



# CLEANING OF CLAY BRICKWORK



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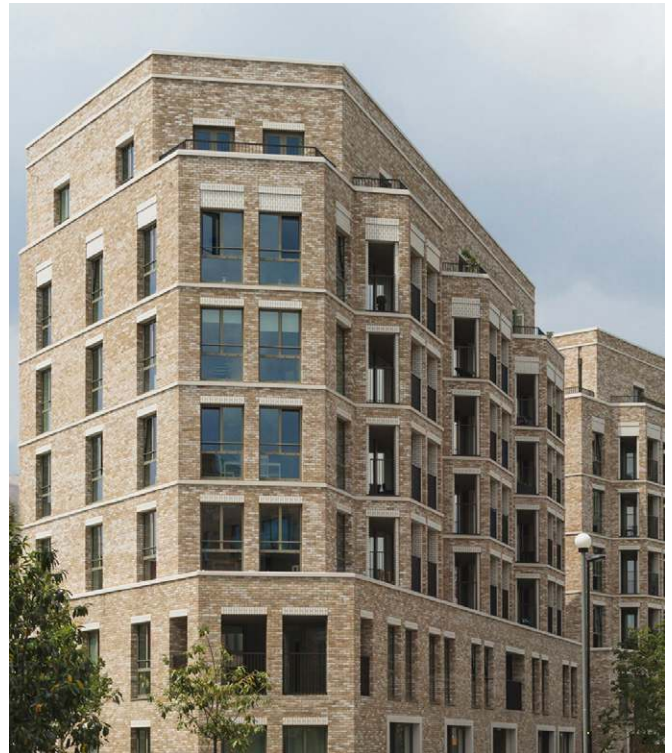


# INTRODUCTION

This document provides an introduction to the cleaning of clay brick works. Of course prevention is better than cure and by following good practice during the design and build process, many of the common post construction issues can be avoided.

During occupation accidents, poor maintenance and vandalism can all result in staining to brickworks, which will require cleaning and treatment.

This is an initial guidance document for the general public and members of the construction profession. Brickwork staining can result from a large number of sources, so this document is not intended to be a comprehensive guide for cleaning professionals, but rather a summary of the key issues and a signpost to further information, if required.



South Gardens, Elephant Park

# SCOPE OF DOCUMENT

This document provides a summary of the common staining issues which occur in newly built brickwork and during occupation. Recommendations are made with regards to treating the staining and there is a summary of the key rules to follow with each cleaning technique.

There is also a general cleaning section which provides a brief introduction to how good design, workmanship and site management can minimise the likelihood of 'building in' long term issues. More detailed information on good practice in design, workmanship and construction can be found in further BDA documents and building standards.



Timekeepers Square



Dujardin Mews

# GENERAL CLEANING

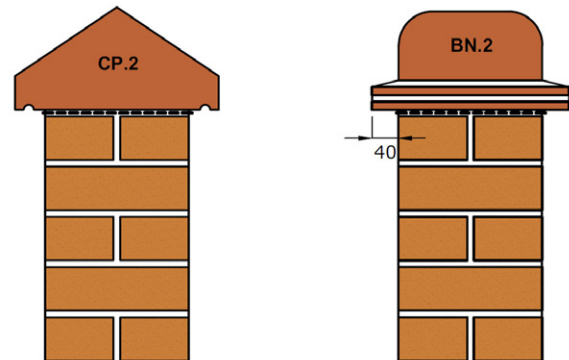
Staining in newly built brickwork can result from a number of different causes including; poor detail design, building components, poor site management, sub-standard workmanship and accidents. Staining causes a negative perception with clients and residents, which is why prevention is preferable to cure.

## DESIGN AND SPECIFICATION

Due to the quantity of potential sources for staining, a holistic approach needs to be taken. Good design is essential to avoid areas of brickwork becoming saturated, which is the main mechanism for creating and spreading many stains.

The BDA document 'Severely Exposed Brickwork' is a useful introduction to robust detail design, which will reduce the number of 'inbuilt' problems.

It is rare, but possible, that there is a defect with the building components; specifically the bricks and mortar. If you suspect the staining has originated from a defective component, the first step is to contact the manufacturer who will be able to make an assessment.



Robust detailing will avoid brickwork from becoming saturated



Stored bricks must be protected from inclement weather.

Preparation and trials should be carried out well before the main cleaning operation. Trials should be carried out on a limited and less conspicuous area of brickwork.

Once established as successful, work should continue at the earliest opportunity to avoid additional work and therefore cost.

For a more detailed analysis and recommendations please see the BDA document 'Good site practice and workmanship'.

## SITE MANAGEMENT AND WORKMANSHIP

Staining during construction is often due to poor site management and sub-standard workmanship. Primarily due to the brickwork becoming saturated prior to and during construction.

This can upset the client, increase the construction cost and may ultimately risk the final appearance.

Normal cleaning of brickwork is the responsibility of the contractor and is usually carried out as a final operation before scaffolding is struck.



Bricks protected from rainfall, including stacks.



# GENERAL CLEANING

Some site management and workmanship considerations:

- Store bricks in a protected area, avoiding standing water and contaminants.
- Protect brickwork from splashes and contamination by passing vehicles and at scaffold platforms.
- Ensure that joints are tidy and avoid dropping mortar on brick faces.
- If mortar is dropped, avoid smearing of mortar across the face of bricks – this is often harder to remove than small dried lumps.
- Correct installation of DPC's and DPM's.
- Fully fill mortar joints so no pockets are left in which water can collect.
- Protect brickwork from potential spills and splashes from other work being carried out after brickwork has been completed.
- Avoid bags and other materials being stacked against or close to brickwork.
- Make all personnel, including other contractors, aware of the importance of the final brickwork appearance.
- Care should be taken with concrete or cast stone which may allow lime to migrate into the brickwork.



The result of cleaning brickwork can be spectacular. Copyright S A Hay

## POST CONSTRUCTION

Providing that the design and construction is correct, one of the benefits of brickwork is that it requires almost zero maintenance during its long lifetime. However due to general wear, accidents, poor maintenance and vandalism, there can be a need to clean brickwork during occupation.

Identifying the cause of staining and the material to be cleaned can be difficult, but is essential to ensure that the correct cleaning technique is applied.

If there is any doubt then a cleaning professional should be consulted. Before carrying out any clean you must always refer to the manufacturers' recommendations and consider the health, safety and environmental requirements.

# EFFLORESCENCE

## DESCRIPTION

Efflorescence is the appearance of salt deposits on the surface of brickwork. They can derive from the brick body, mortar, contamination from other materials or ground water. The texture may vary from light and fluffy to hard and glassy depending on the composition.

Salts within brickwork are dissolved by water which is introduced whilst in storage, during construction or from rain. Shrink-wrapped packs of bricks may also be affected when condensation forms.

As the brick or brickwork begins to dry out the solution of salts will be drawn to the surface where the salts become more concentrated as moisture evaporates.

This tends to be most prevalent when temperatures reach optimum levels for drying, i.e. Spring onwards.

Recurrent efflorescence on older established brickwork can often be taken as an indication that water is entering the masonry as a result of poor design detailing or other protective measures, such as faulty gutters or tanking materials.

## TREATMENT

Preventing bricks from becoming saturated through good design, management and workmanship is the most effective treatment. Efflorescence is a transitory effect which should ideally be allowed to weather away naturally before remedial treatment is considered.

Its removal can be accelerated by replicating weathering conditions such as dry-brushing with a nylon/bristle brush (a wire brush should not be used). The residue should be removed so that it does not re-enter the brickwork at a lower level. A sponge dampened with clean water can be used to draw out salts. Excessively wetting of brickwork may force some re-dissolved salts back in to the brickwork which could re-appear as it dries.



Efflorescence is the most common form of brick staining



Efflorescence on brickwork under construction



# LIME STAINING



A severe case of lime staining

## DESCRIPTION

Lime staining, otherwise known as lime running or lime leaching, may occur on newly erected masonry which has become saturated during construction. It may also occur under certain circumstances on established brickwork.

The free lime originates from mortar joints and stone or concrete components when they become saturated, in a similar fashion to efflorescence.

Lime staining is mostly characterised by stains appearing from the line of a mortar joint, often perpendicular joints, and running down the bricks below in the form of streaks. This generally indicates that the source of the staining is from the mortar.

When newly built brickwork becomes saturated in its early life and as the Portland cement sets (hydrates) it can release a lime solution. On drying out, calcium hydroxide is precipitated at the surface and converts slowly to insoluble calcium carbonate by reaction with carbon dioxide from the atmosphere. Lime staining will often be accompanied by efflorescence salts, due to the masonry being excessively saturated. However because lime staining is insoluble it will not weather away in the same fashion.



Lime staining caused by runoff from a concrete coping

## TREATMENT

When fresh, lime staining may be removed by scrubbing with water using a bristle brush, taking care not to damage the face of the brick. For stains that have been exposed for longer and have started to carbonate, forming limestone, chemical treatment is likely to be required, similar to cement staining.

Pre-damp, not saturate, the wall to minimise the brick suction. Then carefully apply a proprietary brick cleaning solution with a paint brush to dissolve the lime. Gently scrub with a bristle brush and water.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.

# IRON, MANGANESE AND VANADIUM

## DESCRIPTION

Iron, manganese and vanadium are normal constituents of raw clay, or additives which are used in the manufacture of various clay bricks.

Staining from these constituents, although not a common occurrence are a recognised phenomenon. Good detailing, management and workmanship will prevent brickwork becoming saturated and therefore reduce the potential for staining.

Iron staining can appear in several forms, from orange through to dark brown in colour and can impact both the brick face and surface staining of the mortar joint.

Manganese is added during the manufacturing process to achieve a brown brick body colour. Small amounts of manganese not locked in to the brick during firing can result in similar brown staining. Vanadium salts, contained in fireclay, can leach out and cause a yellow/green stain. This staining is a type of efflorescence and is only visible on cream or buff coloured bricks.

## TREATMENT

Where, in severe cases, staining is present on the brick face, it is best left to weather away naturally. If waiting is not acceptable then removal from the face of the mortar joint is best achieved by rubbing with carborundum abrasive (similar to sandpaper). Where overall cleaning is required, it is recommended that a reputable brick cleaning contractor is consulted.

Proprietary brick cleaners may be effective on iron and manganese. However a standard acidic brick cleaner should be avoided for vanadium as this may "fix" the stain and turn it brown in colour. Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.



Iron staining visible on a mortar joint



Vanadium staining visible on a light brick



Staining on saturated brick work



# PICTURE FRAMING/PEACOCKING

## DESCRIPTION

Staining of blue bricks is commonly called 'Peacocking'. It has the appearance of an oil coloured stain around the perimeter of the face of the bricks 'Picture Framing', or over the entire face 'Peacocking'.

It takes the form of an iridescent stain often around the edges of the bricks and is caused by light diffraction through a very thin surface layer of colloidal silica or cementitious material, originating from the mortar.

The staining is superficial and not detrimental to the performance of the brick.



Peacocking is unique to blue brick

Good detailing, management and workmanship will prevent brickwork becoming saturated and reduce the potential for staining.



Picture framing likely due to saturation during construction

## TREATMENT

Picture framing and Peacocking are extremely difficult to remove. Cleaning the brickwork down with a proprietary brick cleaner at the end of construction may lessen the effect. If the stain has accumulated to the extent where it takes the form of white calcified material, it is recommended that a reputable brick cleaning contractor is consulted.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.



# CEMENT STAINING



Staining from runoff over adjacent concrete components

## DESCRIPTION

Cement staining can happen during and after construction. Runoff from concrete components and concrete structures can leave a residue on brickwork.

The other cause of cement staining is from mortar splashes and smearing. Often if mortar joints are brushed before the mortar is sufficiently set, it will result in smearing on the face of the brick. Sometime it is better to wait for splashed mortar drops to harder, when they can be picked off without smearing.

## TREATMENT

Remove large deposits with wooden implements to avoid damaging the brick face. For concrete smearing a proprietary cleaner should be suitable to break down the cementitious components. Following the pre-wetting of the wall, treat the residue of mortar by careful application using a paintbrush.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.

# DIRT, GRIME AND SOOT



St Pancras Station before restoration

## DESCRIPTION

Dirt, grime, soot and smoke on brickwork can build up over time. Such deposits are generally the result of long-term airborne deposition.

City centre pedestrian routes are particularly susceptible to this type of staining; brick is often specified in these locations because of its robust nature. The texture and colour of the brick will have an impact on how visible and ingrained the stain becomes.

## TREATMENT

The first step is to scrub the brick with a stiff nylon brush and detergent solution. More care should be taken with handmade and stock bricks, which have a less smooth texture to ensure that the brick face is not damaged. If the result is not satisfactory then it is likely that the techniques used by specialist cleaning contractors will be required. This may subsequently involve cosmetic tinting to restore the original colouring.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.



# OIL, GREASE AND TAR

## DESCRIPTION

Oils, Greases and Tar can be difficult to remove from brickwork. They can look similar but the treatment is quite different, so it is important to understand the material that is to be removed.

Oil will often penetrate into the face of the brick making it extremely difficult to remove completely.

Traditional 'tar' products were all oil based, however many modern materials used in the same situations are acrylic based. If there is any doubt then a specialist cleaning contractor should be consulted.



Tar stain on a textured brick

## TREATMENT

If fresh, oil can be 'soaked' off with absorbent materials. Surrounding areas of brickwork should be dampened to reduce the likelihood of the stain spreading and care must be taken to prevent contamination of surrounding structures, ground and water courses. Ensure an adequate supply of absorbent material for collection of residues.

Fresh grease can be scraped off, taking care not damage the brickwork or spread it further. Following this a proprietary cleaner may be used on oil and grease stains. The nature of this type of stain may leave a permanent stain that will require subsequent remedial "tinting" to blend the appearance of the affected area back into the surrounding brickwork.

For bitumen and tar the best method of removal is to leave the bitumen until it has cooled. A paint scraper or a similar mechanical device can then often remove it. If it is particularly resistant ice can be used to make the bitumen even more brittle, prior to scraping.



Oil stain on a light brick

For older and deep seated stains it is recommended that a specialist cleaner is consulted, as some older tar products contained compounds that are hazardous to health.

Older stains may be cleaned using proprietary cleaning products. The heavier deposits should be removed as far as possible by absorbent materials or scraping with wooden or similar implements to avoid damaging the brick face.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.



# PAINT AND GRAFFITI



Vandalism on a building site

## DESCRIPTION

Both paint and graffiti are difficult to remove. Correctly identifying the paint to be removed is essential as it will determine the cleaning product to be used. Modern paints are generally acrylic. However polyurethane and epoxy paints are also in use. Aerosol paints, generally used in graffiti, are particularly difficult to clean.

The nature of the brick surface will also affect the cleaning complexity. Handmade and stock bricks, with a heavily textured surface, allow paint to penetrate further in to the brick body.

Where the painted areas are extensive, or where the paint film is particularly stubborn, it will be necessary to consult with a cleaning specialist.



Specialist paint removal



Further layers of paint may require an alternative treatment

## TREATMENT

Fresh wet paint should be soaked up with an absorbent material, without wiping the paint as this will spread the stain. It should then be treated with a compatible solvent and then the area washed with hot water and detergent, taking care in the disposal of the run-off material. With dried paint, the paint should be scraped off as far as possible and then a proprietary paint remover should be applied. In many cases numerous layers of paint are applied of differing formulations, requiring a different solvent for each layer. Tinting of the bricks will often be required following paint removal.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.



# ORGANIC GROWTH AND IVY

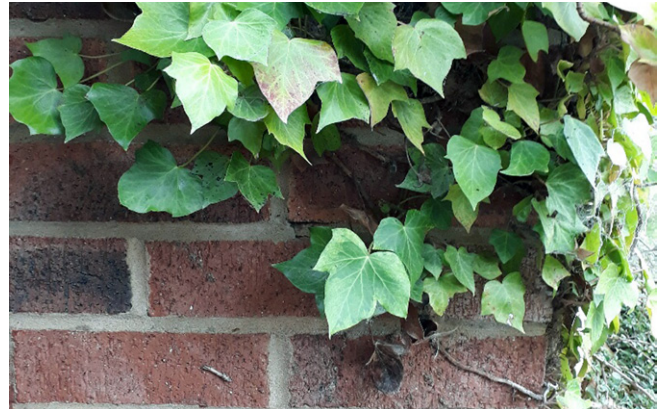
## DESCRIPTION

Moss or algae growth may appear as a green stain on brickwork and should not be confused with vanadium staining as, although it can at times look similar, vanadium salts are only present in buff bricks, whilst algae can occur on any brick type.

Such growths do not survive in direct sunlight or dry conditions and therefore tend to be more of a problem in the winter and early spring.

Ivy by its nature can be extremely difficult to remove, especially where the brickwork is of a textured variety. Due consideration must also be given to safe working requirements as an elevated platform is likely to be required rather than working from a ladder. New growth can normally be carefully pulled away from the brickwork without leaving any significant residue.

Established growth can embed itself into the open texture of the brick through aerial roots and will almost always leave small tendrils of residue which can be extremely difficult, if not impossible to remove.



Ivy can have a serious impact on brickwork



A coping detail could have reduced dampness.

## TREATMENT

Physically remove any loose growth then apply an algacide to kill off the growths. Dead vegetation can then be removed by careful pressure washing. The application of weed-killer will help to slow down any re-growth. See pressure washing rules before proceeding.

Extreme care must be taken to avoid damaging the brickwork during removal of ivy, including the mortar joint. The supporting branch should be cut from a trial area and allowed to weaken for one to two weeks before pulling carefully away from the brickwork with any residue being removed with a wooden implement such as a spatula or a nylon brush.

Should the ivy still prove difficult to remove, it is advisable to cut the root near the ground and leave the ivy to die over up to two years before attempting removal by the above method.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.



# CLAY PAVERS

## INTRODUCTION

Clay paving provides a durable, hard wearing surface and should be treated in a similar fashion to facing brickwork. However there are a number of staining issues and treatment options which are specific to pavers.

As for any other surfacing material regular maintenance and good cleaning practice will enhance the overall appearance of the paving.

## FLEXIBLY LAID PAVERS

During the very early life of the pavement, the joints between the pavers will be relatively porous.

The ingress of water will consolidate the jointing sand and it is important that the joints are regularly filled with jointing sand to replace any sand consolidated by the rainwater.

The joints will soon become semi-impervious due to detritus tending to seal the joints. Until this has occurred the paving should only be brushed by hand.

Mechanical sweepers, and in particular sweepers with high suction forces should not be used. If they are used, there is a risk of loss of jointing sand from between the pavers.

There are a number of water miscible liquids that can help to stabilise the joint filling sand. These can aid in the reduction of the removal of sand by suction cleaners, and at the same time, helps to prevent the ingress of water during the early life of the pavement.

It is essential to consult with the paver manufacturer before applying any form of surface treatment.



Clay pavers at the Barbican, London. Copyright Ketley Brick.

## SMOKE, FIRE AND TOBACCO STAINS

Normally these stains can be removed by scrubbing with hot soapy water. Where the stains persist, scouring powder or household bleach solution has been found to be successful.

## BEVERAGE STAINS

These can normally be removed by scrubbing the stain with hot soapy water. If the stain is persistent, apply bleach solution and then rinse the area with clean water, taking care to dispose of the run-off.

# CLAY PAVERS

## CHEWING GUM

Chewing gum is one of the most difficult substances to remove from any surface material.

Newly discarded gum can be scraped off by using a scraper, but hardened gum can only be removed by freezing the gum and chiseling it from the surface of the paving or, alternatively, by using a hot water/steam cleaner.

There are a number cleaning contractor who specialise in gum removal.



Gum will usually require specialist removal.

## SCUFF MARKS FROM VEHICLE TYRES

These can normally be removed by steam cleaning, or by scrubbing the area with hot water and a detergent solution.

## MECHANICAL CLEANING FOR CLAY PAVING

The following recommendations deal with vehicles, associated equipment and their use:

- Equipment should be purpose designed to sweep the particular area. If there is any doubt, the vehicle manufacturer should be consulted.
- Tyres should be inflated according to the manufacturer's recommendations to ensure maximum weight distribution.
- Polypropylene, not wire, brushes should be used.
- Sweeping brush pressures should be set to the minimum required to suit the particular task, i.e. surfaces swept regularly will require a lesser setting than those swept infrequently or those covered with heavy deposits.
- When sweeping, engine revolutions should be set at the minimum required to maintain vacuum (suction) pressure.
- Operators, including reliefs, should be trained to vehicle manufacturer's recommendations and tyre and brush pressures should be regularly checked.
- Advice should be given to operators that, when equipment is stationary or left unattended, suction, brush rotation and water jetting equipment should be switched off to avoid the risk of damage to the area below the stationary equipment.
- In new or re-laid areas, agreement should be reached with the local Highways Authority to allow the pavement to settle and the joints to seal before manual cleaning.
- When water jetting equipment to wash such areas is used, the jets or hand held lance should be directed at the surface at an angle not greater than 30° and across the diagonal (i.e. not parallel to joints) using a suitable detergent solution.
- The area should be inspected after cleaning to ensure that joints are refilled with jointing sand if necessary.



# CLEANING TECHNIQUES

## WATER CLEANING

Hot water and detergent will likely be the first cleaning solution for most stains. Cleaning should not be carried out in frosty conditions unless adequate measures are taken to protect the wet brickwork from becoming frozen.

During hot weather it is preferable that brickwork to be cleaned should be shaded from sunlight, in order to prevent the areas being treated from drying out prematurely.



Hot water, detergent and a bristle brush

Water cleaning is generally low risk, but some simple rules must be observed:

- Avoid using metal tools to clean brick surfaces.
- If brushing, only use stiff bristled brushes, never wire brush.
- Never use excessive pressure, especially on sand faced bricks, as this can change the appearance and texture of the brick.
- Make sure that mortar is sufficiently matured so that it is not spread across the face.
- Always test on an inconspicuous area first.



## CHEMICAL CLEANING

When using any chemical solutions it is important to follow the manufacturers directions on the packaging and be certain that the product is suitable for the desired application. If there is any doubt then a specialist cleaning contractor should be consulted.

Some simple rules must be observed:

- Always test on an inconspicuous area first.
- All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed.
- Normally brickwork should be pre-dampened before application.
- Never use on brickwork that may have Vanadium stain present without further investigation – see vanadium.
- Ensure that there is an adequate supply of absorbent material to control runoff.

# CLEANING TECHNIQUES

## JET WASHING

It is tempting to reach for a pressure washer when faced with staining, however this should be considered **VERY CAREFULLY** before any sort of pressure washing on brickwork.

Pressure washing of older brickwork is never recommended without a detailed survey of its condition. There are several ways in which pressure washing can severely and irrevocably damage brickwork:

- If the mortar is not fully hardened, high-pressure jets can eat into the joint. Never use pressure washers on lime mortar.
- It is very easy to blast off the surface of sand faced bricks, especially handmade or soft mud. This sand is fired onto the face of the brick but will not resist high pressure.
- The face of heavily textured bricks can be physically broken leaving chips.
- Older brickwork may not have a cavity which when saturated may lead to damp penetration.

If pressure washers are used, then some simple rules must be observed:

- Always test on an inconspicuous area first.
- Washers should be set to fan type sprays at the lowest pressure .
- Never apply too close and always maintain a constant distance from the brickwork face.
- Spray jets should be at least 100mm wide when they contact the brickwork.



Jet wash with caution.



Tinting can completely change the look brickwork

## COSMETIC TINTING

It is often not possible to completely remove staining from brickwork and sometimes the finished effect is not satisfactory. Therefore cosmetic tinting can be required following cleaning. It is recommended that a specialist is consulted to complete these works.

Testing on an inconspicuous area is advised. All health, safety and environmental guidelines from the cleaning solution manufacturer should be strictly followed. It should also be noted that acrylic tints need at least 5 degrees so are not suited to winter months.



## REFERENCES AND FURTHER READING

EN 771-1, Specification for masonry units Part 1: Clay masonry units

EN 772-5, Methods of test for masonry units Part 5: Determination of the active soluble salts content of clay masonry units

EN 772-7, Methods of test for masonry units Part 7: Determination of water absorption of clay masonry damp proof course units by boiling in water

EN 772-11, Methods of test for masonry units Part 11: Determination of water absorption of aggregate concrete, autoclaved aerated concrete, manufactured stone and natural stone masonry units due to capillary action and the initial rate of water absorption of clay masonry units

BS 8000-3, Workmanship on building sites – Part 3: Code of practice for masonry

BS EN 845-1, Specification for ancillary components for masonry – Part 1: Ties, tension straps, hangers and brackets

BS EN 845-2, Specification for ancillary components for masonry – Part 2: Lintels

BS EN 845-3, Specification for ancillary components for masonry – Part 3: Bed joint reinforcement of steel meshwork

BS EN 998-2, Specification for mortar for masonry – Part 2: Masonry mortar

BS EN 1990:2002+A1:2005, Eurocode – Basis of structural design

BS EN 1996-1-1:2005, Eurocode 6 – Design of masonry structures – Part 1-1: General rules for reinforced and unreinforced masonry structures

BS EN 1996-1-2:2005 Eurocode 6. Design of masonry structures. General rules. Structural fire design

BS EN 1996-2:2006, Eurocode 6 – Design of masonry structures – Part 2: Design considerations, selection of materials and execution of masonry

BS EN 1996-3:2006 Eurocode 6. Design of masonry structures. Simplified calculation methods for unreinforced masonry structures

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

BRE 370 Control of lichens, moulds and similar growths

BRE 418 Bird, bee and plant damage to buildings

BS 8221-1:2012 Code of practice for cleaning and surface repair of buildings – Part 1: Cleaning of natural stone, brick, terracotta and concrete

BDA document - Good site practice and workmanship

BDA document - Severely exposed brickwork



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