

Design & specification considerations  
**Durability of High Density masonry in finished construction**  
 (based on Table 15 – PD 6697 and our own recommendations)

Condition or situation	Durability of Brick	Mortar Strength Class
<b>Work below or near external ground level (below dpc)</b>		
High risk of saturation and freezing (masonry most vulnerable is situated 150mm above and 150mm below finished ground level) MX3.2	F2 S2 or S1*	M12 M6* *consider sulphate resisting mortar
<b>Masonry dpcs</b>		
In buildings MX3.1 MX4	F2 DPC 1	M12
In external works MX3.1 MX4 MX5	F2 DPC 2	M12
<b>External fair faced wall (other than chimneys, cappings, copings, parapets, sills)</b>		
Low risk of saturation (sheltered areas) MX3.1 MX4 MX5	F2,F1 S2,S1	M12 M6 M4 protective detailing still required to minimise saturation of walling
High risk of saturation MX3.2 MX4 MX5	F2 S2,S1*	M12 M6* *consider sulphate resisting mortar
Rendered external walls *consider sulphate resisting Portland cement in joints and base coat of render.	F2, F1 S2, S1* Do not use F1, S1 with full fill cavity insulation.	M12 M6 M4
Internal walls and inner leaves of cavity walls above dpc MX1	F2, F1,F0* S2, S1, S0*	M12 M6 M4 M2* *must be fully protected from saturation and freezing.
<b>Parapets (unrendered) (overhanging throated copings are recommended)</b>		
High risk of saturation (overhanging throated copings are recommended) MX3.1 MX4	F2 S2, S1*	M12 M6 *consider sulphate resisting mortar
<b>Rendered parapets (overhanging throated copings are recommended)</b>		
*consider sulphate resisting Portland cement in joints and base coat of render. Only render one side of single leaf walls. MX3.1 MX3.2 MX4	F2, F1 S2 or S1*	M12 M6 M4 M12 M6 *consider sulphate resisting mortar
<b>Chimneys MX3.1 MX3.2 MX4 MX5</b>		
High risk of saturation. Consider sulphate resistant Portland cement to protect against flue gases Use copings to afford adequate protection.	F2 S2, S1	M12 M6
Rendered Chimneys consider sulphate resisting mortar in joints and any render to protect against flue gasses.	F2, F1 S2 or S1	M12 M6 M4 M12 M6
<b>Cappings, Copings &amp; Sills MX3.1 MX3.2</b>		
	F2, S2, S1	M12 consider the mortar joint profile
<b>Freestanding boundary walls (below capping/coping) MX3.1 MX3.2 MX4 MX5</b>		
With overhanging coping (preferred method) Dpcs should be provided at base of wall (DPC2 bricks) - and under capping/coping ( flexible high-bond bitumen polymer type)	F2, S2 or S1*	M12 M6 M4 M12 M6 *consider sulphate resisting mortar. Do not use recessed joints
With capping (not recommended in areas of severe exposure) Dpcs should be provided at base of wall (DPC2 bricks) - and under capping/coping ( flexible high-bond bitumen polymer type)	F2 - S2*, S1*	M12 M6* *consider sulphate resisting mortar. Do not use recessed joints
<b>Earth Retaining Walls (careful choice of materials to exclude water is recommended)</b>		
With coping or capping and waterproofing on retaining face. MX3.1 MX3.2 MX4	F2 S2, S1	M12 M6
With Coping or Capping but no waterproofing on retaining face. (not recommended) MX3.1 MX3.2 MX4 MX5	F2 S2, S1	M12
<b>Drainage &amp; Sewage – manholes, inspection chambers etc. MX3.1 MX3.2 MX5</b>		
Surface water drains	Engineering A or B F2, F1 + S2, S1*	M12 *consider sulphate resisting mortar
Foul drainage (continuous or occasional contact with masonry)	Engineering A or B F2, F1 + S2, S1*	M12 *consider sulphate resisting mortar

Mortar prescription assumes the use of OPC or CEM 1. For other types of cement seek cement manufacturers recommendations.  
 MX refers to micro-climate conditions; see next page for further details.

## Design & specification considerations

### Durability of High Density masonry in finished construction (continued)

BS EN 1996-2 introduces micro conditions which are localised climatic and environmental factors depending on the position of a masonry element within the over-all structure and taking into account the effect of protection, or lack of, by constructional details or finishes. These should be taken into account in the Design.

#### Classification of micro conditions of exposure of completed masonry

Class	Micro condition of masonry	Examples
<b>MX1</b>	<b>In a dry environment</b>	Interiors of buildings for normal habitation and for offices, 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.
<b>MX2</b>	<b>Exposed to moisture or wetting</b>	
MX2.1	Exposed to moisture but not exposed to freeze/thaw cycles or external sources of sulfates or aggressive chemicals	Internal masonry exposed to high levels of water vapour such as 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 wetting but not exposed to freeze/thaw cycles or external sources of sulfates or aggressive chemicals	Masonry not exposed to frost or aggressive chemicals located in exterior walls with cappings or flush eaves, parapets, freestanding walls, in the ground or under water.
<b>MX3</b>	<b>Exposed to wetting plus freeze/thaw cycles</b>	
MX3.1	Exposed to moisture or wetting and freeze/thaw cycling but not exposed to external sources of sulfates or aggressive chemicals	Internal masonry exposed to high levels of water vapour. Masonry exterior walls sheltered by overhanging eaves or coping not exposed to severe driving rain. Masonry below frost zone in well drained non-aggressive soil. Exposed to freeze/thaw cycling.
MX3.2	Exposed to severe wetting and freeze/thaw cycling but not exposed to external sources of sulfates or aggressive chemicals	Masonry not exposed to aggressive chemicals located in exterior walls with cappings or flush eaves, parapets, freestanding walls, in the ground or under water. Exposed to freeze/thaw cycling.
<b>MX4</b>	<b>Exposed to saturated air, seawater or de-icing salts</b>	Masonry in coastal areas or adjacent to roads that are salted during the winter
<b>MX5</b>	<b>An aggressive chemical environment</b>	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.

When deciding on the exposure of masonry any applied finishes or protective claddings should be taken into account.

#### Acceptable assumed equivalent mixes for prescribed masonry mortars

Compressive strength class <sup>A</sup>	Prescribed mortars (proportion of materials by volume)				Mortar designation
	cement <sup>B</sup> :lime:sand with or without air entrainment	cement <sup>B</sup> : sand with or without air entrainment	Masonry cement <sup>C</sup> :sand	Masonry cement <sup>D</sup> : sand	
M12	1: 0 to ¼ :3	1:3	Not suitable	Not suitable	(i)
M6	1: ½ : 4 to 4 ½	1:3 to 4	1 : 2 ½ to 3 ½	1 : 3	(ii)
M4	1: 1: 5 to 6	1: 5 to 6	1 : 4 to 5	1 : 3 ½ to 4	(iii)
M2	1: 2: 8 to 9	1: 7 to 8	1 : 5 ½ to 6 ½	1 : 4 ½	(iv)

A The number following 'M' is the expected compressive strength at 28 days in N/mm<sup>2</sup>  
 B Cement or combinations of cement in accordance with table NA.3 National Annex to BS EN 1991-1, except masonry cements  
 C Masonry cement in accordance with table NA.3 National Annex to BS EN 1991-1 (inorganic filler other than lime)  
 D Masonry cement in accordance with table NA.3 National Annex to BS EN 1991-1 (lime)

Note: When a choice of sand proportion is given 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.

For further information or advice regarding this topic please contact Ibstock's Design & Technical Helpline on 0844 800 4576 or email [technical@ibstock.co.uk](mailto:technical@ibstock.co.uk)

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