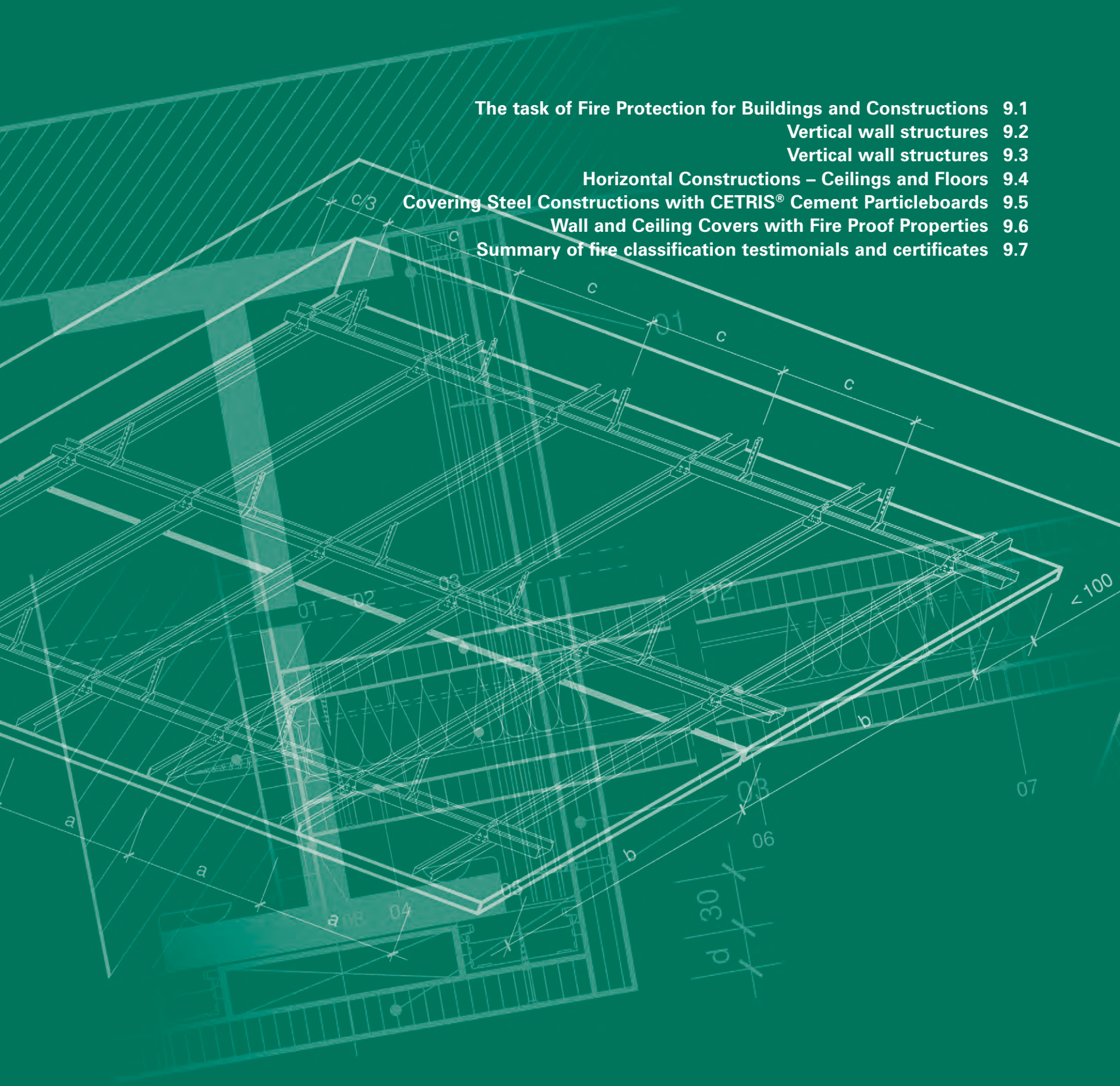
Applications of the CETRIS® Boards for

fire protection

According to European Standards



CETRIS®
CEMENT-BONDED PARTICLEBOARD

9.1 The task of Fire Protection for Buildings and Constructions

The aim of this chapter is to inform the customer about the potential protection benefits for buildings and structures, against the threat of fire by using CETRIS® cement bonded particle-boards. This text is based on the fire resistance test results as per the European standards.

The facts introduced in this chapter represent the results of theoretical and experimental solutions, which have been then used to create the table below. The tables show horizontal and vertical fire dividing constructions as per the applicable ČSN EN standard. The catalogue also features new texts about the horizontal ceiling (floor) constructions and the steel construction linings.

All other construction details that have been introduced were processed by Ing. Bauma CSc. and Ing. Karpaš CSc. They are based on the test records of PAVÚS – Veselí nad Lužnicí and test reports provided by the testing body Fires s.r.o. Batizovce. For links to individual reports please refer to the end of this chapter.

Assembly instructions and examples have been compiled based on tests carried out on individual applications, as stated in the test reports and in accordance with building requirements.

9.1.1 Requirements for a Building Constructions Fire Resistance

The requirements for buildings and in-built products concerning fire resistance are stated in the fire protection codex. These standards are divided into four groups:

- Design standards (building design requirements with regards to fire safety)
- Test standards (defining testing and validating methods of required properties)
- Value standards (fire resistance technical properties for specific constructions and materials)
- Material standards (technical requirements for fire safety devices)

9.1.2 Fire resistance properies of Building materials – Flammability and Fire spread rate

Flammability of Building Materials
The flammability of building materials is rated according to ČSN 73 0862 – "flammability specifications for building materials".
According to this standard, building materials are divided into the following levels:

A ..... Fireproof
B ..... Not easily flammable
C1 ..... Hardly flammable
C2 ..... Medium flammable
C3 ..... Easily flammable

The standard includes two different methods for both non-foam building materials (evaluation index Q), and for materials with a weight drop. According to this standard, the CETRIS® cement bonded particle-board has been classified as level **A – fireproof** (Q < 10 – see Report No. H – 10/Ve - 1991).
This test method was made redundant on the 31st December, 2003. Results that correspond with this standard will become invalid on the 31st December, 2007.

The cement bonded particle-board is also classified in accordance with other national standards:
- DIN 4102 (Zulassung Z-9.1-267) Class B1 – "**schwer entflambar**" (hardly flammable)
- PN-B-02874:1996 (Report No. NP-595/02/JF) – Classified as "**niezapalny**" (fireproof)

Flame Propagation Index
Flame spread is rated according to ČSN 73 0863 – "Flame propagation rating for building material surfaces". The Flame spread index i_s identifies the speed of flames spreading in relation to time under strictly defined test conditions. The flame propagation index i_s for the CETRIS® cement bonded particle-board coated with Denasil paint (Report No. 10474), Bayosan facade plaster (Test report No.Z-7.04-94) and with Rudicolor dispersion plaster (Test report No. Z-7.03-94) – which produced a result of $i_s = 0$.

9.1.3 Building Products and Classification into the Euro Classes According to their Reaction to Fire

EU countries are working extensively towards harmonizing the technical standards for fire safety in buildings. These standards should serve as a basis for the fundamental requirements, and are so called CPD regulations. The aim of this regulation is to harmonize individual national legislation standards for EU countries in order to provide the building industry with products that conform to the following fire safety requirements:

- Maintain loading capacity and stability for a specific time
- Prevent occurrence and the spread of fire and fumes inside the building
- Minimize the spread of fire outside the building
- Facilitate evacuation of people and animals
- Facilitate the safe intervention of fire and rescue teams

The significant component of harmonized European standards is the new classification system for building materials (products) according to their expected fire reaction class, the so called EUROCLASSS, and the new related EN test standards.

The new classification system has obtained the legislative frame of publications in the EU Central Gazette. It was completed and implemented as the EN 13 501-1 standard and accepted in the Czech Republic in 2003. It removes major differences in the national systems of the EU countries, as these present a serious obstacle in international business. Additionally, the building products are evaluated in more detail. According to the new test standards, this system is more similar to the results of large volume testing, i.e. the materials reaction in a real fire.

The test methods for classification purposes, classification criteria, the new EUROCLASSES and their indication are stated in Table № 1.

The Tables represent the classification process for dividing individual building products into the seven classes: a conditioned test sample is subjected to the test methods, which correspond to the specific test standards. The test results are registered in the test reports, the test results are then compared to the appropriate classification criteria and the final results are documented in the EUROCLASS building material classification report.

The classification of building products in accordance to their reaction to fire uses the test results conforming to the following European Standards:

- **EN ISO 1182:2002 "Fireproofing Test"**

This test is used to identify products, which burn very slightly or not at all disregarding their practical use. This test is applied together with the test for the classification of building products into Classes A1, A2, $A1_{fl}$ and $A2_{fl}$ in accordance with EN ISO 1716.

- **EN ISO 1716:2002 "Combustion Heat Determination"**

This test identifies the maximum amount of heat released by a fully burnt product disregarding its practical use. This test is applied together with the test for the classification of building products into Classes A1, A2, $A1_{fl}$ and $A2_{fl}$ in accordance with the EN ISO 1182.

- **EN 13823:2002 "Testing Individual Burning Objects" (furthermore referred to as the SBI)**

This test evaluates the contribution of a product in fire development. The tested product is exposed to a heat source, representing an individual burning object placed in the corner of the room near the tested product. This test is used for the classification into Class A2, B, C and D. The test can also be used for classification of combined compounds of a non-homogenous product into Class A1 under special conditions.

- **EN ISO 11925-2:2002 "Flammability Test by a Small Flame Source" (furthermore referred to as the 'Flammability Test')**

This test determines a products flammability while it is next to a small flame source. This test is used for the classification into Classes B, C a D, E, B_{fl}, C_{fl}, D_{fl} and E_{fl}.

- **EN ISO 9239-1: 2002 "Reaction of Burning Floor Covers Ignited by a Radiant Heat Source" (furthermore referred to as the "Radiant Panel Test")**

This test specifies the critical heat current preventing the flames from spreading further along a horizontal surface. This test is used for the classification into Class $A2_{fl}$, B_{fl}, C_{fl} and D_{fl}.

The fireproof ability and combustion heat represent material properties that are independent on the use of the building product.

Table № 1: The following criteria apply to the building product classification and their reaction to fire

CLASS	TEST METHOD	CLASSIFICATION CRITERIA	ADDITIONAL CLASSIFICATION
A1	EN ISO 1182:2002 (1) and	T ≤ 30°C; and m ≤ 50 %; and t_f = 0 (without steady burning)	
	EN ISO 1716:2002	PCS ≤ 2,0 MJ/kg (1) and PCS ≤ 2,0 MJ/kg (2) and PCS ≤ 1,4 MJ/m² (3) and PCS ≤ 2,0 MJ/kg (4)	
A2	EN ISO 1182:2002 (1) or	T ≤ 50 °C; and m ≤ 50 %; and t_f ≤ 20 s	
	EN ISO 1716:2002 and	PCS ≤ 3,0 MJ/kg (1) and PCS ≤ 4,0 MJ/m² (2) and PCS ≤ 4,0 MJ/m² (3) and PCS ≤ 3,0 MJ/kg (4)	
	EN 13823:2002	FIGRA ≤ 120 W/s; and LSF sample edge; and THR_{600s} ≤ 7,5 MJ	smoke (5) and drops/particles producing flame (6)
B	EN 13823:2002 and	FIGRA ≤ 120 W/s; and LSF sample edge; and THR_{600s} ≤ 7,5 MJ	smoke (5) and drops/particles producing flame (6)
	EN ISO 11925-2:2002 (8) exposure time = 30 s	F_s ≤ 150 mm during 60 s	
C	EN 13823:2002 and	FIGRA ≤ 250 W/s; and LSF sample edge; and THR_{600s} ≤ 15 MJ	smoke (5); and drops/particles producing flame (6)
	EN ISO 11925-2:2002 (8) exposure time = 30 s	F_s ≤ 150 mm during 60 s	
D	EN 13823:2002 and	FIGRA ≤ 750 W/s	smoke (5); and drops/particles producing flame (6)
	EN ISO 11925-2:2002 (8) exposure time = 30 s	F_s ≤ 150 mm during 60 s	
E	EN ISO 11925-2:2002 (8) exposure time = 15 s	F_s ≤ 150 mm during 20 s	drops/components burning by flame(7)
F		**No requirement**	

Remarks to Table № 1:

(1) For homogeneous products and for substantial components of non-homogeneous products
(2) For any external unsubstantial components of non-homogeneous products,
(2a) Alternatively any unsubstantial component having PCS 2 MJ/m² provided that the product conforms to the criteria EN 13 823: FIGRA 20 W/s, LFS sample edge and THR_{600s} 4 MJ and s1 and d0,
(3) For any internal unsubstantial components of non-homogeneous products,
(4) For the product as a whole,
(5) s1 = SMOGRA 30 m²/s² and TSP_{600s} 50 m², s2 = SMOGRA 180 m²/s² and TSP_{600s} 200 m², s3 = not s1 nor s2,
(6) d0 = non burning drops/particles during 600 s (EN 13823), d1 = drops/components do not burn longer than 10 s during 600 s of the test (EN 13 823), d2 = not d0 nor d1. Classification d2 identifies paper ignition (EN ISO 11 925-2),
(7) Pass = no paper ignition (not classified), fail = paper ignition (classification d2),
(8) Provided that the flame spreads on the surface. If applicable, the effect on the edge regarding the final use.

The results of the flammability test, SBI test and radiant panel test depend upon the operational conditions of the products. Some application conditions include:

- Product position
- Position of the product related to neighbouring products (ground layers, connecting elements etc.)

The following positions of the product are considered typical:

- Vertical, head side into open space (position of wall/facade)
- Vertical, head side into a cavity
- Horizontal, exposed side down (position of ceiling)
- Horizontal, exposed side up (position of floor)
- Horizontal, inside a cavity

For the purposes of classification, every product except floor covers must be tested in a vertical position. The floor covers must be tested with the exposed side up - according to EN ISO 9239-1, and down - according to EN ISO 11925-2.

Examples of typical product positions related to other products are as follows:

- Free standing: without any other product placed directly in front of or next to the tested product. In this case the product is tested standing freely while suitably fixed
- On a base: glued, mechanically fixed or only touching. In this case the product is tested with the base and fixture typical for its normal use
- When a cavity is between the product and the base. It must be tested in this position.

To classify the CETRIS® cement board reaction to fire, the following test standards have been applied:

- ČSN EN ISO 1182:2002 "Flammability Test"
- ČSN EN ISO 1716:2002 "Combustion Heat Identification"
- EN 13823:2002 "Single Burning Item Test" (SBI)
- EN ISO 11925-2:2002 "Ignition Test by a Small Flame Source" (Ignition Test)

The aforementioned tests carried out by the IBS – "Institut für Brandschutztechnik" und Sicherheitsforschung in Linz (Austria) have identified the CETRIS® board as class **A2**. Additional classification regarding smoke **s1**, burning drops (particles) **d0**, which leads to a resulting classification of **A2-** $_{s1,d0}$. This result applies to the classification of fire reaction excluding floor covers.

Using the classification results is subject to the following rules. Applying the classification results is based on the test types depending on the product application. Different applications may cause the product to be placed in a different class. For using standard bases and fixtures, including their effect on the classification please refer to the previous chapters.

Relating the classification to products of similar composition but different thickness and density values is stated in the European product standards. Generally, if two products of different thickness and density are classified, then all products of a thickness/density between these two values are evaluated as the lower alternative.

9.1.4 Building Construction Fire Resistance

Fire resistance is a specific and definitive property for building constructions. It is expressed in time (minutes) that constructions are able to withstand the effects of the so called "Standard fire" i.e. a fire burning under exact and defined conditions. As these parameters are specific for different types of constructions and depend on the loading of the construction as well, there is a multitude of test methods and standards to evaluate these properties.

Fire resistance is determined based on either: tests or calculations, extrapolation and comparison with the test standards and instructions.

Fire resistance classification is either based on tests including conditions of direct application, or using extensive application methods (calculations, extrapolation, etc.) carried out by an authorized person issuing a Fire Classification Certificate.

From the year 2000, European Standards have been implemented into the ČSN System of Standards. Any contradicting Czech Standards are being eliminated accordingly. The test results according to the eliminated ČSN standards (ČSN 73 0851-7) remain valid for 4 years, the validity period ended, in most cases on the 30th June, 2004, though later for some standards.

Table № 3: The following test standards and instructions apply to fire resistance tests

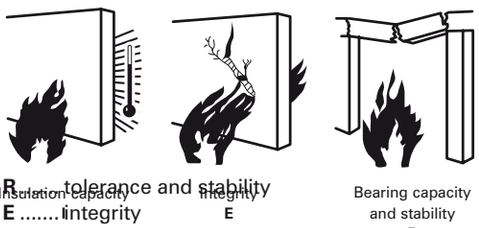
CONSTRUCTION TYPE	INITIAL CZECH TEST STANDARD	IMPLEMENTED/PREPARED EUROPEAN TEST STANDARD
Non-bearing walls: separating and outer walls	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, EN 1363-2, EN 1364-1
Non-bearing walls: hinge construction systems: – general layout – partial layout	ČSN 73 0855	EN 1363-1, prEN 1364-3, EN 1363-1, prEN 1364-4
Non-bearing walls – facade and hinge construction systems		EN 1363-1, EN 1363-2, EN 1364-5
Non-bearing walls – outer wall systems		EN 1363-1, EN 1363-2, EN 1364-6
Ceilings	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, EN 1364-2
Bearing walls: interior and outer walls	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, EN 1363-2, EN 1365-1
Ceilings and roofs	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, EN 1365-2
Girders	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, EN 1365-3
Columns	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, EN 1365-4
Balconies	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, prEN 1365-5
Staircases	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, prEN 1365-6
Air conditioning pipelines	ČSN 73 0857	EN 1363-1, EN 1366-1
Fire dampers	ZP 5/1994	EN 1363-1, EN 1366-2
Sealing of outlets	ZP 4/1992 ZP 7/1995	EN 1363-1, prEN 1366-3
Sealing of gaps	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, prEN 1366-4
Operational shafts and pipelines	ČSN 73 0857/ČSN EN 1366-1	EN 1363-1, prEN 1366-5
Raised floors and suspended floors (double floors)	ČSN 73 0851 (ZP 14/2000)	EN 1363-1, prEN 1366-6
Stops for conveyer and track systems	ČSN 73 0852 (ZP 15/2000)	EN 1363-1, prEN 1366-7
Smoke exhaust pipelines	ČSN 73 0857/ČSN EN 1366-1	EN 1363-1, prEN 1366-8
Smoke exhaust pipelines from separated area	ČSN 73 0857/ČSN EN 1366-1	pr EN 1366-9
Smoke dampers	ZP 10/1998 (in part)	pr EN 1366-10
Protective systems for operational installations		pr EN 1366-11
Fireproof doors and closures	ČSN 73 0852 (ZP 15/2000)	EN 1363-1, EN 1634-1
Fireproof door equipment		EN 1634-2
Smoke-tight doors and closures	ZP 1/1991 (partially)	EN 1363-1, EN 1634-3
Roof reaction when exposed to external fire	ZP 2/1991 (partially)	ENV 1187
Additional fire protective equipment of construction components		
Protective vertical layer	ČSN 73 0851 (ZP 14/2000)	ČSN 1363-1, ENV 13381-2
Protective horizontal layer	ČSN 73 0856	ČSN 1363-1, ENV 13381-1
Concrete components	ZP 12/1999	ČSN 1363-1, ENV 13381-3
Steel components	ČSN 73 0851 (ZP 14/2000)	ČSN 1363-1, ČSN P ENV 13381-4
Composite concrete comp. concrete/profiled steel sheet metal	ČSN 73 0851 (ZP 14/2000)	ČSN 1363-1, ENV 13381-5
Steel columns filled with concrete	ČSN 73 0851 (ZP 14/2000)	ČSN 1363-1, ENV 13381-6
Wooden elements	ZP 9/1997	ČSN 1363-1, ENV 13381-7

The temporary provisions implemented in the EN include as an addition:

- EN for fire resistance testing does not consider the classification of the constructions. Until relevant classification standards are issued (EN 13 501-2 – will probably be issued in the 1st or the 2nd quarter of 2004) the Fire Classification Certificate will be issued by the authorized persons.
- If the area of direct application does not cover the practical use and construction requirements regarding the dimensions or the completed product, the test cannot be carried out, these constructions can be evaluated according to the principle of the extensive test results application

ČSN 73 0810 standard for "Fire Safety of Buildings – building construction fire resistance requirements" have been used to evaluate the construction fire results.

The fire resistance is expressed in minutes according to the following scale: 15, 30, 45, 60, 90, 120 and 180 minutes. The values of fire resistance of individual limit values are as follows:



R ..... tolerance and stability
E ..... integrity
I ..... insulating ability– threshold temperature on an unheated surface
W ..... density limit of heat flow from the unheated side
S ..... penetration of fumes
(…and many more, though used less frequently)

Each construction has a defined limit value corresponding to the relevant standard. These values form a basis for classification of suitable constructions, for example:

- a construction conforming the requirements of the three basic limit values, i.e. stability (R), integrity (E) and insulating ability (I) shows fire resistance **REI**. In most cases, the requirements for fire bearing separating constructions are concerned, i.e. walls and ceilings.
- fire resistance requirements of non-bearing fire separating constructions (interior separating walls, ceilings) are defined by only 2 limit values, i.e. by integrity (E) and insulating ability (I), Represented by: **EI**
- load bearing bar elements (girders and columns) are required to only show tolerability and stability - **R**
- the fire closures, where integrity (E) and insulating ability (I) are demanded, which were formerly identified as PB closures, are identified as EI closures according to the ČSN 730810 standard, the closures, formerly identified as PO, where integrity (E) and limit density of heat flow (radiation – W) is demanded, are identified as **EW** type closures.

9.1.5 Classification of Fire Divisions based on Fire Resistance and Flammability

Czech standards ČSN 73 0802:2000 Fire safety of buildings, Non production halls or ČSN 73 0804:2002 Fire safety of buildings – Production halls are used for classification of construction parts, with the following specification:

A) D1 type structures do not increase the intensity of fire during the required period of fire resistance, these structures may contain:

- non-flammable materials only
- Flammable materials applied so that the structure stability and bearing capacity does not depend on them. Flammable materials are fully protected against fire by non-flammable materials ensuring that they will not ignite and produce heat during the required period of fire resistance.

B) D2 type structures do not increase the intensity of fire during the required period of fire resistance. These structures also contain flammable materials so that the structure stability and bearing capacity depends on them. The flammable materials are fully protected against fire by non-flammable or hardly flammable materials ensuring they will not ignite and produce heat during the required period of fire resistance.

C) D3 type Structures – increase the intensity of fire during the required period of fire resistance.

9.1.6 Document List for the Application of CETRIS® – Boards in Fire Protection

The data provided in this publication has resulted from a series of tests and expert reports, from which the individual performance of structures have been established. As they are mainly complex works or partial tests of individual material properties, not aimed at evaluating the given structure only but concentrating on the properties of CETRIS® – boards as whole instead, they could not be added to the individual sheets of applications. All the references are given here in chronological order.

1 Classification report, PK-04-035.
2 Determination of heat conductivity index according to EN 12 667.
3 Coefficient of thermal expansion for CETRIS®-boards, certificate No. 91-027, SZ 227, VÚPS Praha.
4 Test protocol no. H-10/Ve-1991 flammability level determination, issued by PAVUS Praha 1991.
5 Protocol no. 1074 – Flame propagation determination for CETRIS® - board with DENASIL paint
6 Test record No. Z-7.03-94 – Flame propagation index determination for CETRIS® - board with dispersive plaster RUDICOLOR.
7 Test record No. Z-7.04-94 – Flame propagation index determination for CETRIS® - board with facade plaster BAYOSAN.
8 Zulassung Nr: Z-9.1-267.
9 Klasyfikacja ogniowa Nr: NP-595/02/JF.
10 Proposed extent of fire resistance tests according to EN 1363-1 and corresponding standards for application of CETRIS® - boards in fire fighting measures (prepared by PAVUS Praha a.s. ing. Karpaš CSc., Sept. 2002).
11 Fire resistance test Protocol no. Pr-02-02.089, issued on 22nd Nov, 2002 – Non bearing internal fire division, thickness 82 mm, covered by CETRIS® - board thickness of 16 mm, without filling (with air gap) – carried out by PAVUS Veselí nad Lužnicí.
12 Fire resistance classification certificate no. PKO-02.1.063, issued on 22nd Nov, 2002. Non bearing internal fire division, thickness 82 mm, covered by CETRIS® boards, of thickness 16 mm, without filling (with air gap) – carried out by PAVUS Veselí nad Lužnicí.
13 Fire resistance test Protocol no. Pr-02-02.090, issued on 22nd Nov, 2002 – Non bearing internal fire division with a thickness of 234 mm, covered by CETRIS® - boards of thickness 18+12+12 mm with filling from rockwool (heat load from the

side of the internal cavity) – carried out by PAVUS Veselí nad Lužnicí.

14 Fire resistance test Protocol No. PKO-02.1.064, issued on 22nd Nov, 2002 - Non bearing internal fire division of thickness 234 mm, covered by CETRIS® - boards of thickness 18+12+12 mm with filling from rockwool (heat load from the side of the internal cavity) – carried out by PAVUS Veselí nad Lužnicí.

15 Fire resistance test Protocol No. Pr-03-02.066, issued on 27th June, 2003 – Fire divisions for wooden structures, a non symmetric cover (outer side CETRIS® thickness 14 mm, internal side Knauf thickness 12,5 mm) – carried out by PAVUS Veselí nad Lužnicí.

16 Fire resistance test Protocol No. Pr-03-02.088, issued on 12th Sept, 2003 – Hinged fire proof lower ceiling covered by 1 × CETRIS® thickness 12 mm (heat load from below) – carried out by PAVUS Veselí nad Lužnicí.

17 Fire resistance test Protocol no. Pr-03-02.089, issued on 12th Sept, 2003 – Hinged fire proof ceiling covered by 2 × CETRIS® thickness 12 mm (heat load from below) – carried out by PAVUS Veselí nad Lužnicí.

18 Fire resistance test Protocol no. Pr-03-02.091, issued on 27th Sept, 2003 – Front shaft wall on steel frame, from one side covered by CETRIS® - boards of thickness 2 × 12 mm – carried out by PAVUS Veselí nad Lužnicí.

19 Fire resistance classification certificate no. PKO-03-047/PAVUS for the product Wall structures, covered with CETRIS® boards - carried out by ing. Bauma CSc. and ing. Karpaš CSc. PAVUS Praha, November 2003.

20 Fire resistance classification certificate no. PKO-03-048/PAVUS for product: Ceiling structures covered with CETRIS® - boards - carried out by ing. Bauma CSc. and ing. Karpaš CSc. PAVUS Praha, November 2003.

21 Dimension determination for all ceiling structures with CETRIS® - boards from fire resistance point of view (Extended application of tests results), carried out by ing. Bauma CSc. and ing. Karpaš CSc. PAVUS Praha, November 2003.

22 Stress determination in steel profiles of bearing columns - static calculation of front wall (ing. Ředina, November 2003).

23 Static calculation – Lower ceiling structures from CETRIS® - boards on steel and wooden grid (ing. Ředina, March 2003).

24 Ing. Pavel Vaniš CSc.: Classification of building products according to European standards for determination of reaction to fire (Stavební listy 06/2002).

25 Pplk. Ing. Otto Dvořák Ph.Dr.: Classification of building products according to fire reaction (Hoří 1/2003).

Basic documentation supplied by ORSIL (Isover), SIMEK SYSTEM, Knauf, Tora Spytihnûv, Sika, Den Braven, Nobasil, Terranova, Rigips and further additional documents.

9.2 Vertical wall structures

9.2.1. Scope

According to the references mentioned above, the CETRIS® - boards can be applied in the following types of fire proofing vertical wall structures:

- Non bearing walls and partitions up to a height of 6 meters and with a fire resistance up to 180 minutes, with/out mineral filling (with air gap).
- Additional wall cover or additional front walls, increasing the fire resistance of the existing structure. Provided that the structure has a fire resistance of 30 minutes (EI) as a minimum before being covered.
- shaft wall or additional independent wall – wall structure covered (sheathed) from one side
- Outer wall on wooden frame – as a bearing wall with a maximum height of 3 meters, as a non bearing wall (dividing) with a maximum height of 4 meters.

Taking the protocols into account, it is necessary to observe the assembly technology and all assembly (installation) methods used to prepare the samples and tests. This leads to the proposed connecting elements, their distances and location on the structure as well as other details being obligatory, they should be observed to enable referencing for the construction. Additionally, there are recommended versions of solutions for the application and for the elements unable to be tested due to the current methodology or to the furnaces capacity. These solutions have been evaluated and validated by experts of the PAVUS Praha Company.

Warning: All data is valid for the conditions and for the loading of wall structures during a fire, according to the applicable standards: EN 1363-1, EN 1364-1, EN 1365-1.

Selected samples of structures with various wall compositions have been tested by a state accredited test laboratory at PAVÚS – Veselí n. L. Based on the results of these tests, the test laboratory issued the Fire resistance protocols no. Pr-02-02.089, no. Pr-02-02.090, no. Pr-03-02.066, no. Pr-03-02.091. These reports, together with further tests from previous years, served as a reference for PAVUS a.s. Praha (ing. Karpaš CSc., ing. Bauma CSc.) to create extended applications and the necessary dimensional tables stating general application of the findings used to create the final expert report.

Warning: The results of fire resistance tests and the resulting tables may be used to determine the fire protection properties of the structures and their resistance during a fire. This forms the reason to present the axial distances and CW profiles having passed the test. The distances should be considered as minimum limit values. Attention must be paid to measuring fire divisions, it is always necessary to evaluate the static structure requirements according to the real load.

Fire division Installations can only be performed by trained personnel – see Chapter 9.4 Training for installation companies for the applications of CETRIS® - cement bonded particle-boards.

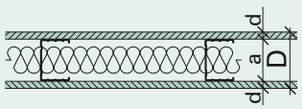
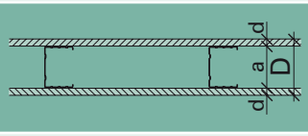
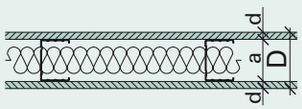
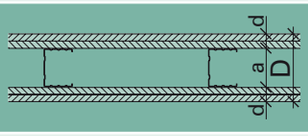
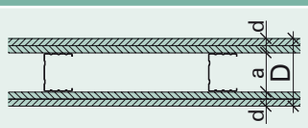
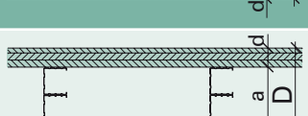
Description of the structure

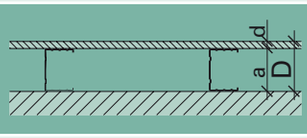
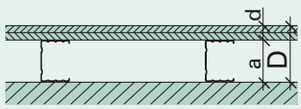
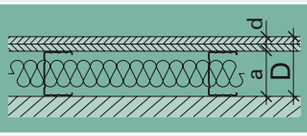
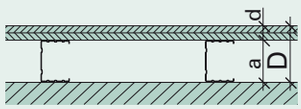
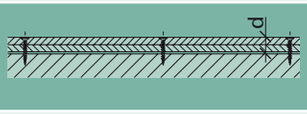
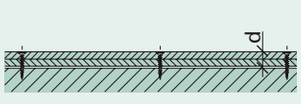
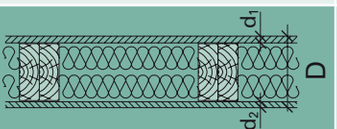
Vertical Fire dividers – walls and partitions – covered with CETRIS® - cement bonded particle-boards can be designed with regards to the fire resistance test results and extended result applications. The design is based on theoretical calculations using several basic alternatives and different fire resistance values, as shown in the following table: see table 4.

Applications of the CETRIS® Boards for fire protection

According to European Standards

Table no. 4 – Overview of Wall Structures

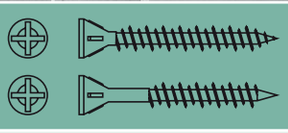
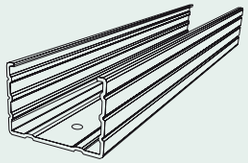
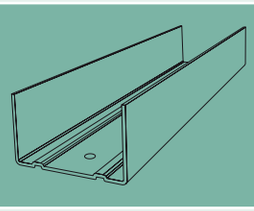
TYPE	CONSTRUCTION DIAGRAM	CONSTRUCTION DIMENSIONS (mm)			WEIGHT	MAX. WALL HEIGHT	ROCKWOOL [1]		FIRE RESIS-TANCE	HEAT RESIS-TANCE	DESCRIPTION
		a (mm) (CW profile)	d (mm)	D (mm) (wall thickness)	(kg/m²)	(m)	Volume weight (kg/m³)	Insulation thickness (mm)		(m²K/W)	
Non-bearing division on steel construction		75	12	99	38.10	3.60	75	60	EI 45 D1	1.61 [2]	Page 126
		100		124		4.40					
		2×75		174		6.00					
		75	16	107	44.80	4.00	-	-	EI 30 D1	0.15 [2]	
		75	16	107	49.30	3.60	75	60	EI 60 D1	1.65 [2]	
		100		132		4.80					
		2×75		182		6.00					
		75	10+10	107	56.00	4.00	-	-	EI 54 D1	0.19 [2]	
		100		132		5.00	-	-	EI 30 D1 [9]		
		2×75		182		6.00					
		75	12+12	123	67.20	4.00	-	-	EI 60 D1	0.23 [2]	
		100		148		5.00	-	-	EI 45 D1 [9]		
		2×75		198		6.00					
		75	12+12	123	71.70	4.00	75	60	EI 90 D1	1.73 [2]	
		100		148		5.00					
		2×75		198		6.00					
		75	16+18	143	95.20	4.00	-	-	EI 90 D1	0.32 [2]	
		100		168		4.90			EI 60 D1 [7]		
		2×75		217		6.00					
		75	16+16	139	94.10	4.00	75	60	EI 120 D1	1.80 [2]	
		100		164		5.00					
		2×75		214		6.00					
		2×75	18+12+12	234	117.60	4.00	-	-	EI 120 D1	0.40 [2]	
						6.00	-	-	EI 90 D1 [9]		
		2×75	18+12+12	234	122.10	4.00	75	60	EI 180 D1	1.90 [2]	

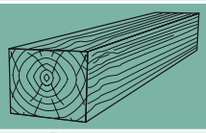
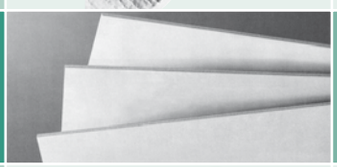
TYPE	CONSTRUCTION DIAGRAM	CONSTRUCTION DIMENSIONS (mm)			WEIGHT	MAX. WALL HEIGHT	ROCKWOOL [1]		FIRE RESIS-TANCE	HEAT RESIS-TANCE	DESCRIPTION
		a (mm) (CW profile)	d (mm)	D (mm) (wall thickness)	(kg/m²)	(m)	Volume weight (kg/m³)	Insulation thickness (mm)		(m²K/W)	
Shaft wall		75	12+12	99	33.60	4.00	-	-	EI 30 D1 [3]	0.11 [2]	Page 127
Preassembled wall on steel construction		75	10	85	14.00	4.00	-	-	Ei (x) [4] +15	0.05 [2]	
		75	18	93	25.20	4.00	-	-	Ei (x) [4] +30	0.09 [2]	
		75	12+12	99	33.60	4.00	-	-	Ei (x) [4] +45	0.11 [2]	Page 131
		75	16+16	107	44.80	4.00	-	-	Ei (x) [4] +60	0.15 [2]	
		75	18+18	111	54.15	4.00	75	50	Ei (x) [4] +90	1.67 [2]	
		75	12+12	99	33.60	4.00	-	-	Ei 30 D1 [5]	0.11 [2]	
Direct facing of walls using CETRIS® boards			12	-	16.80	4.00	-	-	Ei (x) [4] +15	0.06 [2]	Page 131
			10+10	-	28.00	4.00	-	-	Ei (x) [4] +30	0.10 [2]	
			14+14	-	39.20	4.00	-	-	Ei (x) [4] +45	0.13 [2]	
			18+18	-	50.40	4.00	-	-	Ei (x) [4] +60	0.17 [2]	
Peripheral supporting wall	 Outdoor cladding CETRIS® BASIC. Indoor cladding Knauf GKF	Wooden post 100 × 120 mm (axially max. 625 mm)	d_1 = 14 CETRIS® BASIC d_2 = 12.5 Knauf GKF	146.5	58.10	3.00 (4.00) [8]	40	120	REI 60 D3 [6] REW 60 D3 [7]	3.11 [3]	Page 134

Notes to table 4:

1) Rockwool slab of specific thickness and volume weight, flammability class max. B (hardly flammable) as per ČSN 73 0862 (fire reaction class A2 as per ČSN EN 13501-1).
2) Heat resistance value for indication only
3) Fire resistance value for fire load of the side covered with CETRIS® (full coverage) as well as on the profile covered side (cavity)
4) EI (x) is initial fire resistance value of a wall with additional fire protection (minimum 30 minutes).
5) Fire resistance for such a construction is not required
6) Fire resistance value for external fire load (fire outside)
7) Fire resistance value for internal fire load (fire inside) – as a fire closure
8) If not loaded, wall height of a wooden construction may be increased up to 4.0 m,
9) For wall height exceeding 4.0 m

Applications of the CETRIS® Boards for
fire protection
According to European Standards

DESCRIPTION MARKING	PICTURE (DIAGRAM)	REMARK	WALL STRUCTURE TYPE			
			DIVIDERS	ADD. FRONT WALLS	BEARING WALLS	SHAFT WALLS
CETRIS® BASIC - board Cement bonded particleboard, smooth surface, cement gray. Basic format 1,250×3,350 mm, Volume weight 1,320 ±70 kgm^{-3}		Thickness according to desired fire resistance.	X	X	X	X
Screw 4.2×25, 35, 45, 55 mm Self-tapping screws with flush head.		Screw type according to thickness and bearing of structure type.	X	X	X	X
CW profile 75, 100 (vertical) Zinc coated metal sheet profile. 75×50×0.6 mm 100×50×0.6 mm		Dimensions according to requirements to fire resistance and wall height. Alternatively Steel profiles can be used.	X	X	-	X
UW profile 75, 100 (horizontal) Zinc coated metal sheet profile. 75×40×0.6 mm 100×40×0.6 mm			X	X	-	X
Steel wall plugs For anchoring of profiles to the walling (concrete).		Dimensions (Diam. + length) acc. to structure weight, type of base and anchored material.	X	X	X	X
DEXAFLAMM-R cement White thyrotrophic material for filling of joints and screw head coverings.		Alternatively single component fire proof elastic cements can be used (acrylic, silicon) (Sika Firesil, Den Braven Pyrocryl).	X	X	X	X

DESCRIPTION MARKING	PICTURE (DIAGRAM)	REMARK	WALL STRUCTURE TYPE			
			DIVIDERS	ADD. FRONT WALLS	BEARING WALLS	SHAFT WALLS
ORSIL (ISOVER) Rockwool, thickness 60 mm. Volume weight 75 kgm^{-3}		Alternatively, use rockwool with the same volume weight, of a max. flammability level B acc. ČSN 73 0862, with a fire reaction class to A2 (acc. EN 13501).	X	X	-	-
ORSIL (ISOVER) type UNI Rockwool, thickness 60 mm. Volume weight 40 kgm^{-3}			-	-	X	-
Glued on spikes Glued on spikes.		Used to stabilize the position of insulation boards in the framework.	X	X	X	-
Wooden column Pine sawn wood of class min. SII, max. humidity 18%, dimensions 120×100 mm.		Alternatively an improved wood can be used – glue of class 000 as minimum.	-	X	-	-
SIBRAL paper Mats from aluminium silicon fibres, thickness 13 mm.		Used under profiles, splitting heat bridges, as insulation for temperatures up to 1,260 °C.	X	X	X	X
KNAUF GKF board Plasterboard - type KNAUF, thickness 12.5 mm. Basic format 1,250×2,000 (2,500) mm.		Processing, anchoring, sealing, surface treatment of board according to instructions by the company KNAUF Praha spol. s r.o.	-	-	X	-
KNAUF Uniflott Plasterboard joint sealing.		**Must not be used for joint filling with CETRIS® boards!**	-	-	X	-
TN 35 screw Screw (3.5×35 mm) for anchoring plasterboards.		**Must not be used for anchoring CETRIS® boards!**	-	-	X	-

9.2.2 Fire Divisions and Shaft Walls on a Steel Frame

9.2.2.1 Bearing Structure

The bearing frame is made of a zinc coated steel CW profiles (vertical columns) and UW profiles (horizontal profiles). To determine the dimensions of a CW profile, the height and total wall thickness must be taken in account, where the ratio between wall height hs and wall thickness d should always be less than 40. The ratio $\mathbf{h_s/d} > 40$ represent a thickness **L/i** of approx. 140. The recommended profile sizes with regards to the structure height are given in table № 4.

The outer profiles are anchored to the frame via steel wall plugs spaced every 625 mm, the joint between the profiles and the wall is filled with DEXAFLAMM-R mastic. axial distances of the internal profiles should not exceed 625 mm.

9.2.2.2 Composition of the Structure

The structure is symmetrically or asymmetrically covered from one or from both sides, with one or more layers of CETRIS®-cement bonded particle-boards. The thickness and quantity of CETRIS®-cement bonded particle-boards, and the use of rockwool are decisive elements which determine the fire resistance value (see dimension tables for the given types of structures). The horizontal off-set of the boards is a minimum of 400 mm. In case multiple layers of wall cover panels are used, the joints are cross-bonded – along a whole profile vertically (625 mm), by a minimum overlap of 400 mm horizontally.

CETRIS®-cement bonded particle-boards on sheet profiles are fixed using self-tapping flush screws, the screw dimensions are 4.2 × 25 or 35, 45, 55 mm. The screw length should be at least 10 mm longer than the thickness of the fastened board (minimum 10 mm longer than the total thickness of all anchored layers in case of a multi-layer cover). Joints of a minimum width of 5 mm should be left between the boards. The joints, outer walls and screw heads should be filled with DEXAFLAMM-R mastic.

Table № 6 – Wall Dimensions with a height of up to 4 m
(Steel frame from CW profiles, covered on both sides with one or more layers of CETRIS® boards, with/without thermal insulation based on rockwool)

FIRE RESISTANCE [1]	THICKNESS OF DOUBLE SIDED COVER OF CETRIS® BOARDS (mm)					
	With air gap [2]			With rockwool [3]		
	Cover	Gap	Cover	Cover	Insulation	Cover
EI 30 D1	16	-	16	not used		
EI 45 D1	10 + 10	-	10 + 10	12	60	12
EI 60 D1	12 + 12	-	12 + 12	16	60	16
EI 90 D1	18 + 16	-	18 + 16	12 + 12	60	12 + 12
EI 120 D1	18 + 12 + 12	-	18 + 12 + 12	16 + 16	60	16 + 16
EI 180 D1	to be considered			18 + 12 + 12	60	18 + 12 + 12

Remarks to table № 6:
1) Classification of limit stages for Fire resistance according to ČSN 73 0810, the structures tested according to EN 1364-1
2) Air gap min. 50 mm
3) Rockwool insulation of Orsil (Isover) type or another type of mineral fibreboard with a minimum volume weight 75 kgm^{-3}, flammability level max. B (not easily flammable) according to ČSN 73 0862 (the fire reaction class A2 according to EN 13501-1 is assumed)

Table № 7 – Dimensions of Dividers with a height between 4 and 6 m
(Steel frame from CW profiles, covered on both sides with one or more layers of CETRIS® boards, with/without thermal insulation based on rockwool)

FIRE RESISTANCE [1]	THICKNESS OF DOUBLE SIDED COVER FROM CETRIS® BOARDS (mm)					
	With air gap [2] and additional modification [4]			With rockwool [3]		
	Cover	Gap	Cover	Cover	Insulation	Cover
EI 30 D1	10 + 10	-	10 + 10	not used		
EI 45 D1	12 + 12	-	12 + 12	12	60	12
EI 60 D1	18 + 16	-	18 + 16	16	60	16
EI 90 D1	18 + 12 + 12	-	18 + 12 + 12	12 + 12	60	12 + 12
EI 120 D1	to be considered			16 + 16	60	16 + 16

Remarks to table № 7:
1) Classification of limit stages for Fire resistance according to ČSN 73 0810, the structures tested according to EN 1364-1
2) Air gap a min of 75 mm
3) Mineral insulation of Orsil (Isover) type or another type of mineral fibreboard with a minimum volume weight of 75 kgm^{-3}, flammability level max. B (not easily flammable) acc. ČSN 73 0862 (the fire reaction class A2 according to EN 13501-1 is assumed). If the insulation does not fill the whole gap, the insulation requires additional fixing – for instance use glue on spikes.
4) Constructions with a larger weight should be taken into account when considering dividers with a height 4 – 6 m due to the stress increase in the steel cross section, which causes a decrease in the critical temperature of steel. As higher dividers require a better protection of the steel frame when they are not filled with rockwool, it is necessary to fill the places where the boards meet the steel CW profiles with a CETRIS® belt strip with a minimum thickness of 12 mm in a way that overlaps the CW profile width by at least 60 mm on both sides.

Remark: At a wall height over 6 m, it is necessary to provide an individual evaluation of fire resistance according to the determined conditions.

Table № 8 – Shaft or additional front Wall dimensions
(steel frame from CW profiles, covered on one side with two layers of CETRIS® boards, without thermal insulation)

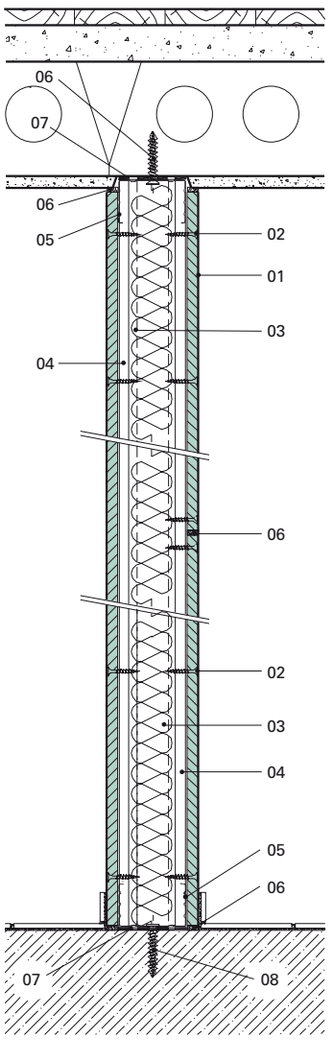
FIRE RESISTANCE [1]	THICKNESS OF A SINGLE COVER LAYER OF CETRIS® BOARD (mm)	FIRE LOAD
EI 30 D1	12 + 12	From side of CETRIS® boards (full cover)
		From side of profiles (cavity)

Remarks to table № 8:
1) Classification of limit stages to fire resistance according to ČSN 73 0810, the structures tested according to EN 1364-1

Remark: The structure can also be used as an additional front wall – to increase the fire resistance of the existing wall structure, whereas fire resistance of the existing structure is not required. The maximum height of such structure is 4.0 m.

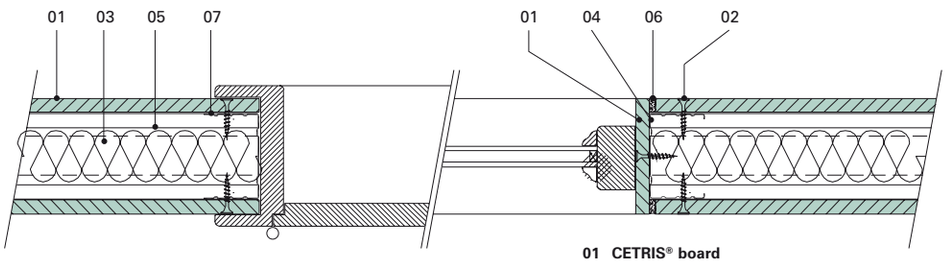
9.2.2.3 Examples of Structure Types with Dividers and Details of a Wall with a Single Layer Cover

Vertical view



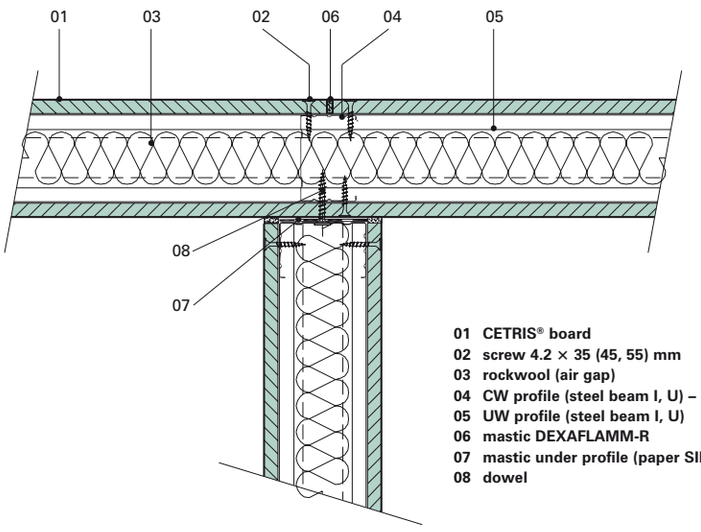
01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel

Hole in a wall
Horizontal view



01 CETRIS® board
02 screw Cetris-Hobau 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 UA profile

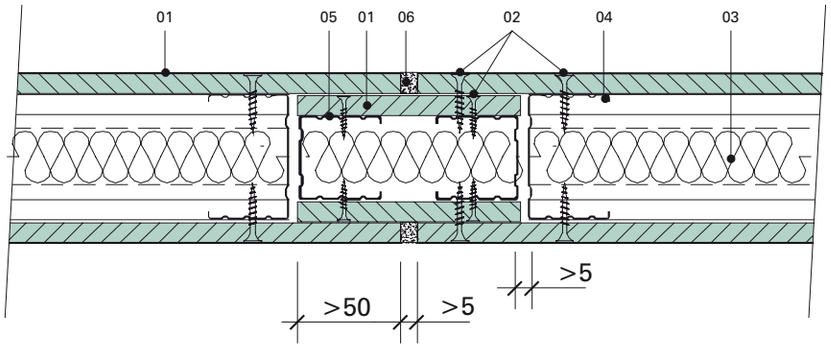
T joint
Horizontal view



01 CETRIS® board
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel

Detailed joint – EI > 60 min

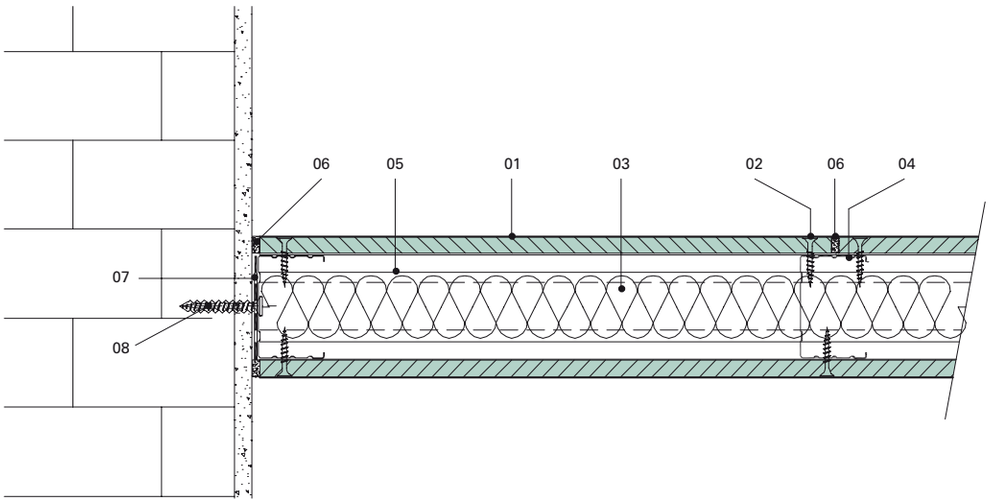
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile 75
05 UW profile 50
06 mastic DEXAFLAMM-R

Joint to a Wall

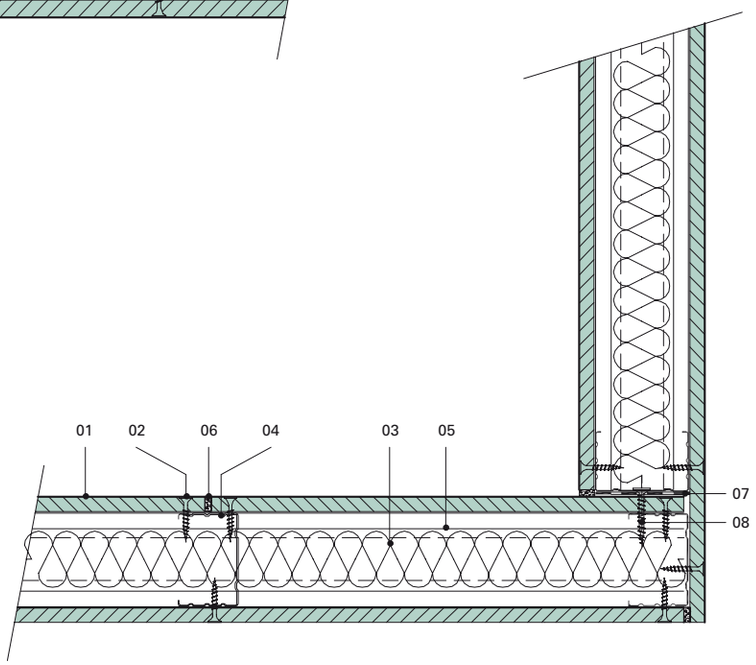
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel

L-joint

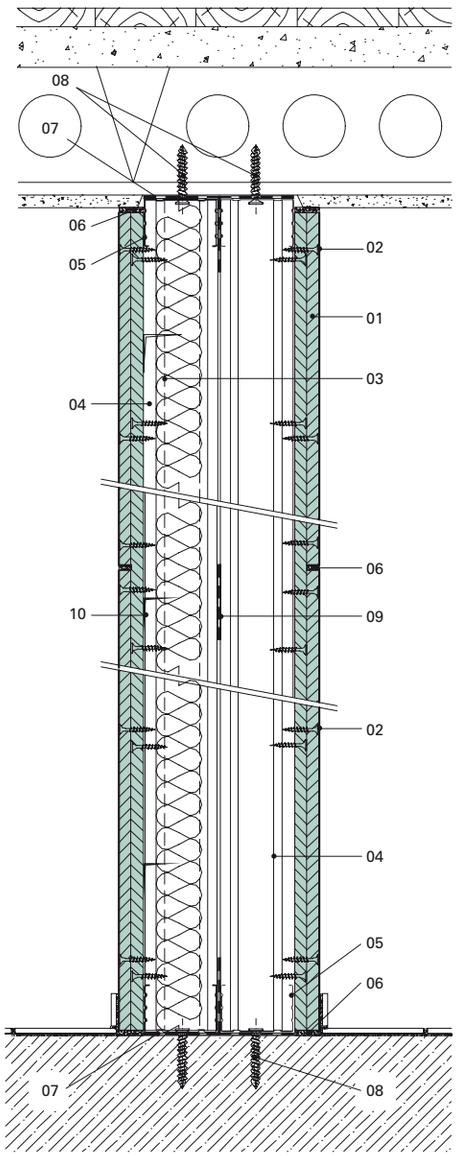
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel

9.2.2.4 Examples of Structure Types with Dividers – Details of a Wall with a Multiple Layer Cover

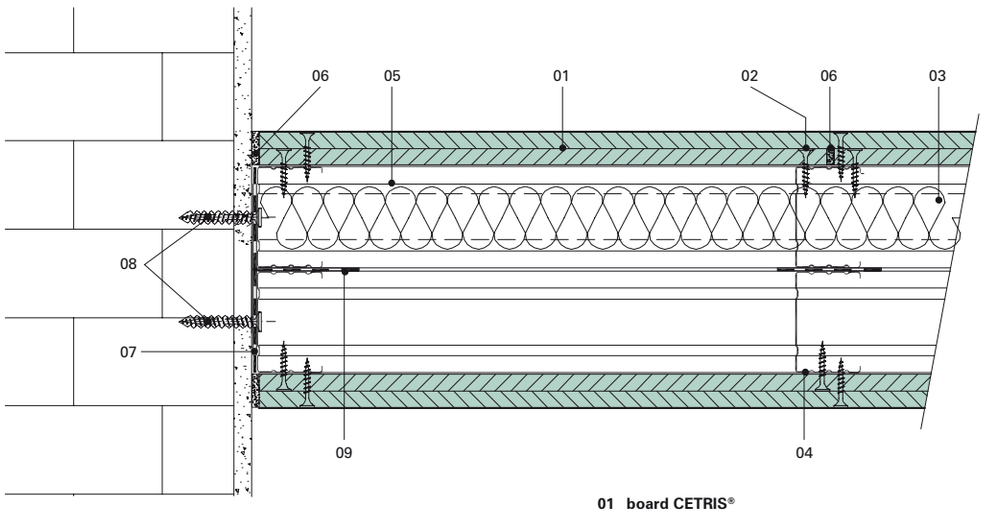
Vertical view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U))
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel
09 sealing tape
10 glue-on spike

Joint to a wall

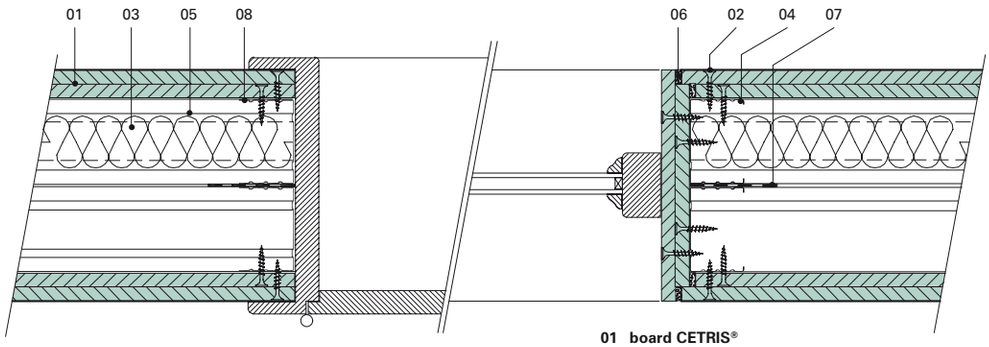
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel
09 sealing tape

Hole in a wall

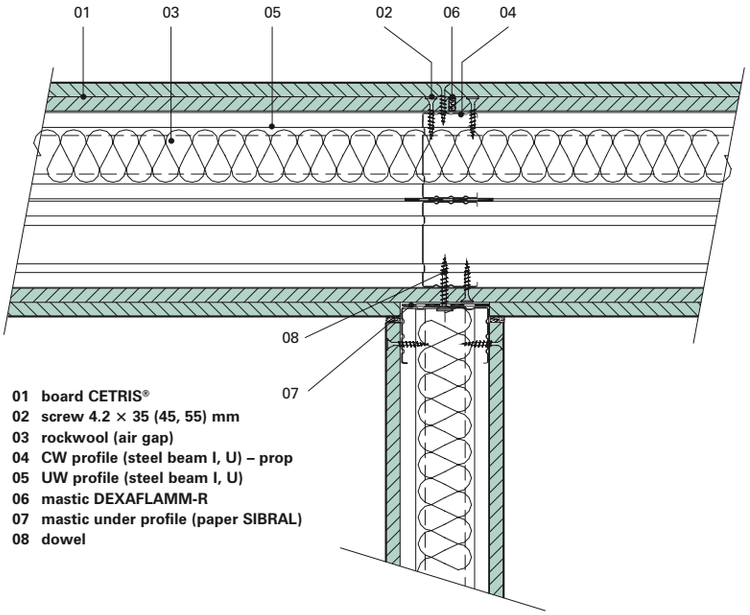
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 sealing tape
08 UA profile

T-joint

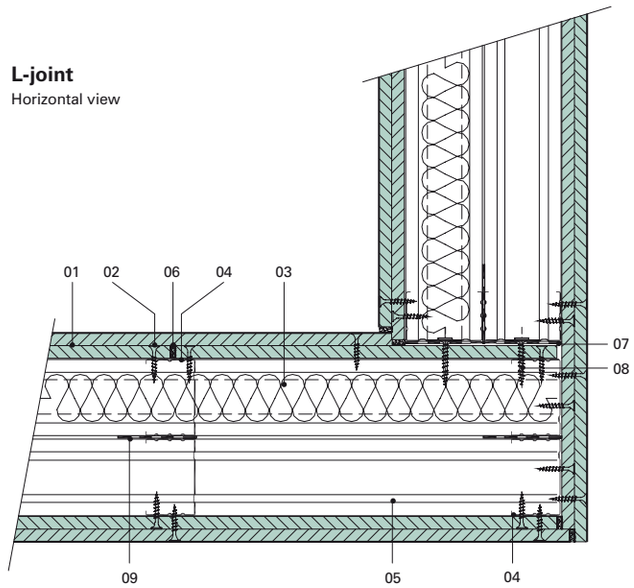
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel

L-joint

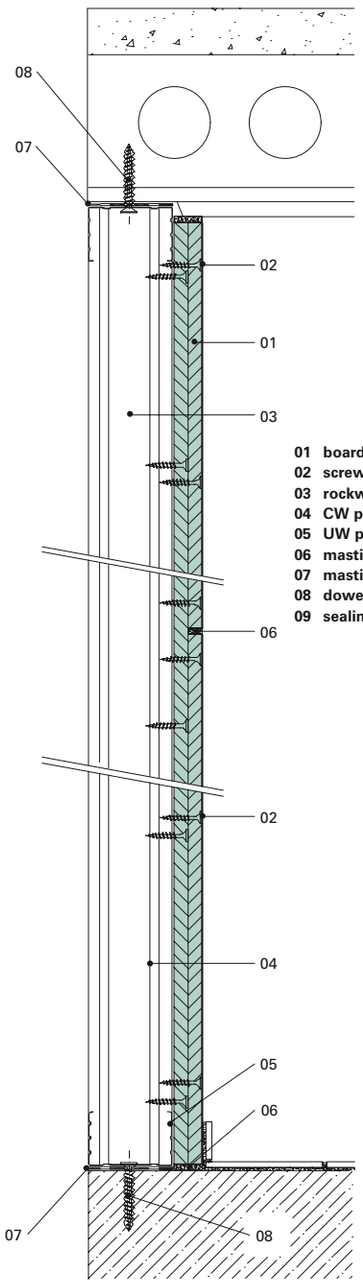
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel
09 sealing tape

9.2.2.5 Examples of Structure Types with Dividers – Details of a Shaft Wall

Vertical view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 rockwool (air gap)
04 CW profile (steel beam I, U) – prop
05 UW profile (steel beam I, U)
06 mastic DEXAFLAMM-R
07 mastic under profile (paper SIBRAL)
08 dowel
09 sealing tape

9.2.3 Additional Front Walls, Fire Proof Wall Covers

Covers and additional front walls enable an increased fire resistance to existing fire divisions for a D1 or D2 type, provided that such structures already have a fire resistance of at least 30 minutes. The additional walls or covers do not increase the fire resistance of walls and dividers without a fire resistance, disregarding the material they are made of (for instance single layer metal walls made from corrugated sheets etc.).

Remark: in case the existing wall structure is different from the D1 or D2 types or it fails the required value for fire resistance EI 30, the version with a shaft wall (additional front wall) can be used– see the previous chapter.

9.2.3.1 Bearing Structure from Additional Walls

The bearing structure consists of a frame composed of zinc coated steel profiles – type CW 75 × 50 × 0.6 mm.

The profiles are anchored into the existing wall structure by means of steel wall plugs at an axial distance of 625 mm, the joints between the profiles and the walls are filled with DEXAFLAMM-R mastic. The distance between the axes of vertical profiles should not exceed 625 mm.

9.2.3.2 Composition of the Structure

The additional front wall has one side covered with one or more layers of CETRIS® cement bonded particle-boards, where the direct cover made of CETRIS® boards is applied directly onto the existing structure. The horizontal distance between the boards is a minimum of 400 mm. In case multiple layers of wall cover panels are used, the joints are cross-bonded – along a whole profile vertically (625 mm), by a minimum overlap of 400 mm horizontally.

Table № 9 – Dimensions for Additional Front Walls

The additional walls of the CETRIS® type are structures that are covered on one side, fastened on a grid with metal profiles and anchored to the existing bearing structure with a gap. The size of this gap, or a decision if the gap is (not) filled with rockwool and the fire resistance of CETRIS® board cover for the final fire resistance of whole system are to be considered.

CETRIS® BOARD THICKNESS (mm)	INSULATION TYPE	GAP WIDTH (mm)	INCREASE IN FIRE RESISTANCE BY… (min)	FINAL FIRE RESISTANCE (min)
10	Air	50	15	EI (x)[1] + 15
18	Air	50	30	EI (x)[1] + 30
2 x 12	Air	50	45	EI (x)[1] + 45
2 x 16	Air	50	60	EI (x)[1] + 60
2 x 18	Rockwool[2]	50	90	EI (x)[1] + 90

Remarks to table № 9:

1) Initial fire resistance value of an additionally protected wall EI (x).
2) Mineral fibreboard of Orsil (Isover) type with a thickness of 50 mm, with a volume weight of at least 75 kgm^{-3}, and a flammability class max. B (not easily flammable) according to ČSN 73 0862 (fire reaction class A2 according to ČSN EN 13501-1 is assumed).

Table № 10 – Dimensioning of direct covers

The application, taking into account a larger cover weight, has to be considered from the static point of view. The direct cover can be put only on even walls with an unevenness of less than 5 mm in order to prevent the structure from overloading.

The fastening to the walls or concrete may only be carried out using steel dowels into a roster 300 × 300 mm (valid for thickness 10 – 12 mm) or in a roster 450 × 450 mm (valid for a thickness of 14 mm and more). The thickness of the CETRIS® boards and a number of layers depend on the required fire resistance value.

CETRIS® BOARD THICKNESS (mm)	INCREASE IN FIRE RESISTANCE BY… (min)	FINAL FIRE RESISTANCE (min)
12	15	EI (x)[1] + 15
2 × 10	30	EI (x)[1] + 30
2 × 14	45	EI (x)[1] + 45
2 × 18	60	EI (x)[1] + 60

Remarks to table № 10:

1) Existing fire resistance value of an additionally protected wall EI (x).

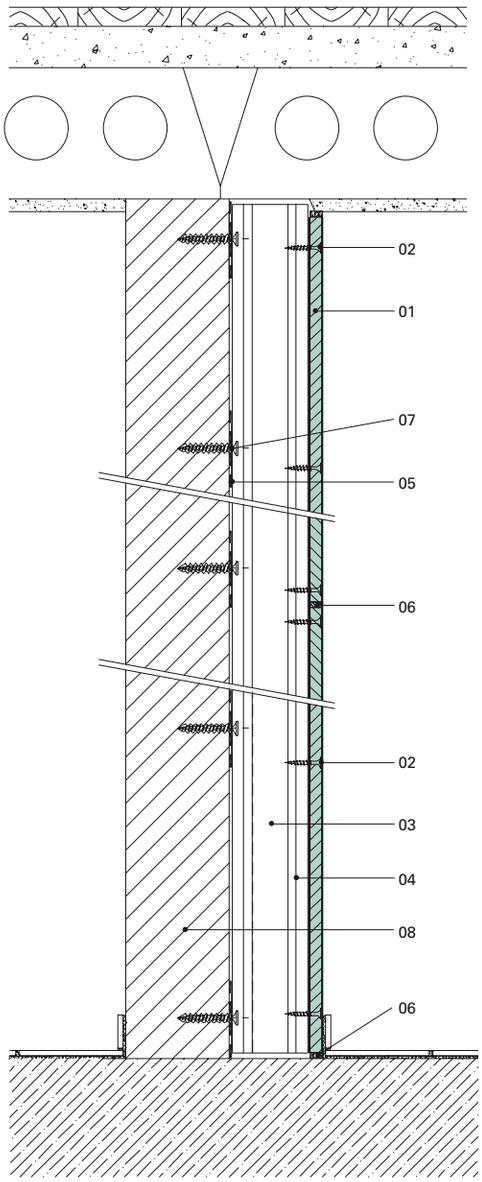
As shown in the tables above, the fire resistance of walls with a resistance exceeding 30 minutes may be increased by adding the additional fire resistance to the original value. Even an extreme increase from 120 to 180 minutes has been validated. The increase in fire resistance also applies to all walls of D1 and D2 types with a fire resistance of at least 30 minutes. However, the tables do not apply to walls of D3 type.

The covers are not suitable for walls/dividers made from plaster-cardboard and plaster fibreboard.

Remark: if required, applying a direct cover onto the walls is recommended only in a small area due to the fact that the points where the boards are fixed onto the wall show tension, which may cause cracking during fire and decrease the fire resistance of the cover.

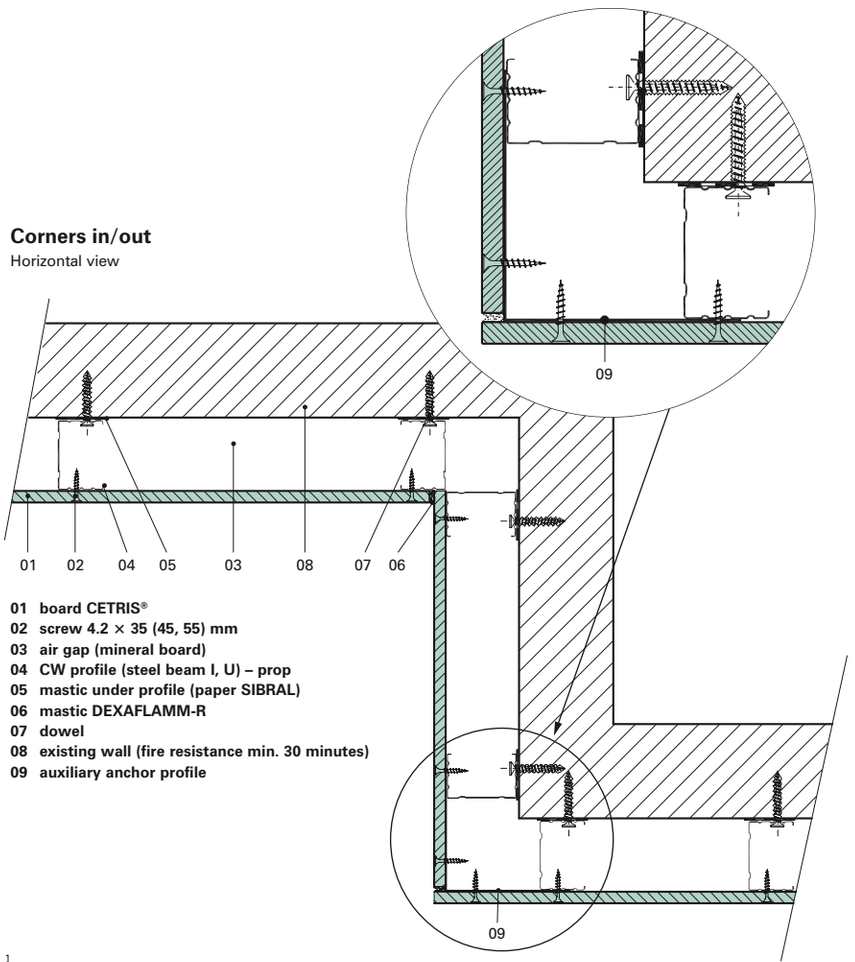
9.2.3.3 Examples of Structures – Details of Additional Walls

Vertical view



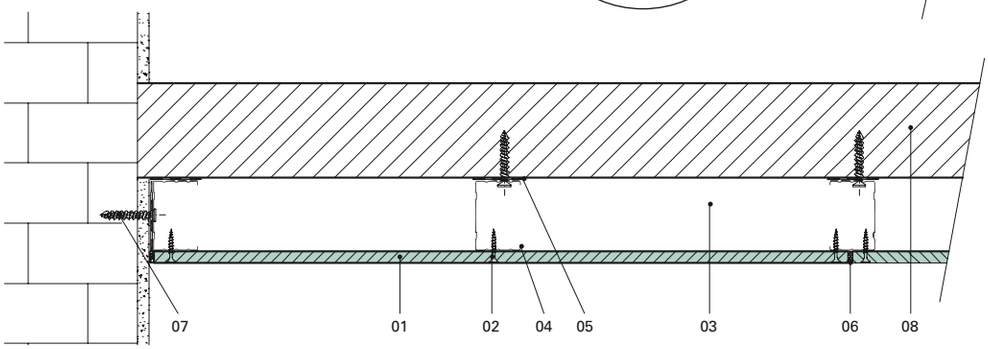
01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 air gap (mineral board)
04 CW profile (steel beam I, U) – prop
05 mastic under profile (paper SIBRAL)
06 mastic DEXAFLAMM-R
07 dowel
08 existing wall (fire resistance min. 30 minutes)

Corners in/out
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 air gap (mineral board)
04 CW profile (steel beam I, U) – prop
05 mastic under profile (paper SIBRAL)
06 mastic DEXAFLAMM-R
07 dowel
08 existing wall (fire resistance min. 30 minutes)
09 auxiliary anchor profile

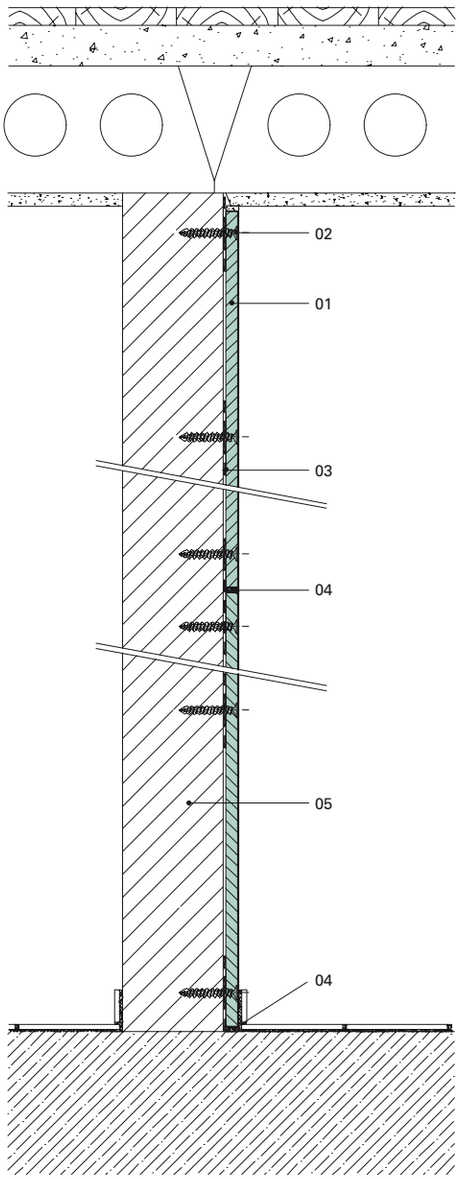
Joint to a wall
Horizontal view



01 board CETRIS®
02 screw 4.2 × 35 (45, 55) mm
03 air gap (mineral board)
04 CW profile (steel beam I, U) – prop
05 mastic under profile (paper SIBRAL)
06 mastic DEXAFLAMM-R
07 dowel
08 existing wall (fire resistance min. 30 minutes)

9.2.3.4 Examples of Structures – Details of Direct Covers for Walls

Vertical view



01 board CETRIS®
02 dowel
03 mastic under (paper SIBRAL)
04 mastic DEXAFLAMM-R
05 existing wall (fire resistance min. 30 minutes)

9.2.3.5 General Rules for Installation Fire Divisions onto a Steel Frame

All building structures with fireproof non bearing walls and partitions of CETRIS® type, which are fastened or support such walls, where their failure could endanger the stability, should have the same fire resistance as the partition of a CETRIS® type. If such structures are under static load, their possible deformation must not break the integrity of the wall composed of CETRIS® boards. This requirement does not apply if the supporting and the bearing structures, even under the worst conditions, are not exposed to thermal load from the fire during the required fire resistance.

- The maximum spacing of screws anchoring the CETRIS® boards onto the CW profiles of fire divisions should not be greater than 200 mm (screws at edges), or 400 mm (on the surface) respectively, and to be at a distance of less than 25 mm from the board edge. The spacing of screws can be doubled on a multiple layer cover.
- The maximum spacing of screws on rows of CETRIS® boards or installation inserts should be at a maximum of 100 mm or less.
- The screws used for anchoring the CETRIS® board on CW profiles should be at least 10 mm longer than the thickness of the fastened board.
- The maximum spacing of dowels for anchoring the CW and UW profiles should not be greater than 625 mm.
- Installation inserts of CETRIS® or CETRIS® type rows should have the same thickness as the thickness of the wall cover, and at least 12 mm.
- The strips of CETRIS® type for covering the joints between the CETRIS® boards should overlap both sides of the joint by at least 60 mm, if not stated otherwise
- The maximum spacing of mounted CW profiles should not be greater than 625 mm, it also has to be determined according to the board thickness and based on the static calculation. The length of CW profile is approximately 15 mm shorter than the height of the room.
- The dilation joints and all connections with the wall and the corner connections should always be filled with fireproof DEXAFLAMM - R mastic. The mastic should be pressed into a depth of at least 5 mm.
- The surfaces of CW or UW profiles touching the floor, ceiling or the walls should be filled with fireproof DEXAFLAMM – R mastic. Additionally, if the walls fire resistance should be greater than 60 minutes, it is recommended to lay the bottom of the profiles with SIBRAL paper. The SIBRAL paper is also suitable for partial insulation of possible thermal bridges in the structure.
- The boards of a multiple layer cover should be laid down with an overlap at of least 400 mm and principally with no cross joints.
- The joints of one layer cover should always be propped with a CW profile or (where not technologically possible) with a row of CETRIS® strip, and in the more demanding cases – higher requirements for fire resistance with both methods; the boards should be laid together tightly and the joints should be filled with mastic. Multiple layer covers also need the internal joints in the bottom layers filling with mastic.
- All dilation joints in the fire divisions with a fire resistance greater than 60 minutes must always be insulated with a row of CETRIS® boards of the same thickness as the boards already used according to fig on page152.
- For structures with a fire resistance of over 60 minutes, it is recommended to insulate the inside of the CW and UW profiles touching the bearing walls and ceilings with pieces of rockwool.
- It is recommended to ensure the position of rockwool is of a thickness less than the thickness of the air gap using the glued on spikes.
- In places of board connections with steel CW profiles and walls without rockwool filling with a height from 4 m to 6 m, it is necessary to insulate the profiles with a row of CETRIS® boards with a thickness of at least 12 mm so that the row overlaps the width of the CW profile by at least by 60 mm on each side.
- All openings in the fire partitions of the CETRIS® type should be fireproof sealed with a filling or another suitable method according to the design. The installations inside the partition (water pipes, wiring etc.) should be fireproof treated with rockwool; otherwise the resistance to fire could be reduced.

9.2.3.6 Installation Method

a) The horizontal position of UW profiles and the position on the floor and on the ceiling are measured first and the boards are then laid on a layer of DEXAFLAMM – R mastic, or on SIBRAL paper if needed.
b) The profiles are fastened to the floor or ceiling, or to the walls using steel dowels. The maximum spacing for the dowels is determined with regards to the height of the board up to 625 mm.
c) The CW profiles are built into the structure, spaced in accordance to the static calculations and board thickness, but a maximum spacing of 625 mm must be maintained. The length of CW profiles is approx 15 mm shorter than the height of the room.
d) Rockwool is inserted between the profiles if needed.
e) The CETRIS® boards are then fastened onto the prepared structure using screws so that a gap of at least 10 mm is left between the floor or ceiling and the lower or upper edge. The CETRIS® board is fastened to CW profiles using screws only.
f) The boards of a single or multi layer should overlap by at least 400 mm. ATTENTION – in a three layer cover, the joints of the bottom and upper layers should not be in the same place.
g) The following rule applies to anchoring CETRIS® boards to the structure: axial spacing of the screws is a maximum of 200 mm; the spacing of two or multiple-layer cover can be increased up to 400 mm in the first layer.

9.2.4 Bearing outer Walls on a wooden Frame – alternatively (Non Bearing outer Walls on wooden Frame)

9.2.4.1 Bearing Structure

The bearing structure consists of a frame composed of vertical wooden columns that have the dimensions: 120 × 100 mm and horizontal girders of 120 × 50 mm, which are connected with screws. The girders can be from dried pine cut wood (humidity 18 %, resistance class min. S II); alternatively laminated timber can be used.

The wooden girders are anchored onto the frame using steel dowels spaced at 625 mm intervals, the joints between the profiles and the wall are filled with DEXAFLAMM-R mastic. The axial spacing of internal vertical wooden columns does not exceed that of 625 mm.

9.2.4.2 Composition of the Structure

The structure is symmetrically covered:

- From the outer side with one layer of CETRIS® cement bonded particle-board of with a thickness of 14 mm. The horizontal overlap of boards is a minimum of 400 mm. Self-tapping flush screws are used for anchoring the CETRIS®-cement bonded particle-boards, the screw dimensions are 4.2 × 35 mm. Gaps with a minimum width of 5 mm should be left between the boards. The gaps, the outer walls and screws should be filled with DEXAFLAMM-R mastic.
- From the interior side, one layer of plasterboards of Knauf® GKF type of thickness 12.5 mm. The horizontal overlapping of the boards is a minimum of 400 mm. self-tapping flush screws of type TN 4.2 × 35 mm are to be used for anchoring the Knauf® GKF boards. The boards must be laid with minimum possible joints between the boards. The joints and screw heads are filled with Uniflott cement.
- The volume between the columns of the frame is filled with rockwool with a minimum thickness 120 mm.

Table № 11 – Fire characteristics for outer walls on wooden frames up to a height of 3 m

FIRE RESISTANCE [1]	COMPOSITION OF THE STRUCTURE			FIRE LOAD
	External cover	rockwool [2]	Internal cover	
REI 60 D3	CETRIS® 14	120	Knauf® GKF 12,5	External fire (to CETRIS® board)
REW 60 D3[3]				Internal fire (to Knauf® board)

Remarks to table № 11:

1) Classification for limit stages for the fire resistance according to ČSN 73 0810, the structures tested according to EN 1365-1
2) Mineral fibreboard – Orsil (Isover) UNI type or other mineral fibreboard, with a volume weight of at least 40 kgm^{-3}, with a flammability class of max. B (not easily flammable). According to ČSN 73 0862 (a fire reaction class A2 according to ČSN EN 13501-1 is assumed).
3) An enclosed area for fire

9.2.4.3 General Rules for the Installation of Fire Divisions on Wooden Frames

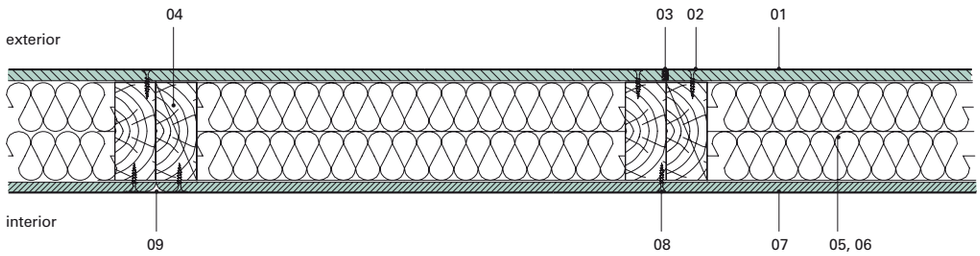
The aforementioned rules apply to constructions of wood bearing frames and for the anchoring of CETRIS® boards. The anchoring of Knauf boards, the filling of joints and the surface finish should be carried out according to instructions in the Knauf Praha spol. s r.o. company.

- The maximum spacing of screws anchoring the CETRIS® boards to wooden columns in a fire division should not be greater than 200 mm (screws on edges), or 400 mm (inside the surface) respectively, and the screws should not be at a distance of less than 25 mm from the board edge.
- The maximum spacing of dowels for anchoring wooden girders should not be greater than 625 mm.
- The maximum spacing of vertical wooden columns should not be greater than 625 mm. The minimum profile size used is 120 × 100 mm, its static characteristics must be calculated.
- The dilation joints and all its connections with the wall and the corner connections should be filled with fireproof DEXAFLAMM - R mastic. The mastic should be pressed into a depth of at least 5 mm.
- The wooden girders surface adjacent to the floor, ceiling and to the walls should be covered with fireproof DEXAFLAMM – R mastic.
- It is necessary to inspect the position of the rock wool in case it does not fill the whole volume of the air gap, for instance using glued on spikes.
- All openings in the fire proof outer wall should be fireproof sealed with filling or with another method in accordance to the design. The installations inside the partition (water pipes, wiring etc.) should be fireproof treated with rockwool; otherwise the fire resistance could be reduced.

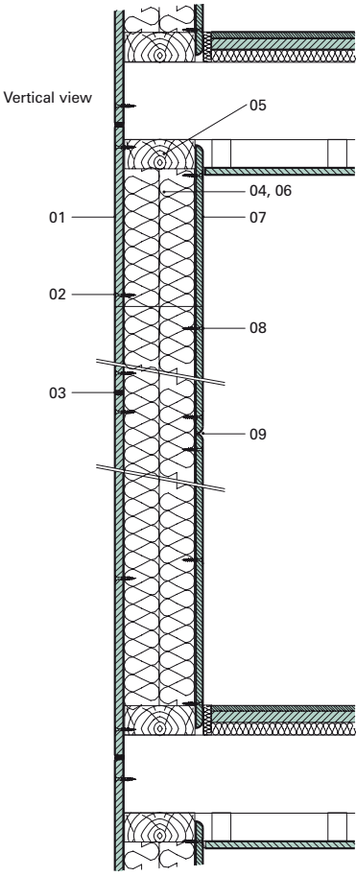
9.2.3.4 Examples of Structures – Outer Bearing Wall with a Wooden Frame – DETAILS

01 CETRIS® board thickness 14 mm
02 screw 4.2 × 35 mm
03 mastic DEXAFLAMM-R
04 vertical wooden column 120 × 100 mm (distance 625 mm)
05 wooden beam 120 × 50 mm
06 rockwool (Orsil Uni) – 2× thickness 60 mm
07 Knauf GKF board thickness 12,5 mm
08 screw TN 3.5 × 35 mm
09 joint filling material – Knauf Uniflott

Horizontal view



Vertical view



9.3 Horizontal Structures – Ceilings

9.3.1. Scope

According to the above mentioned documents, the CETRIS® boards can be applied to the following fire proof horizontal structures:

- Independent fire proof ceiling (lower ceiling), where the thermal exposure (fire load) is produced from below. In this case, the fire resistance is directly determined by the result of fire resistance test.
- Ceiling under a ceiling (roof) structure, the thermal exposition (fire load) is produced from below. Using the boards in such way, the final fire resistance of the whole structure will be equal to the sum of the fire resistance of the ceiling (roof) structure and the protecting ceiling from CETRIS® boards.

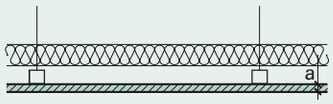
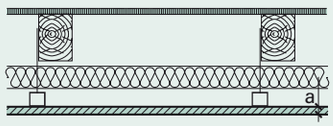
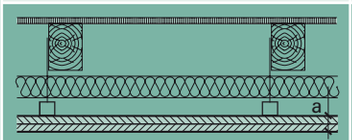
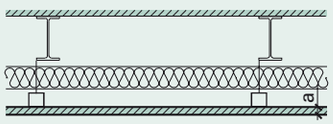
Taking the protocols into account, it is also necessary to observe the installation technology of the lower ceiling and all installation methods used during the preparation and testing of the sample. The ceiling structures can be of any dimension, provided that the spacing between the suspending elements will not increase and the dilation measures will increase respectively. The test results apply to cavities of any height. This means that the proposed connecting elements, their spacing and localization on the structure and other details are obligatory and that they should be observed in order to apply the above mentioned test results onto a construction.

Selected samples of structures with various wall compositions have been tested by a state accredited test laboratory at PAVÚS – Veselí n. L. The results based on these tests, have enabled the issue of the Fire resistance protocols no. Pr-03-02.088, no. Pr-03-02.089. These reports, together with further tests from previous years, served as reference for the company PAVUS a.s. Praha (ing. Karpaš CSc., ing. Bauma CSc.). To create extended applications and the necessary dimensional tables stating general application of the findings, used to create the final expert report.

Warning:

- All data is applicable for conditions and the exposure of horizontal structures during fire, according to the applicable standards EN 1364-2. This forms the reason to present the axial distances and CD profiles having passed the test. The distances should be considered as minimum limit values. Attention must be paid to measuring fire divisions, it is always necessary to also evaluate the static structure requirements according to the real load. These values should be considered as limit values, which should not be breached. When calculating the dimensions of fire proof ceilings, it is necessary to take in account the static requirements independently and to modify the bearing structure according to the real load regarding the weight of the CETRIS® boards.
- **Installation of fire divisions can be performed only by trained personnel – see Chapter 9.4 Training for installation companies for applications with the CETRIS® - cement bonded particle-boards.**

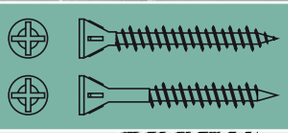
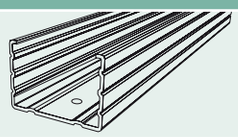
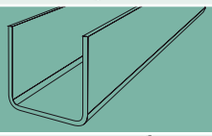
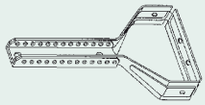
Table № 13 – Overview of Horizontal Structures

	FIRE RESISTANCE [1]	CEILING COVER	ROCKWOOL		CEILING CONSTRUCTION WEIGHT (kg/m²)	BEARING CONSTRUCTION				FIRE RESISTANCE	HEAT RESISTANCE	DETAILED DESCRIPTION
		a (mm)	Volume weight (kg/m³)	Thickness (kg/m³)		Description	Installation profiles distance (mm)	Bearing profiles distance (mm)	Suspension distance (mm)			
Independent ceiling		1×12	75	2×40	21.60	CD 60 × 27	420	1,000	420	EI 15 [3]	2.06 [2]	Page 138
		2×12			41.60	CD 60 × 27	420	900	420	EI 45 [3]	2.12 [2]	
Ceiling for wooden beams	 Overlap thickness 25 mm joint and groove.	1×12			21.60	CD 60 × 27	420	1,000	420	REI 30 [3]	2.06 [2]	Page 144
	 Overlap thickness 30 mm joint and groove.	2×12			41.60	CD 60 × 27	420	900	420	REI 60 [3]	2.12 [2]	
Ceiling for steel sheets	 Uncovered steel beams diam. O/A ≤ 300 m⁻¹	1×12			21.60	CD 60 × 27	420	1,000	420	REI 30 [3]	2.06 [2]	Page 145
	 Uncovered steel beams diam. O/A ≤ 150 m⁻¹	2×12			41.60	CD 60 × 27	420	900	420	REI 60 [3]	2.12 [2]	

Remarks to table № 13:

1) Fibreboard thickness and volume weight, flammability class max. B (hardly flammable) as per ČSN 73 0862 (fire reaction class A2 as per ČSN EN 13501-1 presumed).
2) Heat resistance value of the individual ceiling for indication
3) Fire resistance value of an individual ceiling loaded from below
4) Fire resistance value of a multiple construction loaded from below, final fire resistance value of the multiple construction equals the fire resistance value of ceiling (roof) construction and protective ceiling regarding the CETRIS® boards. For rules for a different type of ceiling (roof) construction see chapter 9.3.3 Fireproof ceiling for ceiling (roof) construction.

Table № 14 Materials for Installation of Horizontal Structures – Specification

DESCRIPTION MARKING	PICTURE (DIAGRAM)	REMARK	TYPE OF LOWER CEILING	
			INDEPENDENT CEILING	CEILING UNDER CEILING (ROOF) STRUCTURE
CETRIS® BASIC - board Cement bonded particleboard, smooth surface, cement gray. Basic format 1,250×3,350 mm, Volume weight 1,320 ±70 kgm^{-3}		Thickness 12 mm, number of layers according to requirements to fire resistance.	X	X
Screw 4.2×25, 45 mm Self-tapping flush screws.		Screw 4.2×25 – cover 1×12 mm Screw 4.2×45 – cover 2×12 mm	X	X
CD profile Zinc coated metal sheet open profile 27×60×0.6 mm, length 2.50 – 4.50 m		These create the bearing grid for installation of lower ceiling. The profiles are fastened to the ceiling (roof) structure by means of direct or vernier hangings.	X	X
UD profile Zinc coated metal sheet open profile 28×27×0.6 mm length 3.00 m		Serves for anchoring the lower ceiling to walls with steel dowels.	X	X
Connection element for CD profile		For mechanic connection of CD profiles.	X	X
Direct hanging thickness 1 mm, length 125 mm, bearing capacity 40 kg		Serves for hanging the metal grid from the CD profiles on a wooden girder of the ceiling structure.	X	X
Vernier hanging, bearing capacity 40 kg Three part system, serving for fastening of grid from CD profiles to the bearing ceiling structure		Enables the adjustment of different cavity heights between the lower ceiling and the bearing structure.	X	X
Cross coupling element		Serves for mechanical fastening of crossing CD profiles vertically.	X	X
Cross planar coupling element NIVEAU		Serves for mechanical fastening of CD profiles crossing in one plane.	X	X
Steel wall plugs (dowels) For anchoring profiles to the walls (concrete)		Dimensions (Diam. + length) acc. to structure weight, type of base and anchored material.	X	X
DEXAFLAMM-R cement White thyrotrophic material for filling joints and screw heads		Alternatively single component fire proof elastic cements can be used (acrylic, silicon) (Sika Firesil, Den Braven Pyrocryl).	X	X

DESCRIPTION MARKING	PICTURE (DIAGRAM)	REMARK	TYPE OF LOWER CEILING	
			INDEPENDENT CEILING	CEILING UNDER CEILING (ROOF) STRUCTURE
SIBRAL paper Mats from aluminium silicon fibres with a 13 mm thickness		Used under profiles, splitting heat bridges, with an insulation up to temperatures of 1,260 °C.	X	X
ORSIL (ISOVER) Rockwool, thickness 2×40 mm, Volume weight 75 kgm^{-3} (Max. volume weight 100 kgm^{-3})		Alternatively, use rockwool with the same volume weight, with a max. flammability level B acc. ČSN 73 0862, with assumed fire reaction class A2 (acc. EN 13501).	X	X

9.3.2 Independent Fire Proof Lower Ceiling

9.3.2.1 Bearing Structure

The bearing structure consists of a grid composed from zinc coated steel profiles of a CD type 60 × 27 × 0.6 mm both lengthwise and across. The lengthwise and cross profiles can be in one plane (the profiles are connected by a planar cross coupling element) or in two planes (the cross grid over the lengthwise grid, interconnected with two level cross coupling elements). The grid is fastened to the ceiling (roof) structure by means of a system of hangings. The distance of the profiles in the cross and lengthwise directions and the spacing together with the type of hangings depends on the cover type (ceiling weight). The grid structure is covered by thermal insulation; the insulation consists of two layers of mineral fibreboards with a thickness of 40 mm.

The bearing roster can be fixed to the wall structures by a UD profile, which is used for anchoring the lower ceiling to the vertical structures. The anchoring is provided by means of steel dowels.

9.3.2.2 Composition of the Structure

The lower side of the lower ceiling structure is covered with one or two layers of CETRIS® cement bonded particle-board with a thickness of 12 mm. The boards should overlap by a minimum of at least 400 mm to prevent the occurrence of cross joints. Joints of a multi-layer cover should overlap as well – always at least one profile width (420 mm).

Self-tapping flush screws are used for anchoring the CETRIS®-cement bonded particle-boards into the metal sheet profiles. The screw dimensions are 4.2 × 25 mm. The length of the screws should be at least 10 mm longer than the thickness of the fastened board, for anchoring of the second layer of CETRIS® boards into the multi-layer cover use screws with a minimum length of 35 mm. Joints with a minimum width of 5 mm should be left between the boards. The joints, perimeter walls and screw heads should be filled with DEXAFLAMM-R mastic.

Table № 15 – Fire Resistance Characteristics of an Independent Lower Ceiling Covered by CETRIS® Boards

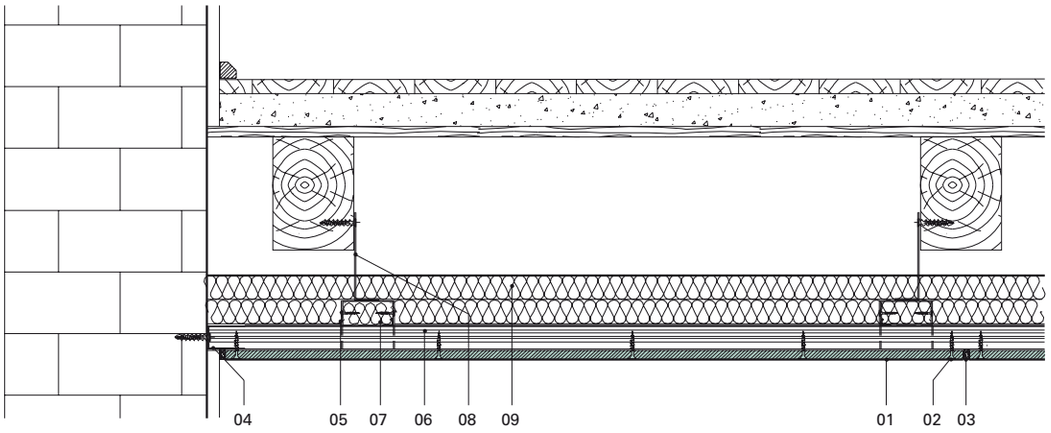
FIRE RESISTANCE [1]	STRUCTURE COMPOSITION		FIRE LOAD
	Cover	Rockwool [2]	
EI 21 D1	CETRIS 1×12 mm	2×40 mm	Thermal load from below
EI 46 D1	CETRIS 2×12 mm	2×40 mm	Thermal load from below

Remarks to table № 15:

1) Classification of limit stages of fire resistance according to ČSN 73 0810, the structures tested according to ČSN EN 1364-2
2) Mineral fibreboard of Orsil (Isover) type or another mineral fibreboard, with a volume weight at least 75 kgm^{-3} and a flammability class of max. B (not easily flammable) according to ČSN 73 0862 (a fire reaction class A2 according to ČSN EN 13501-1 is assumed).

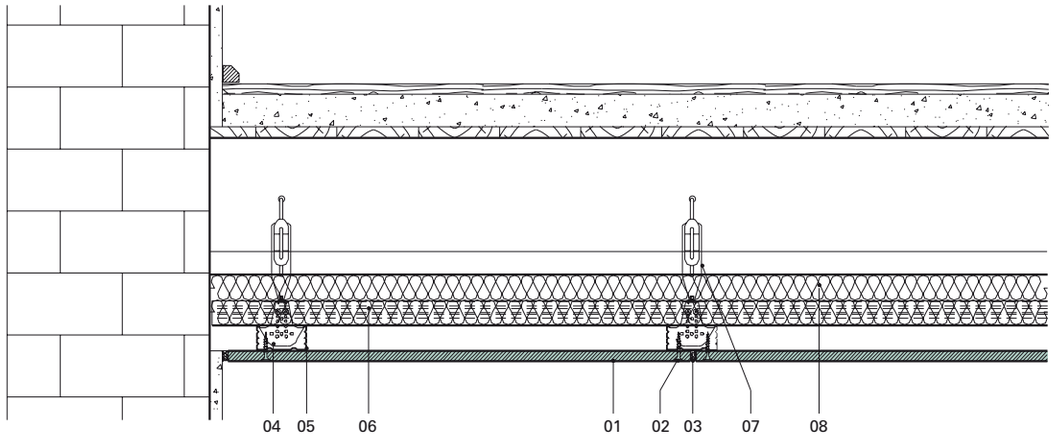
9.3.2.3 Examples of Structures – Details

Longitudinal view



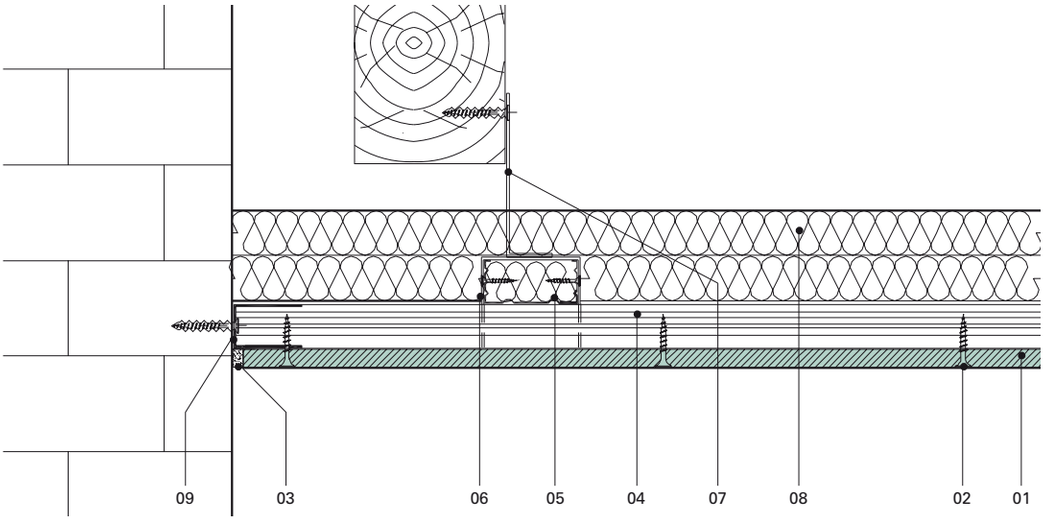
01 board CETRIS®
02 screw 4.2 × 25 (35, 45) mm
03 mastic DEXAFLAMM-R
04 UD profile
05 cross joint element
06 CD profile to mount
07 CD profile bearing
08 suspension
09 rockwool

Transverse view



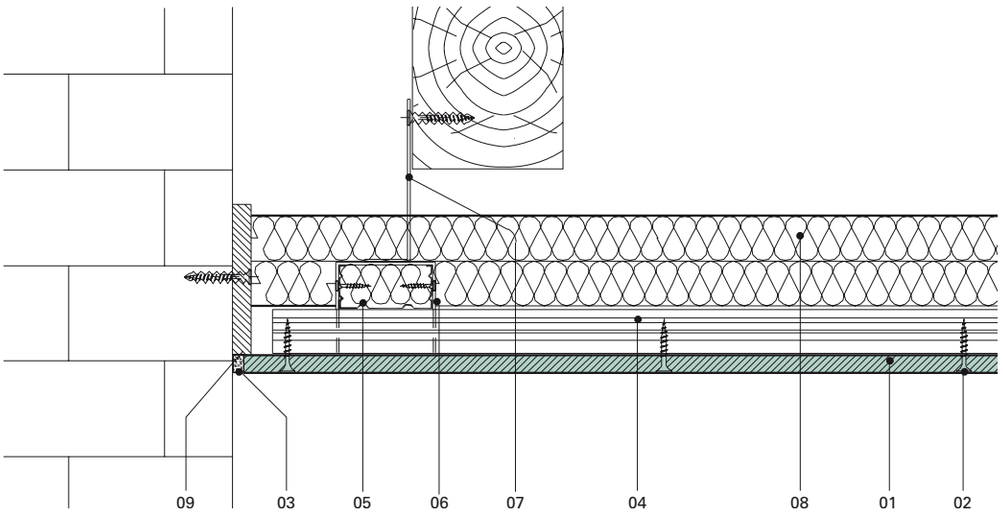
01 board CETRIS®
02 screw 4.2 × 25 (35, 45) mm
03 mastic DEXAFLAMM-R
04 cross joint element
05 CD profile to mount
06 CD profile bearing
07 suspension
08 rockwool

Joint incl. mastic-filled grout (on a profile)



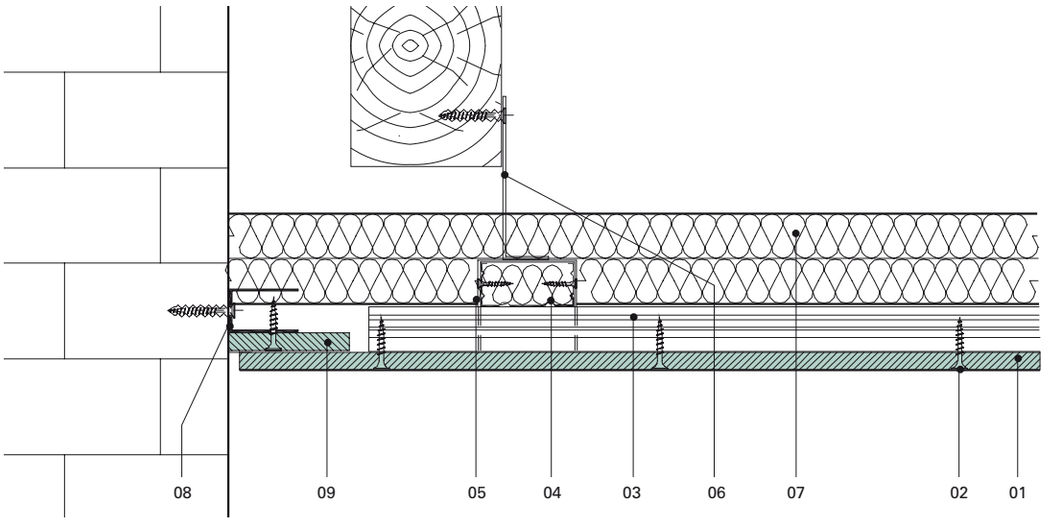
01 board CETRIS®
02 screw 4.2 × 25 (35, 45) mm
03 mastic DEXAFLAMM-R
04 CD profile to mount
05 CD profile bearing
06 cross joint element
07 suspension
08 rockwool
09 UD profile

Joint incl. mastic-filled grout (on a strip)



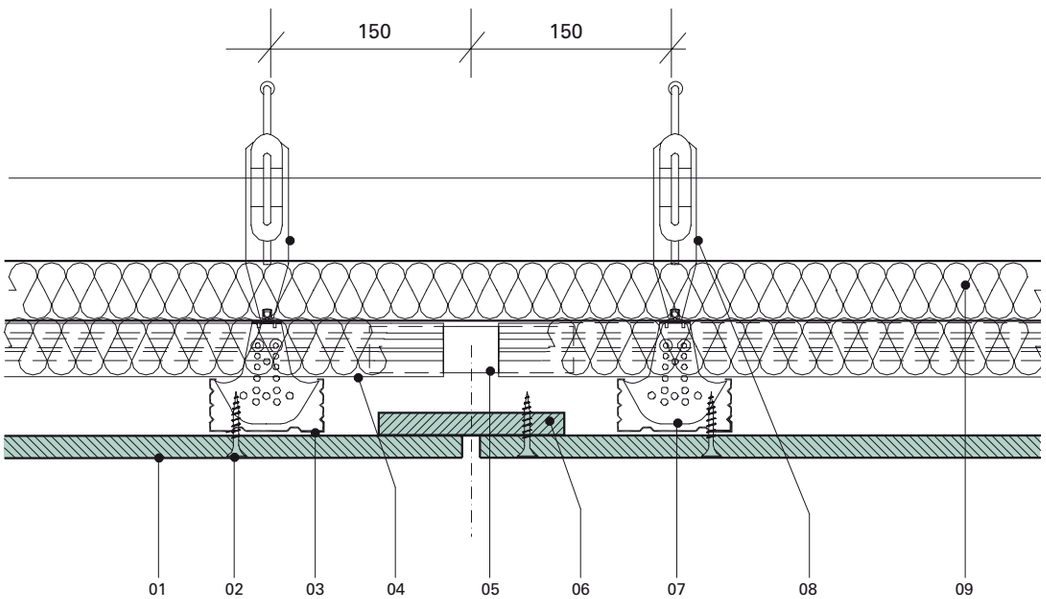
01 board CETRIS®
02 screw 4.2 × 25 (35, 45) mm
03 mastic DEXAFLAMM-R
04 CD profile to mount
05 CD profile bearing
06 cross joint element
07 suspension
08 rockwool
09 strip CETRIS®

Joint incl. grout (on a strip a profile)



01 board CETRIS®
02 screw 4.2 × 25 (35, 45) mm
03 CD profile to mount
04 CD profile bearing˘
05 cross joint element
06 suspension
07 rockwool
08 UD profile
09 strip CETRIS®

Dilation grout in the ceiling



01 board CETRIS®
02 screw 4.2 × 25 (35, 45) mm
03 CD profile to mount
04 CD profile bearing˘
05 joint element CD
06 strip CETRIS®
07 cross joint element
08 suspension
09 rockwool

All dimensions in mm.

9.3.2.4 General Rules for Installation of the Fire Proof Lower Ceilings

- All independent static bearing structures with fire proof lower ceilings of the CETRIS® type, which are fastened or interconnected by any method making a border of an independent fire proofing section, where failure could endanger their stability, should have at least the same fire resistance as the ceiling and lower ceiling of type CETRIS® on its own. When such structures are under static load, their potential deformation must not affect the integrity of the ceiling or lower ceiling. This requirement does not apply to supporting and adjacent bearing structures, which will not be exposed to a thermal load from the fire during the required fire resistance period even under the most unfavourable conditions.
- The maximum spacing of screws anchoring the CETRIS® boards to CD profiles of the fire proof lower ceiling should not be greater than 200 mm (screws at edges), or 400 mm (on the surface) respectively, in distances no less than 25 mm from the board edge
- The screws used for installation the CD and UD profiles should be at least 10 mm longer than the thickness of the fastened board.
- The installation inserts of the CETRIS® type or rows of CETRIS® type should have a minimum thickness of 12 mm.
- The rows of the CETRIS® type for covering the joints between the CETRIS® boards should overlap on both sides of the joint by at least 100 mm, if not stated otherwise.
- The spacing of dowels for anchoring the UD profiles should not be grater than 625 mm.
- The bottom layer of insulation boards is laid onto the fitting CW profiles and serves as a filling for the bearing CW profile.

Table № 16 – Axial spacing for installation CD profiles, bearing CD profiles and hangings

COMPOSITION OF THE LOWER CEILING COVER	SPACING OF INSTALLATION PROFILES “a” (mm)	SPACING OF BEARING PROFILES “b” (mm)	SPACING OF HANGINGS “c” (mm)	REMARK
1×12 mm	< 420	< 1,000	< 420	see Fig. 1
2×12 mm	< 420	< 900	< 420	see Fig. 2

The aforementioned values apply to lower ceilings and ceiling structures without additional loads (lighting, air conditioning, etc.). The structures of lower ceiling in rooms, where underpressure or overpressure could occur under the influence of air conditioning, should be calculated individually.

Fig. 1)
Diagram of a ceiling bearing structure covered with cemented board CETRIS® (thickness 12 mm)

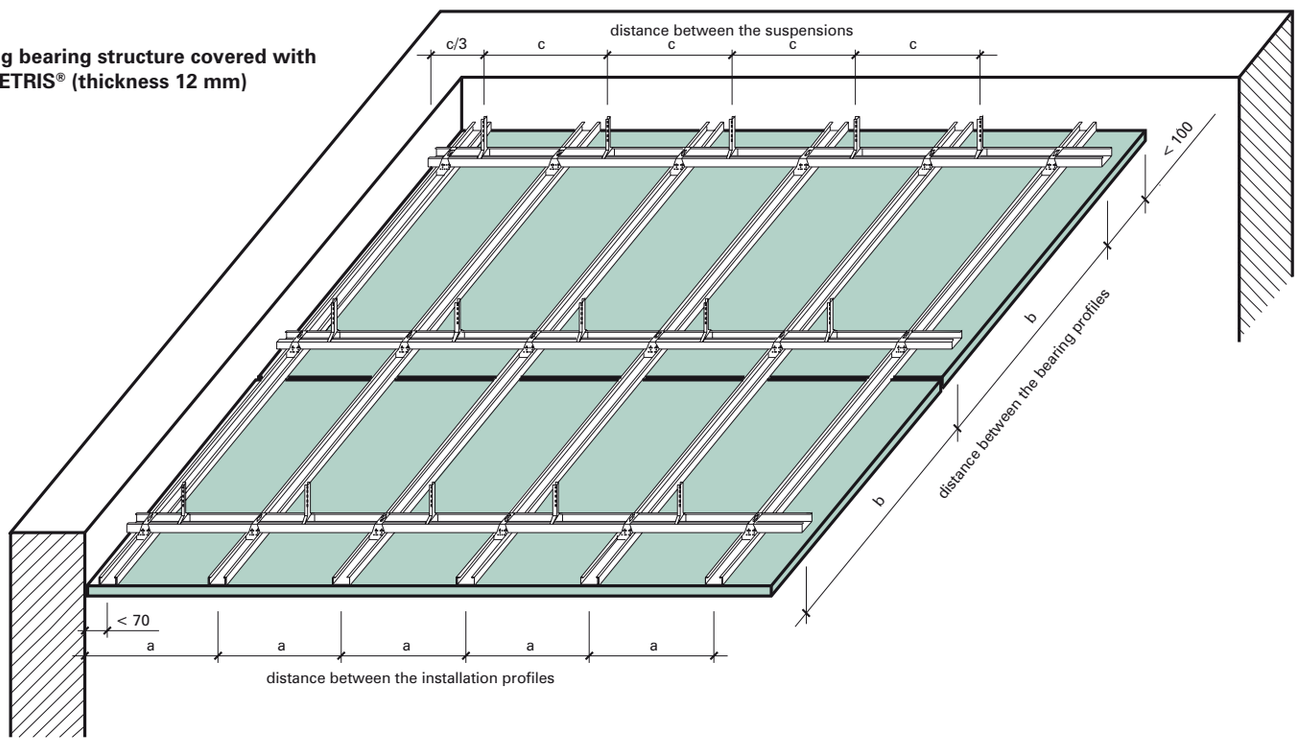
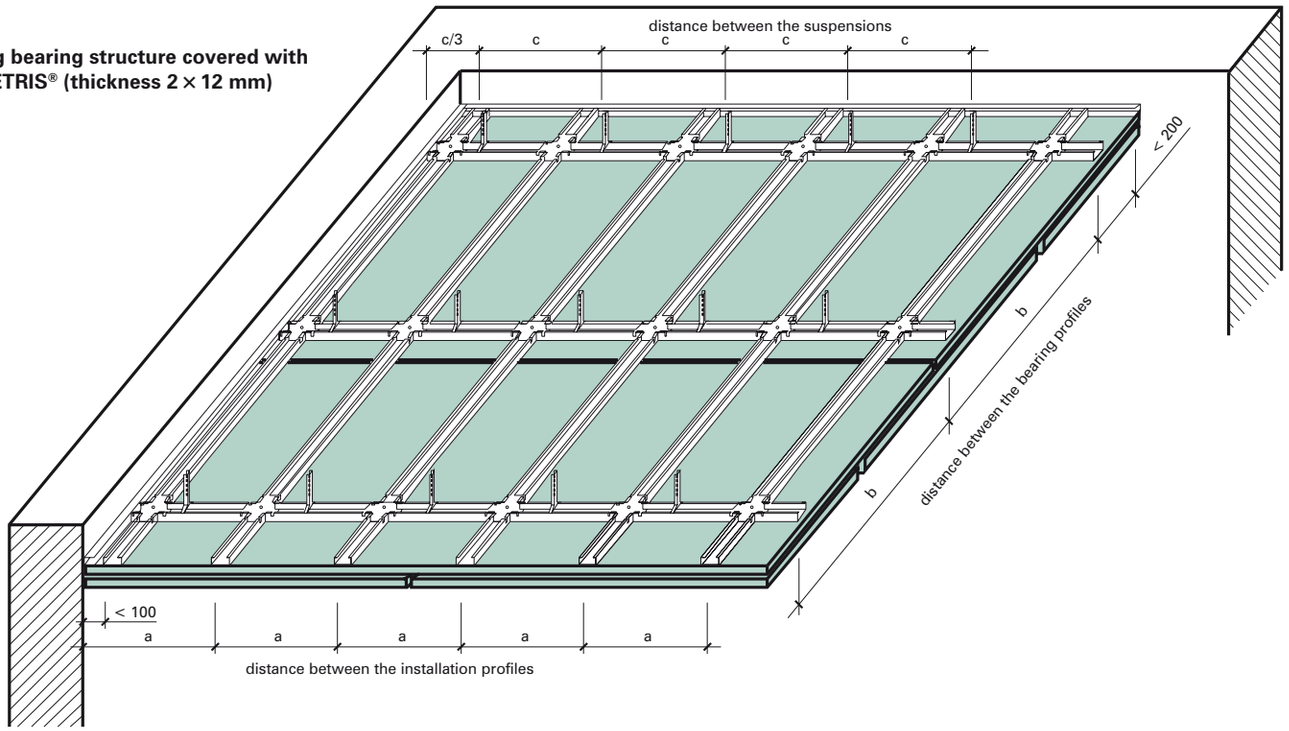


Fig. 2)
Diagram of a ceiling bearing structure covered with cemented board CETRIS® (thickness 2 × 12 mm)



- The dilation joints and all connections for the boards with the walls and the corner connections should be filled with fireproof DEXAFLAMM - R mastic. The mastic should be pressed into a depth of 5 mm.
- The surfaces of a CD or UD profiles that are adjacent to walls should be covered in fireproof DEXAFLAMM - R mastic and sealed with SIBRAL paper if required.
- The NIVEAU coupling elements for KNAUF, which is for the CD 60 × 27 type profiles is used for lower ceilings with two layers of CETRIS® boards. The liners of these coupling elements should be bent and screwed onto the bearing profile using screws that of the type LN 3.5 × 9 mm.
- The cross coupling elements for KNAUF, which is for the CD 60 × 27 profiles are used for lower ceilings with one layer of CETRIS® boards. We recommend fixing the coupling with screws using a minimum of M 6 × 40 with a nut and washer.
- The joints of a multiple layer cover should be laid in turns preventing the occurrence of cross joints with a minimum overlap of 100 mm.
- The joints of one layer cover should always be reinforced with a CD profile or (where not feasible) with a row of CETRIS® boards, and at exposed places – where the fire resistance requirements are higher – using both methods; all joints should be filled with mastic. Internal joints in the lower layers of a multiple layer cover should also be filled.

9.3.2.5 Notes for Installation

The lower ceiling of CETRIS® type is fastened to a metal grid of CD profiles, where the profiles cross in one plane (using cross coupling elements) or in two planes (couplings) one or in two layers of CETRIS® boards are fastened onto the profiles using screws.

The CETRIS® boards forming the lower ceiling must not bear any additional load (for instance lighting), drilling unprotected openings (e.g. air vents etc.) into the boards is forbidden. Any modifications made in such a way must be performed according to the specifications.

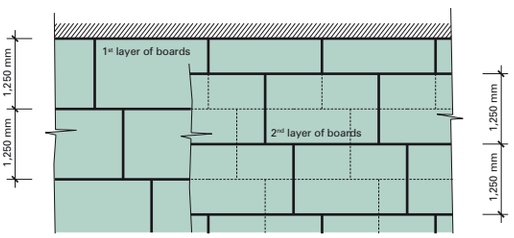
The lighting should be hung on the bearing structure under the lower ceiling, holes must be sealed with SIBRAL paper or with rockwool and DEXAFLAMM - R mastic. The Location and type of lighting elements built into the lower ceiling should be agreed with the person responsible for fire protection in advance, and the openings must conform to all fire fighting measures according to the lighting and structure type.

The venting grids for air conditioning outlets should have the same fire resistance as the thoroughfares.

The following rules should be observed when installation:

- The CETRIS® boards should always be mounted with their longer side perpendicular to the bearing profiles.
- All cross joints should be supported with a profile or an installation insert and they should overlap by at least 400 mm.
- The fastening should always be carried out from the middle or from a corner of the board (eliminating possible stresses).
- When screwing, press the board tightly towards the bearing CD profiles; pre-drilled holes in the boards are recommended.

When applying another layer, the second (external) layer should overlap as shown below:



9.3.3 Fire Proof lower Ceiling under a Ceiling (Roof) Structure

The fire proof lower ceilings mentioned in the previous chapter can also be used under ceiling (roof) structures according to regulations.

Adding the fire resistant lower ceiling to the fire resistance of the protected ceiling (roof) structure will result in the final value for fire resistance of the whole system: the ceiling (roof) + the lower ceiling. Such values apply to all types of ceiling (roof) structures – concrete, steel, reinforced concrete, and wooden structures.
The following standards are used to calculate the fire resistance for ceiling (roof) structures:
ČSN 73 0821 Building fire safety – Building structures fire resistance
ČSN P ENV 1992-1-2 Design of concrete structures – Part 1.2: Design according to the influence of fire
ČSN P ENV 1993-1-2 Design of steel structures – Part 1.2: Design according to the influence of fire
ČSN P ENV 1994-1-2 Design of reinforced concrete structures– Part 1.2: Design according to the influence of fire
ČSN P ENV 1995-1-2 Design of wooden structures – Part 1.2: Design according to the influence of fire

For more detailed information about individual structures, namely in wooden and steel ceiling (roof) structures, please refer to the following chapters.
Calculation of fire resistance for concrete ceiling (roof) structures is not specified in this document due to their generally high resistance value (additional protection of concrete structures is scarcely required); to determine the value please refer to the tables in standards ČSN 73 0821, ČSN P ENV 1992-1-2.

9.3.3.1 Fire Proof Lower Ceiling Under a Wooden Structure

When calculating the fire resistance of a wooden ceiling (roof) structure, the whole structure must be taken in account, i.e. including the layers above the decking (of ceiling) – e.g. insulation, filling, floor covering (roof covering), which also contribute to the structural integrity.
A simple method to determine the fire resistance of a wooden ceiling- roof (timber structure with decking) is to take into account the lower value for fire resistance: of bearing timber (joist timber) and the fire resistance of plank decking.
Table № 17 is used to determine the fire resistance of wooden ceilings. As the thickness of the decking is usually very high, the fire resistance of the whole wooden ceiling (roof) structure will be governed by the decking. The type of decking also plays an important role – the integrity of the decking depends highly on the connections between the planks; full thickness is evaluated only if joints are covered with lathes.
The values of fire resistance in this document are given for the most common structures (with the minimum fire resistance for the ceiling – roof structure), for more details please refer to the Czech standards ČSN 73 0821 and ČSN P ENV 1995-1-2.

Table № 17 – Fire resistance of wooden bearing elements (copied from ČSN 73 0821)

ELEMENT NAME, DESIGN	FIRE RESISTANCE IN MINUTES
Wooden girders (ceiling beams), bending stress, not protected from three sides:	
a) min. width 100 mm, min. height 140 mm	25
b) min. width 120 mm, min. height 160 mm	30
c) min. width 140 mm, min. height 200 mm	40
d) min. width 180 mm, min. height 260 mm	50

Remark: Fire resistance of wooden girders is determined for girders of full cross sections, using soft wood class I – II is assumed (spruce, pine, fir).

Table № 18 – Fire resistance of wooden decking (according ČSN P ENV 1995-1-2)

DECKING THICKNESS (mm)	FIRE RESISTANCE (FAILURE IN PLANKS) IN MINUTES ACCORDING TO DESIGN:			
	Planks with tight joints [1]	Connection to rebate [1]	Tongue and groove connection [1]	With lathe covered joints [2]
20	4.4	6.7	8.9	18.2
25	6.2	9.3	12.4	27.1
30	8.2	12.2	16.3	36.8
35	10.3	15.4	20.6	47.5
40	12.6	18.9	25.2	58.9

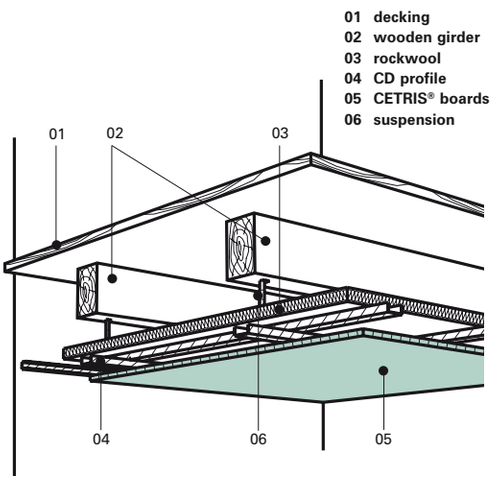
Remarks to table № 18:
1) Fire resistance is determined by the time taken for the connections (joints) in the planks to be damaged
2) Fire resistance is determined by the time taken for the whole cross section to be damaged

Example:
An existing wooden slab ceiling has girders with a 140 × 160 mm cross section and full decking with tongue and groove connections from planks of a 25 mm thickness, the fire resistance value after modification (with the lower ceiling) should reach 30 minutes.

Process steps:
1. Use the tables to determine the fire resistance of the existing wooden ceiling structure as the lower of the two values:
- *Fire resistance for girders (joist) – 30 minutes.*
- *Fire resistance for decking, with a thickness of 25 mm and a tongue and groove connection – 12 minutes*

Therefore the fire resistance of the existing ceiling is 12 minutes.

2. Design of the lower ceiling structure
The fire resistance of the lower ceiling = the required fire resistance – fire resistance of the existing structure i.e. 30 – 12 = 18 minutes; a structure covered with 1 layer of CETRIS® thickness 12 mm with a fire resistance of EI 21 D1 will suffice.



9.3.3.2 Fire Proof Lower Ceiling Under a Steel (reinforced concrete) Structure

The fire resistance – the effectiveness of protection and the ability to resist fire – for steel structures is determined by their shape or the ratio between the perimeter of the steel structure exposed to fire O (in mm) and the cross section surface of the steel structure A (in mm²) together with the protection type of the girders (unprotected, protected – cover, paint etc.).

The fire resistance values in this document are given for the most common structures (with a minimum fire resistance for a ceiling – roof structure), for more details please refer to Czech standards ČSN 73 0821, ČSN P ENV 1993-1-2.

Table № 19 is used to determine fire resistance for ceilings from steel girders (unprotected), which are exposed to the influence of fire from three sides:

DESCRIPTION OF STRUCTURE, DESIGN	FIRE RESISTANCE IN MINUTES AT RATIO O/A*10³ (m⁻¹)	
	>100 <150	>150 <300
Ceiling from unprotected steel girders, exposed to fire from 3 sides	15	10

Fire resistance of a structure from unprotected cold-drawn sheets

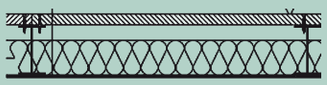
ELEMENT DESCRIPTION, DESIGN	FIRE RESISTANCE IN MINUTES
Sheet filled with concrete class B20, thickness min. 40 mm, without additional reinforcement	20
Sheet filled with concrete class B20, thickness min. 40 mm, with additional reinforcement (surface min. 15 % of sheet cross section, covering 30 mm)	45

9.4 Horizontal Constructions – Ceilings and Floors

9.4.1 Introduction

Horizontal constructions (ceilings, roofs, floor constructions) are usually loaded by heat from below. The required fire resistance is typically ensured by lower ceilings (for more details please refer to chapter 9.3 Horizontal constructions lower ceilings). The Cement particleboards CETRIS® help protect the horizontal constructions against heat exposure from above. This type of fire proofing is typical mainly for ceiling and floor constructions representing a horizontal barrier between floors.

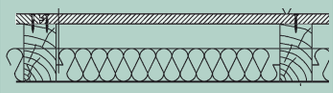
Ceiling constructions (steel bearing constructions) – fire load from above

DIAGRAM	Thickness of CETRIS® top cover d (mm)	Axial distance of bearing profiles[1] (mm)	Rockwool		Lower ceiling type	Fire resistance[2]
			Thickness a (mm)	Volume weight (kgm⁻³)		
	22	625	80	25	Zinc coated sheet th. 0.55 mm	REI 45 RE 60
	22	625	80	25	Chipboard th.10 mm	
	22	625	80	25	Plasterboard th. 12.5 mm	
	18	420	80	25	Zinc coated sheet th. 0.55 mm	

Remarks for the table:

1) Test using steel I-profiles 140 distance 4 m.
2) ČSN EN 13 501-2, constructions tested as per ČSN EN 1365-1 and ČSN EN 1364-2 under a reduced vertical load of 100 kg/m².

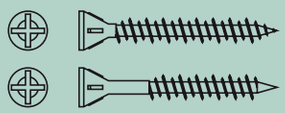
Ceiling constructions[3] (wooden bearing constructions) – fire load from above

DIAGRAM	Thickness of CETRIS® top cover d (mm)	Axial distance of bearing profiles[1] (mm)	Rockwool		Lower ceiling type	Fire resistance[2]
			Thickness (mm)	Volume weight (kgm⁻³)		
	22	625	80	25	Wooden lathes 50 × 30 mm (axial 500 mm) for fixing all types of ceilings	REI 45 RE 30
	2 × 12	625	80	25		

Remarks for the table:

1) Test using wooden beams 80 × 140 mm (spruce wood) distance 4 m.
2) Classification of limiting fire resistance values according to ČSN EN 13 501-2, constructions tested as per ČSN EN 1365-1 and ČSN EN 1364-2 under reduced vertical load of 100 kg/m².
3) May also be used as a floor construction.

Materials for fire proof constructions

DESCRIPTION	PICTURE/DIAGRAM	REMARK
CETRIS® Basic, PD (PDB) Board Cement particleboard, smooth surface, cement grey. Basic size 1,250 × 3,350 mm. Volume weight 1,320 ±70 kgm^{-3}.		Thickness according to the fire resistance. Floor board CETRIS® PD (PDB) – Tongue and groove along the perimeter.
Screws 4.2 × 45, 55 mm Self-tapping flush screws.		For fixing CETRIS® boards onto the bearing construction.
ORSIL (ISOVER) Orstrop Rockwool th. 80 mm, Volume weight 25 kgm^{-3}.		An alternative type of rockwool may be used providing the volume weight is the same, fire reaction at least A2 (as per EN 13501-1).

9.4.2 General Rules for Installation

For complete instructions for installation floor systems please see chapter 7 Floor systems. This part of the document deals with the most important rules:

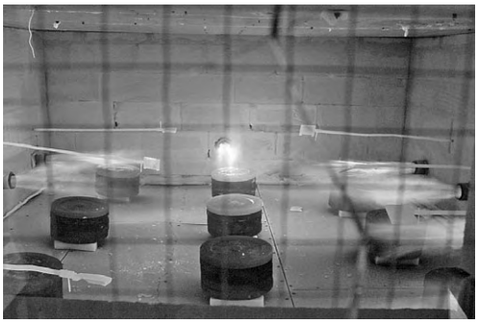
- Maximum distances between the screws fixing the CETRIS® boards onto the beams must not exceed 300 mm. Minimum distance from the edge is 25 mm. The screw length must be at least 20 mm longer than the thickness of the fixed board (steel construction) or 30 mm (wooden construction). When laying two layers of CETRIS® boards, each layer has to be laid separately.

- In ceiling/ floor constructions, the CETRIS® boards are laid without gaps. The tongues and grooves of floor boards CETRIS® PD (or PDB) must be treated with dispersion glue – e.g. Uzin MK 33, Henkel Ponal etc. When using CETRIS® boards without edges (tongue and groove), the grout must be fitted with a row of CETRIS® boards of the same thickness. Minimum row width is 100 mm, maximum distance between the fixing screws is 200 mm.

- The boards must be laid in a way preventing occurrence of cross joints – the boards must overlap by at least 625 mm. Minimum size of cut board is 250 mm. CETRIS® boards are laid with their longer side perpendicular to the beams.

- Filling of ceiling cavity – rockwool – must be carried out over the whole area, the required thickness must be observed.

- All grouting – adjacent to the ceiling and floor constructions – must be sealed with rockwool.



9.5 Covering Steel Constructions with CETRIS® Cement Particleboards

9.5.1 Introduction

Steel is an inorganic material, which classifies it as a non-flammable material with no testing requirements. If exposed to fire and high temperatures (increase by 550° C after 5 minutes), a steel construction element loses its loading capacity after several minutes, which leads to a decrease in the constructions stability. Therefore it is necessary to protect all steel construction parts in an appropriate way if fire resistance is required.

Cover from CETRIS® boards ensures the critical temperature of the steel component is reached after the specific time. Steel constructions may be covered with CETRIS® particleboards applied directly onto the steel cross-section or using an auxiliary construction.

Selected thicknesses of a CETRIS® particleboard used for protecting a steel construction depends mainly on the following three aspects:

- Length of the required protection – fire resistance in minutes
- Design temperature
- Cross-sectional ratio A_p/V

Length of the required protection (fire resistance) is accounted in the following categories: 15, 30, 45, 60, 90, 120, 180 and 240 minutes.

Design temperature depends on the intensity of loading in the element (cross-section ratio under regular temperature θ_D). If not stated otherwise, the value of 500° C is used, which conforms a cross-sectional ratio of between 0.78 – 0.80.

For more detailed information to determine the cross-sectional ratio please refer to ČSN EN 1993-1-2 Euro-code 3: Design of steel constructions – pt. 1 – 2: General guidelines – Design of constructions regarding their fire proof properties, chapter 4.2.4.

The cross section is described by the A_p/V ratio – **cross-section ratio of a protected steel profile** (O/A ratio used in the past).

The A_p/V ratio represents:

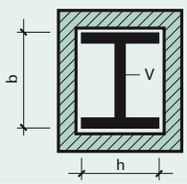
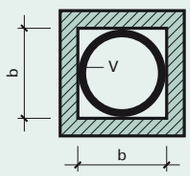
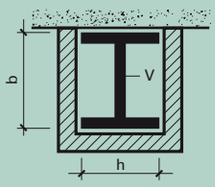
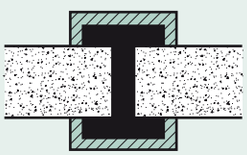
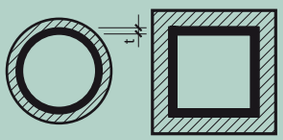
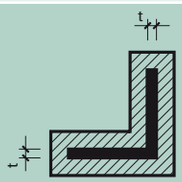
A_p .... **perimeter** of the protected steel profile in cm (formerly marked O).

V ..... **area** of the steel profile cross-section in cm^2 (formerly marked A).

When calculating the heated perimeter value, consider only the parts of the steel construction exposed to fire (all sides of columns, three sides of girders) – see the table below.

This factor plays an important part – fine profiles (with a high cross-section ratio A_p/V) show a faster increase towards the critical temperature, therefore such profiles must be protected with a thicker cover.

9.5.2 Calculating the A_p/V Ratio

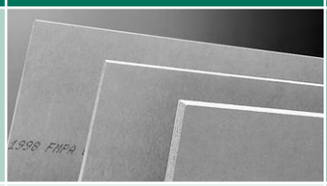
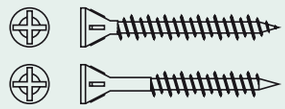
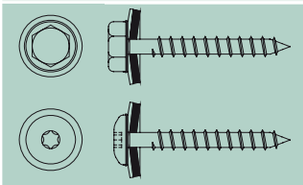
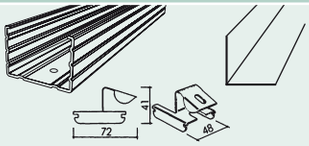
CROSS SECTION SHAPE	FIRE LOAD	A_P/V (m^{-1})	CROSS SECTION SHAPE	FIRE LOAD	A_P/V (m^{-1})
	From four sides	$1000 \frac{2b + 2h}{V}$		From four sides	$1000 \frac{4b}{V}$
	From three sides	$1000 \frac{b + 2h}{V}$		From four sides	$\frac{2000}{t}$
	From four sides	$1000 \frac{O}{V}$		From four sides	$\frac{1000}{t}$
	From four sides	$\frac{1000}{t}$		From four sides	$\frac{2000}{t}$

Cross-section sizes **b**, **h**, **t** are expressed in mm, cross-section area **V** in mm^2.

Applications of the CETRIS® Boards for fire protection

According to European Standards

Materials for fire proof constructions

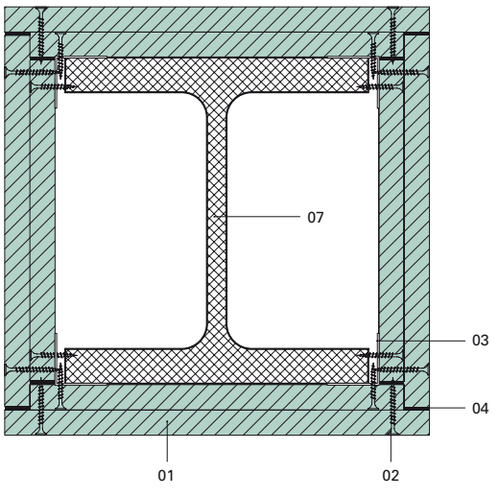
DESCRIPTION	PICTURE/ DIAGRAM	REMARK
CETRIS® Basic, PD (PDB) board Cement particleboard, smooth surface, cement grey. Basic size 1,250 × 3,350 mm, Volume weight 1,320 ±70 kgm^{-3}.		Thickness as per the fire resistance requirements (maximum 24 mm).
Screw 4.2 × 25, 35, 45, 55 mm Self-tapping flush screws.		Screws type (length) according to the board thickness. Suitable for interior and external use (fixing bottom layers)
Screw 4.8 × 38, 45, 55 mm Stainless steel or plated button-headed or hexagonal screws with washers.		Screws type (length) according to the board thickness. Designed for fixing CETRIS® boards for external use. **Board must have pre-drilled holes of min. 8 mm!**
Auxiliary constructions Zinc coated steel profiles CD 60 × 27 × 0.6 mm L 50 × 50 × 0.6 mm Fixture for "I" shape girders		Creating auxiliary constructions for application of boards. Profiles or fixtures are applied onto the cross-section using screws or bolts.
Mastic DEXAFLAMM-R White material for filling of grouting and covering screw heads.		Fireproof single-phase mastic may be used as an alternative (acrylic or silicone) with permanent plasticity (Den Braven Pyrocryl).

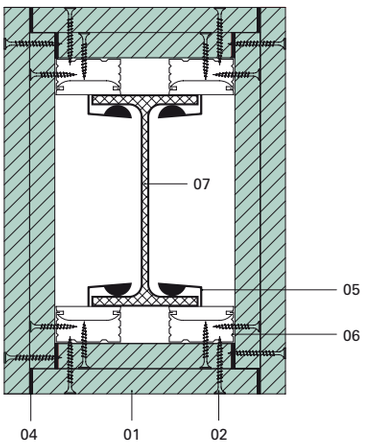
9.5.3 Types of Covering (directly, on an auxiliary construction)

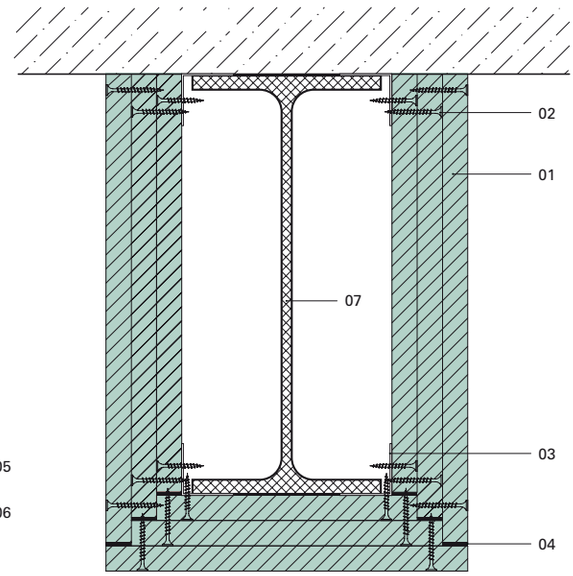
A cover of CETRIS® particleboards may be applied directly onto the steel profile – to facilitate easier fixing of the CETRIS® boards protecting the prop, we recommend using an auxiliary L profile 50 × 50 × 0.6 mm. The profile is laid directly onto the strip, approx. 6 mm from the profile edge – the gap serves for inserting the screw fixing the top CETRIS® board (protecting the profile strip).

Alternatively, cover from CETRIS® particleboards may also be applied onto the auxiliary construction – e.g. on CD profiles fixed on the I-girders using fixtures or suspensions.

01 cover from CETRIS® boards
02 screw 4.2 × 25 (35, 45, 55) mm
03 auxiliary 'L' profile 50 × 50 × 0.6 mm
04 mastic Dexaflamm R
05 fixture for the "I" girder
06 CD profile 60 × 27 × 0.6 mm
07 protected steel cross section







9.5.4 Dimension Tables

Fire resistance classification R 15

PROFILE TYPE	OPEN PROFILE (I, U, L…)									CLOSED PROFILE (□, ○,…)								
Design temperature	350	400	450	500	550	600	650	700	750	350	400	450	500	550	600	650	700	750
Ap / V	Thickness of a CETRIS® board necessary to keep the steel temperature under the designed value (mm)																	
44	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
80	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
120	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
160	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
200	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
240	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
280	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
320	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
360	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
400	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12
440	10	10	10	10	10	10	10	10	10	12	12	12	12	12	12	12	12	12

Applications of the CETRIS® Boards for fire protection

According to European Standards

Fire resistance classification R 30

PROFILE TYPE	OPEN PROFILE (I, U, L,...)									CLOSED PROFILE (□, ○,...)								
Design temperature	350	400	450	500	550	600	650	700	750	350	400	450	500	550	600	650	700	750
Ap / V	Thickness of a CETRIS® board necessary to keep the steel temperature under the designed value (mm)																	
44	12	10	10	10	10	10	10	10	10	12	12	10	10	10	10	10	10	10
80	14	12	10	10	10	10	10	10	10	16	14	12	12	12	12	12	12	12
120	16	14	12	10	10	10	10	10	10	18	16	14	12	12	12	12	12	12
160	16	14	12	10	10	10	10	10	10	20	18	14	12	12	12	12	12	12
200	18	16	14	12	10	10	10	10	10	22	18	16	14	12	12	12	12	12
240	18	16	14	12	10	10	10	10	10	22	20	18	14	12	12	12	12	12
280	18	16	14	12	10	10	10	10	10	22	20	18	14	12	12	12	12	12
320	18	16	14	12	10	10	10	10	10	24	20	18	14	12	12	12	12	12
360	18	16	14	12	10	10	10	10	10	24	20	18	16	12	12	12	12	12
400	18	16	14	12	10	10	10	10	10	24	20	18	16	14	12	12	12	12
440	18	16	14	12	10	10	10	10	10	24	20	18	16	14	12	12	12	12

Fire resistance classification R 45

PROFILE TYPE	OPEN PROFILE (I, U, L,...)									CLOSED PROFILE (□, ○,...)								
Design temperature	350	400	450	500	550	600	650	700	750	350	400	450	500	550	600	650	700	750
Ap / V	Thickness of a CETRIS® board necessary to keep the steel temperature under the designed value (mm)																	
44	16	16	14	12	10	10	10	10	10	18	16	14	14	12	10	10	10	10
80	22	20	18	16	14	12	10	10	10	24	22	20	18	16	14	12	12	12
120	24	22	20	18	16	14	12	10	10	26	24	22	20	18	16	14	12	12
160	26	24	22	20	18	16	14	12	10	30	28	26	24	20	18	16	14	12
200	26	24	22	20	18	16	14	12	10	32	30	28	24	22	20	18	16	12
240	28	24	22	20	18	16	14	12	10	34	30	28	26	24	20	18	16	14
280	28	26	24	22	20	18	16	12	12	34	32	30	28	24	22	20	16	14
320	28	26	24	22	20	18	16	14	12	36	34	30	28	24	22	20	18	14
360	28	26	24	22	20	18	16	14	12	36	34	30	28	24	22	20	18	14
400	28	26	24	22	20	18	16	14	12	36	34	30	28	26	22	20	18	14
440	30	26	24	22	20	18	16	14	12	38	34	30	28	26	24	20	18	14

Fire resistance classification R 60

PROFILE TYPE	OPEN PROFILE (I, U, L,...)									CLOSED PROFILE (□, ○,...)								
Design temperature	350	400	450	500	550	600	650	700	750	350	400	450	500	550	600	650	700	750
Ap / V	Thickness of a CETRIS® board necessary to keep the steel temperature under the designed value (mm)																	
44	22	20	18	18	16	14	12	12	10	24	22	20	18	16	16	14	12	10
80	28	26	24	22	20	18	18	16	14	32	30	26	24	22	20	20	18	16
120	32	30	28	26	24	22	20	18	16	36	34	32	28	26	24	22	22	18
160	34	32	30	28	26	24	22	20	18	40	36	34	32	30	28	26	24	20
200	36	34	32	30	26	24	22	20	18	42	40	38	36	32	30	28	24	22
240	36	34	32	30	28	26	24	22	20	46	44	40	38	34	32	30	28	24
280	38	36	32	30	28	26	24	22	20	48	44	40	38	36	34	30	28	26
320	38	36	34	32	30	26	24	22	20	48	44	42	40	38	34	30	28	26
360	38	36	34	32	30	28	26	24	20	48	46	44	40	38	34	32	30	26
400	40	36	34	32	30	28	26	24	22	50	46	44	40	38	34	32	30	28
440	40	38	34	32	30	28	26	24	22	50	48	44	40	38	36	32	30	28

Fire resistance classification R 90

PROFILE TYPE	OPEN PROFILE (I, U, L,...)									CLOSED PROFILE (□, ○,...)								
Design temperature	350	400	450	500	550	600	650	700	750	350	400	450	500	550	600	650	700	750
Ap / V	Thickness of a CETRIS® board necessary to keep the steel temperature under the designed value (mm)																	
44	32	32	30	28	26	24	24	22	20	34	34	32	30	28	26	26	22	20
80	42	40	38	36	34	32	30	28	28	46	44	42	40	38	36	34	32	30
120	48	46	44	42	40	38	36	34	32	54	52	50	46	44	42	40	38	36
160	52	50	48	44	42	40	38	36	34	60	58	56	52	50	48	46	42	40
200	54	52	50	48	44	42	40	38	36	64	62	60	58	54	52	48	46	44
240	56	54	50	48	46	44	42	40	38	70	68	64	60	58	56	52	50	48
280	58	54	52	50	48	46	42	40	38	72	68	66	62	60	58	54	50	48
320	58	56	54	50	48	46	44	42	40	74	70	68	64	60	58	54	52	50
360	58	56	54	52	50	46	44	42	40	74	70	68	64	62	58	56	54	50
400	60	58	54	52	50	48	46	42	40	74	72	68	66	62	60	58	54	50
440	60	58	56	52	50	48	46	44	40	76	72	70	66	64	60	58	54	50

Fire resistance classification R 120

PROFILE TYPE	OPEN PROFILE (I, U, L,...)									CLOSED PROFILE (□, ○,...)								
Design temperature	350	400	450	500	550	600	650	700	750	350	400	450	500	550	600	650	700	750
Ap / V	Thickness of a CETRIS® board necessary to keep the steel temperature under the designed value (mm)																	
44	44	42	40	38	36	34	34	32	30	46	44	42	40	38	36	36	34	32
80	56	54	52	50	48	46	44	42	40	62	60	58	54	52	50	48	46	44
120	64	62	60	58	56	54	52	48	46	72	70	68	64	62	60	58	54	52
160	68	66	64	62	60	58	56	52	50	-	-	76	72	70	68	64	62	58
200	72	70	68	66	62	60	58	56	54	-	-	-	-	76	72	70	66	64
240	74	72	70	68	64	62	60	58	56	-	-	-	-	-	-	76	72	70
280	-	74	72	68	66	64	62	60	56	-	-	-	-	-	-	-	74	70
320	-	76	72	70	68	66	62	60	58	-	-	-	-	-	-	-	76	74
360	-	-	74	72	68	66	64	62	58	-	-	-	-	-	-	-	-	74
400	-	-	74	72	70	68	64	62	60	-	-	-	-	-	-	-	-	74
440	-	-	76	72	70	68	66	62	60	-	-	-	-	-	-	-	-	76

Fire resistance classification R 180

PROFILE TYPE	OPEN PROFILE (I, U, L,...)									CLOSED PROFILE (□, ○,...)								
Design temperature	350	400	450	500	550	600	650	700	750	350	400	450	500	550	600	650	700	750
Ap / V	Thickness of a CETRIS® board necessary to keep the steel temperature under the designed value (mm)																	
44	64	62	62	60	58	56	54	52	50	68	66	64	62	60	58	56	56	54
80	-	-	-	-	76	74	72	70	68	-	-	-	-	-	-	-	-	74

Remarks for the table:

- Values calculated for the minimum cross-section ratio may also be used for profiles with a lower cross-section ratio.
- Dimension tables apply to all classes of steel excluding steel class S 185 and all types of steel marked E (as per EN 10 025 and/or EN 10 113).

9.5.5 General Rules for the Installation of the Covers

- Maximum thickness of the CETRIS® board to use is 24 mm; any exceeding thickness must be made of multiple layers of boards with a single minimum thickness 24 mm.

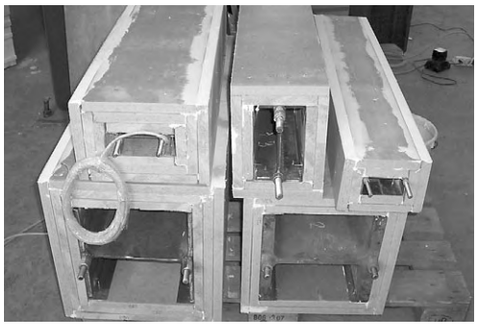
- Maximum screw spacing must not exceed 400 mm, which must be decreased to 200 mm when using CETRIS® boards with a maximum thickness of 14 mm. The minimum distance from the edge is 25 mm. The screw must be at least 10 mm longer than the thickness of the fixed board. For multiple layers, use screws that are a min 5 mm longer than the thickness of the two layers being fixed.

- When fixing interior areas and for bottom layers of the external cover from CETRIS® use flush screws. Use button headed or hexagonal screws with washers for fixing the top layer from CETRIS® boards outside. The CETRIS® boards must be pre-drilled (min diam. 8 mm) and the holes filled with fireproof mastic DEXAFLAMM-R.

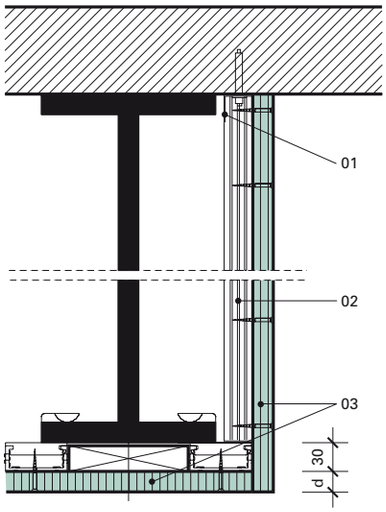
- Grouting of a multiple layer cover must overlap by at least 400 mm preventing occurrence of cross joints.

- Grouting in a single layer not touching the steel profile must be filled with a strip of CETRIS® with the same thickness as the cover. Minimum strip width of 100 mm; maximum spacing of screws fixing the strip is 200 mm.

- All grout between CETRIS® boards width 3 – 10 mm, joint areas of walls and corner joints must be filled with mastic Dexaflamm-R.

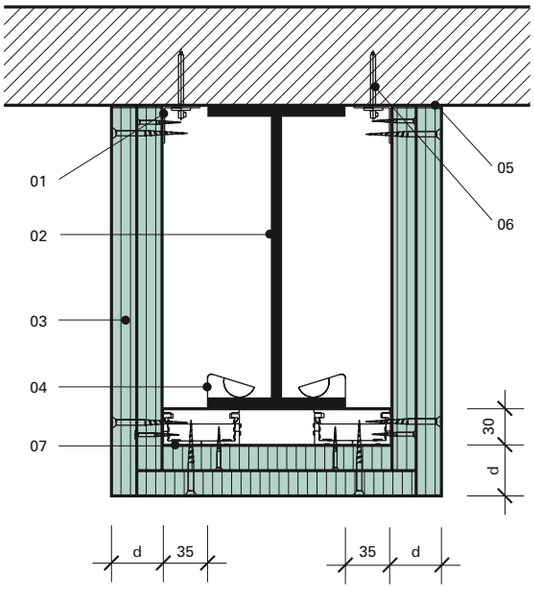


Cross-sectional view



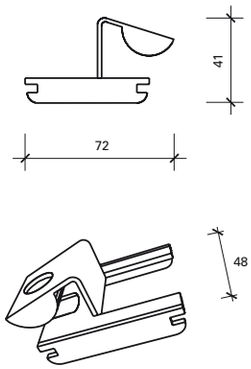
01 UD profile 28 × 27 × 0.6 mm
02 CD profile 60 × 27 × 0,6 mm, spacing 400 to 600 mm, as per the girder height and in the grouting
03 cement particle-boards CETRIS®

Cross-sectional view

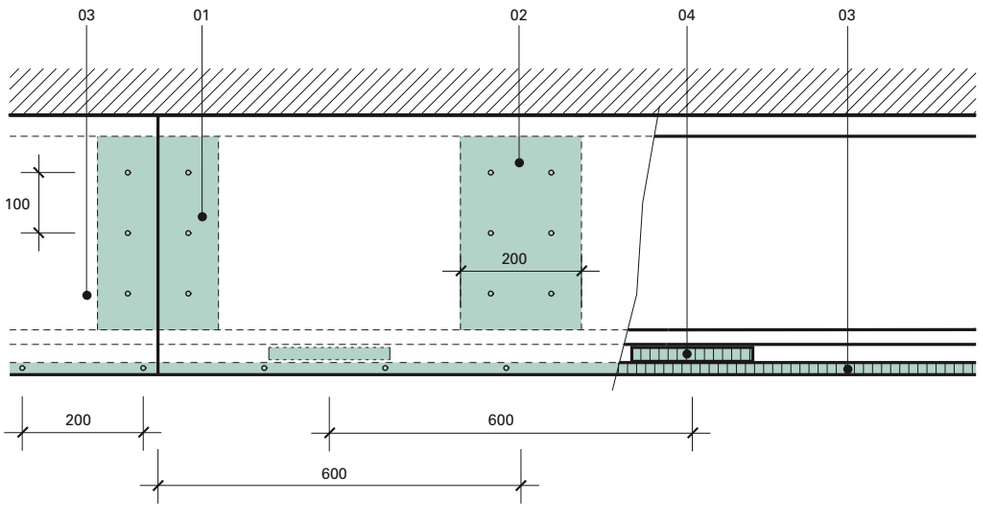


01 angle 50 × 50 × 0.6 mm
02 steel girder
03 cement particle-boards CETRIS® covering grout
04 Knauf® fixtures
05 filled with Dexaflamm R
06 steel dowel incl. screw
07 CD 60 × 27 × 0.6 mm

KNAUF fixture



Lengthwise view

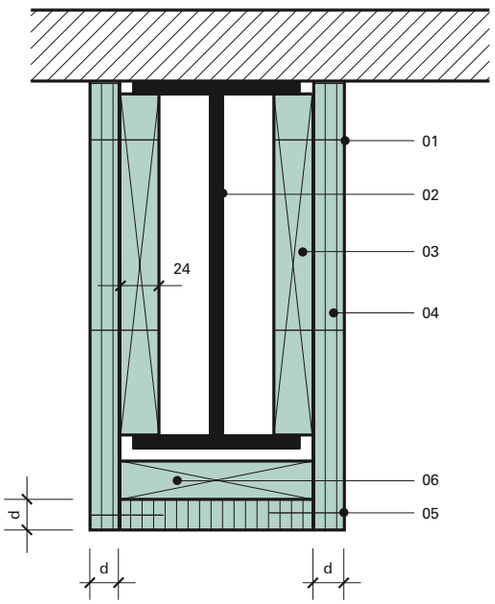


01 particle-board CETRIS® under grout
02 insert from cement particle-boards CETRIS®
03 CETRIS® particle-board
04 row of cement particle-boards CETRIS®

Applications of the CETRIS® Boards for fire protection

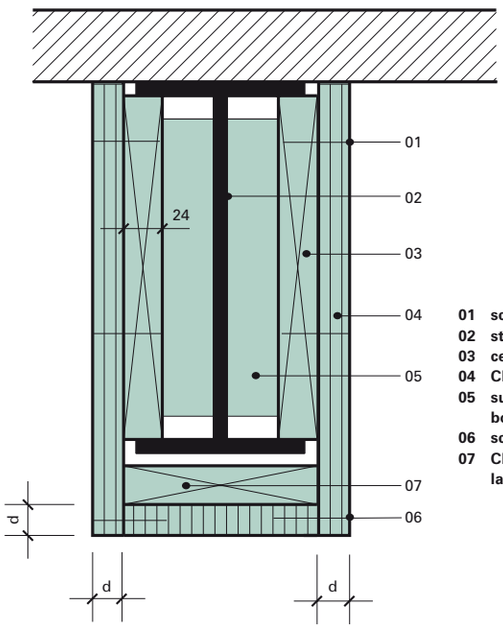
According to European Standards

Cross-sectional view



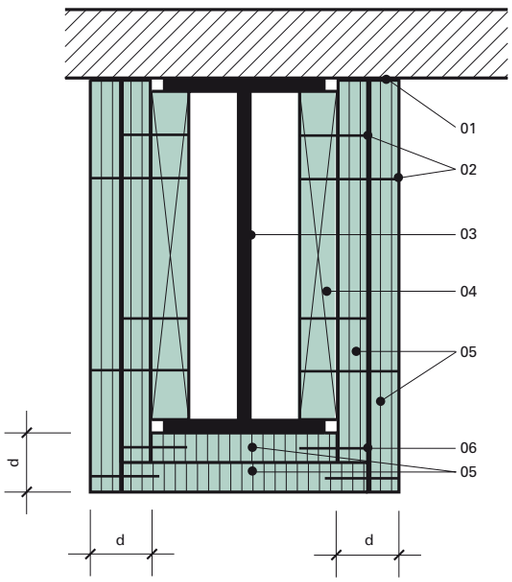
01 screws
02 steel girder
03 insert from CETRIS® particle-board
04 CETRIS® particle-board
05 screws
06 CETRIS® board only for a single layer to cover the grout

Cross-sectional view



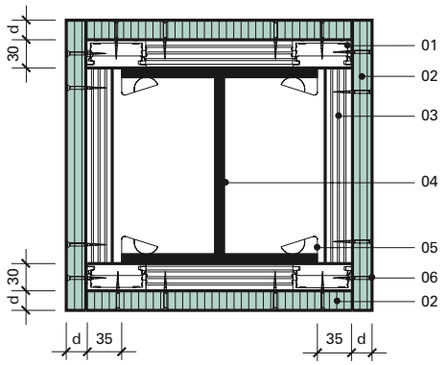
01 screws
02 steel girder
03 cement particle-boards CETRIS®
04 CETRIS® cement particle-board
05 supporting cement particle-boards CETRIS®
06 screws
07 CETRIS® board only for a single layer to cover the grout

Cross-sectional view



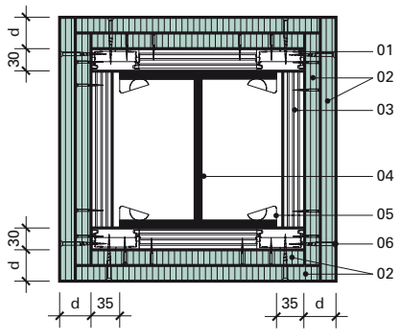
01 laid in Dexaflamm R mastic
02 screws
03 steel girder
04 insert from cement particle-boards CETRIS®
05 cement particle-boards CETRIS® (grout overlap by min. 50 mm)
06 screws

Horizontal view



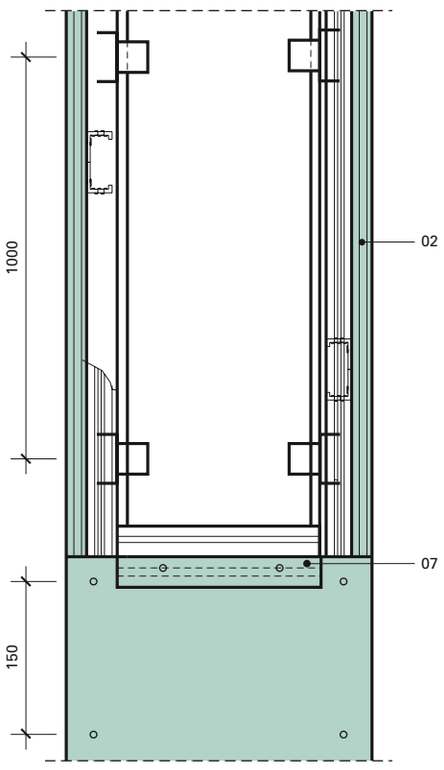
01 CD profile 60 × 27 × 0.6 mm
02 CETRIS® board
03 CD profile 60 × 27 × 0.6 mm (under grout)
04 steel column
05 Knauf fixtures
06 screws
07 CD profile 60 × 27 × 0.6 mm (under grout)

Horizontal view

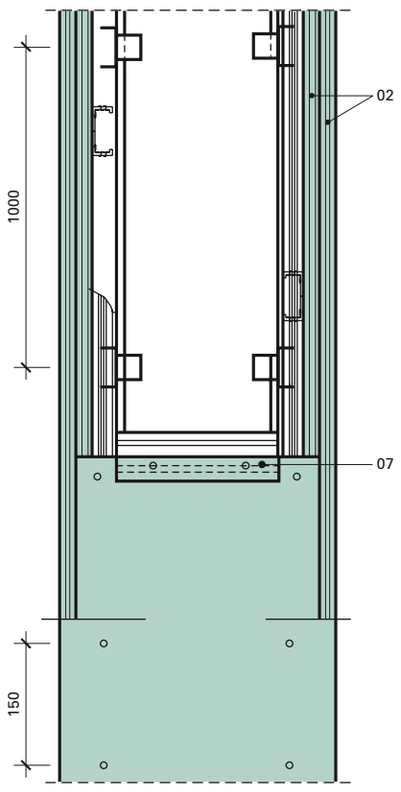


01 CD profile 60 × 27 × 0.6 mm
02 CETRIS® board (overlapping grout)
03 CD profile 60 × 27 × 0.6 mm (under grout)
04 steel column
05 Knauf fixtures
06 screws
07 CD profile 60 × 27 × 0.6 mm (under grout)

Vertical view



Vertical view



All values in mm

9.6 Wall and Ceiling Covers with Fire Proof Properties

As an addition, the CETRIS® cement particle-boards are tested for fire proof properties in order to protect flammable materials. This application is described in the testing and classification standards as the covering for walls and ceilings with fire proof properties – covering flammable parts of constructions. This requirement is applicable especially for wooden constructions in Western European countries.

The term "covering" refers to the outer part of a vertical element (e.g. walls, dividers, perimeter walls) as well as the bottom part of a horizontal element or an element with a drop angle (e.g. ceilings and roofs). The aim of the covering is to protect flammable materials against combustion.
Cover class K protects the material underneath against ignition, charring or any other damage for a specific time. The cover also prevents occurrence of fire on both sides at the same time. Additional fire reaction requirements may be applied.

9.6.1 Test Procedure for Fire Proof Covers

For test procedures to determine the ability of the cover to protect flammable materials underneath during a specific exposure time, please refer to EN 14 135 Covers, "Fire proof properties".
Fix the cover onto a bottom side of a horizontal flammable bases, place in a furnace and expose to preset standard temperature and pressure from below.
for the test purpose, covered (flammable) materials with a minimum density of 300 kg/m³ are represented by a 19 mm thick chipboard with a minimum density of 680 kg/m³ not treated with retarding agent (fire proofed).
The tested cover is applied onto a standard horizontal construction - wooden top planks 45 × 95 mm (approx 600 mm) and 19 (±2 mm) thick chipboard – forming a full ceiling.
The cover may be applied directly onto the DTD (without cavity) or on auxiliary lathes (with cavity).
Temperature increases on the bottom of the flammable basis is recorded. The cover is monitored; time when damage occurs is recorded. Damage to the cover and the bases are Recorded at the end of the test.
The covers are intended to protect the materials underneath and prevent fire in the cavities provided that the cover or its part does not deform during the test time (e.g. 10, 30 or 60 minutes) according to EN 14 135 and the fire does not reach any cavity in the cover.

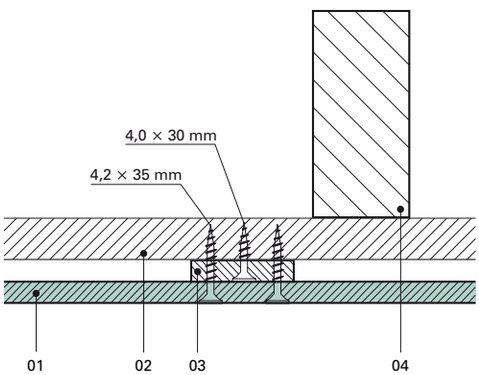
The following criteria are fulfilled for the specified time:
- average temperature measured at the bottom of the chipboard and average temperature on the unexposed side of the cover does not exceed the initial temperature by more than 250 °C, and maximum temperature measured anywhere on the elements does not exceed the initial temperature by more than 270 °C,
- any part of the bottom of the chipboard or the unexposed side of the cover must not ignite or char. Melting and shrinking is considered damage, whereas discolouring not.

9.6.2 Layers of the Cement Particle-board CETRIS® with Fireproof Properties

Cement particle-board CETRIS® are approved for installation onto flammable parts of constructions with the following composition:

LAYER COMPOSITION	CAVITY	AUXILIARY CONSTRUCTION	RESISTANCE	CLASS
CETRIS® boards without bonding 10 mm	10 mm	Wooden planks 70 × 10 mm	10 minutes	K 10

01 cement particle-board CETRIS®
02 chipboard 19 mm
03 wooden planks 10 × 70 mm
04 wooden girder 49 × 95 mm



9.6.3 General Rules for Laying Cement Particle-boards CETRIS® with Fireproof Properties

- The CETRIS® boards must be laid to prevent occurrence of cross joints
- The CETRIS® boards are laid side-by-side without joints along the perimeter of the construction. If the area exceeds 6 × 6 m, a joint with a minimum 15 mm width must be made, a row of CETRIS® boards of the same thickness as the layer (10 mm) width minimum 150 mm is laid underneath.
- Maximum distance between the screws holding the CETRIS® board with a thickness of 10 mm, must not exceed 200 mm (along the edge) or 400 mm (on the surface), their minimum distance from the edge is 25 mm
- Minimum length of screws holding the CETRIS® boards is 35 mm
- All joints of CETRIS® boards are located on wooden lathes
- Maximum distance between the wooden lathes is 625 mm, minimum lath width 70 mm
- Minimum cavity height (lath thickness) is 10 mm.

9.7 Summary of fire classification testimonials and certificates

CERTIFIKÁT SYSTÉMU MANAGEMENTU JAKOSTI

Potvrzujeme, že systém managementu jakosti společnosti:

CIDEM HRANICE, a. s.
Hranice
Česká republika

byl schválen společností Lloyd's Register Quality Assurance podle následujících standardů systému managementu jakosti:

EN ISO 9001:2000 BS EN ISO 9001:2000
ČSN EN ISO 9001:2001 DIN EN ISO 9001:2000

Systém managementu jakosti zahrnuje činnosti:

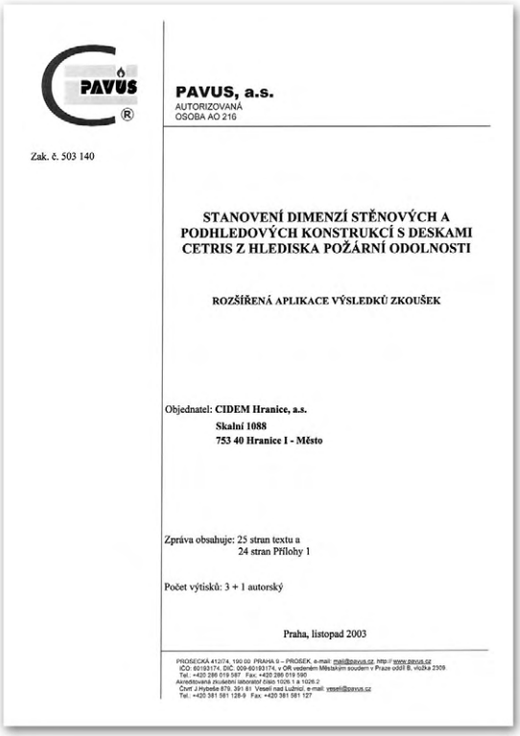
Výroba cementotřískových desek.

Certifikát č.: PRA 202336

První certifikát vystaven: 24. dubna 1996
Současný certifikát vystaven: 7. ledna 2004
Platnost certifikátu do: 6. ledna 2007

Vystavena v IBQA Praha

Tento dokument je vystaven za podmínek uvedených na zadní straně.



Zak. č. 503 140

PAVUS, a.s.
AUTORIZOVANÁ
OSOBA AO 216

STANOVENÍ DIMENZÍ STĚNOVÝCH A PODHLEDOVÝCH KONSTRUKCÍ S DESKAMI CETRIS Z HLEDISKA POŽÁRNÍ ODOLNOSTI

ROZŠÍŘENÁ APLIKACE VÝSLEDKŮ ZKOUŠEK

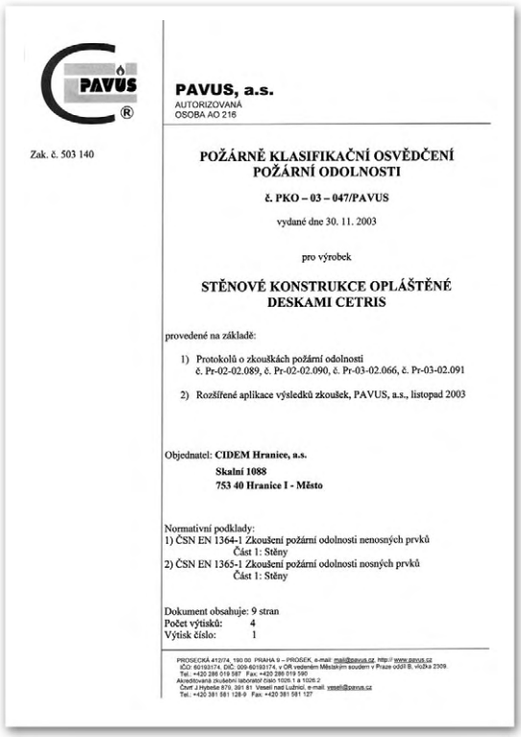
Objednatel: **CIDEM Hranice, a.s.**
Skalní 1088
753 40 Hranice I - Město

Zpráva obsahuje: 25 stran textu a
24 stran Přílohy 1

Počet výtisků: 3 + 1 autorský

Praha, listopad 2003

PROSECKÁ 412/74, 190 00 PRAHA 9 – PROSEK, e-mail: mail@pavus.cz, http:// www.pavus.cz
IČO: 60193174, DIČ: 009-60193174, v OR vedeném Městským soudem v Praze oddíl B, vložka 2309
Tel.: +420 286 019 587 Fax: +420 286 019 590
Akreditovaná zkušební laboratoř číslo 1026.1 a 1026.2
Čsrt J.Hybeše 879, 391 81 Veselí nad Lužnicí, e-mail: veseli@pavus.cz
Tel.: +420 381 581 128-9 Fax: +420 381 581 127



Zak. č. 503 140

PAVUS, a.s.
AUTORIZOVANÁ
OSOBA AO 216

POŽÁRNĚ KLASIFIKAČNÍ OSVĚDČENÍ POŽÁRNÍ ODOLNOSTI

č. PKO – 03 – 047/PAVUS

vydané dne 30. 11. 2003

pro výrobek

STĚNOVÉ KONSTRUKCE OPLÁŠTĚNÉ DESKAMI CETRIS

provedené na základě:

1) Protokolů o zkouškách požární odolnosti
č. Pr-02-02.089, č. Pr-02-02.090, č. Pr-03-02.066, č. Pr-03-02.091

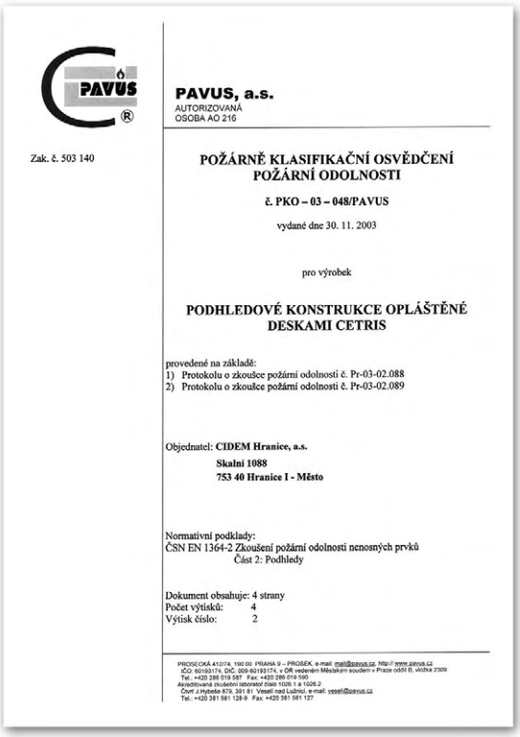
2) Rozšířené aplikace výsledků zkoušek, PAVUS, a.s., listopad 2003

Objednatel: **CIDEM Hranice, a.s.**
Skalní 1088
753 40 Hranice I - Město

Normativní podklady:
1) ČSN EN 1364-1 Zkoušení požární odolnosti nenosných prvků
Část 1: Stěny
2) ČSN EN 1365-1 Zkoušení požární odolnosti nosných prvků
Část 1: Stěny

Dokument obsahuje: 9 stran
Počet výtisků: 4
Výtisk číslo: 1

PROSECKÁ 412/74, 190 00 PRAHA 9 – PROSEK, e-mail: mail@pavus.cz, http:// www.pavus.cz
IČO: 60193174, DIČ: 009-60193174, v OR vedeném Městským soudem v Praze oddíl B, vložka 2309
Tel.: +420 286 019 587 Fax: +420 286 019 590
Akreditovaná zkušební laboratoř číslo 1026.1 a 1026.2
Čsrt J.Hybeše 879, 391 81 Veselí nad Lužnicí, e-mail: veseli@pavus.cz
Tel.: +420 381 581 128-9 Fax: +420 381 581 127



Zak. č. 503 140

PAVUS, a.s.
AUTORIZOVANÁ
OSOBA AO 216

POŽÁRNĚ KLASIFIKAČNÍ OSVĚDČENÍ POŽÁRNÍ ODOLNOSTI

č. PKO – 03 – 048/PAVUS

vydané dne 30. 11. 2003

pro výrobek

PODHLEDOVÉ KONSTRUKCE OPLÁŠTĚNÉ DESKAMI CETRIS

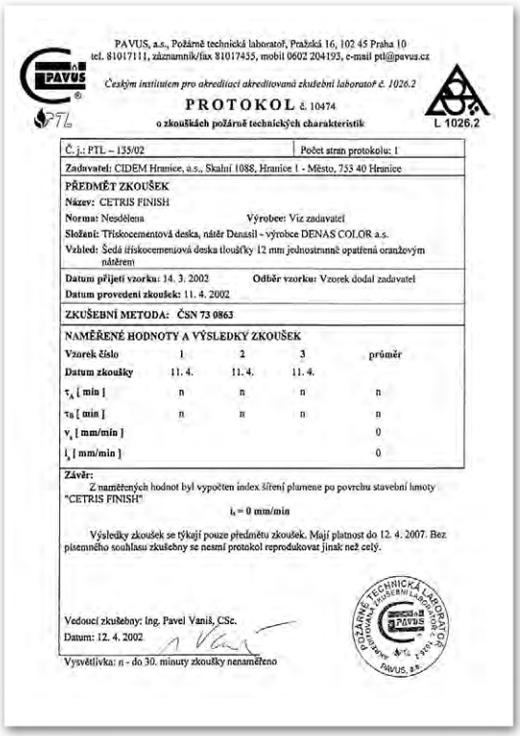
provedené na základě:
1) Protokolu o zkoušce požární odolnosti č. Pr-03-02.088
2) Protokolu o zkoušce požární odolnosti č. Pr-03-02.089

Objednatel: **CIDEM Hranice, a.s.**
Skalní 1088
753 40 Hranice I - Město

Normativní podklady:
ČSN EN 1364-2 Zkoušení požární odolnosti nenosných prvků
Část 2: Podhledy

Dokument obsahuje: 4 strany
Počet výtisků: 4
Výtisk číslo: 2

PROSECKÁ 412/74, 190 00 PRAHA 9 – PROSEK, e-mail: mail@pavus.cz, http:// www.pavus.cz
IČO: 60193174, DIČ: 009-60193174, v OR vedeném Městským soudem v Praze oddíl B, vložka 2309
Tel.: +420 286 019 587 Fax: +420 286 019 590
Akreditovaná zkušební laboratoř číslo 1026.1 a 1026.2
Čsrt J.Hybeše 879, 391 81 Veselí nad Lužnicí, e-mail: veseli@pavus.cz
Tel.: +420 381 581 128-9 Fax: +420 381 581 127



PAVUS, a.s., Požárně technická laboratoř, Pražská 16, 102 45 Praha 10
tel. 81017111, záznamník/fax 81017435, mobil 0602 204193, e-mail ptl@pavus.cz

Českým institutem pro akreditaci akreditovaná zkušební laboratoř č. 1026.2

PROTOKOL č. 10474
o zkouškách požárně technických charakteristik

L 1026.2

Č. j.: PTL – 135/02				Počet stran protokolu: 1
Zadavatel: CIDEM Hranice, a.s., Skalní 1088, Hranice 1 - Město, 753 40 Hranice				
PŘEDMĚT ZKOUŠEK				
Název: CETRIS FINISH				
Norma: Nespecifikována			**Výrobce:** Viz zadavatel	
Složení: Třískocementová deska, nátěr Denasil - výrobce DENAS COLOR a.s.				
Vzhled: Šedá třískocementová deska tloušťky 12 mm jednostranně opatřená oranžovým nátěrem				
Datum přijetí vzorku: 14. 3. 2002			**Odběr vzorku:** Vzorek dodal zadavatel	
Datum provedení zkoušek: 11. 4. 2002				
ZKUŠEBNÍ METODA: ČSN 73 0863				
NAMĚŘENÉ HODNOTY A VÝSLEDKY ZKOUŠEK				
Vzorek číslo	1	2	3	průměr
Datum zkoušky	11. 4.	11. 4.	11. 4.	
τ_A [min]	n	n	n	n
τ_B [min]	n	n	n	n
v_s [mm/min]				0
i_s [mm/min]				0

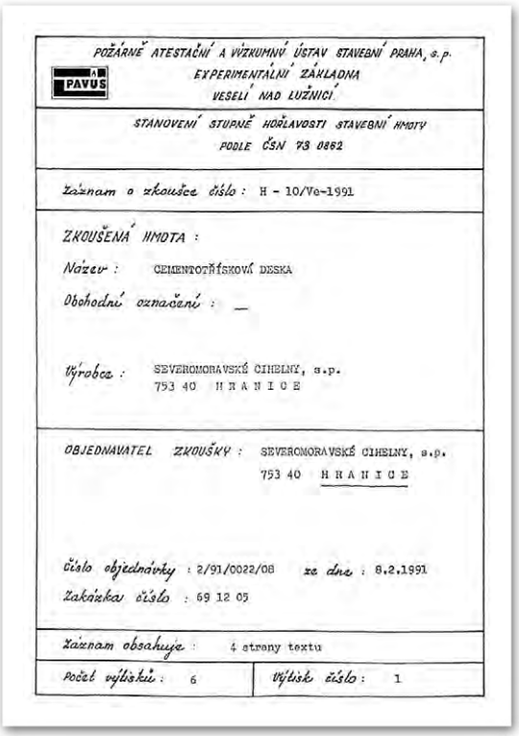
Závěr:
Z naměřených hodnot byl vypočten index šíření plamene po povrchu stavební hmoty "CETRIS FINISH"

$i_s = 0$ mm/min

Výsledky zkoušek se týkají pouze předmětu zkoušek. Mají platnost do 12. 4. 2007. Bez písemného souhlasu zkušebny se nesmí protokol reprodukovat jinak než celý.

Vedoucí zkušebny: Ing. Pavel Vaniš, CSc.
Datum: 12. 4. 2002

Vysvětlivka: n - do 30. minuty zkoušky nenaměřeno



POŽÁRNĚ ATESTAČNÍ A VÝZKUMNÝ ÚSTAV STAVEBNÍ PRAHA, s.p.
EXPERIMENTÁLNÍ ZÁKLADNA
VESELÍ NAD LUŽNICÍ

STANOVENÍ STUPNĚ HOŘLAVOSTI STAVEBNÍ HMOTY
PODLE ČSN 73 0862

Záznam o zkoušce číslo : H - 10/Ve-1991

ZKOUŠENÁ HMOTA :

Název : CEMENTOTŘÍSKOVÁ DESKA

Obchodní označení : —

Výrobce : SEVEROMORAVSKÉ CIHELNY, s.p.
753 40 H R A N I C E

OBJEDNAVATEL ZKOUŠKY : SEVEROMORAVSKÉ CIHELNY, s.p.
753 40 H R A N I C E

Číslo objednávky : 2/91/0022/08 ze dne : 8.2.1991
Zakázka číslo : 69 12 05

Záznam obsahuje : 4 strany textu

Počet výtisků : 6 | Výtisk číslo : 1