

# Design and application of gypsum blocks

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ICS 91.100.10

## National foreword

This British Standard is the UK implementation of EN 15318:2007.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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## Design and application of gypsum blocks

Conception et exécution des ouvrages en carreaux de  
plâtrePlanung und Ausführung von Bauteilen aus Gips-  
Wandbauplatten

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## Foreword

This document (EN 15318:2007) has been prepared by Technical Committee CEN/TC 241 “Gypsum and gypsum based products”, the secretariat of which is held by AFNOR.

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## 1 Scope

This European Standard defines the rules for the design of gypsum blocks as specified in EN 12859, assembled with adhesives as specified in EN 12860. Accessory products are also defined in this document. It is applicable to non-loadbearing partition walls and internal insulation of walls in rooms of residential buildings, offices, hospitals, schools etc. and to linings of posts, beams, ducts, shafts etc, that are suitable to receive finishes such as paint and wallpaper without any prior traditional plastering, but having had normal preparation prior to painting.

Certain components requiring special provisions are not covered by this standard and require special consideration.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies

EN 12859:2001, *Gypsum blocks - Definitions, requirements and test methods*

EN 12860, *Gypsum based adhesives for gypsum blocks - Definitions, requirements and test methods*

EN 13501-2, *Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services*

### 3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

#### 3.1

##### **partition**

non-loadbearing, self-supporting vertical wall fixed to the shell construction at the periphery

#### 3.2

##### **dividing partition**

partition separating two rooms or spaces belonging to the same structural unit (office, school, house, etc.)

#### 3.3

##### **backing partition**

partition placed back-to-back with a wall element to which it is not connected

#### 3.4

##### **partition connected at top**

partition extending over the whole distance between the floor and the ceiling and connected to the shell construction at the top

#### 3.5

##### **partition free at top**

partition extending over the whole distance but not connected to the shell construction at the top

#### 3.6

##### **dwarf partition**

partition extending only over part of the distance between the floor and the ceiling

#### 3.7

##### **single partition**

partition of thickness equal to that of the gypsum block

#### 3.8

##### **multiple partition**

partition comprising several single gypsum block partitions separated by a cavity, possibly fitted with insulation

#### 3.9

##### **composite partition**

single or multiple partition connected to other materials to satisfy specific performance requirements

#### 3.10

##### **free-ended partition**

partition with an unconnected vertical edge

#### 3.11

##### **overhanging partition**

partition at the end of the top floor

#### 3.12

##### **lining (of posts)**

encasement of any load bearing element

#### 3.13

##### **duct**

vertical or inclined structure that incorporates shafts and does not convey fluids (air, smoke) directly

**3.14**

**shaft**

vertical structure that conveys fluids or gases directly

NOTE Shafts made of gypsum blocks are intended to convey only air or smoke

**3.15**

**panel**

part of partition between stiffeners, between structural elements, between stiffener and structural elements

**3.16**

**stiffener**

existing or additional structural element contributing to the stability of the gypsum block structure

**3.17**

**additional vertical stiffener**

vertical reinforcing element connected at its two ends to the structure or to an additional horizontal stiffener

**3.18**

**additional horizontal stiffener**

horizontal reinforcing element ensuring the load is transferred to the structure

**3.19**

**horizontal stiffener for dwarf partition**

horizontal reinforcing element connected at its two ends to the structure or to an additional stiffener to ensure the horizontal loads are transferred

**3.20**

**mechanical stress level**

- HIGH: stresses in non-residential rooms
- NORMAL: stresses in residential rooms

## **4 Design**

### **4.1 General**

By following the recommendations in this document, the designer can specify partitions suitable for the use for which they are intended.

### **4.2 Materials**

- gypsum blocks according to EN 12859;
- gypsum-based adhesives for gypsum blocks according to EN 12860;
- other materials and accessories can be used.

### **4.3 Structure and Functions**

#### **4.3.1 General**

The following factors can influence the choice of the type of gypsum blocks and shall be taken into account with the structural requirements:

- a) type of building (single-family houses, buildings, etc.), purpose (accommodation, schools, offices, hospitals, etc.) and use (for example: damp rooms);



- b) dimensional accuracy of the structure;
- c) service arrangements (distribution of fluids, electricity);
- d) type of connections to the structure and to the incorporated elements (frames, etc.), fixing loads.

The following functions shall also be taken into account in the choice of the type of gypsum blocks:

- e) exposure to impacts and abrasion;
- f) temperature and humidity conditions;
- g) thermal insulation;
- h) sound insulation;
- i) safety in the event of fire.

#### **4.3.2 Dividing or separating partitions**

The partitions ensure one or more of the following functions:

Separation, fire protection, sound insulation or thermal insulation, supporting of loads, impact strength.

#### **4.3.3 Backing partitions**

Backings are structures intended to reinforce the thermal insulation, sound insulation or fire resistance properties of the structures against which they are backed.

#### **4.3.4 Ducts**

The ducts ensure one or more of the following functions:

- protecting the ambient medium against noise generated or transmitted by the shafts;
- protecting the shafts against fire;
- preventing propagation of the fire from one room to another.

Vertical ducts can be made of gypsum blocks on one or more faces according to their positioning relative to the shell construction. The duct walls can be single or composite according to the performance required.

#### **4.3.5 Lining of posts**

For aesthetic or technical reasons (fire resistance), all types of post (wood, metal, concrete ...) can be protected by gypsum block structures.

### **4.4 Specific structural requirements**

#### **4.4.1 General**

Depending on the type of building or purposes of the rooms, special precautions shall be taken into account.

#### **4.4.2 Damp rooms**

In rooms exposed intermittently to water, either by use or by the need to wash the surface of the partition or the adjacent floor, water-repellent gypsum blocks shall be used.

The type of blocks is determined depending on the planned use of the room and on the level of exposure of the wall to water.

#### **4.4.3 Walls exposed to impacts**

In rooms where a higher surface resistance is required with respect to impacts (e.g. schools, corridors ...), it is recommended to use high-density blocks in the area's involved.

#### **4.4.4 Safety in the event of fire**

Where the structure is considered to meet fire resistance requirements, it shall have been the subject of a test and a classification according to EN 13501-2.

The blocks can also be selected as a function of the fire resistance values in use specified in 4.5.2.2, Table 1.

#### **4.4.5 Protection against noise**

Where the structure is considered to meet sound insulation requirements, the blocks are selected as a function of the information in 4.5.5.

#### **4.4.6 Overhanging partitions**

Special provisions shall be made to improve the safety conditions in use.

### **4.5 Requirements**

#### **4.5.1 Mechanical strength and stability**

Gypsum block partitions are self-supporting non-loadbearing structures that do not affect the general stability of the structure. The mechanical requirements linked to safety in use are covered in 4.5.3.

#### **4.5.2 Fire behaviour**

##### **4.5.2.1 Reaction to fire**

Gypsum blocks conforming to EN 12859 are classed as Euroclass A1 (non-combustible) without testing when they contain less than 1% by volume or by mass (according to the most unfavourable value regarding reaction to fire) of homogeneously distributed organic material.

If they contain more than 1 % of organic material by mass or by volume, they shall be tested and classified according to EN 13501-1.

##### **4.5.2.2 Fire resistance**

###### **a) Fire resistance of single partitions**

The values in use established in previous tests to be confirmed or determined subsequently on the basis of EN 1364-1 are given in Table 1.

Table 1 — Fire resistance: values in use

Thickness	Density class	E min.	E min.	EI min.	EI min.
		Solid blocks	Blocks with cavities	Solid blocks	Blocks with cavities
50	low (L)				
50	medium (M)	60		60	
50	high (H)				
60	L				
60	M	120	60	120	60
60	H	120	60	120	60
70	L				
70	M	180	120	180	120
70	H	180	120	180	120
80	L				
80	M				
80	H				
100	L				
100	M	240	180	240	180
100	H	240	180	240	180

For cases not covered above, a test by an accredited laboratory is necessary to determine performance. This test may be replaced by the opinion of a laboratory based on extrapolation of a close solution.

#### b) Fire resistance of composite partitions and other gypsum block structures

For cases not covered above, the structure shall be the subject of a test and classification according to EN 13501-2. This test may be replaced by the opinion of a laboratory based on extrapolation of a related solution.

### 4.5.3 Safety in use

#### 4.5.3.1 General

Gypsum block partitions are self-supporting and present no risk to the safety of the user as long as the requirements of this subclause are met. The maximum dimensions indicated in the tables below result from

just mechanical considerations. This allows the structure to withstand the normal and high mechanical stresses.

The tables below define the maximum permitted dimensions for gypsum blocks of all densities.

Dimensioning of the partition is obtained by dividing into panels, the maximum dimensions of which are indicated according to the stress levels in Table 2 and Table 3. The panels are limited by the structure of the building or stiffeners as shown in Figures 1, 2 and 3.

**Table 2 — Maximum dimensions of single partitions**  
**Stress level: normal**

Blocks solid HD	Blocks solid MD	Blocks solid LD	Blocks with cavities MD	Type 1a partition <sup>b</sup>			Type 1b partition <sup>c</sup>			Type 2 partition <sup>d</sup>			Type 3 partition <sup>e</sup>		
				S max. m <sup>2</sup> <sup>a</sup>	H max. m	L max m	S max. m <sup>2</sup> <sup>a</sup>	H max. m	L max m.	S max. m <sup>2</sup> <sup>a</sup>	H max. m	L max m.	S max. m <sup>2</sup> <sup>a</sup>	H max. m	L max m.
		50	50												
	50	60	60												
50	60	70	70	32	4,00	8,00								1,50	1,50
60	70	80	80	55	5,00	11,0				2,75				2,50	2,50
70	80	100	100	77	5,50	14,0				3,50				3,50	3,50
80	100				5,50	16,5				5,00				4,00	4,00

<sup>a</sup> The maximum surface area is the first criterion to be met.

<sup>b</sup> Type 1a partitions = partitions without openings.

<sup>c</sup> Type 1b partitions = partitions without openings and with large height dimension.

<sup>d</sup> Type 2 partitions = partitions with openings.

<sup>e</sup> Type 3 partitions = partitions not connected at top.

NOTE The same limits apply to partitions made of water-repellent blocks.

**Table 3 — Maximum dimensions of single partitions**  
Stress level: high

Blocks solid	Blocks solid	Blocks solid	Blocks with cavities	Type 1a partition <sup>b</sup>			Type 1b partition <sup>c</sup>			Type 2 partition <sup>d</sup>			Type 3 partition <sup>e</sup>		
				S max.	H max.	L max.	S max.	H max.	L max.	S max.	H max.	L max.	S max.	H max.	L max.
HD	MD	LD	MD	m <sup>2 a</sup>	m	m.	m <sup>2 a</sup>	m	m	m <sup>2 a</sup>	m	m.	m <sup>2 a</sup>	m	m.
		50	50	10	2,5	4									
	50	60	60	12	3	5	8	4		10	2,5	4			
50	60	70	70	16	4	6	10	8		12	3	5	10	2,5	4
60	70	80	80	18	5	7	14	9		16	4	6	12	3	5
70	80	100	100	24	6	8	18	10		18	5	7	16	4	6
80	100			32	8	10	24	12		24	8	8	18	5	7
				32	8	10									

<sup>a</sup> The maximum surface area is the first criterion to be met.

<sup>b</sup> Type 1a partitions = partitions without openings.

<sup>c</sup> Type 1b partitions = partitions without openings and with large height dimension.

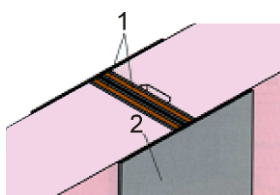
<sup>d</sup> Type 2 partitions = partitions with openings.

<sup>e</sup> Type 3 partitions = partitions not connected at top.

NOTE The same limits apply to partitions made of water-repellent blocks.

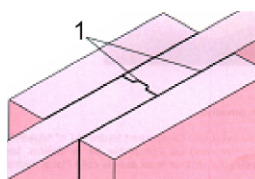
#### 4.5.3.2 Stiffeners

The stiffeners shall be designed according to the details given in the figures below. Other solutions are possible if the stability of the partitions has been proven.



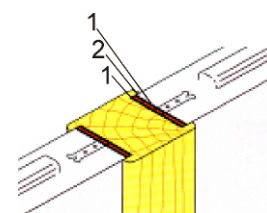
Key

- 1 resilient foam tape
- 2 metallic stiffener



Key

- 1 gypsum based adhesive



Key

- 1 gypsum based adhesive
- 2 cork

**Figure 1 — Metallic stiffener    Figure 2 — Stiffener out of gypsum blocks    Figure 3 — Wood with stiffener**

#### 4.5.4 Noise protection

The sound insulation performance of the gypsum block partitions is indicated in Table 4. The values in use for  $R_w$ , (and  $C$ ,  $C_{tr}$ ) expressed in dB (decibels) are determined on the basis of previous tests or tests to be confirmed or determined based on EN ISO 717-1 with flexible and tight joints.

Table 4 — Sound insulation of type 1a and 1b single partitions

Partition thickness (mm)	Density class L 600 to 800	Density class M 800 to 1100	Density class H 1100 to 1500
50	29 <sub>(-2,-3)</sub> to 30 <sub>(-1,-2)</sub>	30 <sub>(-1,-2)</sub> to 33 <sub>(-1,-3)</sub>	33 <sub>(-1,-3)</sub> to 35 <sub>(-1,-2)</sub>
60	30 <sub>(-1,-3)</sub> to 31 <sub>(0,-2)</sub>	31 <sub>(0,-2)</sub> to 34 <sub>(-1,-2)</sub>	34 <sub>(-1,-2)</sub> to 37 <sub>(0,-2)</sub>
70	31 <sub>(-1,-3)</sub> to 33 <sub>(-1,-2)</sub>	33 <sub>(-1,-2)</sub> to 35 <sub>(0,-2)</sub>	35 <sub>(0,-2)</sub> to 39 <sub>(-1,-3)</sub>
80	31 <sub>(-1,-2)</sub> to 34 <sub>(-1,-2)</sub>	34 <sub>(-1,-2)</sub> to 37 <sub>(-1,-3)</sub>	37 <sub>(-1,-3)</sub> to 40 <sub>(0,-3)</sub>
100	32 <sub>(-1,-2)</sub> to 35 <sub>(0,-3)</sub>	35 <sub>(0,-3)</sub> to 39 <sub>(-1,-4)</sub>	39 <sub>(-1,-4)</sub> to 44 <sub>(-1,-5)</sub>

For cases not covered above, the performances shall be determined by an accredited laboratory. This test may be replaced by the opinion of a laboratory based on extrapolation of a related solution.

#### 4.5.5 Energy saving and thermal insulation: thermal resistance of structures

The thermal resistance R per unit of surface area of the gypsum block structures can be calculated for homogenous elements using the formula given in EN ISO 6946, Building components and building elements - Thermal resistance and thermal transmittance - Calculation method :

$$R = \Sigma \left[ \frac{\lambda}{e} + \left( \frac{1}{h_i} + \frac{1}{h'_i} \right) \right] \quad (1)$$

where

- R is the thermal resistance in m<sup>2</sup>K/W;
- λ is the thermal conductivity of the block in W/mK (at 23 °C and 50 % RH);
- h<sub>i</sub> and h'<sub>i</sub> are the heat transfer coefficients of the wall in m<sup>2</sup>K/W;
- e is the thickness of the blocks in m.

For the calculation, the values of λ given in 5.3.2 of EN 12859:2001 shall be used as shown in Table 5.

Table 5 — Thermal conductivity values of gypsum as a function of the density

<b>P</b>	<b><math>\Lambda_{23/50}</math></b>
600	0,18
700	0,22
800	0,26
900	0,30
1000	0,34
1100	0,39
1200	0,43
1300	0,47
1400	0,51
1500	0,54

NOTE 1  $\rho$  is the density in kg / m<sup>3</sup>.

NOTE 2  $\lambda_{23/50}$  is the thermal conductivity of the gypsum in W/mK.

In the case of blocks of the medium-density class as defined in EN 12859 Gypsum blocks, the values given in Table 6 below may be used:

Table 6 — Conventional thermal resistance (R) values for medium-density (class M) blocks

<b>Thickness in mm</b>	<b>50</b>	<b>60</b>	<b>70</b>	<b>80</b>	<b>100</b>
Thermal resistance R in m <sup>2</sup> K/W	0,14	0,17	0,20	0,23	0,29
	(solid)	(solid)	(solid)	(solid)	(solid)
	0,17	0,20	0,23	0,29	0,35
	(with cavities)	(with cavities)	(with cavities)	(with cavities)	(with cavities)

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