

FROST ATTACK AND SPECIFYING FREEZE/THAW RESISTANT MASONRY UNITS



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Introduction

This technical document provides additional guidance relating to how the Functional Requirements in the Technical Manual may be satisfied when addressing the risk of frost attack on masonry units.

What is it frost attack?

Frost attack can occur through the repeated action of rain water freezing and thawing. When water turns into ice, there is increase in volume which can eventually cause stresses to masonry units and lead to spalling. A number of factors can influence frost attack, these include (but are not limited to):

- Freeze/thaw resistance of the masonry units.
- Saturation of the masonry.
- Degree of exposure to wind driven rain.
- Localised protection from other buildings, topography, roof overhangs, copings or capping.

What are the Warranty providers concerns?

Masonry specifications and architectural detailing are not fully considering the influence of exposure to prevailing weather and climatic conditions of specific sites – most often where 'house type' specifications and designs are adopted and used irrespective of a geographical location. This is increasing the opportunity for frost attack to occur and raising risk levels in relation to potential failures in affecting durability and service life attainment.

Warranty stance

Failure to provide appropriate specification of masonry units to combat the effects of frost attack is considered to compromise the ability of the wall construction and associated materials in meeting with the Functional Requirements and Performance Standards stipulated by the Technical Manual, notably those relating to durability, weather resistance and service life.

What Developers should action after reading this document?

Developers can reduce the risks associated with frost attack by specifying freeze/thaw resistant masonry units in areas that are prone to prolonged periods of saturation due to the site's location or exposure.

All masonry units should be of an appropriate durability and evidence of suitability should be provided to the Warranty Surveyor. If there are any doubts about the suitability of face work masonry units in areas of severe frost exposure, written clarification by the manufacturer confirming the suitability of the brick should be provided.

To assist in appropriate selection, masonry and mortar specification should be in accordance with the detailed guidance of PD 6697 'Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2'. As a quick guide, freeze/thaw resistant masonry units should be selected using the recommendations in the following table.

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Freeze/thaw resistance category	Possible use case*
F2 – Severe exposure to freeze/thaw	Can be used in normal building situations and all exposures to wind driven rain. F2 rated masonry units should be used: • Below DPC • Brickwork plinths • Chimneys • Capping, coping and sills
F1- Moderate exposure to freeze/thaw	Provides a moderate freeze/thaw resistance and in general F1 rated masonry units can be used between DPC and eaves. However, they should not be used in areas of severe or very severe exposure to wind driven rain or elevated sites.
F0 – Passive exposure to freeze/thaw	Not freeze/thaw resistant – should not be used externally unless completely protected by impermeable cladding
* Please note, possible use cases are not an exhaustive list. In all situations, confirmation of suitability of the masonry unit for the intended use must be confirmed by the manufacturer of the masonry units and reference to PD 6697.	

Additionally, the following should be considered which may influence specification:

- Masonry units with low soluble salts should be specified where there is a risk of brickwork being persistently wet.
- Most concrete masonry units have a strength of 22N/mm² and are durable in most situations and are equivalent to frost resistance class F2 for clay masonry units.
- For copings and sills, masonry units with a compressive strength of 36N/mm² should be used.
- Concrete block masonry units used in the outer leaf without protective cladding or render must have a compressive strength >7.3N/mm² or have a density of at least 1,500kg/m³.
- In Scotland, all clay masonry units used externally, should be frost-resistant, F2, S2 or F2, S1 to BS EN 771-1 'Specification for masonry units - Clay masonry units'.
- All concrete masonry units used in face work should be 22 N/mm² to BS EN 771-3 'Specification for masonry units - Aggregate concrete masonry units (Dense and lightweight aggregates)'.
- In areas of severe and very severe exposure to wind driven rain, the following points are relevant to appropriate specification:
 - Clay facing masonry units which are frost-resistant F2, S2 or F2, S1 to BS EN 771-1.
 - Concrete masonry units with a minimum strength of 22N/mm² to BS EN 771-3.
 - Concrete block masonry units with a minimum density of 1,500kg/m³ or compressive strength greater than 7.3N/mm².
 - Calcium silicate masonry units must be confirmed to be F2 rated to BS EN 771-2 'Specification for masonry units - Calcium silicate masonry units' by the manufacturer.

For situations where the specified masonry units are natural stone, they must be selected based on its suitability for:

- The specific cladding proposal design requirements.
- For the specific site exposure and orientation that the building / plot will be located – using that stone.

The Architect must ensure the units are selected based on the performance of the actual sourced product and not a generic one. BS EN 771-6 specifies the characteristics and performance requirements of masonry units manufactured from natural stone. It should be noted that a soft porous type stone in a severe exposure zone is not recommended.

The selected stone masonry unit's performance information may be found in a Declaration of Performance document issued by the quarry supplier. The document providing the performance information must include a statement from that supplier that the selected stone units are freeze/thaw resistant.

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A copy of this document must be given to the Warranty surveyor, if this information is not available, we may not be able to accept the proposed stone cladding.

Developers can also reduce the risks associated with frost attack by using appropriate detailing and practises for the specific site which safeguards against water saturation from the prevailing weather and climatic conditions, site exposure, expected rainfall duration and intensity.

For example:

- Parapet walls should have a coping or capping - extensive guidance on parapet wall construction and protection can be found within the 'External Walls – Parapets' section of the Technical Manual.
- Sills and copings should have a weathered upper surface.
- Paths around the building should drain away from walls to avoid saturating masonry.
- External painted finishes on masonry, have the potential to trap moisture and as such the manufacturer should be consulted to ensure the decorative finish will not have a detrimental impact on masonry durability.

In summary, although frost attack can cause significant stresses in the masonry units, Developers and their specifiers and designers can mitigate this risk by ensuring that their selected masonry units have an appropriate durability. In addition, employing protective design elements can also help lessen the effects of saturation which leads to a heightened risk of frost attack in masonry.