Basic Properties of CETRIS® Cement Bonded Particleboards

2.1 Basic Parameters and Properties

Table of basic physical mechanical properties	Norm values	Values achieved
Density according to ČSN EN 323	min. 1000 kg/m^3	1450 kg/m^3
Tensile bending strength acc. to ČSN EN 310	min. 9,0 N/mm^2	min. 11,5 N/mm^2
Modulus of elasticity acc. to ČSN EN 310	min. 4500 N/mm^2	min. 6800 N/mm^2
Tensile strength perpendicular to the board plane acc. to ČSN EN 319	min. 0,5 N/mm^2	min. 0,63 N/mm^2
Mass balanced moisture at 20° and relative humidity 50 % according to EN 634-1	9+/-3 %	9,5 %
Linear expansion with changes in humidity from 30% to 85 % at 20°		Max. 0,2 %
Thermal expansion coefficient pursuant to VUPS methodology		0,011 mm/m °C
Water absorption by the board when stored in water for 24 hours		max. 16 %
Thickness swelling when stored in water for 24 hours	max. 1,5 %	max. 0,28 %
Coefficient of thermal conductivity pursuant to ČSN EN 12 664		th. 8 mm – 0,200 W/mK
		th. 22 mm – 0,251 W/mK
		th. 40 mm – 0,287 W/mK
Airborne sound insulation pursuant to ČSN 73 0513		th. 8 mm – 30 dB
		th. 24 mm – 33 dB
		th. 40 mm – 35 dB
Diffusion resistance factor pursuant to ČSN EN ISO 12 572		th. 8 mm – 52,8
		th. 40 mm – 69,2
Weight activity Ra 226	150 Bq/kg	22 Bq/kg
Weight activity index	I = 0,5	I = 0,21
Internal bond after cycling in a humid environment pursuant to ČSN EN 321	min. 0,3 N/mm^2	min. 0,41 N/mm^2
Thickness swelling after cycling in a humid environment pursuant to ČSN EN 321	max. 1,5 %	max. 0,31 %
Resistance to frost at 100 cycles pursuant to ČSN EN 1328	R_L > 0,7	R_L = 0,90
Board surface resistance to water and chemical de-icing agents pursuant to ČSN 73 1326	Waste after 100 cycles max. 800 gr/m^2 (Method A) Waste after 75 cycles max. 800 gr/m^2 (Method C)	Waste after 100 cycles max 20.4 gr/m^2 (Method A) Waste after 100 cycles max 47.8 gr/m^2 (Method C)
Resistance to arc discharge of high voltage at low intensity pursuant to EN 61 621		tl. 10 mm - min. 143 sec
pH of board material		12,5
Shearing friction coefficient		Static μs = 0,73, Dynamický μd = 0,76
Surface sound permeability (up to 1200 Pa) pursuant to ČSN EN 12 114, $Q_{A,100,N}$		thickness 8 mm - 0,13 thickness 24 mm - 0,035

Table of basic fire properties	Achieved value
Reaction to fire – without surface treatment, type BASIC, PD, PDB, PDP, PROFIL, INCOL, AKUSTIC, INCOL AKUSTIC	A2 - s1,d0
Reaction to fire – without surface treatment, type PLUS, PROFIL PLUS, FINISH, PROFIL FINISH, AKUSTIC FINISH, LASUR, PROFIL LASUR, DEKOR	B-s1,d0
Surface flame propagation index pursuant to ČSN 73 0863	i = 0 mm/min
Reaction to fire – CETRIS ECO (BASIC, PDB) board	B-s1,d0

2.2 Linear Expansivity

One of the properties of the products, which contain a portion of wood material is linear expansivity and shrinking during changes in air humidity. This applies to the CETRIS® boards and it is necessary to count on this property when using them and allow for the dilatation of the CETRIS® boards. When cladding vertical structures, the dilatation over a length of 1,250 mm is over a width of 4 – 5 mm, for 3,350 mm it is 12 mm. For load-bearing horizontal structures (e.g. floors) the CETRIS® boards are laid end-to-end and the dilatation gaps are created around the walls in a width of min. 15 mm. Dimensional changes to not affect the quality or the durability of the CETRIS® boards.

2.3 Load Tables

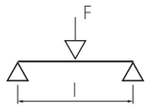
The static calculation of the load-bearing capacity of the CETRIS® boards was done for installation of the boards on beams (the boards act as a continuous beam). The interaction of the individual CETRIS® boards is ensured in the case of beams with two or more fields by bonding of the tongue and groove jointing, for smaller thicknesses by bonding the edges. The calculation was done assuming the elastic behaviour of the material while respecting the following mechanical and physical characteristics:

- bending tensile strength of min. 9 Nmm^{-2}
- modulus of elasticity min. 4500 Nmm^{-2}
- density 1450 kg/m^3

When determining the load capacity, the dead weight of the board was also taken into consideration. The maximum normal stress in the terminal fibres under load did not exceed 3.60 Nmm-2 (a 2.5 multiple of safety is achieved). The maximum elastic deflection from operating load including dead weight shall not exceed 1/300 of the span. The calculation proved that concentrated load is decisive for the load capacity of the CETRIS® boards. The following tables and graphs show the considered load for an area of 50 x 50 mm at the middle of a board of minimum thickness 1 m (according to EN). The static calculation further assumes that the load acts directly on the surface of the board. The given data cannot be used for dimensioning the thickness of the CETRIS® boards for the floor systems. The sample solutions of the CETRIS® board floors and the board load tables are given in chapter 6 CETRIS® Floor Systems.

CETRIS® load tables – concentrated load – 1 field beam

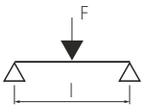
(applies, for instance, to determination of the thickness of a ceiling board – with isolated load)



Beam span l (mm)	Maximum load F (kN)											
	10 mm	12 mm	14 mm	16 mm	18 mm	20 mm	22 mm	24 mm	26 mm	28 mm	30 mm	32 mm
200	0,298	0,431	0,587	0,767	0,972	1,201	1,454	1,731	2,032	2,357	2,707	3,080
250	0,291	0,420	0,573	0,750	0,951	1,175	1,423	1,694	1,990	2,309	2,651	3,018
300	0,250	0,410	0,559	0,732	0,929	1,148	1,391	1,657	1,946	2,259	2,595	2,954
350	0,205	0,361	0,545	0,714	0,906	1,121	1,359	1,619	1,903	2,209	2,538	2,889
400	0,170	0,302	0,489	0,695	0,883	1,093	1,326	1,581	1,858	2,157	2,479	2,824
450	0,141	0,255	0,417	0,632	0,860	1,065	1,292	1,541	1,812	2,105	2,420	2,757
500	0,117	0,216	0,357	0,546	0,789	1,036	1,258	1,501	1,766	2,053	2,360	2,690
550	0,097	0,183	0,307	0,473	0,688	0,958	1,223	1,461	1,719	1,999	2,300	2,622
600	0,078	0,154	0,263	0,410	0,601	0,842	1,137	1,420	1,672	1,945	2,239	2,553
650	0,062	0,128	0,225	0,356	0,526	0,741	1,006	1,325	1,624	1,891	2,177	2,483
700	0,047	0,105	0,191	0,308	0,461	0,654	0,892	1,179	1,520	1,836	2,115	2,414
750	0,033	0,084	0,160	0,265	0,402	0,576	0,790	1,050	1,359	1,720	2,052	2,343
800	0,020	0,065	0,132	0,226	0,349	0,506	0,700	0,935	1,216	1,544	1,925	2,273
850	0,007	0,047	0,106	0,190	0,301	0,443	0,619	0,832	1,087	1,387	1,734	2,132
900		0,030	0,082	0,157	0,257	0,385	0,545	0,739	0,971	1,245	1,562	1,926
950		0,014	0,060	0,127	0,217	0,333	0,478	0,654	0,866	1,116	1,406	1,739
1000			0,039	0,098	0,179	0,284	0,416	0,577	0,770	0,998	1,264	1,570
1050			0,020	0,072	0,144	0,239	0,358	0,505	0,682	0,890	1,134	1,415
1100			0,001	0,047	0,112	0,197	0,306	0,439	0,600	0,791	1,014	1,272
1150				0,024	0,082	0,158	0,256	0,378	0,525	0,700	0,904	1,141
1200					0,003	0,053	0,122	0,211	0,321	0,455	0,615	0,802

CETRIS® load tables – linear load – 1 field beam

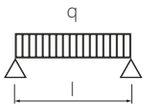
(applies, for instance, to determination of the thickness of a board with linear load)



Beam span l (mm)	Maximum load F (kN)											
	10 mm	12 mm	14 mm	16 mm	18 mm	20 mm	22 mm	24 mm	26 mm	28 mm	30 mm	32 mm
200	1,186	1,711	2,332	3,050	3,863	4,772	5,777	6,878	8,076	9,369	10,758	12,243
250	0,938	1,361	1,857	2,430	3,079	3,805	4,608	5,488	6,444	7,477	8,588	9,774
300	0,640	1,121	1,539	2,014	2,554	3,158	3,826	4,558	5,353	6,213	7,137	8,125
350	0,459	0,810	1,301	1,716	2,178	2,694	3,265	3,891	4,572	5,307	6,098	6,943
400	0,340	0,606	0,980	1,480	1,894	2,344	2,842	3,389	3,983	4,626	5,316	6,054
450	0,257	0,465	0,758	1,151	1,657	2,070	2,512	2,996	3,523	4,093	4,706	5,361
500	0,196	0,362	0,597	0,913	1,321	1,833	2,246	2,681	3,154	3,665	4,215	4,803
550	0,150	0,285	0,477	0,735	1,070	1,491	2,006	2,421	2,850	3,313	3,812	4,345
600	0,114	0,225	0,384	0,599	0,878	1,228	1,659	2,178	2,595	3,018	3,474	3,962
650	0,085	0,177	0,310	0,491	0,726	1,022	1,387	1,827	2,348	2,767	3,187	3,635
700	0,061	0,138	0,250	0,404	0,604	0,857	1,169	1,546	1,993	2,517	2,939	3,354
750	0,041	0,106	0,201	0,332	0,504	0,722	0,991	1,317	1,704	2,158	2,683	3,109
800	0,024	0,078	0,159	0,272	0,421	0,610	0,844	1,128	1,466	1,862	2,321	2,848
850	0,009	0,054	0,124	0,221	0,350	0,516	0,721	0,970	1,266	1,615	2,019	2,483
900		0,034	0,093	0,177	0,290	0,435	0,615	0,835	1,097	1,406	1,764	2,175
950		0,015	0,066	0,139	0,238	0,366	0,525	0,720	0,952	1,227	1,546	1,912
1000			0,042	0,106	0,192	0,305	0,446	0,619	0,827	1,072	1,358	1,686
1050			0,021	0,076	0,152	0,252	0,377	0,532	0,718	0,937	1,194	1,489
1100			0,001	0,049	0,116	0,204	0,316	0,454	0,621	0,819	1,050	1,317
1150				0,025	0,083	0,162	0,262	0,386	0,536	0,714	0,923	1,165
1200				0,003	0,054	0,123	0,213	0,324	0,459	0,621	0,810	1,029

CETRIS® load tables – continuous load – 1 field beam

(applies, for instance, to determination of the thickness of a board used in permanent shuttering)



Beam span l (mm)	Maximum load q (kN/m²)											
	10 mm	12 mm	14 mm	16 mm	18 mm	20 mm	22 mm	24 mm	26 mm	28 mm	30 mm	32 mm
200	11,860	17,112	23,324	30,496	38,628							
250	6,004	10,449	14,857	19,437	24,631	30,440						
300	3,416	5,976	9,560	13,429	17,028	21,053	25,505	30,384				
350	2,099	3,701	5,948	8,947	12,444	15,393	18,657	22,234	26,124	30,328		
400	1,360	2,424	3,920	5,920	8,496	11,720	14,212	16,944	19,916	23,128	26,580	30,272
450	0,913	1,652	2,695	4,091	5,892	8,148	10,910	13,317	15,660	18,192	20,913	23,825
500	0,628	1,159	1,911	2,922	4,227	5,864	7,870	10,281	12,615	14,661	16,860	19,213
550	0,437	0,829	1,387	2,139	3,113	4,336	5,836	7,641	9,778	12,048	13,861	15,801
600	0,304	0,600	1,024	1,596	2,340	3,276	4,424	5,808	7,448	9,364	11,580	13,205
650	0,210	0,436	0,763	1,208	1,787	2,517	3,414	4,496	5,780	7,282	9,018	11,007
700	0,140	0,316	0,572	0,922	1,380	1,959	2,672	3,533	4,555	5,752	7,137	8,723
750	0,088	0,225	0,428	0,708	1,075	1,540	2,115	2,810	3,636	4,603	5,724	7,009
800	0,048	0,156	0,319	0,544	0,842	1,220	1,689	2,256	2,932	3,724	4,643	5,696
850	0,016	0,102	0,233	0,416	0,660	0,971	1,356	1,825	2,383	3,040	3,801	4,674
900		0,060	0,165	0,315	0,516	0,773	1,094	1,484	1,951	2,499	3,136	3,867
950		0,025	0,111	0,235	0,401	0,616	0,884	1,212	1,604	2,066	2,603	3,221
1000			0,067	0,169	0,308	0,488	0,714	0,991	1,323	1,715	2,172	2,698
1050			0,032	0,116	0,232	0,383	0,575	0,810	1,094	1,428	1,819	2,269
1100			0,002	0,071	0,169	0,297	0,460	0,661	0,904	1,191	1,527	1,915
1150				0,035	0,116	0,225	0,364	0,537	0,745	0,994	1,284	1,620
1200				0,004	0,072	0,164	0,284	0,432	0,612	0,828	1,080	1,372

2.4 Thermal Technical Properties

Thermal conductivity or coefficient of thermal conductivity is the most important indicator of the building materials in terms of heat technology. The CETRIS® cement bonded particleboards are thanks to their perfect bonding of wood and cement free of any air bubble pores are thus a very good conductor of heat. For this reason, they can be used in all places with a requirement for material strength and the least possible heat resistance, which could cause heat losses, e.g. floor heating. Floor heating is elaborated separately in chapter 6.10 Floor Heating.

λ = max. 0.287 W/mK (at a mass moisture content of 9±3 %)

At higher humidity, thermal conductivity rises, but it should not exceed 0.35 W/mK.

Thermal conductivity of the CETRIS® boards in relation to their thickness:

Thickness of CETRIS® board (mm)	Thermal conductivity λ (W/mK)	Heat resistance R (m²K/W)
8	0,200	0,040
24	0,251	0,096
40	0,287	0,139

The given thermal conductivity values are measured in dry state, but the effect on thermal conductivity is not negligible. The thermal conductivity of the material increases with rising humidity, for which reason it is suitable to state the thermal conductivity value in stable humidity of the CETRIS® boards.

2.5 Sound Insulation Properties

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

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

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

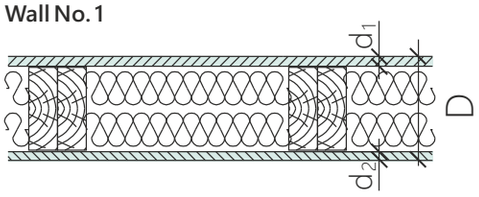
One of the possibilities for reduction of noise transmission from the source to the recipient is effective noise protection. The capability of building construction structures to transmit and weaken airborne noise transmission is provided by acoustics materials (insulation and the like). Airborne sound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

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

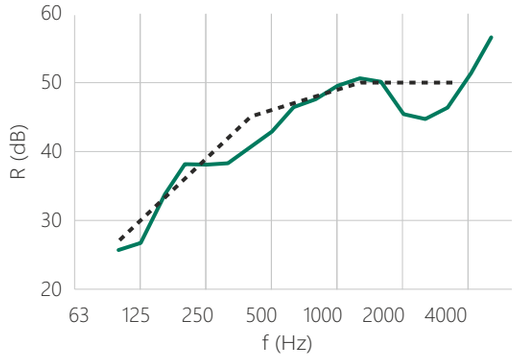
Space	Requirements for sound insulation of partition walls R'_w	Design structure
Residential houses – one living room in a multi-room apartment		
All other rooms of the same apartment unless they are functional parts of the protected space	42 dB	CETRIS®12 mm, CW profil 75 + 60 mm mineral wool, CETRIS®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

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

Wall No. 1



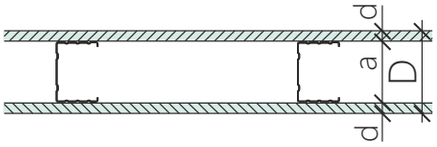
- CETRIS® board, th. 14 mm
- wooden frame, th. 120 mm
- ORSIL Uni 2x60 mm
- KNAUF GKB plasterboard, th. 12.5



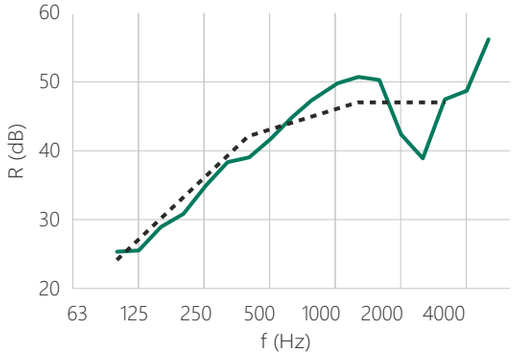
Evaluation pursuant to ČSN EN ISO 717-1
R_w (C;Ctr) = 46 (-2; -6) dB

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

Wall No. 2



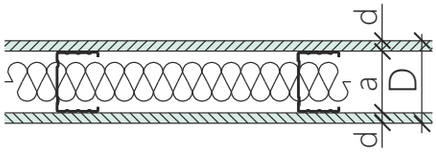
- CETRIS® board of thickness 12 mm
- CW profile 75 mm
- CETRIS® board of thickness 12 mm



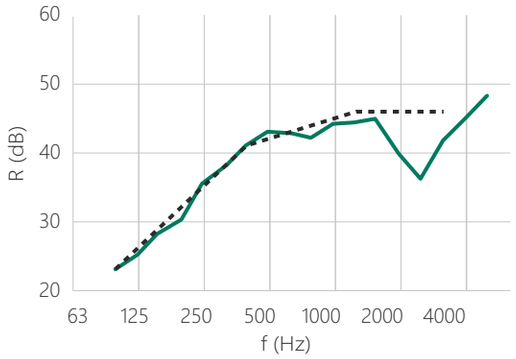
Evaluation pursuant to ČSN EN ISO 717-1
R_w (C;Ctr) = 43 (-2; -5) dB

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

Wall No. 3



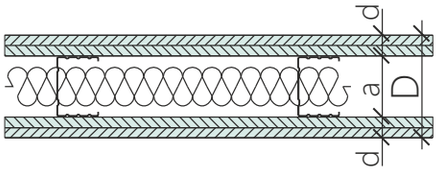
- CETRIS® board of thickness 12 mm
- CW profile 75 mm
- ORSIL Hardsil 60 mm
- CETRIS® board of thickness 12 mm



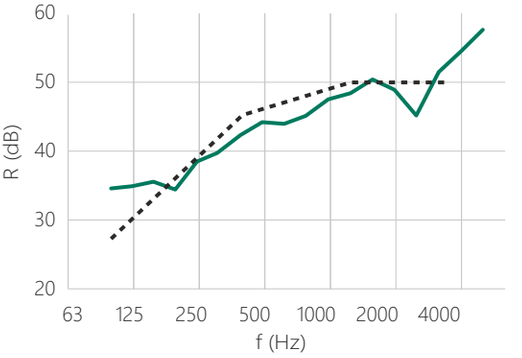
Evaluation pursuant to ČSN EN ISO 717-1
R_w (C;Ctr) = 52 (-2; -5) dB

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

Wall No. 4



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



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

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

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

2.6 Vapour Permeability

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

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

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

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

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

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

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

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

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

2.7 Fire Protection Properties

Classification of the cement bonded particleboard by reaction to fire class pursuant to European standard

For the uniform classification of building construction materials, a new system was established that was designed and implemented under the standard EN 13 501-1 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests. Classification of CETRIS® cement bonded particleboard based on its reaction to fire was performed on the basis of results of tests carried out pursuant to the following European standards:

- ČSN EN ISO 1716:2002 – Specification of Burning Heat
- EN 13823:2002 – Test by Single Burning Item (SBI)
- EN ISO 11 925-2 Test on Reaction to Fire - Flamability of Construction Products Exposed to Direct Flame

Based on these tests, CETRIS® cement bonded particleboards are classified as follows:

Reaction to fire class A2 additional classification according to smoke generation is s1, according to flame-ignited droplets (particles) is d0, i.e. after modification, the classification is A2-s1,d0.		Reaction to fire class B additional classification according to smoke generation is s1, according to flame-ignited droplets (particles) is d0, i.e. after modification, the classification is B-s1,d0.			
BASIC (8- 28 mm) PD (16-28 mm), PDB (16-28 mm) PROFIL (10,12 mm) INCOL (12 mm)	AKUSTIC AKUSTIC INCOL	PLUS PROFIL PLUS	FINISH AKUSTIC FINISH PROFIL FINISH	LASUR PROFIL LASUR DEKOR	ECO Basic ECO PDB

2.8 Board Resistance against Arc Discharge of High Voltage and Low Intensity

CETRIS® cement bonded particleboard is a universal board material for interior and exterior use. It is distinguished from other board materials by its high resistance to weather effects, fire, mechanical damage and demanding technological space conditions. On the basis of requirements coming from electricity distribution companies, cement bonded particleboard CETRIS® has been tested for resistance against arc discharge of high voltage and low intensity pursuant to EN 61 621:1998 (IEC 61621:1997) The testing was performed in May 2003 in the Electro-technical Test Institute in Prague with the testing apparatus MICAFIL ART 68 with the following result for CETRIS® board, thickness 10 mm:

- Minimum time to conductive path 143 s
- Mean time to conductive path 180.25 s

CETRIS® cement bonded particleboard complies with its resistance to electrical arc in spaces with high voltage wiring (collectors). Justification: The mean and the minimum value of the measured times to the conductive path is lower than the protection switch off times of distribution network HV and LV wiring.

2.9 Biological Resistance

Pursuant to European standard ČSN P CEN/TS 15083-1 Durability of wood and wood-based products - Definition of the natural durability of timber and resistance to wood-destroying fungi, testing methods - Part 1: Basidiomycetes was used to test the durability of the CETRIS® cement bonded particleboard against Baisiomycetes fungi. By assessment of the test results pursuant to Annex D to the above-stated standard, CETRIS® cement bonded particleboards are classified as Durability Class 1 – Very Durable.

Testing of resistance to micro-organisms (various stems of mould) was done according to ČSN EN 60068-2-10 : 2006 Environmental testing - Part 2-10: Tests - Test J and guidance: Mould growth.

CETRIS® cement bonded particleboards are fully fungi-resistant – after testing on the samples, there was no mould growth, visible change or damage.

The resistance CETRIS® cement bonded particleboards to termites is verified pursuant to ČSN EN 117 (490698) Wood preservatives - Determination of toxic values against Reticulitermes species (European termites) (Laboratory method). After visual assessment, only mild disruption was confirmed (level 2).