INTERNATIONAL STANDARD

ISO 9652-2

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Masonry —

Part 2: Unreinforced masonry design by simple rules

Maçonnerie —
Partie 2: Conception de la maçonnerie non armée par des règles simplifiées

Reference number
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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 9652 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 9652-2 was prepared by Technical Committee ISO/TC 179, *Masonry*, Subcommittee SC 1, *Unreinforced masonry*.

ISO 9652 consists of the following parts, under the general title *Masonry*:

— *Part 1: Unreinforced masonry design by calculation*

— *Part 2: Unreinforced masonry design by simple rules*

— *Part 3: Reinforced masonry design by calculation*

— *Part 4: Test methods*

— *Part 5: Vocabulary*

Annexes A and B form a normative part of this part of ISO 9652.

Introduction

The rules in this part of ISO 9652 are intended to provide certain masonry designs without the need for structural calculations. ISO 9652-1 and some national standards will be more restrictive in certain circumstances.

Annex A gives additional rules for use in seismic zones. Annex B gives rules for certain small single-storey buildings and annexes.

Masonry —

Part 2:
Unreinforced masonry design by simple rules

1 Scope

This part of ISO 9652 gives limited rules for the structural design and construction of unreinforced masonry for which calculations of loading and strength criteria are not required. This part of ISO 9652 is applicable to masonry built with Group 1, 2, or 3 masonry units [see 5.2.1 of ISO 9652-1:—] of clay, calcium silicate, concrete (including autoclaved aerated concrete), and manufactured stone units. The field of application is defined in Table 1 and is subject to the limitations of normative annex A.

NOTE Clauses 5, 6, 7 and 8 should be taken together; clauses 9 and 10 may be applied separately; clause 11 applies to all walls covered by this part of ISO 9652.

For masonry designed by calculation, see ISO 9652-1.

Table 1 — Field of application

Type of wall	Type of building	Location	Type of loading
Loadbearing	Low-rise dwelling of not more than two floor levels in addition to any basement	Sheltered coastal sites and inland sites except very exposed hills and crests	Vertical and wind loads (for limits see clause 6)
	Other small single-storey buildings		
Basement walls	All buildings	All sites	Earth pressure and vertical loads
External non-loadbearing	All buildings up to and including four storeys except low-rise dwellings of not more than two floor levels in addition to any basement	Site with many windbreaks, such as city, town or well-wooded areas	Wind load. No significant vertical load
Internal non-loadbearing	All buildings	Inside buildings without large openings	No significant vertical or wind loads

The following are not covered by this part of ISO 9652:

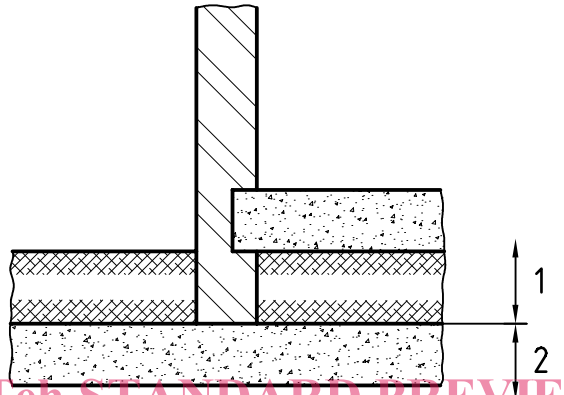
a) foundations as shown in Figure 1;

b) free-standing walls;

c) retaining walls other than basement walls;

d) basement walls subjected to hydrostatic pressure;

e) masonry in seismic areas with expected ground accelerations in excess of 1,0 m/s^2 (see normative annex A).



Key

1 Within scope
2 Outside scope

Figure 1 — Foundations

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 9652. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 9652 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. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 9652-1:— [1)], *Masonry — Part 1: Unreinforced masonry design by calculation.*

ISO 9652-3:—[1)], *Masonry — Part 3: Reinforced masonry design by calculation.*

ISO 9652-4:—[1)], *Masonry — Part 4: Test methods.*

ISO 9652-5:2000, *Masonry — Part 5: Vocabulary.*

1) To be published.

3 Terms and definitions

For the purposes of this part of ISO 9652, the terms and definitions given in ISO 9652-5 apply.

4 Symbols

A_o	Permitted area of opening, in square metres (m^2)
a_1, a_2, a_3	Lengths of wall between one opening and another or between an opening and a buttressing wall or pier
d	Maximum dimension of an opening (height or width) in a wall, which relates to the distance of the opening from the main restraints or roof
H	Height of a wall
h_u	Height of a masonry unit, in millimetres (mm)
h_t	Height of the ground above the basement floor
l or L	Length of a wall
l_1, l_2	Widths of openings in a wall
t	Wall thickness (whether of solid or cavity construction), in millimetres (mm)
t_1	Thickness of the outer leaf of a cavity wall, in millimetres (mm)
t_2	Thickness of the inner leaf of a cavity wall, in millimetres (mm)
t_a, t_b	Thickness of restraining wall and wall to be restrained respectively, in millimetres (mm)
u	Minimum overlap between the perpend in a course of masonry and the perpend in the course immediately above or below it, in millimetres (mm)
x	Depth of a chimney or pier (direction perpendicular to the plane of the wall), in millimetres (mm),
X	A factor which governs the relationship between the widths of openings in a wall and a) the lengths of wall between one opening and another, b) the lengths of wall between an opening and a buttressing wall or pier
y	Depth of a pier (direction perpendicular to the plane of the wall), in millimetres (mm).

5 Stability and robustness

For a robust and stable structure, it will be necessary to provide a layout of walls which will enable all lateral forces to be resisted in the two main directions. Such a design can be achieved most satisfactorily when the walls are arranged in a cellular form in which the loadbearing walls are provided with substantial returns, piers or chimneys. The connections between interacting walls and between walls, roofs or floors should be capable of transmitting lateral forces to the foundations; one way of achieving this is by the use of ring beams. The design should also ensure that any foreseeable negative loads, particularly suction loads on flat or shallow pitched-roof structures are resisted by suitable connections.

Connections may be achieved by the bonding of masonry or, in some cases, by friction at floor and beam bearings on masonry. Alternatively, strong, durable, creep-resistant straps, ties, hangers, brackets and angles may be used as connections between walls and restraining walls and between walls and floors or roofs acting as buttresses. Ring beams at the head of each storey may also be used to provide horizontal supports.

6 Limiting loads, strengths and dimensions

6.1 General

If loads, strengths or dimensions fall outside the limits given in this clause then calculations should be made for that part of the structure affected.

6.2 Limits in respect of walls (but see Table 1)

6.2.1 The imposed load on any roof, for example snow load, should not exceed 0,9 kN/m^2, excluding wind load.

6.2.2 The imposed load on any suspended floor, excluding the load from internal walls, should not exceed 2,0 kN/m^2.

6.2.3 The imposed load on any floor due to any internal walls should not exceed 1,2 kN/m^2.

6.2.4 The wind load, including internal and external pressures, should not exceed 1,2 kN/m^2.

6.2.5 Floors and roofs should not have a mass greater than 550 kg/m^2, including any screed or concrete topping.

6.2.6 The minimum normalized compressive strength of masonry units measured in accordance with ISO 9652-4 should be 4,0 N/mm^2 unless otherwise required by the rules (normative annex A and Table 2). If the minimum wall thickness of 100 mm is increased to 240 mm then the minimum normalized strength may be reduced to 3,0 N/mm^2. Linear interpolation is permitted. The minimum mortar class in accordance with ISO 9652-1 should be M2, except where the web thickness of units that have more than 50 % voids is 20 mm or less. In that case, the minimum mortar class should be M10.

6.2.7 The thickness of the loadbearing leaf of a cavity wall may be reduced to 90 mm provided that the minimum normalized compressive strength given in 6.2.6 is increased by 10 %.

6.2.8 The clear span of floors or concrete roof members should not exceed 6 m.

6.2.9 The clear span of timber roofs should not exceed 12 m when the reaction of the timber roof on the loadbearing leaf is sensibly axial, otherwise the clear span should not exceed 9 m.

6.2.10 The clear span of lintels over openings should not exceed 3 m (see Figure 2 and 6.3).

6.2.11 In the absence of calculations, the length of lintel bearings (see Figure 2) should be not less than the following for masonry built from units of Group 1:

a) for timber floors spanning at right angles to the lintel, one tenth[2)] of the length of the opening; or

b) for concrete floors spanning at right angles to the lintel, one sixth of the length of the opening

but, in any case not less than 150 mm except where the length of masonry between openings is less than 300 mm in accordance with 6.3, when the bearing length should be not less than 120 mm and the bearing area should be not less than 15 000 mm^2.

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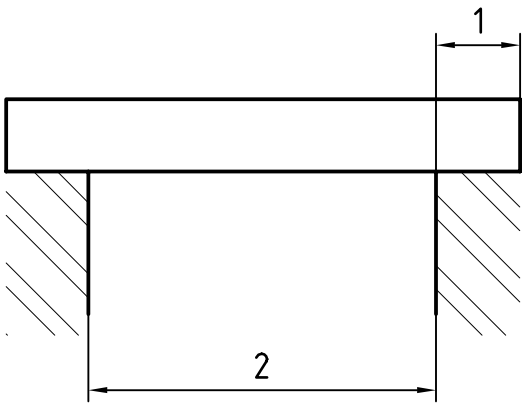
2) For a single-leaf wall or the inner leaf of a cavity wall of thickness greater than 100 mm, the minimum length of bearing given here may be multiplied by the ratio: 100 / leaf thickness (in millimetres)

For masonry built from units of Groups 2 or 3, the length of lintel bearing shown above should be increased by 1/3.

6.2.12 The bearing for floors spanning on walls should be not less than 85 mm.



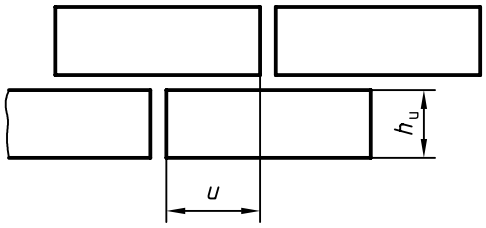
Key

1 Bearing length (see 6.2.11 and 6.2.12)
2 Opening (see 6.2.10)

Figure 2 — Length of lintel bearing

6.2.13 For single-leaf construction, masonry units should have a normalized compressive strength equal to or greater than that for the inner leaf of a cavity wall in the same position.

6.2.14 To ensure adequate bonding, masonry units should overlap by a length of at least 0,4 × the height of the unit when looking at the face of the wall, or 45 mm, whichever is the greatest (see Figure 3).



Key

u Minimum overlap which should be greater than or equal to 0,4 h and greater than or equal to 45 mm
h Height of a masonry unit, in millimetres

Figure 3 — Bonding of units; minimum overlap

6.3 Limits on sizes of openings

The sizes of openings should be determined in accordance with the following rules:

— $l_1 + l_2$ should not exceed $\frac{2l}{3}$

— l_1 or l_2 should not exceed 3 m