Learning text part 09

mpa Mortar

Specifications

Contents

Health and safety

All mortar mixtures, both wet and dry, are abrasive and alkaline. When working with wet mortar, waterproof or other suitable protective clothing should be worn. Guidance on the use of these materials can be found in MPA Mortar data sheet No. 20.

Introduction

This learning text looks at the specification of masonry and rendering mortars, covering its historical evolution and current requirements. Information is given on the parameters that need to be considered in the preparation of a specification. Additionally, a glossary of terminology and bibliography is included and a final section provides self-assessment questions and answers.

Historical

The earliest documented use of mortar is around 4000 BC and it is mentioned several times in the Bible's old testament. However, it was the Romans who really developed its structural use. Vitrivius, a military engineer who worked under Julius Caesar, wrote a specification for sand, lime and bricks to be used in masonry. He stated, "In buildings of rubble work it is of the first importance that the sand be fit for mixing with the lime and unalloyed with earth". He added "though pit sand is excellent for mortar, it is unfit for plastering for being such a rich quality, when added to the lime and straw, its great strength does not suffer it to dry without cracks".

Historically, mortars have been specified on a volume basis, probably because they have almost always been mixed on site by the shovelful, for example one shovelful of cement or lime to perhaps three or six shovelfuls of sand. This would be written in specification terms as a 1:3 or a 1:6.

The term specification may be defined in relation to construction as a document containing a detailed description of the particulars of some projected work in building, engineering or similar, giving the dimensions, materials, quantities etc, of the work, together with directions to be followed by the builder or constructor.

The functions of masonry mortar

Before specifying masonry mortar it is very important to understand how the constituent materials determine the fresh and hardened properties of the material and how it contributes to the successful performance of the masonry. Masonry mortar has a number of functions:

- To act as an adhesive to glue the masonry units together
- To glue joint reinforcement and connectors to the masonry units
- To act as a spacer between masonry units
- To compensate for irregularities between masonry units
- To seal any gaps so minimising rain or wind penetration
- To have sufficient strength to suit the application
- To be durable in the particular environment.

As the colour of hardened masonry mortar contributes to the overall aesthetic appearance of the finished construction, its colour and the method of finishing (workmanship) need to be considered when drafting the specification.

MPA Mortar learning text 6, Properties of masonry mortar, covers the desirable qualities for a masonry mortar in greater depth.

Design requirements

Many parameters have to be taken into account when drafting a specification and the following section points up a number of those factors.

Design of masonry construction is covered by BS 5628-3, with clause 5 entitled "Design" listing the factors that should be taken into account. It states, "Consideration should be given to the interaction of the whole structure, of which the masonry forms a part". This highlights the importance of not considering masonry and mortar in isolation from the other building components. Parts 1 and 2 of BS 5628 provide further guidance for the masonry and mortar designer in the preparation of the specification for particular construction applications and environments.

The parameters include:

- Strength and stability
- Weather resistance
- Durability
- Fire resistance
- Thermal insulation
- Sound insulation

Strength and stability (structural requirements)

A large percentage of masonry construction comprises walls for houses or walls and piers for other buildings. These together with the roof form the environmental envelope of the building, with the walls very frequently becoming the basic supporting elements.

The designer of a masonry construction must consider the forces acting on the element being designed, these include:

- The thickness in relation to the height and width of the construction
- The weight of the element
- The presence of piers
- The application of concentrated loads to walls
- The application of lateral loads to walls (eg, wind)
- Movement
- The interaction with other construction elements.

Consideration of these factors enables the designer to determine the most suitable form of construction and the range of materials that may be used.

Weather resistance

External walls of a building must provide adequate resistance to wind and rain penetration. The actual degree of resistance required will depend largely upon the height of the wall, its location and exposure environment.

Wind force and rainfall vary considerably throughout the United Kingdom so that a form of construction that is adequate for one locality may not be satisfactory in another. BS 5628: Part 3, contains a table that lists categories of exposure for local wind driven rain and also lists other publications that provide further guidance (See Bibliography). The standard lists a number of factors that should be considered in preparing a specification for external wall construction.

These include:

- Type of masonry unit
- Mortar composition
- Thickness of leaf and presence of cavities
- Mortar joint profile and finish
- Architectural features

- Application of applied external surface finishes
- Quality of workmanship to be achieved on site

Detailed guidance on how these factors should be taken into account is given within BS 5628-3. Guidance is also given on other types of masonry construction (eg, chimneys).

Durability

To achieve long-term durability in masonry construction, not only the physical characteristics of the masonry unit need to be taken into consideration but also the mortar and exposure conditions. Ingress and saturation by water is the commonest potential cause of durability failure. Masonry can become saturated directly by rainfall, indirectly by upward movement of water from the foundations, or laterally from retained material as in a retaining wall.

Earlier in this text it was stated that walls form part of the environmental envelope of a building. If water is to be prevented from reaching the inside of a solid wall by means of absorption, it is essential that the mortar and the masonry units should have similar absorptive characteristics. Strong dense mortars should be avoided to ensure sufficient porosity in the joint and to reduce shrinkage so that cracking between the mortar and masonry units is minimised. It is very difficult to produce a barrier to water penetration in a solid masonry wall. The dense mortars required to provide joint impermeability generally have a high initial shrinkage, resulting in cracking at the joint interface and thus allowing water to penetrate the joints by capillary attraction. Cavity wall construction, however, does overcome the problems of water penetration. A cavity wall is constructed in two leaves or skins with a space between them so that the outer surface of the wall is isolated from the inner surface by a continuous gap.

Ingress of water to masonry units and mortar joints can cause durability failures for two primary reasons. Firstly, freezing when the masonry unit and mortar are saturated with water and secondly by transporting dissolved salts (primarily sulfates), which may attack the matrix of the mortar and the masonry unit.

The architect or designer may minimise the likelihood of water saturation by incorporating design features such as roof overhangs or copings.

Most parts of the UK experience night frosts during the winter months. Low temperatures alone do not lead to the deterioration of masonry units and mortar but a combination of water saturation and low temperatures may lead to ice formation. This change of state results in an increase in water volume of approximately 9%. This transformation can result in stresses which the masonry unit or mortar cannot withstand leading to spalling of the masonry unit and crumbling of the mortar. Severity of freeze/thaw damage increases with more frequent cold cycles rather than a prolonged period of freezing.

BS 5628-3 contains an extensive table entitled "Durability of masonry in finished construction", which lists various exposure conditions, types of masonry units and appropriate mortar designations. The specification of a mortar containing an air entraining admixture improves the resistance of the mortar to freeze thaw deterioration.

Certain types of masonry construction are more likely to become water saturated and remain so for considerable periods of time. These include chimney stacks, retaining walls, parapets and construction below damp proof courses. The designer should specify appropriate materials for these environments.

Sulfate attack is principally caused by the reaction between sulfates in solution and the tricalcium aluminate in cement (C3A), - see MPA Mortar learning text 2: Cementitious materials. The risk of sulfate attack can be reduced by using a cement with a low C3A content or a Portland cement (CEM 1), with which pulverised fly ash or ground granulated blastfurnace slag has been combined.

Some types of bricks can provide a source of sulfates. It is possible to specify bricks with a low acid soluble content and calcium sulfate bricks and concrete masonry units do not contain soluble sulfates. Where masonry construction is to take place below ground level, or masonry retaining walls are to be constructed, it is essential that chemical analysis be undertaken to determine the concentration and type of sulfates present. BRE Special Digest 1 provides guidance on "Concrete in aggressive ground" and much of the information provided is applicable to mortar. The digest contains information on site investigations, the classification of aggressive chemicals in the soil and the mobility of groundwater.

Fire resistance

BS 5628 provides guidance on the notional fire resistance of walls, while tables list the thickness of masonry required for different time periods of fire resistance based on the composition of the masonry unit. (See Glosaary for further information on fire resistance.)

Thermal insulation

European and domestic legislation now attaches increased importance to the use of energy resources. Additionally, conservation of heat in buildings has become more important as the cost of fuels increases. Designers should design walls of buildings to minimise the quantity of energy required to maintain the required internal temperature. Masonry units may be specified based on their thermal resistance. Specialist publications are available to assist the designer to specify insulation and the design of insulated masonry. Part L of the Building Regulations, is entitled "Conservation of fuel and power". The revised edition came into force in 2006, while a number of approved documents providing guidance on meeting the requirements are published by BRE.

Sound insulation

Transmission of sound through solid material occurs as a result of vibration. The efficiency of walls in minimising sound transmission depends upon their mass, with sound insulation improved by discontinuous construction. To achieve this a wall may be divided into two leaves, which are separate. BS 5628-3 provides guidance on sound control.

For good sound insulation it is essential that all mortar joints are fully filled. Further guidance may be found within Part E of the Building Regulations, entitled "Resistance to the passage of sound".

Consideration of the factors discussed in this section on design and the required aesthetic appearance enable the designer to specify a masonry type, construction details and an appropriate type of masonry mortar.

Methods of specifying masonry mortar

General

The previous section of this learning text has described the many factors that a designer or specifier of masonry construction needs to consider in compiling a specification. When drafting a specification it is important to avoid vague requirements that cannot be measured such as "to the specifier's or engineer's satisfaction", because a manufacturer cannot be held responsible for conforming to requirements that cannot be defined in quantitative terms.

There are two methods for specifying masonry mortar, the prescriptive approach and the performance approach.

Prescribed masonry mortars

Historically, the specification of mortars has been based on the prescription or recipe concept. The prescription concept involves specifying the proportion of each of the constituent materials to be used in producing a product. The traditional prescriptive approach served the industry well in the past when the industry as a whole was much less sophisticated than it is now.

Prescriptions or recipes have been developed to encompass a range of material properties, including those at the lower end of the range permitted by their standards. This has resulted in the lowest common denominator being set as the material requirement. This means that in practice, mix proportions have been set to allow the lowest quality sand permitted by the standard to be used, and to produce a mortar with satisfactory properties. Clearly, for much better quality sand, the mix proportions that were set to accommodate the lower quality material, will produce a product that greatly exceeds the actual requirements. See Note 2 of Table 1.

This approach tends to inhibit the most efficient use of the constituent materials available to produce a mortar.

The prescriptive system of specifying masonry mortar adopted by British Standards many years ago is based on mortar designations. Mortars of different constituent material compositions that had approximately equivalent compressive strengths were given the same numeric designations. Conformity with a prescription specification and the associated strength class does not provide the specifier with a guarantee of the durability of the mortar. However, some specifiers prefer to prescribe the mortar constituents based on their own personal experience of the use of particular materials.

BS 5628-3 includes a table (an extract from this is reproduced as Table 1) showing the traditional mortar designations. The compressive strength class is that that may be expected from the use of these materials when tested at twenty-eight days. Compressive strength is determined on prism not cube specimens and a conversion factor needs to be applied where cube specimens are used. The compressive strength classes listed in Table 1 do not correspond to the strength classes listed in BS 998-2. The values listed in Table 1 are based on limited laboratory data for each of the designations. (These values have been included within the informative national annex to BS EN 998-2 [NA.1]. However these are being reconsidered to reflect experience gained from actual production since the introduction of the standard.)

Designed masonry mortars

A specifier of a factory-produced designed masonry mortar should specify one of the mortar classes listed in Table 1 of BS EN 998-2, together with requirements for workable life. Where relevant, chloride content and/or air content should also be specified. For some specialised applications, the specifier may need to call for additional requirements (eg, density or water vapour permeability). The presence of chlorides can cause corrosion of any embedded metal, while the incorporation of an air entraining admixture increases the resistance of the mortar to freeze/thaw attack. The mortar producer will use knowledge and a database to select an appropriate combination of constituent materials to produce a masonry mortar with the desired characteristics. Conformity of the mortar with the specification will be evaluated in accordance with Clause 8 of BS EN 998-2.

Where a designed mortar is produced on site, the contractor will have to undertake trials to establish suitable combinations of materials

Specifications *Table 1:* ***Masonry mortars***

Mortar Designation	Mortar Strength Class	Prescribed Mortars (proportion of materials by volume) (see notes 1 and 2)				Compressive Strength at 28 days
		Cement (or combination of cement except masonry cement): lime: sand with or without air entrainment	Cement: sand with or without air entrainment	Masonry cement (inorganic filler other than lime) sand	Masonry cement (lime): sand	
(i)	M12	1 : 0 to _ :3	-	-	-	12
(ii)	M6	1 : _ : 4 to 4_	1 : 3 to 4	1 : 2_ to 3_	1 : 3	6
(iii)	M4	1 : 1 : 5 to 6	1 : 5 to 6	1 : 4 to 5	1 : 3_ to 4	4
(iv)	M2	1 : 2 : 8 to 9	1 : 7 to 8	1 : 5_ to 6_	1 : 4_	2

NOTE 1: *All proportions are by volume. Proportioning by mass will give more accurate batching than assessing by volume, provided that the bulk densities of the materials are checked on site.* NOTE 2: *When the sand proportion is given as, for example 5 to 6, the lower figure should be used with sands containing a higher proportion of fines whilst the higher figure should be used with sands containing a lower proportion of fines.*

to satisfy the requirements for the particular applications. The specifier should include in the requirements routine quality control, sampling and the evaluation of conformity of the mortar.

Specification drafting

BS EN 998-2 is a performance-based standard. It recognises the prescriptive concept but gives no guidance on prescribed mortar mix proportions. BS EN 998-2 requires that:

- The proportions of all prescribed mortars shall be declared by the manufacturer; and
- The compressive strength of all prescribed mortars shall be declared using publicly available references. The national annex (NA.1) to BS EN 998-2, is an example.

A specifier of masonry mortar has two possible options when drafting the specification:

(a) Specify a factory-produced mortar (see definitions)
(b) Specify or permit the use of a site-made mortar.

Where a prescribed factory-produced mortar is specified, the specification should list the mortar designation and type. The producer will then select materials to ensure the product conforms to the specification. Drafting of a specification for a factory-produced mortar is much simpler than for a site-produced mortar, as the factory-produced material will be manufactured under a production control system. This requires that procedures are in place for the selection of constituent materials, their storage, batching and mixing. The standard BS EN 998-2 also prescribes conformity evaluation requirements for factory-produced mortar.

The specification of site-produced mortar requires the specifier to list all the relevant criteria that is included within a factory production control system. Clause 8 of PD 6678 provides guidance on the requirements to be included within a specification for site-produced masonry mortar. Site investigations have shown that the principal reasons for inconsistencies in site-produced mortar are the methods used to batch the constituent materials, the order of placing these in the mixer and the duration of mixing. Therefore the specifier should prescribe how these activities are to be undertaken during site-produced mortar production.

A general principle of specification drafting mentioned at the start of this section is that characteristics that cannot be measured should not be specified, as the assessment of conformity would be subjective. An exception is the specification of colour and workmanship. Where this is to be specified, reference panels should be constructed. It is important that the standard used to construct these represents that which can be achieved with normal construction methods.

The function of rendering mortar

The functions of rendering mortar MPA Mortar learning text 12, Properties of rendering mortar, states that the principal reasons for using a rendering mortar are to:

- Provide a barrier to prevent rain from penetrating into the background masonry
- Enhance the appearance of a plain masonry structure.

A rendering mortar must adhere to the background in the fresh state and maintain this adhesion for the life of the building. The render should be resistant to frost and sulfate attack.

Design requirements

In designing a rendering system, consideration should be given to the desired appearance (MPA Mortar learning text 13 discusses a number of finishes), the type of background and the functional requirements.

A rendering system normally consists of a minimum of two coats. However, specially formulated one-coat systems have been developed.

Background

The background to which the render is to be applied must be assessed. If physical adhesion of the applied render is insufficient then an effective mechanical key is essential. Where metal lathing is used, adhesion is solely based on mechanical key. The background is required to support adequately and restrain the rendering and should not be weaker and preferably stronger than the rendering to be applied. This may necessitate the application of stronger renders on to an expanded metal lathing fixed to preservative-treated timber battens.

Rendering adhesion is largely determined by the suction of the background particularly when there is not an adequate key. High and low rates of suction can impair the development of a satisfactory bond and suction rates can be affected significantly by the moisture content of the background at any particular time.

The background should be clean and free of dust and ideally provide a natural key for the render but where it does not, an artificial key must be provided. There are two factors needing attention when assessing the background; absorption or suction and texture or roughness. Table 2 (based on BS EN 13914 and BS 5262) summarises the properties of a number of background types.

Movement joints in the rendering should be aligned with joints in the background. Where rendering is to be continued across dissimilar backgrounds, a joint should be formed in the render in line with the change of background to take account of the likelihood of differential movement. The specification should include details of the type and the method of forming joints.

Rendering should not be applied over cracks in the background material without the causes of the cracks being determined and appropriate repairs being undertaken. This may involve removing material or providing reinforcement or support for the rendering.

To prevent corrosion the composition of the metal lathing should be stainless or zinc-coated steel.

Before applying a render to an existing structure that is either contaminated or deteriorated, an assessment should be made of the presence of eroding or painted surfaces, salt contamination, oil splashes or organic growth. Where any of these are found, appropriate remedial action should be taken prior to the application of the render.

Table 2: ***Backgrounds for renderings***

Background type	Suction	Properties)	
		Bond or key	**Movement**
Dense, strong and smooth: Concrete, High density bricks.	Low to moderate.	Poor. Mechanical key required. Hardened concrete may be textured by cooling.	Low to high. Clay materials may expand. Concrete materials may shrink.
Moderately strong and porous. Bricks. Blocks.	Moderate to high.	Good if joints are well raked out or keyed bricks are used.	Shrinkage moderate to high.
Moderately weak and porous. Lightweight aggregate. Low strength blocks.	Moderate to very high.	Moderate to good.	Shrinkage low to high.
Metal lathing.	-	Good.	None providing lathing is tightly stretched.

Durability
Rendering will be affected by exposure to the combined actions of frost, wind sun and rain. The effects of these environmental factors will depend to some extent to the degree of exposure. MPA Mortar learning text 13 covers the exposure classification system. The type of background, the composition of the rendering and workmanship will also influence durability. The specification of a durable rendering system requires the specifier to consider the following parameters.

Rain penetration
One of the prime purposes of applying a rendering system is to minimise or eliminate rain penetration into the background construction so attention should therefore be given to minimising cracking. Where a prescribed mortar is to be used, the specifier will have to rely on his knowledge of the local constituent materials to specify a suitable mortar for the exposure conditions. The specification of a designed mortar simplifies the process, as this does not require the specifier to have local knowledge of the constituent materials. For severe conditions of exposure where the rendering is subject to heavy rainfall a rendering mortar with a capillary water absorption of Class W2 should be specified. In sheltered and moderate conditions a render with capillary water absorption of Class WO or W1 should provide a satisfactory barrier to rain ingress. Where masonry is in contact with the ground, special waterproofing mortars may be required. On backgrounds that are susceptible to dampness the specification of a renovation mortar may be appropriate. The national annex to BS EN 13191-1 contains guidance on exposure categories for wind-driven rain and measures to increase resistance to rain penetration.

Soluble salts
Some backgrounds may contain soluble salts, which may arise from the masonry or from rising damp. In new construction attention to detailing can minimise the occurrence of the problem but in older construction, a renovation mortar may need to be used.

Atmospheric pollution
Atmospheric pollution may result in localised surface discolouration due to airborne dirt and dust. In selecting a rendering system, the specifier should take into account the exterior features of the building.

Frost attack
Potential problems associated with frost attack can be minimised by the specification of a render incorporating an air-entraining admixture.

Corrosion of metals
Specifying stainless or zinc-coated steel products minimises the risk of corrosion of metal lathing and fixings. In extreme exposure conditions (splash zones) stainless steel products should be specified.

Movement
Movements in the building or in the background to which the render is applied may can be caused in several ways and these may lead to cracking and debonding of the render. The designer/specifier should take into account the following:

- Structural movements
- Shrinkage of the masonry materials during initial drying out and shrinkage of the rendering system
- Differential shrinkage due to the use of components with dissimilar properties
- Long term creep of concrete members
- Movement due to wetting and drying of the background during the life of the building
- Thermal movements of the components of a rendering system (eg, metal lathing).

The specification should take account of workmanship to ensure that each coat of rendering is allowed sufficient time to dry out prior to the application of subsequent coats.

Joints
Joints should be formed in rendering in line with joints in the background material. Particular care is needed in applying render to metal lathing and large areas should be divided at specified intervals.

Methods of specifying rendering mortar

Rendering mortar may be specified as either a designed or prescribed mortar. BS EN 998-1 gives no guidance on the composition of prescribed mortar, although it follows a similar approach to BS EN 998-2 and is a performance-based standard. However, there is no national annex covering the use of traditional materials. Guidance on the use of prescribed mortars may be found in the national annex to BS EN 13914-1.

Prescribed rendering mortars

The national annex to BS EN 13914-1 contains tables showing the composition of traditional rendering mortar and typical application details. Comment is also made on the general properties that can be expected from the each of the designations.

Table 3 of this text gives details of mix compositions suitable for rendering based on traditional proportions

Designed rendering mortars

The specification of a designed rendering mortar requires consideration of the fresh and hardened properties of the material. The manufacturer of a factory-produced mortar is required to declare the workable life of the fresh mortar and, where relevant, for the intended end-use.

A range of hardened rendering mortars are included within BS EN 998-1, the type that should be specified depending on the proposed end-use and desired properties. The standard lists the following types of designed rendering mortar:

- General purpose
- Lightweight
- Coloured
- One coat for external use
- Renovation
- Thermal insulating.

The specifier should look carefully at the proposed end-use. Compressive strength class should be specified for all designed rendering mortar. There are four possible strength classes (MPA Mortar learning text 13 lists the strength ranges). Not all of the strength classes are applicable to each of the types of rendering mortar as shown in Table 4.

For each of the types of rendering mortar listed in Table 3, the manufacturer is required to declare the dry bulk density when tested in accordance with BS EN 1015-10. The manufacturer is also required to declare an adhesion value and fracture pattern for all types except one-coat rendering systems (determined in accordance with BS EN 1015-12). For one-coat systems, the adhesion should be determined after the

Specifications *Table 3:* ***Composition of rendering mixes***

	Prescribed Mortars-proportion by volume - See Note 1				
Mix Designation	**Cement: lime: sand**	**Ready-mixed lime: sand**	**Cement: ready-mixed concrete**	**Cement: sand using plasticiser**	**Masonry cement sand**
i.	1: _ : 3	1: 12	1: 3	-	-
ii.	1: _ : 4 to 4	1: 9	1: 4 to 4_	1: 3 to 4	1: 2_ to 3_
iii.	1: 1: 5 to 6	1: 6	1: 5 to 6	1: 5 to 6	1: 4 to 5
iv.	1: 2: 8 to 9	1: 4_	1: 8 to 9	1: 7 to 8	1: 5_ to 6_
v.	1: 3: 10 to 12	1: 4	1: 10 to 12	-	-

NOTE 1: *The ready-mixed lime: sand material proportions as outlined in column 3, when gauged with cement, in the proportions outlined in column 4, will produce a final mix with proportions equivalent to column 2.*

Table NA.3 of the national annex to BS EN 13194 provides guidance on suitable mortar designations and thickness. These are based on background materials and exposure conditions.

Specifications *Table 4:* ***Hardened properties of designed rendering***

Type of designed rendering mortar	**Compressive strength classes** (determined in accordance with BS EN 1015-11)	**Capillary water absorption** (determined in accordance with BS EN 1015-18)	**Water vapour permeabillity coefficient (_)** (determined in accordance with BS EN 1015-91)
General purpose	CS I to CS IV	W 0 to W 2.	≤ Declared value
Lightweight	CS I to CS III	W 0 to W 2.	≤ Declared value
Coloured	CS I to IV	W 0 to W 2.	≤ Declared value
One coat	CS I to IV	W 1 to W 2.	≤ Declared value
Renovation	CS II	≥ 0.3 kg/m^2 after 24 hours	< 15
Thermal insulating	CS I to CS II	W 1	≤ 15

test specimens have undergone a series of weathering cycles (BS EN 1015-21) and the water permeability on relevant substrates should also be determined.

Where the render is to be used in external elements, the capillary water absorption should be specified in accordance with the ranges shown in Table 4. Additionally, for renovation renders the water penetration should be determined after the completion of the capillary water absorption test and is required to be equal to or less than 5mm.

The water vapour permeability coefficient should be determined and declared by the manufacturer. For renovation and thermal insulating mortars specific maximum values are prescribed. Thermal conductivity may be calculated from tabulated values while specific requirements are prescribed for thermal insulating rendering mortars.

Glossary of Terms

Background
The surface to which the rendering is applied.

Cavity wall
Wall of two leaves effectively tied together and a space between them.

Coloured rendering mortar
Designed mortar for rendering that has been specially coloured.

Coping
Construction that protects the top of a wall, balustrade or parapet and sheds rain water clear of the surfaces beneath.

Damp-proof-course
Device, usually comprising a layer or strip of material, placed within a wall, chimney or similar construction to prevent passage of moisture.

Declared value
A value that a manufacturer is confident in achieving, bearing in mind the precision of the test and the variability of process.

Test results are required to equal or exceed the declared value.

Designed masonry mortar
Mortar with a composition and method of manufacture that is chosen by the producer in order to achieve specified properties (performance concept).

Factory made masonry (rendering) mortar
Mortar batched and mixed in a factory. It may be "dry mortar" which is ready-mixed, only requiring the addition of water or "wet mortar" which is supplied ready for use.

Final coat
Ultimate coat of a multicoat rendering system.

Fire resistance
Cementitious rendering and masonry mortar are classified as non-combustible without testing when the organic material content is less than 1%. Where the organic material is greater than 1% the mortar should be tested and classified in accordance with BS EN 13501-1.

Lathing
Mesh which when fixed to a background provides a key for rendering and in some cases support and stability.

Lightweight rendering/plastering mortar
Designed rendering/plastering mortar with a dry hardened density below a stated value. (BS EN 998-1 states a value of equal to or below 1300kg/m^3.)

Masonry
Assemblage of masonry units, either laid in-situ or constructed in prefabricated panels, in which the masonry units are bonded and solidly put together with mortar or grout.

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Self-assessment questions

1 What are the parameters that need to be considered in the design of a masonry structure?

A

2 What are the two ways of specifying a masonry mortar?

A

3 What is lathing?

A

4 What are the functions of a masonry mortar?

A

5 What are the two prime requirements of a background for a render?

A

6 What are the functions of a rendering mortar?

A

7 List the categories of designed rendering mortar given in BE EN 998-1.

A

8 What is the range of strengths for each of the categories of hardened rendering mortar given in BS EN 998-1?

A

9 What is the name and number of the standard applicable to the design of external rendering?

A

10 What parameters should be considered when specifying a rendering mortar?

A

Answers to self-assessment questions

1 • Strength and stability, • Weather resistance, • Durability, • Fire resistance, • Thermal insulation, • Sound insulations.
2 • A prescribed mortar, • A designed mortar.
3 Mesh fixed to a background to provide a key and in some cases support and stability for render.
4 • Adhesion to the masonry units and other building component, • To provide a gap between the masonry units, • To compensate for irregularities, • To minimise ingress of rain and wind, • To have adequate strength and durability for the application and environment, • To complement the visual appearance of the masonry units.
5 • Adequate strength and rigidity for support of the render, • Adequate uniform key and suction for adhesion of the render.
6 • To provide a barrier to prevent rain from penetrating into the background masonry, • To enhance the appearance of a plain masonry structure.
7 • General purpose, • Lightweight, • Coloured, • One coat for external use, • Renovation, • Thermal insulating.
8 The range of compressive strengths are: • CS I 0.4 to 2.5 N/mm2, • CS II 1.5 to 5.0 N/mm2, • CS III 3.5 to 7.5 N/mm2 • CS IV > 6 N/mm> 6 N/m
9 BS EN 13914-1: Design, preparation and application of external rendering and internal plastering.
10 • The desired appearance, • The exposure conditions, • The nature of the background, • The functional requirements.

MPA Mortar Learning Texts include:

1 Introduction to modern mortars
2 Cementitious materials
3 Aggregates
4 Admixtures, additives and water
5 Brick and block production
6 Properties of masonry mortar
7 Production, deleivery and storage of mortar
8 Mortar testing
9 Specifications
10 Quality assurance
11 Construction
12 Properties of rendering mortar
13 Best practice - potential site problems

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MPA Mortar is part of the Mineral Products Association, the trade association for the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and industrial sand industries.

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Factory produced mortar products will contain either cement or lime, both of which have properties which are hazardous to health. Please refer to the manufacturers or suppliers Material Safety Data Sheet for the specific product/grade to find more information on the nature of the hazardous properties, the risks and health effects of exposure and the recommended safe use and handling procedures.