EUROPEAN STANDARD
NORME EUROPÈENNE
EUROPÄISCHE NORM

EN 1996-1-2
1st **Draft**
November 2000

EN 1996: Design of masonry structures
part 1-2: General rules - Structural fire design

Eurocode 6: Calcul es ouvrages en maconnerie -Partie 1-2: Règles gènèrales - Calcul du comportement au feu

Eurocode 6: Bemessung und Konstruktion von Mauerwerksbauten - Teil 1-2: Allgemeine Regeln Tragwerksbemessung für den Brandfall

stage 32

((This draft contains the comments which could be accepted by the project team. The text is agreed by the project team. The tables especially the values are under discussion))

Revision 1 - May 2001

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((Foreword up to Chapter 3 will be changed by HGF, comments have to be send to HGF)) changes revision 1

Foreword

This European Standard EN 1996-1-2, Design of masonry structures, part 1-2 structural fire design, has been prepared on behalf of Technical Committee CEN/TC250 " Structural Eurocodes ", the Secretariat of which is held by BSI. CEN/TC250 is responsible for all Structural Eurocodes.

The text of the draft standard was submitted to the formal vote and was approved by CEN as EN 1996-1-2 on **YYYY-MM-DD**.

No existing European Standard is superseded.

Background of the Eurocode programme

In 1975, the Commission of the European Community decided on an action programme in the field of construction, based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonised technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme, which led to the first generation of European codes in the 1980's.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement[1] between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to the CEN through a series of Mandates, in order to provide them with a future status of European Standard (EN). This links *de facto* the Eurocodes with the provisions of all the Council's Directives and/or Commission's Decisions dealing with European standards (e.g. the Council Directive 89/106/EEC on construction products - CPD - and Council Directives 93/37/EEC, 92/50/EEC and 89/440/EEC on public works and services and equivalent EFTA Directives initiated in pursuit of setting up the internal market).

The Structural Eurocode programme comprises the following standards generally consisting of a number of Parts:

EN 1990	Eurocode :	Basis of Structural Design
EN 1991	Eurocode 1:	Actions on structures
EN 1992	Eurocode 2:	Design of concrete structures

[1] Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

EN 1993	Eurocode 3:	Design of steel structures
EN 1994	Eurocode 4:	Design of composite steel and concrete structures
EN 1995	Eurocode 5:	Design of timber structures
EN 1996	Eurocode 6:	Design of masonry structures
EN 1997	Eurocode 7:	Geotechnical design
EN 1998	Eurocode 8:	Design of structures for earthquake resistance
EN 1999	Eurocode 9:	Design of aluminium structures

Eurocode standards recognise the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level where these continue to vary from State to State.

Status and field of application of Eurocodes

The Member States of the EU and EFTA recognise that EUROCODES serve as reference documents for the following purposes :

– as a means to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC, particularly Essential Requirement N°1 – Mechanical resistance and stability – and Essential Requirement N°2 – Safety in case of fire ;

– as a basis for specifying contracts for construction works and related engineering services ;

– as a framework for drawing up harmonised technical specifications for construction products (ENs and ETAs)

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents[2] referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards[3]. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical Committees and/or EOTA Working Groups working on product standards with a view to achieving ~~a~~ full compatibility of these technical specifications with the Eurocodes.

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[2] According to Art. 3.3 of the CPD, the essential requirements (ERs) shall be given concrete form in interpretative documents for the creation of the necessary links between the essential requirements and the mandates for harmonised ENs and ETAGs/ETAs.

[3] According to Art. 12 of the CPD the interpretative documents shall :

a) give concrete form to the essential requirements by harmonising the terminology and the technical bases and indicating classes or levels for each requirement where necessary ;

b) indicate methods of correlating these classes or levels of requirement with the technical specifications, e.g. methods of calculation and of proof, technical rules for project design, etc. ;

c) serve as a reference for the establishment of harmonised standards and guidelines for European technical approvals.

The Eurocodes, *de facto*, play a similar role in the field of the ER 1 and a part of ER 2.

The Eurocode standards provide common structural design rules for everyday use for the design of whole structures and component products of both a traditional and an innovative nature. Unusual forms of construction or design conditions are not specifically covered and additional expert consideration will be required by the designer in such cases.

National Standards implementing Eurocodes

The National Standards implementing Eurocodes will comprise the full text of the Eurocode (including any annexes), as published by CEN, which may be preceded by a National title page and National foreword, and may be followed by a National annex.

The National annex may only contain information on those parameters which are left open in the Eurocode for national choice, known as Nationally Determined Parameters, to be used for the design of buildings and civil engineering works to be constructed in the country concerned, *i.e.* :

- values and/or classes where alternatives are given in the Eurocode,
- values to be used where a symbol only is given in the Eurocode,
- country specific data (geographical, climatic, etc.), e.g. snow map,
- the procedure to be used where alternative procedures are given in the Eurocode,
- decisions on the application of informative annexes,
- references to non-contradictory complementary information to assist the user to apply the Eurocode.

Links between Eurocodes and products harmonised technical specifications (ENs and ETAs)

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works[4]. Furthermore, all the information accompanying the CE Marking of the construction products which refer to Eurocodes should clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific to EN 1996-1-2

The general objectives of fire protection are to limit risks with respect to the individual and society, neighbouring property, and where required, directly exposed property, in the case of fire.

Construction Products Directive 89/106/EEC gives the following essential requirement for the limitation of fire risks:

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[4] see Art.3.3 and Art.12 of the CPD, as well as clauses 4.2, 4.3.1, 4.3.2 and 5.2 of ID 1.

"The construction works must be designed and build in such a way, that in the event of an outbreak of fire

- the load bearing resistance of the construction can be assumed for a specified period of time
- the generation and spread of fire and smoke within the works are limited
- the spread of fire to neighbouring construction works is limited
- the occupants can leave the works or can be rescued by other means
- the safety of rescue teams is taken into consideration".

According to the Interpretative Document "Safety in Case of Fire" the essential requirement may be observed by following various fire safety strategies, including passive and active fire protection measures.

The fire parts of Structural Eurocodes deal with specific aspects of passive fire protection in terms of designing structures and parts thereof for adequate load bearing resistance that could be needed for safe evacuation of occupants and fire rescue operations and for limiting fire spread as relevant.

Required functions and levels of performance are generally specified by the national authorities - mostly in terms of standard fire resistance rating. Where fire safety engineering for assessing passive and active measures is accepted, requirements by authorities will be less prescriptive and may allow for alternative strategies.

This Part 1-2, together with EN 1991-2-2, Actions on structures exposed to fire, gives the supplements to EN 1996-1-1, which are necessary so that structures designed according to this set of Structural Eurocodes may also comply with structural fire resistance requirements.

Supplementary requirements concerning, for example

- the possible installation and maintenance of sprinkler systems
- conditions on occupancy of building or fire compartment
- the use of approved insulation and coating materials, including their maintenance

are not given in this document, because they are subject to specification by the competent authority.

A full analytical procedure for structural fire design would take into account the behaviour of the structural system at elevated temperatures, the potential heat exposure and the beneficial effects of active fire protection systems, together with the uncertainties associated with these three features and the importance of the structure (consequences of failure).

At the present time it is possible to undertake a procedure for determining adequate performance which incorporates some, if not all, of these parameters and to demonstrate that the structure, or its components, will give adequate performance in a real building fire. However the principal current procedure in European countries is one based on results from standard fire resistance tests. The grading system in regulations, which call for specific periods of fire resistance, takes into account (though not explicitly), the features and uncertainties described above.

Due to the limitations of the test method, further tests or analyses may be used. Nevertheless, the results of standard fire tests form the bulk of input for calculation models for structural fire design. This prestandard therefore deals in the main with the design for the standard fire resistance.

Application of this Part 1-2 of Eurocode 6 with the thermal actions given in EN 1991-2-2, is illustrated in figure 0.1. For design according to this part, EN 1991-2-2 is required for the determination of temperature fields in structural elements, or when using general calculation models for the analysis of the structural response.

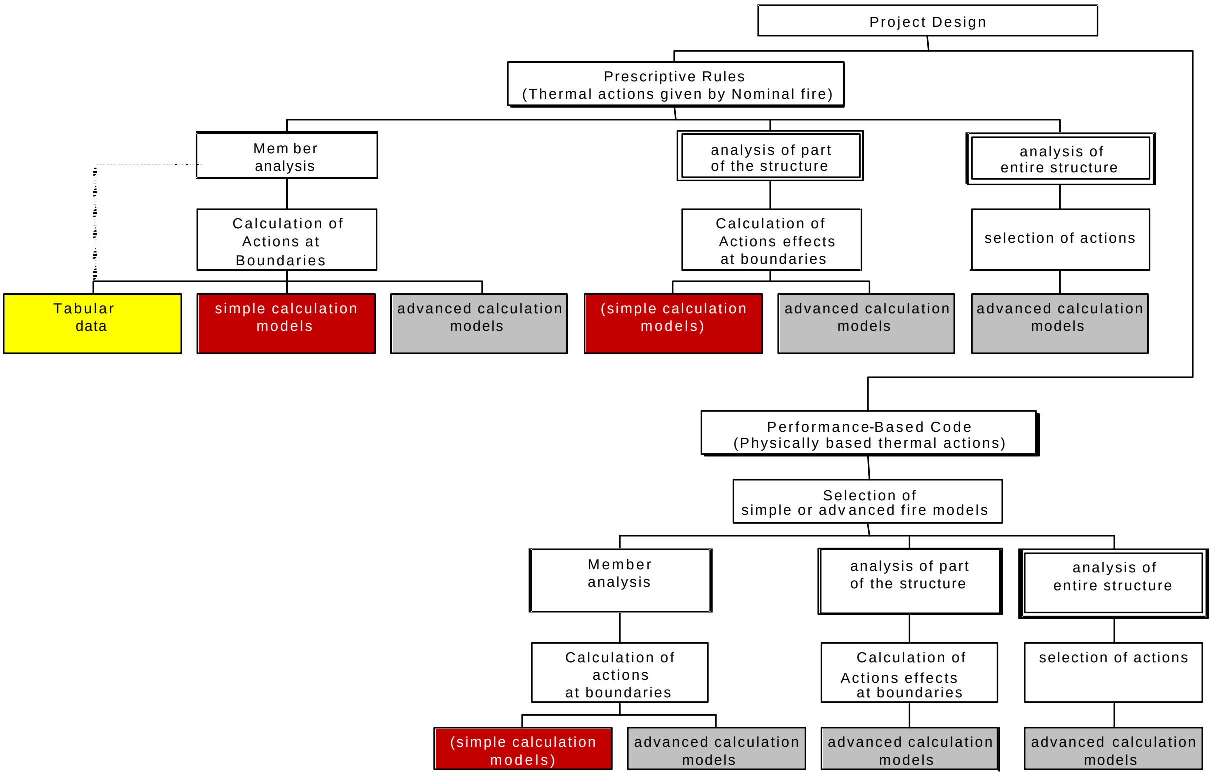

Figure 0.1 : Design procedures

Where simple calculation models are not available, the Eurocode fire parts give design solutions in terms of tabular data (based on tests or general calculation models), which may be used within the specified limits of validity.

It is expected, that design aids based on the calculation models given in ENV 1996-1-2, will be prepared by interested external organisations.

EN 1996-1-2 is intended for the consideration of:

- code drafting committees;
- clients (e.g. for the formulation of their specific requirements on reliability level);
- designers and contractors;
- public authorities.

EN 1996-1-2 is intended to be used together with EN 1990, EN 1991-1-2 and EN 1996-1-1 for the design of structures.

Numerical values for partial factors and other reliability elements are given as basic values that provide an acceptable level of reliability. They have been selected assuming that an appropriate level of workmanship and of quality management applies.

EN1996-1-2 is divided into a main text and a series of annexes.

The main text of EN 1996 together with normative Annex A etc. includes most of the principal concepts and rules necessary for direct application for structural fire design of masonry structures.

National Annex for EN 1996-1-2

This standard gives alternative procedures, values and recommendations for classes with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1996-1-2 should have a National annex containing all Nationally Determined Parameters to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

Section 1. General

1.1 Scope

(1) P This Part 1-2 of EN 1996 deals with the design of masonry structures for the accidental situation of fire exposure and is intended to be used in conjunction with EN 1996-1-1, EN 1996-2 and EN 1991-1-2. This part 1-2 only identifies differences from, or supplements to, normal temperature design.

(2) P This document deals only with passive methods of fire protection. Active methods are not covered.

(3) P This Part 1-2 applies to masonry structures that, for reasons of general fire safety, are required to fulfil certain functions when exposed to fire, in terms of:

- avoiding premature collapse of the structure (load bearing function)
- limiting fire spread (flame, hot gases, excessive heat) beyond designated areas (separating function)

(4) P This Part 1-2 gives principles and application rules (see EN 1991-1-2) for designing structures for specified requirements in respect of the aforementioned functions and the levels of performance.

(5) P This Part 1-2 applies to structures, or parts of structures, that are within the scope of EN 1996-1-1 and EN 1996-2 and are designed accordingly. However, it does not cover reinforced masonry.

(6) P The methods given in this Part 1-2 are applicable to masonry structures, or parts thereof, that are described in EN 1996-1-1 and EN 1996-2 [1)] and are designed accordingly. This Part deals with the following:

- non-loadbearing internal walls.
- non-loadbearing external walls.
- loadbearing internal walls with separating or non-separating functions.
- loadbearing external walls with separating or non-separating functions.

Further boundary conditions are defined in Section 3.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this European Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this European Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

EN 771-1 Specification for masonry units Part 1:Clay masonry units.

[1)] ENV 1996-2 is in course of preparation

EN 771-2 Specification for masonry units Part 2: Calcium silicate masonry units

EN 771-3 Specification for masonry units Part 3: Aggregate concrete masonry units

EN 771-4 Specification for masonry units Part 4: Aerated concrete masonry units

EN 771-5 Specification for masonry units Part 5: Manufactured stone masonry units

EN 771-13 Methods of tests for masonry units Part 13: Determination of net and gross dry density of masonry units

EN 998-2 Specification for mortar for masonry Part 2: Masonry mortar.

EN Plaster and rendering

EN 1363 … Fire resistance: General requirements;
Part 1: General requirements
Part 2: Alternative and additional requirements

ENV 13381 Fire tests on elements of building construction:

Part 2: Test method for determining the contribution to the fire resistance of structural members: by vertical protective membranes;

Part z: Test method for determining the contribution to the fire resistance of structural members: by applied protection to masonry structural elements; ((withdrawn ?))

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

EN 1991 *(Eurocode 1): Basis of design and actions on structures:*

Part 1-2: *Actions on structures exposed to fire*;

EN 1996 *(Eurocode 6): Design of masonry structures:*

Part 1.1: *General rules: General rules and rules for buildings*;
Part 2: *Design, selection of materials and execution of masonry*
Part 3: *Simplified and simple rules for masonry structures*

ISO 1000 *SI units*.

1.3 Definitions

For the purposes of this Part 1-2 of EN 1996, the definitions of EN 1990 and of EN 1991-1-2 apply with the additional definitions:

Effective cross section: Cross section of the member in structure fire design used in the effective cross section method. It is obtained from the residual cross section by removing parts of the cross section with assumed zero strength and stiffness. ~~(EC2)~~

Fire protection material: Any material or combination of materials applied to a structural member for the purpose of increasing its fire resistance

Fire wall: A wall separating two spaces (generally two buildings) that is designed for fire resistance and structural stability, including resistance to horizontal loading **(Criterion M)** such that, in case of fire and failure of the structure on one side of the wall, fire spread beyond the wall is avoided.

NOTE: In some countries fire wall has been defined as a separating wall between fire compartments without a requirement for resistance to mechanical impact; the definition above should not be confused with that more limited one. Fire walls may have to fulfil additional requirements, which are not given in this part 1-2. They are given in the regulations of each country

Loadbearing wall: Flat, membrane-like component predominantly subjected to compressive stress, for supporting vertical loads, for example floor loads, and also for supporting horizontal loads, for example wind loads.

Non-loadbearing wall: Flat membrane-like building component that is loaded predominantly only by its dead weight and does not provide bracing for loadbearing walls; however, it may have to transfer horizontal loads acting on its surface to loadbearing building components such as walls or floors.

Non-separating wall: Loadbearing wall exposed to fire on two or more sides.

Normal temperature design: Ultimate limit state design for ambient temperatures according to Part 1-1 of EN 1992 to 1996 or ENV 1999

Part of structure: isolated part of an entire structure with appropriate support and boundary conditions.

Residual cross section: Cross section of the original member reduced with the burn out depth.

Separating wall: wall exposed to fire on one side only.

Structural failure of a wall in the fire situation: When the wall loses its ability, calculated in accordance with ENV 1996-1-1, to carry a load up to a resistance of NRd divided by average Yr after a certain period of time.

$F_{smax} = fk / \gamma m \bullet \gamma f$

$\gamma m \bullet \gamma f =$

1.4 Symbols

For the purpose of this Part 1-2, the following symbols apply

Latin upper case letters

A_m the surface area of a member per unit length;

A_p the area of the inner surface of the fire protection material per unit length of the member;

$E_{d,fi}$ the design effect of actions in the fire situation;

R 30 or R 60,. . ., a member meeting the load bearing criterion for 30, or 60 .. minutes in standard fire exposure,

E 30 or E 60,. . ., a member meeting the integrity criterion for 30, or 60 ..minutes in standard fire exposure.

I 30 or I 60,. . ., a member meeting the thermal insulation criterion for 30, or 60 .. minutes in standard fire exposure.

M 90 or M 120,. . ., a member meeting the mechanical resistance criterion for 90, or 120 .. minutes in standard fire exposure.

Latin lower case letters

c the specific heat [J/kgK];

c_t combined web thickness [mm/m]

d_p the thickness of fire protection material;

f_b characteristic unit strength [N/mm²]

f working load that means the actual load on the wall [N/mm²]

$h_{net,d}$ the design value of the net heat flux per unit area;

l the length at 20°C ;

t the time in fire exposure [minutes];

Greek upper case letters

Dt the time interval [seconds];

Greek lower case letters

h_{fi}	the reduction factor for design load level in the fire situation;
q	the temperature [°C] (cf *T* temperature [K]);
l	the thermal conductivity [W/mK];
m_0	the degree of utilisation at time $t = 0$.
ρ	is the gross density of the masonry units measured according to EN 772- 13.

1.5 Units

(1)P SI units shall be used in conformity with ISO 1000.

(2) Supplementary to EN 1996-1-1, the following units are recommended :

- area : m^2 ;
- insulation thickness : m;
- temperature : °C;
- absolute temperature : K;
- temperature difference : K;
- specific heat : J/kgK;
- coefficient of thermal conductivity : W/mK.

Section 2. Basic principles and rules

2.1 General

(1)P Where mechanical resistance **(R)** in the case of fire is required, structures shall be designed and constructed in such a way that they maintain their load bearing function during the relevant fire exposure.

(2)P Where compartmentation is required, the elements forming the boundaries of the fire compartment, including joints, shall be designed and constructed in such a way that they maintain their separating function during the relevant fire exposure, i.e.

- no integrity failure **(E)** in order to prevent the passage through it of flames and hot gases and to prevent the occurrence of flames on the unexposed side

- no insulation failure **(I)** in order to restrict the temperature rise of the unexposed face to below specified levels.

- and, when requested, limitation of the thermal radiation ( ) from the unexposed side.

Note: there is no need to consider the thermal radiation with a unexposed surface temperature below 300 °C (see EN 1361-2 § 8.1)

- and, when requested, resistance to mechanical impact (M)

(3)P Deformation criteria shall be applied where the means of protection, or the design criteria for separating elements, require consideration of the deformation of the load bearing structure.

2.2 Performance requirements

2.2.1 Nominal fire exposure

(1)P Members shall comply with criteria R, E and I as follows:

- separating only (EI):	integrity (criterion E) and insulation (criterion I)
- load bearing only (R):	mechanical resistance (criterion R)
- separating and load bearing (REI):	criteria R, E and I
- loadbearing, separating and mechanical impact:	R, E, I and M
- separating and mechanical impact:	E, I and M

(2) Criterion "R" is assumed to be satisfied where the load bearing function is maintained during the required time of fire exposure.

(3) Criterion “I” is assumed to be satisfied where the average temperature rise over the whole of the non-exposed surface is limited to 140 K, and the maximum temperature rise at any point of that surface does not exceed 180 K

(4) Criterion “E” is assumed to be satisfied where the passage through the element of flames and hot gases is prevented.

(5) Where a vertical separating element with or without load-bearing function have to comply with impact resistance requirement (criterion M), the element should resist a horizontal concentrated load as specified in EN 1363 Part 2.

(6) Consideration of the deformation of the load bearing structure is not necessary in the following cases

- the efficiency of the means of protection has been evaluated according to 3.3.3,
- the separating elements have to fulfil requirements according to a nominal fire exposure.

2.2.2 Parametric fire exposure

(1) The load-bearing function is ensured when collapse is prevented during the complete duration of the fire including the decay phase or during a required period of time.

(2) The separating function with respect to insulation is ensured when

- the average temperature rise over the whole of the non-exposed surface is limited to 140 K, and the maximum temperature rise of that surface does not exceed 180 K at the time of the maximum gas temperature,
- and the average temperature rise over the whole of the non-exposed surface is limited to 180 K, and the maximum temperature rise of that surface does not exceed 220 K during the decay phase of the fire or up to a required period of time.

2.3 Actions

(1)P The thermal and mechanical actions shall be taken from EN 1991-1-2.

(2) In addition to EN 1991-1-2, the emissivity related to the surface material of members should be equal to 0.xx

2.3 Design values of material properties

(1)P Design values of mechanical (strength and deformation) material properties $X_{d,fi}$ are defined as follows:

$$X_{d,fi} = k_{\theta} X_k / g_{M,fi} \qquad (2.1c)$$

where:

X_k is the characteristic value of a strength or deformation property *(generally* *f_k or E_k)* for normal temperature design to EN 1996-1-1;

k_{θ} is the reduction factor for a strength or deformation property $(X_{k,\theta} / X_k)$, dependent on the material temperature, see Annex D;

$g_{M,fi}$ is the partial safety factor for the relevant material property, for the fire situation.

(2)P Design values of thermal material properties $X_{d,fi}$ are defined as follows:

- if an increase of the property is favourable for safety:

$$X_{d,fi} = X_{k,\theta} / g_{M,fi} \qquad (2.1a)$$

- if an increase of the property is unfavourable for safety:

$$X_{d,fi} = g_{M,fi} X_{k,\theta} \qquad (2.1b)$$

where:

$X_{k,\theta}$ is the value of a material property in fire design, generally dependent on the material temperature, see section 3;

$g_{M,fi}$ is the partial safety factor for the relevant material property, for the fire situation.

NOTE: For thermal properties of masonry the recommended value of partial safety factor for the fire situation is:

$$g_{M,fi} = 1,0$$

For mechanical properties of masonry, the recommended value of partial safety factor for the fire situation is:

$g_{M,fi}$ = $1{,}0$

2.4 Assessment methods

2.4.1 General

(1)P The model of the structural system adopted for design in the fire situation shall reflect the expected performance of the structure in fire.

(2)P The analysis for the fire situation may be carried out using one of the following:

- member analysis, see 2.4.2.
- analysis of part of the structure, see 2.4.3;
- global structural analysis, see 2.4.4

Note: Thermal expansion may cause large action effect remote from the fire source

(3)P It shall be verified for the relevant duration of fire exposure that

$$E_{\mathrm{fi,d}} \leq R_{\mathrm{fi,d}} \qquad (2.7)$$

where

$E_{\mathrm{fi,d}}$ is the design effect of actions for the fire situation, determined in accordance with EN 1991-2-2, including effects of thermal expansions and deformations

$R_{\mathrm{fi,d}}$ is the corresponding design resistance in fire situation.

(4) For verifying standard fire resistance requirements, a member analysis is sufficient

(5) Where application rules given in this Part 1-2 are valid only for the standard temperature-time curve, this is identified in the relevant clauses

(6) Tabulated data given in 3.5 are based on the standard temperature-time curve.

(7)P As an alternative to design by calculation, fire design may be based on the results of fire tests, or on fire tests in combination with calculations, see EN 1990 clause 5.2 .

2.4.2 Member analysis

(1) The restraint conditions at supports and ends of member, applicable at time t = 0, are assumed to remain unchanged throughout the fire exposure.

(2) As an alternative to carrying out a structural analysis for the fire situation at time t = 0, the reactions at supports and internal forces and moments may be obtained from a structural analysis for normal temperature design by using:

$$E_{fi,d} = h_{fi} E_d \quad (2.3)$$

where:

E_d is the design value of the corresponding force or moment for normal temperature design, for a fundamental combination of actions (see EN 1990);

h_{fi} is the reduction factor for the design load level for the fire situation.

(3) The reduction factor for the design load level for the fire situation η_{fi} for load combination (6.10) in EN 1990 is given by:

$$h_{fi} = \frac{\gamma_{GA} G_k + \psi_{1,1} Q_{k,1}}{\gamma_G G_k + \gamma_{Q,1} Q_{k,1}} 1 \qquad (2.4)$$

or the lower of the two following expressions for load combinations (6.10)a and (6.10b) in EN 1990:

$$h_{fi} = \frac{g_{GA} G_k + y_{1,1} Q_{k,1}}{g_G G_k + g_{Q,1} y_{0,1} Q_{k,1}} \qquad (2.4a)$$

$$h_{fi} = \frac{g_{GA} G_k + y_{1,1} Q_{k,1}}{x g_G G_k + g_{Q,1} Q_{k,1}} \qquad (2.4b)$$

where:

$Q_{k,1}$ is the principal variable load;

g_{GA} is the partial factor for permanent actions in accidental design situations;

$y_{1,1}$ is the combination factor for frequent values, see table xx in EN1990

NOTE: *Regarding equation (2.4), an example of the variation of the reduction factor h_{fi} versus the load ratio $Q_{k,1}/G_k$ for different values of the combination factor $y_{1,1}$ are shown in figure 2.1 with the following* *assumptions: g_{GA} = 1,0, g_G = 1,35 and g_Q = 1,5. Partial factors are specified in the relevant National annexes of EN 1990.Note that equations (2.4a) and (2.4b) give slightly higher values.*

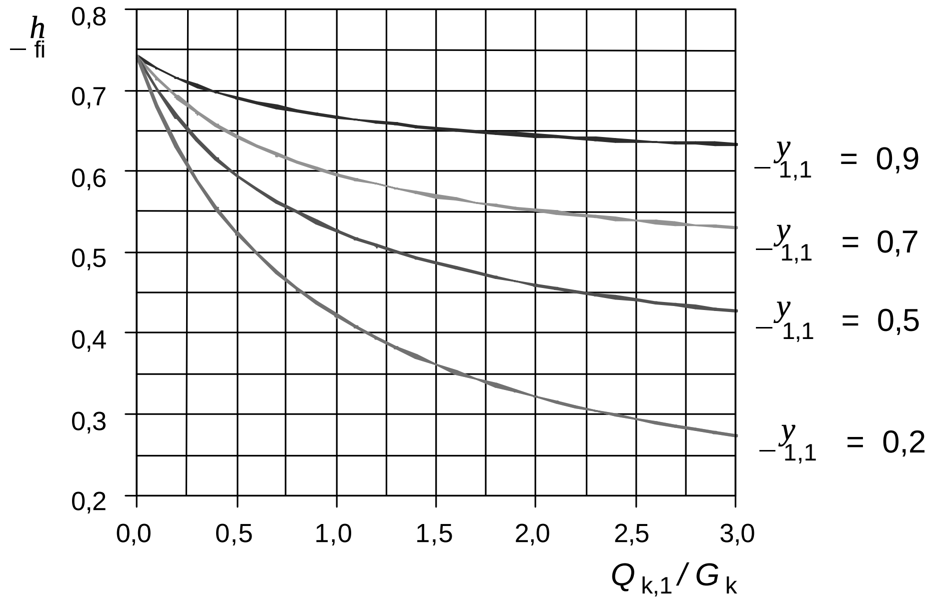

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Figure 2.1: Variation of the reduction factor h_{fi} with the load ratio $Q_{k,1} / G_k$

Note As a simplification h_{fi} = 0,65 may be used, except for load category E as given in ENV 1991-2.1 (areas susceptible to accumulation of goods, including access areas) for which a value of 0,7 should be used.

(4) Only the effects of thermal deformations resulting from thermal gradients across the cross-section need be considered. The effects of axial or in-plain thermal expansions may be neglected.

(5) Tabulated data, simplified or general calculation methods given in 4.2, 4.3 and 4.4 respectively are suitable for verifying members under fire conditions.

2.4.3 Analysis of part of the structure

(1)P The part of the structure to be analysed should be specified on the basis of the potential thermal expansions and deformations such, that their interaction with other parts of the structure can be approximated by time-independent support and boundary conditions during fire exposure.

(2) Within the part of the structure to be analysed, the relevant failure mode in fire exposure, the temperature-dependent material properties and member stiffnesses, effects of thermal expansions and deformations (indirect fire actions) shall be taken into account

(3) The restraint conditions at supports and forces and moments at boundaries of part of the structure, applicable at time t = 0, are assumed to remain unchanged throughout the fire exposure

2.4.4 Global structural analysis

(1)P When global structural analysis for the fire situation is carried out, the relevant failure mode in fire exposure, the temperature-dependent material properties and member stiffnesses, effects of thermal expansions and deformations (indirect fire actions) shall be taken into account.

3 Fire resistance of masonry walls

3.1 General information on the design of walls

3.1.1 General

(1) This Part applies to walls designed and built in accordance with Principles and Application Rules of EN1996-1-1, EN 1996-2 and ENV 1996-3. This part is also valid for non-loadbearing walls.

3.1.2 Wall types by function

(1) For fire protection, a distinction is made between non-loadbearing walls and loadbearing walls and between separating walls and non-separating walls.

(2) Examples of separating walls are walls along escape ways, walls of stair wells, or compartment walls. They serve to prevent fire propagating from one place to another. They are exposed to fire on one side only.

(3) Examples of non-separating loadbearing walls are walls within a fire compartment; they are loadbearing, but are subjected to fire on two or more sides.

(4) External walls may be separating walls, or non-separating walls as required. External separating walls less than 1,0 m in length should be treated as non-separating walls.

(5) Wall areas comprising lintels above openings must fulfil at least the same fire resistance class as the wall.

(6) Fire walls are separating walls that additionally are required to resist mechanical impact, for example to separate buildings or fire compartments. There are additional requirements relating to:

- non-combustible materials
- constructional detailing for preventing fire spread
- thermal reaction or expansion of adjacent construction situated close to the fire wall may not effect the fire wall
- stiffening. Where stiffenings such as cross walls, floors, beams, columns or frames, these must fulfil at least the same fire resistance class as the fire wall.

  Columns and beams made of steel , which are situated directly in front of a fire wall may have to fulfil additional requirements.

  It is possible to place stiffenings without fire resistance on both sides of the fire wall, if it is assessed that the failure of the stiffenings on one side of the fire wall does not lead to a failureof the fire wall.

NOTE: See note for definition of fire walls and impact, chapter 1.3.

3.1.3 Cavity walls and untied walls comprising independing leaves

(1) The fire resistance of a cavity wall depends upon whether one or both leaves of the wall are loaded. When both leaves are loadbearing and carry approximately equal loads, the fire resistance of a cavity wall with leaves of approximately equal thickness is defined as the fire resistance of an equivalent single leaf wall of thickness equal to the sum of the thicknesses of the two leaves, see figure 1.1.

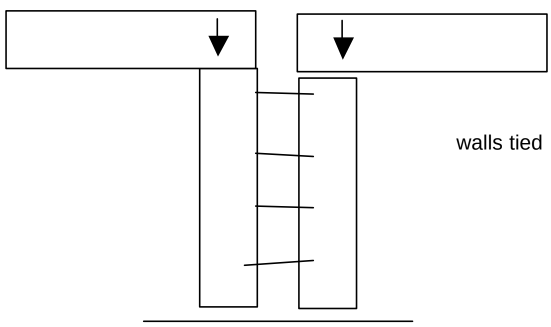

figure1.1: **cavity wall**

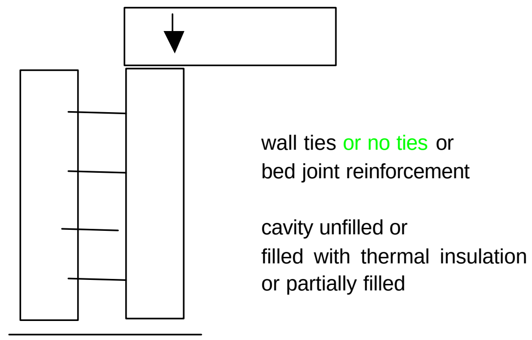

figure 1.2: **cavity wall**

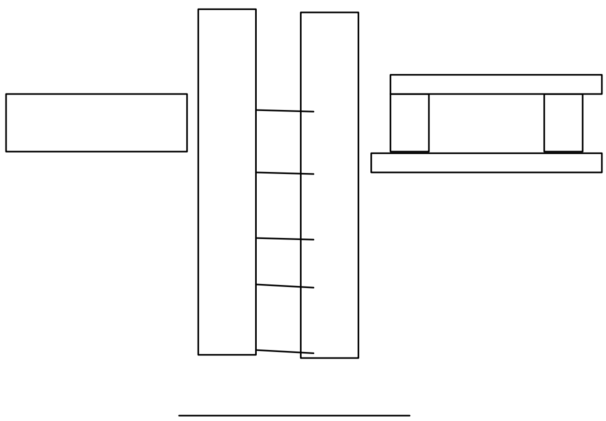

figure 1.3 **cavity wall**

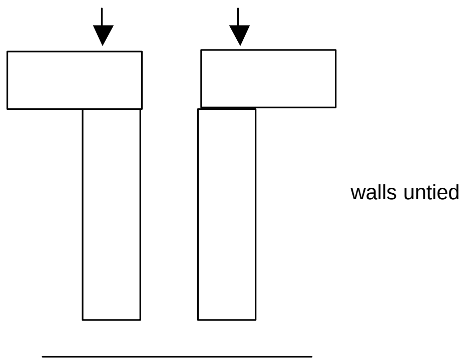

figure 1.4: **double leaf wall**

figure 1: Explanation of cavity walls and double leaf walls

(2) When only one leaf of a cavity wall is loadbearing, the resistance of the wall is usually enhanced over the fire resistance achieved for the loadbearing leaf when considered to act as a single leaf wall, see figure 1.2.

(3) The fire resistance of a cavity wall comprising two non-loadbearing leaves may be taken as the

sum of the fire resistances of the individual leaves with a limit to a maximum of 240 min when fire resistance is determined by this method, see figure1.3.

(4) For untied walls comprising independing leafs the fire resistance of the wall is determined by reference to the appropiate table for single leaf walls – loadbearing or nonloadbearing, see figure 1.4.

3.1.4 Junctions, joints

(1) This Part applies to walls that extend from one floor to the next floor or to the roof; it is assumed that those floors or the roof provide lateral support to the top and bottom of the wall, unless its stability under normal function is achieved by other means, for example buttresses or special ties.

(2)P Joints, including movement joints, in walls or between walls and other fire separating members shall be designed and constructed so as to meet the fire resistance requirement of the wall.

(3)P Where insulating layers are required in movement joints, they shall consist of mineral based materials having a melting point of not less than 1.000^{0}C. Any joints shall be tightly sealed so that movements of the wall shall not adversely effect the fire resistance. If other materials are to be used, it shall be shown by test that they will meet criteria E and I (see EN 1366: Part 4).

(4) Connections of non-loadbearing masonry walls may be built according to EN 1996 - 2 or to the examples given in annex C of this part, figures 1 and 2.

[[EN 1996- 2 or -3 needs to be checked, when draft is presented]]

(5) Connections of loadbearing masonry walls may be built according to EN 1996 - 2 or to the examples given in annex C of this part figures 3 and 4.

[[EN 1996 - 2 needs to be checked, when draft is presented]]

(6) Connections of fire walls to other structures

Connections with no static requirements can be built according to annex C of this part figures 1 and 2 (examples).

Connections to reinforced, unreinforced concrete and masonry structures which have to fulfil static requirements (connections which have to fulfil the mechanic impact according to EN 1363-2) must be built with joints that filled completely with mortar according to EN ~~XXX~~ 998-2 or concrete according to EN XXX or according to the figures 3, 4, and 5 given in annex C of this part (examples).

Method of connecting the fire wall may effect the fire resistance.

3.1.5 Fixtures, pipes and cables

(1) Recesses and chases, that are permitted in EN 1996-1-1 to be included in loadbearing walls without the need for separate calculation, can be assumed not to reduce the period of fire resistance given in the tables referred to in 3.5.

(2) For non-loadbearing walls, vertical chases and recesses should leave at least 2/3 of the required minimum thickness of the wall or at least 60 mm, including any integrally applied fire resistance finishes such as plaster.

(3) Horizontal and inclined chases and recesses in non-loadbearing walls should leave at least 5/6 of the required minimum thickness of the wall or at least 60 mm, including any integrally applied fire resistant finishes such as plaster.They should not be positioned within the middle one-third height of the wall. The width of individual chases and recesses in non-loadbearing walls should be not greater than twice the required minimum thickness of the wall, including any integrally applied fire resistant finishes such as plaster.

(4) If the above rules for recesses and chases are not followed test according to EN 1364 are necessary.

(5) Individual cables may pass through holes sealed with mortar. Non-combustible pipes up to 100 mm diameter may pass through holes, sealed with mortar (see footnote), if the effects of heat conduction through the pipes is not sufficient to infringe the criterion I and E and elongation.

(6) Groups of cables and pipes of combustible material, or individual cables in holes not sealed with mortar, may pass through walls only if

- the method of sealing the penetration has been evaluated by testing according to EN 1366: Part 3 [4)]
- follow recognised national guidance.

3.2 Materials for use in masonry walls

3.2.1 Units

(1) The Tables referred to in 3.5 apply to masonry built with units that comply with EN 771-1,2,3 and 4. Limitations as to strength and density of units are stated in the

---

[4)] If materials other than mortar are approved by CEN Standards, they may be substitutes

Tables. If units not covered by EN 771-1, 2, 3, 4 or units according to EN 771 - 5, are to be used, evaluation by testing should be carried out.

(2)P Masonry units shall be grouped as Group 1, 2 or 3 as given in table 3.1

(3) For the purposes of the tables referred to in 3.5 some thicknesses of walls are further specified to be built in solid units; such units should not contain any perforations, but they may contain indentations, for example frogs, grip holes or grooves in the bed face, that will be filled with mortar in the finished wall. In the case of frogged units the gross volume of the frog should not exceed 20 %.

3.2.2 Mortar

(1) The tables referred to in 3.5 apply to masonry built with general purpose, lightweight, or thin layer mortars complying with EN 998-2 or 1996-1-1. ~~except that the mortar joint thickness is limited to a maximum of 3 mm when mortars based on organic binders are used.~~

3.2.3 Rendering and plastering mortar

(1) The fire resistance of masonry walls may be increased by the use of the following mortar of at least 10 mm thickness:

- plaster type L-G according to EN *998-1* or
- *gypsum premixed plaster according to EN XXX*
- plaster type LW or T according to EN 998-1

(2) The bond between plaster and masonry for fire is only effectiv, if the requirements of EN 998–1 are fullfiled.

Table 3.1: Requirements for grouping of masonry units based on fire aspects.

	Group of masonry units				
	1	2	3 ((Wärmedämm-ziegel))	4 ((Füllziegel))	5 ((Langloch-ziegel))
Volume of holes (% of the gross volume)	≤ 25 (see note 1)	> 25-55 for clay units > 25-60 for concrete aggregate units	≤ 70 Limited by area (see note 3)	(see note 3)	horizontal holes
Volume of any hole (% of the gross volume)	≤ 12,5	≤ 12,5 for clay units ≤ 25 for concrete aggregate units	each of multiple holes ≤ 10%	single holes ≤ 50 %	???
Minimum thickness of material between and around holes (mm)	No requirement	web shell clay 6 10 concrete 20 20 cal-sil 10 15	web shell clay 6 10	web shell clay 6 10	web shell clay 6 10
Combined thickness c_t (% of the overall width or (mm/m) (see note 4)	≥ 37,5 %	≥ 20 or ≥ 30 %	≥ 120 mm/m	≥ 100 mm/m	no requirement

1. Holes may consist of formed vertical holes through the units or frogs or recesses.
2. Further conditions according the unit strength, the density and the loading are given in the tables 3.2 - 3.6.
3. Holes may only consist of formed vertical holes through the unit or recesses.
4. The combined thickness is the thickness of the webs and shells, measured horizontally across the unit at right angles to the face of the wall.

	Grouping of masonry units												
	solid units calcium silicate	1	2			3 (thermal insulating units)			4 (units for mortar or concrete infill)			5 (horizontally perforated units)	
volume of holes (% of the gross volume)	≤ 5	≤ 25	clay	25 < x ≤ 55		clay	55 < x ≤ 70		clay	25 < x ≤ 70		clay	25 < x ≤ 70
			calcium silicate	25 < x ≤ 55		calcium silicate			calcium silicate			calcium silicate	
			concrete	25 < x ≤ 60		concrete			concrete			concrete	
Volume of any hole (% of the gross volume)	≤ 2,5	≤ 12,5	clay	each of multiple holes ≤ 1 % gripholes up to a total of 12,5%		clay	each of multiple holes ≤ 1 % gripholes up to a total of 12,5%		no requirement			clay	each of multiple holes ≤ 12,5 % single hole ≤ 50%
			calcium silicate	each of multiple holes ≤ 15 % gripholes up to a total of 30 %		calcium silicate						calcium silicate	
			concrete			concrete						concrete	
Minimum thickness in and around holes (mm)		no requirement		web	shell		web	shell		web	shell		web or shell
			clay	5	8	clay	3	6	clay	14	20	clay	8
			calcium silicate	5	10	calcium silicate			calcium silicate			calcium silicate	
			concrete	15	15	concrete			concrete			concrete	
Regularity criterion		no requirement	minimum thickness of any web or shell	minimum number of webs and shells per m (length or thickness of the wall)		minimum thickness of any web or shell	minimum number of webs and shells per m (length or thickness of the wall)		minimum thickness of any web or shell	minimum number of webs and shells per m (length or thickness of the wall)		no requirement	
			5	30		5	20		14	6			
			8	20		8	15						
			10	16		10	12						
			15	11		15	8						
			20	8									
			30	6									
			calcium silicate	the minimum of webs and shells (length or thickness of the wall) ≥ 150 mm/m concrete 200 mm/m									

3.3 Additional requirements related to masonry walls

(1)P Any supporting or stiffening part of a structure shall have at least the same fire resistance as the structure being supported or stiffened.

(2) Flammable thin damp proof materials incorporated into a wall may be ignored in assessing fire resistance.

(3) Perforated masonry units should not be laid so that the perforations are at right angles to the face of the wall, i.e. the wall should not be penetrated by the masonry units perforations.

(4) ~~Unplastered~~ Masonry having unfilled vertical joints less than 5mm wide, made with units that are designed to be used and accepted in that way, (i.e. high precision dimension or tonge and groove masonry units) may be treated as being within the tables referred to in 3.5 if plaster of 1 mm thickness is used on at least on one side. The fire resistance periods are those given by the values without (). These values are also valid for walls having sand-cement rendered finish.

(5)P The tables referred to in 3.5 shall not be used for walls either having a height to thickness ratio greater than the following:

- Loadbearing
  - general purpose mortar 27
  - light weight mortar 27
  - thin layer mortar 30
- Non-loadbearing 40

or exceeding the relevant size limits given in EN 1996-1-1 or EN 1996-2**.** Loadbearing walls should additionally meet all regulatory requirements for structural stability in respect of the individual and combined actions and should be designed in accordance with EN 1996-1-1 or ENV 1996-3.

Remark just for information:

	Class	I	II	III	IV
	comments from	*(UK)*	*(Finland)*	*(Germany)*	*(Netherlands)*
-	*Loadbearing*	*27*	*26*	*25*	*30*
-	*Non-loadbearing*	*40*	*26*	*40*	*40*

(6) When rendering or plaster is required for enhance the fire resistance of two leaf walls an additional masonry leaf or masonry cladding can be used instead. For cavity and ~~two~~doubleleaf walls rendering or plaster is only needed on the outside of the leafs - not between the two leafs.

(7) If thermal insulation systems made of insulation and plaster according to EN XXX are used on single leaf external walls

- insulation layers made of combustible materials do not enhance fire resistance,
- insulation layers made of non-combustible materials, e.g. mineral wool or foamglas, can be used instead of the 10 mm rendering or plaster.

3.4 Assessment by testing

(1) For all types of masonry walls the fire resistance may be obtained, using the test methods listed in Annex A.

3.5 Assessment by tabulated data

(1) Assessment for masonry walls may be made by the following tabulated data giving minimum thicknesses of masonry for stated periods of fire resistance, made with units of

- clay complying with EN 771-1,
- calcium silicate complying with EN 771-2,
- aggregate concrete complying with EN 771-3,
- autoclaved aerated concrete, complying with EN 771-4.

.

(2) Masonry walls comprising natural stone and manufactored units are not covered by the tabulated data.

(3) In these tables, the thickness referred to should be of the masonry itself, excluding finishes, if any. The first row is for walls without an applied finish or walls having a sand-cement rendered finish or thin rendering ((Spachtelputz)). Values in brackets () are for walls having an applied finish of rendering or plaster according to 3.2.3 of minimum thickness 10mm on both sides of the wall.

(4) In these tables, the minimum thickness of a wall for fire resistance purposes is given. The thickness required from consideration of EN 1996-1-1, or other requirements, for example sound performance, are not taken into account.

(5) The values that apply to loadbearing walls are stated to cover, as appropriate, a load up to characteristic compressive strength *or less* depending in the type of unit. It is the actual load (working load) that is possible to put on the wall.

> Note: As EN1996-1-1 was not ready when discussion the tables this way of fixing the load was the only way, because the fire behaviour of masonry depends mainly on the percentage of load depending on the type of unit and unit strength.

[for consideration after finishing the tables]

(6) The use of Tables 1.3, 2.3, 3.3, 4.3, is limited to walls of length greater than 1,0 m. For walls less than 1,0 m in length, Tables 1.4, 2.4, 3.4, 4.4, should be used.

Table 1.1: Fire resistance classification for masonary wall made of
Clay units complying with EN 771-1
Criterion EI non-loadbearing

row number	material properties gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **EI - separating non-loadbearing**								
		15	20	30	45	60	90	120	180	240
1	clay units **group 1 - 3** mortar : general purpose, thin layer, lightweight									
1.1 1.2	$500 \leq \rho \leq 2.400$	60 (50)	60 (50)	60 (50)	100 (50)	100 (60)	100 (80)	100 (100)	170 (130)	200 (170)

Table 1.2: Fire resistance classification of masonary walls made of
Clay units conforming To EN 771-1 and EN 771-X
Criterion REI - Separating loadbearing single-leaf walls

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **REI** - separating loadbearing						
		30	45	60	90	120	180	240
1	**group 1** mortar: general purpose, thin layer							
1.1	$5 \le f_b \le 15$ $800 \le \rho < 2.400$							
1.1.1	100 % $f \le 2$ N/mm²	100 (90)		100 (100)	100 (100)	170 (100)	200 (170)	200 (170)
1.1.2	60 % $f \le 1{,}5$ N/mm²	100 (90)		100 (100)	100 (100)	140 (100)	170 (140)	200 (170)
1.1.3	$f \le 0{,}75$ N/mm²	100 (90)		100 (90)	100 (100)	140 (100)	170 (140)	200 (170)
1.2	$15 \le f_b \le 100$ $1.000 \le \rho \le 2.400$							
1.2.1	100 % $f \le 5$ N/mm²	100 (90)		100 (90)	100 (100)	140 (100)	200 (140)	200 (170)
1.2.2	60 % $f \le 3$ N/mm²	90 (90)		100 (90)	100 (90)	100 (100)	170 (140)	200 (170)
1.3	$5 \le f_b \le 35$ $500 \le \rho \le 800$							
1.3.1	100 % $f \le 2{,}25$ N/mm²	100 (100)		200 (170)	240 (240)	365 (300)	365 (365)	
1.3.2	60 % $f \le 1{,}25$ N/mm²	100 (100)		170 (140)	240 (170)	365 (300)	365 (300)	
2	**group 2** mortar: general purpose, thin layer							
2.1	$7{,}5 \le f_b \le 15$ $800 \le \rho \le 2.200$ $ct \ge 250$							
2.1.1	100 % $f \le 2{,}75$ N/mm²	100 (100)		100 (100)	170 (100)	240 (140)	240 (170)	
2.1.2	60 % $f \le 1{,}75$ N/mm²	100 (100)		100 (100)	140 (100)	170 (100)	240 (140)	
2.2	$15 \le f_b \le 35$ $800 \le \rho \le 2.200$ $ct \ge 250$							
2.2.1	100 % $f \le 4{,}25$N/mm²	100 (100)		100 (100)	170 (100)	240 (140)	240 (170)	
2.2.2	60 % $f \le 2{,}5$N/mm²	100 (100)		100 (100)	140 (100)	170 (100)	240 (140)	
2.3	mortar: and lightweight $5 \le f_b \le 10$ $700 \le \rho \le 800$ $ct \ge 250$							
2.3.1	100 % $f \le 2{,}25$N/mm²	(100)		(100)	(100)	(140)	(170)	
2.3.2	60 % $f \le 1{,}25$ N/mm²	(100)		(100)	(100)	(100)	(140)	
2.4	mortar: and lightweight $10 \le f_b \le 25$ $700 \le \rho \le 800$ $ct \ge 250$							
2.4.1	100 % $f \le 3{,}25$N/mm²	(100)		(100)	(100)	(140)	(170)	
2.4.2	60 % $f \le 2$ N/mm²	(100)		(100)	(100)	(100)	(140)	

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **REI** - separating loadbearing						
		30	45	60	90	120	180	240
2.5	mortar: and lightweight 5 ≤ f_b ≤ 10 500 ≤ ρ ≤ 900 160 ≤ ct ≥ 250							
2.5.1 2.5.2	100 % f ≤ 2,25 N/mm²	(100)		(170)	(240)	(300)	(365)	
2.5.3 2.5.4	60 % f ≤ 1,25 N/mm²	(100)		(140)	(170)	(300)	(300)	
2.6	10 ≤ f_b ≤ 25 500 ≤ ρ ≤ 900 160 ≤ ct ≥ 250							
2.6.1 2.6.2	100 % f ≤ 3,25 N/mm²	(100)		(170)	(240)	(300)	(365)	
2.6.3 2.6.4	60 % f ≤ 2 N/mm²	(100)		(140)	(170)	(300)	(300)	
3	**group 3** mortar: general purpose and lightweight and thin layer vertical perforation 5 ≤ f_b ≤ 35 500 ≤ ρ ≤ 1.200 ct ≥ 120							
3.1.1 3.1.2	100 % f ≤ 2 N/mm²	(100)		(240)	(300)	(365)	(425)	
3.1.3 3.1.4	60 % f ≤ 1,25 N/mm²	(100		(170)	(240)	(300)	(365)	
4	**group 4** mortar: general purpose and thin layer vertical perforation 10 ≤ f_b ≤ 35 500 ≤ ρ ≤ 1.200 ct ≥ 100							
4.1.1 4.1.2	σ = 100 % ≤ 3,25 N/mm²	100 (100)		100 (100)	170 (100)	240 (140)	240 (170)	
4.1.3 4.1.4	σ = 60 % ≤ 2 N/mm²	100 (100)		100 (100)	140 (100)	170 (100)	240 (140)	
5	**group 5** mortar: general purpose and lightweight and thin layer horizontal perforation 5 ≤ f_b ≤ 35 500 ≤ ρ ≤ 1.200							
5.1.1 5.1.2	100 % f ≤ 2,25 N/mm²	(100)		(240)	(300)	(365)	(425)	
5.1.3 5.1.4	60 % f ≤ 1,25 N/mm²	(100		(170)	(240)	(300)	(365)	

Table 1.3: **Fire resistance classification for masonary wall made of**
Clay units comforming with EN 771-1 and EN 771-X
Criterion R - Non-separating loadbearing single-leaf walls - **length > 1,0 m**

row number	material properties unit strength f_b [N/mm^2] gross density ρ [kg/m^3] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **R** - non-separating loadbearing						
		30	45	60	90	120	180	240
1	**group 1** mortar: general purpose, thin layer							
1.1	5≤ f_b ≤15 800 ≤ ρ < 2.400							
1.1.1 1.1.2	100 % f ≤ 2 N/mm^2	100 (100)		100 (100)	240 (100)	365 (170)	490 (240)	
1.1.3 1.1.4	60 % f ≤ 1,5 N/mm^2	100 (100)		100 (100)	170 (100)	240 (100)	300 (200)	
	f ≤ 0,75 N/mm^2	100 (100)		100 (100)	170 (100)	240 (100)	300 (200)	
1.2	15 ≤ f_b ≤ 100 1.000 ≤ ρ ≤ 2.400							
1.2.1 1.2.2	100 % f ≤ 5 N/mm^2	100 (100)		100 (100)	240 (100)	365 (170)	490 (240)	
1.2.3 1.2.4	60 % f ≤ 3 N/mm^2	100 (100)		100 (100)	170 (100)	240 (100)	300 (200)	
1.3	5 ≤ f_b ≤ 35 500 ≤ ρ ≤ 800							
1.3.1 1.3.2	100 % f ≤ 2,25 N/mm^2	100 (100)		200 (170)	240 (240)	365 (300)	365 (365)	
1.3.3 1.3.4	60 % f ≤ 1,25 N/mm^2	100 (100)		170 (140)	240 (170)	365 (300)	365 (300)	
2	**group 2** mortar: general purpose, thin layer							
2.1	7,5 ≤ f_b ≤ 15 800 ≤ ρ ≤ 2.200 ct ≥ 250							
2.1.1 2.1.2	100 % f ≤ 2,75 N/mm^2	100 (100)		100 (100)	240 (100)	365 (170)	490 (240)	
2.1.3 2.1.4	60 % f ≤ 1,75 N/mm^2	100 (100)		100 (100)	170 (100)	240 (100)	300 (200)	
2.2	f_b ≥ 15– 35 800 ≤ ρ ≤ 2.200 ct ≥ 250							
2.2.1 2.2.2	100 % f ≤ 4,25N/mm^2	100 (100)		100 (100)	240 (100)	365 (170)	490 (240)	
2.2.3 2.2.4	60 % f ≤ 2,5N/mm^2	100 (100)		100 (100)	170 (100)	240 (100)	300 (200)	
2.3	mortar: and lightweight 5 ≤ f_b ≤ 10 700 ≤ ρ ≤ 800 ct ≥ 250							
2.3.1 2.3.2	100 % f ≤ 2,25N/mm^2	(100)		(100)	(100)	(170)	(240)	
2.3.3 2.3.4	60 % f ≤ 1,25 N/mm^2	(100)		(100)	(100)	(100)	(200)	
2.4	mortar: and lightweight 10 ≤ f_b ≤ 25 700 ≤ ρ ≤ 800 ct ≥ 250							
2.4.1 2.4.2	100 % f ≤ 3,25N/mm^2	(100)		(100)	(100)	(170)	(240)	
2.4.3 2.4.4	60 % f ≤ 2 N/mm^2	(100)		(100)	(100)	(100)	(200)	

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **R** - non-separating loadbearing						
		30	45	60	90	120	180	240
2.5	mortar: and lightweight $5 \le f_b \le 10$ $500 \le \rho \le 900$ $160 \le ct \ge 250$							
2.5.1 2.5.2	100 % $f \le 2{,}25$ N/mm²	(240)		(240)	(240)	(300)	(365)	
2.5.3 2.5.4	60 % $f \le 1{,}25$ N/mm²	(170)		(170)	(240)	(240)	(300)	
2.6	$10 \le f_b \le 25$ $500 \le \rho \le 900$ $160 \le ct \ge 250$							
2.6.1 2.6.2	100 % $f \le 3{,}25$ N/mm²	(240)		(240)	(240)	(300)	(365)	
2.6.3 2.6.4	60 % $f \le 2$ N/mm²	(170)		(170)	(240)	(240)	(300)	
3	**group 3** mortar: general purpose and lightweight and thin layer vertical perforation $5 \le f_b \le 35$ $500 \le \rho \le 1.200$ $ct \ge 120$							
3.1.1 3.1.2	100 % $f \le 2$ N/mm²	(100)		(240)	(300)	(365)	(425)	
3.1.3 3.1.4	60 % $f \le 1{,}25$ N/mm²	(100)		(170)	(240)	(300)	(365)	
4	**group 4** mortar: general purpose and thin layer vertical perforation $10 \le f_b \le 35$ $500 \le \rho \le 1.200$ $ct \ge 100$							
4.1.1 4.1.2	σ = 100 % $\le 3{,}25$ N/mm²	100 (100)		100 (100)	240 (100)	365 (170)	490 (240)	
4.1.3 4.1.4	σ = 60 % ≤ 2 N/mm²	100 (100)		100 (100)	170 (100)	240 (100)	300 (200)	
5	**group 5** mortar: general purpose and lightweight and thin layer horizontal perforation $5 \le f_b \le 35$ $500 \le \rho \le 1.200$							
5.1.1 5.1.2	100 % $f \le 2{,}25$ N/mm²	(100)		(240)	(300)	(365)	(425)	
5.1.3 5.1.4	60 % $f \le 1{,}25$ N/mm²	(100)		(170)	(240)	(300)	(365)	

Table 1.4: Fire resistance classificationof masonary walls made of
Clay units conforming to EN 771-1 and EN 771-X
Criterion R Non-separating leadbearing single-leaf columns – **length ≤ 1,0 m**

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
1 1.1	**Group 1** mortar : general purpose, thin layer, 5 ≤ f_b ≤ 15 800 ≤ ρ ≤ 2.400											
1.1.1	f ≤ 2,5 N/mm²	100			990 (490)		990 (600	(730)				
		170			600 (240)		730 (240)	990 (365)	(365)			
		240			365 (170)		490 (170)	600 (240)	(240)	(365)		
		300			300 (170)		365 (170)	490 (200)	(240)	(300)		
1.1.2	f ≤ 1,5 N/mm²	100			600 (365)		730 (490)	990 (600)	(730)			
		170			490 (240)		600 (240)	730 (240)	990 (300)			
		240			200 (170)		240 (170)	300 (170)	365 (240)	490 (300)		
		300			200 (170)		200 (170)	240 (170)	365 (170)	490 (240)		
1.2	15 ≤ f_b ≤ 100 1.000 ≤ ρ ≤ 2.400											
1.2.1	f ≤ 5 N/mm²	100			990 (490)		990 (600	(730)				
		170			600 (240)		730 (240)	990 (365)	(365)			
		240			365 (170)		490 (170)	600 (240)	(240)	(365)		
		300			300 (170)		365 (170)	490 (200)	(240)	(300)		
1.2.2	f ≤ 3 N/mm²	100			600 (365)		730 (490)	990 (600)	(730)			
		170			490 (240)		600 (240)	730 (240)	990 (300)			
		240			200 (170)		240 (170)	300 (170)	365 (170)	490 (240)		
		300			200 (170)		200 (170)	240 (170)	365 (170)	490 (240)		
1.3	5 ≤ f_b ≤ 35 500 ≤ ρ ≤ 800											
1.3.1	f ≤ 2,25 N/mm²	170										
		240										
		300										
1.3.2	f ≤ 1,25 N/mm²	170										
		240										
		300										

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
2 2.1	**Group 2** mortar : general purpose, thin layer, 7,5 ≤ f_b ≤ 15 800 ≤ ρ ≤2.200 ct ≥ 250											
2.1.1	f ≤ 2,75 N/mm²	100			990 (490)		990 (600	(730)				
		170			600 (240)		730 (240)	990 (365)	(365)			
		240			365 (170)		490 (170)	600 (240)	(240)	(365)		
		300			300 (170)		365 (170)	490 (200)	(240)	(300)		
2.1.2	f ≤ 1,75 N/mm²	100			600 (365)		730 (490)	990 (600)	(730)			
		170			490 (240)		600 (240)	730 (240)	990 (300)			
		240			200 (170)		240 (170)	300 (170)	365 (240)	490 (300)		
		300			200 (170)		200 (170)	240 (170)	365 (170)	490 (240)		
2.2	15 ≤ f_b ≤ 35 800 ≤ ρ ≤2.200 ct ≥ 250											
2.2.1	f ≤ 4,25 N/mm²	100			990 (490)		990 (600	(730)				
		170			600 (240)		730 (240)	990 (365)	(365)			
		240			365 (170)		490 (170)	600 (240)	(240	(365)		
		300			300 (170)		365 (170)	490 (200)	(240)	(300)		
2.2.2	f ≤ 2,5 N/mm²	100			600 (365)		730 (490)	990 (600)	(730)			
		170			490 (240)		600 (240)	730 (240)	990 (300)			
		240			200 (170)		240 (170)	300 (170)	365 (240)	490 (300)		
		300			200 (170)		200 (170)	240 (170)	365 (170)	490 (240)		
2.3	5 ≤ f_b ≤ 10 700 ≤ ρ ≤ 800 ct ≥ 250											
2.3.1.1 2.3.1.2	f ≤ 2,25 N/mm²	100			(490)		(600)	(730)				
2.3.1.3 2.3.1.4		170			(240)		(240)	(240)	(365)	(365)		
2.3.1.5 2.3.1.6		240			(170)		(170	(240)	(240)	(365)		
2.3.1.7 2.3.1.8		300			(170)		(170)	(200)	(240)	(300)		
2.3.2.1 2.3.2.2	f ≤ 1,25 N/mm²	100			(365)		(490)	(600)	(730)			
2.3.2.3 2.3.2.4		170			(240)		(240)	(240)	(300)			
2.3.2.5 2.3.2.6		240			(170)		(170)	(170)	(240)	(300)		
2.3.2.7 2.3.2.8		300			(170)		(170)	(170)	(170)	(240)		

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
2.4	$10 \le f_b \le 25$ $700 \le \rho \le 800$ ct ≥ 250											
2.4.1.1 2.4.1.2 2.4.1.3 2.4.1.4 2.4.1.5 2.4.1.6 2.4.1.7 2.4.1.8	$f \le 3{,}25$ N/mm²	100			(490)		(600)	(730)				
		170			(240)		(240)	(365)	(365)			
		240			(170)		(170)	(240)	(240)	(365)		
		300			(170)		(170)	(200)	(240)	(300)		
2.4.2.1 2.4.2.2 2.4.2.3 2.4.2.4 2.4.2.5 2.4.2.6 2.4.2.7 2.4.2.8	$f \le 2$ N/mm²	100			(365		(490)	(600)	(730			
		170			(240)		(240)	(240)	(300)			
		240			(170)		(170)	(170)	(240)	(300)		
		300			(170)		(170)	(170)	(170)	(240)		
2.5	$5 \le f_b \le 10$ $500 \le \rho \le 900$ 160 ct ≥ 250											
2.5.1	$f \le 2{,}25$ N/mm²	240			(240)		(240)	(300)	(300)	(365)		
		300			(240)		(240)	(240)	(240)	(300)		
		365			(240)		(240)	(240)	(240)	(240)		
	$f \le 1{,}25$	240			(240)		(240)	(240)	(240)	(365)		
		300			(170)		(170)	(170)	(240)	(240)		
		365			(170)		(170)	(170)	(240)	(240)		
2.6	$10 \le f_b \le 25$ $500 \le \rho \le 900$ 160 ct ≥ 250											
2.6.1	$f \le 3{,}25$ N/mm²	240			(240)		(240)	(300)	(300)	(365)		
		300			(240)		(240)	(240)	(240)	(300)		
		365			(240)		(240)	(240)	(240)	(240)		
2.6.2	$f \le 2$ N/mm²	240			(240)		(240)	(240)	(240)	(365)		
		300			(170)		(170)	(170)	(240)	(240)		
		365			(170)		(170)	(170)	(240)	(240)		
3	**Group 3** mortar: general purpose and lightweight, vertical perforation $5 \le f_b \le 35$ $500 \le \rho \le 1.200$ ct ≥ 120											
3.1.1 3.1.2 3.1.3 3.1.4 3.1.5 3.1.6	$f \le$	240			(240)		(240)	(300)	(300)	(365)		
		300			(240)		(240)	(240)	(240)	(300)		
		365			(240)		(240)	(240)	(240)	(240)		
3.2.1 3.2.2	$f \le$	240			(240)		(240)	(240)	(240)	(365)		

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
3.2.3 3.2.4		300			(170)		(170)	(170)	(240)	(240)		
		365			(170)		(170)	(170)	(240)	(240)		
4 4.1.1 4.1.2	**Group 4** mortar: genral purpose and thin layer vertical perforation 5 ≤ f_b ≤ 35 500 ≤ ρ ≤ 1.200 ct ≥ 100											
4.1.3 4.1.4	f ≤ 2 N/mm²	100			990 (490)		990 (600)	(730)				
4.1.5 4.1.6		170			600 (240)		730 (240)	990 (365)	(365)			
4.1.7 4.1.8		240			365 (240)		490 (170)	600 (240)	(240)	(365)		
4.2.1 4.2.2		300			300 (170)		365 (170)	490 (200)	(240)	(300)		
4.2.3 4.2.4	f ≤ 1,25 N/mm²	100			600 (365)		730 (490)	990 (600)	(730)			
4.2.5 4.2.6		170			490 (240)		600 (240)	730 (240)	990 (300)			
4.2.7 4.2.8		240			200 (170)		240 (170)	300 (170)	365 (240)	490 (300)		
		300			200 (170)		200 (170)	240 (170)	365 (170)	490 (240)		
5 5.1.1	**Group 5** mortar: general purpose and lightweight horizontal perforation 5 ≤ f_b ≤ 35 500 ≤ ρ ≤ 1.2											
5.1.2 5.1.3	f ≤ 2,25 N/mm²	240			(240)		(240)	(300	(300)	(365		
5.1.4 5.1.5		300			(240)		(240)	(240)	(240)	(300		
5.1.6 5.2.1		365			(240		(240	(240)	(240)	(240)		
5.2.2 5.2.3	f ≤ 1,25 N/mm²	240			(240		(240	(240	(240	(365		
5.2.4 5.2.5		300			(170)		(170)	(170)	(240	(240		
5.2.6		365			(170)		(170)	(170)	(240)	(240)		

Table 1.5: Fire resistance classification of masonary walls made of
Clay units conforming To EN 771-1 and EN 771-X
Criterion REI-M - Separating loadbearing single-leaf walls

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **REI-M**						
		30	45	60	90	120	180	240
1 1.1	**Group 1** mortar : general purpose, thin layer, $5 \leq f_b \leq 15$ $800 \leq \rho \leq 2.400$							
1.1.1	$f \leq 2$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
1.1.2	$f \leq 1{,}5$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
1.1.3	$f \leq 0{,}75$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
1.2	$15 \leq f_b \leq 100$ $1.000 \leq \rho \leq 2.400$							
	$f \leq 5$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
	$f \leq 3$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
1.3	$5 \leq f_b \leq 35$ $500 \leq \rho \leq 800$							
1.3.1	$f \leq 2{,}25$ N/mm²							
1.3.2	$f \leq 1{,}25$ N/mm²							
2 2.1	**Group 2** mortar : general purpose, thin layer $7{,}5 \leq f_b \leq 15$ $800 \leq \rho \leq 2.200$ $ct \leq 250$							
2.1.1	$f \leq 2{,}75$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
2.1.2	$f \leq 1{,}75$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
2.2	$15 \leq f_b \leq 35$ $800 \leq \rho \leq 2.200$ $ct \leq 250$							
2.2.1	$f \leq 4{,}25$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
2.2.2	$f \leq 2{,}5$ N/mm²	240		240	240		365	
		(175)		(175)	(175)		(365)	
2.3	mortar: and lightweight $5 \leq f_b \leq 10$ $700 \leq \rho \leq 800$ $ct \leq 250$							
2.3.1	$f \leq 2{,}25$ N/mm²	365		365	365			
		(175)		(175)	(175)		(365)	
2.3.2	$f \leq 1{,}25$ N/mm²	365		365	365			
		(175)		(175)	(175)		(365)	
2.4	mortar: and lightweight $10 \leq f_b \leq 25$ $700 \leq \rho \leq 800$ $ct \leq 250$							
2.4.1	$f \leq 3{,}25$ N/mm²	365		365	365			
		(175)		(175)	(175)		(365)	
2.4.2	$f \leq 2$ N/mm²	365		365	365			
		(175)		(175)	(175)		(365)	

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **REI-M**						
		30	45	60	90	120	180	240
2.5 2.5.1 2.5.2	mortar: and lightweight $5 \leq f_b \leq 10$ $500 \leq \rho \leq 900$ ct $160 \leq 250$							
	$f \leq 2{,}25$ N/mm²	365		365	365			
		(240)		(240)	(240)		(365)	
	$f \leq 1{,}25$ N/mm²	365		365	365			
		(240)		(240)	(240)		(365)	
2.6 2.6.1 2.6.2	mortar: and lightweight $10 \leq f_b \leq 25$ $500 \leq \rho \leq 900$ ct $160 \leq 250$							
	$f \leq 3{,}25$ N/mm²	365		365	365			
		(240)		(240)	(240)		(365)	
	$f \leq 2$ N/mm²	365		365	365			
		(240)		(240)	(240)		(365)	
3	**Group 3** mortar : general purpose, lightweight, thin layer, vertical perforation $5 \leq f_b \leq 35$ $500 \leq \rho \leq 1.200$ ct ≥ 120							
3.1.1	$f \leq 2$ N/mm²							
3.1.2		(365)		(365)	(365)			
3.2.1	$f \leq 1{,}25$ N/mm²							
3.2.2		(365)		(365)	(365)			
4	**Group 4** mortar : general purpose, thin layer, vertical perforation $5 \leq f_b \leq 35$ $500 \leq \rho \leq 1.200$ ct 100							
4.1.1	$f \leq 2$ N/mm²							
4.1.2		(175)		(175)	(175)			
4.2.1	$f \leq 1{,}25$ N/mm²							
4.2.2		(175)		(175)	(175)			
5	**Group 5** mortar : general purpose, lightweight, thin layer, horizontal perforation $5 \leq f_b \leq 35$ $500 \leq \rho \leq 1.200$ ct ≥ 120							
5.1.1	$f \leq 2{,}25$ N/mm²							
5.1.2		(365)		(365)	(365)			
5.2.1	$f \leq 1{,}25$ N/mm²							
5.2.2		(365)		(365)	(365)			

Table 1.6: **Fire resistance classification of masonary walls made of** Clay units conforming to EN 771-1 and EN 771-X

Criterion REI - Separating loadbearing cavity wall with one leaf loaded

row number	material properties unit strength f_b [N/mm²] density ρ [kg/m³] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - cavity wall**						
		30	45	60	90	120	180	240
1 1.1	**Group 1** mortar : general purpose, thin layer $5 \leq f_b \leq 15$ $800 \leq ρ \leq 2.400$							
1.1.1 1.1.2	$f \leq 2$ N/mm²	90 (90)		90 (90)	100 (100)	170 (100)	200 (170)	200 (170)
1.1.3 1.1.4	$f \leq 1,5$ N/mm²	90 (90)		90 (90)	100 (90)	140 (100)	170 (140)	200 (170)
1.1.5 1.1.6	$f \leq 0,75$ N/mm²	90 (90)		90 (90)	90 (90)	140 (100)	170 (140)	200 (170)
1.2	$15 \leq f_b \leq 100$ $1.000 \leq ρ \leq 2.400$							
1.2.1 1.2.2	$f \leq 5$ N/mm²	90 (90)		90 (90)	100 (100)	140 (100)	200 (140)	200 (170)
1.2.3 1.2.4	$f \leq 3$ N/mm²	90 (90)		90 (90)	90 (90)	100 (100)	170 (140)	200 (170)
1.3	$5 \leq f_b \leq 35$ $500 \leq ρ \leq 800$							
1.3.1 1.3.2	$f \leq 2,25$ N/mm²	100 (100)		170 (140)	240 (200)	365 (300)	365 (365)	
1.3.3 1.3.4	$f \leq 1,25$ N/mm²	100 (100)		170 (140)	200 (170)	300 (300)	365 (300)	
2 2.1	**Group 2** mortar : general purpose, thin layer, $7,5 \leq f_b \leq 15$ $800 \leq ρ \leq 2.200$ $ct \leq 250$							
2.1.1 2.1.2	$f \leq 2,75$ N/mm²	100 (100)		100 (100)	170 (100)	240 (140)	240 (170)	
2.1.3 2.1.34	$f \leq 1,75$ N/mm²	100 (100)		100 (100)	140 (100)	170 (100)	240 (140)	
2.2	$15 \leq f_b \leq 35$ $800 \leq ρ \leq 2.200$ $ct \leq 250$ mm/m							
2.2.1 2.2.2	$f \leq 4,25$ N/mm²	100 (100)		100 (100)	170 (100)	240 (140)	240 (170)	
2.2.3 2.2.4	$f \leq 2,5$ N/mm²	100 (100)		100 (100)	140 (100)	170 (100)	240 (140)	
2.3	mortar: and lightweight $5 \leq f_b \leq 10$ $700 \leq ρ \leq 800$ $ct \leq 250$							
2.3.1 2.3.2	$f \leq 2,25$ N/mm²	(100)		(100)	(100)	(140)	(170)	
2.3.3 2.3.4	$f \leq 1,25$ N/mm²	(100)		(100)	(100)	(100)	(140)	
2.4	mortar: and lightweight $10 \leq f_b \leq 25$ $700 \leq ρ \leq 800$ $ct \leq 250$							

row number	material properties unit strength f_b [N/mm^2] density ρ [kg/m^3] combined thickness ct [mm/m]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - cavity wall**						
		30	45	60	90	120	180	240
2.4.1 2.4.2	$f \leq 3{,}25$ N/mm^2	(100)		(100)	(100)	(140)	(170)	
2.4.3 2.4.4	$f \leq 2$ N/mm^2	(100)		(100)	(100)	(100)	(140)	
2.5	mortar: and lightweight $5 \leq f_b \leq 10$ $500 \leq \rho \leq 900$ ct $160 \leq 250$							
2.5.1 2.5.2	$f \leq 2{,}25$ N/mm^2	(100)		(170)	(240)	(300)	(365)	
2.5.3 2.5.4	$f \leq 1{,}25$ N/mm^2	(100)		(140)	(170)	(300)	(300)	
2.6	$10 \leq f_b \leq 25$ $500 \leq \rho \leq 900$ ct $160 \leq 250$							
2.6.1 2.6.2	$f \leq 3{,}25$	(100)		(170)	(240)	(300)	(365)	
2.6.3 2.6.4	$f \leq 2$	(100)		(140)	(170)	(300)	(300)	
3	**group 3** mortar: general purpose and lightweight and thin layer vertical perforation $5 \leq f_b \leq 35$ $500 \leq \rho \leq 1.200$ ct ≥ 120							
3.1.1 3.1.2	100 % $f \leq 2$ N/mm^2	(100)		(240)	(300)	(365)	(425)	
3.1.3 3.1.4	60 % $f \leq 1{,}25$ N/mm^2	(100		(170)	(240)	(300)	(365)	
4	**group 4** mortar: general purpose and thin layer vertical perforation $10 \leq f_b \leq 35$ $500 \leq \rho \leq 1.200$ ct ≥ 100							
4.1.1 4.1.2	$\sigma = 100$ % $\leq 3{,}25$ N/mm^2	100 (100)		100 (100)	170 (100)	240 (140)	240 (170)	
4.1.3 4.1.4	$\sigma = 60$ % ≤ 2 N/mm^2	100 (100)		100 (100)	140 (100)	170 (100)	240 (140)	
5 5.1.1 5.1.2 5.1.3 5.1.4	**group 5** mortar: general purpose and lightweight and thin layer horizontal perforation $5 \leq f_b \leq 35$ $500 \leq \rho \leq 1.200$							
	100 % $f \leq 2{,}25$ N/mm^2	(100)		(240)	(300)	(365)	(425)	
	60 % $f \leq 1{,}25$ N/mm^2	(100		(170)	(240)	(300)	(365)	

Table 2.1: Fire resistance classification for masonary wall made of Calcium-silicate units complying with EN 771-2
Criterion EI - separating non-loadbearing

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **EI - separating non-loadbearing**								
		15	20	30	45	60	90	120	180	240
1	**Group 1 – 2**									
1.1	mortar : general purpose, 600 ≤ ρ < 2.200			70 (50)		100 (70)	100 (100)	100 (100)	175 (140)	
1.2	precision units mortar: thin layer 600 ≤ ρ < 2.200			70 (50)		70 (70)	100 (100)	100 (100)	175 (140)	

Table 2.2: **Fire resistance classification for masonary wall made of** Calcium-silicate units complying with EN 771-2

Criterion REI - Separating loadbearing single-leaf walls

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - separating loadbearing**						
		30	45	60	90	120	180	240
1	**Solid units**							
	precision units mortar: thin layer $15 \leq f_b \leq 60$ $1.700 \leq \rho < 2.200$							
1.1.1 1.1.2	100 % $f \leq$ 4,5 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	200 (140)	200 (175)	
1.2.1 1.2.2	60 % $f \leq$ 2,7 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	120 (100)	200 (140)	
2	**Group 1**							
2.1	mortar : general purpose, $15 \leq f_b \leq 60$ $1.400 \leq \rho < 2.200$							
2.1.1 2.1.2	100 % $f \leq$ 4,5 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	200 (140)	240 (175)	
2.1.3 2.1.4	60 % $f \leq$ 2,7 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	140 (100)	200 (140)	
2.2	precision units mortar: thin layer $15 \leq f_b \leq 60$ $1.400 \leq \rho < 2.200$							
2.2.1 2.2.2	100 % $f \leq$ 4,5 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	200 (140)	200 (175)	
2.2.3 2.2.4	60 % $f \leq$ 2,7 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	120 (100)	200 (140)	
3	**Group 2**							
3.1	mortar : general purpose, $6 \leq f_b \leq 60$ $700 \leq \rho < 1.600$							
3.1.1 3.1.2	100 % $f \leq 3,0$	100 (100)	100 (100)	100 (100)	100 (100)	140 (100)	200 (140)	
3.1.3 3.1.4	60 % $f \leq 1,8$	100 (100)	100 (100)	100 (100)	100 (100)	140 (100)	200 (140)	
3.2	precision units mortar: thin layer $6 \leq f_b \leq 60$ $700 \leq \rho < 1.600$							
3.2.1 3.2.2	100 % $f \leq 3,0$	115 (115)	115 (110)	115 (115)	115 (115)	200 (140)	240 (175)	
3.2.3 3.2.4	60 % $f \leq 1,8$	115 (115)	115 (115)	115 (115)	115 (115)	140 (115)	200 (140)	

Table 2.3: Fire resistance classification of masonary walls made of Calcium-silicate units complying with EN 771-2

Criterion R - Non-separating loadbearing single-leaf walls - **length > 1,0 m**

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing						
		30	45	60	90	120	180	240
1	**Solid units**							
	precision units mortar: thin layer $15 \leq f_b \leq 60$ $1.700 \leq \rho < 2.200$							
1.1.1 1.1.2	100 % $f \leq$ 4,5 N/mm²	100 (100)	100 (100)	100 (100)	140 (100)	200 (175)	240 (200)	
1.1.3 1.1.4	60 % $f \leq$ 5,4 N/mm²	100 (100)	100 (100)	100 (100)	140 (100)	175 (100)	200 (175)	
2	**Group 1**							
2.1	mortar : general purpose, $15 \leq f_b \leq 60$ $1.400 \leq \rho < 2.200$							
2.1.1 2.1.2	100 % $f \leq$ 4,5 N/mm²	115 (115)	115 (115)	115 (115)	115 (115)	200 (175)	240 (190)	
2.1.3 2.1.4	60 % $f \leq$ 2,7 N/mm²	115 (115)	115 (115)	115 (115)	115 (115)	175 (115)	200 (175)	
2.2	precision units mortar: thin layer $15 \leq f_b \leq 60$ $1.400 \leq \rho < 2.200$							
2.2.1 2.2.2	100 % $f \leq$ 4,5 N/mm²	100 (100)	100 (100)	100 (100)	140 (100)	200 (175)	240 (200)	
2.2.3 2.2.4	60 % $f \leq$ 2,7 N/mm²	100 (100)	100 (100)	100 (100)	140 (100)	175 (100)	200 (175)	
3	**Group 2**							
3.1	mortar : general purpose, $6 \leq f_b \leq 35$ $700 \leq \rho < 1.600$							
3.1.1 3.1.2	100 % $f \leq 3{,}0$	115 (115)	115 (115)	115 (115)	150 (115)	200 (175)	240 (100)	
3.1.3 3.1.4	60 % $f \leq 1{,}8$	115 (115)	115 (115)	115 (115)	140 (115)	175 (115)	200 (175)	
3.2	precision units mortar: thin layer $6 \leq f_b \leq 60$ $700 \leq \rho < 1.600$							
3.2.1 3.2.2	100 % $f \leq 3{,}0$	115 (115)	115 (115)	115 (115)	150 (115)	200 (175)	240 (100)	
3.2.3 3.2.4	60 % $f \leq 1{,}8$	115 (115)	115 (115)	115 (115)	140 (115)	175 (115)	200 (175)	

Table 2.4: Fire resistance classificationof masonary walls made of
Calcium-silicate units complying with EN 771-2
Criterion R - Non-separating leadbearing single-leaf columns - **length ≤1,0 m**

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall thickness (mm)	Minimum wall length (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
1	**Solid units**											
	precision units mortar: thin layer 15≤ f_b ≤ 60 1.700≤ ρ < 2.200											
1.1.1 1.1.2	100 % f ≤ 4,5 N/mm²											
1.1.3 1.1.4	60 % f ≤ 2,7 N/mm²											
2	**Group 1**											
2.1	mortar : general purpose, 15 ≤ f_b ≤ 60 1.400≤ ρ < 2.200											
2.1.1 2.1.2 2.1.3 2.1.4 2.1.5 2.1.6 2.1.7 2.1.8 2.1.9 2.1.10 2.1.11 2.1.12 2.1.13 2.1.14 2.1.15 2.1.16 2.1.17 2.1.18 2.1.19	100 % f ≤ 4,5 N/mm²	100										
		115			365 ( )		? (490)	? (730)	--[1)]	--[1)]		
		175			240 ( )		240 ( )	300 ( )	300 ( )	490 ( )		
		200										
		214										
		240			175		175	240	240	365		
		300										
		365										
	60 % f ≤ 2,7 N/mm²	100										
		115			? (365)		? (490)	? (615)	? (990)	--[1)]		
		175			240 (?)		240 (?)	240 (?)	240 (?)	365 (?)		
		200										
		214										
		240			175 (?)		175 (?)	175 (?)	175 (?)	300 (?)		
		300										
		365										
2.2	precision units mortar: thin layer 15 ≤ f_b ≤ 60 1.400≤ ρ < 2.200											

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall thickness (mm)	Minimum wall length (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
2.2.1 2.2.2 2.2.3	100 % f ≤ 9 N/mm²	100										
		115			365		490	730	--[1)]	--[1)]		
		175			240		240	(616) 240	(990) 300	490		
		200										
		214										
		240			175		175	240	240	365		
		300										
		365										
2.2.17	60 % f ≤ 5,4 N/mm²	100										
		115			365		490			--[1)]		
		175			( ) 240		240	(616) 240	(990) 240	365		
		200										
		214										
		240			175		175	175	175	300		
		300										
		365										
3	**Group 2**											
3.1	mortar : general purpose, 6 ≤ f_b ≤ 60 700 ≤ ρ < 1.600											
3.1.1 3.1.2 3.1.3	100 % f ≤ 4,5	100										
		115										
		175										
		200										
		214										
		240										
		300										
3.1.17		365										

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall thickness (mm)	Minimum wall length (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
	60 % $f \leq 2{,}7$	100										
		115										
		175										
		200										
		214										
		240										
		300										
		365										
3.2	precision units mortar: thin layer $6 \leq f_b \leq 35$ $700 \leq \rho < 1.600$											
3.2.1 3.2.2	100 % $f \leq$	100										
		115										
		175										
		200										
		214										
		240										
		300										
		365										
3.2.17	60 % $f \leq$	100										
		115										
		175										
		200										
		214										
		240										
		300										
		365										

Table 2.5: ire resistance classification of masonary walls made of
Calcium-silicate units complying with EN 771-2
Criterion REI-M - Separating loadbearing single-leaf walls

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI-M**						
		30	45	60	90	120	180	240
1	**Solid units**							
	precision units mortar: thin layer $15 \leq f_b \leq 60$ $1.700 \leq \rho < 2.200$							
1.1.1 1.1.2	100 % $f \leq$ 4,5 N/mm²	175	175	175	175		365	
1.1.3 1.1.4	60 % $f \leq$ 2,7 N/mm²	175	175	175	175		240	
2	**Group 1**							
2.1	mortar : general purpose, $15 \leq f_b \leq 60$ $1.400 \leq \rho < 2.200$							
2.1.1 2.1.2	100 % $f \leq$ 4,5 N/mm²	240	240	240	240		365	
2.1.3 2.1.4	60 % $f \leq$ 2,7 N/mm²	175	175	175	175		240	
2.2	precision units mortar: thin layer $15 \leq f_b \leq 60$ $1.400 \leq \rho < 2.200$							
2.2.1 2.2.2	100 % $f \leq$ 4,5 N/mm²							
2.2.3 2.2.4	60 % $f \leq$ 2,7 N/mm²							
3	**Group 2**							
3.1	mortar : general purpose, $6 \leq f_b \leq 60$ $700 \leq \rho < 1.300$							
3.1.1 3.1.2	100 % $f \leq$ 3,0	300 (300)	300 (300)	300 (300)	300 (300)			
3.1.3 3.1.4	60 % $f \leq$ 1,8	300 (300)	300 (300)	300 (300)	300 (300)			
3.2	precision units mortar: thin layer $6 \leq f_b \leq 60$ $700 \leq \rho < 1.600$							
3.2.1 3.2.2	100 % $f \leq$ 3,0							
3.2.3 3.2.4	60 % $f \leq$ 1,8							

Table 2.6: Fire resistance classification of masonary walls made of Calcium-silicate units complying with EN 771-2

Criterion REI - Separating loadbearing cavity wall with <u>one</u> leaf loaded

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - cavity wall**						
		30	45	60	90	120	180	240
1	**Solid units**							
	precision units mortar: thin layer $15 \leq f_b \leq 60$ $1.700 \leq \rho < 2.200$							
1.1.1 1.1.2	100 % $f \leq 4{,}5$ N/mm²	2 x 150	2 x 150	2 x 150	2 x 150			
1.1.3 1.1.4	60 % $f \leq 2{,}7$ N/mm²	2 x 150	2 x 150	2 x 150	2 x 150			
2	**Cavity Walls Group 1**							
2.1	mortar : general purpose, $8 \leq f_b \leq 60$ $1.400 \leq \rho < 2.200$							
	100 % $f \leq 4$ N/mm²				2 x 175			
	60 % $f \leq 2$ N/mm²				2 x 175			
2.2	mortar: thin layer $12 \leq f_b \leq 20$ $1.800 \leq \rho < 2.200$							
	100 % $f \leq 4{,}5$ N/mm²				2 x 150			
	60 % $f \leq 2{,}7$ N/mm²				2 x 150			
2.3	mortar: general purpose, thin layer $12 \leq f_b \leq 60$ $800 \leq \rho < 900$							
	100 % $f \leq 4{,}5$ N/mm²				2 x 240 (2 x 175)			
	60 % $f \leq 2{,}7$ N/mm²				2 x 240 (2 x175)			
2.4	mortar: general purpose, thin layer $12 \leq f_b \leq 60$ $900 \leq \rho < 2.200$							
	100 % $f \leq 4{,}5$ N/mm²				2 x 200 (2 x 175)			
	60 % $f \leq 2{,}7$ N/mm²				2 x 200 (2 x 175)			

Table 3.1: Fire resistance classification for masonary wall made of dense and lightweight aggregate concrete units complying with EN 771-3

Criterion EI - separating non-loadbearing

Row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **EI - separating non-loadbearing**								
		15	20	30	45	60	90	120	180	240
1	**Group 1** mortar : general purpose, thin layer, lightweight									
1.1	lightweight aggregate $2 \le f_b \le 8$ $400 \le \rho < 1.400$	50 (50)	50 (50)	50 (50)	70 (50)	90 (70)	90 (75)	100 (75)	100 (90)	100 (100)
1.2	dense aggregate $6 \le f_b \le 20$ $1.400 \le \rho < 2.000$	50 (50)	50 (50)	50 (50)	70 (50)	90 (70)	90 (75)	100 (75)	100 (90)	100 (100)
2	**Group 2** mortar : general purpose, thin layer, lightweight									
2.1	lightweight aggregate $2 \le f_b \le 8$ $400 \le \rho < 1.400$									
2.2	dense aggregate $6 \le f_b \le 20$ $1.400 \le \rho < 2.000$		50 (50)	50 (50)	70 (50)	70 (50)	95 (70)	115 (95)	140 (115)	175 (140)
3	**Group 3**									
	lightweight aggregate $2 \le f_b \le 8$ $400 \le \rho < 1.400$									
	dense aggregate $6 \le f_b \le 20$ $1.400 \le \rho < 2.000$									

Table 3.2: Fire resistance classification for masonary wall made of dense and lightweight aggregate concrete units complying with EN 771-3

Criterion REI - Separating loadbearing single-leaf walls - **length > 1,0 m**

Row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - separating loadbearing**						
		30	45	60	90	120	180	240
1	**Group 1** mortar : general purpose, thin layer, lightweight							
1.1	lightweight aggregate $2 \leq f_b \leq 10$ $400 \leq ρ < 1.400$							
1.1.1 1.1.2	100 % $f \leq$ 2,4 N/mm²	175 (140)		175 (140)	175 (140)	190 (175)	240 (190)	300 (240)
1.2.3 1.2.4	60 % $f \leq$ 1,3 N/mm²	*90* 140 (115)		*90* 140 (115)	*100* 175 (115)	*100* 175 (140)	*140* 190 (175)	*150* 240 (190)
1.2	dense aggregate $6 \leq f_b \leq 20$ $1.400 \leq ρ < 2.000$							
1.2.1 1.2.2	100 % $f \leq$ 4,4 N/mm²	175 (140)		175 (140)	175 (140)	190 (175)	240 (190)	300 (240)
1.2.3 1.2.4	60 % $f \leq$ 2,5 N/mm²	90 140 (115)		90 140 (115)	90 175 (115)	100 175 (140)	140 190 (175)	150 240 (190)
2	**Group 2** mortar : general purpose, thin layer, lightweight							
2.1	lightweight aggregate $2 \leq f_b \leq 8$ $400 \leq ρ < 1.400$							
2.1.1 2.1.2	100 % $f \leq$ 2 N/mm²	175 (140)		175 (140)	175 (140)	190 (175)	240 (190)	300 (240)
2.1.3 2.1.4	60 % $f \leq$ 1 N/mm²	140 (115)		140 (115)	175 (115)	175 (140)	190 (175)	240 (190)
2.2	dense aggregate $6 \leq f_b \leq 20$ $1.400 \leq ρ < 2.000$							
2.2.1 2.2.2	100 % $f \leq$ 4 N/mm²	175 (140)		175 (140)	175 (140)	190 (175)	240 (190)	300 (240)
2.2.3 2.2.4	60 % $f \leq$ 2 N/mm²	140 (115)		140 (115)	175 (115)	175 (140)	190 (175)	240 (190)
	Group 3 mortar : general purpose, thin layer, lightweight							

Table 3.3: Fire resistance classification of masonary walls

dense and lightweight aggregate concrete units complying with EN 771-3

Criterion R - Non-separating loadbearing single-leaf walls **- length > 1,0 m**

Row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **R - non-**separating loadbearing									
		15	20	30	45	60	90	120	180	240	360
1	**Group 1** mortar : general purpose, thin layer, lightweight										
1.1	lightweight aggregate $2 \le f_b \le 8$ $400 \le \rho < 1.400$										
1.1.1 1.1.2	100 % $f \le$ 2,4 N/mm²			175 (175)		175 (175)	240 (175)	300 (240)	300 (240)	365 (300)	
1.1.3 1.1.4	60 % $f \le$ 1,3 N/mm²			175 (140)		175 (140)	190 (175)	240 (190)	240 (240)	300 (240)	
1.2	dense aggregate $6 \le f_b \le 20$ $1.400 \le \rho < 2.000$										
1.2.1 1.2.2	100 % $f \le$ 4,4 N/mm²			175 (175)		175 (175)	240 (175)	300 (240)	300 (240)	365 (300)	
1.2.3 1.2.4	60 % $f \le$ 2,5 N/mm²			175 (140)		175 (140)	190 (175)	240 (190)	240 (240)	300 (240)	
2	**Group 2** mortar : general purpose, thin layer, lightweight										
2.1	lightweight aggregate $2 \le f_b \le 8$ $400 \le \rho < 1.400$										
2.1.1 2.1.2	100 % $f \le$ 2 N/mm²			175 (175)		175 (175)	240 (175)	300 (240)	300 (240)	365 (300)	
2.1.3 2.1.4	60 % $f \le$ 1 N/mm²			175 (140)		175 (140)	190 (175)	240 (190)	240 (240)	300 (240)	
2.2	dense aggregate $6 \le f_b \le 20$ $1.400 \le \rho < 2.000$										
2.2.1 2.2.2	100 % $f \le$ 4 N/mm²			175 (175)		175 (175)	240 (175)	300 (240)	300 (240)	365 (300)	
2.2.3 2.2.4	60 % $f \le$ 2 N/mm²			175 (140)		175 (140)	190 (175)	240 (190)	240 (240)	300 (240)	
	Group 3 mortar : general purpose, thin layer, lightweight										

Table 3.4: Fire resistance classificationof masonary walls made of
dense and lightweight aggregate concrete units complying with EN 771-3
Criterion R - Non-separating leadbearing single-leaf columns - **length ≤1,0 m**

Row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
1	**Group 1** mortar : general purpose, thin layer, lightweight											
1.1	lightweight aggregate $2 \leq f_b \leq 8$ $400 \leq \rho < 1.400$											
1.1.1 1.1.2	100 % f ≤ 2,4 N/mm²	100 175 240 300			490 (365)			(490)				
1.1.3 1.1.4	60 % f ≤ 1,3 N/mm²	100 175 240 300										
1.2	dense aggregate $6 \leq f_b \leq 20$ $1.400 \leq \rho < 2.000$											
1.2.1 1.2.2	100 % f ≤ 4,4 N/mm²	100 175 240 300			300 (240)			365 (300)	(365)	(490)		
1.2.3 1.2.4	60 % f ≤ 2,5 N/mm²	100 175 240 300			240 (240)			300 (240)	365 (300)	490 (365)		
2	**Group 2** mortar : general purpose, thin layer, lightweight											
2.1	lightweight aggregate $2 \leq f_b \leq 8$ $400 \leq \rho < 1.400$											
2.1.1 2.1.2	100 % f ≤ 2 N/mm²	100 175 240 300			490 (365)			(490)				

Row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
2.1.3 2.1.4	60 % f ≤ 1 N/mm²	100 175 240 300										
2.2	dense aggregate 6 ≤ f_b ≤ 20 1.400≤ ρ < 2.000											
2.2.1 2.2.2	100 % f ≤ 4 N/mm²	100 175 240 300			300 (240)			365 (300)	(365)	(490)		
2.2.3 2.2.4	60 % f ≤ 2 N/mm²	100 175 240 300			240 (240)			300 (240)	365 (300)	490 (365)		
	Group 3 mortar : general purpose, thin layer, lightweight											

Table 3.5: Fire resistance classification of masonary walls made of dense and lightweight aggregate concrete units complying with EN 771-3
Criterion REI-M - Separating loadbearing single-leaf walls

Row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI-M**						
		30	45	60	90	120	180	240
1	**Group 1** mortar : general purpose, thin layer, lightweight							
1.1	lightweight aggregate $2 \leq f_b \leq 8$ $400 \leq \rho < 1.400$							
1.1.1 1.1.2	100 % $f \leq$ 2,4 N/mm²				300 (240)			
1.1.3 1.1.4	60 % $f \leq$ 1,3 N/mm²							
1.2	dense aggregate $6 \leq f_b \leq 20$ $1.400 \leq \rho < 2.000$							
1.2.1 1.2.2	100 % $f \leq$ 4,4 N/mm²				240 (175)			
1.2.3 1.2.4	60 % $f \leq$ 2,5 N/mm²							
2	**Group 2** mortar : general purpose, thin layer, lightweight							
2.1	lightweight aggregate $2 \leq f_b \leq 8$ $400 \leq \rho < 1.400$							
2.1.1 2.1.2	100 % $f \leq$ 2 N/mm²				300 (240)			
2.1.3 2.1.4	60 % $f \leq$ 1 N/mm²							
2.2	dense aggregate $6 \leq f_b \leq 20$ $1.400 \leq \rho < 2.000$							
2.2.1 2.2.2	100 % $f \leq$ 4 N/mm²				240 (175)			
2.2.3 2.2.4	60 % $f \leq$ 2 N/mm²							

Table 3.6: Fire resistance classification of masonary walls made of
dense and lightweight aggregate concrete units complying with EN 771-3
Criterion REI - Separating loadbearing cavity wall with <u>one</u> leaf loaded

Row number	material properties unit strength f_b [N/mm²] density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - cavity wall**						
		30	45	60	90	120	180	240
1	**Cavity Walls-Group 1** mortar : general purpose, thin layer, lightweight							
1.1	lightweight aggregate $2 \leq f_b \leq 8$ $400 \leq \rho < 1.400$							
1.1.1 1.1.2	100 % $f \leq 2,4$ N/mm²				2 x 240 (2 x 175)			
1.1.3 1.1.4	60 % $f \leq 1,3$ N/mm²							
1.2	dense aggregate $6 \leq f_b \leq 20$ $1.400 \leq \rho < 2.000$							
1.2.1 1.2.2	100 % $f \leq 4,4$ N/mm²				2 x 175 (2 x 175)			
1.2.3 1.2.4	60 % $f \leq 2,5$ N/mm²							
2	**Cavity Walls-Group 2** mortar : general purpose, thin layer, lightweight							
2.1	lightweight aggregate $2 \leq f_b \leq 8$ $400 \leq \rho < 1.400$							
2.1.1 2.1.2	100 % $f \leq 2$ N/mm²				2 x 240 (2 x 175)			
2.1.3 2.1.4	60 % $f \leq 1$ N/mm²							
2.2	dense aggregate $6 \leq f_b \leq 20$ $1.400 \leq \rho < 2.000$							
2.2.1 2.2.2	100 % $f \leq 4$ N/mm²				2 x 175 (2 x 175)			
2.2.3 2.2.4	60 % $f \leq 2$ N/mm²							

Table 4.1: **Fire resistance classification for masonary wall made of** autoclaved aerated concrete units complying with EN 771-4

Criterion EI - separating non-loadbearing

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **EI - separating non-loadbearing**								
		15	20	30	45	60	90	120	180	240
1	**Group 1**									
1.1	mortar : general purpose									
1.1.1 1.1.2	300 ≤ ρ < 500	65 (50)	65 (50)	65 (50)	65 (65)	65 (65)	70 (70)	70 (70)	100 (100)	100 (100)
1.1.3 1.1.4	500 ≤ ρ ≤ 1.000	50 (50)	50 (50)	50 (50)	60 (60)	65 (65)	65 (65)	70 (70)	100 (100)	100 (100)
1.2	mortar : thin layer									
1.2.1 1.2.2	300 ≤ ρ < 500	65 (50)	65 (50)	65 (50)	65 (65)	65 (65)	70 (70)	70 (70)	100 (100)	100 (100)
1.2.3 1.2.4	500 ≤ ρ ≤ 1.000	50 (50)	50 (50)	50 (50)	60 (50)	60 (50)	60 (50)	65 (65)	100 (90)	100 (100)

Table 4.2: **Fire resistance classification for masonary wall made of** autoclaved aerated concrete units complying with EN 771-4

Criterion REI - Separating loadbearing single-leaf walls

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - separating loadbearing**						
		30	45	60	90	120	180	240
1	**Group 1**							
1.1	mortar : general purpose							
	$2 \le f_b < 4$ $350 \le \rho < 500$							
*)	100 % $f \le$ 0,6 N/mm²	100 (100)	100 (100)	100 (100)	125 (125)	150 (150)	175 (175)	225 (225)
	60 % $f \le$ 0,36 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	125 (125)	150 (150)	200 (200)
	$4 \le f_b \le 8$ $500 \le \rho \le 1.000$							
**)	100 % $f \le$ 2,0 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	125 (125)	150 (150)
	60 % $f \le$ 1,2 N/mm²	100 (100)	100 (100)	100 (100)	100 (100)	100 (100)	125 (125)	150 (150)
1.2	mortar : thin layer							
1.2.1 1.2.2	$2 \le f_b < 4$ $350 \le \rho < 500$							
	100 % $f \le$ N/mm²							
	60 % $f \le$ N/mm²							
1.2.3 1.2.4	$4 \le f_b \le 8$ $500 \le \rho \le 1.000$							
	100 % $f \le$ N/mm²							
	60 % $f \le$ N/mm²							

(*) for row 2.1: Assumption: The new European test method is based on centric loading
**) for row 2.2: Excentric loading is taken into account, because we have no other testing experience

Table 4.3: Fire resistance classification of masonary walls made of autoclaved aerated concrete units complying with EN 771-4

Criterion R - Non-separating loadbearing single-leaf walls - **length > 1,0 m**

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing									
		15	20	30	45	60	90	120	180	240	360
1	**Group 1**										
1.1	mortar : general purpose,										
	$2 \leq f_b < 4$ $350 \leq ρ < 500$										
*)	100 % $f \leq$ 0,6 N/mm² ???	150 (125)	150 (125)	175 (150)	175 (150)	175 (150)	240 (175)	300 (240)	300 (240)	300 (300)	
	60 % $f \leq$ 0,36 N/mm² ???	100 (100)	125 (100)	125 (100)	150 (125)	150 (125)	175 (150)	175 (150)	240 (175)	300 (200)	
	$4 \leq f_b \leq 8$ $500 \leq ρ \leq 800$???										
**)	100 % $f \leq$ 2,0 N/mm² ???	125 (100)	125 (100)	125 (100)	125 (100)	150 (125)	175 (150)	240 (175)	240 (175)	240 (240)	
	60 % $f \leq$ 1,2 N/mm² ???	100 (100)	100 (100)	100 (100)	100 (100)	125 (100)	150 (125)	150 (125)	175 (120)	240 (175)	
1.2	mortar : thin layer r										
1.2.1 1.2.2	$2 \leq f_b < 4$ $350 \leq ρ < 500$										
	100 % $f \leq$ N/mm²										
	60 % $f \leq$ N/mm²										
1.2.3 1.2.4	$4 \leq f_b \leq 8$ $500 \leq ρ \leq 800$???										
	100 % $f \leq$ N/mm²										
	60 % $f \leq$ N/mm²										

Table 4.4: Fire resistance classificationof masonary walls made of autoclaved aerated concrete units complying with EN 771-4

Criterion R - Non-separating leadbearing single-leaf columns - **length ≤ 1,0 m**

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
1	**Group 1**											
1.1	mortar : general purpose,											
	$2 \leq f_b < 4$ $350 \leq ρ < 500$											
*)	100 % f ≤ 0,6 N/mm² ???	100	? ( )	?	?	?	?	?	?	?		
		125	? ( )	?	?	?	?	?	?	?		
		150	? ( )	?	?	?	?	?	?	?		
		175	300 ( )	365	490	490	490	*)	*)	*)		
		200	240 ( )	300	365	490	490	*)	*)	*)		
		240	200 ( )	240	300	365	365	615	730	730	730	
		300	175 ( )	200	240	300	300	490	490	615	615	
		365	150 ( )	175	200	240	240	365	490	615	490	
	60 % f ≤ 0,36 N/mm² ???	100	?	?	?	?	?	?	?	?	?	
		125	?	?	?	?	?	?	?	?	?	
		150	?	?	?	?	?	?	?	?	?	
		175	240	300	365	365	365	490	490	490	*)	
		200	175	200	240	365	365	365	490	490	*)	
		240	175	200	240	240	240	300	365	365	730	
		300	150	175	240	240	240	240	300	300	615	
		365	150	175	175	175	175	240	240	240	615	
	$4 \leq f_b \leq 8$ $500 \leq ρ \leq 1.000$											
**)	100 % f ≤ 2,0 N/mm² ???	100	?	? ( )	?	?	?	?	?	?	?	
		125	?	? ( )	?	?	?	?	?	?	?	
		150	?	? ( )	?	?	?	?	?	?	?	
		175	240	300 ( )	365	365	365	730	*)	*)	615	
		200	200	240 ( )	300	365	365	615	730	730	615	
		240	175	200 ( )	240	300	300	490	615	615	615	
		300	150	175 ( )	200	240	240	365	365	490	490	
		365	150	150 ( )	175	200	200	300	365	490	365	

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
	60 % f ≤ 1,2 N/mm² ???	100	?	?	?	?	?	?	?	?		
		125	?	?	?	?	?	?	?	?		
		150	?	?	?	?	?	?	?	?		
		175	175	240	300	300	300	365	365	490		
		200	150	175	200	300	300	300	365	490		
		240	150	175	200	200	200	240	300	490		
		300	150	150	200	200	200	200	240	365		
		365	150	150	150	150	150	200	200	300		
1.2	mortar : thin layer r											
1.2.1 1.2.2	2 ≤ f_b < 4 350 ≤ ρ < 500											
	100 % f ≤ N/mm²	100										
		125										
		150										
		175										
		200										
		240										
		300										
		365										
	60 % f ≤ N/mm²	100										
		125										
		150										
		175										
		200										
		240										
		300										
		365										

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	minimum wall length (mm)	Minimum wall thickness (mm) for fire resistance classification (min) **R** - nonseparating loadbearing column									
			15	20	30	45	60	90	120	180	240	360
1.2.3 1.2.4	$4 \leq f_b \leq 8$ $500 \leq \rho \leq 1.000$											
	100 % $f \leq 2$ N/mm²	100 125 150 175 200 240 300 365										
	60 % $f \leq 1$ N/mm²	100 125 150 175 200 240 300 365										

**) Do the changes in row 3 have an influence on the values in row 4? Are there possibilities for minimum wall length: 100, 125 and 150 mm?

Table 4.5: **Fire resistance classification of masonary walls made of** autoclaved aerated concrete units complying with EN 771-4

Criterion REI-M or EI-M - Separating loadbearing single-leaf walls

row number	material properties unit strength f_b [N/mm²] gross density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) REI-M or EI-M					
		30	60	90	120	180	240
1	**Group 1 - REI - M**						
1.1	mortar : general purpose						
	$2 \leq f_b < 4$ $350 \leq \rho < 500$						
*)	100 % f ≤ 0,6 N/mm² ???						
	60 % f ≤ 0,36 N/mm² ???						
	$4 \leq f_b \leq 8$ $500 \leq \rho \leq 1.000$						
**)	100 % f ≤ 2,0 N/mm² ???	300 ( )	300 ( )	300 ( )	365 ( )	365 ( )	
	60 % f ≤ 1,2 N/mm² ???						
1.2	mortar : thin layerr						
1.2.1 1.2.2	$2 \leq f_b < 4$ $350 \leq \rho < 500$						
	100 % f ≤ N/mm²	300 ( )	300 ( )	300 ( )	365 ( )	365 ( )	
	60 % f ≤ N/mm²						
1.2.3 1.2.4	$4 \leq f_b \leq 8$ $500 \leq \rho \leq 1.000$						
	100 % f ≤ N/mm²	240 ( )	240 ( )	240 ( )	300 ( )	300 ( )	
	60 % f ≤ N/mm²						
2	**Group 1 - EI - M**						
2.1	mortar : general purpose						
	$2 \leq f_b < 4$ $350 \leq \rho < 500$						
*)	100 % f ≤ 0,6 N/mm² ???						
	60 % f ≤ 0,36 N/mm² ???						
	$4 \leq f_b \leq 8$ $500 \leq \rho \leq 1.000$						
**)	100 % f ≤ 2,0 N/mm² ???	300 ( )	300 ( )	300 ( )	365 ( )	365 ( )	
	60 % f ≤ 1,2 N/mm² ???						
2.2	mortar : thin layerr						
1.2.1 1.2.2	$2 \leq f_b < 4$ $350 \leq \rho < 500$						
	100 % f ≤ N/mm²	300 ( )	300 ( )	300 ( )	365 ( )	365 ( )	
	60 % f ≤ N/mm²						
1.2.3 1.2.4	$4 \leq f_b \leq 8$ $500 \leq \rho \leq 800$???						
	100 % f ≤ N/mm²	240 ( )	240 ( )	240 ( )	300 ( )	300 ( )	
	60 % f ≤ N/mm²						

Table 4.6: **Fire resistance classification of masonary walls made of** autoclaved aerated concrete units complying with EN 771-4

Criterion REI - Separating loadbearing **cavity wall** with one leaf loaded

row number	material properties unit strength f_b [N/mm²] density ρ [kg/m³]	Minimum wall thickness (mm) for fire resistance classification (min) **REI - cavity wall**						
		30	45	60	90	120	180	240
1	**Group 1**							
1.1	mortar : general purpose							
	$2 \leq f_b < 4$ $350 \leq \rho < 500$							
*)	100 % $f \leq$ 0,6 N/mm² ???	2 x 90 (2 x 90)		2 x 90 (2 x 90)	2 x 100 (2 x 100)	2 x 100 (2 x 100)		
	60 % $f \leq$ 0,36 N/mm² ???							
	$4 \leq f_b \leq 8$ $500 \leq \rho \leq 1.000$							
**)	100 % $f \leq$ 2,0 N/mm² ???	2 x 90 (2 x 90)		2 x 90 (2 x 90)	2 x 100 (2 x 100)	2 x 100 (2 x 100)		
	60 % $f \leq$ 1,2 N/mm² ???							
1.2	mortar : thin layer							
1.2.1 1.2.2	$2 \leq f_b < 4$ $350 \leq \rho < 500$							
	100 % $f \leq$ N/mm²							
	60 % $f \leq$ N/mm²							
1.2.3 1.2.4	$4 \leq f_b \leq 8$ $500 \leq \rho \leq 1.000$							
	100 % $f \leq$ N/mm²							
	60 % $f \leq$ N/mm²							