

Brick Technical Bulletin - Product Comparison

BTB 2

INTRO

This Technical Bulletin details the comparison between Marshalls concrete bricks and clay bricks. Historically there was also a third type of brick used in the British Isles, namely the Calcium Silicate or Sand Lime brick, but as these are no longer produced in this country they have been ignored for comparison purposes.

BRITISH STANDARDS

Concrete bricks are produced to BS EN 771-3: Aggregate Concrete Masonry Units. This replaced BS 6073: Parts 1 and 2.

Clay bricks are produced to BS EN 771-1: Clay Masonry Units. This replaced BS 3921.

Both Standards for concrete masonry and clay units specify the characteristics and performance requirements for both products but do not give any reference to their use or application. This is covered generally by BS 5628: Code of Practice for Walling, now replaced by a new Standard PD 6697:2010 and other Codes and Standards.

COMPRESSIVE STRENGTH

Marshalls bricks have a minimum compressive average strength of 22.5N/mm², increasing where required to 50N/mm². Concrete bricks continue to gain strength with age.

Clay bricks vary in strength, depending on type, with a typical strength range of 15-90N/mm². There is no strength gain with clay bricks.

Strength and cement content are indicative of durability in Marshalls bricks, whereas in clay bricks strength is a function of the constituent raw material and firing technique. For example, in PD 6697 the minimum strength requirement for use in a typical external wall above and below dpc requires a concrete brick of 22.5N/mm², whereas a clay brick has to be selected from one with the preferred frost resistance and soluble salts content.

DIMENSIONS

The tolerances on concrete bricks are broken down into three categories:

D1	+3-5mm in all dimensions
D2	+1-3mm in all dimensions; ±2mm in height
D3	+1-3mm in all dimensions; ±1.5mm in height

Clay brick tolerances are:

T1	+1-6mm if the bricks are between 209-221 mm in length
T2	+1-4mm if the bricks are between 211-219mm in length
T1	+1-6mm if the bricks are between 59-71mm in height
T2	+1-4mm if the bricks are between 61-69mm in height

Fundamentally concrete bricks, because of their manufacturing method, tend to be produced to finer tolerances than clay bricks.

Marshalls bricks are produced and certified to D1 category.

DURABILITY

Durability in the form of frost resistance and soluble salts content in concrete bricks is a function of the compressive strength and mix design. Independent tests that have been carried out by the Building Research Establishment and other approved Testing Laboratories have confirmed that concrete bricks are frost resistant in most locations. They may not however be resistant to de-icing salts or certain situations experiencing high wear or high acid environments.

Further tests show Marshalls bricks to have a minimal soluble salts content and the admixtures used both within the mix and on the surface of certain facing bricks ensure that bricks have minimal efflorescence.

By contrast clay bricks may contain metallic salts such as sodium, potassium and magnesium, and consequently are categorised as either SO, S1 or S2. These define the maximum level of soluble salts.

Under the more recent BS EN 771-1 the old original FL grade is now categorised as F2/S2. There is no such requirement for concrete bricks and they can be classified as being equivalent to F2/S2.

COMPOSITION

Marshalls bricks are manufactured by compacting under a combination of high pressure and vibration a semi-dry mix of naturally occurring aggregates, portland cements, various admixtures, and synthetic iron oxide pigments. The bricks are through coloured. This gives the major advantage that any small chips or damage will be predominantly the same colour as the main face of the brick.

Clay bricks are also produced using naturally dug materials, frequently blended with other materials and they are then fired in kilns. Certain bricks may only have applied faces and the body of the brick may be different from that of the applied face.

WATER ABSORPTION AND WEATHERING RESISTANCE

The standard for concrete bricks requires a moisture absorption by capillarity test, and results are given in the relevant Product Data Sheets. This test has superseded the more traditional 24 hour water absorption test, the results of which are also shown in the individual Product Data Sheets.

The water absorption test approach is different for concrete bricks compared with that, for example, of clay bricks, but the requirements are there for different reasons. For clay bricks the test is primarily related to mortar adhesion and frost resistance, the former being important in cases of minimal or excessive suction from the mortar before it has had a chance to cure, and the latter to ensure that the correct type of brick is used in exposed conditions. A high absorption brick of low strength may be susceptible to frost attack.

With concrete bricks a low-medium absorption is important to inhibit the absorption of surface dirt whilst at the same time giving sufficient suction to allow the mortar bond to develop properly. Marshalls bricks are unique in that they contain certain specialist additives which not only maintain the overall appearance but also inhibit any potential efflorescence. At the same time the continuous ageing of Marshalls bricks means the absorption reduces over time whilst the bricks still increase in strength, resulting in excellent durability characteristics.

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ACOUSTIC AND THERMAL PROPERTIES

Concrete bricks tend to have a higher density than clay and hence have a higher sound reduction index. This can lead to better degrees of sound attenuation in flanking walls, which may be critical in those properties of lightweight construction. Conversely, concrete bricks will have a higher value of thermal conductivity than clay bricks. In real terms this will have minimal effect on the "U" value of a wall construction due to the degree of secondary thermal insulation necessary to meet Building Regulations.

GREEN CREDENTIALS

Marshalls bricks have beneficial "green" credentials including the following:

- The bricks are manufactured using low cement content, with raw materials sourced generally within 50 miles of the manufacturing works.
- No additional heat is used in the production of the bricks. The natural exothermic reaction of the process is sufficient to cure the product.
- Bricks from the core range of the same colour and texture can be replicated at different works. The core range allows manufacture in a number of locations thus minimising delivery distances and subsequent CO2 emissions.
- Concrete by its very composition is a CO2 absorber.
- Water consumption and usage during the whole manufacturing process is minimal.
- CO2 emissions in the whole manufacturing process are minimal. There is no pre-drying of materials or any firing process.
- Marshalls bricks are recyclable with no deleterious materials present when crushed.
- Marshalls does not need to import bricks to sustain demand.
- The embodied CO2 of Marshalls bricks is low and <50% of that for clay bricks.

Clay bricks use a process that starts with materials which have to be extracted, aged, milled and mixed. The bricks are then dried before being fired. Firing temperatures in kilns are between 700-1100oC and the process is very energy intensive. Large amounts of CO2 are emitted during the firing process and the burning technique can be difficult to control.

Capital costs of introducing extra capacity by the opening of new factories are significantly more than that of an equivalent output factory for concrete bricks.

Clay manufacturers frequently need to import stocks to maintain supply levels.

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COMPARISON TABLE

CONCRETE BRICKS	CLAY BRICKS
BRITISH STANDARDS	
BS EN 771-3: Aggregate Concrete Masonry Units	BS EN 771-3: Aggregate Concrete Masonry Units
<i>Note: Both of the above Standards are manufacturing Standards only and as such make no reference to use or application.</i>	
COMPRESSIVE STRENGTH	
>22N/mm2 available up to 50N/mm2 to special order	Depends on brick type and manufacturer
<i>Note: Both BS 5628: Part 3 and the new PD 6697 give recommendations for which brick properties are required in various locations. For example, a minimum strength of 22.5N/mm2 is recommended for a concrete brick used above and below dpc.</i>	
DIMENSIONS	
D1: +3-5mm in all dimensions	T1: +1-6mm if the bricks are between 209-221 mm in length
D2: +1-3mm in all dimensions; +/- 2mm in height	T2: +1-4 mm if the bricks are between 211-219mm in length
D3: +1-3mm in all dimensions; +/-1.5mm in height	T1: +1-6mm if the bricks are between 59-71mm in height T2: +1-4mm if the bricks are between 61-69 mm in height
WATER ABSORPTION	
Generally 5-9% by weight	Depends on brick type and manufacturer
COMPOSITION	
Produced from naturally occurring aggregates, Portland cement, various admixtures and synthetic iron oxide pigments. Bricks are through coloured.	Produced from naturally dug materials, frequently blended with other materials. Certain bricks may only have applied faces.
DURABILITY	
Fully frost resistant and with minimal soluble salts	May contain metallic salts such as sodium, potassium and magnesium, and consequently are categorised as either SO (no requirement), S1 or S2. Under BS EN 771-1 the original FL grade is categorised as F2/S2.
<i>Although produced to a different standard, Marshall's bricks are equivalent to the old clay FL Grade</i>	
ACOUSTIC & THERMAL PERFORMANCE	
Highly resistant to sound transmission Moderate rate of thermal conductivity	Depends on brick density and mass
GREEN CREDENTIALS	
Produced using low cement content No additional heat required during curing Minimal water content used in manufacture CO ₂ emissions are minimal Bricks are recyclable No imports Flexibility in production factories Embodied CO ₂ is low @ 84Kg/CO ₂ /Tonne	Bricks are dried out prior to firing Kiln temperatures between 700-1100oC and very energy intensive Large amounts of CO ₂ are emitted during firing process Frequent imports to subsidise stocks Bricks types tend to be unique to specific factories Embodied CO ₂ is high at 220Kg/CO ₂ /Tonne

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