Technical brochure
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Fire and sound

"Dog houses" made of conventional chipboard and Cement Bonded Particleboard

Elam Oy

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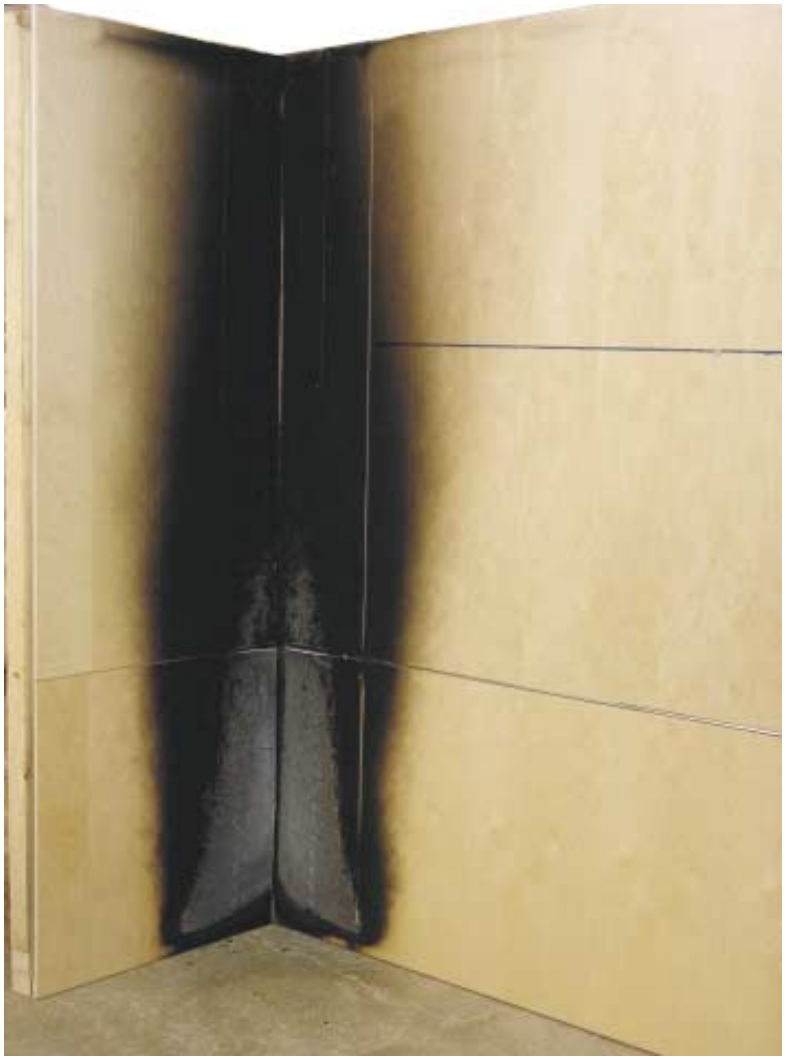
Fire classifications

Cement bonded particleboard, EN std 643-2: **B-s1, d0**,

Wood based panels (chipboard, MDF and plywood): **D-s2, d0.**

Classification in some other countries:

USA	**Russia**
ASTM E-84 Birch veneered CBP Class A, Flame Spread 0 to 25	GOST 26816-86- "Difficulty flamable material"

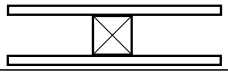
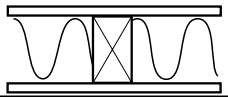
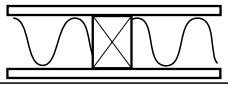
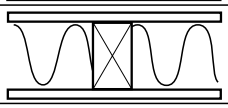
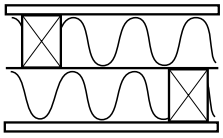
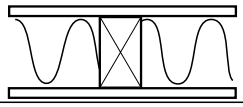
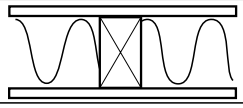
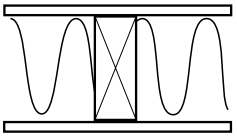
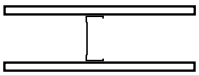
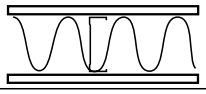
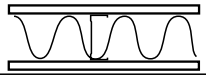
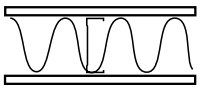
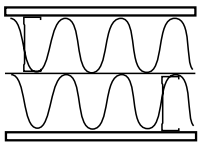
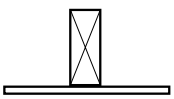
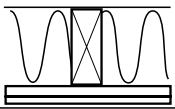
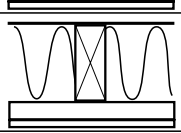
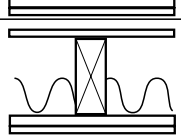


Elam panel in SBI (Single Burning Item)-test

Fire resisting time of cement bonded particleboard:

Thickness	Time
mm	min
8	10
10	15
12	18
16	24
20	30
24	36
37	56

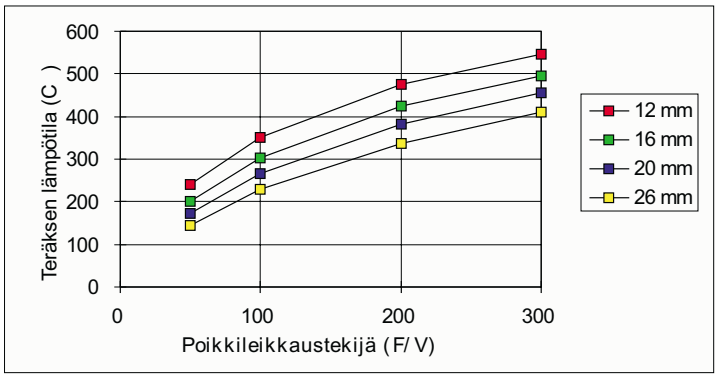
Wall constructions made of Elam-panel and cement bonded particleboard.Fire resisting time bases on Nordtest Method 005 when the temperature on the back surface reaches 140 C^{o} (comparable to ISO 834):

	Panel thickness mm	Frame mm	Density of mineralwool kg/m^3	Wall thickess mm	Sound insulation dB	Fire resisting time min
1 	8	42x42			32...35	EI15
2 	10	92x42	17		44...48	30
3 	8	68x42	30		40...44	30
4 	8	92x42	30		44...46	60
5 	8	2x68x42	30		48...56	90
Fire division wall with wooden frame, load bearing:						
1 	10	92x42	17	112	44...48	30
2 	8	92x42	30	108	44...46	30
3 	8	138x42	30	154	44...48	60
Fire division wall with steel frame, non load bearing:						
1 	8	68x42			32...35	15
2 	10	x42	17		44...46	30
3 	8	68x42	30		40...44	30
4 	8	92x42	30		44...48	60
5 	10	2x68x42	30		48...57	90
Ceiling construction with wooden frame						
1 	12	Ceiling panel fixed to wooden joist (bearing beam min. 45x170 mm, cc *1200 mm)				15
2 	2x8	Ceiling panel fixed to wooden joist (bearing beam min. 45x170 mm, cc *1200 mm). Between panel and joist boards /92x22 mm cc *250 mm. Mineral wool min. 17 kg/m3. Thickness /140 mm.				30
3 	8	Ceiling panel fixed to wooden joist (bearing beam min. 45x170 mm, cc *1200 mm). Between panel and joist boards /72x32 mm cc *180 mm Mineral wool min. 17 kg/m3. Thickness /140 mm. Above wool has to be a tight panel, e.g. wind barrier.				30
4 	8	Ceiling panel fixed to wooden batten (min.44x42 mm, cc *600 mm). Between panel and batten boards /92x22 mm cc *150 mm Mineral wool min. 17 kg/m3. Thickness /42 mm. Above wool has to be a tight panel, e.g. wind barrier.				30

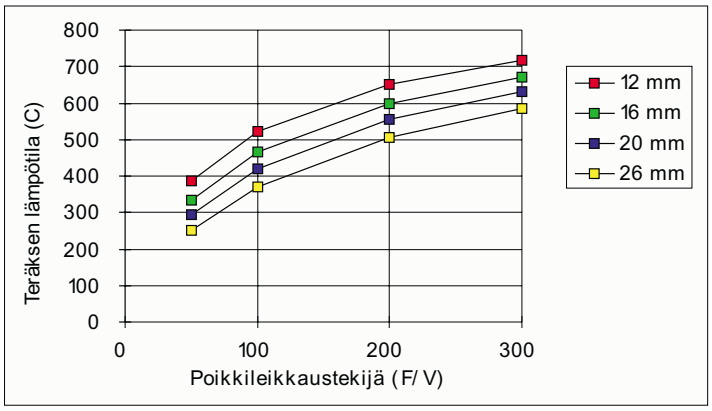
Cement bonded particleboard as protection of steel constructions:

Cement bonded particle-board as protection of steel constructions:

t = 30 min

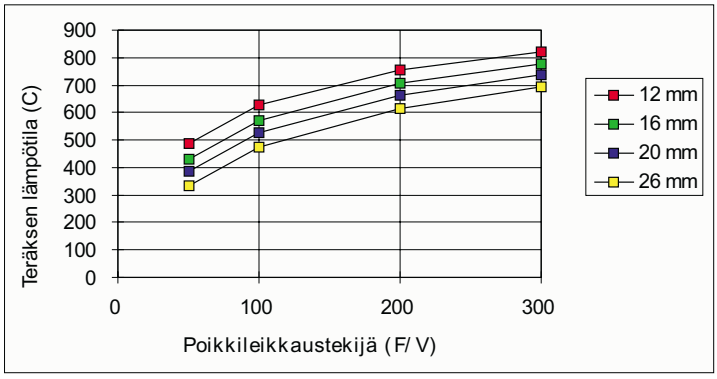


t = 60 min



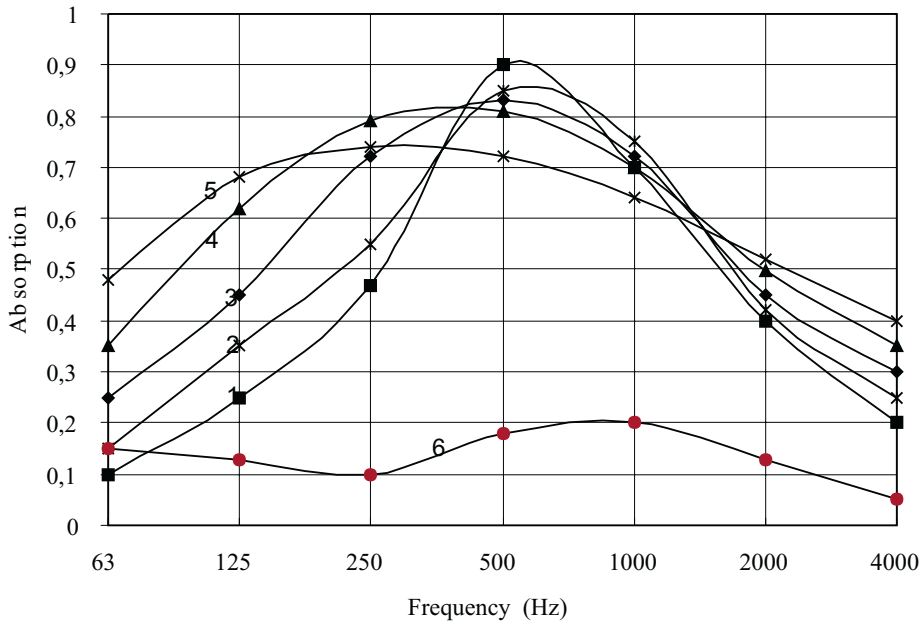
The temperature of steel construction protected with cement bonded particleboard with various
beam form factors (F/V) and board thicknesses.
Testing times 30, 60 and 90 min.

t = 90 min

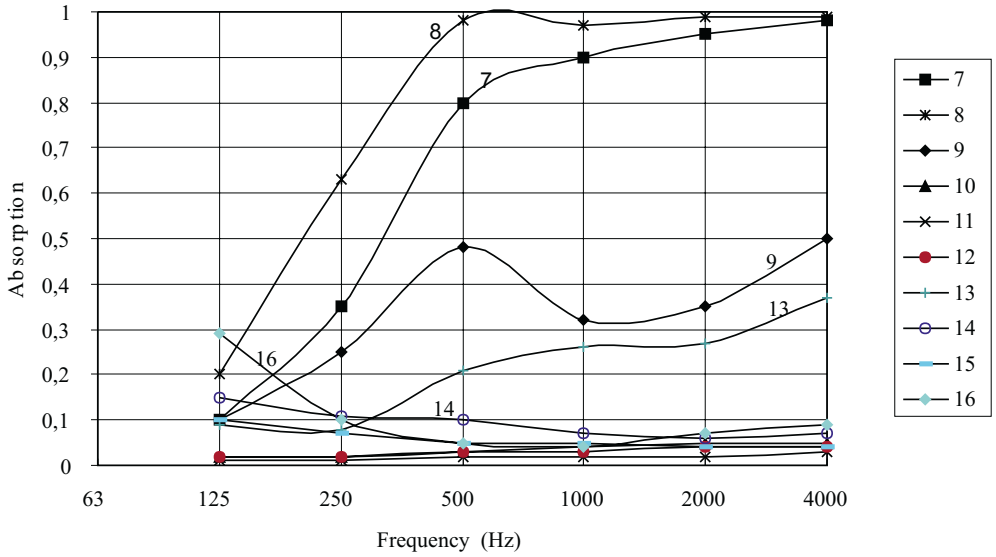


Sound

Sound absorption of Elam acoustic panels:



Sound absorption of some building materials:



1. Hole area 10-15 %, no mineral wool, air gap behind the panel 30...50 mm
2. Hole area 10.15 %, mineral wool 30...50 mm
3. Hole area 10-15 %, mineral wool 50 mm, air gap behind the panel 200 mm
4. Hole area 10-15 %; mineral wool 50 mm, air gap behind the panel 300 mm
5. Hole area 10-15 %, mineral wool 200 mm, air gap behind the panel 200 mm
6. Plain panel without perforation, no mineral wool, air gap behind the panel 30...50 mm
7. Acoustic mineral wool 30 mm
8. Acoustic mineral wool 50 mm
9. Low density fibreboard
10. Brick wall
11. Concrete wall
12. Vinyl carpet on concrete floor
13. Textile carpet on concrete floor
14. Wooden floor on joists
15. Wood paneled wall
16. Wall of plasterboard

The back side of ELAM panels can be coated with black fiber fabric in the factory.

The acoustical design is important in large buildings, such as arenas, concert halls, etc. Both speech intelligibility and background noise control have to be maintained. The room has to "tune" for desired purposes. The transfer of speech or music signals from performers to listeners in the room has to be optimized. Sound absorbing materials, which have high absorption at an arbitrary specified frequency band, are often needed in architectural acoustics. In such cases some resonator-type absorbers, such as perforated boards with circular holes or slit panels with air cavities, are widely used. To get high absorption at not only specific but also other frequencies by such panels, some porous material like fiberglass may also be filled in the air cavity.
Acoustic panels can be used for acoustical or architectural reasons. The combination of perforated and plain Elam -panels makes it possible to find right solution for music and speech acoustics. Perforated panels are diffusors and plain reflectors. Wooden surface gives the panel good reflection properties - like a musical instrument
Sound reduction technology in buildings is based on two parts: sound isolation and sound absorption.

When good sound insulation between two rooms is necessary, the wall construction has to be thick, heavy and tight. A perfect sound absorber has a Sound Absorption Coefficient of one, while a perfect reflector has an coefficient of zero. Proper sound absorption has influence to:

Reverberation time of the room, and
Sound reduction

Perforated (as well as slotted) Elam acoustic panels function as resonance muffler being at their most effect with medium and low frequencies. Behind the panel has to be an air gap to ensure flawless function.

The sound absorption of acoustic panels depends on:

Hole area:

The larger the hole area, the higher absorption with medium frequency.

Distance from background:

Longer distance makes the curve more even.

Mineral wool behind the panel:

Mineral wool makes the absorption curve more even. Thin plastic sheet can be used behind the panel if necessary.

Total equivalent absorption area of a room is calculated by summarizing the absorption of all surfaces, furniture, etc.

"Sabines formula": $T = 0{,}16 \times V/A$ $A = \alpha \times \text{area}$

T = Reverberation time (s)
V = volume of the room (m^3)
A = total absorption area (m^2) (=summarized absorption of all room surfaces)
α = sound absorption coefficient

With this formula and the earlier diagrams the necessary area of Elam- acoustic panels can be evaluated in round figures for various room types.

Example:
A meeting room, length 10 m, breadth 5 m, height 3 m.
Floor area 50 m2 and V= 150 m3
Desired reverberation time T=0,8

$A = 0{,}16 * V/T = 30\ m^2$

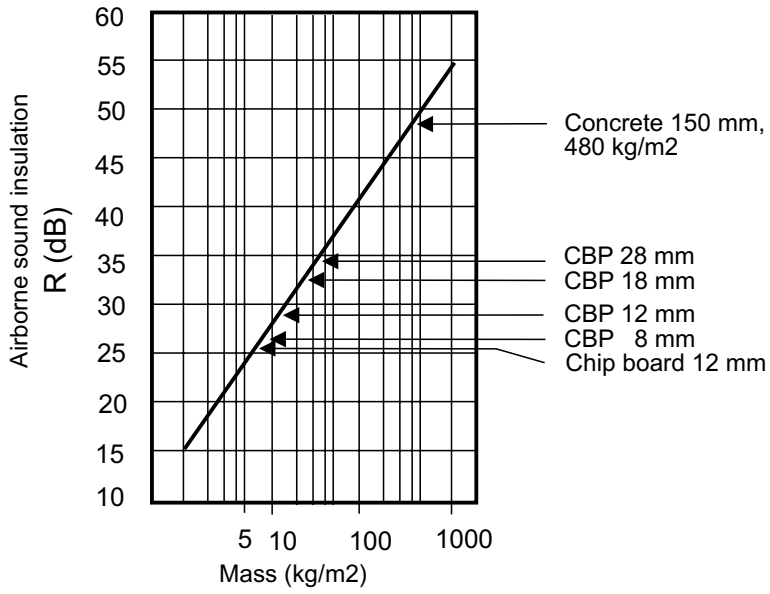
	Material:	α	A
Floor	Vinyl carpet on concrete	0,03 x (5x10) m^2	=1,5
Walls	Plaster board	0,05 x (3x30) m^2	=4,5
Ceiling	Elam-panel, plain	0,15 x (5x10) m^2	=7,5
Absorption area together			13,5
The need of additional absorption area		30 - 13,5 = 16,5	
The need of Elam -acoustic panels (α 0,6 in average)		16,5/0,6 = 27,5 m^2	

Recommended Reverberation times

	Reverberation time (s) 250...400 Hz
Music halls	0,8...1,5
Offices	0,5...0,6
Computer rooms	0,5
Halls and corridors	0,8...1
Staircases	1,0...1,5
Meeting rooms, large	0,8
Class rooms	0,6
Shopping stores	0,5...1,5
Day nurseries	0,6...0,8
Restaurants	0,6
Industrial kitchens	0,5
Industrial buildings	0,5
Swimming pools	1,0...1,5
Homes for the aged	0,6
Sports halls	1,2...1,5

Sound absorption of cement bonded particleboard:

Thickness	Critical Coincidence	Air sound isolation
(mm)	(Hz)	R(dB)
8	6300	27
10	5000	29
12	4200	30
16	3100	32
18	2800	31
20	2500	32
24	2100	33
28	1800	34



Berger -diagram