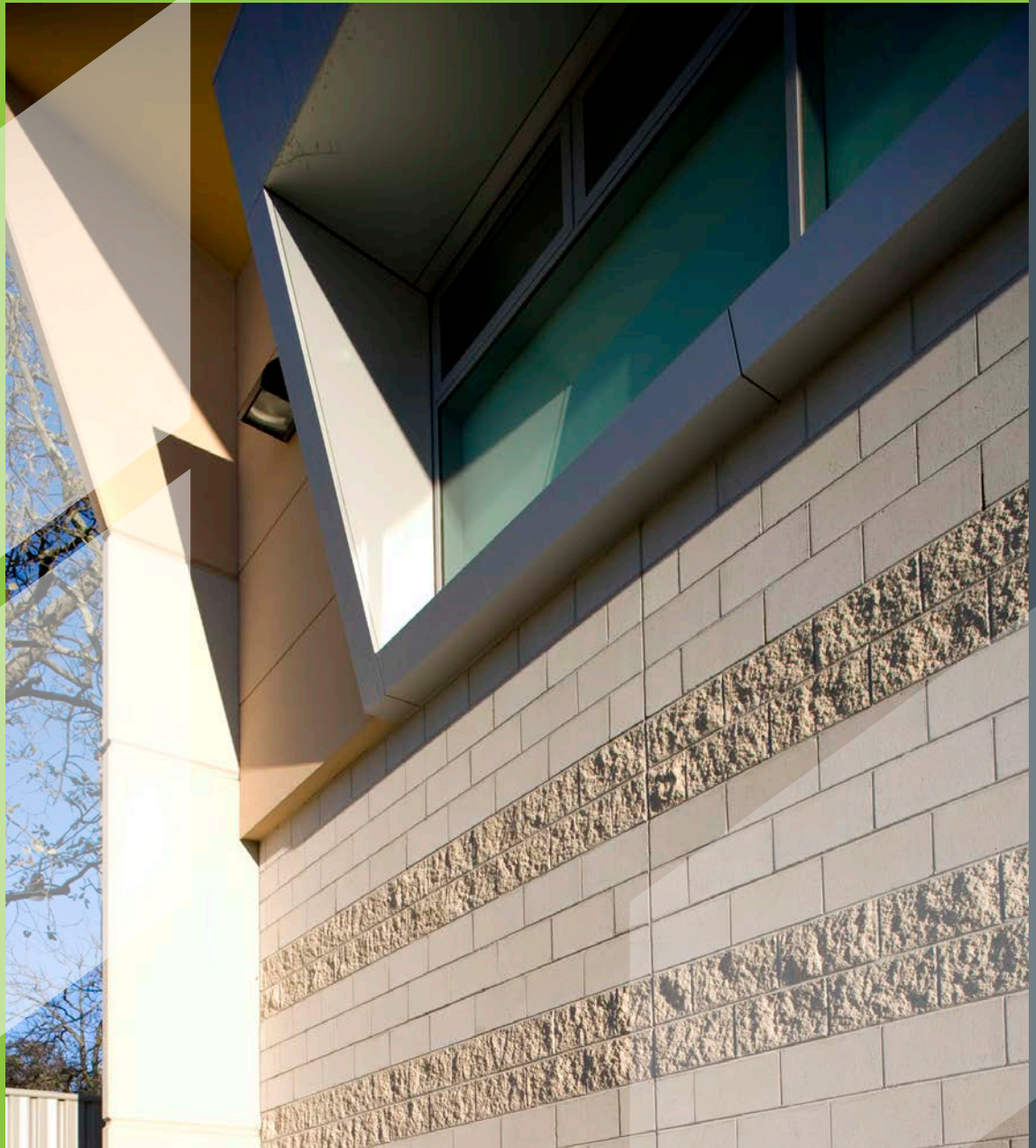


Concrete Masonry Walling



MA41

Concrete Masonry Structures Cleaning and Maintenance

CMAA

CONCRETE MASONRY
ASSOCIATION OF AUSTRALIA

Concrete Masonry
Association of Australia

PO Box 370
Artarmon NSW 2064

T: 02 8448 5500

F: 02 9411 3801

E: admin@cmaa.com.au

W: www.cmaa.com.au

CONTENTS

Part A: Cleaning of Concrete Masonry

1	DESIGN CONSIDERATIONS	2
1.1	Unit Selection	2
1.2	Mortar Selection	2
1.3	Retaining Walls	2
1.4	Copings, Sills, Weathering	2
1.5	In-built Elements	2
1.6	Water Repellant Treatment	2
2	CONSTRUCTION TECHNIQUES TO MINIMISE STAINING DURING INSTALLATION	3
2.1	Block Laying	3
3	CLEANING TECHNIQUES	4
3.1	Hand Cleaning	4
3.2	High Pressure Water Cleaning	4
3.3	Low-Pressure Water Cleaning	5
3.4	Steam Cleaning	5
3.5	Sandblast Cleaning	5
3.6	Chemical Cleaning	6
3.7	Cleaning Internal Block Work	7
4	STAIN REMOVAL	7
4.1	Efflorescence	7
4.2	Calcium Carbonate	8
4.3	Acid Burn (Iron Oxide / Rust Stains)	9
4.4	Copper Stains	9
4.5	Organic Growths	10
4.6	Paint and Ink (Graffiti)	10
4.7	Oils, Tar and Grease	11
4.8	Beverages – Coffee, Tea and Cola	11
4.9	Blood	11
4.10	Soil	11
4.11	Dirt, Pollution and Grime	11
4.12	Chewing Gum	11
4.13	Smoke / Fire	12
4.14	Wood (tannin) Stains	12
4.15	Tobacco	12
4.16	Asphalt	12
4.17	Iron and Welding Splatter	12

Part B: Maintenance

1	GENERAL BUILDING MAINTENANCE	13
2	WEATHERPROOFING	13
3	CRACKING, FOOTING, MOVEMENT AND CONTROL JOINTS	13
3.1	Footing Movement	13
3.2	Control Joints	13

References	14
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FIGURES

Figure 1	Typical block wall after laying (a)	4
Figure 2	Typical block wall after laying (b)	4
Figure 3	Damaged block wall due to high pressure cleaning	5
Figure 4	Damaged block wall due to incorrect use of pressure cleaning	5
Figure 5	Efflorescence as seen on block faces (a)	7
Figure 6	Efflorescence as seen on block faces (b)	7
Figure 7	Calcium carbonate on face block work	9
Figure 8	Acid burn on concrete masonry block	9
Figure 9	Copper stains on face block work	9

TABLES

Table 1	Water Jet Cleaning	5
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Part A: Cleaning of Concrete Masonry

This manual covers the cleaning of concrete masonry only and should not be applied to other masonry materials. In addition to detailing cleaning methods, guidance is given on design and construction techniques, to minimise staining and the need for subsequent cleaning.

Simple precautions will help avoid staining and disfigurement and are always preferable to later cleaning. The methods detailed here are based on successful practices implemented over many years. However tests to determine the most effective technique should always be conducted before undertaking any cleaning or stain removal process.

1 Design Considerations

Consideration should be given during design to minimise the occurrence of stains and the need for subsequent cleaning of concrete masonry.

1.1 Unit Selection

The different elements of a block should be taken into account with respect to the location of the masonry and the building. Different textures and colours lend themselves to different purposes and can optimise or enhance the aesthetics of an area. For example, while darker coloured units can mask oil and grimy deposits they tend to accentuate the presence of efflorescence.

1.2 Mortar Selection

Less staining will occur if the mortar selected matches the colour of the unit, preferably with a slightly darker shade. Iron oxide pigments can be used to alter the colour of the mortar. The use of off-white cement in the mortar mix is recommended to minimise stains in lighter coloured units, where the presence of pigments may cause cleaning problems.

1.3 Retaining Walls

In instances where the rear face of the wall does not incorporate a continuous grout curtain, waterproofing methods such as cement rendering, waterproofing membrane or bituminous coatings should be employed. This will prevent the migration of soluble salts through the wall if properly applied. Proper drainage should also be provided behind the wall.

1.4 Copings, Sills, Weathering

Stormwater should be shed so as to clear the masonry immediately below. Copings and sills should project at least 10 mm beyond the wall face at the underside of the sill or coping. Sills should be angled to properly shed water. Water from guttering should be diverted away from the blockwork where the installation of downpipes has not taken place.

1.5 In-built Elements

In-built elements should slope away from masonry. The underside of major construction elements, or soffit, such as balconies or eaves, should be provided with a drip mould. It is desirable for all roofs to be provided with sufficient overhang to protect the wall below.

1.6 Water Repellent Treatment

Caution must be exercised when using water repellents such as silicone on external walls. Though they can control water absorption in the masonry and its joints, they are not water proofers and have a short serviceability life because water can still penetrate under pressure. That said, it can provide a degree of self-maintenance as dirt and grime will wash off rather than be absorbed into masonry during rain. Manufacturer's specifications must be adhered to when opting to use water repellent treatments.

2 Construction Techniques to Minimise Staining During Installation

2.1 Block Laying

Mortar extruded from masonry joints during laying should be cut off with a trowel. This way, a clean cut can be made with little smearing on the unit face. On completion of laying and joint tooling, mortar smears on the work face should be removed by dry brushing. Wet sponging of the mortar joints is a common practice with smooth face blocks. Although this creates a smoother joint finish, it smears a cement-rich mortar film over the unit face that often develops into staining.

Apart from mortar deposits resulting from the laying procedure, other incorrect practices causing mortar deposits on the face work should be avoided which can come from:

Scaffolding

Scaffolding planks should be laid at least 150 mm clear of the wall allowing mortar droppings to fall clear instead of building up on the plank and disfiguring the wall. At the end of each day's work (or when rain interrupts work), the plank nearest the wall should be propped on its edge to prevent mortar which may have collected on it being splattered onto the wall.

Concrete droppings

Masonry supporting reinforced concrete slabs and beams are frequently disfigured by droppings and spattering from the concrete pour. If these deposits are allowed to set, it may be impossible to rectify the damage. Protection is best achieved by covering the walls with plastic sheeting. Where this is not done, any deposits on the wall must be thoroughly removed before they set.

Paint overspray and splashing

Extreme care is needed to avoid paint and timber stains being splashed onto masonry. Dried paint is extremely difficult to remove, therefore prevention is desirable.

Cleaning cavities

The technique of hosing out cavities may be unsuitable for concrete units as it may lead to efflorescence. The best course of action is removing the mortar as it is being laid, which ensures that minimal amounts of mortar need to be cleaned out after the job is completed. Cleanout units should be used at the bottom of the wall so that the hardened mortar can be removed easily from the cavity.

Mortar additives

Some mortar additives if used incorrectly may create problems during the block-cleaning process, examples being:

■ *Air-entraining agents*

Air-entraining agents used to improve the workability of mortar. Its overuse creates a highly porous mortar that is easily eroded during cleaning.

■ *Water modifying agents*

Water modifying agents used to retard the absorption of water from the mortar into the block, is extremely difficult to remove from the block if left on for more than one to two weeks.

■ *Clay content*

Up to 10% of naturally-occurring clay in bush sand is useful in enhancing the plasticity of the mortar. However clay content around 15% is detrimental to the mortar as excessive shrinkage will occur, creating cracks within the mortar and at the mortar/block interface.

■ *Sugar*

Sugar used as a mortar retarder is not recommended as it creates a hard mortar surface that inhibits the absorption of acid, thereby preventing the softening and dissolution of the cement when cleaning mortar residue. The use of sugar in mortar does not comply with the relevant Codes and Standards.

Retaining walls

The rear face of retaining walls should be waterproofed by such methods as cement rendering, use of a plastic sheet membrane or bituminous coating. This will prevent the migration of soluble salts through the wall if properly applied. Drainage must also be provided behind the wall.

Rain interruption

The top of the newly laid walls should be protected with plastic sheeting, when walls are left overnight and during rain periods.

3 Cleaning Techniques

The cleaner the block layer leaves the wall the easier the cleaning task will be. However, in most cases, some additional cleaning will be required to achieve the desired outcome. Basic cleaning advice and techniques are detailed in this section.



Figure 1 Typical block wall after laying (a)



Figure 2 Typical block wall after laying (b)

3.1 Hand Cleaning

Procedure:

1. Wait for mortar to harden.
2. Remove mortar particles with hand tools BEFORE applying water. A wooden paddle or chisel may be used if necessary to remove hardened mortar. It is important to do this step meticulously as it shouldn't be assumed that the solution will remove the build-up.
3. Cover adjacent areas to protect other surface materials from the cleaning process.

NOTE: Test a small area of wall not in a prominent position, to ensure solution does not cause damage to the wall.

4. Wet the wall with clean water until the blocks are saturated. The wall has to remain in this state until the surface is ready to be cleaned, if not continue to wet the dried out areas to prevent the appearance of cleaning stains once the solution is applied.

5. If a stain is being removed using this method, (as outlined in Section 4), the manufacturer's recommendations of the proprietary cleaning solution must be followed.
6. Use a brush or spray to apply the cleaning solution and begin the process from the top of the wall down. It is also important to note to scrub the blocks not joints. It is recommended to clean small areas at a time and working ahead of sunshine so as to avoid surface evaporation of the cleaning solution.
7. Let the cleaning solution stay on the wall or as directed by the manufacturer.
8. Start at the top of the wall, rinse with clean water thoroughly until all surface cleaning products are removed.
9. Repeat until desired results are achieved.

NOTE: Extensive use of cleaning solutions may damage the surface of the block and care must be taken when cleaning away blockwork.

3.2 High Pressure Water Cleaning

Concrete masonry blocks may be damaged due to overpowered water pressures employed for the cleaning application (See Figure 3 and Figure 4), so care should be taken not to damage blocks or mortar joints when using pressure cleaning units, proper training is required.

Guidelines must be carefully followed when operating or maintaining high pressure water cleaning units:

- Never use a straight water jet. Opt for a fan jet with a spray angle of around 15 degrees. It should also be noted that turbo or rotary head attachments damage blockwork and are not recommended.
- Jet should be held no closer than 200mm from the wall.
- Sample a small, hidden area of the surface prior to executing the full scale operation to measure the effectiveness of the cleaning. You can also check the wall for possible damage caused by the system.
- The maximum pressure at the pump should be kept below 6,900 kPa (1,000 psi), to prevent damage to either the masonry units or the mortar.
- For correct water jet pressure to prevent damage to either the masonry units or the mortar refer to **Table 1 (next page)**.
- Chemical cleaning is often used in conjunction with pressure cleaning. The pressure cleaner should not contain the cleaning chemical but should only be used to wet and wash down the wall.
- Avoid pulling hoses against the corners of block work, as this can cause fretting, especially with a pulsating water blaster.

Table 1 *Water Jet Cleaning*

General pressure	Pressure (kPa)	Damage	Cleaning ability
Mains	300	Low	Low
Low	Up to 1500	Low	Moderate
Medium	1500 – 3000	Damage to smooth-face masonry	Moderate to high
High	3000 – 5000	Damage to polished-face masonry	High
Very high	5000 – 50 000	Damage to split-face masonry	High



Figure 3 *Damaged block wall due to high pressure cleaning*



Figure 4 *Damaged block wall due to incorrect use of pressure cleaning*

Procedure:

1. Allow mortar to harden. Cleaning with pressure cleaning equipment should not start before mortar is 7 days old.
2. Remove all large mortar particles with a wooden paddle or chisel BEFORE applying water or cleaning solutions. Be very thorough with this step as it cannot be assumed that pressure cleaning or acids alone will remove these build ups. (It is also crucial because operators may instinctively move the pressure nozzle closer to the wall or increase the strength of the acid to remove the stubborn build up and cause damage to adjacent areas.)

3. Provide adequate protection for all non masonry surfaces adjacent to work areas. Use plastic sheeting and tape to protect windows, doors etc.
 4. Saturate the wall with clean water as well as the masonry below, and keep the surfaces wet throughout the cleaning operation. Cleaning solutions containing dissolved mortar particles will be drawn into a dry masonry wall, causing further staining. A consistent result will be achieved by working on small sections at a time.
 5. Apply the cleaning solution starting at the top of the wall with a cleaning brush. If applying pressure, make sure to use a sprayer that does not reach an excess of 300kPa. Leave solution on wall for 3-6mins, or as directed on the product label. Wash the wall/area with pressure water from top to bottom so all dissolved mortar particles are flushed from the surface. Clean in "runs" from the top of the wall down. The width of a run is usually 1m – 1.2m which should be the typical width in which the operator can maintain full control of the pressure gun. It is important that as the operator is conducting the run that the gun is kept moving to avoid surface abrasion.
 6. Any lumps or smears remaining after initial treatment will require the procedure to be repeated.
- NOTE:** *excessive applications will erode and damage the face of the block.*
7. Once cleaning is finished, return and clean off any loose sand and dirt from the eaves, walls and windows.

3.3 Low-Pressure Water Cleaning

A pump unit projects a low-pressure water jet against the surface to dislodge loosely held material. Often used as a follow up to a loosening process, e.g. chemical or brushing. Cleaning should begin at the top of the masonry so water will run down and pre-soften the dirt below.

3.4 Steam Cleaning

This is not often used because it is slow. However, it can sometimes help remove deep-seated soiling, softening oily, greasy or tarry deposits and for killing mould or algae on damp surfaces.

3.5 Sandblast Cleaning

Both dry and wet sandblasting can be effective in cleaning masonry. Wet blasting is more favoured on building sites as there is a strong awareness of the detrimental health effects of silica dust. It is a viable alternative to acid cleaning, however, the skill of the operator is of paramount importance as incorrect usage can badly damage a surface at a rapid rate.

Grits used for sandblasting can be hard or soft. Suitable grits for use on masonry works include zircon and crushed limestone.

Its wider use is for the removal of calcium carbonate stains. The speed and effectiveness of blasting is measured by:

- The abrasive used
- Nozzle size

- Air pressure
- Nozzle to wall distance.

NOTE: This cleaning method should NOT be used on concrete blocks having a slurry or sand face finish.

Procedure:

1. Wait for the mortar to be at least 7-14 days old.
2. Remove all large mortar particles with a wooden paddle, metal scraper or chisel BEFORE sandblasting. (Make sure this step is meticulously performed as any remaining large droppings of mortar may provoke the operator to excessively sand blast the area and cause irreparable damage).
3. Provide adequate protection for all non-masonry surfaces adjacent to work areas. Use plastic sheeting and tape to protect windows, doors etc.
4. The operator can begin their first test cleaning in which the nozzle can be worked at varying distances from the surface to determine the optimum space. Deciding this from the start can assure the operator the correct working distance to give the best cleaning job with no damage.

3.6 Chemical Cleaning

3.6.1 Acids

Many chemicals can be applied to concrete masonry without appreciable injury to the surface, but strong acids or chemicals with a strong acid reaction should definitely be avoided. Even weak acids should be used only as a last resort as it dissolves the cement matrix of the masonry, beginning at the surface. This leaves the face more porous so that it absorbs more water and exposes more aggregate, thereby changing the colour and texture of the masonry. It should be noted that the use of acids in cleaning should be a last resort to any cleaning operation. Once walls are 'burnt' through acid washing, they cannot be fixed and repaired.

Acid Concentrations and Cautions

The traditional concrete masonry cleaning chemical is hydrochloric acid, (also known as muriatic acid or spirits of salts). Milder acids like citric acid can also be used. The main function is to put Portland cement into solution, that is, dissolve the cement in the mortar mix. It should not be used to remove other stains. The recommended maximum strength for hydrochloric acid is 1 part acid to 20 parts water, and 1 part acid to 10 parts water for milder acids.

Saturate the Wall

The concrete block work must be thoroughly saturated with clean water before any acid solution is applied and kept wet ahead of the acid application. The area to be cleaned must be completely saturated as well as all block work areas below. If the wall appears to be drying on the surface, reapply water until the diluted acid solution is ready to be applied. Failure to completely saturate the wall is a major cause of cleaning stains.

Furthermore saturating the wall keeps the acid solution on the face of the masonry where the mortar smears are present. Recommended acid strengths

are based on application to a saturated wall and it is a myth to consider that pre-wetting 'weakens' the acid.

Acid Application

The general procedure is to thoroughly wet the masonry surface, spray or brush a minimum amount of chemical, allow it to act for 1 to 5 minutes and then scrub. Wash it off using one of the methods described above.

Hose off

If the acid is left on the wall too long it can be absorbed into the block work and may cause permanent staining. It is extremely important to thoroughly hose off the wall with water as the work proceeds. The acid solution and debris cleaned off the wall must not be allowed to dry on the wall. Generally 2m² to 6m² should be treated at a time.

Safety Requirements

All acids and proprietary cleaners are dangerous. Users are required by law to obtain a copy of the manufacturer's Material Safety Data Sheet (MSDS) for every chemical used in the conduct of their work and to only use the product in accordance with the instructions in the MSDS. Hydrochloric Acid is classified as a corrosive S6 poison.

To avoid personal injury users should always:

- Wear all necessary safety equipment detailed in the MSDS including but not limited to goggles or face mask, gloves, and protective clothing as advised.
- Pour acids into water – this avoids splashes of highly concentrated acid onto the operator.
- If an acid or proprietary cleaner is splashed onto the skin, it should be immediately swabbed with clean water or more effectively with a solution of bicarbonate of soda and water that will neutralise the acid. Medical attention should be sought with respect to any injury arising from the use of chemicals.
- Chemical spills are required to be treated in accordance with the advice contained in the MSDS.
- For transport and environmental care of such chemicals, users should refer to their State regulatory authorities.

3.6.2 Organic Solvents

Organic solvents are generally used on small areas of greasy substances by using a bandage or poultice. This can be expensive since they tend to evaporate or be absorbed. The more commonly used solvents are white spirit, carbon tetrachloride, methyl and ethyl alcohols, proprietary paint stripper or dry-cleaning agents. They also tend to leave a visible residue or stain on the masonry.

3.6.3 Detergents

Detergents are surfactants (surface active agents) and promote wetting of the soiled surface by water. Small quantities of detergent are often used when washing with water, usually at low pressure. Detergents are by no means harmless, with many being chemically-aggressive. They are most

effective and can be used in the removal of earth stains.

3.7 Cleaning Internal Block Work

Using hydrochloric acid to clean mortar deposits on internal masonry requires special care. The work should be done before the building is enclosed to ensure maximum ventilation of acid fumes. If this procedure is not followed and the masonry is cleaned at the completion of building, it becomes impractical to use large quantities of water. The result can be acid fumes expelled from the masonry for some time after occupation, attacking metal door frames, light fittings, steel furniture, exposed metal grid ceilings and other metal components. In addition to early cleaning, the following procedures are recommended when cleaning internal block work:

- Use a proprietary cleaner containing an acid inhibitor that reduces fumes from Hydrochloric acid.
- After washing down, apply a neutralising wash consisting of 65 grams of Sodium Bicarbonate per litre of water. Leave this on the wall. If acid fumes are suspected to be coming from the wall, test using litmus paper. Moisten a strip and apply it to the wall. If the blue paper turns red, acid is present and a neutralising wash should be applied. It should be mentioned that neutralising wash can also be applied to external brickwork.

4 Stain Removal

Quite often stains occur on block work from the failure to follow correct cleaning procedures when removing mortar residue. Stains are aesthetic blemishes and do not affect the structural adequacy of the block. The correct identification of stains on concrete masonry is the first step of the removal process. Testing on one or more small areas is the safest way to determine the correct chemical solution and technique to remove a particular stain. This must take place well ahead of final cleaning as it will usually not be possible to assess the effectiveness of the test clean until the masonry dries.

4.1 Efflorescence

Efflorescence is not necessarily a stain, it is a white powdery deposit that forms as a result of salts out of the masonry and travelling to the surface.

Efflorescence means there is:

- Presence of soluble salts
- Excessive amount of water entering the masonry



Figure 5 Efflorescence as seen on block faces (a)



Figure 6 Efflorescence as seen on block faces (b)

Concrete Masonry Structures

Cleaning and Maintenance

Soluble salts that contribute to efflorescence may enter a wall via the following means:

- Mortar
- Grout
- Soil or fill in contact with the wall
- Sea spray in coastal areas
- Masonry units
- Sills

It is commonly found after the completion of the structure and is known as “early age” or “new building bloom” efflorescence. Where there is a re-occurrence or heavy presence of efflorescence, corrective measures must be taken as it is an indicator of inferior workmanship or the lack of precautionary measures being taken. These can include the following:

- Poor coping and flashings
- The failure to protect new block work when rain interrupts block laying
- Exposure to ground salts and excessive water due to poor storage of masonry units on site

Though this phenomenon may be aesthetically displeasing, it does not affect the structural integrity of the masonry.

Detailing to Avoid Efflorescence

The following measures should be taken to minimise the occurrence of efflorescence in masonry walls.

Tops of walls and parapets

Walls and parapets should have protection such as flashings or capping to the top surface. A common source of staining of masonry is water entering walls and cavities at this point via the exposed horizontal surface.

Window sills

Window sills with an inadequate projection provide a source of water entry to the walls and will promote staining. The incorrect installation of window flashings will exacerbate this problem.

Flashings

Flashings should protrude to the outside face of the brickwork. If the flashing is stopped short of the core holes in the external leaf, any moisture entering the wall will be channelled into the units, permeating the mortar, dissolving calcium hydroxide and eventually passing to the outside surface where the calcium hydroxide carbonates.

Masonry units

Unless required otherwise, it is a reasonable expectation that concrete masonry units have an efflorescence potential of nil or slight.

Mortar

Mortar should be hard and sound. The recommended mixes are:

Type M3 For general applications (except as listed for M4).

Preferred: 1 part Type GP cement, 5 parts sand plus methyl cellulose water thickener.

Alternative: 1 part Type GP cement, 1 part lime, 6 parts sand.

Type M4 For applications subject to saline wetting and drying, in aggressive soils, in severe marine environments, in saline or contaminated water including tidal splash zones and within 1 km of an industry producing chemical pollutants.

Preferred: 1 part Type GP cement, 4 parts sand plus methyl cellulose water thickener.

Alternative: 1 part Type GP cement, 1/2 part lime, 4 1/2 parts sand.

Methyl cellulose is an agent which holds moisture in the mortar while the cement hydrates. It is quite different from the air-entraining agent commonly used in mortars.

Control joints

Walls should include well-positioned control joints to prevent indiscriminate cracking of the wall that would permit ingress of moisture. Control joints should be correctly sealed.

Weep holes

Cavity walls should include numerous well-positioned weep holes to allow any moisture in the cavity to escape. Cavities should be free of mortar droppings.

Removal of mortar smears

The external face of the masonry should be kept clear of mortar smears.

Removal Technique for Efflorescence

Efflorescence will usually disappear over time. The process can be accelerated by dry brushing off any solidified matter on the surface before scrubbing it with a brush and clean water. It is advised to use a dustpan or vacuum cleaner immediately after the dry brushing to clean all fallen material prior to wetting the surface. This prevents any salts being reabsorbed into the masonry and being expelled once it dries. Using an absorbent cloth to scrub or a dense high-suction sponge to press against the wall and regularly to rinse in clean water can optimise this method.

4.2 Calcium Carbonate

Characterised as white hard deposits, this stain occurs as a result of:

- The failure to fully cover and protect the masonry when rain interrupts work
- Lime leaching from concrete and cement elements by water
- Incorrect hydrochloric acid cleaning

When either a lot of acid or little water is used for cleaning, the reaction between acid and other cement products found on the surface is absorbed into the faces of the blocks instead of being washed off the wall.



Figure 7 Calcium carbonate on face block work

Removal Technique for Calcium Carbonate

Apply Noskum, Wallkleen 150 or Account at full strength and let stand for 4-6 minutes according to manufacturer's recommendation. Extra chemical may erode face of block and therefore it must be thoroughly washed off with clean water.

4.3 Acid Burn (Iron Oxide / Rust Stains)

Characterised by its yellow to earthy orange rust like colour, these blemishes appear on masonry where oxides are added to deliver a coloured finish. Rust and copper stains occur usually as a result of the misuse of hydrochloric acid in the cleaning of concrete masonry blocks.



Figure 8 Acid burn on concrete masonry block

The stain can also be referred to as 'Acid burn' because the reaction between hydrochloric acid and the oxides present in the composition of the blocks cause the formation on the face of the block. The same deterioration can happen to mortar, as the oxides present in the sand will form the stain and can actually allow the leaching of it into joints.

The most common cause of incorrect hydrochloric acid cleaning leading to rust and copper stains are the following:

- Using a hydrochloric acid solution which is not sufficiently diluted for the desired application. It is recommended to avoid using a stronger acid to water ratio of 1:20 for lighter coloured units and 1:10 for darker units.

- The failure to allow sufficient stand-by time for solution to act effectively on the cleaning surface, which usually provokes the operator to increase the acid strength of solution.
- Insufficiently carrying out the pre-wetting phase of the cleaning operation and maintaining the surface saturated until the area is to be cleaned.
- Failing to adequately hose down with water the cleaned area properly after sufficient acting time for the solution has ended.

Pre-wetting and frequent washing off is vital to prevent the over-absorption of the cleaning solution into the masonry unit where further reactions and staining can occur.

Removal Techniques for Iron Oxide Stains

A mixture of 1 part sodium or ammonium citrate, 6 parts water and 7 parts glycerine can be dissolved and made into a thick paste or poultice. It then can be applied to the area at a thickness of 6-13mm and left until it dries. Once it reaches that point, the hardened paste can then be brushed or scraped off using a scraper (or wooden paddle, if block has a tile like finish), followed with a thorough rinsing of the surface with water.

An alternative is to use the same chemicals above but also adding sodium hydrosulphite crystals on the paste and applying it to the problem area using a trowel so that the crystals are in contact with the blocks. Thorough rinsing must then follow. Poultice materials such as whiting or diatomaceous earth can also be used.

NOTE: A poultice is a paste made with a solvent or reagent and a finely powdered, absorbent, inert material used to keep stains from penetrating deeper or spreading. This technique tends to pull stains out of the pores.

4.4 Copper Stains

These stains are caused by water run-off from roofs and fittings, which leave green markings on the block surface.



Fig 9 Copper stains on face block work

Removal Technique for Copper Stains

To remove, stir 1 part ammonium chloride or ammonium hydroxide per 4 parts talc (1:4) to form a thick paste. Apply 6-13mm of the paste to the problem area and wait until it dries. Once dry, remove the paste off the surface using a brush or scraper (or wooden paddle, if block has a tile like finish) and repeat the process until the desired outcome is achieved.

4.5 Organic Growths

Organic are moss, lichen and mould growing on the face of the wall. These are common in damp buildings and can often be confused with copper stains that can result from gutter flows. Areas deprived of sunlight and ventilation may continual growth.

Removal Technique for Organic Growth

Steam Cleaning / Fungicide:

The use of a fungicide or steam cleaning is the most effective way to kill organic growths as they allow for the organic matter to weather away without compromising the aesthetic integrity of the masonry. Repeated applications may be necessary. A method in which to remove moss and plant growth is to apply ammonium sulphamate or sodium hypochlorite, let stand and then remove with a scraper or stiff bristle brush.

Herbicides:

For ferns and shrubs, a herbicide should be used as per manufacturers instruction. All excess foliage and roots should be cut away and left to decay.

NOTE: Root systems growing through mortar joints over time may cause damage to the wall if not properly controlled.

Mildew:

The appearance of this particular stain is dark and greenish. To remove, a cleaning solution containing the following proportions is to be used:

- 1 part laundry detergent;
- 3 parts trisodium phosphate;
- 32 parts sodium hypochlorite and;
- 96 parts water

Alternatively commercial household cleaner, such as Ajax Spray n Wipe, Bleach, BAM or CLR, can be used according to manufacture instruction. Once prepared the solution should be applied to the surface using a brush, scrubbed well and thoroughly rinsed with clear water.

4.6 Paint and Ink (Graffiti)

Paint and ink are difficult stains to move, particularly when it has aged. There is a wide range of methods in removing this from masonry but employing a combination of them may be necessary. The determination of what cleaning method is suitable for the application is dependent on the type of paint or ink and how long it has been on the surface.

Removal Techniques for Paint and Ink

Always test a small area, as the cleaning may damage the face of the block.

Acrylic, Epoxy or Alkyd:

Use paint remover with a bristle brush or a medium-pressure jet cleaner. If using this method renders unsuccessful results, resorting to commercial paint remover in accordance with manufacturer's instruction may be required.

Oil Based Paints or Enamels:

Burn off the paint with a blow torch or hot air gun and follow with scraping and wire brushing ensuring not to damage block work.

Dried Paint:

A 1:10 solution of hydrochloric acid and water respectively can be applied after scraping off loose areas of paint and thoroughly pre-wetting masonry. Using a brush, scrub attended surfaces and give solution the required stand-by time. Meticulously water down until all remaining acid is off the wall. If that fails a poultice of benzene mixed with talc or whiting evenly applied around 6-13mm thick on the surface and then chipped off should pull the stain from out of the pores of the block after a few applications. This allows for the stain to be dissolved through many applications.

Fresh Paint:

Trisodium phosphate is an alternative to commercial paint remover when removing fresh paint. Absorb the paint with a soft cloth or paper towels then scrub vigorously. Apply the chemical and scrub with a brush then follow up by rinsing the surface thoroughly with water.

Ink (ordinary):

Blue ink can be removed by using sodium perborate. The solid chemical must be dissolved in hot water and mixed until it produces a thick pasty consistency. Apply about 6-13mm of the poultice to the stain and wait until it dries. Brush, or scrape off once dry and repeat as required. In the event of the stain turning brown, treat it as if it were an iron stain.

Ink (containing Prussian blue):

Bandage with saturated cloth of ammonium hydroxide or strong detergent solution.

Ink (containing indelible synthetic dyes):

Use sodium perborate or calcium hypochlorite and mix with water until it transforms into a thick paste, then apply 6-13mm of the poultice to the affected area. Alternatively, sodium hypochlorite with whiting can be mixed until it transforms into a thick paste and applied in the same way. Scrape off once dry and repeat as needed.

An alternative is to mix ammonia or sodium hypochlorite or calcium hypochlorite with hot water. Saturate a cloth or cotton ball and place on the problem area. Repeat until desired result is achieved.

Ink (containing silver salt):

Bandage with saturated cloth or cotton ball of ammonium hydroxide. Proprietary cleaners may be used as per manufacturer's instructions.

4.7 Oils, Tar and Grease

Oils usually appear as dark coloured spots on concrete masonry walls. Various oils require different treatment methods.

Removal Techniques for Oil, Tar and Grease

Linseed Oil

It is essential that excess oil is absorbed then scrubbed vigorously using a soft cloth or paper towels. Then dissolve 1 part trisodium phosphate (0.91kg of chemical per 3.8L of water), 1 part sodium perborate and hot water/strong detergent then stir until it forms a poultice. Once it dries brush or remove with a scraper and thoroughly rinse with clean water. Repeat until no further improvement can be achieved on the surface.

Lubricating Oil or Grease

Oil that has penetrated into the surface can be removed by scraping any solidified matter off the surface prior to scrubbing the surface with a brush and a solution of 0.91kgs of trisodium phosphate to 3.8L of water. Caution must be taken when scrubbing as too much may disperse the stain and make it penetrate into the masonry. The surface of the block may also be damaged through extensive scrubbing on the face.

An alternative solution is to stir either kerosene, carbon tetrachloride or benzene with talc or whiting to produce a thick paste. Apply the paste to problem areas at around 6-13mm in thickness and allow hardening. Once hardened, brush or scrape it off and rinse thoroughly with clean water.

Treatment with a commercial emulsifying agent or degreasing solution can be used as per the manufacturer's specification.

Steam cleaning with a hot 1:10 sodium hydroxide solution may also be used but care must be taken as one of the side effects of the cleaning operation includes bleaching.

4.8 Beverages – Coffee, Tea and Cola

The spill of beverages can leave tan/brown stains on concrete masonry walls.

Removal Techniques for Coffee, Tea and Cola

Where the use of hot water and soap isn't sufficient, a 1% solution of sodium hypochlorite or 25% glycerine or trichloroethylene may be more effective. Scrubbing the surface with chemicals and a brush is sufficient. The sodium hypochlorite alternative requires bandaging with a saturated cloth/cotton ball and thoroughly rinsing the surface clean with water. Trichloroethylene is used for making a poultice and applying it to the problem area around 6-13mm thick. Once the paste has dried it should be brushed or scraped off and rinsed thoroughly with water.

4.9 Blood

Removal Techniques for Blood

The wall can be scrubbed with 3% hydrogen peroxide followed by a thorough rinse with clean water afterwards.

An alternative to this method is to use a trisodium phosphate mix of 0.91kg of to 3.8L of water. Mix until it transforms into a thick paste and apply 6-13mm of the poultice to the affected area. Scrape off once dry and repeat as needed. Repeat until no further improvement can be achieved on the surface.

4.10 Soil

Masonry units which are in constant contact with soil or have had soil splashing onto their face can experience soil stains. Deposits should be removed as soon as possible.

Saturate the soiled areas with water and scrub with a bristle brush and strong detergent solution. A ratio of 1 cup detergent to 5 litres water (approx. 1:20) is recommended. Rinse with clean water once finished.

4.11 Dirt, Pollution and Grime

These stains are common in industrial areas and can also be known as light to heavy industrial grime. The extent to which the dirt or pollution has accumulated and settled on a surface and its source can influence the right method of cleaning

Removal Techniques for Dirt, Pollution and Grime

Scrubbing the surface with water and a manual or mechanical brush may be sufficient in instances where stains are heavily bonded to the substrate. Detergents may be used to compliment the process but testing in a small hidden area is recommended prior to beginning a full scale operation.

Heavily pre-wetting the wall and scrubbing a 5% mixture of hydrochloric acid solution (that is, 1:20) with a brush may render desirable results on tougher stains. Care must be taken during standby time to not allow the chemical to act on the surface for longer than needed as it may burn the blockwork. Times should never exceed 6 mins between application and thorough rinsing stages.

A final alternative is to use alkaline gels or proprietary cleaners as per the manufacturer's specifications.

4.12 Chewing Gum

A common stain in many urban environments and varies in colour due to aging and original colour of chewing gum.

Removal Techniques for Chewing Gum

Mechanical scraping and/or steam cleaning are the most effective methods of removing chewing gum. It can also be frozen using dry ice and chipped off where stains are more localised.

4.13 Smoke / Fire

These stains can vary from minor, resulting around domestic open fireplaces, to major in the form of fire damaged buildings. The degree of difficulty of removing such stains can greatly vary between the two extremes.

NOTE: Buildings that have experienced fire damage may also have had the structural integrity of the blockwork compromised.

Removal Techniques for Smoke / Fire

Sugar soap (soap to hot water ratio of 1:4) can be used to remove minor deposits using a brush. Further cleaning treatments may necessitate the use of a scouring powder containing some degree of sodium hypochlorite.

Fire damaged buildings will almost definitely need further treatment due to the intense localised harm experienced in more active areas of the blaze. The use of full strength sodium hypochlorite on the surface may achieve the desired result followed with a hosing down once the surface has been scrubbed and left for a maximum of 10 minutes.

For severely-affected areas, trichloroethylene shall be mixed with talc to form a poultice. The paste should be applied by trowel or float at a thickness of around 5mm and left on the surface for 24 - 48 hours. After the stand-by time has expired, the hardened paste should be removed by scrubbing or hosing.

This final technique can also be used to remove perspiration stains on concrete masonry walls.

4.14 Wood (tannin) Stains

These brown stains occur as a result of water spreading tannin or resin stains on the wall, most particularly from hardwoods. They become evident on both the masonry unit and mortar.

Removal Techniques for Wood (tannin) Stains

These blemishes can be removed by scrubbing with a solution containing 1 part glycerine to 4 parts water. Where the stain cannot be removed, continuing the above procedure combined with the procedure to eliminating smoke and fire stains is recommended. A solution of 20 grams oxalic acid per litre of water is also effective to clean off wood stains.

Proprietary bleach or liquid pool chlorine can also be helpful in exterminating stubborn areas and should be used to manufacturers specification provided the option is used.

4.15 Tobacco

Commonly found on surfaces of domestic households and communal environments, the stain is characterised as a brown spot.

Removal Techniques for Tobacco

Mix 1% sodium hypochlorite with talc to form a paste. Apply the poultice to the surface at a thickness of around 6-13mm and scrape / scrub off once the poultice is dry. Rinse surface thoroughly with clean water and repeat the process if needed.

4.16 Asphalt

Asphalt is characterised as a black and removal techniques vary according to its form.

Removal Techniques for Asphalt

Molten asphalt can be removed using dry ice followed by scouring powder if the affected area is small. Cool until brittle and chip away with a chisel. Care must be taken not to damage the blockwork. Scrub with a brush and clean water.

Emulsified asphalt only needs scouring powder for its removal, hence scrubbing with a brush and water is sufficient.

Asphalt cutback can be removed by using either kerosene, carbon tetrachloride or benzene with talc or whiting to form a paste. Apply the blend to form a 6-13mm film on the problem area. Scrape or brush off once dry and repeat until desired result is achieved. Once complete, a follow up scrub with scouring powder, brush and water can then finish it off.

4.17 Iron and Welding Splatter

These stains occur when welding operations are performed close to the masonry work and can leave unsightly rust stains on both bricks and joints.

Removal Techniques for Iron and Welding Splatter

The removal of this type of stain can usually be done by using 1:8 solution of oxalic acid to hot water. After its removal, be sure to neutralise the surface using a bicarbonate of soda solution and leaving it on the wall. Should the previous method be ineffective, adding 250g/l of ammonium bifluoride to the oxalic acid solution will generate hydrofluoric acid which can etch into block masonry. Great caution must be taken when using this method.

Proprietary cleaners can also be used as per manufacturer's specification.

Part B: Maintenance

1 General Building Maintenance

Concrete masonry may be generally described as a 'low-maintenance' walling material. However, there are some important simple precautions that should be taken to ensure its long-term attractiveness and its ability to perform the required structural function. These involve:

- Ensuring that the masonry remains weatherproof
- Repairing any cracks or deterioration of control joints
- Cleaning off any efflorescence, staining or mould and, if necessary, sealing the surface.

2 Weatherproofing

Buildings should be designed and constructed so as to prevent water from penetrating masonry walls. This can be achieved by the following steps:

- Ensuring that the building is correctly designed and detailed to account for weatherproofing requirements, foundation movement, shrinkage and the efficient removal of rain water.
- All rainwater downpipes and gutters should be regularly inspected and kept clean, free of corrosion, and connected to a correctly functioning storm water drain.
- Flashings should be secured and the joints sealed with flexible sealant such as silicone. It may be necessary to renew sealants over time if they deteriorate.

3 Cracking, Footing, Movement and Control Joints

Unreinforced concrete masonry is a brittle material which will crack if long walls are constructed without a break or if supports move. Cracking may occur in the concrete masonry units themselves or in the cement mortars and cement renders used in conjunction with them.

3.1 Footing Movement

Footing movement is a major source of cracking in unreinforced masonry. When buildings are constructed on clay or similar soils, moisture movements in the soils lead to expansion and contraction of the soil, causing the building to either cantilever on its footings beyond a shrinking soil mound or to sag between an expanded soil rim. As the supporting soil contracts or expands, any unreinforced masonry may crack, moving sympathetically with the deflected concrete footings supporting the structures. The main contributing factors to footing movement are:

- Inadequately designed footings with insufficient strength and stiffness which deflect and cause the masonry to crack.
- Clay soils which are prone to expansion and contraction.
- Trees which may suck the moisture out of the soil causing it to shrink.
- Poor or badly maintained drainage systems which allow a build-up of moisture in the soil causing it to expand.

A completed building and its surrounding site should be regularly maintained, ensuring that:

- The site storm water drainage system is removing rainwater
- The plumbing reticulation system is not leaking
- Trees have not grown too close to the footings and other structures.

3.2 Control Joints

The strategic placement of control joints will limit the position and width of cracks. In a wall exposed to the weather, contraction joints must be weatherproof with a flexible sealant at the surface.

Periodically the sealants should be inspected, and if they have deteriorated, they should be removed and replaced.

Expansion joints (for thermal movement) and articulation joints (for footing or support movement) must be kept free of hard material such as mortar droppings and must be free to close under the action of thermal expansion and footing movement.

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Industry Support. Most of the manufacturers of quality concrete masonry products in Australia are members of the Concrete Masonry Association of Australia (CMAA). It is recommended that advice be obtained from local CMAA members to adapt or supplement information contained in this Guide.

Remember, when working with cement and concrete/mortar or manufactured or prefabricated concrete products, ALWAYS follow the manufacturer's instructions and seek advice about working safely with the products from the manufacturer, your nearest WorkCover Authority or Worksafe Australia.

Concrete Masonry Walling



CONCRETE MASONRY
ASSOCIATION OF AUSTRALIA

PO Box 370
Artarmon NSW 2064

T: 02 8448 5500

F: 02 9411 3801

E: admin@cmaa.com.au

W: www.cmaa.com.au

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