

# ST.ANN'S GATE ARCHITECTS

The Close · Salisbury · Wiltshire · SP1 2EB

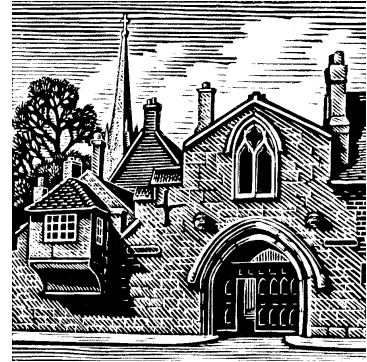
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## Gloucester Cathedral: Infirmary ruins, northern arcade: **Repairs to standing piers**

### **D SPECIFICATION**

to be read in conjunction with the preliminaries, the schedule of works and the drawings

#### **C20 REMOVALS/TAKING DOWN WORKS**

##### SAFETY

- 10 **SHORING:** Provide and maintain all shoring and strutting necessary to ensure the safety of the existing building or any other services, alter and adapt as necessary, clear away when no longer required and make good any damage. The Contractor shall acquaint the Cathedral Architect with the measures they propose to adopt to ensure the safety of the existing building or other services before any such work is put in hand.
- 20 **NUISANCE:** Avoid generally by preventing smoke, dust, fumes, spillage, pollution of waterways and other harmful activities.

##### DESCRIPTION

- 30 **GENERALLY:** Provide and maintain all requisite fans, screens, casings, tarpaulins, dust sheets, barriers, notices and all other measures necessary for the protection from damage, dust and inclement weather of the existing building and for the protection from injury of the occupiers thereof or visitors thereto and the public generally.
- 40 **ALTER AND ADAPT** as necessary, clear away when no longer required and make good any damage. All necessary arrangements shall be made to divert rainwater away from the existing building and to ensure its proper disposal.
- 50 **NOTE THAT THE MINIMUM POSSIBLE** original fabric is to be removed, in line with the adopted Cathedral masonry conservation policy. Extent of masonry replacement will be reviewed with the Cathedral Architect and Cathedral Archaeologist on site before any material is cut away.

## **C40 MATERIALS AND TECHNIQUES TO BE USED IN THE CLEANING OF MASONRY**

To be read with preliminaries, general conditions and drawings.

### **10 CONSERVATION CLEANING METHODS**

The following cleaning methods are to be used in succession, starting with 'low intensity' methods and progressing through the list as required.

### **20 FUNGICIDAL WASH**

Apply Dulux Weathershield fungicidal wash to specified areas of stonework 48 hours in advance of first cleaning.

### **30 WATER SPRAY (MOUNTED NOZZLES)**

Equipment: Spray nozzle types: Atomising/nebulous

Nozzles: Position and direction adjustable, relative to surfaces and profiles.

Controls: Time clock.

Other requirements: Subject to close inspection and trial sample.

### **40 AMMONIUM CARBONATE POULTICE**

Reduce black sulphation deposits using a 3% (30 grams per litre) solution of ammonium carbonate in tap water poultice. The poultice medium to be Arbocel 800 (cellulose fibres) combined with small amounts of Sepiolite (magnesium silicate 100 mesh) and Polycell (carboxy methyl cellulose) to be agreed on site. Dwell time of poultice to be at least 24 hours. Stone surface to be rinsed thoroughly with clean water after poultice removal. Any soot crusts unaffected by two applications to be cleaned again using DOFF steam cleaning system.

### **50 TORC/DOFF CLEANING SYSTEMS**

'Torc' Low Pressure Swirling Vortex

'Doff' Superheated Water System

Clean stonework surfaces using temperature control set at maximum of 150 °C, pressure of 30 bars and using specialist nozzle ¼MEG25035. No variations on these proven settings are permitted. Check that all moss, algae, lichens and superficial dirt without damaging stonework surface.

Control of wash water: Collect and divert to prevent ingress and damage to building fabric and adjacent areas. Above and below ground drainage systems: Keep free from detritus and maintain normal operation.

Experienced operatives only to use this equipment.

## F32 STONE TYPES

To be read in conjunction with Preliminaries/General Conditions

### TYPE(S) OF WALLING/DRESSINGS

10 STONE IS TO BE SOURCED AS FOLLOWS:

20 Stone Suppliers: Note: Sample of intended bed to be used to be approved by CA before any bulk orders placed.

For weathering stones (i.e. which perform a rainwater-shedding function):

Beaunotte Beauval French limestone (coarse grain)

For plain ashlar work, decorative mouldings, carved work and 'piecing-in' either:

Beaunotte French limestone (fine grain)

or

Lepine French limestone (fine grain)

- supplier:

Pierre Heritage

Maisonnette des Fontenelles

Route Departementale 951

86800 JARDRES

France

+33 (0) 672 453825

email: steven@pierreheritage.com

30 STONE IS TO BE selected by the Cathedral Master Mason and approved by the Cathedral Architect.

40 STONE IS TO BE free from vents, cracks, fissures, discolouration, or other defects which may adversely affect strength, durability or appearance. Thoroughly seasoned, dressed and worked before delivery to site in accordance with shop drawings prepared by the supplier.

50 BEDDING: Stone shall be laid in its natural bed: face bedding will not be permitted. Any stone found to be face bedded shall be replaced by the contractor at no cost to the contract.

60 VOUSOIRS & STRING COURSES shall be edge bedded, except for string courses at outer corners, which shall be laid on their natural bed.

70 TOOLING: To match existing, identified during archaeological masonry recording.

80 LIME MORTAR: see section Z21

90 JOINTS around replacement stones are to be as fine as the existing or adjoining one; the stone shall be cut square, not hollow jointed.

- 100 JOINTING: Wherever possible, replacement of complete stone sections is to follow the original medieval coursing of blocks rather than the coursing of previous repairs which, in general are incongruous and inaccurate.
- 110 POINTING: No struck or patterned pointing will be permitted. The stonework is to be well-wetted beforehand, the mortar being pressed home; it is to be bagged off after the initial set and the stonework cleaned with a wet brush. No feather edges to pointing will be permitted.
- 120 REPOINTING: In cutting out joints for repointing care is to be taken not to widen the joint or damage the arriss of adjoining stone. Cutting out may be done with plugging, long-handled jointing or toothed masonry chisels; cold chisels must not be used, nor a disc cutter. Impact should be at an oblique angle.
- 130 REPOINTING FINE JOINTS: For very fine joints cut out using a steel plate or plasterer's jointing tool, marked to ensure a 25mm deep cut. joints are then to be flushed out using a 35 cc hypodermic syringe. Fine joint mortar is to be inserted by means of a syringe or gun with flat rubber nozzle until the joint is filled and leaving mortar in the joint. If necessary surplus can be trimmed off with a sharp, bent knife.
- 140 CUTTING OUT EXISTING STONE: Great care is to be taken to avoid damaging adjoining stones which are not being replaced. On no account must angle grinders be used.
- 150 PROPPING AND STRUTTING: Include any strutting and propping necessary when cutting out and replacing stones.
- 160 SIZES: The contractor is responsible for checking all sizes on site.
- 170 DOWELS. CRAMPS. PLATES & RODS: To be stainless steel type 316s dowels to be ribbed. obtain from:  
Severn Metals Ltd. 22 Coker Road  
Worle Industrial Estate. Weston super Mare  
Avon. BS22 OBX. tel no: 01934 518418
- 180 GROUTING: to be 2.5: 1: 1 :6.5 (stone dust:lime:sand:water) to form pouring consistency.
- 190 GROUT JOGGLES: form joggles in perpends and bed joints to receive grouting and prevent lateral movement.
- 200 LEAD GROUTING: For free standing elements:  
Lead grouting will be used only for free standing elements such as pinnacles or mullions. Lead is to be heated until molten. and poured into prepared grout holes with all joints plugged with clay for a depth of 19mm. Blow holes are to be left open and located on the opposite side from the pour. Lead is to be heated adjacent to the works within a non combustible "bund" and no personnel are to work beneath the area whilst the work is in progress. A "hot works" certificate must be obtained.

## LAYING AND JOINTING

### 210 QUALITY OF WORK:

- Store dressed stone clear of the ground. protect from inclement weather and keep dry. Prevent soiling. chipping and contamination by salts and other deleterious substances.
- Dampen stones and lay on a full even bed of mortar with all joints filled and approximately 5mm wide. Use temporary lead or stainless steel distance pieces to ensure consistent joint width; remove when mortar is sufficiently strong.
- Keep courses level and in line. and accurately plumb all wall faces. angles and features. Set out clearly to ensure satisfactory junctions and joints with adjoining or built-in elements and components.
- Keep stonework clean during construction and until practical completion. Ensure that no mortar encroaches on face when laying. Turn back scaffolding boards at night and during heavy rain. Rubbing to remove marks or stains will not be permitted.

### 220 INCLEMENT WEATHER:

- Do not use frozen materials and do not lay on frozen surfaces.
- Do not lay blocks/dressings when air temperature is at or below 3'C unless mortar has a minimum temperature of 4'C when laid and walling is protected.
- Maintain temperature of the work above freezing until mortar has fully hardened.
- Adequately protect newly erected walling against rain and snow by covering when precipitation occurs and at the completion of each day's work.
- Rake out and replace mortar damaged by frost and where instructed, rebuild damaged work.

### 230 PROTECTION:

- Prevent damage to stonework, particularly arrisses and projecting features.
- Protect with wooden slats, boards etc, securely fixed. Remove at Practical Completion.
- Prevent staining and other disfigurement of stonework during construction and by following trades.

### 240 GROUTING:

Wet stone well before grouting to increase adhesion.

250 GROUT HOLES: Form holes for grouting including holes to prove grouting has penetrated to all areas. Flush out with water before grouting. Plug grout holes on completion.

### 260 SAMPLES:

For repairs, patches, re-pointing and include for setting up samples of pointing for mortar mixes types for approval by the Architect. Once approved, these samples shall set the standard for the works.

### 270 DEVELOPMENT OF CARVED DETAIL

- Skills and experience of stonemasons to be allocated to this task to be presented to design team at outset, for comment and approval.

- Master mason to take responsibility for development of accurate and appropriate mouldings/profiles for new work, based on evidence available from the building itself, archaeological knowledge, from historic photographs and drawings.  
It is important to arrive at working dimensions and forms by checking from different examples of the same masonry feature, i.e. do not take measurements in isolation. Use various means of measurement, in particular callipers, sinking squares and depth gauges.
- Drawings and other research to be presented to Cathedral Architect, for comment before moving on to next stage.
- Masons to then develop 3D representations of proposed new detail, using clay formed onto existing stone in-situ, and/or forming polystyrene 'models' for approval.
- Resulting maquettes to be presented to Architect and client for comment before moving on to next stage.
- Obtain approval of final maquette before moving on to carve the final stone for fixing on the building.

280 'TILE REPAIRS'

Where scheduled on the drawing, use thinly cut 'tiles' or 'slices' of natural stone to build up developed detail.

This technique will be used to re-create arrisses where significant erosion has occurred, but where the host stone remains viable.

This will enable a 'soft' outline to be maintained, providing support for the structure above, without resorting to complete replacement of the stone in question.

## F-X MASONRY CONSERVATION METHODS

- 10 REMOVAL OF EXISTING CEMENT BASED POINTING AND PREVIOUS REPAIRS  
As a general rule all cement removal to be carried out by hand using a hammer/dummy and sharp tungsten chisels. Angle grinders are only to be used by skilled stonemasons, and only to prepare the joints for treatment by hand.
- 20 IRON REMOVAL  
Any embedded ironwork currently causing damage, or likely to cause future damage, is to be carefully removed. Mechanical techniques are restricted to masonry 'stitch' drilling; disc cutters and hand grinders must not be used.
- 30 PINNING AND DOWELLING OF NEW AND EXISTING MASONRY  
All pinning and dowelling to be carried out using threaded stainless steel rod (grade 316) or keyed phosphor bronze set in either fine non-hydraulic lime mortar or hydraulic lime for non-structural work and polyester resin for structural work.
- MORTAR REPAIR TECHNIQUES for face repair or 'developed form'  
(see drawings for direction as to extent of each method)
- 40 RAKING OUT
- Carefully rake out the Portland cement-based mortar mixes in exposed joints, back to the lime-based bedding mortar. Use an appropriate sharp tool. Only remove loose and/or decayed material after prior assessment of historic significance and consultation with Cathedral Architect and Cathedral Archaeologist.
  - Note that joint depth is relative to joint width rather than to a generalised specification; thus removing all mortar back to a 'standard' depth is inappropriate for the historic fabric.
  - Consider if it is necessary to remove all residual cementitious pointing. Hard and well-recessed mortars may result in consequent damage during extraction; it may be less damaging to leave them in-situ and apply a shallow fill on top. A correctly mixed lime mortar can be made to adhere to relatively shallow 'facial' joints, as well as to deeply recessed joints. Confirm depth of raking out with Cathedral Architect in all cases prior to removal of any material.
  - Take care to wear a suitable face mask during raking out operations as the cement used in some mortar repairs may be deleterious.
  - Where fine joints are to be re-pointed the joints are to be raked out to a depth at least equal to the width of the joint and deeper if possible without damaging stonework, i.e. adjacent arrisses.
  - Where old mortar has become sandy and de-natured or has failed it should be cleaned out and deep tamped leaving at least 25 mm for the final pointing.
  - Mechanical cutting of joints is not to be undertaken without the express agreement of the Cathedral Architect. Well-sharpened hand tools (i.e. quirk chisels or various blade tools) of the correct width must be used so as not to damage the ancient stones or in any way widen the joints.

- 50      DRY BRUSHING OUT
- Clean out all debris thoroughly by brushing along each joint, or blowing out with a portable compressor unit. Remove all dust from the masonry face and remove all debris from foot of the work area before commencing wet work.
- 60      DAMPENING
- Use a fine mist spray (fitted to a hand-operated pump sprayer unit or hosepipe) or flick with a stock brush and bucket. Continue with a more controlled application from the pump sprayer.
  - Introducing water into the work area and surrounding masonry is absolutely necessary to counter suction of water from the mortar. However, extreme care should be taken not to flood the heart of the masonry, or the lower sections of the elevation which may already be damp.
  - Wet once and allow time for absorption. Re-apply as many times as is necessary, paying particular attention to the varying rates of absorption across the work area and to prevailing weather conditions. Ensure wetting extends to at least 150 mm beyond the work area for each application.
- 70      PREPARATION OF 'GALLETS'
- Small pieces of terracotta tile 'gallets' are to be used where areas of mortar pointing exceed 25 mm<sup>3</sup>. The colour is to be yellow/buff/salmon pink to give a reasonable colour match to the local Cotswold stone.
  - Tiles are to be handmade (i.e. not machine pressed), rough textured and frost resistant. The approved supplier is:
  - Cambridgeshire Tile and Brick Co. Ltd.  
Goosehall Farm, Factory Road, Burwell, Cambs. CB5 0BN  
tel. 01638 743953
  - Either new whole or breakage grade tiles from this supplier are permitted provided that they are properly fired.
  - New material only is to be used as salvaged materials may be contaminated with aggressive salts.
  - Tile gallets are deemed necessary for the following reasons:  
To counter shrinkage of mortar during carbonation.  
To give structural support to the mortar; initial application and long-term.  
To reduce the volume and mass of mortar, thereby accelerating carbonation.  
To economise on mortar.
  - Tile gallets are to be prepared in a range of suitable sizes and shapes appropriate to the specific work area.
  - Prepare gallets by breaking each tile with a hammer. Use flat and end-on blows to delaminate tile and produce gallets of varying thicknesses. Volumetric accuracy of each gallet (i.e. its precise size and shape) is vital in carrying out small tile and mortar repairs.
- 80      APPLICATION OF 'TACK COAT'
- Provide a 'sticky' interface to improve adherence of mortar to stone inside joint faces. The joints and 'lacunae' (i.e. cavities) are to be coated in advance with a slurry coat of lime putty mixed with some fine sharp silver sand and suitably pigmented.
  - Carefully apply tack coat to inside faces of joint and ensure uniform application.



- Allow tack coat to 'take up' and become 'cheesy' before consolidating lacunae and pointing the wider joint.
  - Leave all fine joints to the latter stages of the work in each section of wall or scaffold lift.
- 90 POINTING
- Flush finish throughout. Whilst fine joints in ashlar work may be filled in a single application, the filling of deeper lacunae should be done in several stages: Carefully smear a small quantity of mortar on the back and sides of the lacuna. Add more mortar and bed in gallet(s) as necessary. Fill joint flush, erring on the slightly proud side. Keep the work dampened and well sheltered. Rain and water from operations being carried out in other work areas must not be allowed to run down any masonry faces immediately after they have been pointed.
- 95 BUILDING UP DETAIL (where scheduled)
- Ceramic armatures manufactured by  
TAENA Pottery, Upton, St.Leonards, Gloucester.  
Diameter: 5mm x 7mm.  
Fixing: Resifix 33  
manufactured by  
Exchem Mining and Construction Ltd.  
PO Box 7, Venture Crescent, Alfreton, Derbyshire.
- 100 PRESSING IN
- Compaction or 'pressing in' of the joint or build-up is vital in order to counter the effects of shrinkage and cracking as the mortar carbonates. The rate of cracking should be assessed and adequate time allowed for pressing in as and when cracks start to appear.
  - Some mortars may require pressing operations to be carried out over a period of a day or more before the work becomes suitably stable. Water dampening can be used to slow the rate of cracking but extreme care should be exercised not to flood the work area. The final pressing involves neatening up the joint edges and levelling as necessary.
  - For maximum sensitivity towards the surrounding historic surfaces, a small hand-size block of foam (e.g. high-density, pink under-floor foam is an ideal tool) should be used to produce the perfect texture.
- 110 PARING BACK
- When the work has dried out to a 'leather hard' state, carefully pare back the mortar surface with a sharp trowel edge or spatula to achieve the following:  
Remove the white film of 'laitance' to create an open-pored surface to aid carbonation of the mortar.  
Blend in the new work with adjacent existing/retained pointing.  
Achieve the required flush finish.
  - Note that a stiff bristle brush may be used as an alternative to a blade in 'opening up' the mortar surface.
  - Visual assessment of the work area should be carried out after paring back to ensure broad consistency in texture and appearance. Note that some variation in texture

will be necessary to make it relevant to the specific stone type(s) and finishes of each work area, e.g. mortar joints to course 'weather stone' should be textured differently to those on fine grained ashlar.

#### 120 DRY BRUSHING

- Allow mortar surface to progress beyond 'leather hard' state and set firm; typically at least 24 hours after the mortar application.
- Brush off all loose material on masonry and joints using a soft bristle brush to further refine the texture of the pared back mortar.

#### 130 SPONGING OFF

- It is important when patch-pointing an isolated area, filling smaller lacunae or working a single joint to avoid isolated 'white' areas showing up against an otherwise untouched surface.
- Ensure mortar surface is firm from previous operations.
- Fill bucket with clean water, soak flat clean sponge and squeeze out water.
- Pass the slightly damp sponge flat across the work using a horizontal 'swipe'/ 'planing' action.
- Use each face of the sponge once only and then rinse in clean water to avoid re-depositing lime residue on the work. Regularly replenishing the water supply, rinsing of the sponge and repeated 'planings' will help further refine and mellow a brushed surface.
- Fine joints in ashlar work are best pressed in as and when shrinkage dictates, then finished with a well-squeezed out clean, damp sponge using the planing action described above.
- Cleanliness and a clean supply of water are essential throughout the sponging off operations.

#### 140 INCLEMENT WEATHER

- Do not use frozen materials and do not lay on frozen surfaces.
- Do not lay stone, attempt any mortar pointing and/or repairs or apply sheltercoat when air temperature is at or below 5°C unless mortar has a minimum temperature of 5°C when laid and walling is thermally protected.

#### 150 PROTECTION

- Arrange the work so that there is sufficient time at the end of each day to consolidate, re-dampen and cover up work areas as necessary.
- Check condition of previously worked areas the following morning.
- Work should be planned and carried out such that it will not suffer over a weekend, unless adequate labour can be provided to tend it as necessary.
- Prevent damage to stonework, particularly arrises and projecting features. Protect with wooden slats, boards, etc., securely fixed. Remove at Practical Completion.
- Ensure work is shielded from strong sunlight, drying winds, driving rain and frost. Scaffolding should be erected such that vertical sheeting and damp hessian can be left in-situ to create a suitable environment for controlled carbonation of mortar repairs and sheltercoating.
- Prevent staining and other disfigurement of stonework during the works. Ensure that scaffolding rainwater detailing is adequate to keep run-off well away from work areas.

- Take care not to let damp hessian or plastic sheeting be blown against work areas. Keep covers taut and approximately 150 mm away from vertical plane of the stonework.
- Allow for some ventilation behind the protection layers, especially at ground level. This is necessary because saturated work cannot carbonate and is vulnerable to freezing at low temperatures.

- APPLICATION OF SHELTERCOATS

To repaired and new stone where scheduled.

160 SHELTERCOAT (if required)

Use the following mix as demonstrated during the trial conservation works of 2008, subject to final approval by CA after selective trial panel application:

Lime putty	2 parts
Chieveley yellow sand ≤ 300 micron	1 part
Bath stone dust ≤ 300 micron	4 parts
Hornton ironstone brown dust ≤ 300 micron	1 part

Alternative mixes using local Ashton Keynes sands (suitably graded), white silver sand (175 micron), quartz sand and yellow brick dust may be acceptable subject to preparation of respective trial panels and approval by CA.

The 'hardness' of the sheltercoat can be varied by adding up to 20% of yellow brick dust to the lime putty component, i.e. 1 part lime putty and 0.2 part brick dust maximum ratio. This gives a pozzolanic effect for robustness to create adherence to the substrate. Use soft-burnt finely ground yellow brick dust from the following approved supplier:

- ☐ Bulmer Brick & Tile Company  
The Brickfields, Bulmer, Sudbury, Suffolk CO10 7EF  
tel. 01787 269232

Pigments (e.g. yellow ochre and burnt umber) may be also added to the mix if deemed appropriate by the CA.

Ensure adequate time is allowed for the application of the proposed shelter coat to a one metre square masonry sample panel in order to adjust the final colour. It is wise to establish final colour on the first coat application but it can be modified through additional pigmentation of the second coat. Further pigmentation to subsequent shelter coats is not permitted.

Some variation of the final colour is anticipated across the elevations. This should be allowed-for by the contractor.

170 MIXING AND STORAGE

Sheltercoat to be thoroughly mixed in batches using a paddle mixer and matured in airtight containers. Water may be added to the mix as required. Store in plastic bins to prevent carbonation. Do not store sheltercoat for longer than two weeks after addition of yellow brick dust. Formaldehyde may be added to sheltercoat prior to use as a preservative subject to prior approval from CA.

## 180 APPLICATION OF SHELTERCOAT

Sheltercoat is to be applied to all exterior masonry surfaces except the War Memorial. The following sequence of operations is to be adhered to at all times:

- Dry brush loose dust from substrate, then lightly wash down if necessary using soft bristle brushes.
- Wet stone several times with limewater (which must be kept as cool as possible before and during application).
- Re-mix matured sheltercoat putty to plastic state.
- Dilute to single cream 'rounded' consistency with 50:50 limewater/skimmed milk (casein) mixture.
- Apply with a soft short-haired bristle brush to damp (not wet) stone surface working the sheltercoat well into the surface; especially hairline cracks. The sheltercoat must be able to diffuse into the open grain. At the first sign of clogging, re-dampen surface and allow it to absorb, then continue.
- As the sheltercoat application starts to turn matt (i.e. as water is absorbed into the stone) work in sheltercoat a second time with a damp bristle brush. Because this activity is likely to be rigorous, take great care not to damage any fragile projecting stone and/or new mortar repairs.
- Pay special attention to the coating and subsequent rubbing up of all arrisses and high points; these tend to receive less sheltercoat per application but need uniformity of covering given their salient exposure to weathering.
- Timing is imperative during each sheltercoat application; if the sheltercoat is too wet it is just moved around the surface and if it is too dry, it is brushed off. If done well the brushstrokes should be barely visible.
- Particular vigilance is required in revisiting any areas of sheltercoat which are slow to 'catch up', i.e. appear to be taking longer to 'matt' than adjoining areas. Aim for a homogenous effect which fills flush all fissures and disaggregated open-pored areas. There should be no cumulative build-up of sheltercoat in re-entrant angles of masonry mouldings as this will tend to blur the architectural detail.  
When the surface has completely dried a small brush can be used to remove any excess that may have built up in undercut areas and fine detail.
- Protect sheltercoat immediately after initial application with damp hessian/cloth, which is in turn to be covered with polythene sheet. Ensure sheltercoat remains damp for at least two days. Periodic re-wetting of sheltercoating during first few weeks after application will aid carbonation and should be carried out using a fine water mist spray. Experience has shown that water misting will be less critical if there is a high humidity, low temperature environment.
- Each coat is to be allowed to 'set firm' and carbonate fully in the controlled environment so that it does not rub off on the hand when applying the next coat.
- Once fully carbonated, repeat the above procedure for all subsequent applications of sheltercoat.
- Three separate coats of sheltercoat are to be applied in total. Each coat is to extend from the top of the crenellated stone parapet down to the base of the stone plinth in one homogenous and seamless application.

## **M6o PAINTING/CLEAR FINISHING**

To be read with Preliminaries/General conditions.

100 COATING SYSTEMS to upper surface of western pier, acting as 'weather-shedding but breathable coating'

- Keim Royalan
- KEIM MINERAL PAINTS LTD  
Santok Building  
Deer Park Way  
Donnington Wood  
Telford TF2 7NA
  
- Telephone: 01952 231250  
sales@keimpaints.co.uk  
www.keim.com/en-gb

300 PREPARATION GENERALLY:

Comply with BS 8000: Part 12. Section 2 and additional requirements in this specification.

When removing or partially removing coatings. use methods which will not damage the substrate or adjacent surfaces or adversely affect subsequent coatings.

Materials used in preparation to be types recommended by their manufacturers and the coating manufacturer for the situation and surfaces being prepared.

GENERALLY

400 HANDLING AND STORAGE:

Coating materials must be delivered in sealed containers, each clearly labelled with the brand name, type of material and manufacturer's batch number.

Wherever possible materials must be from one manufacturing batch. Inform the CA if materials from more than one batch are to be used, store separately and allocate to distinct parts or areas of the work.

Store materials in accordance with. manufacturer's recommendations. Use in order of delivery and before expiry of any shelf-life date.

APPLICATION

700 UNSUITABLE CONDITIONS:

Take all necessary precautions including restrictions on working hours, providing temporary protection and allowing extra drying time, to ensure that coatings are not adversely affected by climatic conditions during and after application.

Prevent or control exposure of operatives to solvent vapour levels exceeding occupational exposure standards set in the current Health and Safety Executive (HSE) document EH40.

Unless it is specifically permitted by the coating manufacturer, do not apply coatings:

To surfaces affect by moisture, frost or airborne dust.

When the air or substrate temperature is below 5degC.

When the relative humidity is above 80%.  
When heat is likely to cause blistering or wrinkling.

711

**COATING GENERALLY:**

To BS 6150, Section 5.

Do not use materials which show any bittiness or other defects when applied. Do not thin or intermix unless specified or recommended otherwise.

Apply priming coats as soon as possible on the same day as preparation is completed. They must be of adequate thickness and suit surface porosity.

Apply coatings by brush or roller unless otherwise specified or approved.

Keep brushes and equipment in a clean condition. Dispose safely of cleaning and waste materials, do not pour into sanitary appliances or drains.

Subsequent coats of the same pigmented material must be of a different tint to ensure that each coat provides complete coverage.

Apply coatings to clean, dry surfaces in accordance with the manufacturer's recommended intervals between coats.

Apply coatings evenly to give a smooth finish of uniform colour, free from brush marks, sags, runs and other defects. Cut in neatly and cleanly. Do not splash or mark adjacent surfaces.

Adequately protect drying and completed work from damage.

## Z21 MORTARS

To be read with preliminaries, general conditions and drawings.

### 10 MORTAR MIX FOR ALL REPAIR, BEDDING and POINTING

- Fine mix :  
Shauncote quarry sand sieved to 1mm + Daglingworth stone dust 50% 50% 2:1 mixed aggregates with lime putty
- Medium mix sieved to 2mm with same proportions as above.
- Coarse mix: 3:1 proportions , aggregates sieved to 4mm .
- English lime putty and natural hydraulic lime (NHL) from approved sources, see clause 30 and clause 40 below.
- Sands: Suitably graded and washed local Ashton Keynes 'sharp' sand (actually 'ovoid' or rounded/sub-rounded according to English Heritage nomenclature) may be substituted subject to guidance from CA approval.
- A sample section of re-pointing will be carried out by the contractor under guidance from the CC before mix is approved by CA for the remainder of the repair works. This operation will allow the exact aggregate grading and proportions to be adjusted and refined in order to achieve the best performing mix for the works.

### 16 MORTAR MIX FOR MORTAR REPAIRS – 'BUTTERCOAT' AND SURFACE FINISHING

The following mortar mix is to be used for a 'buttercoat' backing coat to the inner faces of lacuna. Also, for surface finishing of all mortar repairs in achieving a good textural and colour match to the existing stone:

- 4: 8 ratio lime to aggregate as follows:

Natural hydraulic lime NHL 2	3 parts
Lime putty (added for workability)	1 part
Chieveley yellow sand ≤ 300 micron	2 parts
Bath stone dust ≤ 300 micron	2 parts
Guiting white stone dust ≤ 300 micron	4 parts

### 18 MORTAR MIX FOR DEEPER MORTAR REPAIRS

The following mortar mix is to be used for 'coring out' mortar repairs deeper than 12 mm.

- 3: 8 ratio lime: aggregate as follows:

Natural hydraulic lime NHL 2	2 parts
Lime putty (added for workability)	1 part
Chieveley yellow sand ≤ 2 mm	2 parts
Bath stone dust (with fines removed) ≤ 3 mm	2 parts
Guiting white stone dust ≤ 3 mm	4 parts
- This mix will comprise the bulk of the repairs and is purposely coarser to counteract the effects of shrinkage.
- Nylon fibre reinforcement is to be added in the appropriate quantities under guidance from CC.

### 20 APPLICATION OF MORTAR FOR MORTAR REPAIRS AND BUILD-UPS

- Cut around edge of area to be repaired with a sharp chisel to provide a neat, strong edge or rebate to work to. Always follow the irregular outline of each area of decay so as to produce a naturally unobtrusive effect, cf. a straight-edged repair outline following a square or rectangular outline which will appear dominant.

- Exercise extreme care during these operations in order to strike an appropriate balance between:  
Executing a thorough workmanlike task of cutting into the stone to create effective rebated perimeters to lacuna.  
Conscientious conservation which involves the retention of maximum historic fabric (which in itself precludes cutting out more stone than is absolutely necessary). A sensitive 'stone-by-stone' approach is vital. Repairs in particularly sensitive areas of architectural detailing will be decided on site under guidance from CC and subject to CA approval.
- Lightly 'peck' area within this margin with sharp chisel to give a good key and to remove any loose, friable material.
- Dry brush the surface and remove all debris from stone and scaffold. Flush loose dust from surface and wet stone several times with limewater.
- Re-mix matured mortar to plastic state and add pozzolanic additive if required.
- Prepare slurry of diluted 'surfacing' mortar (refer to clause 16 for mix) to be used as a 'tack coat'.
- Paint 'tack coat' onto area to be repaired and allow some slurry moisture to be absorbed by stone.
- Take care to remove any slurry outside repair area to avoid 'halo' marks on surrounding stone.
- Apply mortar firmly by spatula, small-tool and/or rounded pointing trowel to a maximum coat thickness of 12-15 mm. Take care to pack mortar tightly into all lacuna before laying in the bulk of each repair.
- For deep lacuna, broken pieces of pre-wetted terracotta tile should be tapped down into the mortar (refer to clause F21/113 for tile specification). Where practicable bed the tiles as in brickwork, i.e. with horizontal emphasis rather than face bedding. Create bonding in all directions wherever possible.
- Ensure an ample supply of clean, suitably shaped and dampened tile fragments for quick selection of appropriate shape(s) for each repair.
- Non-ferrous armatures may be required, e.g. Nimbus Conservation 'Nim-T' ceramic armature types (available in two sizes). They are often more useful broken up into short 'stubs'. Set them horizontally into dampened holes at an approximate depth of 10 mm using a dab of the 'buttercoat'. The location holes should be of a slightly larger diameter than the armature so that they grip.
- Compress mortar after it has stiffened slightly; typically 5 to 15 minutes after application. In general, press in the work as and when shrinkage cracks appear.
- A second coat can be applied when the first is leather hard; typically 12 to 24 hours after first application. The surface of the first coat should be keyed. Build up and compress further layers as required.
- Surface can be textured by scraping back or beating with a bristle brush when leather hard.
- Protect mortar repair after initial compression using damp cotton hessian/cloth.

## 25 SAND FOR MORTAR

- To BS 1200 unless specified otherwise.
- Sand for facework mortar to be from one source, different loads to be mixed if necessary to ensure consistency of colour and texture.



- 30 LIME PUTTY
- Use mature lime putty which has a minimum age of 3 years (essential). CC and CA reserve the right to verify source and age of lime putty used for all repairs.
  - Lime putty is to have been made by slaking freshly burnt lime, with enough water to obtain a soft mass of putty. The slaking lime must be hoed and raked and stirred until the visible slaking reaction has ceased. Sieve to remove un-burnt lumps and coagulations using a 2 mm screen.
  - Lime putty, with a shallow covering of water, to have been stored for a minimum period of three years.  
There is no upper limit to the storage period, providing the lime is properly 'knocked up' prior to use.
  - Obtain lime from approved suppliers, in plastic bins, dated with date of slaking.
  - Approved suppliers of lime:  
Cotswold Lime  
Climperwell Farm  
Brimpsfield  
Stroud  
GL4 8LQ  
www.cotswoldlime.net  
contact: Paul Leaver  
tel: 01452 862168  
mob: 07901 794094  
email: paul@cotswoldlime.net
- 40 HYDRAULIC LIME
- Use hydraulic lime, from approved sources only.
  - Approved suppliers of hydraulic lime:  
Cotswold Lime as above
- 50 ADMIXTURES: Do not use any admixtures.
- 60 MAKING MORTAR
- Measure materials accurately by volume using clean gauge boxes. Proportions of mixes are for dry sand; allow for bulking if sand is damp.
  - By adding the sand to the lime putty, mix ingredients thoroughly to a consistency suitable for the work and free from lumps.
  - Ensure 'coarse stuff' is well beaten, rammed and chopped to ensure the best mix.
  - Do not add excess water to the mix. It is not required. By following the above instructions, excess water is not needed.
  - Do not use an ordinary cement mixer for mixing. A traditional 'larry' or a paddle mixer may be used.
  - Make up a large enough batch of mortar to complete work on each elevation at the commencement of works. This ensures consistency of mix, and also a mature coarse stuff.
  - Store coarse stuff in air-tight containers, to allow for later knocking up when required.  
There is no upper limit for the storage period of coarse stuff if stored properly.
  - Mortar is to be tipped out of the containers and the whole batch knocked up. Again, no excess water is required at this point.

- Keep plant and banker boards clean at all times.
- 70 ALL LIME-BASED MORTARS
- Are to be thoroughly protected from running or surface water for a minimum period of 36 hours after incorporation into the works.
  - Unprotected work may require removal and re-instatement at discretion of the CA.
- 80 LIME-BASED MORTARS
- Must not be used in adverse weather conditions, i.e. when outside air temperature is less than 1°C.
  - Work in cold weather shall be protected to ensure a minimum temperature of 5°C is maintained in the work when laid, and must be maintained for at least seven days after use.
  - In any case, work with mortar shall cease at 2°C on a falling temperature and only re-commence on a rising temperature on 1°C, even when protected.
  - No mortar plasticisers or anti-freezes may be used at any time.
  - During any break in use of mortar, all work shall be protected against rain, frost and snow with waterproof coverings.
  - Work in hot weather shall be permitted even when the air temperature adjacent to the work exceeds 25°C, so long as ambient humidity is kept sufficiently high. Avoid all draughts and hang wetted hessian on the outer scaffold. Protect the work at night with additional wetted hessian hanging slightly away from the work, this in turn to be covered by plastic sheeting.
  - Wet hessian must not be allowed to blow against any of the work areas in order to avoid lime blooming.
  - During any period where the temperatures exceed 25°C, all work less than three days old is to be kept moist and prevented from rapid drying out by using hessian and plastic sheeting as stated above.
- 90 CEMENT
- Do not use cement of any type for lime-based mortar repairs.