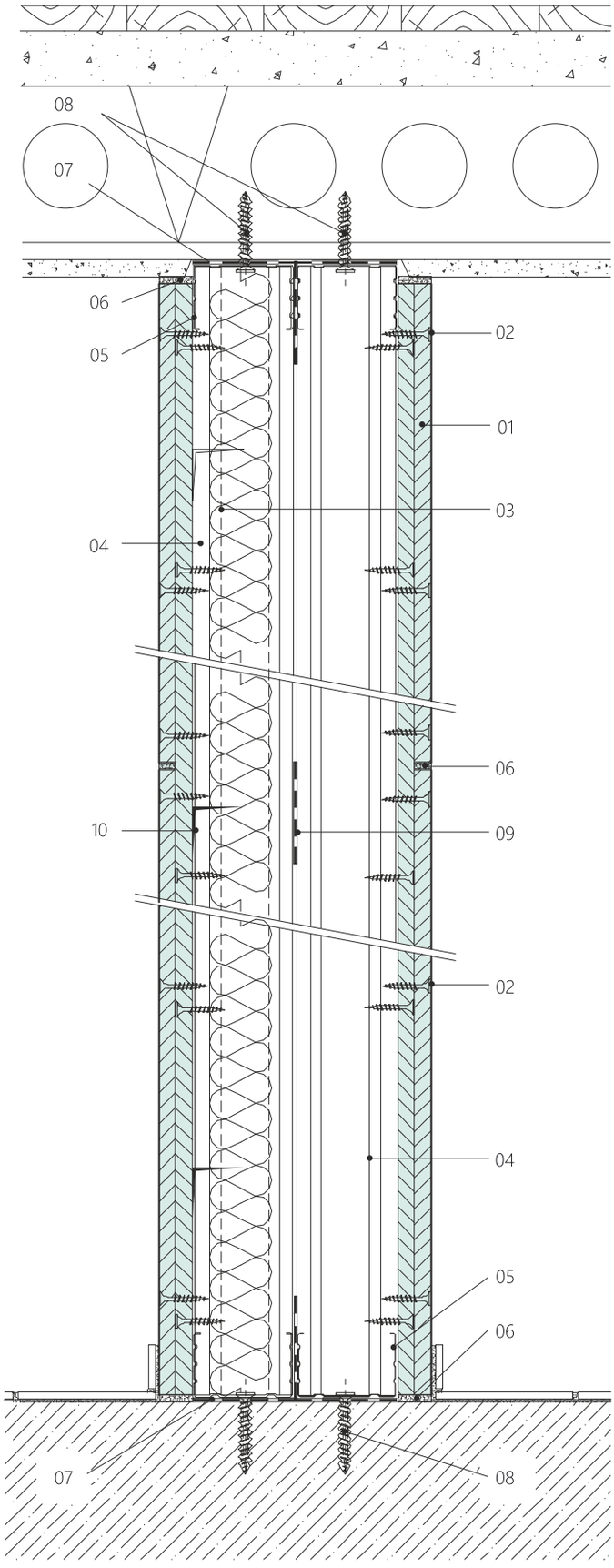
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing of the profile underside (FIBERFRAX DURAFELT paper)
08 dowel

L-joint - Horizontal section

01 CETRIS® board
02 screw 4.2×35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing of the profile underside (FIBERFRAX DURAFELT paper)
08 dowel

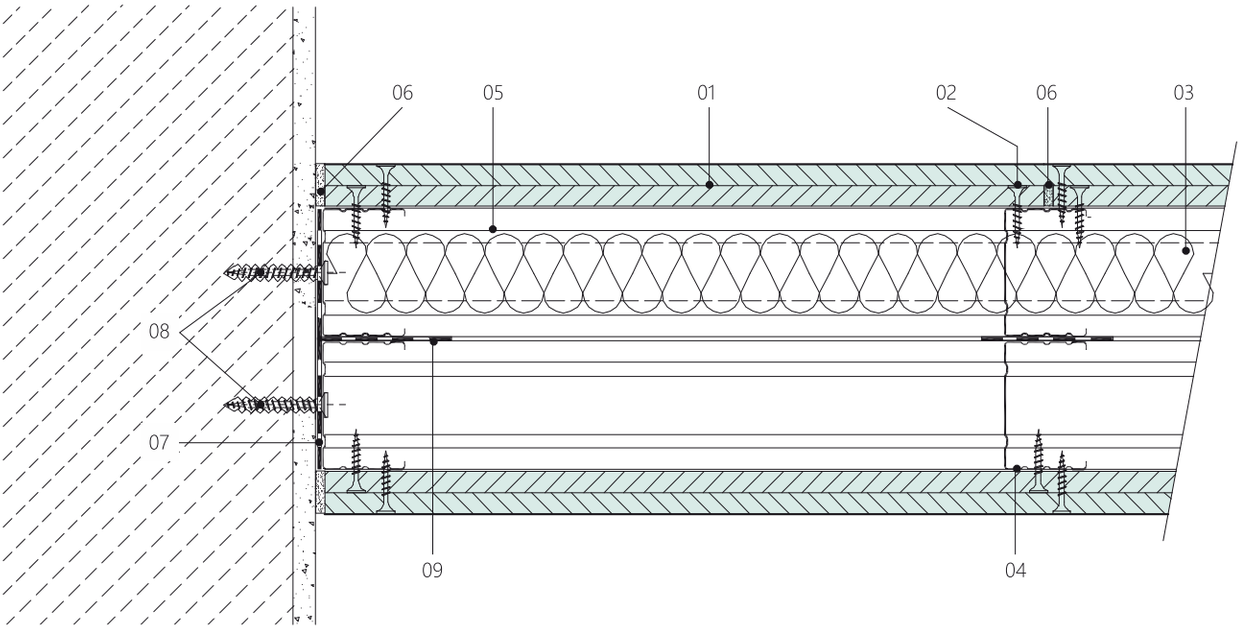


Vertical section



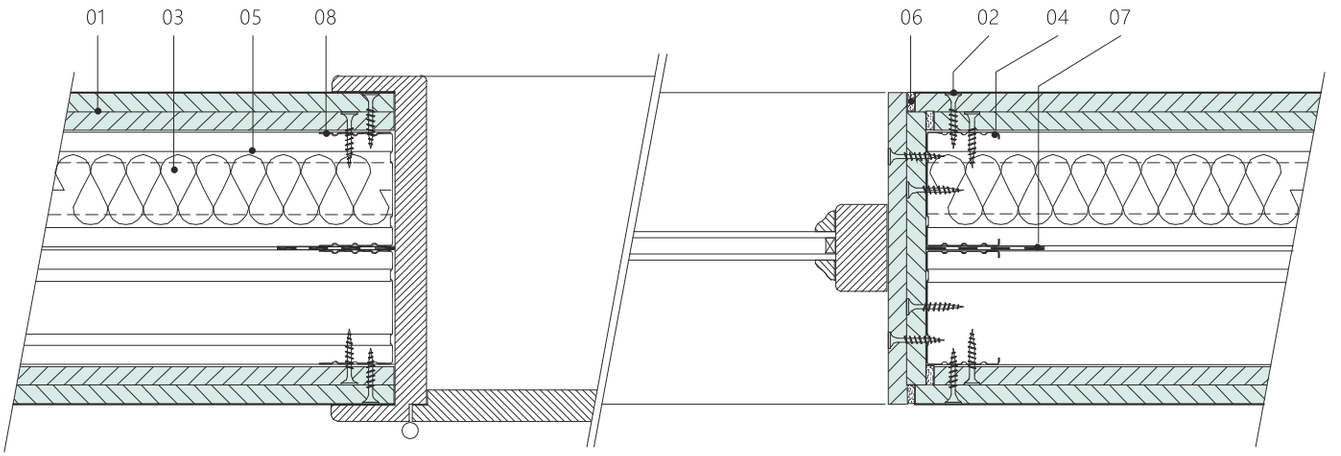
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing of the profile underside (FIBERFRAX DURAFELT paper)
08 dowel
09 sealing tape
10 adhesive pins

Connection at the wall Horizontal section



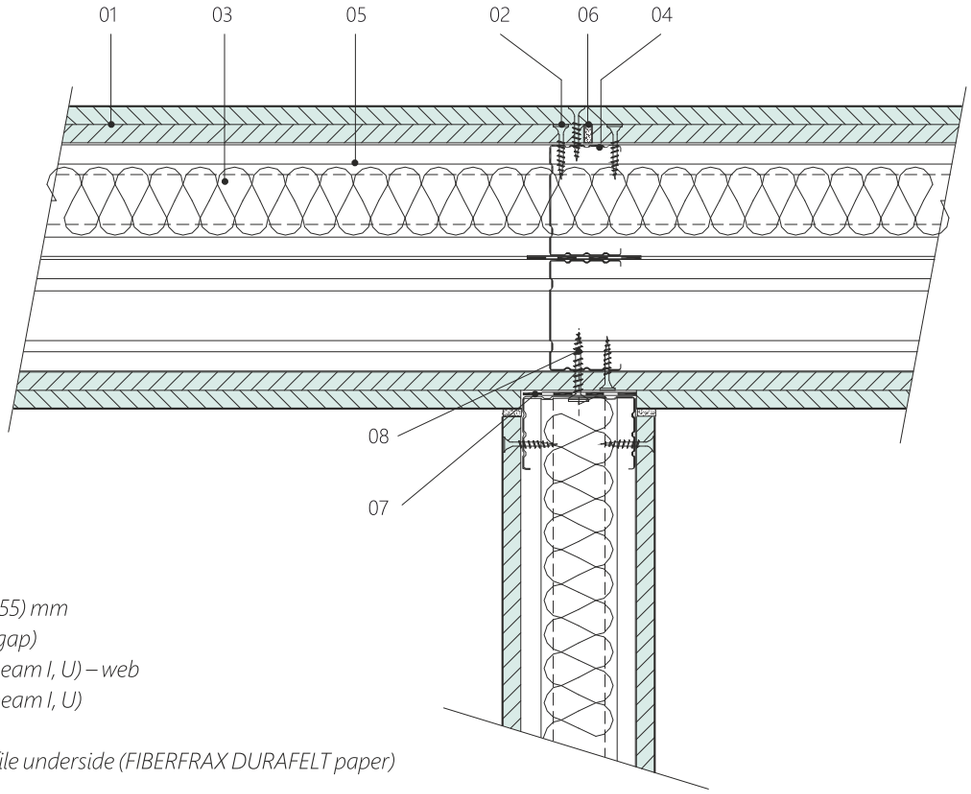
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing of the profile underside (FIBERFRAX DURAFELT paper)
08 dowel
09 sealing tape

Hole in the wall Horizontal section



01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing tape
08 UA profile (opening jamb)

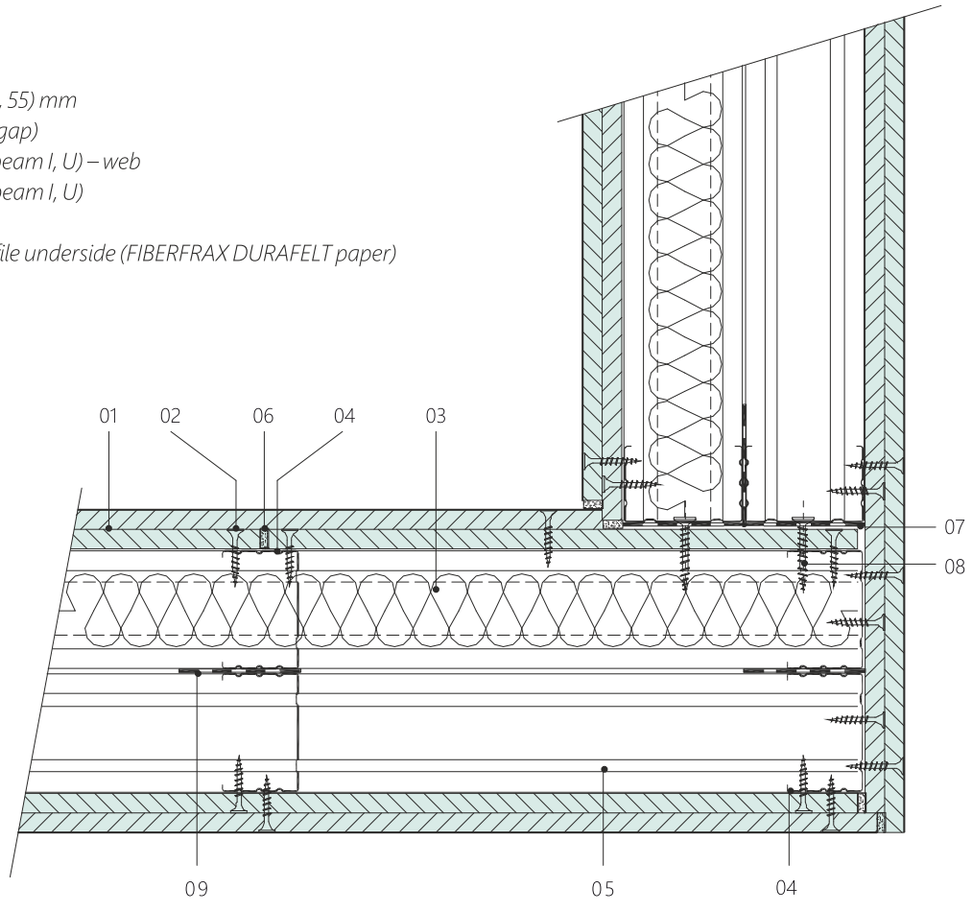
T-joint - Horizontal section



01 CETRIS® board
02 screw 4.2×35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing of the profile underside (FIBERFRAX DURAFELT paper)
08 dowel

L-joint - Horizontal section

01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 mineral wool (air gap)
04 CW profile (steel beam I, U) – web
05 UW profile (steel beam I, U)
06 fire resistant filler
07 sealing of the profile underside (FIBERFRAX DURAFELT paper)
08 dowel
09 sealing tape



8.2.3 Shaft (Advanced) Firewalls

Shaft (advanced) firewalls are wall constructions clad only with single-layer CETRIS® cement-bonded particleboards, which ensure the stipulated fire resistance.

They can be used as separate shaft walls as well as advanced walls - to increase the fire resistance of the existing constructions. In this case, it is not required for the existing constructions to exhibit any fire resistance. The maximum separate height of these constructions is 4 m. In the case of cladding of lift shafts in multi-storey buildings, use at a higher height is conditional:

- the load-bearing constructions of the cladding are anchored to the load-bearing wall of the building, or other load-bearing constructions with a maximum spacing of 4,000 mm using steel dowels,
- the load-bearing construction to which the shaft wall is fixed must have a fire resistance that is higher than that of the shaft wall itself,
- all the joints (also between the lift shaft and the load-bearing construction) must be filled fire-resistant filler.

The mechanical requirements of the lift shaft cladding are described in ČSN EN 81-20 Safety rules for the construction and installation of lifts – Lifts for the transport of persons and goods – Part 20: Passenger and goods lifts. For safe operation of the lift, the shaft wall must have such a mechanical strength that withstands the action of 1,000 N (100 kg) perpendicular to the wall from one or the other side at an arbitrary point, proportionately to the circular or square area of 300 x 300 mm:

- without permanent deformation
- with elastic deformation up to 15 mm.

This parameter was verified by the Strojírenský a zkušební ústav Brno. The CETRIS® cement bonded particleboard of thickness 12 mm in one layer anchored to the frame construction was chosen.

During the repeated test, neither permanent deformation occurred nor was the prescribed elastic deformation limit exceeded.

Overview of shaft (advanced) firewalls

Fire resistance	One-sided cladding with CETRIS® boards	Insulation thickness	Density	Fire stress
EI 15	16	-	-	only on the cladding side – CETRIS® boards
EI 30	12+12	-	-	on the cladding side – CETRIS® boards also on the side of the gap (profiles)
EI 45	16+16	60	50	only on the cladding side – CETRIS® boards

Supplementary classification according to ČSN 73 0810: 2010 – DP1.

8.2.3.1 Load-bearing Construction of Advanced Walls

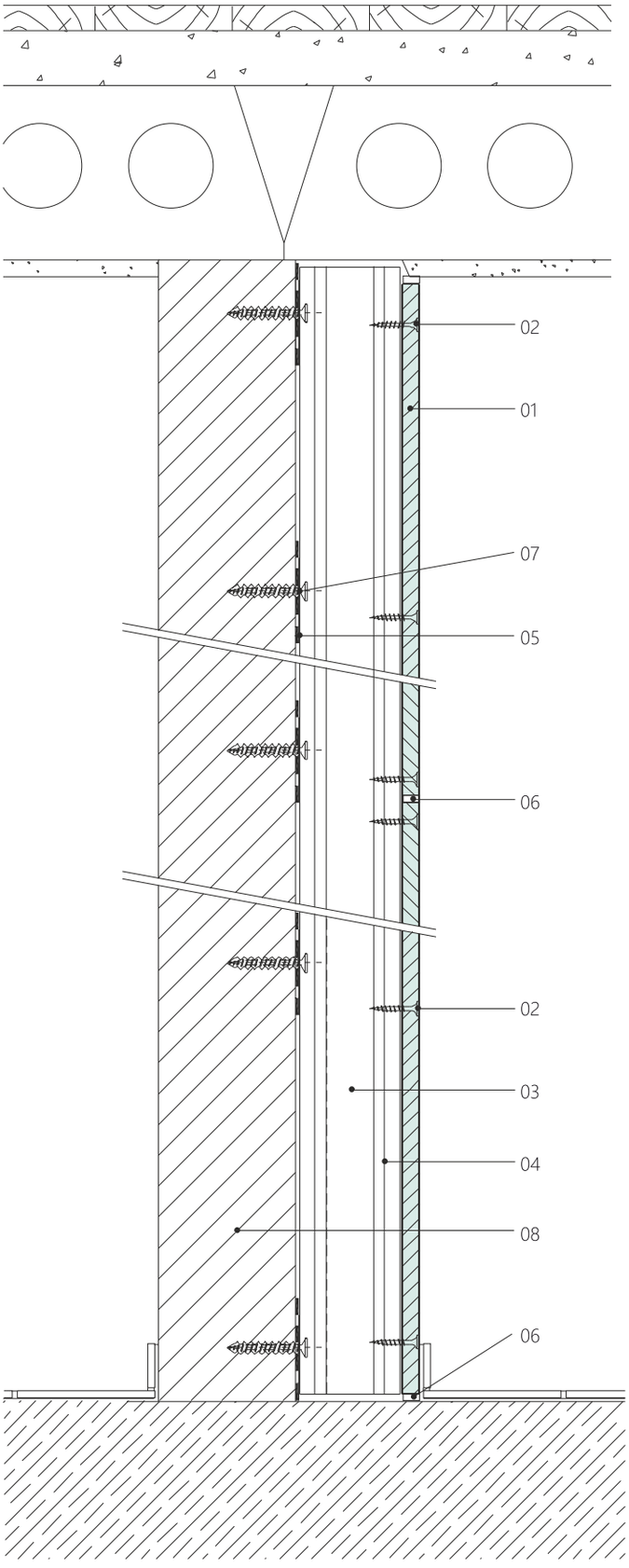
The load-bearing construction is a frame consisting of steel zinc-coated CW profiles CW 75 × 50 × 0.6 mm. The peripheral profiles are anchored into the existing masonry construction with steel dowels with a spacing of 625 mm, the joint between the profiles and the masonry is filled with fire-resistant filler. The axial distance of the vertical profiles does not exceed 625 mm.

8.2.3.2 Construction Composition

The shaft (advanced) wall has one-sided cladding with one or more layers of CETRIS® cement bonded particleboards with the option to insert thermal insulation between the vertical profiles. The horizontal overlap of the boards is min. 400 mm. For multi-layer cladding, the gaps between the boards mutually overlap – in the vertical direction by the profile (625 mm), in the horizontal direction min. 400 mm. In the case of the composition with a fire resistance of EI 45 (cladding with two layers of CETRIS® cement bonded particleboards of thickness 16 mm), it is necessary:

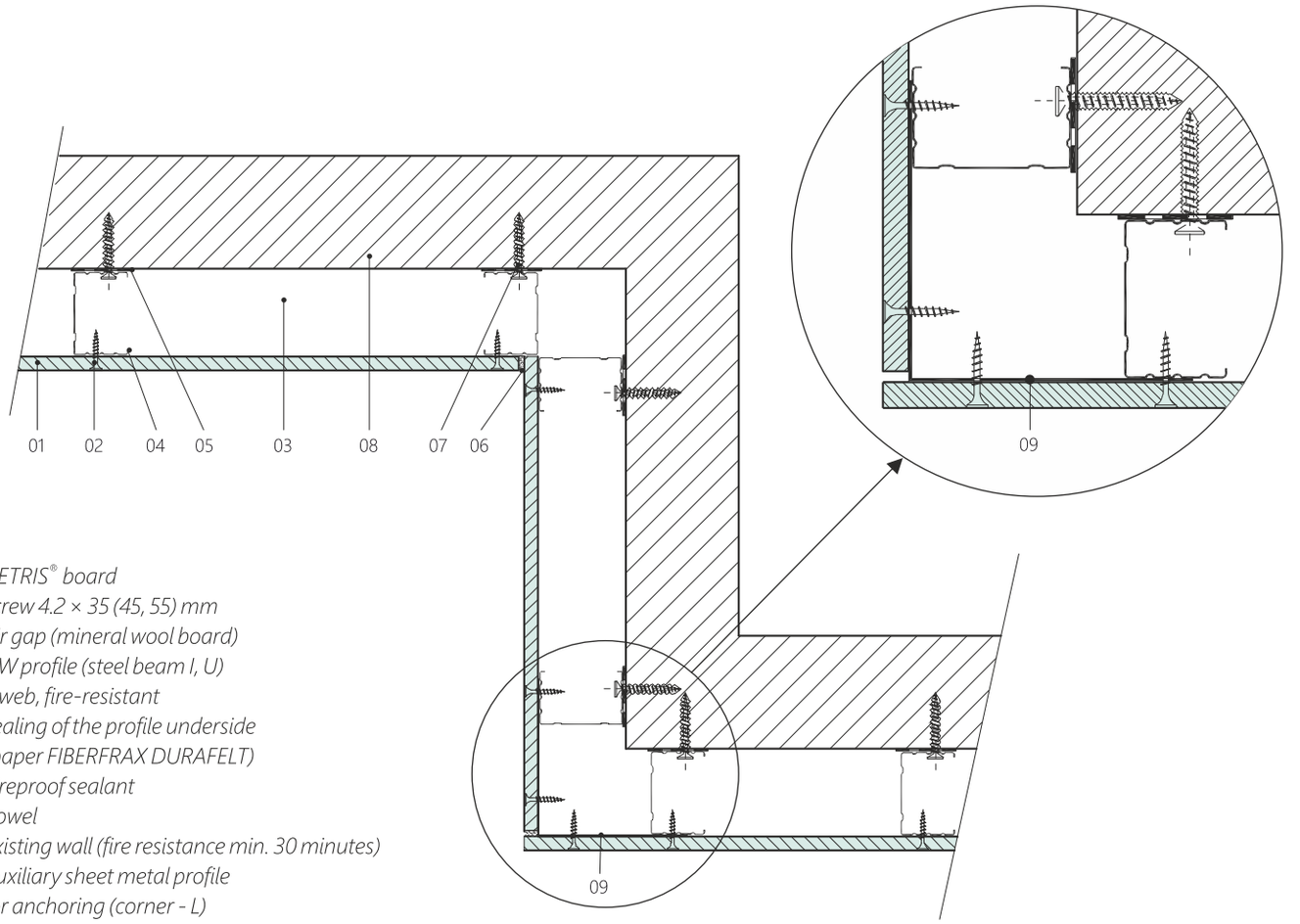
- mineral wool (of thickness 60 mm, minimum weight 50 kg/m3) and secure it against failure of the UW steel profiles of approximate length 100 mm. These profiles are located at the point of the vertical joints of the mineral wool boards (inserted insulation) and are fixed to the vertical CW post.
- apply fire-resistant filler to the contact surface of the CW steel posts with the CETRIS® boards, e.g. DEXAFLAMM-R, Den Braven acrylic fire-resistant filler.

Vertical section



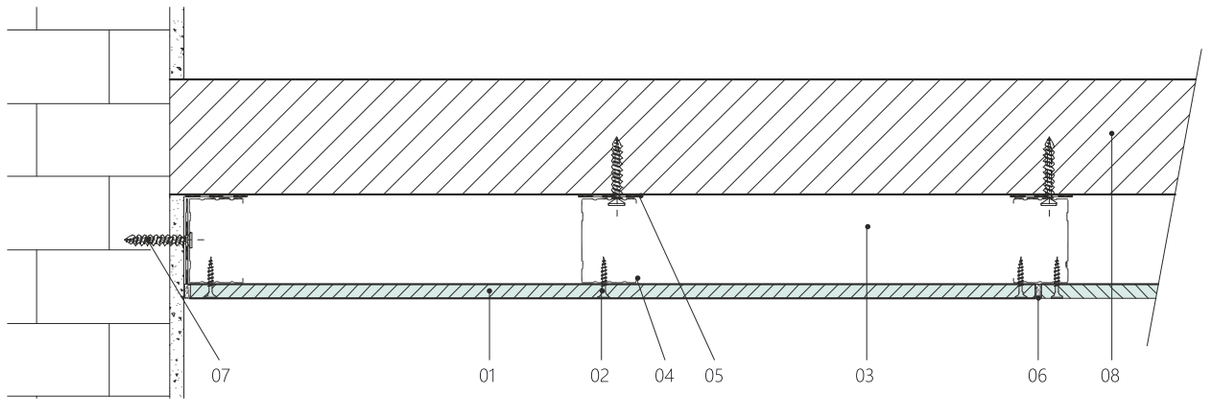
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 air gap (mineral wool board)
04 CW profile (steel beam I, U) – web
05 sealing of the profile underside (FIBERFRAX DURAFELT paper)
06 fire resistant filler
07 dowel
08 existing wall

Inner corner, outer corner Horizontal cross-section



01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 air gap (mineral wool board)
04 CW profile (steel beam I, U) – web, fire-resistant
05 sealing of the profile underside (paper FIBERFRAX DURAFELT)
06 Fireproof sealant
07 dowel
08 existing wall (fire resistance min. 30 minutes)
09 auxiliary sheet metal profile for anchoring (corner - L)

Connection at the wall Horizontal cross-section



01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 air gap (mineral wool board)
04 CW profile (steel beam I, U) – web
05 sealing of the profile underside (FIBERFRAX DURAFELT paper)
06 fire resistant filler
07 dowel
08 existing wall

8.2.3.5 General Principles of Assembly of Fire Walls on a Steel Frame

All building constructions to which the non-load-bearing fire partitions and walls of CETRIS® boards are fixed in any manner, or by which they are supported and which might threaten their stability, must have at least the same fire resistance as the CETRIS® partition itself. If these constructions are structurally stressed then their potential deformations must not interfere with the integrity of the wall of CETRIS® boards. This requirement does not apply if the supporting and load-bearing construction cannot be exposed to thermal stress by fire even under the least favourable conditions for the period of the prescribed fire resistance.

- Maximum spacing of the screws anchoring the CETRIS® boards to the CW profiles must not exceed 200 mm (screws by the edges), or 400 mm (across the surface) and the distance from the board edges must not be less than 25 mm in the case of fire walls. In the case of multilayer cladding the screw spacing may be doubled.
- Maximum spacing of screws on CETRIS® strips or assembly inserts must be 100 mm, or less.
- Screws used for anchoring CETRIS® boards to CW profiles must be at least 10 mm longer than the thickness of the anchored board.
- If the CETRIS® board is used as visible coating of an exterior fire construction it must be anchored as façade cladding – i.e. with pre-drilled holes (8 or 10 mm) and screws with visible heads and sealing washers (see chapter 7.1.6.2).
- Maximum spacing of dowels for anchoring CW and UW profiles must not exceed 625 mm.
- CETRIS® assembly inserts or strips must always be at least 12 mm thick and their thickness must be equal to the thickness of the wall cladding.
- The CETRIS® strip at the joints of the CETRIS® boards must overlap on both sides by at least 60 mm, unless otherwise specified in the detail drawing.
- Maximum spacing of CW assembly profiles must not exceed 625 mm, and at the same time must be based on the board thickness and the respective structural assessment. The length of CW profiles is about 15 mm shorter than the room height. For walls with a height greater than 4 m, the CW profile must be shorter by 20 mm – the dilatation in the lower and upper mounting of the base (U) profile must be min. 10 mm. In case of wall height > 4 mm, it is necessary to observe the principles given in the table on page 146 + points 4 and 5.
- Dilation joints and all contacts with the wall and the corner joints must be filled with fire resistant filler (e.g. DEXAFLAMM-R, Den Braven acrylic fire resistant filler). The filler must be driven in to a minimum depth of 5 mm.
- The surfaces of the CW or UW profiles adjacent to the floor and the ceiling or wall must be covered with fire resistant filler; if the fire resistance of the wall is greater than 60 minutes, we recommend lining with FIBERFRAX DURAFELT paper. This paper is also suitable for partial insulation of potential thermal bridges in the construction.
- The boards of multilayer cladding must be placed with an overlap of at least 400 mm and always without any cross joint.
- Joints of single-layer coats must always be supported with a CW profile under the joint or (in the places where this is impossible for construction reasons) with a CETRIS® strip; in exposed cases – in the case of higher demand for fire resistance – both methods may be used. In the case of multilayer coating even the inside joints of the bottom layers must be filled with filler.
- All dilation joints in fire partitions with fire resistance above 60 minutes must always be supported with CETRIS® board strips under the joints of the same thickness as the thickness of the coat pursuant to the figure on page 153.
- For fire resistances of constructions above 60 minutes, it is recommended to insulate the insides of the CW and UW profiles adjacent to the load-bearing walls and ceilings with cut mineral felt.
- The position of mineral wool in an air gap of higher thickness than the thickness of the mineral wool strip should be fixed with adhesive pins.
- All openings in CETRIS® fire partitions must be sealed with inserts or in other ways pursuant to the project specifications. Installations inside the partition walls (water distribution lines, electrical wiring, etc.) must be protected against fire with mineral wool, otherwise the fire resistance of the wall could be reduced.
- In the case of cladding of large wall constructions (longer or higher than 6 m) dilations in the load-bearing construction must be designed and made visible in the cladding of CETRIS® boards as well.
- Surface treatment and filling of CETRIS® boards can be done only after acclimatization of boards in installed condition

8.2.3.6 Assembly Procedure

- Measure the locations of the UW profiles in the horizontal planes and apply fire resistant filler to the floor and ceiling, or underline it as necessary with FIBERFRAX DURAFELT paper.
- Fix the profiles to the floor, ceiling or to the walls, as the case may be, with steel dowels. The maximum spacing of the dowels with regard to the weight of the boards has been specified as 625 mm.
- Install the CW profiles in the construction with the spacing as per the structural assessment and board thickness, but with a max. spacing of 625 mm. The length of the CW profiles must be about 15 mm shorter than the height of the room.
- Insert cut mineral felt between the profiles if required.
- Screw in the CETRIS® boards on the prepared construction leaving a gap of at least 10 mm between the floor and the ceiling and the bottom and top edges of the boards. Fix the CETRIS® boards with the screws to the CW profiles only.
- In the case of double or multilayer cladding the boards are laid with an overlap of minimum 400 mm.
  Note: In the case of three-layer coats the joints of the bottom and the top coat must not be in the same places.
- The following applies to anchoring CETRIS® boards to the construction: The maximum axial distances of the screws from each other is 200 mm, only in the case of double or multilayer cladding the spacing can be increased in the first layer up to a maximum of 400 mm.

8.2.4 Fire Walls with a Wooden Supporting Structure Clad with a CETRIS® Cement Bonded Particleboard

Based on the new fire resistance tests of wall constructions, we have significantly extended the offer of wall compositions with wooden supporting structure clad with CETRIS® cement bonded particleboards. The list of structures includes compositions of bearing walls (wall height up to 3 m) and non-load-bearing walls (height up to 4 m) is given in table 6. fire resistance is determined according to EN 13 501-2 with sorting of construction components (DP2/ D. P3) in accordance with ČSN 73 0810, article 3.2.

Fire resistance	Composition of CETRIS® board double-sided cladding				Maximum height (m)
	Exterior cladding	Insulation thickness	Density	Interior cladding	
EI 15 DP2	14	-	-	-	3
REI 15 DP2					4
REI 30 DP3	14	-	-	14	3
REI 15 DP2					3
EI 30 DP3					4
REI 60 DP3	12+12	-	-	12+12	3
REI 45 DP2					3
EI 60 DP3					4
REI/REW 60 DP3	12	120	40	Knauf plaster-board GKF 12,5	3
REI/REW 15 DP2					3
EI 60 DP3					4

8.2.4.1 Load-bearing Construction

The load-bearing construction consists of a frame of wooden vertical and horizontal beams mutually connected with screws.
The cross-section of the vertical wooden beams depends on the composition of the construction – it is necessary to keep the cross section mentioned in the table with a list of compositions. The beams can be made of dry spruce lumber (moisture content 18 % compactness class min. S II), alternatively glued lumber can be used.
The wooden prisms are anchored into the frame (masonry) with steel dowels with a spacing of 625 mm, the joint between the profiles and the masonry is filled with fire-resistant filler (e.g. DEXAFLAMM-R, Den Braven acrylic fire resistant filler). The axial distance of the vertical internal wooden posts must not exceed 625 mm.

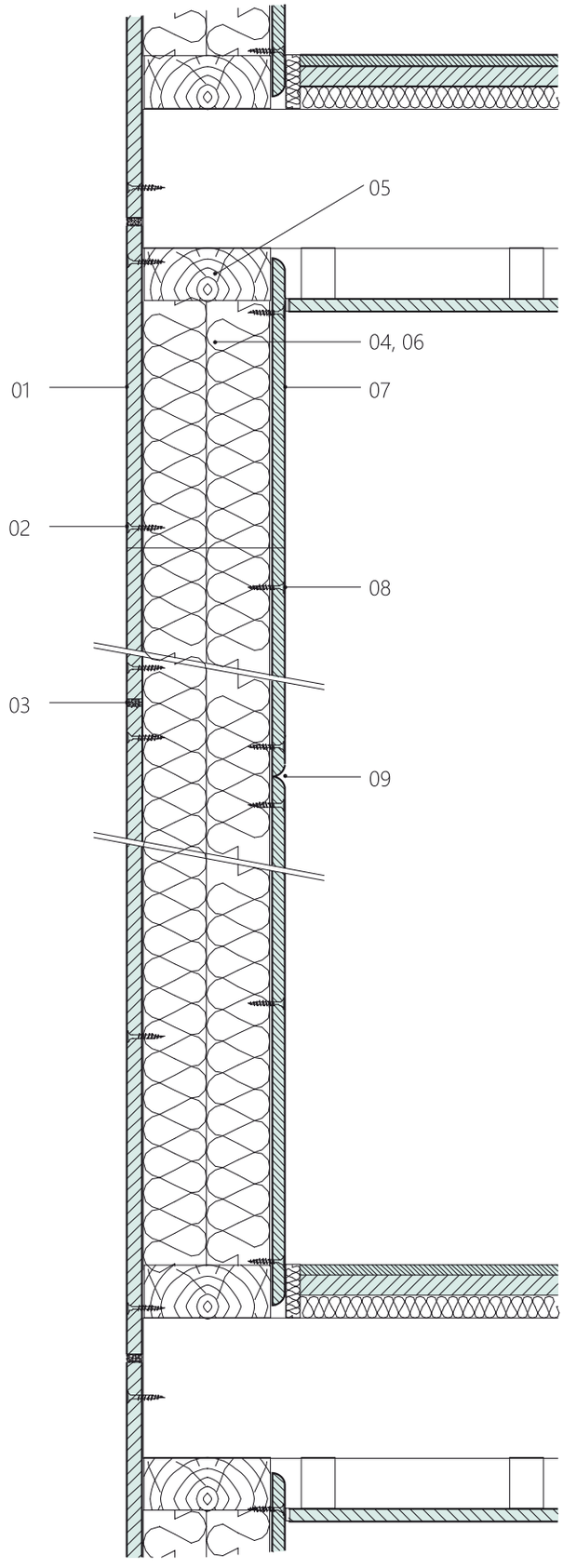
8.2.4.2 General Principles of Assembly of Fire Walls on a Wooden Frame

The following principles apply to the implementation of the load-bearing wooden frame and for anchoring of CETRIS® boards.

- Maximum spacing of the screws anchoring the CETRIS® boards to the wooden posts must not exceed 200 mm (screws by the edges), or 400 mm (across the surface) and the distance from the board vertical edges must not be less than 25 mm in the case of fire walls. • When installing CETRIS® boards it is necessary to keep joints with a minimum width of 5 mm, the joints must be filled with filler (DEXAFLAMM-R, Den Braven acrylic fire resistant filler).
- In case of two layers of CETRIS® boards, it is necessary to overlay the joints – in horizontal direction by 625 mm of the post distance, in the vertical direction by min. 400 mm. The joints must be filled with fire resistant filler. • A horizontal joint created when cladding CETRIS® boards on a wall must be supported with wooden beam of minimum width 60 mm.
- Maximum spacing of dowels for anchoring the wooden beams must not exceed 625 mm.
- The maximum spacing of the dowels for anchoring the wooden posts should not be more than 625 mm.
- Dilation joints and all contact surfaces with the wall and the corner joints must be filled with fire resistant filler. The filler must be driven in to a minimum depth of 5 mm.
- The surfaces of the wooden prisms in contact with the floor and the ceiling or masonry must be treated with fire resistant filler.
- The position of cut mineral felt in an air gap of higher thickness than the thickness of the cut mineral felt must be fixed with adhesive pins.
- If there is an underlay tape prescribed on the wooden posts in the composition, it is necessary to use a minimum board width 200 mm. The underlay tape is fixed to the wooden posts with screws with countersunk head and the screw spacing is max. 300 mm.
- All openings in the peripheral firewall must be sealed with fire packing or in some other way according to the project specifications. Installations inside the partition walls (water distribution lines, electrical wiring, etc.) must be protected against fire with cut mineral felt otherwise the fire resistance of the wall could be reduced.

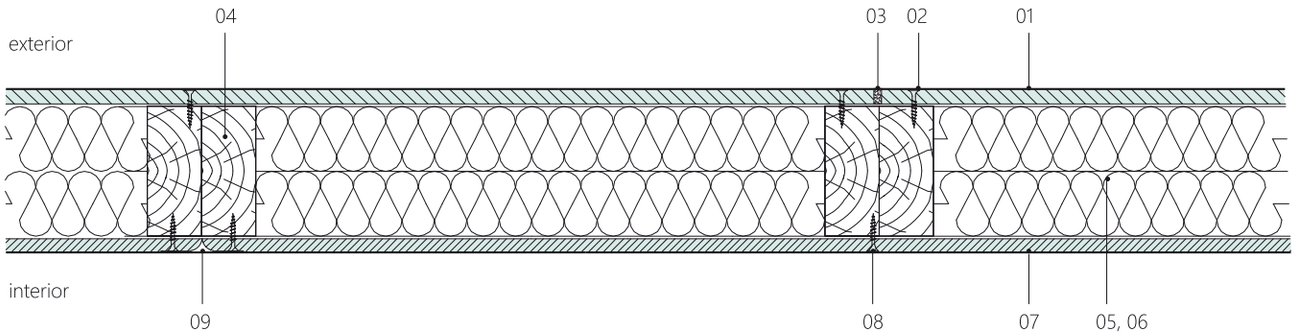
Note: Anchoring of KNAUF Red boards, joint filling and surface finish must be done in compliance with the manufacturer's recommendations.

Vertical cross-section



01 CETRIS® board of thickness 14 mm
02 screw 4.2×35 mm
03 fire resistant filler
04 vertical wooden pillar (axial spacing max. 625 mm)
05 wooden prism
06 cut mineral felt (Orsil Uni) - 2× thickness 60 mm
07 Knauf GKF board - thickness 12.5 mm
08 screw TN 3.5×35 mm
09 gap filler – Knauf Uniflott

Horizontal cross-section



01 CETRIS® board of thickness 14 mm
02 screw 4.2 × 35mm
03 fire resistant filler
04 vertical wooden pillar (axial spacing max. 625 mm)
05 wooden prism
06 mineral wool (Orsil Uni) - 2× thickness 60 mm
07 Knauf GKF board - thickness 12.5 mm
08 screw TN3.5×35mm
09 joint filler – Knauf Uniflott

2.5 Sound Insulation Properties

According to the evaluation of the acoustic properties tests done by Výzkumný ústav pozemních staveb Praha, CETRIS® boards have excellent acoustic properties and are suitable to cladding partitions, walls and ceilings and can also be used as ceiling sound insulation. The CETRIS® cement bonded particleboard have low sound absorption, they are thus a reflexive element. To increase sound absorption, it is necessary to use CETRIS® boards in combination with absorptive material. For use of the boards from the acoustics viewpoint, the following variables were ascertained:

dynamic modulus of elasticity	5 800 MPa
loss coefficient	0,013
propagation speed of the longitudinal waves	2 128 m/s
material constant	22,7
index Rw tl. 8, 10 mm	30 dB
thickness 12, 14mm	31 dB
thickness 16,20 mm	32 dB
thickness 24 mm	33 dB
thickness 32 mm	34 dB
thickness 40 mm	35 dB

Soundproofing of the wall structures with CETRIS® cement bonded particleboard cladding

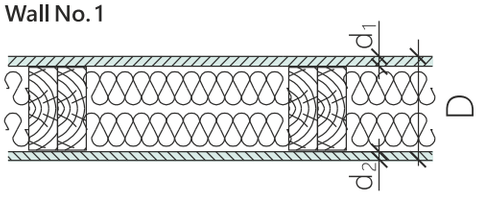
One of the possibilities for reduction of noise transmission from the source to the recipient is effective noise protection. The capability of building construction structures to transmit and weaken airborne noise transmission is provided by acoustics materials (insulation and the like). Airborne sound insulation is a property of the structure to acoustically isolate two neighbouring rooms in terms of airborne sound. Basic rule – the higher the airborne sound insulation the better! The weighted laboratory airborne sound insulation Rw (dB) of selected wall structures with CETRIS® cement bonded particleboard cladding was measured in the laboratory on samples of prescribed size pursuant to EN ISO 140-3 Acoustics - Measurement of sound insulation in buildings and of building elements - Part 3: Laboratory measurement of airborne sound insulation of building elements. For other calculated wall and partition wall compositions, the sound insulation values stated in the table on page 141 (chapter on Application of CETRIS® boards in fire protection, overview of fire walls). Weighted building sound insulation R`w (dB) – measured on a specific building structure on the building construction site. For reason of differences in the measurement conditions (effect of lateral paths) the results on the construction site are always worse than in the laboratory. For building sound insulation R`w (dB), the following relationship applies: R`w = Rw – k (dB) where k is correction dependent on the auxiliary air dispersion paths (normally k = 2-3 dB, for composite structures it is recommended to determine them individually with knowledge of the surroundings and lateral paths).

Orientation compositions – requirements for sound insulation between the rooms in the buildings according to ČSN 73 0532 Acoustics – Protection against noise in buildings and evaluation of acoustic properties of building elements:

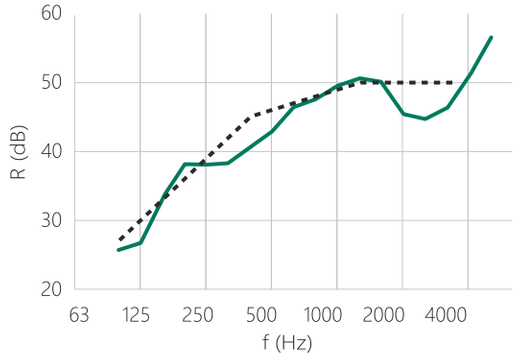
Space	Requirements for sound insulation of partition walls R'_w	Design structure
Residential houses – one living room in a multi-room apartment		
All other rooms of the same apartment unless they are functional parts of the protected space	42 dB	CETRIS®12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Residential houses – appartments		
All the rooms of other appartments	52 dB	CETRIS® 2x12 mm, CW profil 75 + 60 mm mineral wool, CETRIS®2x12 mm
All other areas used (stairways, corridors and the like)	52 dB	CETRIS® 2x12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 2x12 mm
All non-public areas (e.g. attics)	47 dB	CETRIS® 12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Thoroughfares, underpasses	52 dB	CETRIS® 2x12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 2x12 mm
Hotels and accommodation facilities – bedroom space, guest rooms		
Other guest rooms	47 dB	CETRIS® 12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Public areas (corridors, stairways)	47 dB	CETRIS® 12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Hospitals, sanatoria... - hospital bed rooms, physicians' rooms		
Hospital bed rooms, therapy rooms	47 dB	CETRIS®12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Auxiliary and ancillary areas	47 dB	CETRIS® 12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Schools and the like – Teaching space		
Learning areas	47 dB	CETRIS®12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Public areas	42 dB	CETRIS®12 mm, CW profil 75 + 60 mm mineral wool, CETRIS® 12 mm
Noisy spaces (gyms, workshops, canteens)	52 dB	CETRIS®2x12 mm, CW profil 75 + 60 mm mineral wool, CETRIS®2x12 mm
Offices and studies		
Offices and working rooms	37 dB	CETRIS® 12 mm, CW profil 75, CETRIS® 12 mm
Working rooms with higher demands for noise protection	47 dB	CETRIS® 12 mm, CW profil 75 + 60 mm mineral wool, CETRIS®12 mm

Laboratory measurement of airborne sound insulation pursuant to ČSN EN ISO 140-3

Wall No. 1



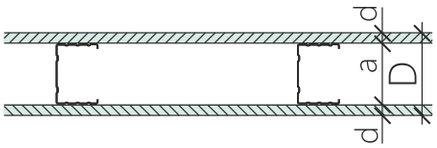
- CETRIS® board, th. 14 mm
- wooden frame, th. 120 mm
- ORSIL Uni 2x60 mm
- KNAUF GKB plasterboard, th. 12.5



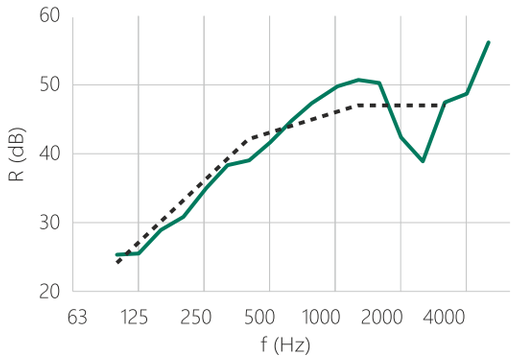
Evaluation pursuant to ČSN EN ISO 717-1
R_w (C;Ctr) = 46 (-2; -6) dB

Frequency Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R 1/3 okt. dB	25,6	26,7	33,2	38,1	38,0	38,2	40,8	42,9	46,5	47,6	49,5	50,6	50,1	45,5	44,7	46,4	51,1	56,6

Wall No. 2



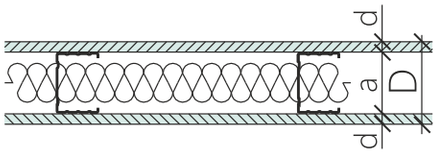
- CETRIS® board of thickness 12 mm
- CW profile 75 mm
- CETRIS® board of thickness 12 mm



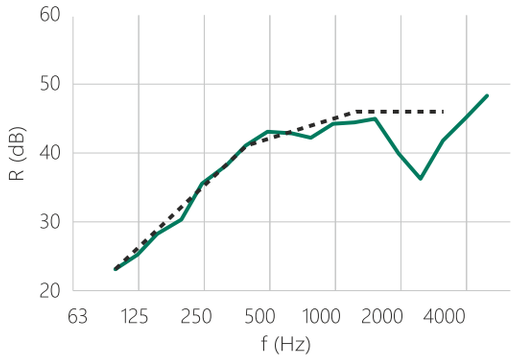
Evaluation pursuant to ČSN EN ISO 717-1
R_w (C;Ctr) = 43 (-2; -5) dB

Frequency Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R 1/3 okt. dB	25,2	25,4	28,8	30,7	34,8	38,3	38,9	41,7	45,0	47,7	49,7	50,7	50,3	42,3	38,7	47,5	48,6	56,2

Wall No. 3



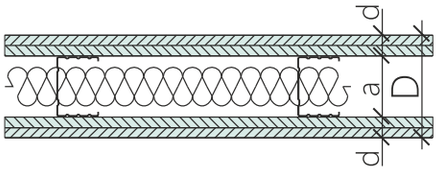
- CETRIS® board of thickness 12 mm
- CW profile 75 mm
- ORSIL Hardsil 60 mm
- CETRIS® board of thickness 12 mm



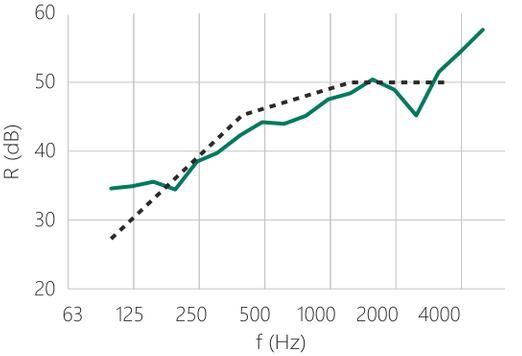
Evaluation pursuant to ČSN EN ISO 717-1
R_w (C;Ctr) = 52 (-2; -5) dB

Frequency Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R 1/3 okt. dB	33,2	35,3	38,5	40,3	45,7	48,0	51,2	53,2	53,0	52,3	54,3	54,5	55,1	50,2	46,2	51,8	55,1	58,4

Wall No. 4



- 2x CETRIS® board of thickness 12 mm
- CW profile 75 mm
- ORSIL Hardsil 60 mm
- 2x CETRIS® board of thickness 12 mm



Evaluation pursuant to ČSN EN ISO 717-1
Rw (C;Ctr) = 56 (-1; -3) dB

Frequency Hz	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R 1/3 okt. dB	44,5	44,8	45,5	44,3	48,4	49,8	52,4	54,2	54,0	55,2	57,5	58,4	60,4	59,0	55,2	61,4	64,4	67,6

Note: Measurement of the boards was done by the Centrum stavebního inženýrství, a. s. Praha, Zlín Branch in October 2006 under the following conditions: Area of test sample 10.3 m^2, volume of broadcasting chamber 90.3 m^3, volume of receiving chamber 70 m^3, temperature 18 – 19 °C, relative humidity 44 – 47 %.

2.6 Vapour Permeability

Diffusion is the ability of molecules of gas, vapour or liquid to permeate the molecules of the porous material. In a case where porous material divides two environments with a difference in the partial pressures of water vapour, diffusion of water vapour occurs. Diffusion occurs in the environment where partial water vapour pressure is higher and in the macro-capillaries with a diameter of d > 10-7 m, because capillary condensation occurs in such capillaries. Diffusion (diffusion resistance factor) is tested according to ČSN EN ISO 12 572 Hygrothermal performance of building materials and products - Determination of water vapour transmission properties. Diffusion is tested on a precisely defined sample, which tightly closes the space of the test cup that contains either the desiccant (Silicagel) or saturated solution (wet cup). The system is placed into a test chamber with a controlled temperature and air humidity. For reason of different partial water vapour pressure between the test cup and the chamber, the water vapour shall flow through the permeable sample. The permeation of the vapour is determined by regular weighing of the system in stable state. The capability of the building materials to release water vapour by diffusion can be expressed by:

- diffusion conductivity coefficient (water vapour diffusion) δ
- diffusion resistance factor μ
- equivalent diffusion thickness s_d. These values include precisely defined relationships.

The diffusion conductivity coefficient (water vapour diffusion) δ (s) is the product of the permeability of water vapours and thickness of the homogeneous sample. The coefficient was determined for the CETRIS® cement bonded particleboard in 1991 (according to ČSN 72 7031, tested th. 12 mm) at 0,00239 * 10^{-9} s, or 8,604 * 10^{-6} $m^{-1}h\text{-}1Pa^{-1}$

More frequently used value is diffusion resistance μ (without dimensions), which is the ratio of the diffusion conductivity factor and the building material. The factor expresses the number of times it is greater than the diffusion resistance of the building material in comparison with the air layer of the same thickness and temperature, it thus applies that the higher the resistance value – the lesser the permeable material (mineral wools reach the value of 1-2, concrete value 17-32, hydro-insulation in tens of thousands). The diffusion resistance factor was set by a test pursuant to ČSN EN ISO 12 572 for CETRIS® boards with this result:

- for thickness 8 mm (thinnest) μ = 52.8
- for thickness 40 mm (thickest) μ = 69.2

The equivalent diffusion thickness s_d (m) – thickness of the equivalent air gap is the thickness of the layer of calm air, which has the same diffusion resistance as the test sample. For the CETRIS® cement bonded particleboard the equivalent diffusion thickness is generally s_d = μ * d, where d is the thickness of the material, i.e.:

- for thickness 8 mm (thinnest) s_d = 52,8 * 0,008 = 0,43 m
- for thickness 40 mm (thickest) s_d = 69,2 * 0,040 = 2,78 m
- for different thicknesses (generally) s_d = μ * d

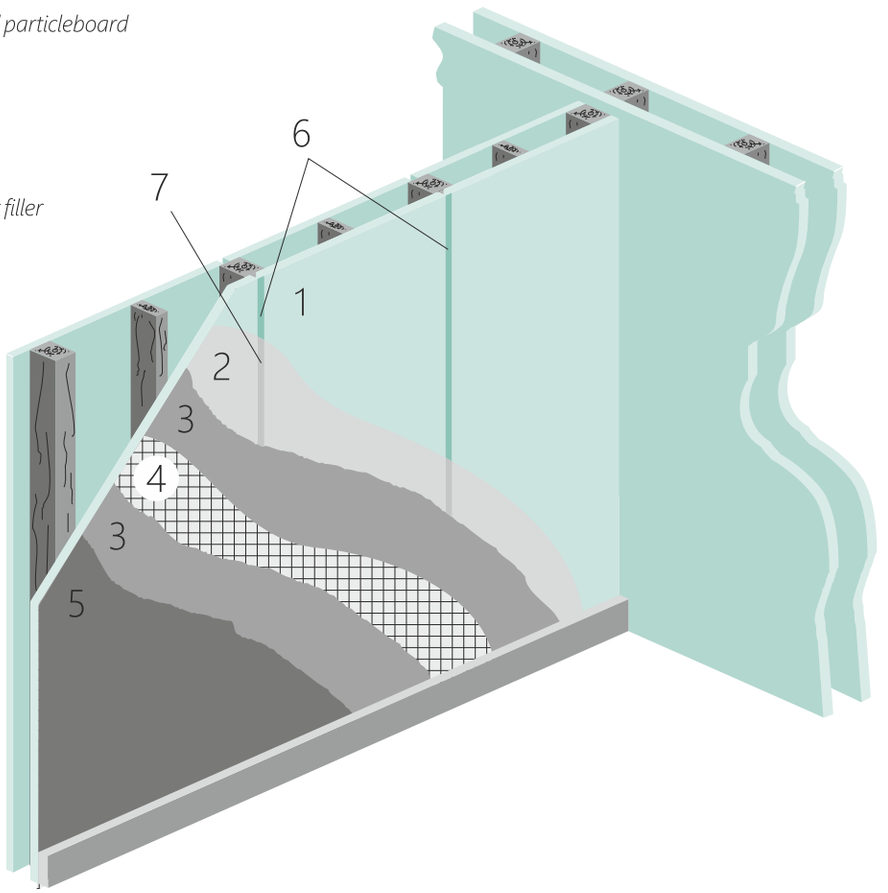
d ... CETRIS® board thickness in m
μ ... interpolated value from the table (for th. 10-38 mm)

d (mm)	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
μ (-)	52,8	53,7	54,6	55,5	56,4	57,3	58,2	59,1	60	60,9	61,8	62,7	63,6	65	66,4	67,8	69,2
s_d (m)	0,43	0,54	0,66	0,78	0,90	1,03	1,16	1,30	1,44	1,58	1,73	1,88	2,04	2,21	2,39	2,58	2,78

5.3 Interior Plasters

Plastering creates surface finish with an invisible joint. The CETRIS® boards must first be primed, the joints must be filled with permanently elastic filler. Subsequently a trowel-on coating is applied on the full surface and the glass-fibre bandaging material is embedded in it. After the smoothing layer, the trowel-on material is re-applied and is followed by the final finish. We recommend use of the complete system of one surface finish manufacturer and observation of the technological procedures of the given manufacturer. The underside of the CETRIS® board must be treated with at least one coating layer (for instance, primer – base coat or coat with higher diffusion resistance) to prevent bending of the board during surface finishing work on the face of the board.

1 *CETRIS® cement bonded particleboard*
2 *primer*
3 *filling compound*
4 *bandage fabric*
5 *plaster*
6 *dilatation joint*
7 *permanently elastic joint filler*



5.4 Exterior Plasters

Application of plasters is surface finishing with an invisible joint. The CETRIS® boards continuously expand and shrink as a result of humidity dilatation movements. To prevent damage of the façade plaster by hair-thin cracks caused by these movements, it is necessary to cover the CETRIS® board with an insulation board (polystyrene, mineral wool) with the minimum thickness of 30 mm. When using a CETRIS® cement bonded particleboard of max. format 1,250 x 1,250 mm, an insulation board thickness of 20 mm suffices. The insulation will create a separation layer to which other layers are applied, like in the case of the contact thermal insulating systems – filling compound, bandage, noble plaster. The CETRIS® boards must be treated with a penetration agent, the joints need not be filled in this case. Polystyrene and mineral wool are glued with cement glue or low-expansion foam to cover the joints between the CETRIS® cement bonded particleboards.

Mechanical anchoring of insulation boards to CETRIS® boards is implemented with disc dowels (self-tapping screw with disc head of high-quality polyethylene). The number of anchoring elements are specified by the manufacturers of the insulation boards, or the manufacturer of the discs shall be minimum 4 pieces/m^2

Recommended products for anchoring the insulation:

- EJOT SBH-T 65/25, screw diameter 4.8 mm, anchoring length 20 – 40 mm. Used in combination with the self-tapping screws EJOT® Climadur-Dabo SW 8 R.
- Subsequently a trowel-on coating is applied on the full surface and the glass-fibre bandaging material is embedded in it. After the smoothing layer, the filling compound is re-applied and is followed by the final finish.

1 CETRIS® cement bonded particleboard
2 primer
3 insulation board
4 filling compound
5 bandage fabric
6 priming
7 plaster
8 dilatation joint