

Brick

This Easy Guide on bricks aims to provide an overview of this method of construction for housing. The guidance is a practical introduction to the characteristics, performance benefits and latest design guidance for bricks in construction.

For detailed design guidance and requirements for regulatory/warranty compliance, refer to further guidance listed on the back page.

Our series of Easy Guides for Housing are available at modernmasonry.co.uk

Introduction: Brick

For centuries, bricks have been a defining feature of our built environment, being one of the most commonly used materials for external walls in the UK. There are good reasons for the enduring popularity of brick, which centre on its aesthetic and practical qualities, including durability, fire and flood resistance, flexibility and good acoustic performance, with the need for little or no maintenance over its considerable lifespan. As a consequence, brick and other masonry products can outperform most construction materials.

Alongside its inherent performance benefits, brick remains a cost-effective and simple product to use, supported by a well-established and knowledgeable UK supply chain. The vast majority of bricks are made of clay, offering a wide range of types, shapes, colours and finishes available to suit all needs.

This guide provides an introduction to brick types, options, properties and their specification. More detailed information on a broad range of brick topics, including construction methods and standards, is available from the Brick Development Association (BDA). See 'Further Information on brick and masonry' at the back of this guide.



The gatehouse at Hampton Court Palace has been standing for nearly 500 years – a testament to the longevity of brick © Alamy.

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Basic types of brick

Bricks are categorised by use, which is covered by three types: facing, common and engineering bricks. These represent the starting point when specifying, with a wide range of finishes and varying levels of strength, durability and frost-resistance (see 'Durability').

1. Facing bricks

These are the most widely used brick type in the UK, particularly for housing. Facing bricks are typically specified on the basis of colour and texture, which can significantly influence a building's appearance. The finish and appearance is partly determined by the manufacturing process, which also has a bearing on cost (see 'Colours and textures', on page 4). There is a broad range of facing bricks to choose from, ensuring that many options can be found for all types of project and individual preference.

2. Engineering bricks

These are specified for their physical properties rather than appearance as they provide high compressive strength and a low rate of water absorption. They are primarily used in civil engineering applications and where resistance to water penetration and/or frost damage is required. Applications include damp-proof courses, retaining walls, groundworks and manholes. Engineering bricks are rated as either Class A (compressive strength greater than 125N/mm²) or Class B (compressive strength greater than 75N/mm²), with the latter being more commonly used. Both types have a smooth finish and are typically reddish in appearance, although blue engineering bricks are also available.

3. Common bricks

These are actually the least common type of brick used in the UK and are suited to internal applications, sometimes being referred to as a 'fill' brick. They are relatively cheap to produce and are of a lower quality than the other types, with lower strength and less resistance to water and frost damage. Since common bricks will typically be hidden by an internal finish, limited emphasis is placed on appearance in the production process and product range.

Reclaimed bricks

The use of reclaimed bricks may provide an environmental benefit, but their main appeal is visual, as their weathered appearance gives them particular character. However, many specifiers choose them in the mistaken belief that newly manufactured bricks of similar appearance are not available.

In particular, they are not aware that handmade bricks continue to be manufactured in the UK, with a broad selection of types on offer. Some are traditionally clamp-fired and produced in exactly the same way as brick makers have done for centuries. Other companies have developed simulated products that look handmade but have been manufactured by modern machine methods. The advantage of specifying new rather than reclaimed bricks is that they are made to an established European Standard, ensuring they will deliver a specified level of performance; a factor that will typically be unknown for reclaimed options.

In particular, it can be difficult to assess their frost-resistance, requiring a sample of bricks to be subjected to a freeze thaw cycle test. Even then, consistency of quality is not ensured as the results cannot be extended to the whole consignment. So it is typically more practical to specify new brick that has been produced to achieve the same aesthetic. There is a wide selection available and they are generally more cost-effective than reclaimed bricks.

For more information on reclaimed bricks see '*BDA Comment on the Use of Reclaimed Clay Bricks*', published by the BDA.

Other brick types

Specials

These describe anything that is a non-standard shape. They are a useful feature in masonry construction, delivering a range of design requirements while also providing a decorative touch that enhances the overall visual appeal. Their use saves time on site and helps to ensure durability. Suppliers offer a standard range of specials, covering the most popular options such as radials, cants, bullnose and angle bricks. Many suppliers can also provide non-standard specials when something more unusual or bespoke is needed.



Concrete bricks

These provide an alternative to clay bricks and are available in the usual formats – facing, common and engineering – making them suitable for a wide variety of internal and external applications, including below ground, where strength and durability are prime considerations. Concrete coursing bricks are also widely available for general coursing work, infilling small areas, and maintaining the coursing over lintels and at sills. For external walling and other visual applications, concrete facing bricks are produced in a range of colours and formats.

Calcium silicate bricks

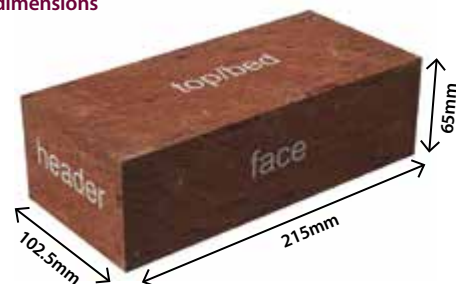
These are made by mixing lime, sand and/or crushed flint or stone containing silica with water, and moulding the mixture into bricks under high pressure. These are then steam-autoclaved, causing the lime to react with the silica. In their natural state, the bricks are pale white, but pigments can be added during the mixing stage, enabling a wide range of colours to be produced. Calcium silicate bricks offer good freeze/thaw resistance, but, as with concrete bricks, it is important that they are used correctly – their detailing in respect of shrinkage and expansion differs from other types of brick.

Sizes and strength

Bricks are produced to a standard size of 215mm x 102.5mm x 65mm (face x bed x header). This gives a coordinating dimension of 225mm x 75mm when used in conjunction with a 10mm-wide mortar joint, which is usual. Non-standard brick sizes are also available if required, for example with an alternative header height of 73mm or 75mm. Some reclaimed bricks may conform to the old Imperial size of 3" or 2 5/8" instead of 65mm, making them incompatible with modern bricks. Requirements for the design strength of bricks are given in the British Standard PD 6697:2019. Typically, clay bricks with a minimum compressive strength of 9N/mm² are suitable for one- and two-storey dwellings and 13N/mm² for three storeys.

For guidance on setting out brickwork for buildings and determining the coordinating size in various applications see *'Designing to Brickwork Dimensions'*, published by the BDA.

Standard brick dimensions



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Smooth



Soft Mud



Rusticated



Wire Drag



Waterstruck



Handmade

Colours and textures

The combination of different colours and textures results in thousands of different brick types. The UK brick industry makes products with varied surface textures and a rich diversity of colours, both facilitating the creation of innovative brickwork and allowing credible brick-matching when working with existing builds. A blend of different brick types and finishes can also be used in the same construction in order to create a unique appearance.

The body colour is largely dependent on the clay type. However, variation can also be achieved through methods such as body staining, surface sanding and different firing conditions.

Extruded products can be left with their initially smooth finish, but may also be modified, for example, by removing a sliver from the top and sides using a taut wire to produce a 'wiredrag' effect. Extruded and semi-dry pressed bricks can also be textured by placing textured rollers around the brick column to




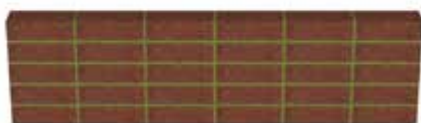


create a rusticated or patterned effect when impressed into the clay.

Machine-made soft mud bricks generally have a sanded face and, as a result of the clay being dropped into the moulds, can also have a creased surface texture. The sand, which is used as a releasing agent, also greatly affects the finish of the brick. Water-struck bricks have a relatively smooth, sand-free texture as a result of water being used as the release medium. Handmade bricks have subtle creases and other natural irregularities that contribute to their individual appearance and charm. Further possible modification of fired products includes rumberling, whereby bricks are turned over in a machine similar to a large tumble dryer. The resulting attrition removes the sharp edges by chipping and rubbing.

For more information on colours, textures and brick making, see *'The UK Clay Brickmaking Process'*, published by the BDA.

Brick bonds

The bond describes the pattern in which brick is laid, with the various formats depicted below. For further information, see '*Brick Bonds*', published by the BDA.

<p>Stretcher bond</p> 	<p>Originally used for half-brick-thick walls, it became the obvious choice for cavity walls, as it requires the least amount of cutting. It is therefore the most economical bond pattern and is extensively used in modern building.</p>
<p>Header bond</p> 	<p>A brick course laid flat with the short end of the brick exposed. This method is particularly strong as the width of the wall is the whole length of a brick. Historically, it was used for buildings of high quality, and often used for curved brickwork.</p>
<p>English bond</p> 	<p>This comprises alternative courses of headers and stretchers. It provides a strong bond when the wall is one brick thick, and is the preferred bonding pattern for bridges, viaducts, embankment walls and other civil engineering architecture.</p>
<p>Stack bond</p> 	<p>In stack bond the bricks do not overlap and therefore the arrangement is inherently weak. To compensate for the lack of bonding, stainless steel ladder reinforcement is typically built into every third bed-joint.</p>
<p>Flemish bond</p> 	<p>Flemish bonds can be replicated in the half-brick outer leaf of a cavity wall by using whole bricks as stretchers, while the headers are created by half bricks called bats or snap-headers. At one brick thick, it is not as strong as English bond.</p>
<p>Monk bond</p> 	<p>This has two stretchers between the headers in each row, and the headers centred over the join between the two stretchers in the row below. It was commonly used in the region around the Baltic Sea until the turn of 13th and 14th centuries, until it was gradually replaced by Flemish bond.</p>

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Mortar

Mortar is a workable paste (generally comprising sand, cement and water) used to bind bricks and other masonry units together. A mortar joint acts as a sealant and a bearing pad. It is the glue that sticks bricks, blocks and other masonry units together yet keeps them apart, and in this sense performs as a gap-filling adhesive. Its role is also to seal irregular gaps between masonry elements and to provide a barrier to the passage of moisture. The correct designation of mortar is very important in providing not only strength to the wall construction but also durability against water ingress. Mortar accounts for approximately 17.5% of the brickwork built in stretcher bond, so it is important to specify it correctly – it can be designed or prescribed in accordance with BS EN 998-2-2016 Specification for mortar for masonry.

Key characteristics for consideration when selecting mortar include:

- Appearance (joint profile and colour)
- Structural requirements
- Type of construction and position in the building
- Degree of exposure
- Compatibility between brick and mortar strength.

For guidance on these considerations and issues including mortar types, selection and performance, visit the Mortar Industry Association site, which offers a broad range of practical information. Also see *'Mortar for Brickwork'*, published by the BDA.

Durability and longevity

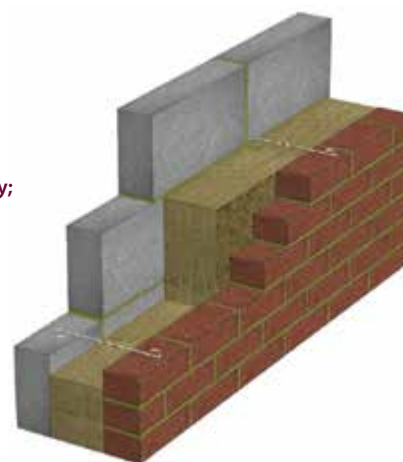
Clay bricks have a typical lifecycle of 150 years, but often last much longer. Qualities supporting their longevity include good versatility, with an ability to fulfil multiple uses from extensions to facade renovations and alterations to internal configurations. Brick also provides the durability to withstand the wear of multiple occupants over an extended period, all of which contribute to its position as a sustainable construction component.

To ensure the longevity of brickwork, it is important that the right type of brick is used for a given application and location in the country. The durability of brickwork is determined by its resistance to the effect of freeze/thaw cycles. The recurring action of water freezing and thawing in saturated brickwork can result in surface spalling. There is also a risk that the soluble salts in some types of clay brick will react with the constituents of the Portland cement used in the mortar, leading to cracks and crumbling of the mortar. The physical properties of the bricks and mortars must therefore be taken into account, as must the degree of exposure to which parts of the building will be subjected. In severely exposed locations this may require the use of F2, S2 brick (where the term "F2" means it's rated to cope with repeated freeze/thaw conditions and "S2" indicates it has a low category of active soluble salts) and reduced sulphate cement in the mortar. Exposure and durability guidance is provided by the BDA and in online NHBC technical guidance.

The level of exposure is largely determined by geographical location and is a primary factor when designing and specifying the walls of buildings. External works such as freestanding garden and retaining walls and chimneys should always be considered as very severely exposed to frost attack, regardless of geographic location.

Combining brick with other durable construction materials will help to ensure a structure's longevity and long-term viability. This is achieved most readily in masonry external walling using cavity construction – that is, brick outer leaf with a concrete block inner leaf.

For more information and design guidance on durability see *'Severely Exposed Brickwork'*, published by the BDA. For more information on masonry cavity walls see the *Housing Easy Guide on Cavity Walls*.



Brick and block cavity walls provide longevity; a key attribute of masonry materials.

Sustainability

Bricks are made using abundant natural materials that are locally sourced in the UK through a domestic supply chain. A typical lifespan of around 150 years ensures longevity, with the potential for reuse at the end of the building life or recycling for other applications. All of these properties are key tenets of a circular economy and the move towards designing for whole-life building performance. Another important factor from a whole-life perspective is the ability to easily alter or extend brick constructions to meet changing future needs, helping to ensure homes remain useful and extending their life span.

As with other masonry materials, brick provides good resilience to the impacts of climate change, which include an increased risk of flooding and hotter summers. The good thermal mass properties of brick can be used in the design of buildings to reduce the risk of overheating and to help maintain comfortable conditions in the summer months. For information on thermal mass, see *Thermal Mass Explained*, published by The Concrete Centre.

For more information and design guidance on durability see the Sustainability page on the BDA website.

Specification

There are two main routes of engagement with regards to the initial specification for brick: direct to the manufacturer or through a brick supplier. The brick manufacturer will have a better understanding of their product, whereas brick suppliers will usually be able to provide a range of bricks from multiple manufacturers. Whichever route you decide to follow, a good starting point for procurement is often local brick manufacturers. It is likely that they will have a history of supplying the local area and will be able to provide guidance on specification.

The key considerations for the specification process are:

- Consider the preferred colour and texture of brick
- Consider the preferred size of brick and mortar joints if deviating from standard
- Consider the brick bonding – stretcher, header, Flemish bond, English bond etc.
- Consider whether special shapes will be required
- Request physical samples.

The key information needed by the manufacturer/supplier is:

- Project location, so that the exposure zone for brickwork can be determined and the appropriate specification identified
- Details of the application/project, so that brick suitability can be determined
- Preliminary cost information to source brick options at an appropriate range/budget
- Details of the initial construction strategy including planning and preliminary start date
- Likely total volume that will be required.

Pack sizes and types are dependent on the brick factory, but they generally range between 300-500 bricks per pack, and weigh between 1-1.5 tonnes. They are commonly stacked and strapped in a self-supporting manner and designed with forklift holes to enable transportation. They can also be palletised, shrink-wrapped or bagged, sometimes as standard, and in some cases on request.

For more information, see *Brickwork Procurement Guidance* and *Good Site Practice and Workmanship*, published by the BDA, which also includes guidance on delivery and storage, handling and blending, setting out, mortar joints, bricklaying and protection of brickwork.

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Further information on brick and masonry

For general guidance, see the [BDA General Guides web page \(www.brick.org.uk/technical/guides\)](http://www.brick.org.uk/technical/guides), which includes:

- Brickwork procurement
- Good site practice and workmanship
- Brick bonds
- Brickwork durability
- The UK clay brickmaking process
- Clay brick factories of the UK
- The use of reclaimed clay bricks
- Cleaning of clay brickwork
- Scottish traditional brickwork

For structural guidance, see the [BDA Structural Guides web page \(www.brick.org.uk/technical/structural-brickwork\)](http://www.brick.org.uk/technical/structural-brickwork), which includes:

- Eurocode 6 vertical resistance
- Eurocode 6 lateral resistance
- Freestanding brick walls
- Laterally loaded walls
- Brickwork retaining walls
- Masonry design for disproportionate collapse
- Post-tensioned brickwork
- Brick diaphragm walls
- Brick fin walls in tall single-storey buildings

For technical guidance, see the [BDA Technical Guides web page \(www.brick.org.uk/technical/design-details\)](http://www.brick.org.uk/technical/design-details), which includes:

- Hit and miss brickwork
- Textured brickwork
- Designing to brickwork dimensions
- Mortar for brickwork
- Designing for movement in brickwork
- Brick skin thermal performance
- A brick arch
- Brickwork dimensions tables

Other masonry guidance

Housing Easy Guide | Blocks: www.modernmasonry.co.uk

Housing Easy Guide | Cavity walls: www.modernmasonry.co.uk

Housing Easy Guide | Beam and block floors: www.modernmasonry.co.uk

Eurocode 6 (BS EN 1996) Design of masonry structures

PD 6697:2010 Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2

BS 8103-2:2013 Structural design of low rise buildings. Code of practice for masonry walls for housing

BS 8000-3:2001 Workmanship on construction sites, Part 3: Code of practice for masonry

About these Easy Guides

This series of guides has been authored by Tom De Saulles, The Concrete Centre, on behalf of Modern Masonry. Tom would like to thank the Modern Masonry technical working group, the Concrete Block Association and the Aircrete Products Association for their contributions in developing these guides.

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To download the Housing Easy guides and to access information about masonry construction visit www.modernmasonry.co.uk

The Modern Masonry Housing Easy Guides are part of the Better Built in Blockwork campaign to share best practice for the design and construction of high performance housing.

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Modern Masonry, The Old Rectory, Main Street, Glenfield, Leicestershire LE3 8DG

Tel: +44 (0)116 232 5170 Email: info@britishprecast.org

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