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Eurocode 6 — Design of masonry structures — Part 2: Design considerations, selection of materials and execution of masonry

*Eurocode 6 — Bemessung und Konstruktion von Mauerwerksbauten - Teil 2: Planung, Auswahl der Baustoffe und Ausführung von Mauerwerk*

*Eurocode 6 — Calcul des ouvrages en maçonnerie - Partie 2: Conception, choix des matériaux et mise en œuvre des maçonneries*

ICS:

Descriptors:

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European foreword

This document (prEN 1996-2:2022) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes and has been assigned responsibility for structural and geotechnical design matters by CEN.

This document is currently submitted to CEN Enquiry.

This document will supersede EN 1996-2:2006.

The first generation of EN Eurocodes was published between 2002 and 2007. This document forms part of the second generation of the Eurocodes, which have been prepared under a Mandate M/515 given to CEN by the European Commission and the European Free Trade Association.

The Eurocodes have been drafted to be used in conjunction with relevant execution, material, product and test standards, and to identify requirements for execution, materials, products and testing that are relied upon by the Eurocodes.

The Eurocodes recognize the responsibility of each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level through the use of National Annexes.

0 Introduction

**0.1 Introduction to the Eurocodes**

The Structural Eurocodes comprise the following standards generally consisting of a number of Parts:

— EN 1990 Eurocode: Basis of structural and geotechnical design

— EN 1991 Eurocode 1: Actions on structures

— EN 1992 Eurocode 2: Design of concrete structures

— 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

— New parts are under development, e.g. Eurocode for design of structural glass

The Eurocodes are intended for use by designers, clients, manufacturers, constructors, relevant authorities (in exercising their duties in accordance with national or international regulations), educators, soft-ware developers, and committees drafting standards for related product, testing and execution standards.

NOTE Some aspects of design are most appropriately specified by relevant authorities or, where not specified, can be agreed on a project-specific basis between relevant parties such as designers and clients. The Eurocodes identify such aspects making explicit reference to relevant authorities and relevant parties.

**0.2 Introduction to EN 1996 (all parts)**

EN 1996 (all parts) apply to the design of building and civil engineering works, or parts thereof, in unreinforced, reinforced, prestressed and confined masonry.

EN 1996 (all parts) deal only with the requirements for resistance, serviceability and durability of structures. Other requirements, for example, concerning thermal or sound insulation, are not considered.

EN 1996 (all parts) do not cover the special requirements of seismic design. Provisions related to such requirements are given in EN 1998, which complements, and is consistent with EN 1996.

EN 1996 (all parts) do not cover numerical values of the actions on building and civil engineering works to be taken into account in the design. They are provided in EN 1991 (all parts).

**0.3 Introduction to prEN 1996-2**

This document describes the rules for design considerations, selection of materials and execution of masonry structures.

**0.4 Verbal forms used in the Eurocodes**

The verb “shall" expresses a requirement strictly to be followed and from which no deviation is permitted in order to comply with the Eurocodes.

The verb “should” expresses a highly recommended choice or course of action. Subject to national regulation and/or any relevant contractual provisions, alternative approaches could be used/adopted where technically justified.

The verb “may" expresses a course of action permissible within the limits of the Eurocodes.

The verb “can" expresses possibility and capability; it is used for statements of fact and clarification of concepts.

**0.5 National annex for prEN 1996-2**

National choice is allowed in this standard where explicitly stated within notes. National choice includes the selection of values for Nationally Determined Parameters (NDPs).

The national standard implementing this document can have a National Annex containing all national choices to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

When no national choice is given, the default choice given in this standard is to be used.

When no national choice is made and no default is given in this standard, the choice can be specified by a relevant authority or, where not specified, agreed for a specific project by appropriate parties.

National choice is allowed in prEN 1996-2 through a note to the following clause:

|  |  |  |  |
| --- | --- | --- | --- |
| 4.3.4.2 (7) |   |   |   |

National choice is allowed in prEN 1996-2 on the application of the following informative annexes

|  |  |  |  |
| --- | --- | --- | --- |
| Annex A | Annex B | Annex C |   |

The National Annex can contain, directly or by reference, non-contradictory complementary information for ease of implementation, provided it does not alter any provisions of the Eurocodes.

# Scope

## Scope of prEN 1996‑2

(1) This document gives basic rules for the selection of materials and execution of masonry to enable it to comply with the design assumptions of the other parts of Eurocode 6.

(2) This document deals with ordinary aspects of masonry design and execution including:

— selection of masonry materials;

— factors affecting the performance and durability of masonry;

— masonry detailing, joint finishes, movement joints, resistance of buildings to moisture penetration;

— storage, preparation and use of materials on site;

— execution of masonry;

— masonry protection during execution;

(3) This document does not cover the following items:

— aesthetic aspects;

— applied finishes;

## Assumptions

(1) The assumptions of EN 1990 apply to this document.

(2) This document is intended to be used together with EN 1990, EN 1991, EN 1996‑1-1, EN 1996-1-2 and EN 1996-3.

(3) The design of masonry is carried out in accordance with EN 1996‑1‑1.

# Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE See the Bibliography for a list of other documents cited that are not normative references, including those referenced as recommendations (i.e. in ‘should’ clauses), permissions (‘may’ clauses), possibilities ('can' clauses), and in notes.

EN 206, Concrete — Specification, performance, production and conformity

EN 771‑1, Specification for masonry units — Part 1: Clay masonry units

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 (Dense and lightweight aggregates)

EN 771‑4, Specification for masonry units — Part 4: Autoclaved aerated concrete masonry units

EN 771‑5, Specification for masonry units — Part 5: Manufactured stone masonry units

EN 771‑6, Specification for masonry units — Part 6: Natural stone masonry units

EN 998‑2, Specification for mortar for masonry — Part 2: Masonry mortar

EN 1015‑11, Methods of test for mortar for masonry — Part 11: Determination of flexural and compressive strength of hardened mortar

EN 1015‑17, Methods of test for mortar for masonry — Part 17: Determination of water-soluble chloride content of fresh mortars

EN 1990, Basis of structural and geotechnical design

EN 1996‑1‑1, Eurocode 6 — Design of masonry structures — Part 1-1: General rules for reinforced and unreinforced masonry structures

# Terms, definitions and symbols

## Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1990, EN 1996‑1‑1 and the following apply.

### Terms relating to the communication of the design of masonry

3.1.1.1

design specification

documents describing the designer's requirements for the construction, including drawings, schedules, test reports, references to parts of other documents and written instructions

### Terms relating to climatic factors and exposure conditions

3.1.2.1

macro conditions

climatic factors depending on the general climate of the region in which a structure is built, modified by the effects of local topography and/or other aspects of the site

3.1.2.2

micro conditions

localized climatic and environmental factors depending on the position of a masonry element within the overall structure and taking into account the effect of protection, or lack of protection, by constructional details or finishes

### Other Terms

3.1.3.1

applied finish

covering of material bonded to the surface of the masonry

3.1.3.2

cavity width

distance perpendicular to the plane of the wall between the cavity faces of the masonry leaves of a cavity wall or that between the cavity face of a veneer wall and the masonry backing structure

3.1.3.3

cladding

covering of material(s) fastened or anchored in front of the masonry and not in general bonded to it

## Symbols

For the purposes of this document, the material-independent symbols given in EN 1990, the material-dependent symbols given in EN  1996-1-1 and the following material-dependent symbols apply.

*Latin lower case letters*

|  |  |
| --- | --- |
| *d*p | minimum depth for pointing; |
| *l*m | maximum horizontal distance between vertical movement joints in external non-loadbearing walls. |

# Design considerations

## Factors affecting the durability of masonry

### General

(1) Masonry shall be designed to have the performance required for its intended use.

### Classification of environmental conditions

#### Micro conditions of exposure

(1) The micro conditions to which the masonry is expected to be exposed shall be taken into account in the design.

(2) When deciding the micro conditions of exposure of the masonry, the effect of applied finishes, protective claddings and details should be taken into account.

(3) Micro conditions of exposure of completed masonry should be categorized into classes, as follows:

— MX1 - In a dry environment;

— MX2 - Exposed to moisture or wetting;

— MX3 - Exposed to moisture or wetting plus freeze/thaw cycling;

— MX4 - Exposed to saturated salt air, seawater or de-icing salts;

— MX5 - In an aggressive chemical environment.

NOTE 1 For a structure more than one exposure class can apply.

NOTE 2 When necessary, more closely defined conditions within these classes can be specified using the sub-classes in Annex A (e.g. MX2.1 or MX2.2 and M X 3.1 or M X 3.2).

(4) To produce masonry that meets specified performance criteria and withstands the environmental conditions to which it is exposed, the determination of the exposure class should take into account:

— climatic factors;

— severity of exposure to moisture or wetting;

— exposure to freeze/thaw cycling;

— presence of chemical materials that may lead to damaging reactions.

#### Climatic factors (macro conditions of exposure)

(1) The effect of the macro conditions on the micro conditions shall be taken into account when determining the wetting of masonry and its exposure to freeze/thaw cycling.

(2) Concerning the macro conditions, the following should be taken into account:

— rain and snow;

— combination of wind and rain;

— temperature variation;

— relative humidity variation.

NOTE It is acknowledged that climates (macro conditions) vary considerably throughout Europe and that certain aspects of climate can influence the risk of exposure of masonry to wetting and/or freeze/thaw cycling. However, it is the classification of the micro conditions that is relevant for determining the durability of masonry rather than the ranking of the macro conditions. Examples of relative exposure to wetting of masonry elements in a typical building are shown in Annex A.

### Aggressive chemical environments

(1) In coastal areas, the exposure of masonry to airborne chlorides or seawater should be taken into account.

(2) Possible sources of sulphates include the following:

— natural soils;

— groundwater;

— waste deposits and filled ground;

— construction materials;

— airborne pollutants.

(3) Where the presence of aggressive chemicals in the environment, other than airborne chlorides or seawater, can affect masonry, class MX5 should be assumed. Where salts can be transported by water moving through the masonry, the potential for increased concentrations and quantities of available chemicals should be taken into account.

## Selection of materials

### General

(1) Materials, where incorporated in the works, shall be able to resist the actions to which they are expected to be exposed, including environmental actions.

(2) Only materials, products, and systems with established suitability shall be used.

NOTE Acceptable masonry unit specifications and mortar can be selected from Annex B, Table B.1 and B.2, in relation to durability.

### Masonry units

(1) The requirements for masonry units shall be specified in accordance with the relevant product standard:

— EN 771-1 for clay masonry units;

— EN 771-2 for calcium silicate masonry units;

— EN 771-3 for aggregate concrete masonry units;

— EN 771-4 for autoclaved aerated concrete masonry units;

— EN 771-5 for manufactured stone masonry units;

— EN 771-6 for natural stone masonry units.

(2) For reclaimed products, the design specification should state the required product performance characteristics and the means of their verification including the requirements for sampling and frequency of testing.

(3) Flatness and parallelism of the bed faces should be taken into account when applicable.

(4) Where masonry units are to be used with thin layer mortar the tolerance specification for the masonry units should be at least as follows for:

— clay masonry units: T1+ or T2+ and R1+ or R2+;

— calcium silicate masonry units: T2 or T3;

— aggregate concrete masonry units: D3 or D4;

— autoclaved aerated concrete masonry units: TLMA or TLMB;

— manufactured stone masonry units: Dm (+/- 1 mm);

— natural stone masonry units: D3.

(5) When TLMA is specified, the thin layer mortar should accommodate joint thicknesses up to 3 mm.

### Masonry mortar and concrete infill

#### General

(1) Masonry mortar should be selected according to the exposure condition of the masonry, the specification of the masonry units, the required compressive strength and the required adhesion.

(2) Until a European Standard method of test for durability is available, the suitability of masonry mortars should be determined on the basis of established local experience of the performance of the particular materials and mix proportions.

#### Selection of factory-made masonry mortar and concrete infill

(1) When factory-made masonry mortar or concrete infill is considered for use in exposure classes MX4 or MX5, the manufacturer's advice should be sought as to its suitability.

#### Selection of site-made masonry mortar and concrete infill

(1) For site-made masonry mortar and concrete infill, the design specification should state the required product performance characteristics and the means of their verification including the requirements for sampling and frequency of testing. In addition, where the design specification provides a prescriptive specification with the required performance, a detailed specification of the constituent materials, their proportions and the method of mixing may be given either on the basis of tests carried out on trial mixes and/or on the basis of authoritative publicly available references acceptable in the place of use.

(2) The guidance in 5.3.1 on the preparation of site-made masonry mortar and concrete infill should be taken into account particularly where admixtures, additions and pigments are to be used.

(3) In exposure classes MX1, MX2 or MX3, the masonry mortar shall be specified for durability using the terms defined in EN 998-2:

— masonry subjected to passive exposure;

— masonry subjected to moderate exposure;

— masonry subjected to severe exposure.

NOTE (1) requires performance characteristics to be specified in all cases. For durability, (3) requires it to be done by reference to the stated terminology. It is then an option for the designer to give a prescriptive specification that will fulfil the performance requirements, informed if necessary by the result of tests carried out in accordance with 5.3.1.1(2). For general applications, mortar durability designations can be selected from Table B.2.

(4) When site-made masonry mortar or concrete infill is to be specified for use in exposure classes MX4 or MX5, the mix proportions to provide adequate durability for the particular conditions should be selected on the basis of authoritative publicly available references acceptable in the place of use.

(5) Where adhesion between masonry units and mortar (bond strength) is a particular design requirement, the mix proportions should take this into account.

NOTE The manufacturer of masonry units can give advice on the type of masonry mortar to be used or tests can be carried out in accordance with relevant parts of EN 1052.

### Ancillary components and reinforcement

(1) Ancillary components and their fixings shall be corrosion resistant in the environment in which they are used.

NOTE 1 Annex C gives guidance on materials and corrosion protection systems for ancillary components in relation to exposure classes.

NOTE 2 Reinforcing steel can be selected following the recommendations given in 6.3.3 of EN 1996-1-1:2022.

## Masonry

### Detailing

(1) Where the detailing of masonry is not otherwise covered in this document, it should be done in accordance with local practice and experience.

### Joint finishes

(1) Pointing mortar should be compatible with the jointing mortar.

### Masonry movement

(1) The possibility of masonry movement shall be allowed for in the design such that the performance of the masonry in use is not adversely affected by such movement.

(2) Where intersecting walls do not all have similar deformation behaviour, the connection between such walls should be able to accommodate any resulting differential movement.

(3) Movement tolerant ties should be provided where required to accommodate relative in-plane movements between masonry leaves or between masonry and other structures to which the masonry is attached.

(4) Where cavity wall ties that are not movement tolerant are used, the uninterrupted height between horizontal movement joints in the outer leaf of external cavity walls should be limited to avoid the loosening of the wall ties.

(5) Movement joints should be used, or reinforcement should be incorporated into the masonry, in order to minimize cracking, bowing or distortion caused by expansion, shrinkage, differential movements or creep.

### Movement joints

#### General

(1) Vertical and horizontal movement joints should be provided to allow for the effects of thermal and moisture movement, creep and deflection and the possible effects of internal stresses caused by vertical or lateral loading, so that the masonry does not suffer damage.

(2) The position of movement joints should take into account the need to maintain the structural integrity of the wall.

(3) Movement joints should be designed and positioned having regard to:

— the type of masonry unit material and mortar taking into account the moisture movement (expansion and/or shrinkage), thermal properties and creep characteristics of the masonry (see EN 1996-1-1);

— the geometry of the structure taking into account openings (location, dimensions and intermediate distance) and the proportions of panels as well as the location of the fixed and restrained points of the masonry construction;

— the degree of restraint;

— the response of the masonry to long and short term loading;

— the response of the masonry to thermal and climatic conditions;

— fire resistance;

— sound and thermal insulation requirements;

— the presence or not of reinforcement.

(4) The detailing of a movement joint should enable the movement joint to accommodate the anticipated movements, both reversible and irreversible, without damage to the masonry.

(5) All movement joints should pass through the full thickness of the wall or the outer leaf of a cavity wall and through any finishes that are insufficiently flexible to be able to accommodate the movement.

(6) Movement joints in fire resistant masonry walls shall be designed and constructed in accordance with EN 1996-1-2.

(7) Movement joints in masonry walls complying with sound and thermal insulation requirements shall be designed and constructed accordingly.

(8) Slip planes should be designed to allow parts of the construction to slide, one in relation to the other, to reduce tensile and shear stresses in the adjacent elements.

(9) In external walls, movement joints should be designed to allow any water to flow off without causing harm to the masonry or penetrating into the building. Particular attention should be given to possible external inclined movement joints.

(10) There should be a clear distinction between any separation joints required to isolate parts of a building or buildings and movement joints.

#### Spacing of movement joints

(1) The horizontal spacing of vertical movement joints in masonry walls should take into account the type of wall, masonry units, mortar, the specific construction details, humidity and temperature variation.

(2) The positioning of movement joints should take into account the need to maintain structural integrity of loadbearing internal walls.

(3) In unreinforced loadbearing masonry walls vertical movement joints should be considered at:

— strong discontinuities in the geometry of the wall;

— strong discontinuities in the loads of the walls.

(4) The distance between the movement joints should take into account characteristics of the mortar: e.g. the adhesion of the mortar to the masonry unit and the compressive strength of the mortar.

(5) The distance between movement joints in external non-loadbearing walls also should take into account the type of wall ties, allowing or not independent in plane movement between masonry leaves or between the external masonry leaf and other structures to which the external masonry is attached.

(6) The need for vertical movement joints in loadbearing unreinforced walls should be considered.

(7) Unless specified, the horizontal distance between vertical movement joints in external non-loadbearing unreinforced masonry walls should not exceed *l*m.

NOTE 1 The values for *l*m are given in Table 4.2 (NDP), unless the National Annex gives different values (a single value or a range of values) for each type of masonry.

NOTE 2 Table 4.2 (NDP) is applicable for unreinforced non-loadbearing external single-leaf walls, for unreinforced non-loadbearing leaf of cavity walls, and for unreinforced veneer walls, etc.

Table 4.2 (NDP) — Horizontal distance, *l*m, between vertical movement joints for unreinforced, non-loadbearing external walls

|  |  |
| --- | --- |
| **Type of masonry** | ***l*m (m)** |
| Clay masonry | 10 to18 |
| Calcium silicate masonry | 5 to 9 |
| Dense aggregate concrete and manufactured stone masonry | 5 to 9 |
| Lightweight aggregate concrete masonry | 4 to 8 |
| Autoclaved aerated concrete masonry | 4 to 8 |
| Natural stone masonry | 10 to 20 |

NOTE 3 Exposed features such as parapets and freestanding walls can require the spacing of movement joints to be reduced.

(8) The maximum horizontal spacing of vertical movement joints may be increased for walls containing bed joint reinforcement conforming to EN 845-3.

NOTE Guidance can be obtained from the manufacturers of bed joint reinforcement and /or the manufacturers of the masonry units.

(9) The distance of the first vertical joint from a restrained vertical edge or any other restrained point of a wall of a wall should not exceed half the value of *l*m.

NOTE In order to avoid a restrained edge, a movement joint can be provided at the edge, or in the case of cavity walls tied with wall ties, the first tie can be placed at a suitable distance from the edge. The distance of the ties from the corner can be determined on the basis of the movements which can occur in the corner and on the stiffness of the ties and their anchorage.

(10) Where horizontal movement joints are required to accommodate vertical movement in an unreinforced veneer wall or in an unreinforced non-loadbearing outer leaf of a cavity wall, the spacing of horizontal movement joints should take into account the type and positioning of the support system. Unless determined by calculation, the vertical spacing of horizontal movement joints should be limited to 9 m.

(11) For the evaluation of the spacing of movement joints, specific calculations may be performed using the information provided in EN 1996-1-1.

### Permissible deviations

(1) Permissible deviations of the constructed masonry from its intended position should be specified.

(2) The permissible deviations should be stated as values in the design specification.

NOTE Compliance with tolerances is important in order to ensure that, despite the inevitable inaccuracies at each stage in the building process, the functional requirements can be met and the correct assembly of structures and components can take place without the need for adjustment or reworking.

(3) Unless specifically allowed for in the structural design, the permissible construction deviations should not be greater than the lesser of the values given in Table 5.1 and the values specified by locally accepted practice.

NOTE Table 5.1 gives the maximum permissible construction deviations that have been taken into account in EN 1996-1-1.

### Resistance to moisture penetration through external walls

(1) Where there is a need for greater resistance to moisture penetration than can be provided by the masonry alone, the application of a suitable rendering, ventilated cladding or other suitable surface treatment should be used.

NOTE Guidance on the use of external renderings is given in EN 13914‑1. Where a total barrier to rain penetration is required, a ventilated waterproof cladding system can be applied to the masonry.

# Execution

## General

(1) All materials used and all work constructed shall be in accordance with the design specification. Mortar joints should be in accordance with the requirements of 10.1.5 of EN 1996-1-1:2022.

(2) Precautions shall be taken to ensure the overall stability of the structure or of individual walls during construction.

## Acceptance, handling and storage of materials

### General

(1) The handling and storage of materials and masonry products for use in masonry shall be such that the materials are not damaged, thus becoming unsuitable for their purpose.

(2) Where required by the design specification, materials should be sampled and tested.

(3) Different materials should be stored separately.

### Reinforcement and prestressing materials

(1) The surface condition of reinforcement and prestressing materials shall be examined prior to use and it shall be free from deleterious substances, which may affect adversely the steel, concrete or mortar or the bond between them.

(2) Damage or deformation of reinforcement should be avoided during storage and handling.

(3) Steel reinforcing bars, steel prestressing bars and/or tendons and prefabricated bed joint reinforcement should be clearly identified, stored off the ground, and kept away from mud, oil, grease, paint or welding operations.

(4) During storage and handling of prestressing steel, welding in the vicinity of tendons, without the provision of special protection (from welding splatter), should be prevented.

(5) For sheaths, the following should be taken into account:

— local damage and corrosion inside should be avoided;

— water-tightness should be ensured.

## Preparation of materials

### Site-made mortars and concrete infill

#### General

(1) Site-made mortars and concrete infill should be produced using a mix prescription that will result in the required performance characteristics. When a mix prescription is not given in the design specification, the detailed specification of constituent materials, their proportions and the method of mixing should be selected on the basis of tests carried out on trial mixes and/or on the basis of authoritative publicly available references acceptable in the place of use.

(2) When tests are required, they should be carried out in accordance with the design specification. When test results indicate that the mix prescription is not giving the required performance characteristics, the mix prescription should be amended and, if it is part of the design specification, any amendments should be agreed with the relevant parties.

#### Chloride content

(1) When sampled in accordance with EN 998-2 and tested in accordance with EN 1015-17, or when using a calculation method based on measured chlorine ion content of the constituents of the mortar, the maximum value permitted in EN 998-2 shall not be exceeded.

#### Strength of mortar and concrete infill

(1) When the properties of mortar need to be verified, specimens shall be prepared and tested in accordance with EN 1015-11.

(2) When the properties of concrete infill need to be verified, specimens shall be prepared and tested in accordance with EN 206.

#### Admixtures and additions

(1) Unless permitted by the design specification, admixtures, additions or pigments shall not be used.

#### Gauging

(1) Materials for mortar and concrete infill shall be measured by weight or by volume into the specified proportions in clean suitable measuring devices.

(2) In the proportioning of the materials for concrete infill, account should be taken of the amount of water that will be absorbed by the masonry units and mortar joints.

#### Mixing method and mixing time

(1) The mixing method and the time of mixing should ensure consistent production of the correct mix proportions. Mortar should not be contaminated during subsequent handling.

(2) Unless hand mixing is permitted by the design specification, a suitable mechanical mixer should be used.

(3) The mixing time should be counted from the time when all constituent materials have been added to the mixer. Wide variation in the mixing time of different batches should be avoided.

(4) In general, a machine mixing time of 3 minutes to 5 minutes after all the constituents have been added, should be suitable and, except in the case of retarded mortars, the mixing time should not exceed 15 minutes.

NOTE Prolonged mixing where air-entraining agents are used can lead to excessive air entrainment and thus to a reduction in adhesion and durability.

(5) The mortar or concrete infill should be mixed so as to have sufficient workability for it to fill the spaces into which it is placed, without segregation, when it is compacted.

#### Workable life of mortars and concrete infill containing cement

(1) Mortars and concrete infill containing cement should be ready for use when they are discharged from the mixer, and no subsequent additions of binders, aggregates, admixtures, or water should be made.

NOTE Water can be added to site-made mortars to replace water lost by evaporation.

#### Mixing in cold weather

(1) Constituents of masonry mortar containing ice particles shall not be used.

(2) Unless specifically permitted by the design specification, de-icing salts or other anti-freezing agents should not be used.

### Factory made masonry mortars, pre-batched masonry mortars, pre-mixed lime sand masonry mortars and ready mixed concrete infill

(1) Factory made masonry mortars and pre-batched masonry mortars shall be used in accordance with the manufacturer's instructions, including mixing time and type of mixer.

(2) Mortar should be mixed effectively so that a uniform distribution of the constituents is ensured.

(3) The site mixing equipment, procedures, including mixing in cold weather and care of mixing plant and mixing time specified by the manufacturer, should be used.

(4) Pre-mixed lime sand masonry mortars should be mixed with the binder according to 5.3.1.1.

(5) Fresh masonry mortar shall be used before the expiry of the workable life stated by the manufacturer or the specifier.

(6) Ready mixed concrete infill should be used according to the design specification.

## Permissible deviations

(1) All work shall be constructed in accordance with the specified details within permissible deviations.

(2) Dimensions and planeness should be checked as the work proceeds.

(3) Deviations of the constructed masonry from its intended position should not exceed the values given in the design specification.

(4) Unless specifically allowed for in the structural design, the permissible deviations, when design is carried out in accordance with EN 1996-1-1, should not be greater than the lesser of:

— the values given in Table 5.1, see also Figure 5.1;

— the values in accordance with locally accepted practice.

|  |  |
| --- | --- |
|  |  |
| **b) Deviations between centres** |
|  |
| **a) Verticality** | **c) Straightness/flatness –****Curvature of the wall in the vertical direction** |

Key

|  |  |
| --- | --- |
| 1 | intermediate floor |
| a | clear height of a masonry wall |
| b | total height of a structure, from the top of the foundation |
| c | ≤ min(20 mm; *h*/225) |
| d | when *t* ≤ 200 mm |
| e | when *t* > 200 mm |
| f | ≤ min(50 mm; *h* tot 0,5/130) |

Figure 5.1 — Maximum permitted construction deviations

Table 5.1 — Permitted construction deviations for masonry walls

|  |  |
| --- | --- |
| **Verticality** | **Maximum deviation** |
| in any one storey a | ± 20 mm or ± *h*/225 whichever is the lesser |
| in total height of building of three storeys or more b | ± 50 mm or ± *htot0.5*/130 whichever is the lesser |
| **Deviation between centres** |   |
| in any one storey | ± 20 mm for walls up to 200 mm thick;± 10 % of the wall thickness of the storey below for walls over 200 mm thick |
| **Straightness/flatness** c |   |
| Curvature of the wall in the vertical direction between adjacent storeys | ± 20 mm or ± *h*/225 whichever is the lesser |
| in any one metre | ± 10 mm |
| in 10 metres | ± 40 mm |
| **Thickness** |   |
| of wall leaf d | ± 5 mm or ± 5 % of the leaf thickness whichever is the greater |
| of overall cavity wall | ± 10 mm. |
| a Verticality in any one storey depends on initial eccentricity *e*init in accordance with 7.5.1.1 in EN 1996-1-1:2022. If in the calculations *e*init is assumed larger than *h*eff/450, the value of the maximum deviation of the verticality in any one storey may be enhanced by a factor equal to 450·*e*init/*h*eff.b Verticality in the total height of building depends on global imperfections, assuming that the structure is inclined at an angle *θ*1 in accordance with 7.3 in EN 1996-1-1:2022. *h*tot is the total height of the building in metres. |
| c Deviation from straightness/flatness is measured from a straight reference line between any two points. It also depends on initial eccentricity *e*init in accordance with 7.5.1.1 in EN 1996-1-1:2022. If in the calculations *e*init is assumed larger than *h*eff/450, the value of the maximum deviation of the curvature of the wall in the vertical direction between adjacent storeys may be enhanced by a factor equal to 450·*e*init/*h*eff. |
| d Excluding leaves of single masonry unit width or length, where the dimensional tolerances of the masonry units govern the leaf thickness. The permissible tolerances for dimensions of masonry units are specified in EN 771. |

(4) Unless otherwise specified, the first course of masonry should not overhang the edge of a floor or foundation by more than 15 mm.

NOTE This limit if 15 mm only refers to the construction tolerances and does not apply if the effect of the overhang has been checked by calculation in accordance with EN 1996-1-1.

## Execution of masonry

### Adhesion

(1) The masonry units and mortar should be properly prepared to allow satisfactory adhesion.

(2) The necessity for wetting masonry units before use should be obtained from the design specification.

(3) Where there are no requirements in the design specification, the recommendations from the manufacturer of the units and, where appropriate, from the manufacturer of factory made masonry mortar, should be followed.

### Laying masonry units

(1) Unless otherwise stated in the design specification, masonry units with frogs should be laid so that they are fully filled with mortar.

(2) Unless otherwise specified, joints should not be recessed to a depth more than 5 mm in walls of thickness 200 mm or less.

(3) When using perforated masonry units, the mortar joints should not be recessed more than 1/3 of the shell thickness unless otherwise specified.

(4) Bed joints may be considered as fully filled when (2), (3) and the requirements in 5.5.3 are fulfilled.

NOTE In fully filled joints using group 2 and 3 units, mortar is present on all webs and shells.

### Pointing and jointing for masonry other than thin layer masonry

#### Pointing

(1) Where joints are to be pointed, the unhardened mortar joints should be raked out so as to have clean sides to a depth of at least *d*p, depending on the application.

(2) Before pointing loose material should be brushed out. The whole area should be cleaned and if necessary wetted to give the best practicable adhesion.

(3) The maximum values of *d*p given in this clause shall not be exceeded unless the capacity of the masonry is checked by calculation, taking into account the reduced cross-section of the masonry when the joint is raked out. In such a case, higher maximum values of *d*p may be used.

(4) For non-loadbearing walls, the maximum value of *d*p is 15 mm but the remaining width of the joint should be at least 70 % of the wall thickness.

(5) For loadbearing walls, the maximum value of *d*p is 15 mm but no more than 15 % of the wall thickness, measured from the finished surface of the joint, and not more than 30 % of the declared values of combined thickness of webs and shells for walls made with Groups 2, 3 and 4 units.

(6) For loadbearing columns, the maximum value of *d*p is 15 mm but no more than 10% of the column thickness, measured from the finished surface of the joint.

#### Jointing

(1) Where masonry is finished by jointing during execution, the mortar should be compacted before it has lost its plasticity.

### Incorporation of damp proof course membranes

(1) Where no instructions are available, laps at corners and intersections of walls should extend the full width of the wall and all other laps should be not less than 150 mm.

### Movement joints

(1) Except for slip ties, components including copings and cappings should not bridge movement joints.

### Incorporation of thermal insulation materials

(1) Where insulation is installed by injecting or blowing materials into the cavity, the masonry leaves should have sufficient strength to resist the pressures imposed during and after installation.

### Cleaning facing masonry

(1) Splashes of mortar, grout or other stains should be cleaned off as soon as practicable after they occur and preferably by brushing before cementitious based materials have hardened.

(2) The cleaning method should be one recommended by the manufacturer of the masonry units taking into account the kind of staining or efflorescence.

## Curing and protective procedures during execution

### General

(1) Suitable precautions shall be taken to avoid damage to newly constructed masonry.

(2) During mortar hydration, newly constructed work should be protected against excessive moisture loss or uptake.

### Protection against rain

(1) Completed masonry should be protected from rain falling directly onto the construction until the mortar has matured. It should be protected from mortar being washed out of the joints and from cycles of wetting and drying.

(2) In order to protect the completed masonry, sills, thresholds, gutters and provisional rain water downpipes should be installed as soon as practicable after finishing the bricklaying and pointing.

(3) Bricklaying and pointing should be stopped during periods of heavy rain and the masonry units, mortar and the fresh pointing should be protected.

(4) Freshly pointed masonry should be protected from spells of heavy rain.

### Protection against freeze/thaw cycling

(1) Precautions should be taken to avoid damage to freshly completed masonry and pointing from freezing and thawing cycles.

(2) Masonry should not be laid on or with frozen materials. The minimum working temperature for the mortar should be observed.

### Protection against effects of low humidity

(1) Newly constructed masonry should be protected from low humidity conditions including the drying effects of wind and high temperatures. It should be kept moist until the cement in the mortar has hydrated.

### Protection against mechanical damage

(1) Masonry surfaces, vulnerable arises at corners and openings, plinths and other projecting features should be protected from damage and disturbance taking into account:

— other works in progress and subsequent construction operations;

— activities of construction traffic;

— concrete being poured above;

— use of scaffoldings and the construction processes carried out from them.

(2) Completed masonry should be protected from construction operations that would stain fair-faced masonry or affect bonding with future work such as rendering.

### Construction height of masonry

(1) The height of masonry to be built in one day should be limited so as to avoid instability and overstressing of the fresh mortar.

(2) The wall thickness, the type of mortar, the shape and density of the units and the degree of exposure to the wind should be taken into account in determining an appropriate limit.

1. (informative)

Classification of micro conditions of exposure of completed masonry
	1. Use of this Informative Annex

(1) This Informative Annex provides additional guidance to 4.1.2.1 for the micro conditions of exposure.

NOTE National choice on the application of this Informative Annex is given in the National Annex. If the National Annex contains no information on the application of this informative annex, it can be used.

* 1. Scope and field of application

(1) This Informative Annex specifies a subdivision of the basic classification given in 4.1.2.1(3) with examples.

* 1. Classification

Table A.1 — Classification of micro conditions of exposure of completed masonry

| **Class** | **Micro condition of the masonry** |   | **Examples of masonry in this condition** |
| --- | --- | --- | --- |
| **MX1** | **In a dry environment** |   |   |
|   |   |   | Interior of buildings for normal habitation and for offices, including the inner leaf of external cavity walls not likely to become damp. |
|   |   |   | Rendered masonry in exterior walls, not exposed to moderate or severe driving rain, and isolated from damp in adjacent masonry or materials. |
| **MX2** | **Exposed to moisture or wetting** |   |   |
| MX2.1 | Exposed to moisture but not exposed to freeze/thaw cycling or external sources of significant levels of sulfates or aggressive chemicals |   | Internal masonry exposed to high levels of water vapour, such as in a laundry. Masonry exterior walls sheltered by overhanging eaves or coping, not exposed to severe driving rain or frost. Masonry below frost zone in well drained non-aggressive soil. |
| MX2.2 | Exposed to severe wetting but not exposed to freeze/thaw cycling or external sources of significant levels of sulfates or aggressive chemicals |   | Masonry not exposed to frost or aggressive chemicals, located: in exterior walls with capping or flush eaves; in parapets; in freestanding walls; in the ground; under water. |
| **MX3** | **Exposed to wetting plus freeze/thaw cycling** |   |   |
| MX3.1 | Exposed to moisture or wetting and freeze/thaw cycling but not exposed to external sources of significant levels of sulfates or aggressive chemicals |   | Masonry as class MX2.1 exposed to freeze/thaw cycling. |
| MX3.2 | Exposed to severe wetting and freeze/thaw cycling but not exposed to external sources of significant levels of sulfates or aggressive chemicals |   | Masonry as class MX2.2 exposed to freeze/thaw cycling. |
| **MX4** | **Exposed to saturated salt air, seawater or de-icing salts** |   |   |
|   |   |   | Masonry in a coastal area. Masonry adjacent to roads that are salted during the winter |
| **MX5** | **In an aggressive chemical environment** |   |  |
|   |   |   | Masonry in contact with natural soils or filled ground or groundwater, where moisture and significant levels of sulfates are present. |
|   |   |   | Masonry in contact with highly acidic soils, contaminated ground or groundwater. Masonry near industrial areas where aggressive chemicals are airborne. |
| NOTE In deciding the exposure of masonry, the effect of applied finishes and protective claddings can be taken into account. |

* 1. Exposure to wetting

(1) Figures A.1 and A.2 give examples of relative exposure to wetting.

NOTE The figures are based on typical modern construction but for clarity they do not show all the detailing of cavities and damp proofing.

|  |  |
| --- | --- |
|  |  |
| **a) non masonry coping with overhang** | **b) masonry coping without overhang(simple capping)** |
|  |  |
| **c) sill with overhang** | **d) sill without overhang(flush sill)** |

Key

|  |
| --- |
| Relative exposure to wetting |
| Protected  | Severe |
|  |

Figure A.1 — Examples of the effect of building detail on
relative exposure to wetting of masonry

Key

|  |
| --- |
| Relative exposure to wetting |
| Protected  | Severe |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | flush eaves | 6 | overhanging eaves |
| 2 | balcony | 7 | freestanding wall |
| 3 | coping | 8 | depending on soil and ground water conditions |
| 4 | render | 9 | earth retaining wall |
| 5 | parapet |  |   |

Figure A.2 — Examples of relative exposure to wetting of masonry
(not protected by applied finishes)

1. (informative)

Acceptable specifications of masonry units and mortar for durable masonry in various exposure conditions
	1. Use of this Informative Annex

(1) This Informative Annex provides additional guidance to 4.2.1for the selection of masonry units and mortar.

NOTE National choice on the application of this Informative Annex is given in the National Annex. If the National Annex contains no information on the application of this informative annex, it can be used.

* 1. Scope and field of application

(1) This Informative Annex specifies acceptable specifications of masonry units and mortar in relation to the exposure of the masonry.

* 1. Selection of masonry units and mortar

(1) Masonry units and mortar may be selected from Tables B.1 and B.2, according to the exposure class of the masonry determined from Table A.1.

(2) Masonry mortar is specified for durability using the terms defined in EN 998-2. For the purposes of Table B.2 they are abbreviated using the following symbols:

— P mortar for use in masonry subjected to passive exposure;

— M mortar for use in masonry subjected to moderate exposure;

— S mortar for use in masonry subjected to severe exposure.

(3) Until a European test method is available, the designation of site-made mortar mix prescriptions, for which authoritative data are available, may be related to the P, M, or S designations.

(4) In addition to selecting a mortar for durability, other performance characteristics such as compressive strength, bond strength, and water retentivity need to be taken into account so that the mortar is compatible with the selected masonry units and enables the masonry to satisfy all relevant design requirements.

(5) In the present state of the art, guidance on the suitability of mortars should be obtained from the manufacturers of factory made masonry mortars or in the case of site-made mortars from authoritative sources accepted in the place of use, see 4.2.3.

(6) When clay masonry units of Soluble Salts Content Category S1 is to be used in masonry where the Exposure Class is MX2.2, MX3.2, MX4 and MX5, the mortars should in addition be sulphate resisting.

Table B.1 — Acceptable specifications of masonry units for durability

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Exposureclass****(see Table A.1)** | **Clay masonry units** | **Calcium silicate masonry units** | **Aggregate concrete masonry units** | **Autoclaved aerated concrete masonry units** | **Manufactured stone masonry** **units** | **Natural stone masonry units** |
|   |   |   | Dense aggregate | Lightweight aggregate |   |   |   |
| MX1a | Any | Any | Any | Any | Any | Any | Any |
| **MX2.1** | F0, F1 or F2 / S0, S1 or S2 | Any | Any | Any | Any | Any | Any |
| **MX2.2** | F0, F1 or F2 / S1 or S2 | Any | Any | Any | ≥ 400 kg/m3 | Any | Any |
| **MX3.1** | F2 / S1 or S2 | F1or F2 | Freeze/thaw resistant | Freeze/thaw resistant | Freeze/thaw resistant | Freeze/thaw resistant | Consult manufacturer |
| **MX3.2** | F2 / S1 or S2 | F2 | Freeze/thaw resistant | Freeze/thaw resistant | Freeze/thaw resistant | Freeze/thaw resistant | Consult manufacturer |
| **MX4** | In each case, assess the degree of exposure to salts, wetting and freeze/thaw cycling and consult the manufacturer. |
| **MX5** | In each case, a specific assessment should be made of the environment and the effect of the chemicals involved taking into account concentrations, quantities available and rates of reaction and consult the manufacturer |
| a Class MX1 is valid only as long as the masonry, or any of its components, is not exposed during execution to more severe conditions over a prolonged period of time. |

Table B.2 — Acceptable specifications of mortars for durability

|  |  |
| --- | --- |
| **Exposure class****(see Table A.1)** | **Mortar in combination with any type of unit, classified according to B.1(2)** |
| **MX1 a,b** | P, M or S |
| **MX2.1** | M or S |
| **MX2.2** | M or S |
| **MX3.1** | M or S |
| **MX3.2** | S |
| **MX4** | In each case, assess the degree of exposure to salts, wetting and freeze/thaw cycling and consult the manufacturers of the constituent materials. |
| **MX5** | In each case, a specific assessment should be made of the environment and the effect of the chemicals involved taking into account concentrations, quantities available and rates of reaction and consult the manufacturers of the constituent materials. |
| a Class MX1 is valid only as long as the masonry, or any of its components, is not exposed during execution to more severe conditions over a prolonged period of time.b When designation P mortars are specified it is essential to ensure that masonry units, mortar and masonry under construction are fully protected from saturation and freezing. |

1. (informative)

Selection of material and corrosion protection specifications for ancillary components according to exposure class
	1. Use of this Informative Annex

(1) This Informative Annex provides additional guidance to 4.2.4 for the selection of ancillary components.

NOTE National choice on the application of this Informative Annex is given in the National Annex. If the National Annex contains no information on the application of this informative annex, it can be used.

* 1. Scope and field of application

(1) This Informative Annex specifies acceptable corrosion protection systems for ancillary components according to exposure classes.

* 1. Exposure classes

(1) The range of environmental conditions encountered by ancillary components is classified into the five exposure classes MX1, MX2, MX3, MX4 and MX5 as given in Table A.1.

(2) The choice of exposure class should take into account either the exposure of products during execution or in the finished work, whichever will be the more onerous.

* 1. Selection of materials

(1) The material and protective coating, if any, for ancillary components shall be selected from the relevant part of EN 845.

NOTE Materials for the manufacture of ancillary components and their corrosion protection systems are specified in full in the relevant part of EN 845 and each one is given a unique material/coating reference. This reference gives no indication of relative performance or quality.

(2) Materials for ties, tension straps, hangers and brackets, conforming to EN 845-1, should be selected using Table C.1.

(3) Materials for lintels, conforming to EN 845-2, should be selected using Table C.2.

(4) Materials for bed joint reinforcement, conforming to EN 845-3 should be selected using Table C.3.

NOTE 1 Tables C.1, C.2 and C.3 show the material/coating reference with a brief description of the materials and the exposure classes, in which the specification is suitable. This guidance is based on long term experience of the durability of such materials in a range of exposure conditions. Currently there is no accepted accelerated exposure test for measuring this parameter.

NOTE 2 Materials allocated to each exposure class will be expected to have an economically reasonable working life under the conditions described, subject to specialist advice being obtained in some cases, as indicated in the table. The choice will be dependent upon the particular application, its location and the intended working life.

(5) Where ancillary components need to be movement tolerant during installation or use, the ability of the materials and coatings to withstand the expected movement should be taken into account.

Table C.1 — Corrosion protection systems for ties, tension straps, brackets and hangers
conforming to EN 845-1 in relation to exposure classes

|  |  |  |
| --- | --- | --- |
|   |   | **Exposure class** |
| **Material** a | **Ref No** | **MX1** | **MX2** | **MX3** | **MX4** | **MX5** |
| Austenitic stainless steel (molybdenum chrome nickel alloys) | 1 | U | U | U | R | R |
| Plastic used for the body of ties | 2 | U | U | U | R | R |
| Austenitic stainless steel (chrome nickel alloys) | 3 | U | U | R | X | X |
| Ferritic stainless steel | 4 | U | X | X | X | X |
| Phosphor bronze | 5 | U | R | R | X | X |
| Aluminium bronze | 6 | U | R | R | X | X |
| Copper | 7 | U | R | R | X | X |
| Zinc coated (940 g/m2) steel component | 9 | U | U | R | R | X |
| Zinc coated (710 g/m2) steel component | 10 | U | R | R | R | X |
| Zinc coated (460 g/m2) steel component  | 11 | U | R | R | R | X |
| Zinc coated (395 g/m2) steel component | 11A | U | R | R | R | X |
| Zinc coated (300 g/m2) steel strip or sheet with organic coating over all outer surfaces of finished component | 12.1 | U | R | R | R | X |
| Zinc coated (300 g/m2) steel strip or sheet with organic coating over all outer surfaces of finished component | 12.2 | U | R | R | R | X |
| Zinc coated (265 g/m2) steel wire | 13 | U | R | X | X | X |
| Zinc coated (300 g/m2) steel strip or sheet with all cut edges organic coated | 14 | U | R | R | X | X |
| Zinc pre-coated (300 g/m2) steel strip or sheet | 15 | U | R | R | X | X |
| Zinc coated (137 g/m2) steel strip or sheet with organic coating over all outer surfaces of finished component | 16.1 | U | R | R | R | X |
| Zinc coated (137 g/m2) steel strip or sheet with organic coating over all outer surfaces of finished component | 16.2 | U | R | R | R | X |
| Zinc pre-coated (137 g/m2) steel strip with zinc coated edges | 17 | U | R | X | X | X |
| Zinc coated (60 g/m2) steel wire with organic coating over all surfaces of finished component | 18 | U | R | R | R | X |
| Zinc coated (105 g/m2) steel wire | 19 | U | R | X | X | X |
| Zinc coated (60 g/m2) steel wire | 20 | U | X | X | X | X |
| Zinc pre-coated (137 g/m2) steel sheet | 21 | U | X | X | X | X |
| Zinc coated (60 g/m2) steel wire with epoxy coating over all surfaces of finished component | 22 | U | U | U | R | X |
| Austenitic ferritic stainless steel | 23 | U | X | X | X | X |
| KEY: U - unrestricted use of the material in listed class of exposure. R - restricted use; consult the manufacturer or a specialist consultant for advice for the specific design conditions. X - material not recommended for use in this exposure class. |
| a The full specification of the material and coating or concrete cover corresponding to the reference number or letter is given in EN 845-1. The coating weights shown are approximate values for one surface. |

Table C.2 — Corrosion protection systems for lintels
conforming to EN 845-2 in relation to exposure classes

|  |  |  |
| --- | --- | --- |
|   |   | **Exposure class** |
| **Material a** | **Ref No** | **MX1** | **MX2** | **MX3** | **MX4** | **MX5** |
| Austenitic stainless steel (molybdenum chrome nickel alloys) | L1 | U | U | U | U | R |
| Austenitic stainless steel (chrome nickel alloys) | L3 | U | U | R | R | X |
| Austenitic ferritic stainless steel | L4 | U | X | X | X | X |
| Zinc coated (710 g/m2) steel component | L10 | U | R | R | R | X |
| Zinc coated (460 g/m2) steel component | L11 | U | R | R | R | X |
| Zinc coated (460 g/m2) steel component with organic coating (type 1) on specified upper surfaces | L11.1 | U | R | R | R | X |
| Zinc coated (460 g/m2) steel component with organic coating (type 2) on specified upper surfaces | L11.2 | U | R | R | R | X |
| Zinc coated (395 g/m2) steel component | L11.A | U | R | R | R | X |
| Zinc coated (395 g/m2) steel strip or sheet with organic coating (type 1) over all outer surfaces of finished component | L11.1A | U | R | R | R | X |
| Zinc coated (395 g/m2) steel strip or sheet with organic coating (type 2) over all outer surfaces of finished component | L11.2A | U | R | R | R | X |
| Zinc coated (300 g/m2) steel strip or sheet with organic coating (type 1) over all outer surfaces of finished component | L12.1 | U | R | R | R | X |
| Zinc coated (300 g/m2) steel strip or sheet with organic coating (type 2) over all outer surfaces of finished component | L12.2 | U | R | R | R | X |
| Zinc coated (300 g/m2) steel strip or sheet with all cut edges organic coated | L14 | U | R | R | X | X |
| Zinc coated (137 g/m2) steel strip or sheet with organic coating (type 1) over all outer surfaces of finished component | L16.1 | U | R | R | R | X |
| Zinc coated (137 g/m2) steel strip or sheet with organic coating (type 2) over all outer surfaces of finished component | L16.2 | U | U | R | R | X |
| Austenitic ferritic stainless steel | L23 | U | X | X | X | X |
| Concreteb,c or concrete and masonry | A | U | U | R | R | R |
| Concreteb,c or concrete and masonry | B | U | U | R | R | X |
| Concreteb,c or concrete and masonry | C | U | U | R | X | X |
| Concreteb,c or concrete and masonry | D | U | U | X | X | X |
| Concreteb,c or concrete and masonry | E | U | X | X | X | X |
| Autoclaved aerated concrete with stainless steel reinforcement | F | U | U | R | R | R |
| Autoclaved aerated concrete with reinforcement protected by a coating system | G | U | R | R | R | R |
| KEY: U - unrestricted use of the material in listed class of exposure. R - restricted use; consult the manufacturer or a specialist consultant for advice for the specific design conditions. D - with a damp proof course on top of the lintel the use is unrestricted (U). Without a damp proof course on top of the lintel the use is restricted (R) X - material not recommended for use in this exposure class. |
| a The full specification of the material and coating or concrete cover corresponding to the reference number or letter is given in EN 845-2. The coating weights shown are approximate values for one surface.b The reference number of the concrete, combined with the column number of EN 845-2:2013, Table C.3 gives the specified concrete cover.c The manufacturer, or a specialist consultant, can permit a less restrictive use for prefabricated lintels, based on local experience. |

Table C.3 — Corrosion protection systems for bed joint reinforcement
conforming to EN 845-3 in relation to exposure classes

|  |  |  |
| --- | --- | --- |
|   |   | **Exposure class** |
| **Material** a | **Ref No** | **MX1** | **MX2** | **MX3** | **MX4** | **MX5** |
| Austenitic stainless steel (molybdenum chrome nickel alloys) | R1 | U | U | U | U | R |
| Austenitic stainless steel (chrome nickel alloys) | R3 | U | U | U | R | X |
| Zinc coated (265 g/m2) steel wire | R13 | U | X | X | X | X |
| Zinc coated (60 g/m2) steel wire with organic coating over all surfaces of finished component | R18 | U | R | R | R | X |
| Zinc coated (105 g/m2) steel wire | R19 | U | X | X | X | X |
| Zinc coated (60 g/m2) steel wire | R20 | U | X | X | X | X |
| Zinc pre-coated (137 g/m2) steel sheet | R21 | U | X | X | X | X |
| Zinc coated (60 g/m2) steel wire with epoxy coating over all surfaces of finished component | R22 | U | R | R | R | X |
| Austenitic ferritic stainless steel | R23 | U | X | X | X | X |
| KEY: U - unrestricted use of the material in listed class of exposure. R - restricted use; consult the manufacturer or a specialist consultant for advice for the specific design conditions. X - material not recommended for use in this exposure class. |
| a The full specification of the material and coating or concrete cover corresponding to the reference number or letter is given in EN 845-1. The coating weights shown are approximate values for one surface. |

Bibliography

References contained in recommendations (i.e. “should” clauses)

The following documents are referred to in the text in such a way that some or all of their content constitutes highly recommended choices or course of action of this document. Subject to national regulation and/or any relevant contractual provisions, alternative documents could be used/adopted where technically justified. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 845‑1, Specification for ancillary components for masonry — Part 1: Wall ties, tension straps, hangers and brackets

EN 845‑2, Specification for ancillary components for masonry — Part 2: Lintels

EN 845‑3, Specification for ancillary components for masonry — Part 3: Bed joint reinforcement of steel meshwork

References contained in possibilities (i.e. “can” clauses) and notes

The following documents are cited informatively in the document, for example in "can" clauses and in notes.

EN 13914‑1, Design, preparation and application of external rendering and internal plastering — Part 1: External rendering