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Code of practice for cleaning and surface repair of buildings –

Part 1: Cleaning of natural stone, brick, terracotta and concrete

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Foreword

Publishing information

This part of BS 8221 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 July 2012. It was prepared by Technical Committee B/560, *Conservation of tangible cultural heritage.* A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

The start and finish of text introduced or altered by Corrigendum(a) No. 1 (and No. 2) is indicated in the text by tags [C1⟩ and ⟨C1].

Supersession

[C1⟩ This part of BS 8221 supersedes BS 8221-1:2000, which is withdrawn. ⟨C1]

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

As a code of practice, this part of BS 8221 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 8221 is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

This British Standard is intended to give building owners, architects, surveyors, engineers, and contractors general information on cleaning.

Buildings are cleaned either to enhance their appearance or to assist maintenance and/or conservation.

Reasons for wanting to enhance appearance include:

a) removal of disfigurements (e.g. stains, graffiti); revealing the nature, colour or details of a building; and

b) unification of the appearance of a building that has been altered, extended or repaired.

Reasons for cleaning a building prior to maintenance and/or conservation include:

1) removal of harmful or undesirable deposits or applied materials from the fabric in order to slow down the rate of decay;

2) exposure of concealed defects, where surfaces are very thickly soiled, in order to establish the extent and nature of repairs required;

3) preparation of a surface for additional treatments; and

4) to fulfil the terms of a lease that requires periodic cleaning of a building.

Buildings have a variety of surfaces and materials and types of soiling that each need to be cleaned with appropriate methods and materials. It is essential to identify, in advance, the type, properties, and condition of masonry (in particular, whether it is limestone or sandstone) and jointing materials.

1 Scope

This part of BS 8221 gives recommendations on the removal or partial removal of deposits from the original surface or substrate of a building.

It includes the principal cleaning methods in use and the characteristics of surface deposits. It is applicable to the cleaning of natural stones, clay brick, calcium silicate brick, glazed and unglazed terracotta/faience, and cast concrete and concrete products such as cast stone, concrete brick and concrete blockwork.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 1139-2 *Metal scaffolding – Part 2: Couplers – Aluminium couplers and special couplers in steel. Requirements and test method*

BS 1139-4 – *Metal scaffolding – Part 4: Specification for prefabricated steel splitheads and trestle*

BS 2482, *Specification for timber scaffold boards*

BS 6037 (all parts), *Code of practice for permanently installed suspended access equipment*

BS 6100-5, *Building and civil engineering – Vocabulary – Part 5: Civil engineering – Water engineering – environmental engineering and pipe lines*

BS 6100-6, *Building and civil engineering – Vocabulary – Part 6: Construction parts*

BS 8221-2, *Code of practice for cleaning and surface repair of buildings – Part 2: Surface repair of natural stones, brick and terracotta*

BS EN 39, *Loose steel tubes for tube and coupler scaffolds. Technical delivery conditions*

BS EN 1004, *Mobile access and working towers made of prefabricated elements. Materials, dimensions, design loads, safety and performance requirements*

BS EN 12811-1, *Temporary works equipment. Part 1: Scaffolds. Performance requirements and general design*

BS EN 15898, *Conservation of cultural property. Main general terms and definition*

3 Terms and definitions

For the purposes of this part of BS 8221, the terms and definitions given in BS 6100-5, BS 6100-6 and BS EN 15898 the following apply.

3.1 faience
masonry, similar to terracotta, with some surfaces covered with a clear or coloured glaze

3.2 fireskin
thin, smooth, outer layer on unglazed terracotta, containing a high proportion of fines

NOTE In traditional firing processes, fireskin is vitrified to a greater degree than the body of the clay beneath. Fireskin is protective and retention of it is a priority in cleaning and repair works.

3.3 glaze
mixed paste of fluxes and colouring ingredients that, applied to a surface and fired, fuses with the open-pored underbody to form a thin, vitreous, transparent, or coloured coating of glassy, opaque or translucent consistency

NOTE Glazes can be plain, mottled or textured and can range from high-gloss to egg-shell finish.

3.4 historic masonary
masonry that forms an integral part of a building or structure which is listed, scheduled or in a conservation area or is of acknowledged historic merit

3.5 specialist contractor
contractor who has demonstrable expertise that is based upon knowledge and experience of best practice

3.6 terracotta
fired-clay, fine textured and unglazed, usually yellow to brownish-red

4 Considerations affecting cleaning decisions

*COMMENTARY ON Clause **4***

All cleaning operations present different criteria to consider, including a suitable method, the materials of construction, and their condition.

4.1 General

The following should be determined prior to carrying out a cleaning programme:

a) the type and properties of masonry and jointing material;

b) the condition of the masonry units and joints;

c) the types, extent and nature of surface deposits;

d) the susceptibility of substrates to various cleaning materials and processes;

e) any effects that the cleaning methods and processes could have on the interior of the building; and

f) the likelihood of any historic polychromy surviving beneath the soiling.

Information on current penetrating dampness problems or other problems caused by such dampness should be taken into account when deciding upon the cleaning method and processes.

Each project should be considered carefully, taking into account previous experience with the building (or similar buildings) and available materials and methods which might be useful but should not be assumed to apply fully.

If treatment of one material or surface could harm other materials or surfaces, these areas should be protected.

If features of artistic or historic importance are to be cleaned, specialist guidance should be sought.

Historic buildings sometimes have a conservation management plan, in which case the Conservation Policies contained therein should be followed. In the absence of a conservation management plan, the impact that cleaning and surface repair of the building has on the significance of the building should be understood and any detrimental consequences mitigated as appropriate.

Some deposits are not fully removable from surfaces without causing damage. Residual or uneven marks can remain, but should not be mistaken for poor quality cleaning.

Apart from cost, the factors listed in Table 1 should be taken into account prior to selecting a cleaning programme.

Where it is determined that surface repairs are required as part of the cleaning process these should be done in accordance with BS 8221-2.

Table 1 **Factors affecting choice of cleaning method**

Factor	Remarks
Type and condition of material	Stonework (see Clause **5**); clay and calcium silicate brickwork (see Clause **6**); terracotta and faience (see Clause **7**); and concrete (see Clause **8**) should be identified
Type and condition of surface	Extent of deterioration, nature of joints, extent of ornamentation and other surfaces should be considered (see **4.2**)
Amount and type of deposits	See **4.3**
Construction	A) B)
Type and use of building	C) D)
Location of building	E) F) G) H) I)
Health and safety risk assessment	J) K)
Environmental assessment	E) K)
Availability of services	See **4.12**
Weather conditions	I)
Interior work	Where possible an inspection of the interior of the building should be made and if necessary appropriate additional protective measures should be taken to contain the effect of cleaning processes
Risk of re-soiling	Likelihood of re-soiling occurring and timescale for re-soiling should be taken into account.
Risk to other parts of the building fabric	Some methods pose greater risk to the building fabric than others, for example due to run-off of soiled water or chemical cleaning media, or water penetration into the fabric leading to corrosion of embedded metals, rotting of embedded timbers, salt mobilization or mobilization of iron-based minerals.

A) Some buildings might contain embedded ferrous cramps or steel frame supports. These can require cleaning that restricts or eliminates water use.

B) Mortar in joints can entrap and be dissolved by cleaning chemicals, or can be eroded by abrasives.

C) Buildings of architectural or historic interest require special consideration and permission might be required to clean these.

D) The use or contents of a building can limit the cleaning process or add to preparatory and support measures.

E) The proximity of a building to vegetation and waterways and the position of the water table can prevent use of certain chemical agents. Biodegradable proprietary products should be used. Alternatively, special collection or containment measures might be required.

F) The height and position of a building can make water, abrasive or chemical use hazardous, particularly in very windy conditions.

G) The position, use and condition of adjoining buildings (especially listed buildings) can affect selection of a cleaning method.

H) Noise nuisance can restrict working methods or times.

I) Dust nuisance can affect selection of a cleaning method.

Table 1 **Factors affecting choice of cleaning method**

[J] Health and safety considerations might restrict use of certain processes.

[K] All lead-containing and other toxic debris, including masks and filters should be collected in plastic bags and sealed with tape.

NOTE 1 Attention is drawn to the Environmental Protection (Duty of Care) Regulations 1991 [1]. It is advisable to verify appropriate disposal routes with the local waste regulator.

NOTE 2 Consent to discharge waste water from chemical cleaning and from other wet processes might be required from the local authority or the local water authority.

NOTE 3 Where cleaning interiors are concerned any reports on decorative surfaces need to be sought prior to any decisions being made.

4.2 Inspection and identification of substrate

A comprehensive survey should be carried out, in the presence of advisors with expertise in the type of building, prior to carrying out a cleaning programme. The nature and condition of substrate materials and the types of surface deposits should be assessed before an appropriate cleaning method is selected.

Building and structures to be cleaned should be inspected closely ,using the following procedure.

a) Each material should be identified in sufficient detail so that cleaning can proceed without risk to the fabric.

b) The condition of the construction and its joints and associated materials should be assessed and recorded, as well as the effects of previous cleaning operations.

c) The extent and nature of surface deposits should be identified (see **4.3**).

d) Tests to identify a substrate type for susceptibility to various cleaning processes and the effects of deposits should be carried out if appropriate.

NOTE In some cases, it might be necessary to take samples of the substrate or soiling for laboratory testing, in order to accurately identify the materials.

4.3 Identification of surface deposits

*COMMENTARY ON **4.3***

Deposits on external facades of buildings can vary from a few microns to as much as 50 mm in thickness and cleaning can involve removal of one or more of the following deposits:

a) atmospheric particulates, often bound together as well as to the masonry surface with either calcium sulfate or silica, depending on the substrate;

b) growths;

c) mortar splashes and runs;

d) encrustations of calcium carbonate from lime-rich masonry;

e) efflorescent salts;

f) bird fouling;

g) paint and graffiti;

h) bird-repellent gel;

i) heavy and light oils;

j) metallic stains; and

k) previous treatments or reaction products derived from previous treatments.

The layer of soiling and the altered surface of the substrate should be distinguished from each other at investigation stage, so that the level of cleaning (see Clause **9**) can be selected.

4.4 Documentation

Records should be kept of cleaning operations on buildings of significance, including:

a) photographs of the building showing its condition and appearance before and after cleaning is carried out; and/or

b) drawings of deposit patterns, thicknesses, the nature of deposits, and condition of masonry.

NOTE 1 Photogrammetry or rectified photography may be used for complex cleaning programmes.

Specifications and other documents that might be required for a cleaning project should be prepared in sufficient detail to give proper guidance in the preparation of estimates and the execution of the work. Copies of all relevant documents should be available to all parties involved, including site personnel responsible for supervision.

NOTE 2 A cleaning project can involve several parties, including client, main contractor and subcontractors, suppliers and inspectors.

*NOTE 3 General requirements in respect of cleaning specifications are described in **4.8**.*

Documents should be retained to provide background information prior to further assessments or work.

4.5 Selection of cleaning method

Following assessment of the substrate and soiling (see **4.2** and **4.3**), an appropriate cleaning method should be selected (see Clause **10**).

NOTE A cleaning process may involve multiple applications of one system or several removal systems, with procedures specified in the main contract.

Trials should be carried out so that a detailed cleaning procedure can be specified (see **4.6** and **4.7**).

4.6 Trial cleaning areas

A trial area should be cleaned to determine:

a) the suitability of the cleaning method for the masonry, its condition, and the surface deposits; and

b) the standard of cleaning that can be achieved, and its acceptability.

Cleaning processes should be pretested on materials, surfaces and deposits representative of the whole building. If possible, test areas should be located in unobtrusive locations. Test areas should be small in case it is decided not to clean.

When trialling different cleaning methods those which are least harmful should be tested first. Progression made towards methods which are more harmful should be made only if necessary in order to determine a cleaning method which is successful.

A detailed record should be kept of trial cleaning and the location of trial areas. This should be retained for reference throughout the duration of the cleaning contract.

Trial cleaning should be observed and assessed by persons responsible for preparing the cleaning specification. Trial areas should be available for inspection by relevant authorities.

If possible, trial cleaning should be agreed beforehand, and carried out by trained and experienced specialists conversant in a variety of cleaning systems.

4.7 Assessment of trial areas

Trial areas should be assessed wet and dry.

Full assessment should include:

a) potential damage to the fabric as a result of cleaning;

b) colour changes resulting from the cleaning process;

NOTE 1 It can take several weeks for colour changes to become apparent in some stones.

NOTE 2 A colorimeter may be used to make accurate colour comparison between test areas not immediately adjacent to each other, or at different points in time.

c) the probable appearance of the facade after cleaning;

d) the probability and time span of deposits returning to the cleaned facade;

e) an estimate of periodic recleaning operations and the effects of these on the building; and

f) the efficacy of soil removal.

4.8 Specification

*COMMENTARY ON **4.8***

The prime functions of a specification for cleaning a building are as follows:

a) to describe the substrates to be treated and the means by which the required finish is to be achieved. Means includes materials, systems, application methods and the conditions under which the work is to be done;

b) to provide a basis for accurate pricing and tendering;

c) to serve as a comprehensive reference document for all parties; and

d) to act as a reference if disputes arise or arbitration is necessary.

After an assessment has been carried out and documented, a detailed specification for the work should be prepared. Specifications for cleaning should be integrated with specifications for surface repair.

Specifications should be clear, concise and unambiguous.

NOTE 1 Certain aspects of repair work relating to prevention of water penetration might be required prior to cleaning.

*NOTE 2 Aspects to which special attention is to be given in the preparation of specifications for cleaning buildings are described in **4.9** to **4.15.3**.*

4.9 Selection of a specialist contractor

Cleaning should be undertaken by specialist contractors. The competency of the contractor and the skilled operatives assigned to carry out proposed work should be established. Works supervisors should have a full working knowledge of the materials and cleaning processes, as any cleaning method involves potential damage to the fabric of the building.

4.10 Use of scaffolding

Scaffolding should be erected in accordance with BS EN 12811-1, BS 1139-2, BS EN 39, BS EN 1004, and BS 2482. If permanently installed suspended access equipment is used, guidance should be obtained from BS 6037 (all parts).

Means of access should be suitable for the cleaning operation. Particular attention should be paid to:

a) tying-in to avoid or reduce damage to the faces of masonry units;

b) the avoidance of physical damage during erection and striking;

c) the use of base plates to isolate stones or other surfaces from scaffold standards;

d) the avoidance of rust staining of the building and pavements; and

e) capping pole ends if chemicals are used.

4.11 Availability of services

Before choosing a cleaning method the environmental impact of the process should be evaluated. This should include the disposal of run offs, spent abrasive and other residues. The water supply, drainage, and electricity supply should be examined to ensure they are satisfactory.

NOTE 1 Non-ferrous, non-corroding pipes, fittings, nozzles, booms, etc., might be required to avoid staining.

Only mains quality water should be used. Water should not deposit or cause stains.

NOTE 2 Quality of water is important. In some non-potable supplies, a high iron content can cause brown surface stains.

4.12 Weather conditions

If there is a risk of freezing of the building fabric, wet cleaning methods should be suspended, or suitable protection should be provided.

4.13 Protection of buildings and surroundings

Protection and preliminary works requirements for the building should be considered prior to carrying out cleaning work.

Before cleaning, any fractures or open joints, including around windows, should be temporarily sealed to prevent entry of cleaning agents (non-staining, readily removable materials, such as foam rods, or temporary pointing, may be used). Repointing should be carried out if required.

Glazing and window frames should be protected with plastic and tape.

NOTE More durable protection (e.g. purpose-made plywood sheets) might be required to protect stained glass.

Electricity to external signs should be disconnected and external fittings (e.g. signs and nameplates) should be removed and stored, or protected in situ. Protection should be provided for street furniture, railings, signage, meters, vents, etc.

Decorative features (e.g. balustrades, cornices and carved ornamentation) should be protected.

Cleaning areas should be sheeted in. Other masonry materials should be protected within the cleaning area if applicable. Polished granite, limestone, marble, terracotta, and faience should be protected if chemicals are used to clean adjacent materials. Soft or brittle materials should be protected from adjacent abrasive cleaning.

If possible, cleaning should be from the upper parts of a structure downwards. In cases where this is not possible, cleaning should be carried out in a manner that ensures finished work is not affected.

NOTE When cleaning building interiors, special precautions might be required to protect floors, plasterwork, woodwork, and building contents (e.g. electronic equipment, monuments, organs, paintings).

Temporary catchments and gutters should be provided, if required, to remove large amounts of water from the building and to avoid over-saturation at lower levels.

Gullies and other rain water discharge inlets should be protected from blockage through debris arising from cleaning and repair.

4.14 Protection of building surfaces

4.14.1 Water washing

Before cleaning the exterior of a building, the building's rainwater drainage system should be inspected to ensure that it is of sufficient capacity, and free from blockages.

An inspection of the masonry surface should be made. Temporary pointing or filling of any cracks that would let cleaning liquids enter the wall or the building should be carried out prior to cleaning.

Before cleaning the interior of a building, the disposal of water, effluents and other used cleaning materials and the creation of dust, noise and fumes and the affects of increase in RH should be taken into account.

If hot water pressure rinsing is carried out (i.e. with a minimum jet temperature of 80 °C), it is essential to protect against damage caused by localized thermal stresses. Glass, plastics panels, windows, and paintwork should be protected. Hot water jets should not make contact with plastics frames, guttering, pipes, etc.

NOTE Run-down water does not usually distort plastics frames, guttering, pipes, etc.

Cast-off sheets should be installed to prevent unwanted saturation.

4.14.2 Mechanical cleaning

Windows should be protected with polyethylene sheeting, applied in accordance with the manufacturer's instructions, and, if required, a rigid sheet material (e.g. hardboard) prior to air or water abrasive cleaning. Protective materials should be fixed and removed with care.

Hopper heads, rainwater gullies, intake fans, and outlets should be covered and protected from accumulation of abrasive.

Spent abrasive should be cleared from scaffolding each day, in a manner which does not create dust and from the site at regular intervals.

All lead-containing and other toxic debris, including masks and filters should be collected in plastic bags and sealed with tape.

NOTE Attention is drawn to the Environmental Protection (Duty of Care) Regulations 1991 [1]. It is advisable to verify appropriate disposal routes with the local waste regulator.

4.14.3 Chemical cleaning

Marble, glass, polished surfaces (e.g. granite), and other incompatible surfaces should be protected during chemical cleaning.

Surfaces which are incompatible with chemicals used on other types of masonry should be protected from them e.g. limestones from hydrofluoric acid used on brickwork, granite or sandstone.

Pavings, shrubs, plants, tree roots, etc., should be protected if applicable.

Mechanical fixings for protective materials should be attached into joints rather than masonry units. Trials should be carried out to ensure that masking tape and rubberized coatings do not remove paint.

NOTE Some masking tapes and most plastics peelable coatings are not suitable for use on plastics and PVC surfaces.

Exposed metal should be protected if alkaline cleaning agents are used. Paintwork should be protected if acid, alkaline or solvent cleaning agents are used.

5 Stonework

5.1 General

*COMMENTARY ON **5.1***

Stones are naturally formed materials composed of a wide range of minerals and have extremely diverse microstructures and fabrics. Variations in these can be found even within individual masonry units.

When selecting a method of cleaning, the properties and condition of each stone type should be taken into account, together with the type of deposits (see **4.2** and **4.3**).

NOTE 1 All stones are porous and absorb water and chemical agents. Weathered and decayed surfaces are more susceptible to damage by all cleaning methods.

NOTE 2 The three geological groups of rocks and some examples of corresponding building materials are given in Table 2.

Table 2 **Geological groups of rocks and examples of building materials**

Rocktype	Formation	Example of building material
Igneous	By cooling, crystallization and solidification of magma at or below the Earth's surface	Coarse-grained granite; fine-grained basalt
Sedimentary	By sediments composed of particles of eroded rock becoming buried, compacted and naturally cemented.	Sandstone; limestone; magnesian limestone; alabaster; chert/flint. *NOTE 1 Limestones are sedimentary rocks formed by chemical precipitation, mostly with accumulation of shells and skeletons of sea creatures*
Metamorphic	By effect of pressure and heat on igneous or sedimentary rocks	Quartzite; marble; slate

NOTE 2 The terms in this table are sometimes used incorrectly in a descriptive manner, e.g. a hard sandstone might be termed a granite, and hard limestones that can be polished might be termed as marbles.

5.2 Sandstone

*COMMENTARY ON **5.2***

Sandstone is composed mainly of grains of quartz, with variable quantities of feldspar, rock fragments, micas, and clay minerals. The grains are cemented together by a range of materials. There can be more than one cementing material in each sandstone.

The types of sandstone and their potential resistance to weathering and soiling are summarized in Table 3. The types of sandstone matrices and their potential resistance to weathering and soiling are summarized in Table 4.

Table 3 **Types of sandstone and their potential resistance to weathering and soiling**

Type of sandstone	Potential resistance
Orthoquartzite (quartz content > 95%)	Good
Arkosic sandstone (quartz content 75% to 95%; feldspar exceeds rock fragments; "cement" variable or chemical)	Moderate
Lithic sandstone (quartz content 75% to 95%; rock fragments exceed feldspar; "cement" variable or chemical)	Moderate to poor
Feldspathic greywacke (quartz content variable, normally < 75%; feldspar exceeds rock fragments; detrital matrix, > 15% of rock)	Moderate to poor
Lithic greywacke (quartz content variable, normally < 75%; feldspar exceeds rock fragments; detrital matrix, > 15% of rock)	Poor

Table 4 **Sandstone matrices and their potential resistance to weathering and soiling**

Cement in matrix[A)]	Potential resistance
Silica	Good
Calcite	Moderate to poor
Dolomite	Moderate
Iron compounds	Moderate to poor
Clay minerals	Poor
Evaporites (e.g. gypsum)	Poor

[A)] *Cements can be composite (e.g. silica-bonded clay cement).*

NOTE 1 Sandstone can be difficult to clean, for the following reasons:

a) Bedded and laminated sandstone can contain different types of sand grain and/or cement in different layers. These can respond differently to cleaning and ridges can develop on the surface of the stone.

b) Exposure to pollution and cleaning chemicals can significantly alter the porosity and weather resistance of the stone.

c) Most atmospheric deposits on sandstone cannot be removed by water-based cleaning.

d) The high porosity of some sandstones can lead to cleaning chemicals absorbing too deeply to be removed by washing, which could cause long-term damage.

*e) Deposits on highly porous sandstone can penetrate below the surface, and can be difficult or impossible to remove without damage to the stone.(see **4.6** and **4.7**).*

NOTE 2 Calcareous andstones often need to be treated as limestones for cleaning purposes, as they are sensitive to acids.

NOTE 3 Sandstones containing significant quantities of clays are very sensitive to water cleaning and some chemical cleaning.

On-site trials should be carried out to determine an appropriate cleaning method (see **4.6** and **4.7**).

NOTE 4 Changes in the outer surface of sandstone can be highly variable and this can complicate obtaining representative samples and interpreting the results of analytical work. Transportation of lime and calcium salts into sandstone masonry caused by weathering of mortar or by placing limestone above sandstone can also affect interpretation of analysis.

NOTE 5 The colour of some sandstones can be altered by hydrofluoric acid and some alkaline cleaners. Chemical and physical alterations (e.g. bleaching and loss of cementing medium and quartz grains) can occur if chemical products are not used correctly.

Attempts should not be made to remove naturally occurring minerals that migrate to the surface and change the colour of sandstone (even if this results in residual marking).

5.3 Limestone

*COMMENTARY ON **5.3***

The main constituents of limestone are calcium carbonate and variable quantities of dolomite, silica and clay minerals. Limestone can be homogeneous or banded, with the silica and/or clay components concentrated in certain layers. Limestone are acid-sensitive.

Limestone should be cleaned by water-based methods (**10.3**) if the surfaces are not excessively friable. Surfaces of limestones with calcium sulfate (gypsum) formation should be cleaned carefully, as calcium sulfate is sparingly soluble in cold water. Cleaning water should be kept to a minimum and surfaces should be left to dry out quickly, as water can form a brown stain on some limestones (e.g. Portland).

NOTE Alkaline cleaners may be used to soften some deposits on limestone and reduce the amount of cleaning water required. Surfaces need to be thoroughly rinsed afterward and might require neutralization with dilute organic acid.

Dry or wet air abrasion (**10.4.4**) can be used to clean tough, resistant limestones but should not be used on softer limestones, or limestones with localized soft beds or with hardness variations.

Poultices containing solvents, detergents or chemical reagents may be used to remove metallic, oil and grease deposits; where these are to be used, specialist advice should be sought

5.4 Magnesian limestone

*COMMENTARY ON **5.4***

Magnesian limestone (composed of dolomite, the double salt of calcium and magnesium carbonate), can sometimes contain calcite and appreciable quantities of quartz grains.

Magnesian limestone is slightly less acid sensitive than other limestones, but if unweathered should be cleaned in the same way as other limestones (see **5.3**).

Care should be taken when cleaning weathered magnesian limestone as the surface can be very friable. Calcium sulfate and magnesium sulfate on or close to the surface are water soluble. Some varieties of magnesian limestone can exhibit cavernous decay (a mass of powder and crystals concealed behind a hard, sulfate-rich surface skin); the surface skin should not be ruptured as weathered material can be rapidly lost, with formation of large surface cavities.

5.5 Alabaster

Alabaster (a variety of gypsum) should not be cleaned by running water as it is water soluble. The appearance of alabaster should be improved by gentle rubbing with wet cotton wool swabs, or with a suitable soap for more stubborn deposits. Powder detergent should not be used. Liquids should be used sparingly.

Surfaces should be dried thoroughly, as soon as possible after cleaning, with an absorbent cloth or paper to prevent the formation of soluble salts on the surface, in the form of a white powder.

5.6 Marble

*COMMENTARY ON **5.6***

Marbles are composed of calcite, dolomite or both. Coloured varities contain a range of silicates and other minerals, in various proportions. Some of the minerals can be adversely affected by cleaning. Not all stone described as marble is true marble (e.g. Purbeck marble). Different qualities of marble can be found on different building features and on internal and external surfaces.

Marbles are highly susceptible to dissolution by acids and etching by air abrasive cleaning, and should not be cleaned by either of these methods.

Marble should be cleaned with water in the same way as limestone (see **5.3**), if the surfaces are not friable and the deposits are water-soluble. Cleaning water should be kept to a minimum. Deposits on small areas should be softened by hand spraying water or by application of a water-based poultice.

Valuable pieces of marble should be cleaned with deionized water and absorbent material. Loosened deposits should be removed with cotton wool swabs.

Poultices containing solvents, chemical reagents or detergents may be used to remove metallic, oil and grease deposits; where these are to be used specialist advice should be sought.

NOTE Deteriorated surfaces that are extremely friable or sugared can require preconsolidation prior to cleaning.

5.7 Flint and chert

*COMMENTARY ON **5.7***

Flint and chert are very dense, impervious nodular stones composed mainly of silica. Lime-based mortars (with which they are often pointed) are much softer and more porous.

Flint and chert should be cleaned with water in the same way as limestone (see **5.3**). Hydrochloric acid-based chemical cleaners may be used sparingly to clean the faces of knapped flints after repointing, but cleaners containing hydrofluoric acid should not be used. Heavily soiled flint and knapped flint in lime-based mortars should be cleaned with sodium hydroxide formulations, for short dwell times, followed by a neutralizing wash with weak organic acid. Water soluble deposits on flint and chert should be cleaned with water in the same way as limestone.

5.8 Granite

*COMMENTARY ON **5.8***

Granites consist primarily of quartz and alkali feldspar, with variable proportions of other minerals. Because feldspar is prone to breakdown by clay minerals, granites are not always very durable. Different approaches are required to clean unpolished and polished granite.

5.8.1 Unpolished granite

Atmospheric deposits on unpolished granite are not readily water-soluble, and chemical (**10.5**) and abrasive (**10.4.4**) processes should be used to remove these (with caution). Chemical cleaners containing hydrofluoric acid should be used with care at low concentrations for short dwell times. Alkaline cleaner use should be followed by neutralization with a weak organic acid.

5.8.2 Polished granite

Polished granite should not be cleaned with hydrofluoric acid or abrasives (except, in some cases, soft and fine abrasive can be suitable). Cleaning should be with an alkaline cleaner, applied in accordance with **10.5** and **D.3**, followed by thorough rinsing and neutralization with weak organic acid.

Polished granite should be protected from cleaning materials used on neighbouring surfaces.

Atmospheric deposits on polished granite should be removed with a non-aggressive liquid detergent in cold water and scrubbed with non-metallic scourers. Surfaces should be thoroughly rinsed and wiped dry to prevent water marking.

5.9 Slate

*COMMENTARY ON **5.9***

Slate is a fine grained metamorphic rock with well-developed cleavage. It can be any colour, but grey, blue, green, purple, and black varieties are most common. Slate is generally durable unless calcite or pyrite are present, and if both are present together, durability is significantly reduced.

Slate should be washed with clean water and a neutral liquid detergent and leathered off. Further cleaning (if required) should be with an alkaline cleaner, applied in accordance with **10.5** and **D.3**, followed by thorough rinsing, neutralization with weak organic acid and further thorough rinsing with copious amounts of clean water .

NOTE The term stone slate is sometimes used for roofing materials of other types of stone.

5.10 Other natural stones

Many other types of natural stone can be encountered on buildings. Each type should be identified and its sensitivity to cleaning materials and cleaning processes established prior to cleaning.

6 Clay and calcium silicate brickwork

*COMMENTARY ON Clause **6***

*Different methods are needed for cleaning established and newly erected brickwork as these display different types of soiling. Soiling on established brickwork is primarily atmospheric. Soiling on newly erected brickwork usually comprises metallic and construction stains such as mortar residues and splashes. White encrustations (lime bloom) can form on newly erected and repointed brickwork where mortars containing Portland cement (see **10.6**) or lime or both are used. These deposits can take many months to weather away if chemical or abrasive cleaning is not carried out.*

*Efflorescence of soluble salts can also be a problem (see **9.6**). Most brick types are porous and susceptible to impact damage. Caution is needed with chemical and abrasive cleaning.*

6.1 Clay brickwork

*COMMENTARY ON **6.1***

Characteristics of clay bricks (especially in historic buildings) can vary considerably depending on the type of clay, the manufacturing and firing process, and the age and condition of the bricks.

Differences in surface texture, porosity, colour, and hardness of clay bricks, within a wall (or even within individual bricks) should be identified prior to carrying out any cleaning operation.

NOTE 1 Differences among bricks are not always obvious.

NOTE 2 Clay bricks can have different surface colours or coatings (e.g. soft glaze or sand faced).

Constituents and the condition of mortar joints should be assessed.

Water-based cleaning methods (**10.3**) should be used to remove loosely adherent deposits only, with light brushing using a soft brush, if required.

Atmospheric deposits on clay brickwork are generally not water soluble, and chemical (**10.5**) or wet abrasive (**10.4.4.5**) cleaning processes should be used.

Air abrasive cleaning (**10.4.4.5**) methods should not be used on soft or fragile clay brickwork.

Prewetting and rinsing, if required for a treatment, should be carried out with minimum wetting to minimize efflorescence caused by drawing salts to the surface of the brickwork.

Unless there is evidence to the contrary, bricks and joints should be assumed to be moderately to highly porous to chemical cleaner. Concentrated hydrofluoric acid-based cleaners should not be used and dwell times should be minimized. Rinse water should not be applied at excessively high pressures, or through an unsuitable nozzle (e.g. a needle jet).

Chemical and air abrasive cleaning methods can be used to clean brickwork but precautionary procedures should be complied with.

NOTE 3 Some precautions for abrasive cleaning are described in Annex C.

NOTE 4 Further information on chemical cleaning is provided in Annex D.

6.2 Glazed brickwork

*COMMENTARY ON **6.2***

Soiling on glazed brickwork can be difficult to remove because it can be chemically bound to the glaze surface, or lodged beneath or within fractures on the glaze.

Glazed brickwork should be cleaned with hot water, detergents, or sodium hydroxide followed by neutralization with acetic acid, with agitation using a natural bristle or nylon brush.

Soiling that is difficult to remove adjacent to joints might require a weak hydrofluoric acid product applied and agitated by sponge; in these cases areas worked should be very small and dwell times very short.

6.3 Calcium silicate (sand-lime or flint-lime) brickwork

Calcium silicate brickwork should be cleaned using a water spray and detergent if required.

Air abrasive or chemical cleaning methods should be avoided as they can change the colour of calcium silicate brickwork.

7 Terracotta and faience

Unglazed and glazed terracotta and faience are susceptible to impact damage. Abrasive cleaning should not be used.

NOTE 1 Deposits on terracotta and faience are not water-soluble and cannot be removed with water alone.

Terracotta should be cleaned with the same chemicals as clay brickwork (see **6.1**), except without abrasion. Chemical cleaners should be of minimum concentration practicable with short dwell times.

A trial cleaning test should be undertaken prior to carrying out a cleaning operation on terracotta or faience, as some methods can remove fireskin or glaze or cause colour loss to unglazed surfaces (see **4.6** and **4.7**).

Acid only or alkali-acid systems should be used depending on the amount of surface deposits. Hydrofluoric acid-based cleaners should be of the minimum concentration practicable and used with a short dwell time.

NOTE 2 Streaking and uneven cleaning can occur if liquid acidic agents containing hydrofluoric acid are used on unglazed terracotta surfaces. These effects can be reduced by even application and agitation of cleaner while on the wall, or by using a thixotropic or poultice-based cleaner. Neutralization might not be required if thorough washing off of the debris is carried out.

Glazed terracotta and faience should be cleaned by the same method as for glazed brickwork (see **6.2**).

8 Concrete

*COMMENTARY ON Clause **8***

It is essential to identify the substrate components, surface characteristics (binder and aggregate) and material to be removed before a cleaning method for concrete can be decided.

*Surface deposits can vary from a thin surface soiling to a thick encrustation or deep stain affecting several millimetres depth of material. Atmospheric deposits on concrete are typically air or water-borne dirt and are quite often bound together as well as to the surface, with calcium sulfate. Areas of concrete washed by rainwater remain clean and unwashed areas pick up deposits. Surfaces can be painted or stained by a wide range of materials. If the alkalinity of concrete is reduced by carbonation, the surface can become colonized by organic growth. Concrete surfaces can have more organic growth contamination than mineral deposit. Characteristic deposits can be present on concrete and cement-based products (**9.5.1**), i.e. lime bloom, lime weeping (**9.5.2**)and efflorescence (**9.6**). Aggregates can vary from hard to soft and from acid soluble to acid insoluble; cement, lime, and Roman cements are acid soluble.*

As-cast concrete surfaces and cast-stone units consist principally of cement and other fine constituents. Some of these can be removed by weathering, revealing aggregate particles and causing a permanent difference in surface texture. In exposed aggregate surfaces, finer aggregates of the mix can be revealed by light washing, abrasion, or acid etching, and concrete surfaces can be plain or modelled. Binder and aggregate constituents can respond differently to various cleaning procedures. The cementitious surface of as-cast or steel-floated finishes can be visibly affected by acids and could be affected by acid rain before cleaning is carried out. When the surface skin of a smooth or as-cast finish is removed, the characteristics of the aggregate are as important to consider as the characteristics of the binder matrix.

The constituents of the concrete surface should be determined prior to carrying out a cleaning operation.

A cleaning method should be chosen that minimizes damage to existing surfaces. Aggregate-rich surfaces should not be cleaned by processes that could damage the binder.

Concrete should be cleaned by pressure water washing, abrasion, and application of acidic solutions (e.g. containing hydrochloric acid) or alkaline cleaners. Proprietary acidic cleaners should be used on specific deposits and surface types. Cleaners that readily dissolve cement/lime based binding media should be used if determined practicable.

9 Removal of specific deposits

9.1 Calcium sulfate bound deposits

Calcium sulfate is water soluble and calcium sulfate bound deposits should be removed by water cleaning methods (**10.3**).

NOTE Calcium sulfate derives from weathering of limestone, calcareous stones, marble, lime-based mortars and renders, concrete, and some industrial processes.

9.2 Silica bound deposits

Silica and silica bound deposits should be removed by sodium hydroxide or acid-based methods.

NOTE Silica derives from weathering of sandstones, clay bricks, terracotta, and faience and is not water soluble.

9.3 Cement mortar splashes

Cement mortar splashes should be treated with a dilute hydrochloric acid solution (except for stains on limestone, for which a mechanical cleaning method should be used). Thick and fresh cement splashes should be removed by brushing or scraping with wooden scrapers, or, if hardened, a chisel should be used.

9.4 Calcium carbonate deposits

9.4.1 Lime bloom

*COMMENTARY ON **9.4.1***

Lime bloom can occur on surfaces of coloured concrete or coloured products made with Portland cement that are less than 1 year old. It is usually a thin film that can be patchy or generally distributed over the surface. It is usually transient and disappears on its own.

Removal of lime bloom, if required, should be performed by washing with a 5% solution of hydrochloric acid or a proprietary concrete cleaner of similar concentration, applied in accordance with **10.5**.

9.4.2 Lime weeping

Hard encrustations of calcium carbonate (lime weeping) should be removed with dilute hydrochloric acid. Thick deposits that have developed over years should be softened with a steam gun and brushed or scraped.

NOTE 1 Lime weeping usually occurs beneath joints or cracks where water emerges after percolating through a cementitious or lime-rich masonry core.

NOTE 2 Complete removal of lime weeping is not always possible.

9.5 Efflorescence

Efflorescence (a loose water-soluble deposit of salt crystals) should be removed from a surface as soon as practicable to prevent reabsorption.

NOTE 1 Efflorescence is a surface phenomenon and is not always damaging. However, salt crystallization beneath the surface is very harmful to some porous materials.

The source of efflorescence salts should be identified.

NOTE 2 Efflorescence can be due to salts from the atmosphere or materials of construction, de-icing salts, or sources activated by water-based cleaning methods (or other form of water ingress), or remains of a chemical cleaning agent.

Surface salts should be removed by brushing with a soft brush. The powder should be collected simultaneously and contained for disposal. On a large scale, this should be performed using an industrial vacuum cleaner with a soft brush attachment and fine dust collection sack. Light deposits should be removed (or reduced) with a clean, damp sponge with frequent rinsing in clean water so the water-soluble material is drawn into the sponge.

NOTE 3 Wetting with water can lead to reabsorption and further efflorescence.

NOTE 4 Surface salts may be allowed to weather away instead of using a chemical efflorescence treatment that could produce immediate visual effects, but may also leave a different suite of damaging salts if not completely removed by rinsing.

Reduction of salts from within pores should be carried out with plain clay poultices (**10.5.2.2**) and (**D.4.1**).

9.6 Bird fouling

Bird fouling deposits should be sterilized prior to removal, or protective clothing and breathing equipment should be worn. Deposits should be wetted carefully so as not to disturb dust and sodium hydroxide-based degreasant applied with neutralization as appropriate. The deposits should then be removed with a scraper or by water rinsing.

Hazardous waste should be collected and bagged for disposal by a licensed waste disposal agent.

Rinsing water should not run into other parts of the building where it could deposit nutrients that could encourage biological growth.

9.7 Paint and graffiti

9.7.1 General

Cleaning work on graffiti should be carried out to distinct boundaries to avoid unsightly cleaned contact areas on the surfaces. The type of paint used should be indentified prior to attempts to remove it.

Oil based paints should be removed with alkaline cleaners.

NOTE Many paints and some graffiti can be removed with solvent paint removers conforming to BS 3761.

9.7.2 Paint

Paint layers should be softened with steam or solvent-based or alkaline agents. Softened residues of lead-based paints should be collected and bagged for disposal by a licensed waste disposal agent.

Flame burners and hot air guns should not be used on masonry surfaces (moisture inside masonry can expand and cause an explosive shattering of the hot surface).

Lime and cement-based paints should be carefully removed with steam or abrasive methods.

On robust masonry, very low impact abrasives should be used to remove the final residues of softened paint.

NOTE Abrasive paint removal can damage the substrate, especially brickwork or soft mortar. Aged paint can be harder than its substrate.

On-site trials should be carried out (see **4.6** and **4.7**) and a detailed specification of materials and procedures should be prepared prior to carrying out a paint removing operation. Multiple applications of a system or several removal systems should be used if required. The appearance of the stripped surface should be assessed to decide if further cleaning is required.

9.7.3 Graffiti

Graffiti should be removed as soon after it appears as practicable.

Water-soluble graffiti should be removed with a non-aggressive liquid detergent in hot or cold water and scrubbing with soft brushes. Abrasive methods should be avoided.

Chemical cleaners based on organic solvents, alkaline agents and bleach should be used to remove aerosol and felt-tip markers as applicable. Chemical cleaners should be thoroughly removed after a very short dwell time.

NOTE 1 Inclusion of a graffiti remover within a poultice can limit the extent of stain transfer and improve contact between the cleaning agent and marker. Many solvent-based agents do not function on pre-wetted surfaces and some are flammable.

*NOTE 2 It is not always possible to remove graffiti without leaving ghost staining (**9.13**).*

Trials on localized areas of each type of graffiti marker should be carried out with a range of cleaners to determine which are most effective.

NOTE 3 Removal of graffiti can also remove atmospheric deposits, leaving light patches on masonry.

Anti-graffiti coatings should be vapour permeable and should not cause changes in colour or texture of the surface. Coatings should be easily removable.

Consent should be sought prior to application of anti-graffiti coatings to listed buildings.

9.8 Coal tar, pitch and bitumen

Coal tar, pitch and bitumen should be softened with steam or hot water (if required) and removed by careful scraping. Care should be taken on porous materials not to spread the deposit or press it into the pores.

After scraping, an emulsifiable solvent mixture should be brushed directly onto the dry masonry surface. After an appropriate dwell time, the debris should be rinsed off with pressurized water, followed by application of sodium hydroxide-based degreasant and further rinsing and neutralizing if required. The surface should be allowed to dry, and poulticed with a white spirit mixture if required.

NOTE Old coal tar and pitch are usually very hard and firmly adhered to porous substrates, and scraping can readily damage the substrate. Deposits on plain surfaces need to be embrittled by cooling with ice or solid carbon dioxide. Coal tar can contain carcinogens. Care is needed when removing coal tar and disposing of residues.

9.9 Bird-repellent gel

The bulk of bird-repellent gel should be removed with wooden or plastic scrapers and collected in sealable containers. The remainder should be softened with a solvent-based paint stripper or alkaline paint remover or cleaning agent, and rinsed from the surface with low pressure hot water.

NOTE This can leave a residual grease stain; in such cases a solvent based poultice may be used to reduce it.

If an alkaline paint remover or cleaning agent is used, the surface should be thoroughly rinsed with water, neutralized with weak organic acid and further thoroughly rinsed with copious amounts of clean water.

9.10 Heavy and light oils

Heavy and light oils should be removed with an emulsifying or degreasing agent. White spirit should be used with care, as it evaporates slowly and can spread the deposit further into the surface. Deep deposits should be poulticed with white spirit.

Residues should be removed with a hot water pressure lance or steam.

NOTE It is not always possible to remove deep deposits of heavy and light oils. Some deep deposits may be removed by oil-consuming microbes.

9.11 Organic growth

*COMMENTARY ON **9.11***

Organic growth includes algae, lichen, fungi, and higher plant life. Each type of growth can have a different effect on masonry (e.g. acid secretion, intergranular forces, disturbance of masonry units and destabilization of masonry walls or structures).

Surfaces should be inspected at close range to determine which organic growths are present, to differentiate organic growth from particulate deposits, to determine if organic growths are alive, and to select a removal procedure. Surface growths can mask the masonry surfaces beneath. They should be removed by dry brushing or scraping, low pressure water or low-pressure super-heated water so soiling, conditions and defects can be inspected.

Heavy growth, small plants, and moss cushions should be removed with stiff fibre brushes, wooden spatulas, scrapers, or a low pressure water lance. Cutting out roots should normally entail repointing and hand/gravity grouting of soil-filled cavities. This should be carried out after the roots have died and withered after treatment with a systemic biocide.

NOTE 1 Deconstruction and rebuilding of masonry might be necessary where root penetration is deep.

The relatively short life of chemical treatments and the possibility of retreatment should be considered prior to deciding whether to apply a biocide to inhibit further growth (see **10.8**).

A biocide may be used to kill some types of organic growth, such as algae, prior to its removal, and to control re-growth; where this is applied to the leaves of higher plants, drift onto the building fabric should be voided. Some biocides risk introducing soluble salts into masonry, and alternative methods of treating organic growth should be used where possible.

NOTE 2 Steam is also very effective at killing and preventing re-growth of some organic growths.

9.12 Metallic stains

*COMMENTARY ON **9.12***

A number of procedures and products have been developed for removing copper, bronze and iron stains. Purpose-made solutions and poultices aimed at removing stain material have mostly been replaced by proprietary products.

Metallic stains should be removed by a chemical cleaning method specifically designed for the purpose.

NOTE 1 Abrasive cleaning removes the surface material to remove the stain.

NOTE 2 Localized use of either treatment can alter smooth surfaces sufficiently to cause a blemish.

9.13 Ghost staining and damage from previous cleaning

*COMMENTARY ON **9.13***

Ghost staining describes two phenomena. One is an apparent stain due to residual soiling deep within the surface (e.g. from felt tip marker pen), that cannot be removed without refacing the masonry. The other is a stain usually caused by penetration of water or other liquid (e.g. oil or bitumen) from beneath the surface, that usually cannot be removed. Damage from previous cleaning [bleaching, etching, streaking from previous HF-based cleaning operations, or gun shading (uneven surface removal), or marks caused by grinding discs, hand tools, etc.] can be impossible to remove, and can become more conspicuous by cleaning.

Sandstones and limestones that have been saturated with water for long periods can be stained deep into the stone, and cleaning should not be attempted. Air abrasive processes should not be used. Some chemical removal materials can bleach the stone and should not be used.

10 Cleaning methods

*COMMENTARY ON Clause **10***

The recommendations of this clause apply mostly to cleaning external surfaces of buildings. Most methods may be used on internal surfaces but might require some adaptation as appropriate.

10.1 General

A cleaning method once selected should be evaluated with on-site trials (see **4.6** and **4.7**) prior to carrying out the cleaning operation.

10.2 Hand brushing and rubbing

10.2.1 General

The precautions described in Annex A should be taken if cleaning buildings by hand brushing and rubbing methods.

10.2.2 Brushing

Brush fibres should not be of a material or hardness that could damage or stain the masonry surface.

Brushing should be carried out wet or dry using no more effort than is required to remove softened or loosely attached dry matter. Surfaces should be checked continuously to ensure no surface damage occurs. Brushing of surfaces should not cause hazardous types or levels of dust.

10.2.3 Hand-held abrasive blocks

Flat or very simply moulded sound surfaces, with low intrinsic value, that have superficial but stubborn soiling, should be cleaned with a hand-held gritstone or carborundum block lubricated with water.

10.2.4 Plastics mesh non-abrasive hand scourers

Terracotta, faience and glass should be cleaned with plastics mesh non-abrasive hand scourers.

NOTE Self-adhesive stickers may be removed from smooth surfaces with plastics mesh non-abrasive hand scourers.

10.3 Water cleaning

NOTE Some precautions for water cleaning are described in Annex B.

10.3.1 General

Large amounts of water are potentially hazardous to buildings and proper precautions and supervision should be provided so that water does not enter core material, internal iron, plaster, and wood. A system should be established so that the minimum practicable amount of cleaning water is used, and that all potential water entry points are thoroughly sealed with sheet, tape, battens, or non-staining plugging material. Temporary catchments and gutters should be provided, if required, to efficiently remove water from the building and to avoid over-saturation at lower levels.

NOTE Quality of water is important. In some non-potable supplies, a high iron content can cause brown surface stains. Non-ferrous, non-corroding pipes, fittings, nozzles, booms, etc., may be used to avoid staining.

Area drains, including roofs and balcony outlets, should be inspected for efficiency prior to carrying out water washing.

10.3.2 Nebulous water and fine water sprays

Nebulous water, if used, should be tightly screened so that it cannot be transported around the building by draughts. After deposits are softened, they should be removed by brushing or pressure jets as appropriate.

Fine sprays of cold water should be used to soften tougher deposits. After softening, deposits should be removed by brushing or pressure jets as appropriate.

For nebulous water and fine water spray cleaning, the amount of water used should be the minimum required to just keep the surface wet.

10.3.3 Pulse cleaning

Pulse cleaning (water sprayed in pulses controlled by an electronic timer) should be used to reduce the quantity of cleaning water used on a complex facade, if applicable. Softened deposits should be removed by brushing.

10.3.4 Hot water

Hot water (at least 80 °C) should be used to improve the solubility of alkaline cleaning agents to soften and remove some paints.

Hot water should be used to rinse off paint and graffiti removers.

10.4 Pressure operated cleaning

NOTE Some precautions for pressure operated cleaning are described in Annex B.

10.4.1 Water and air pressures

Water and air pressures (just behind the nozzle) should conform to the ranges given in Table 5.

Table 5 **Operating pressures**

Cleaning method	Low pressure psi (bar)	Medium to high pressure psi (bar)
Air abrasion	up to 40 (2.75)	40 to 100 (2.75 to 6.9)
Water washing	up to 250 (17)	250 to 1 000 (17 to 69)

NOTE The operating pressures given in Table 5 are not necessarily the pressures at the wall face. These can be strongly influenced by other significant factors, including:

a) air, water and abrasive flow rates;

b) nozzle shape and size;

c) abrasive shape, hardness and size;

d) distance between the nozzle and wall;

e) distance and height between the pressure equipment and the work face;

f) angle of direction of the nozzle; and

g) nozzle wear.

All the factors, including equipment pressure, should be selected and adjusted to suit the substrate and soiling for each individual case. Nozzle wear and the frequency of replacement required to maintain consistent performance should be considered prior to carrying out a cleaning operation involving pressure nozzles and abrasives.

10.4.2 Pressure washing

10.4.2.1 Low pressure washing

Fan or cone jet nozzles of 25° minimum should normally be used for low pressure washing (hot or cold water). Water pressure (see Table 5) and type of nozzle should be adjusted as applicable to the substrate and its condition. Rotating nozzles should be used for rinsing inside recesses of complex surfaces (e.g. carvings). Pressure, angle and nozzle distance from the surface should be carefully controlled. Cleaning should be carried out by wetting and softening (rather than cutting with the water).

Low pressure washing should be used after softening the deposit with fine water spraying, or to rinse off superficial deposits (e.g. organic growth) from masonry prior to carrying out another cleaning process. Low pressure water should be used for rinsing off wet abrasion debris and for prewetting and rinsing surfaces for chemical cleaning.

10.4.2.2 Medium to high pressure washing

Medium to high pressure washing utilizes water cutting action and should be used only on impact-resistant surfaces.

Very high pressure washing (hydroblasting) should not be used on historic masonry.

10.4.3 Steam cleaning

Steam cleaning should be used for operations that require low water usage (e.g. building interiors).

Steam cleaning (with suitable detergents or chemicals) should be used to remove isolated deposits (e.g. bitumastic paint, oil, grease, and chewing gum).

Care should be taken to ensure that steam cleaning does not cause deposits to move to the edge of the cleaning area, giving an uneven appearance.

NOTE Small scale steam equipment may be used to remove paint and limewash from internal plaster surfaces.

10.4.4 Abrasive cleaning

10.4.4.1 General

When using abrasive cleaning the precautions described in Annex C should be taken.

10.4.4.2 Dry air abrasion

*COMMENTARY ON **10.4.4.2***

In dry blasting, abrasive particles are directed in a stream of compressed air at masonry surfaces. The particles knock or cut off soiling on impact and part of the masonry surface could be removed as well. Abrasive cleaning equipment comprises an air compressor and a pressurized storage pot, to which a hose and nozzles of various shapes and sizes are attached. Some storage pots are small enough to be placed and directly controlled at the level of cleaning. Others are operated at ground level.

Air pressures and abrasive feed to dry air abrasion nozzles should be carefully controlled. The lowest pressure practicable for the cleaning operation should be used.

Quartz and flint are hazardous to health and should not be used as abrasives.

NOTE 1 The following abrasives may be used for dry air abrasion:

a) calcium silicate;

b) aluminium silicate;

c) crushed stone (e.g. olivine);

d) crushed calcium carbonate;

e) mineral slag;

f) copper slag;

g) crushed almond shells and olive stones;

h) glass beads; and

i) aluminium oxide.

NOTE 2 If dry air abrasive cleaning is used on siliceous masonry materials (e.g. sandstone and granite), free silica is produced irrespective of the type of abrasive medium used.

10.4.4.3 Parameters affecting dry air abrasion

The hardness, velocity and concentration of abrasive cleaning particles, the distance between the nozzle and the surface, the configuration of the nozzle, and the angle of abrasive impact should be carefully chosen as appropriate.

NOTE 1 Typical hardness values of abrasives are given in Table 6.

Table 6 **Hardness of abrasives**

Abrasive	Hardness Mohs
Calcium carbonate	2.5 to 3.0
Sodium bicarbonate	4.0
Glass bead	4.0 to 5.0
Crushed glass	5.0 to 6.0
Aluminium silicate	6.0 to 7.0
Olivine	6.5 to 7.5
Iron silicate	7.0 to 8.0
Silicon carbide	7.0 to 8.0
Aluminium oxide	9.0

Abrasive cleaning equipment should enable the pressure, volume of air and concentration of abrasive feed to be easily adjusted. Abrasive cleaning should only be carried out by trained and experienced operatives.

NOTE 2 Abrasive cleaning methods cannot remove deeply penetrated soiling without removing the stained surface. Losses to the surface might be unacceptable and could cause long term soiling, weathering and deterioration problems.

NOTE 3 Dry abrasive systems do not eliminate use of water as surfaces need to be rinsed down afterwards. It is difficult to remove all residual dust from a building facade after this type of cleaning. The immediate appearance can be deceptively light or even, and the true appearance of the cleaned stone might only be apparent after a few months of weathering.

10.4.4.4 Dry micro-abrasion

NOTE Dry micro-abrasion may be used in the workshop or on site, for surfaces and features of historical value (e.g. sculptures).

The following very fine abrasives (15 µm to 200 µm) should be used for micro-abrasion:

a) calcium carbonate;

b) aluminium oxide;

c) sodium bicarbonate;

d) silicon carbide;

e) glass beads; and

f) crushed glass.

10.4.4.5 Wet air abrasion

*COMMENTARY ON **10.4.4.5***

Wet air abrasion (wet blasting) is similar to dry air abrasion but with water introduced into the air and abrasive stream at the nozzle, by a separate delivery line, to contain the dust.

The particulate-containing mist in wet air abrasion cleaning can be hazardous to health, and safety precautions should be taken.

Slurry produced during wet air abrasion cleaning should be rinsed from the wall as soon as practicable.

Air pressure, water, and abrasive feed to wet air abrasion nozzles should be carefully controlled. The lowest pressure practicable for the cleaning operation should be used.

Sand and flint are hazardous to health and should not be used as abrasives. The abrasives listed in **10.4.4.2** should be used for wet air abrasion.

10.4.4.6 Pressure water systems carrying abrasive

There are a number of systems that use pressure water as a vehicle for the abrasive, other than wet air abrasion (**10.4.4.5**), and the suitability and effectiveness of these for a cleaning operation should be assessed by trials prior to use (see **4.6** and **4.7**).

10.5 Chemical cleaning

*COMMENTARY ON **10.5***

Further information on chemical cleaning is provided in Annex D.

10.5.1 General

Care should be taken in selection of a chemical cleaner for each type of material, surface or soiling.

The composition of a chemical cleaner should always be known before it is used.

If other treatments (e.g. biocides or water repellents) have been applied to the facade, the chemical cleaner should be selected so as not to react harmfully with this treatment.

The gentlest cleaner should be tried first on the facade (i.e., detergent before acids or alkalis), and the shortest dwell time should be used. Alkali-based cleaners may be used to remove or break down grease-laden deposits prior to cleaning with acid-based cleaners. Acid cleaners may be used with or without alkaline cleaners. Where they are used, alkaline cleaners should be thoroughly rinsed off, neutralized and further thoroughly rinsed with copious amounts of clean water.

The effectiveness of chemical cleaners depends on the temperature. Strength and dwell times established during on site trials should be confirmed appropriate for the weather conditions during the cleaning operation.

The following procedures should be carried out if chemical cleaners are used:

a) surface prewetting;

b) protection of vulnerable materials during cleaning;

c) thorough rinsing;

d) neutralization of the cleaned surface; and

e) thorough rinsing on completion.

Chemical cleaners should be confined to prevent streaking or other damage outside the cleaning area.

10.5.2 Application

NOTE Chemical cleaning agents may be applied by brushing, spraying or towelling on as poultices.

10.5.2.1 Pre-wetting, application and rinsing

Surfaces should be:

a) pre-wetted with clean water before each application of chemical, to reduce absorption; or

b) dry, if the chemical is applied as a poultice.

After the surface water has drained down, the cleaner should be evenly applied (diluted or undiluted) by brush or spray.

Each application should dwell on the surface for the time determined during on site trials (this can be considerably less than the manufacturer's recommended dwell time).

The chemically treated surface should not be allowed to dry out. If a single application only is required, it should be rinsed off before drying. If long contact times are required, the cleaner should be reapplied before it can dry out.

The chemical should be rinsed off at a pressure applicable to the type and condition of the masonry and joints.

Rinsing should remove the cleaner by volume of water flow, not pressure.

NOTE 1 Excessive rinsing pressures can cause joint erosion and water penetration.

A rinse pattern should be adopted in which the bulk of the cleaner is removed first at low pressure, followed by several complete rinses at a higher pressure. Rinsing should start at a bottom corner of the surface and proceed horizontally, working slowly upwards, with at least 1 min of rinsing per square metre for the initial rinse. Subsequent rinses should be carried out with 2 min application per square metre of surface.

Alkaline cleaners should be neutralized with an acidic agent, and this should be rinsed thoroughly from the surface after use.

NOTE 2 The surface may be tested for residues with pH test strips. Allowance needs to be made for the pH of rinsing water, which might not be neutral. pH testing does not indicate whether chemical cleaners have been absorbed at depth.

10.5.2.2 Pack or poultice cleaning

Pack or poultice materials (e.g. sepiolite clays, paper pulp and methylcellulose) should be used, if applicable, for cleaning and drawing out stains and salts, or as a vehicle for cleaning formulations.

Pack or poultice materials should be applied as pastes in thick and even layers. Packs should be covered with plastics film during the dwell time, poultices left uncovered.

Deposits on areas of limestone or marble substrates vulnerable to running water should be softened with water carried in paper pulp or clay poultices, covered by a plastics film to inhibit drying.

Deionized water should be used, if applicable, for especially vulnerable surfaces.

If possible, non-volatile chemicals should not be used in poultices covered with plastics film, as residues can be left in the masonry, causing efflorescence or subsurface crystallization.

Poultices should be removed dry and packs wet. Surfaces should be thoroughly rinsed and, if required, neutralized and rinsed again.

10.6 Mechanical cleaning

10.6.1 Scalpel cleaning

Scalpel cleaning should be used to remove paint from small scale detail. Light hand pressure should be applied. Scalpel cleaning is a sensitive and labour intensive method and should only be used on valuable surfaces.

10.6.2 Tooling

Tooling (dressing back heavy encrustations of dirt with small, sharp chisels and mallets) should be carried out by experienced stone masons.

10.7 Laser cleaning

CAUTION. Lasers can damage some historic pigments and as such caution should be exercised if it is likely that there is historic polychromy surviving beneath the soiling

The use of laser cleaning should be restricted to light coloured surfaces e.g. Portland limestones, Bath limestones, Carra Marble and some terracottas. It is less effective on red and medium coloured terracottas and sandstones.

Damage from incorrect use of a laser can be severe, resulting in mineralogical, colour, and other surface changes. The type of laser beam and parameters for its use, should be established during trials carried out prior to cleaning (see **4.6** and **4.7**).

10.8 Biocides

Biocides should be applied to weather-protected surfaces. Existing growth should first be killed off, in accordance with **9.11** then the biocide should be reapplied (after cleaning) to inhibit further growth. Loose dirt and dust should be removed before applying the biocide. Some growths (e.g. lichen) should be pre-wetted, if applicable, to aid absorption of the biocide.

Dead growth should be removed by scraping and brushing. Dust and debris should be carefully collected, sealed in plastics bags, labelled, and disposed of safely.

NOTE 1 Biocides can have a short effective lifespan. Regular retreatments can have a cumulatively damaging effect on masonry. Biocides containing phosphates can encourage the growth of algae.

NOTE 2 Attention is drawn to the Control of Pesticides Regulations 1986 (1997) [2].

11 Health and safety

*COMMENTARY ON Clause **11***

The recommendations of this clause concern the manner of dealing with typical hazards to health and safety that can be encountered in the cleaning of buildings and structures. It is beyond the scope of this British Standard to provide complete coverage of all aspects, and attention is drawn to current legislation in relation to health and safety and the relevant statutory requirements.

The public should not be admitted to cleaning operation sites.

The least hazardous product and system of working that is effective should be selected for the cleaning operation. All risks should be identified, assessed and managed.

NOTE Whichever cleaning materials and methods are used, building cleaning presents site operatives with a number of risks when working:

a) at heights where falling can have serious consequences;

b) on building elements of unknown stability and integrity;

c) on scaffolding which depends on correct erection, and which, by its nature, involves unusual and potentially dangerous situations;

d) in harsh and unsafe weather conditions;

e) with potentially hazardous materials, but especially corrosive chemicals (e.g. acids and alkalis) and those with tribological qualities (e.g. soaps, oils and greases); and

f) with certain cleaning methods which involve electrical equipment, trailing leads, ropes, high pressure jetting; combinations of water and rubber materials with other materials and liquids are also potentially hazardous.

Health and safety issues should be clearly identified at the project appraisal stage. Hazard data sheets, and health and safety information should be available on site, with their exact location known to all staff.

Cleaning consultants and contractors should identify the types of residue (i.e. effluent) of building cleaning operations – residues from soiling (including the products of pollution), paint and other surface treatments, especially those involving chemicals which, when discharged to drains, are described as trade effluents. The safe disposal of these residues should be planned before any cleaning work is started.

NOTE Attention is drawn to The Control of Substances Hazardous to Health Regulation 2002 (COSHH), the Health and Safety Executive [3].

Annex A (normative) Precautions for hand cleaning

A.1 Hand brushing

When cleaning by hand brushing steel wire, brushes and brushes with coarse bronze wires should not be used as they can damage the surface. In addition, metallic brushes can corrode and stain masonry if used with acid cleaners.

NOTE Caution is required when using brushes with natural bristles as they can be dissolved by alkaline cleaners and can stain masonry.

A.2 Hand held abrasive blocks

Hand held abrasive blocks should not be used on historic masonry but they can be used on other masonry provided that there is a good level of operative control.

A.3 Plastics mesh non-abrasive scourer

Plastics mesh non-abrasive scourers should only be used on smooth surfaces and small areas.

A.4 Scalpel cleaning

Scalpel cleaning should be carried out by an operative with a high level of skill and is very slow. It may be used to dislodge adherent portions of substrate but can leave remains of coatings within masonry pores.

Annex B (normative) Precautions for water cleaning

B.1 Nebulous cold water spray

Sheeting protection should be used when using a nebulous cold water spray to prevent fine spray drift to stop water penetration and associated damage.

B.2 Low pressure cold water spray

*COMMENTARY ON **B.2***

Low pressure cold water spraying can damage friable stone, soft stone, and weathered or sound sand-lime mortar joints.

Water penetration and staining problems can occur due to the large quantities of water used with this method.

Sheeting protection should be used.

B.3 Low pressure hot water spray at a minimum set temperature of 80 °C

Glass, putty, paintwork, plastics pipes, window frames, and guttering should be protected, for example with sheeting material, when using low pressure hot water spray at a minimum set temperature of 80 °C.

B.4 Medium-high pressure cold water spray

*COMMENTARY ON **B.4***

Medium-high pressure cold water spraying requires a high level of operative control and can have a cutting effect on surfaces. It can also break down friable or delicately carved detail and remove aged but sound mortar pointing.

The method should not be used for initial rinse of chemical cleaning agents as it can cause uncontrolled dispersal of concentrated chemical.

B.5 High pressure cold water spray

High pressure cold water spraying should only be used on sound, hard and very robust surfaces.

High pressure cold water spraying should not be used on historic masonry surfaces.

B.6 Steam cleaning

*COMMENTARY ON **B.6***

Sulfated limestone surfaces can quickly soften and erode with steam cleaning.

Trials should be carried out to (see **4.6** and **4.7**) ascertain the effect of steam temperatures on stone, brick, terracotta and their joints. Steam and condensation can cause problems in interiors of buildings.

Annex C (normative) Precautions with abrasive cleaning

C.1 Dry air abrasion

Dry air abrasion should not be used on:

- Terracotta, most brickwork and many types of sandstone and limestone.
- Surfaces with variable hardnesses or textures.
- Surfaces with soft mortar joints.
- Arrises, mouldings and carvings.

The operator should observe and evaluate the cleaning effect on different soiling and surface conditions, to avoid producing undulations (gun shading) and/or a mottled finish.

Adjacent surfaces should be protected.

The method should be followed by pressure water rinsing to remove dust from wall surfaces followed by low pressure water rinsing.

NOTE Cleaning with dry air abrasive might result in a partial clean. Attempting to clean the masonry completely might result in the removal of surface

C.2 Micro-abrasive (dry)

Dry micro-abrasive techniques should not normally be used on glazed or polished surfaces. Dry micro-abrasive methods should not be used to remove deep soiling.

C.3 Wet air abrasion

Wet air abrasion can damage masonry as slurry and spray can block visibility of the surface. In addition, the collection and the disposal of wet spent abrasive is a major task.

Wet air abrasion should always be followed by pressure water rinsing to remove slurry from wall surfaces.

Annex D (informative) Further information on chemical cleaning

D.1 Liquid detergent

D.1.1 Applicability

Liquid detergent may be used diluted in hot or cold water to remove greasy or loosely adherent soiling and materials with organic binders from most surfaces, with hot water being most effective.

Liquid detergents are mainly used on internally and externally glazed surfaces, and may be used on masonry interiors.

Liquid detergents do not remove chemically-bonded soiling.

D.1.2 Precautions with liquid detergent

Liquid detergent needs to be thoroughly rinsed from surfaces as some contain alkali and can deposit soluble salts.

D.2 Acid-based cleaning

D.2.1 Hydrofluoric acid based solutions

D.2.1.1 Applicability

Hydrofluoric acid (HF) based solutions may be used on some sandstones, some types of brick, unglazed terracotta, and some unpolished granite surfaces, often after alkaline degreaser. They can also be used as thixotropic dilute solution on unglazed terracotta.

Usage at short dwell times and/or low concentration needs to be investigated.

D.2.1.2 Precautions

Hydrofluoric acid based solutions can be detrimental to building materials, to health and to the environment and are only to be used if no suitable alternatives are available.

Hydrofluoric acid based solutions are not suitable for use on limestones, marbles, lime-based renders, calcareous, argillaceous and dolomitic sandstones, polished granite, knapped flint, glazed bricks, glazed terracotta, zinc, aluminium, glass and ceramic glazes.

Hydrofluoric acid based solutions can cause the following issues:

a) chemical and physical alteration of stone (particularly calcareous and argillaceous sandstones);

b) high retention of chemical ions is possible in sandstone;

c) reaction products can remain in porous masonry and defective joints, which can result in discoloration and decay;

d) removal of natural brown iron surface staining on some weathered sandstones, leading to discoloration and bleaching;

e) dissolving and redepositing of iron at the surface of sandstones as brown or orange staining; and

f) damage to lime-based mortar.

Pre-wetting and rinsing procedures only to be carried out consistently with the hydrofluoric acid based solutions.

Dwell times and concentrations need to be kept to a minimum as acid can cause damage if it is allowed to dry out on surfaces.

A high standard of building protection needs to be used.

NOTE Streaks, splashes and chemical runs onto surfaces below the work area are difficult to avoid if the solution is not thixotropic.

D.2.2 Ammonium bifluoride (ammonium hydrogen fluoride)

D.2.2.1 Applicability

Ammonium bifluoride NH_4HF_2 (ammonium hydrogen fluoride) may be used for cleaning sandstones, unpolished granite, brickwork, and unglazed terracotta.

D.2.2.2 Precautions

Ammonium bifluoride dissolves lime-based mortars so it is essential that is does not come into contact with limestone, marble calcareous sandstones, some slates, and lime-based mortars.

Ammonium bifluoride can damage calcareous, dolomitic or argillaceous sandstones and granites. If possible, alternative cleaning materials or methods are preferable for these substrates.

Ammonium bifluoride as it etches glass and ceramic glazes and is therefore not suitable for use of these.

D.2.3 Hydrochloric acid based solutions

D.2.3.1 Applicability

Hydrochloric acid (HCl) based solutions may be used to clean cement and mortar stains from masonry.

Hydrochloric acid based solutions may be used in some proprietary treatments for efflorescence.

D.2.3.2 Precautions

Hydrochloric acid based solutions are not suitable for use on lime mortar, limestone, marble, zinc or aluminium.

Concentrations and dwell times need to be kept to a minimum.

Hydrochloric acid based solutions can form and deposit soluble salts.

D.2.4 Weak organic acids

D.2.4.1 Applicability

Weak organic acids [e.g. acetic acid (CH_3COOH)] may be used to neutralize alkaline cleaners on calcareous surfaces, and are used in some proprietary neutralizing products.

D.2.4.2 Precautions

Weak organic acids are not suitable for use on highly acid-sensitive surfaces.

D.2.5 Formulations containing phosphoric acid (orthophosphoric acid)

D.2.5.1 Applicability

Formulations containing phosphoric acid H_3PO_4 (orthophosphoric acid) may be used with hydrofluoric acid solutions to counteract attack on iron constituents in masonry (usually sandstone).

D.2.5.2 Precautions

Formulations containing phosphoric acid are not suitable for use on limestone or marble.

D.3 Alkali-based cleaning

D.3.1 Applicability

Alkali-based cleaning methods may be used on sandstone, brick, glazed and unglazed terracotta, granite, and limestone as a degreasing agent to break down heavy thicknesses of soiling.

Alkali-based cleaning methods may also be used prior to application of an acid cleaner.

Weak organic acid after-wash may be applied after cleaning to neutralize limestone and siliceous surfaces.

Alkali-based cleaning methods may be used to soften oil-based paints, destroy unwanted organisms and spores on a masonry surface and in bird droppings.

Sodium hydroxide and potassium hydroxide-based formulations can expediate the rate of softening of soiling matter on limestone and reduce the amount of cleaning water required.

D.3.2 Precautions

High concentrations, extended dwell times and repeated applications need to be avoided with alkali-based cleaning agents and surfaces need to be thoroughly pre-wetted.

After removal of alkali-based cleaning agents, masonry surfaces need to be thoroughly rinsed and neutralized.

NOTE Alkali-based cleaning agents can cause brown staining on limestone if not completely rinsed, salt crystallization damage, especially on highly porous surfaces, streaking and uneven cleaning if applied unevenly, physical and chemical alteration of stone and sodium hydroxide and potassium hydroxide can damage paint, aluminium and zinc (galvanized) surfaces.

D.4 Clay poultices

D.4.1 Plain clay packs and poultices

D.4.1.1 Applicability

Plain clay packs and poultices (i.e., not containing chemicals) may be used to soften soiling deposits on limestone and marble surfaces and remove soluble salts.

Plain clay packs and poultices may be used on ornate limestone surfaces with nebulous water spray washing.

D.4.1.2 Precautions

Application of plain clay packs and poultices could require an experienced specialist applicator.

Used clay need to be bagged for disposal by a licensed waste disposal agent.

Plain clay packs and poultices need to be applied in thicknesses of at least 6 mm.

Surfaces need to be brushed or rinsed after removal of the plain clay pack or poultice.

D.4.2 Clay-based aqueous poultice with sequestering agents

D.4.2.1 Applicability

Clay-based aqueous poultices with sequestering agents may be used in proprietary products on limestone, marble and concrete surfaces.

Clay-based aqueous poultices with sequestering agents may be used for general cleaning and removal of metallic and other deep stains and localized areas of atmospheric soiling.

D.4.2.2 Precautions

Used clay need to be bagged for disposal by a licensed waste disposal agent.

Clay-based aqueous poultices with sequestering agents need to be covered with impervious sheeting throughout the dwell time (up to 24 h).

Thorough rinsing with cold water is required after removal.

D.4.3 Alkaline clay-based poultice

D.4.3.1 Applicability

Alkaline clay-based poultices may be used in proprietary products on granites, sandstones, unglazed terracotta, soiled sandstone water tables, sills and cornices.

D.4.3.2 Precautions

Alkaline clay-based poultices need to be completely removed from surfaces, including joints, when soft. Cleaned surfaces need to be rinsed and neutralized.

Alkaline clay-based poultices can deposit alkaline residues.

D.5 Graffiti and paint removers

D.5.1 Solvent-based paint removers

D.5.1.1 Applicability

Solvent-based paint removers may be used to remove most modern paint coatings.

Solvent-based gels may be used to remove aerosol paint.

NOTE Attention is drawn to legislation limiting the use of solvent-based paint removers.

D.5.1.2 Precautions

Some graffiti removers can bleach colour-sensitive sandstones.

Cleaned surfaces should be thoroughly rinsed with hot water and neutralized.

D.5.2 Alkaline paint removers

D.5.2.1 Applicability

Alkaline paint removers are very effective in removing oil-based paints and are available in a variety of gel and paste consistencies.

D.5.2.2 Precautions

Some alkaline paint removers require covering during extended dwell time on heavy paint build-ups.

Surfaces need to be thoroughly pre-wetted.

Alkaline paint removers are not suitable for use on timber. Alkaline paint removers can cause brown staining on limestone if not completely rinsed.

Alkaline residues can cause salt crystallization damage, especially on highly porous surfaces.

Alkaline paint removers can cause streaking and uneven cleaning if not applied evenly.

Alkaline paint removers can cause physical and chemical alteration of stone.

Sodium hydroxide and potassium hydroxide can cause damage to paint, aluminium and zinc (galvanized) surfaces.

Cleaned surfaces need to be thoroughly rinsed and neutralized.

D.5.3 Sodium hypochlorite (NaClO) clay pack

D.5.3.1 Applicability

Sodium hypochlorite (NaClO) clay packs may be used to remove felt-tip pen markings from glazed and unglazed bricks, travertine marble, smooth granite, smooth concrete, and cement render.

D.5.3.2 Precautions

High concentrations and extended dwell times need to be avoided.

Used clay needs to be bagged for disposal by a licensed waste disposal agent.

Thorough rinsing with cold water needs to be applied after removal of sodium hypochlorite clay packs.

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