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# The Specification of an Appropriate Mortar

## Introduction

The constituent materials and the proportions of those in the mix determine the properties of a masonry mortar in both the fresh and hardened states. The relationship between the fresh and hardened properties of mortar is complex; it being impossible to consider individual properties, in either state, in isolation.

In drafting a specification for a masonry mortar it is important to remember the functions that the mortar has in masonry construction:

- 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 to minimise rain or wind penetration,
- To have sufficient strength to suit the application,
- To be durable in the particular environment.

In addition the colour of hardened masonry mortar contributes to the overall aesthetic appearance of the finished construction, therefore the appropriate colour may have to be specified where the mortar is visible.

BS EN 998-2 classifies mortar in terms of its properties and end use; five types of mortar have been identified:

- General purpose masonry mortar
- Designed
- Prescribed
- Lightweight masonry mortar
- Thin layer masonry mortar

## Definitions

**Designed masonry mortar:** Mortar with a composition and method of manufacture that is chosen by the producer in order to achieve specified properties.
**Prescribed masonry mortar:** Mortar made to predetermined proportions the properties of which are assumed from the stated proportions of the constituents.
**Lightweight masonry mortar:** Designed masonry mortar with a dry hardened density below a prescribed figure.
**Thin layer masonry mortar:** Designed masonry mortar with a maximum aggregate size less than or equal to a prescribed figure.

## The Specification of Masonry Mortar

A number of parameters should be considered when specifying a masonry mortar, these include:

- The required hardened strength,
- Appearance,
- Durability,
- Fire resistance,
- Thermal insulation,
- Sound insulation.

Detailed guidance on the selection of an appropriate mortar for a particular application may be found in Table 15 of PD 6697. Where special requirements are applicable discussions should take place with the mortar producer to determine an appropriate specification which takes account of the actual constituent materials to be used.

Each of the parameters required in the specification of a masonry mortar are now considered:

## Fresh properties

Fresh masonry mortar must have a sufficient level of workability in order to achieve satisfactory adhesion. Mortar that does not meet this criterion will not mould to the shape of the masonry unit resulting in the entrapment of air and consequent poor bond strength development. The appropriate level of workability is dependent on the absorption, mass and surface texture of the masonry unit.

The use of hydrated lime in mortars can deliver improved workability and open time as well as reducing the effects of suction and the risks of efflorescence.

## Strength

**The specifier needs to ensure that the selected mortar is appropriate for the point of application for example the strength of designed masonry or overall durability aspects of the structure being constructed.**

**Consideration should be given to the compatibility of the mortar strength with the physical characteristics of the brick, block or masonry. Mortars that are stronger than the units they are bonding can result in cracking of the units.**

**Should a particular compressive strength be required then a designed mortar must be specified.**

## Durability

To achieve long-term durability in masonry construction, consideration has to be given not only to the physical characteristics of the masonry unit but also to the mortar and exposure conditions. Table 15 PD 6697 entitled "Durability of masonry in finished construction"; 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.

British Standard Code of Practice 1996-1-1 states that lime based mortars resist rain penetration through external walls more effectively than any other mortars.

The use of a cementitious material containing ground granulated blast furnace slag or fly ash increases the resistance of the mortar to sulfate attack in aggressive conditions.

Attention should be given to architectural detailing (overhangs, copings etc) to prevent the masonry becoming saturated. Water can come from a number of sources, for example rainwater falling directly on the masonry or the upward movement of water where masonry is placed below ground or in a retaining wall. In the case of retaining walls the use of weep holes and impermeable membranes should be considered. Permeability reducing admixtures may also be incorporated in the mortar mix: these reduce the quantity of capillary absorption into the mortar. Specifiers should note that the use of these admixtures reduce permeability but do not provide total waterproofing.

# Appearance

The colour of a hardened masonry mortar contributes to the overall aesthetic appearance of the finished construction. Colour should be specified by reference to the mortar producers colour range.

Where the specifier requires a non standard colour, discussions should be undertaken with the mortar producer at an early stage to ensure consistency of supply for the duration of the contract.

In all instances, it is strongly recommended that reference panels are always prepared to assess the suitability of the mortar to meet the specifiers expectations, taking into account variations in masonry units, workmanship, masonry joint profile, local weathering conditions, pigments, fine aggregates and cements that may affect the final colour and appearance.

# Fire resistance

BS EN 1996-1-2:2005 provides guidance on the notional fire resistance of walls, tables list the thickness of masonry types required for different time periods of fire resistance based on the composition of the masonry.

# Thermal insulation

Legislation now attaches increased importance to the efficient use of energy resources. Designers should design external walls of buildings to minimise the quantity of energy required to maintain the required internal temperature. 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", and provides data on the thermal conductivity of mortar and masonry.

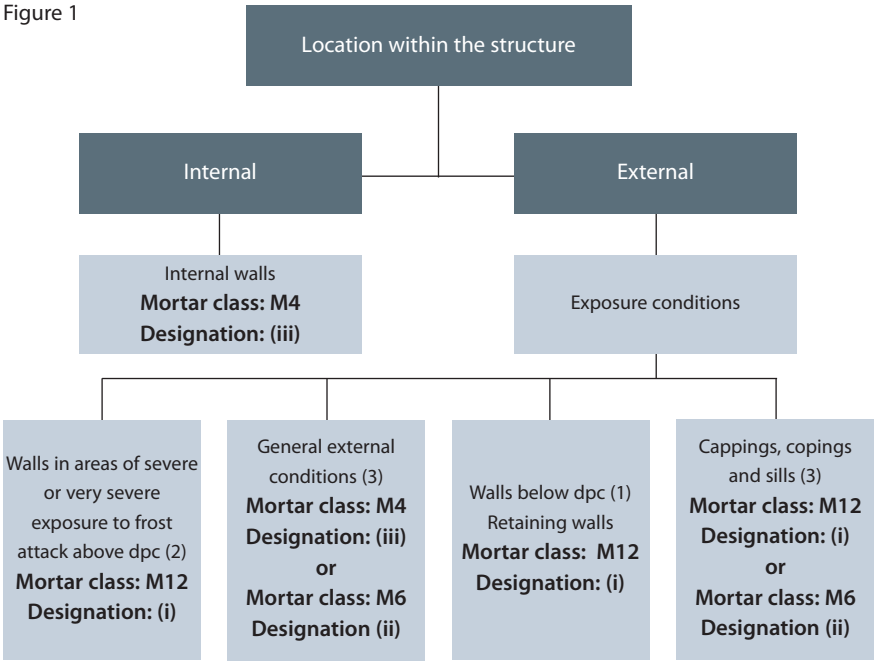
# Sound insulation

The transmission of sound through solid material occurs as a result of vibrations being set up in the material. 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, in the section entitled "Resistance to the passage of sound".

# Mortar Selection

Figure 1 provides guidance on the selection of a suitable mortar for some common applications.

Figure 1




1 In external situations where high levels of sulfates are present, (below or near dpc level or in areas of severe wind driven rain) the use of a mortar with enhanced sulfate resisting properties is recommended.

2 Guidance on areas where exposure to severe frost attack occurs may be found in a number of specialist publications (e.g. NHBC Standards) or advice may be sought from MPA Mortar members. This classification is based on three criteria, a frost incidence of over 60 days a year, rainfall of over 1000mm per year and an elevation of over 90m above sea level. This classification embraces Scotland, most of Northern England and Wales.

3 The selected mortar class or designation to reflect the assessed degree of exposure.

| References | |
|---|---|
| BS EN 998-2 | Specification for mortar for masonry - Part 2: masonry mortar |
| PD 6697:2010 | Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2 |
| BS EN 1996-1 | Design of masonry structures - General rules Structural Fire Design |
| *BS 5628:Part 1 | Code of practice for use of masonry. Structural use of unreinforced masonry |
| *5628:Part 2 | Code of practice for use of masonry. Structural use of reinforced and prestressed masonry |
| *BS 5628:Part 3 | Code of practice for use of masonry. Materials and components, design and workmanship |

Note: The latest revisionof the above documents should be consulted.

## MPA Mortar

**Data sheet 1** Factory-produced lime:sand mortar for masonry.
**Data sheet 2** Factory-produced ready-to-use mortar for masonry.
**Data sheet 3** Factory-produced silo mortar for masonry.
**Data sheet 4** Admixtures, additives and water.
**Data sheet 9** Technical references for mortar and associated topics
**Data sheet 11** The benefits of factory-produced lime:sand mortar for masonry.
**Data sheet 12** Guide to minimising rain penetration through masonry walls
**Data sheet 18** The use of lime in mortar.
**Data sheet 19** New mortar standards.
**Learning Text Part 9:** Specifications

## The Building Regulations:

**Approve Document** E: Resistance to the passage of sound.
**Approved Document** L: Conservation of fuel and power.

## NHBC Standards

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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.