SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

# NPA03

10 June 2016

#### SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

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C Existing site/buildings/services

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C40 Cleaning masonry/ concrete

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C40

#### C40 Cleaning masonry/ concrete

To be read with Preliminaries/ General conditions.

#### **GENERAL/ PREPARATION**

- 110 SCOPE OF WORK
  - Cleaning existing stonework.
- 161 PROTECTION

Surfaces not designated for cleaning: Prevent damage, including marking and staining. Openings: Prevent ingress of water, cleaning agents, and detritus.

Vents and grilles: Seek instructions before sealing up.

- Temporary mechanical fastenings:
- In masonry: Locate in joints.
- In other surfaces: Seek instructions.

# 180 CONTROL AND DISPOSAL OF WASH WATER AND DETRITUS

Disposal: Safely. Obtain approvals/permits from relevant Authority.
 Method statements and contingency plans for the containment of potential

pollutants are to be submitted for the following:

- Silt Cement and concrete Oils, chemicals and solvents Biocides Weedkillers Waste material (including hazardous waste)
- · Control of wash water: Collect and divert to prevent ingress and damage adjacent areas.
- Above and below ground drainage systems: Keep free from detritus and maintain normal operation.
- 190 CLEANING GENERALLY
  - Operatives: Appropriately trained and experienced for each type of cleaning work.
     Evidence of training: Submit on request.
  - Control of cleaning: Confine cleaning processes and materials to designated areas. Prevent wind drift.
  - Detritus: Remove regularly. Dispose of safely.
  - Monitoring: Frequently check results of cleaning compared to approved trial samples. If results established by trials are not achieved, seek instructions.
  - Modifications to cleaning methods and materials: Seek instructions.

#### 225 RECORD OF CLEANING WORKS

Written report: Record cleaning methods and procedures used for each type of surface and deposit.

Content: Relevant attributes of cleaning methods used including:
 Equipment and settings.
 Dwell times.
 Number of applications.
 Ambient temperatures.

PRODUCTS/ EQUIPMENT

 REMOVAL OF ALGAE AND MOSS FROM EXISTING STONE WALLING
 Location: Existing external stone surfaces where identified and permitted. Preparation and application: Remove all loose growths. Surfaces: Prevent damage, including abrasion. Walls should be cleaned by low pressure spray application at 1 litre per square metre. Chemicals, biocides etc - The area to be cleaned is located in a sensitive environmental location. Chemicals to assist cleaning are not permitted. C40

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> C41 Repairing/ Renovating/ Conserving masonry

C41

#### C41 Repairing/ Renovating/ Conserving masonry

# TO BE READ WITH PRELIMINARIES/ GENERAL CONDITIONS

#### **GENERALLY/PREPARATION**

102 THE SITE

The upstanding remains of structures of the Former Gunpowder Works at Pontneddfechan, Glyn Neath are located in the Brecon Beacons National Park along a gentle sloped path parallel to the River Mellte with steep and heavily wooded hillside to the west and shear drop to the river bed on the east. Each structure has been identified by a Nobel number (see below) this number has been included in the tender documents for each building and for clarity the structure chosen for the proposed works have been listed 1-11.

Upstanding ruinous sections comprise of:

Nobel number	Building
No.28	Hydraulic Pump House
No.29	Cake House
No.30	Cake House
No.33	Old Corning House
No.34	New Corning House
No.35	Water Wheel Housing
No.35A	Turbine and Pump House
No.37	Expense Magazine
No.39	Glazing House
No.40	Packing House
No.41	Dusting House
No.43	Boiler House
No.44	Stove House
No.46	Magazine
No.47	Pellet House
No.48	Magazine
No.61	Stable
No.68	Pellet Press House
-	Chimney
-	Tunnel
-	Leat

Proposed repair work and consolidation works will be carried out to the following structures:

Building number	Nobel number	Building
1 2 2 3 4 5 6 7 8 9	No.44 No.35 No.35A - No.33 No.34 No.28 No.37 - No.41	Stove House Water Wheel Housing Turbine and Pump House Leat L08 Old Corning House New Corning House Hydraulic Pump House Expense Magazine Chimney Dusting House

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10	38	Turbine House
11	39	Glazing House

A level area to the north of structure no. 30 is designated as the preferred site compound area enclosed with secure fencing as specified Q40/100. The above buildings shall also be separately enclosed with site fencing as specified. Details of site boundaries are as detailed on drawing NPA03 WD21.

The Employer shall only give the Contractor access to such parts of the site as may be necessary to complete the work No unauthorised entry to adjoining agricultural land or private property.

# 110 WORKING ON SCHEDULED MONUMENTS

The primary aim is to preserve and safeguard the structural integrity of the monument. To preserve underlying archaeology, plants or trees must not be up-rooted. Where trees are in danger of damaging the structure, careful removal will be carried out under the direction of the CA. may be treated to decay in situ.

Vegetation on monuments may be supporting parts of a structure and should be removed carefully so not to disturb or cause collapse of masonry. Where this may occur first seek approval to proceed further.

Monuments are known to shelter bats and other wildlife including protected plant life. Care should be taken not to disturb them and strict controls are in place for use of specified Chemical treatments.

Lichens are not to be removed from stonework.

Any fallen masonry identified on the ground should be recorded and Archaeologist and CA informed. Do not remove from location.

Burning of fires on or near the site of a scheduled monument is strictly forbidden.

#### 112 SCAFFOLDING

- Scaffolding contractors must be able to demonstrate and possess:
  - A sound Health and Safety Policy.
  - Adequate Employers and Public Liability Insurance.
  - Scaffolding operatives should be registered under the Construction Industry Training Board (CITB).
  - Scaffolder's Record Scheme to Identify the level of competence.
  - All operatives are fully trained, registered and competent in activities undertaken.
  - All work is adequately supervised by competent trained Supervisors.
  - Materials conform to the specified standards and are regularly checked and maintained.
  - Work is carried out in accordance with relevant codes of practice.
- Scaffold should stand on planks to spread the load on the ground surface and be free-standing. No part of scaffolding should touch the structure. Putlog scaffolding into the masonry will not generally be allowed and any proposal to do so, must be approved by the CA before proceeding. Timber pads may be used to brace scaffolding against apertures.
   Vulnerable pole ends should be wrapped in felt.
- All scaffold to be built to TG20:13 specification, fully boarded at each required lift including toe boards, certified and scaffold tag system in place on erection.
- Tubular and fittings and Kwik Stage system scaffolding and steel ladders, all approved to relevant Scaffolding code of practice and Site Standards BS EN 5973.

All platforms, ladders, hoists, scaffolding, sheeting, hoarding, and protection to be Inspected regularly in accordance with the regulations and maintain records of these inspections on site.

- Tender quotation to include for erection and dismantling of scaffolding and all decking as described.
- All risk assessment documentation and method statements to be prepared and approved before start date.
- Take all reasonable precautions to ensure that unauthorised persons cannot gain access to

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scaffolds. Remove and lock up all ladders from the bottom lift of scaffolding and secure all hoardings each night. Provide suitable hoarding to the base of the access scaffold with no externals which can be released.

Prevent damage to the existing building. Any damage caused to the building is to be made good to the approval of the NIEA at the Contractor's expense
 Scheduled monuments are of architectural and historical importance. Historic fabric is vulnerable

Scheduled monuments are of architectural and historical importance. Historic fabric is vulnerable to damage and much of it irreplaceable. All personnel should be made aware of this and treat the building with great care.

#### 115 SCOPE OF THE WORKS

• Restoration of ruinous upstands of existing buildings, structural consolidation, grouting of deep voids, repairs to unstable structures, repointing and vegetation control and removal.

#### 120 REPAIRS TO LOOSE AND DANGEROUS MASONRY

Carefully take down inappropriate and or loose masonry material to extent agreed with CADW and CA. All collapsed material to be set aside for reuse. Adequate propping should be placed as required during the course of any dismantling of loose material. Stones salvaged should be cleaned and set aside for possible re-use. Where historic photographs exist, these should be used as a basis for building original stone back into original positions as far as possible. All work to be dismantled should be recorded as clause 140.

Rebuild section to form and style matching existing walling.

Make good surfaces. Leave joints raked back 25mm in preparation to repointing rubble work as clause C41/827. Bedding mortar for stone to be Lime NHL3.5:Sand

Masonry units to be reused: Stones that are found to be loose should be held in place by wooden wedges and suitably propped as required until repair work is undertaken.

Only remove where stonework may fall or collapse. Remove carefully and in one piece after recording.

- Treatment: Clean off old mortar, organic growths and dirt, and leave units in suitable condition for rebuilding.
- Identification: Mark each unit clearly and indelibly on a concealed face, indicating its original position in the construction. Transcribe makings to drawings/photographs/labels as clause 140.
- Wall to be left raked back to a stable angle. Make good surfaces. Leave joints raked back 25mm in preparation to repointing. Bedding mortar for stone to be Lime NHL3.5:Sand (NOTE: adequate quoinstone ties to be inserted to provide stability to wall where required. top of wall to be consolidated as clause 820.

When working to remove loose brickwork to barrel vaulted roof structures adequate temporary formwork props must be in place. Loose bricks to be remove and rebedded in single operation. Do not remove more than two bricks are a time and rebuild before proceeding to next. Repoint arch as clause 827 before applying grout consolidant as clause 720.

#### 121 DISMANTLING SECTIONS OF UNSTABLE WALLING IN PREPARATION TO REBUILDING Structure to be dismantled to be fully recorded as clause 140.

Carefully take down all loose masonry material to extent agreed with CADW and CA. All collapsed material to be set aside for reuse. Adequate propping should be placed as required during the course of any dismantling of loose material. Only work from top downwards.

Stones salvaged should be cleaned and set aside for possible re-use. Where historic photographs exist, these should be used as a basis for building original stone back into original positions as far as possible.

Rebuild section to form and style matching existing walling.

Make good surfaces. Leave joints raked back 25mm in preparation to repointing rubble work as clause C41/827. Bedding mortar for stone to be Lime NHL3.5:Sand

Masonry units to be reused: Stones that are found to be loose should be held in place by wooden wedges and suitably propped as required until repair work is undertaken.

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Only remove where stonework may fall or collapse. Remove carefully and in one piece after recording.

- Treatment: Clean off old mortar, organic growths and dirt, and leave units in suitable condition for rebuilding.
- 122 REPLACE MISSING STONEWORK

Bedding mortar for stone to be Lime NHL3.5:Sand (NOTE: adequate quoinstone ties to be inserted to provide stability to wall where required.

Use only salvaged stone from areas to be rebuilt. Backfill hole with mortar to cover all sides and insert stone. Tamp into position and remove excess mortar. Top of wall to be consolidated as clause 820.

125 REBUILDING RUBBLE MASONRY AND BRICKWORK DRESSINGS GENERALLY Replacement materials: Salvaged materials supplemented as appropriate by agreement with CADW and CA.

Mortar: As section Z21.

- Mortar analysis Existing mortars from each structure to be analysed for aggregate ratio, size and type.
- Sand source/ type: Locally sourced to match sieve test of existing mortar.
- Fixings: As specified elsewhere.
- Rebuilding: To match previous face and joint lines, joint widths and bonding. Joints to be left raked back 25mm in preparation to repointing.
- Adequately bonded to retained work/ backing masonry, as appropriate.
- Joint surfaces: Dampen, as necessary, to control suction.
- Laying masonry units: On a full bed of mortar; perpend joints filled.
- Exposed faces: Remove mortar and grout splashes immediately.
- Joints: As agreed sample but to be flush with exposed aggregate. Do not overfill joints or widen exposed mortar face unnecessarily
- Pointing As clause 827.

# 126 REPLACING ISOLATED MISSING STONE OR UNDERMINED AREAS Location: As identified on drawings.

Preparation: All areas should be adequately propped prior to carrying out work to prevent further collapse. Core of wall if devoid of mortar should be backfilled and or grouted prior to rebuilding work.

Materials: Materials to be used should be as found salvaged to base of collapsed portion and should be set out dry on ground to identify their original pattern. Rebuild: As clause 125.

# 127 REMOVAL OF TREE SAPLINGS AND WOODY VEGETATION Location: As identified on drawings. Preparation: All woody vegetation to be spray treated as clause 130. All root systems to be

removed from wall with loose masonry recorded before removal and set aside for rebuilding. Care to be taken to minimize disruption to wall which may compromise its stability. Re-bed loose masonry as clause 120.

# 128 REFORMING COLLAPSED OPENINGS USING SALVAGED STONE/BRICKWORK

Repairs will be carried out with materials and methods of construction that will be in keeping with the age and type of building. It is important that the CA is kept informed of progress and when any unexpected or untoward items come to light, so that appropriate decisions can be made at the earliest opportunity.

The Contractor shall include for undertaking any repair or reinstatement works required as a result of the chosen method of reconstruction.

The contractor should prepare and submit a risk assessment before work commences on site. Where residual risks remain, the contractor is to prepare method statements to list safe working

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methods and sequences. The contractor must take into account the hazardous nature of the in its method of reforming openings and to ensure the stability of the structure during the course of the works.

All masonry to be retained and where possible reused as part of the reconstruction and reinstated accurately to the historic height and profile of the original opening.

#### 129 REPAIRS TO UNDERMINED MASONRY

All loose masonry to be carefully removed and area propped to prevent further collapse. CA and Engineer to be afforded inspection prior to re-building. Re-building to be carried out using collapsed and salvaged stone. Clean base area down to existing wall and rebuild as C41/125.

- 130 REMOVAL OF PLANT GROWTH FROM MASONRY Location: Existing upstanding sections of walls Chemical for treatment: Systemic weedkiller capable of killing right down to roots Preparation: As clause 610 Application: As clause 620 NOTE: Spray treat active foliage with chemical and leave to absorb through foliage into root system (Spray only on approval and where permitted. No chemical spray treatment to be carried out to structures on or near river bank). The Contractor should remove all dead vegetation by hand from the wall face and core of wall in advance of raking out and re-pointing. Care should be taken not to disturb masonry in the process. It will be inevitable that removal of woody vegetation within the wall core will result in loosening masonry. This should be first recorded, photographed and set aside and rebuilt in the original place. All raked out joints with vegetation removed must be presented to the Architect for approval prior to commencing
  - re-pointing.
    Plants, root systems and associated soil/debris: Carefully remove from joints, voids and facework following preliminary treatment. Tease as much vegetable matter from joints as possible without disturbing masonry.
    - ROOT REMOVAL
  - Removal of roots/stumps: Brush apply glyphosate root stump remover to fresh cuts formed in stump or root with chainsaw and or drill. Cover treated areas with plastic sheeting. Where growth cannot be removed completely without disturbing masonry seek instructions.
  - Unwanted plants close to masonry: Where removal of root systems is not possible or desirable cut through stem as close to the ground as possible. Remove bark from stump and apply herbicide paste. Leave stump to wither.

# 132 REMOVAL OF VEGETATION BY HAND To be carried out where chemicals are not permitted. All foliage, woody growth and root systems to be removed with aid of trowels and hand tools. Appropriate PPE gear to be worn by all operatives. Masonry disturbed to be recorded as clause 140 and set aside for reuse. Waste to be removed to recycle skip. No burning of waste onsite.

# 134 EXCAVATING BY HAND - AREAS OF BURIED WALL FOOTINGS/REMAINS

Photographic records and hand-drawn sections will be completed to recognised standards and to clause 140.

Each feature will be individually documented on context sheets and hand drawn in section and plan at an appropriate scale (1:10 or 1:20). Archaeologists will be informed appropriately of dates and arrangements to allow for adequate monitoring of the works.

Carefully remove all loose collapsed stone. No mechanical excavators will be permitted to unearh structures. All salvaged collapsed stone to be removed and stored in metal gabion baskets. Trowels and scrapping tools to be used to remove all vegetation and soil to remains of wall footings etc. Prepare walls and wallheads to be consolidated.

Risk assessments and Method Statement: Contractor to provide.

All personnel to wear appropriate PPE gear.

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135 REMOVAL OF CEMENTACIOUS POINTING TO HISTORIC ASHLAR CARVED FEATURES Carefully rake out cementitious pointing to all narrow ashlar joints using oscillating and hand tools. Grinders and other cutting tools are not permitted see clause 150. Joints should be raked back 10mm as clause 810.

# 140 RECORDING OF WORK

- General: Record work carried out to masonry clearly and accurately using written descriptions, full mapping of existing stonework pattern using masonry tracing film, sketches, drawings and photographs, as necessary. All stones to be numbered on tracings/sketches and numbering to be carried out on each stone using white masonry paint. Stones to be cleaned of all old mortar, grim and soil etc. Metal plastic coated gabion baskets to be used to store stone with suitable indelible labelling on each basket.
- Numbering and storing of stonework as drawing NPA03 WD20.
- Specific records: Stone replacements/repairs, deep grout filling of voids in masonry walling, biocide applications.
- Documentation: Submit on completion of the work.
  - Number of sets: 2 copies of record information to CA at Practical Completion.
  - Record masonry using tracing film and board panels of area to be carefully dismantled before commencing work, use measurements and photographs as appropriate to record stone patterns, joint widths, special features, etc. Tracing sheets of masonry to be retained on site until job is complete.
  - Digital photography of existing and progress work. Minimum resolution 5 mega pixels.
  - Identification of masonry units to be removed, replaced or repaired to be clearly mark, indelibly, on top bed of masonry units or parts of units to be cut out and replaced.
  - All dismantled masonry to be stored in gabion baskets with adequate numbering of baskets relating to recorded information sheet as per example on drawing NPA03 WD20.
  - NOTE: CA, CADW and Archaeologist should be informed of any part of structures that may be disturbed during the course of removal of masonry.
  - Drawings/ photographs to be marked up accordingly and 2 sets of documents issued to the Architect.

#### 142 SITE VISITS

To confirm type and extent of repair/ renovation/ conservation work shown on drawings and described in survey reports and schedules of work.

Parties involved: CA, CADW, contractor's representative, foreman and mason.

Allow at least five working days before starting each section of work.

Instructions issued during inspection: Confirmed in writing with drawings and schedule as required before commencing work. To be confirmed by CA.

#### 145 REMOVAL OF INAPPROPRIATE CONSTRUCTION MATERIAL

Remove portion of infill walling and clean underlying area of all soil and loose material. Prepare original exposed floor/base and wall surfaces for re-pointing. Leave joints raked back 25mm in preparation to wall topping repointing. Bedding mortar for stone to be Lime NHL3.5:Sand

NOTE: Archaeologist to be present during removal as clause C90/160

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# WORKMANSHIP GENERALLY

150 POWER TOOLS

Usage for removal of mortar: The use of power tools including percussive chisels and grinding wheels will not be permitted without the express permission of the CADW and their use must not be assumed. NOTE: The use of percussive chisels and grinding wheels will not be permitted for raking out stonework or brickwork or pointing cutting out bricks. This operation to be carried out using a heavy duty oscillating power tool Arbortech Allsaw AS170 oscillating power tool with BL170S HP cutting tool and BL170 HN TCT Heritage blades range.

#### 155 PUTLOG SCAFFOLDING

• Usage: Will not be permitted. Building structures unstable.

#### 165 STRUCTURAL STABILITY

- General: Maintain stability of masonry. Report defects, including signs of movement, which become apparent during the removal of masonry units.
- Do not undermine wall footings and do not dislodge stone that could initiate collapse.
- Protect any voids resulting from root removal.
- Where significant structural movement or cracking is identified, inform the Architect immediately and provide sufficient support to prevent collapse and isolate the area until further instructed.

#### 170 DISTURBANCE TO RETAINED MASONRY

- Retained masonry in the vicinity of repair works: Disturb as little as possible.
- Existing retained masonry: Do not cut or adjust to accommodate new or reused units.
- Retained loose masonry units and those vulnerable to movement during repair works: Prop or wedge so as to be firmly and correctly positioned.

#### 182 OPERATIVES

Skill and experience of site operatives: Appropriate for heritage types of work on which they are employed.

Documentary evidence: Submit on request evidence of CRS, CSCS, construction skills accreditation, Heritage skills accreditation or similar.

Contractor has to provide training for at least two apprentice trainees in a specialist trade (stonemasonry) to complete the training and develop the skills required to sustain possible long term employment.

#### 184 WORKMANSHIP

- Keep stonework clean during building and re-pointing and until Practical Completion.
- Ensure that no mortar encroaches on face of stonework.
- Remove all mortar staining from face of stonework immediately after filling of joints.
- Work from top to bottom.

#### 185 ADVERSE WEATHER

- General: Do not use frozen materials or lay masonry units on frozen surfaces.
- Air temperature: Do not bed masonry units or repoint:
  - In hydraulic lime:sand mortars when ambient air temperature is at or below 5°C and falling or unless it is at least 3°C and rising.
  - In nonhydraulic lime:sand mortars in cold weather, unless approval is given.
- Temperature of the work: Maintain above 3 degrees until mortar has fully set.
- Rain, snow and dew: Protect masonry by covering during precipitation, and at all times when work is not proceeding.
- Hot conditions and drying winds: Prevent masonry from drying out rapidly.
- New mortar damaged by frost: Rake out and replace.

C41

#### 190 CONTROL SAMPLES

- General: Complete an area of each of the following types of work, and arrange for inspection before proceeding with the remainder:
  - 1sq m pointing (see also clause 815)
  - Sample protection from adverse weather and damage.

#### 195 QUALITY CONTROL

Remove isolated samples of completed pointing as indicated by the CA for the purpose of ensuring conformation with specification requirements

#### 210 STONE PINNINGS

Material for pinnings: Salvaged stone or new basalt. Pinning stone and methodology to be agreed with CADW in advance of carrying out the works Placing: Tamp pinnings firmly into fresh mortar. Ensure mortar is thoroughly compacted into voids and that levelling and load distribution functions of pinnings are retained.

#### 395 STONE INSERTS

Large voids to receive inserts:

- Clean out debris from existing pocket and flush out with water.
- Replacement stone: All replacement stone to be sourced from loose stone found at ground level at base of wall and to CADW approval.
- Build out pocket using replacement stone to line of existing wall using hydraulic

lime

- mortar 1.5NHL
- Rake back joints 25mm for repointing

#### MASONRY REPAIRS

510 MASONRY STITCHING METHOD A

Material: 6mm Diameter Helifix Helibars.

Methodology: All Helibars should extend 200mm min. either side of crack in walling. The horizontal slot in the mortar bed should be 70-100mm deep. NOTE Joints to be raked out using oscillating tools as clause 150. All mortar and loose debris must be removed to ensure a sound bond. The slot to be prepared with Helifix Helbond Primer. For 6mm diameter Helifix Helibars the slot should be 10mm wide. Using a Pointing Gun inject a bead of Helifix Helibond to the back of the slot. Using a finger trowel push the Helifix Helibar into the grout to obtain good coverage. Insert further bead of Helifix Helbond over the exposed Helibar, finishing 10-15mm from the face and iron into the slot using a finger trowel. Repoint the mortar bed and make good.

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# 520 MASONRY STITCHING METHOD B

Material: 6mm Diameter Stairrib Stainless steel dowels and epoxy resin.

Methodology: Dowels should extend minimum 100mm min. either side of crack in individual stone component. Hole core locations to be agreed in advance with NIEA (retain bore dust for finishing off repairs). Insert dowel(s) in epoxy resin filled hole(s). Bore dust to be mixed with resin and applied over entry holes and dressed to match stone texture.

# SYSTEMIC WEEDKILLER

#### 610 PREPARATION

Ensure that suitable means of protection are employed to protect grassed areas and water sources to prevent run-off and staining.

# SPECIFICATION

Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

C41

# 620 APPLICATION

- For maximum effectiveness treatment should be applied to active growth.
- Treatment should take place in wind free conditions to minimise spray drift.
- Areas should be treated by generous low pressure spray application. Once existing growth has been killed by initial application this should be removed.
- Application should be by experienced operators carefully following the manufacturer's instructions and safety advice.

# WALL CORE GROUT CONSOLIDATION

- 710 REPARATION FOR GROUTING
  - Location: As identified on working drawings.
  - Contractor to present proposals for approval. All forms of propping should be adequate to provide support but not damage walls or vaulted ceilings etc.
  - Grouting holes: 10mm diameter to achieve an effective distribution of grout so that, on completion, all voids in masonry and detached plaster are filled.
  - Maximum height of each grout pour: Regulate to prevent disruption to masonry.
  - Open joints in masonry: Seal with an approved temporary material to prevent leaking of grout.
  - Leave weep holes every two or three courses to assist in flushing out dust and debris, and to prove effectiveness of grouting. Locate temporary seal back from facework to allow for specified repointing. Seek instructions if repointing precedes grouting.

#### 720 GROUT CONSOLIDATION

Preparation as clause 710.

NOTE: All procedures and specification to be agreed on site with Structural Engineer, CA and CADW before commencing work.

Material for grouting: St. Astier NHL3.5 COULINEX grouting and injection mortar

Mixing proportions: As recommended by manufacturers and Structural Engineer.

Finish: Clean up all excess spillages and runs as work proceeds and while material is washable. Any hardened remains to be carefully removed on removal of formwork protection.

730 FLUSHING OUT

Timing: Generally before grouting.

Requirement: No Flushing out of core of masonry walls is to be carried out unless specifically agreed with Structural Engineer.

# 740 APPLICATION OF GROUTING

- Grouting: Continuous operation during each lift. Allow grout to set before commencing subsequent lifts.
- Monitoring: Monitor grouting carefully and continuously at each delivery point (flow and delivery pressure), and at adjacent/ opposite wall faces, to ensure that there is an effective distribution of grout with no leaking, staining, or disruption to the masonry.
- Temporary seals: Remove on completion of grouting and leave joints in a suitable condition for repointing.

# POINTING/RE-POINTING

# 810 PREPARATION FOR REPOINTING BRICKWORK

Removing mortar: Leave joints raked back 10-15mm where rebuilding work proceeds.

Where joints are to be raked back this should be carried out using Arbortech Allsaw AS170 oscillating power tool with BL170S HP cutting tool and BL170 HN TCT Heritage blades range to be agreed with CA approval of sample. The approved sample to be 1sq m to be retained as a reference sample throughout the contract.

- Work from the top of the wall downwards.
- Remove carefully and without damaging adjacent masonry, arrises or widening joints.
  - Existing narrow joints to be assessed by CA before proceeding with raking out.

C41

Recess for repointing: Form a neat recess of depth not less than 10mm When mortar beyond this depth is loose and friable and/ or cavities are found seek instructions.
 Dust and loose debris. Remove. Dampen joints to control suction as necessary.

#### 815 PREPARATION FOR RE-POINTING RUBBLE STONEWORK - RAKING OUT CEMENTACIOUS POINTING

- Removing mortar: Cutting out of joints by hand or percussion tools to be agreed with CA and only on completion of an approved sample.
  - Work from the top of the wall downwards.
  - Remove carefully and without damaging adjacent masonry, arrises or widening joints.
  - All existing mortar should be removed from top and bottom of joint and back face should be square and firm.
  - Recess for repointing: Form a neat recess of depth not less than 25mm. When mortar beyond this depth is loose and friable and/or voids are found seek instructions.
  - Dust and loose debris. Remove using compressed air to ensure that prepared joint is completely free from loose material. Dampen joints before filling with mortar to control suction as necessary.
  - Sample panel to be prepared for approval A 1sq m approved sample panel to be retained as a reference sample throughout the contract.
- Repoint a clause C41/827.
- 816 PREPARATION FOR RE-POINTING RUBBLE STONEWORK SCRAPING BACK EXISTING ERODED LIME MORTAR JOINTS

NOTE: Only to isolated spots of rebuilding where masonry is disturbed during course of propping or tree felling.

Removing mortar: Cutting out of joints by percussion tools is not required.

Permission to use to be agreed with CADW and only on completion of an approved sample.

- Work from the top of the wall downwards.
- Existing lime mortar has eroded back from arrises and requires carefully scrapping out cleaning without damaging adjacent masonry, arrises or widening joints. All existing mortar should be removed from top and bottom of joint and back face should be square and firm.

Recess for repointing: Form a neat recess of depth not less than 25mm. When mortar beyond this depth is loose and friable and/or voids are found seek instructions.

Dust and loose debris. Remove using compressed air to ensure that prepared joint is completely free from loose material. Dampen joints before filling with mortar to control suction as necessary. Sample panel to be prepared for approval - A 1sq m approved sample panel to be retained as a reference sample throughout the contract.

Repoint a clause C41/827.

Other requirements: Operative to wear respirators and eye protection and general PPE.

# 820 PREPARATION FOR TOPPING-OFF WALL HEAD

• Remove all vegetation and roots as clause 130. All loose masonry to be recorded before removal and rebedded before applying capping.

Removing mortar: Cut back by hand method agreed with CA all recently applied top mortar coping as identified to a depth of 25mm around bedded stonework.

- Work from the top of the wall downwards.
- Remove carefully and without damaging adjacent masonry, arrises or widening joints.
- Dust and loose debris. Remove using compressed air to ensure that prepared joint is completely free from loose material. Dampen joints before filling with mortar to control suction as necessary.

# 822 PREPARATION FOR CONSOLIDATING EXPOSED WALL CORE

Removing mortar: Cut back by hand method agreed with CA all recently applied mortar as identified to a depth of 25mm around bedded stonework and or deeper where core stones protrude. Do not loosen stone in the process. Where stones are worked loose. The area should be photographed, each stone face marked and recorded and set aside for re-use.

C41

- Remove carefully and without damaging adjacent masonry, arrises or widening joints. Dust and loose debris. Remove using compressed air to ensure that prepared joint is completely free from loose material. Dampen joints before filling with mortar to control suction as necessary.

# 827 RE-POINTING RUBBLE STONE AND BRICKWORK WALLING

- Preparation of rubble stone joints: As clauses 815 and 816.
- Preparation of brickwork joints: as clause 810.
  - Mortar: As section Z21.
    - Mix: Coarse stuff.
    - Proportions: 1:3 (lime:sand NHL2:aggregate)
    - Sand source/ type: Aggregate to match colour and sieve analysis of existing pointing. Joints: Widths vary, average 20mm wide, finished flush with face of stone. Other requirements: Grout deep voids as recommendations.
      - Joints to be pointed flush and finished as clause 835.

NOTE: Rebuilt masonry to be defined from undisturbed masonry by means of demarcation lines. Method of demarcation lines in pointing to highlight different phases of repair work to be agreed with Architect in advance and in compliance with CADW.

Options for demarcation lines include:

- Hammered in masonry nails in joints.
- Coloured mortar used in pointing for joints between new and old.
- Lead or dpc strip set in bedding joints.

Other requirements: Operative to wear gloves and eye protection to prevent burns and general PPE.

# 828 WALL HEAD CONSOLIDATION

# METHOD 1 - MORTAR PROTECTIVE COATING TO WALL HEADS

- Preparation: As clause 820
- Mortar: As section Z21.
  - Mix: Coarse stuff.
    - Proportions: 1:3 (lime puttyNHL5:aggregate:grit)
    - Sand and grit source/ type: Aggregate to match colour and sieve analysis of existing pointing.
- Joints: Widths vary across wall head in access of 25mm up to 100mm, finished flush with face of stone.
- Other requirements: Grit to match existing in colour and size. Present samples for approval.
- Mixing: Sand: proportions as specified by manufacturers. Grit proportions to prepared mortar as directed by supplier.
- Joints to be pointed flush and finished as clause 835.
   NOTE: Consolidation to chimney head to be carried out on top of new slate capping. Slate to be bedded on 1:3 (lime puttyNHL5:aggregate:grit) to close off and cover entire flue opening and bear onto brickwork to outer perimeter edge of chimney. Mortar protective coating (as above) to be applied over.

#### METHOD 2 - SOFT CAPPING TO WALL HEADS

- Existing vegetation etc to be hand removed (No chemicals) as clause C41/130.
- Caution: when working over ensure no additional loading is imposed over vaulted ceiling roof/
- Operative to take safe measures to ensure works is carried out safely. Contractor to provide method statement for approval before commencing work.
- Roof make up: Grass turfs laid on asphalt layer on Limecrete as clause M14/100 laid on Damp proof membrane 1000 gauge.
- Prepare wall tops and provide protection to areas below work area.
- Source local turf cut by machine and not by hand and sufficiently thick to preserve root system with good grass sward. Turf must be freshly cut.

C41

- Lay turf upside down on edge of wall top ensuring sufficient lap onto wall top to retain turf in
  position. The length of the turf will vary depending on the width of wall head. Leave free end of turf
  strip hanging down wall face. Ensure that the edges of adjacent strips of turf are closely butted
  and that there are no gaps between them.
- Lay continuous 100mm thickness of general medium loam over the turf to cover the entire wall top
  and right up to the edge of the wall face. Screen soil to remove rocks in excess of 50mm in size.
  Soil should be moist enough so that it retains its shape when squeezed but crumbles when
  touched. Do not use saturated soil. Firm soil down but do not compact. Fold hanging ends of turf
  up and over to form a very slight overhanging bulge over the wall edge and remove excess turf.
  Firm down so that the turf is in full contact with the soil and no air pockets are left. Pay particular
  attention to the edges.
- Where necessary trim turfs to length to give tight butt joints with no gaps. Ensure that there is no lapping of turf over turf as this will prevent proper growth.
- Peg turfs in place with short lengths of split bamboo cane pushed in a various angles all over the surface of the soft capping to pin the turf to the soil layer. Pay particular attention to edges. Water completed soft capping as soon as laying complete and keep watered until established. Do not saturate.
- 829 MORTAR WEATHERING LEDGES Preparation: As clause 820 Mortar: As section Z21.
  - Mine Coores stuff
  - Mix: Coarse stuff.
  - Proportions: 1:3 (lime puttyNHL5:aggregate:grit)
     Sand and grit source/ type: Aggregate to match colour and sieve analysis of existing
  - pointing.

Application: Apply mortar sloped ledge within pockets or mortices in wall. Build up max. 20mm feathering to outer ledge.

Other requirements: Grit to match existing in colour and size. Present samples for approval. Mixing: Sand: proportions as specified by manufacturers. Grit proportions to prepared mortar as directed by supplier.

Joints to be pointed flush and finished as clause 835.

#### 830 MORTAR CONSOLIDATION TO EXPOSED WALL CORE - ROUGH RACKING Preparation: As clause 822

Mortar: As section Z21.

- Mix: Coarse stuff.
- Proportions: 1:3 (lime puttyNHL5:aggregate:grit)
- Sand and grit source/ type: Aggregate to match colour and sieve analysis of existing pointing.

Joints: Widths vary across wall in access of 25mm up to 100mm. Build back into original positions and form all loose stonework. The existing state of the wall core should be preserved All pointing in and around stonework should leave stones protruding and retain the appearance of a core and not a false impression of a flush pointed wall face.

Whilst achieving the wall core appearance it is important to prevent areas where water can collect and pond.

Other requirements: Grit to match existing in colour and size. Present samples for approval. Mixing: Sand: proportions as specified by manufacturers. Grit proportions to prepared mortar as directed by supplier.

Joints after the initial set of the mortar has taken place, should be lightly tamped/ stippled with a stiff bristle brush to expose the aggregate. Bristles should not be dragged across the face of the joint. Brushing should be along the joints only to remove any lime latence topping forming.

C41

# 831 FILLING OF JOINTS

Moisten joints before filling by light mist spraying from hand-held spray. Ensure mortar is well packed into joints to ensure no voids are left. No filling of joints should be carried out until the CA has inspected the prepared joints.

#### 832 FILLING OF DEEP VOIDS

Location: Only where loose masonry is to be reinstated.

Where existing mortar is removed to depths exceeding 30 mm, joints should be back-filled with mortar, 1:2.5 mix NHL 1.5:sand, to within 30mm of surface before final pointing with lime mortar. Deep voids should be built out in layers to prevent slump and where voids or joints exceed 25mm in width the void should be built up with pinning stones as clause 210.

#### 835 FINISHING OF JOINTS

Joints should be finished flush with mortar bridging from stone arris to stone arris with arris lines visible in the finished work. Do not allow mortar to encroach onto the stone face. Feathering of mortar at surface of stones shall not be permitted. After the initial set of the mortar has taken place, joints should be lightly tamped/ stippled with a stiff churn bristle brush to expose the aggregate. Bristles should not be dragged across the face of the joint. Brushing should be along the joints only to remove any lime latence topping forming.

#### 840 POINTING WITH TOOLS/IRONS

- General: Press mortar well into joints using pointing tools/ irons that fit into the joints, so that they are fully filled.
- Face of masonry: Keep clear of mortar. Use suitable temporary adhesive tape on each side of joints where necessary. Finish joints neatly.

#### 860 BRUSHED FINISH TO JOINTS

Timing: After initial mortar set has taken place remove laitance and excess fines by brushing, to give a coarse texture. Do not compact mortar.

#### 870 INCLEMENT WEATHER

- Do not use frozen materials and do not apply on frozen surfaces.
- Do not fill joints when air temperature is at or below 3 deg.C unless mortar has a minimum temperature of 4 deg.C when laid and walling is protected.
- Maintain temperature of the work above freezing until mortar has fully hardened.
- Adequately protect newly re-pointed walling against frost, rain and snow by covering when precipitation occurs and at the completion of each days work.
- Rake out and replace mortar damaged by frost and where instructed, rebuild damaged work.

#### 880 PROTECTION

- Prevent damage to stonework, particularly arrises and projections
- Protect with wooden slats, boards, polythene sheeting etc., securely fixed. Remove at
- Practical Completion.
- Prevent lime bloom staining and other disfigurement of stonework during construction and pointing.
- Protection of pointing should be provided by Monarflex sheeting secured to scaffolding to shield from inclement weather or direct sunlight. Hessian sacking should be hung vertically over fresh pointing and kept moist to prevent rapid drying out.

#### 890 SAMPLE PANELS

Prepare and make arrangements for the CA to inspect a sample panel of not less than 1.0m<sup>2</sup> of completed pointing in rubble stonework before commencing general repointing.

C41

#### 900 CLEANING OFF

Every effort should be made to keep the surface of stonework clean as work proceeds. Surface staining should be removed by use of proprietary hydrochloric acid based cleaner used strictly in accordance with manufacturer's instructions.

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

> C51 Repairing/Renovating/Conserving timbers

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

# C51 Repairing/Renovating/Conserving timbers

285 REPLACEMENT OF DECAYED TIMBER SILLS AND LINTELS Carefully remove damaged section. Ensure adequate propping of opening in order to form rebate to receive new section. Replace with new timber as clause 910. Fully coat timber with preservative. Adhesives: As clause 920.

# GENERALLY

910 TIMBER All replacement sections and components to be machined from selected Utile hardwood, Class 1.

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

> C90 Spot items

#### C90 Spot items

- 110 SITE COMPOUND AREA
  - The site is a scheduled monument in a remote rural area. The lane from the entrance to the monument rises gently along the River Mellte with high drops to the river bed on the east side of the path.
  - The site compound area is to be enclosed with secure site fencing as specified. Details of site boundaries are as detailed on drawings NPA03 WD02 and WD21.
  - The path has limited vehicular access width, unloading of materials to be carried out at the site entrance and methodology for transporting materials up to designated buildings is the responsibility of the Contractor.
  - Provide adequate signage and safe access routes for site visitors.

#### 120 TEMPORARY SITE GUARD

- Site guard protection Site compound designated area and to all sides of upstanding ruins where work is to be carried out to be enclosed with Heras type site fencing that does not incur ground disturbance.
- Location: as identified on work drawings and erected as work proceeds. Site compounds are as located on site plan to allow site materials storage and work preparation in agreement with CADW.
- Site guard: Obtain any permits and protection for general public. Dismantle site guard on completion of work.
- Site guard protection to chimney Provide site guard suitable to steep sloping site. Contractor to present proposals for approval.

#### 150 MAKING GOOD AT COMPLETION

Make good all damage to surfaces resulting from the works, remove all temporary works and leave neat and tidy at completion.

#### 160 ARCHAEOLOGISTS WATCHING BRIEF

The area of historic walls/structures are sensitive and may contain archaeological artefacts and early construction. The site work will be monitored by an Archaeologist under the direction of the Conservation Architect. Monitoring of work will be carried out and should any artefacts or historic features be exposed, The Contractor must contact the Architect immediately. An archaeological inspection may ensue whereby an excavation licence will be required for all archaeological excavations. Work may be interrupted during this monitoring process. All excavations will commence carefully on a trail trenching basis. Each excavated are will be given a Reference Licence number. All correspondence and finds relating to this site to have the licence number clearly identified on no account should any other ref number be used. An investigation will involve monitoring excavations and sifting exposed spoil material. The aim of the work by the archaeologist will be to record and interpret the deposits and any other archaeological features exposed during the course of any excavation. A written report will be prepared by the Archaeologist illustrated by photographs and illustrations of the finds. No excavating will be permitted without notification to the CA and Archaeologist. All archaeological finds encountered by the Contractor to be carefully bagged, labelled and set aside to be collected by the Archaeologist for further analysis. All finds are to be treated as 'treasure' Should human remains be found these should not be disturbed. The Architect and Archaeologist should be informed immediately. The archaeologist should be afforded reasonable time before, during and after any ground disturbance by the Main Contractor. Work to comply with Health and Safety regulations and Risk Assessments and Method Statements prepared.

C90

#### 170 GROUND COVER

Locations: To grounds around perimeter of upstanding walls or ruins of each building including internal areas as identified on working drawings.

Remove all vegetation to ground by manual labour. Mechanical excavators are not permitted including any ground disturbance. all surface scraping should be by shovel, spades, trowels and brushes. Spray treat all vegetation where permitted as clause C41/130.

All vegetation to be removed to expose original ground levels and internal floor levels.

Archaeologist to be present during exercise.

Install geotextile membrane on gravel as clause Q23/108 and to detail on working drawing NPA03 WD20.

# 190 PROPPING TO BARREL VAULT CEILING

Location: Structure no. 6 Hydraulic Pump House: Structure no. 7 Expense Magazine NOTE: All procedures and specification to be agreed on site with Structural Engineer and CADW before commencing work.

Protection: Referred to as 'Soft propping' To consist of soft packing and lining material to entire soffit of arch supported of quickstage scaffolding supports and sole boards.

#### 200 FALLEN TREE DEBRIS

Fallen trees and branch limbs or root stumps to be cut to manageable size with chainsaw and either stacked on site or removed as directed by CADW and CA.

Operatives using chainsaw to be fully compliant with Health & Safety legislation Provision and Use of Work Equipment Regulations 1998 (PUWER 98) and wear appropriate Personal Protective equipment and must have approved training and certification. Contractor to provide proof of certification before appointment or carrying out the works.

# 210 REMOVAL OF DETACHED RENDER

Carefully remove all detached render back to sound surface, any underlying masonry to be fully repointed as clause C41/827. Remove any underlying roots or vegetation as clause C41/130. Remove all debris to skip for removal off site.

# 220 INSERTION OF TIE RODS AND PATTRESS PLATES

- The contractor is responsible for all temporary works and design of tie rods. Design proposals to be submitted to Structural Engineer Consultant for approval. Erect as necessary any temporary works, propping and scaffolding to carry out the works.
- Remove vegetation and or loose masonry around existing corroded bars to be removed.
- Record and set aside existing masonry for reuse.
- Core masonry for tie bars both walls to Structure no 7 Expense Magazine and core masonry two walls with concrete pad to excavated area at structure no 6 Hydraulic Pump House.
- Insert two bars through sleeve and remove sleeve and grout holes. Install patress plates and secure bolts until grout has set.
- Patress plates will be bedded on 10mm mortar bed and nut hand tightened. When mortar has set the nuts will be tightened to achieve patress plate design load. Trim off end of bars and grind off sharp edges.
- Pattress plates and threaded tie bars should be mild steel hot dipped galvanised to BS EN ISO 1461:1999 thickness 86 microns.

C90

#### 230 VIDEO SURVEY OF CHIMNEY FLUE

Existing flue to chimney (Structure no.8) is evident at foot of chimney where it is partially collapsed on entry to east side of chimney. Chimney survey to be carried out using 360 degree rotation camera with hand held monitor and recording facility. Flue to be examined for entire length from Chimney to Boiler House located beside stove house Structure no. 1.

The flue originates from the west wall of the Boiler House. Video survey from both ends required should an obstruction be encountered en-route.

Issue 2 copies of report to CA.

#### 240 STEPPED SCAFFOLDED ACCESS TO CHIMNEY

- Contractor is responsible for design and erection of scaffolded steps to gain access to chimney. Site terrain is steep and slippery under foot. Scaffold should be designed in compliance with clause C41/112 and to provide safe footing for operative to access the works and transport materials to and from the site. Dismantle on completion of the works.
- As some digging may be required to achieve firm footing for bases this should be kept to an absolute minimum and should be discussed and agreed with CA and Archaeologist ahead of the works to be undertaken and proposals to be prepared for approval.

#### 250 CLOUD SURVEY

Contractor to provide 3D High Definition Laser Scan digital cloud survey of individual structures on completion of each including complete topographical cloud survey of the entire site.

Individual structure surveys to include all site levels and stone by stone level of detailing on plan and elevations with tree proximity locations.

Site topography to include all site terrain levels including river bank and all building plan layouts with tree locations and fence lines plotted.

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

> F Masonry

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

> F20 Natural stone rubble walling

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

#### F20 Natural stone rubble walling

To be read with Preliminaries/ General conditions.

#### TYPES OF WALLING

115 RANDOM RUBBLE TO EXISTING WALLS Stone: Existing salvaged rubble fallen from structures on site, free from vents, cracks, fissures, discolouration, or other defects which may adversely affect strength, durability or appearance. Finish: Natural rustic finish Mortar: NHL3.5 Sand:lime:aggregate mortar. As section Z21. Joints: Rake out to depth of 25mm in preparation for re-pointing

#### GENERAL

#### 230 OPERATIVES

Cutting, dressing, laying and jointing of stone to be carried out by skilled masons. Provide evidence of previous experience and details of work previously carried out.

#### 235 APPEARANCE

Make arrangements for the CA to inspect samples of stone which represent the range of variation in appearance. Obtain approval of appearance before placing orders with suppliers or proceeding with production.

#### LAYING AND JOINTING

- 300 REFERENCE PANELS
  - General: Prepare panels as follows and obtain approval of appearance before proceeding further.
  - Panel:
    - Walling type/ location: Rubble walling .
    - Size: 2000 x 1000mm .
    - Features: Evidence of bonding stonework across face and through width of wall.

#### 305 PROTECTION

Store stone clear of the ground, protect from adverse weather and keep dry. Prevent soiling, chipping and contamination by salts and other deleterious substances.

Prevent damage to stonework, particularly arrises and projecting features. Protect with suitable slats, boards, etc. and remove at Practical Completion.

Prevent staining and other disfigurement of stonework during the course of subsequent works.

#### 315 ADVERSE WEATHER

- General: Do not use frozen materials or lay on frozen surfaces.
- Air temperature: Do not lay stones:
  - In cement gauged mortars: At or below 3°C and falling or below 1°C and rising.
  - In hydraulic lime:sand mortars: At or below 5°C and falling or below 3°C and rising.
- Temperature of walling during curing: Above freezing until mortar hardened.
- Newly erected walling: Protect at all times from:
  - Rain and snow.
- Drying out too rapidly in hot conditions and in drying winds.

#### SPECIFICATION

Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

# 25 LAYING

- Absorbent stones in warm weather: Dampen to reduce suction. Do not soak.
- Mortar joints:
  - Laying: Full bed of mortar with all joints and voids filled.
  - Appearance: Neat and consistent.
- Orientation for natural bed of stones:
  - In plain walling: Horizontal.
  - Coping and projecting stones: Vertical and at right angles to wall face.
  - Arches: Vertical to line of thrust.
- Appearance and bonding: Achieve a consistent overall appearance and good bond.
- Distribute different shapes, sizes and colours evenly throughout the face of the wall.
  - Vertical joints: Long continuous joints prohibited.
- Accuracy:
- Plumb.
  - Setting out: Achieve satisfactory junctions and joints with adjoining or built-in elements and components.
- Cleanliness: Keep facework clean. Rubbing to remove marks and stains not permitted.
- 360 QUOINS AND JAMBS
   Selection of stones: Large stones, dressed to a more regular shape.
   Laying: In advance of main body of rubble walling.
- 370 BONDERS FOR WALLS FACED BOTH SIDES Bonding stones:
  - Length: Two thirds the thickness of the wall.
  - Height: Not less than one third of length.
  - Distribution: One to every square metre of each side of wall and staggered.
- 380 COURSED WORK Courses: True to line and level.
- 410 SUPPORT OF EXISTING WORKS

Joint above inserted lintel or masonry: Fully consolidated with semidry mortar to support existing structure.

F20

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> M Surface finishes

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

> M14 Limecrete flooring

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

#### M14 Limecrete flooring

- 100 LIMECRETE Lime products and supplier: Hydraulic Lime as specified by specialist supplier Limecrete (1 part sharp sand: 2 parts 12 - 18mm aggregate and approximately 5 - 6 litres of water per 50 KG of lime) blended aggregate as clause 110 and a handful of forta fibre to each mix on existing concrete roof cover.
- 110 AGGREGATE FOR LIMECRETE Blended aggregate: 33% Washed sharp sand, 66% crushed Lytag aggregate 6mm.
- 120 SURFACE PREPARATION The area to be concreted with limecrete should be clean of topsoil and vegetable matter. Existing concrete surfacing to be thoroughly cleaned and spray treated for vegetation as clauses C40/320 and C41/130
- 130 LAYING LIMECRETE Limecrete to be laid level through out.

#### 140 MIXING

- 1 part NHL5:2 parts blended aggregate and 1 part sand plus a handful of Forta fibre to each mix. Aggregate as clause 110
- Limecrete should be mixed to the consistency of a floor screed i.e., a semi-dry state, which will hold together when squeezed by hand, wet traditional concrete type mixes will result in excessive shrinkage. If possible a screed mixer or roller pan mill should be used. Drum cement mixers tend to result in the mix balling and are not acceptable. A hand full of forta fibre should be added to each mix.

#### 150 SURFACE FINISH

Simple limecrete over- sites felt finished by tamping with a wooden or steel tamper and lightly tightened with a timber or polyurethane float (Vibrating plates not permitted). Fine surface should be screeded and tamped in a float screeding manner.

#### 160 AFTERCARE

Once laid limecrete should be kept damp for 96 hours (minimum). Spray with water during warm and hot periods. Limecrete must always be protected from freezing conditions for the first 10 days after laying. Traffic should be avoided for 10 days, and thereafter-protective boards should cover the work for 3 weeks before exposure to general traffic.

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M60 Painting/clear finishing

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

#### M60 Painting/clear finishing

To be read with Preliminaries/General conditions.

#### COATING SYSTEMS

- 125 LIME WASH TO INTERNAL AND EXTERNAL WALL SURFACES
  - Surfaces: Rubble stonework and lime plastered walls
  - Preparation: As clause 910.
  - Coats: 4 coats.
  - Mix: 1:3 (Lime putty:Lime water)
  - Admixture Raw linseed oil
  - Application: As clause 920
  - Colour: Pigment additive. Colours to be agreed.

#### GENERALLY

HANDLING AND STORAGE
 Coating materials: Deliver in sealed containers, labelled clearly with brand name, type of material and manufacturer's batch number.
 Materials from more than one batch: Store separately. Allocate to distinct parts or areas of the work.

#### 330 COMPATABILITY

Check that all materials to be used are recommended by their manufacturers for the particular surface and conditions of exposure and that they are compatible with each other. Where surfaces have been treated with preservatives or fire retardants, check with treatment manufacturer that coatings are compatible with the treatment and do not inhibit its performance. Inform the CA of any discrepancy in specification of coatings and obtain instructions before proceeding with application.

# 333 TESTING OF VISCOSITY ETC samples of materials from each manufacturing batch as follows:

- Unopened containers, or samples from previously unopened containers, for submission to manufacturer for comparison with manufacturer's own retained samples from the same batch. Unopened containers, or samples from previously unopened containers, as a control sample for assessment of samples taken from painters' kettles.
- Samples from painters' kettles for submission with control sample to manufacturer and/or independent testing laboratory for comparative testing.

#### 334 PROTECTION

- Adequately protect internal and external surfaces, fixtures and fittings which are not to be coated, by covering with dust sheets, masking or other suitable materials.
- Exhibit 'Wet paint' signs and provide barriers where necessary to protect other operatives and the general public, and to prevent damage to freshly applied coatings.

M60

# PREPARATION

- 400 PREPARATION GENERALLY
  - Standard: To BS 6150, Section 4.
  - Preparation materials: Types recommended by their manufacturers and the coating manufacturer for the situation and surfaces being prepared.
  - Substrates: Sufficiently dry in depth to suit coating.
  - Efflorescence salts: Remove.
  - Dirt, grease and oil: Remove. Give notice if contamination of surfaces/ substrates has occurred.
  - Surface irregularities: Abrade to a smooth finish.
  - Joints, cracks, holes and other depressions: Fill with stoppers/ fillers. Work well in and finish off flush with surface. Abrade to a smooth finish.
    - Dust, particles and residues from abrasion: Remove.
      - Fill with stoppers/ fillers. Work well in and finish off flush with surface.
      - Abrade to a smooth finish.
  - Water based stoppers and fillers:
    - Apply before priming unless recommended otherwise by manufacturer.
    - If applied after priming: Patch prime.
  - Oil based stoppers and fillers: Apply after priming.
  - Doors, opening windows and other moving parts:
    - Ease, if necessary, before coating.
    - Prime resulting bare areas.

#### APPLICATION

- 710 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

- Application standard: To BS 6150, Section 5.
- Conditions: Maintain suitable temperature, humidity and air quality during application and drying.
- Surfaces: Clean and dry at time of application.
- Thinning and intermixing of coatings: Not permitted unless recommended by manufacturer.
- Overpainting: Do not paint over intumescent strips or silicone mastics.
- Priming coats:
  - Thickness: To suit surface porosity.
  - Application: As soon as possible on same day as preparation is completed.
- Finish:
  - Even, smooth and of uniform colour.
  - Free from brush marks, sags, runs and other defects.
  - Cut in neatly.

M60

#### LIMEWASH

#### 910 PREPARATION

- Remove loose and flaking material with a stiff brush, then with a soft brush.
- Immediately before application thoroughly dampen surfaces to be lime washed using a backpack pneumatic sprayer fitted with a hose and wand with an adjustable nozzle.
- Raw linseed oil to be beaten in with a whisk or electric blender.

#### 920 APPLICATION

- Lime wash is to be applied to the damp surface using a soft-haired brush, working it well into the surface, but not trying to cover cracks and imperfections with the first application. As the lime wash dries out it will be semi-transparent. Subsequent applications, each preceded by light wetting of the surface, will build up more body. Thick applications will show brush texturing and are liable to craze; thin applications should produce a sound surface with a silky texture.
- Lime wash should not be allowed to dry out too quickly by exposure to hot sun and drying winds. Provide temporary polythene sheeting to protect fresh lime wash from excessive drying out and rain

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> Q Paving/Planting/Fencing/Site furniture

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Q20 Granular sub-bases to roads/ pavings

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#### Q20 Granular sub-bases to roads/ pavings

To be read with Preliminaries/ General conditions.

- 110 THICKNESSES OF SUB-BASE/ SUBGRADE IMPROVEMENT LAYERS Thicknesses: See sections: - Q22 and Q23.
- 142 PREPARATION AND COMPACTION OF SUBGRADES
  - Timing: Immediately before placing sub-base.
  - Soft or damaged areas: Give notice..
  - Wet conditions: Do not excavate or compact when the subgrade may be damaged or destabilised.
  - Compaction: Thoroughly, by roller or other suitable means, adequate to resist subsidence or deformation of the subgrade during construction and of the completed roads/ pavings when in use. Take particular care to compact fully at intrusions, perimeters and where local excavation and backfilling has taken place.
- 160 GEOTEXTILE FILTER/ SEPARATOR MEMBRANE below sub-base
  - Product reference: Woven Lightweight Geotextile membrane KSG Grade.
  - Jointing: 300 mm overlap.
  - Protect from:
    - Exposure to light, except during laying (maximum five hours).
    - Contaminants.
    - Materials listed as potentially deleterious by geotextile manufacturer.
    - Damage, until fully covered by fill.
    - Wind uplift, by laying not more than 15 m before covering with fill. Pegs to be driven into ground at 1m centres.
  - Preparation: Remove humps and sharp projections and fill hollows before laying.
- 211 GRANULAR MATERIAL
  - Quality: Of a known suitability for use in sub-base, free from excessive dust, well graded, all pieces less than 75 mm in any direction, minimum 10% fines value of 50 kN when tested in a soaked condition to BS 812-111 or a resistance to fragmentation of LA50 for the
  - Los Angeles test to BS EN 1097-2, and in any one layer only one of the following:
    - Crushed rock (other than argillaceous rock) or quarry waste with not more binding material than is required to help hold the stone together.
      - Crushed concrete, crushed brick or tile, free from plaster, timber and metal.
      - Gravel or hoggin with not more clay content than is required to bind the material together, and with no large lumps of clay.
      - Natural gravel.
      - Natural sand.

# 213 BLINDING PROTECTION FOR MEMBRANES

- Location: On sub-base to receive separating membrane.
- Material: Approved fine material .
- Thickness (minimum): Sufficient to fill interstices and cover all stones.
- Compaction: Moisten as necessary before final rolling to provide a flat, closed, smooth surface.
- Permissible deviations on surface level: +0 -25 mm.

Q20

PLACING GRANULAR MATERIAL GENERALLY
 Preparation: Loose soil, rubbish and standing water removed.
 Structures, membranes and buried services: Ensure stability and avoid damage.

#### 310 ACCURACY

Permissible deviation from required levels, falls and cambers (maximum):

- Subgrades: Roads and parking areas: +20 -30 mm. Footways and recreation areas: ± 20 mm.
- Sub-bases: Roads and parking areas: ± 20 mm.
- Footways and recreation areas: ± 12 mm.

# 330 COLD WEATHER WORKING

Frozen materials: Do not use.

Freezing conditions: Do not place fill on frozen surfaces. Remove material affected by frost. Replace and recompact if not damaged after thawing.

# 340 PROTECTION

Sub-bases: As soon as practicable, cover with subsequent layers, specified elsewhere. Subgrades and sub-bases: Prevent degradation by construction traffic, construction operations and inclement weather.

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> Q22 Coated macadam/asphalt roads/pavings

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# Q22 Coated macadam/asphalt roads/pavings

To be read with Preliminaries/General conditions.

#### TYPE(S) OF PAVING

- 135 ASPHALT BASECOURSE TO BARRELT VALUTED AND LEAN-TO ROOFS
  - Location: See drawing NPA03 WD08 and 09.
  - Thickness: Rolled asphalt to BS 594 Part 1. Thickness 40mm
  - Material: 20mm size dense base course macadam.
  - Sub-base: Limecrete as clause M14/100.
  - Grass soft capping to be applied over asphalt base course as C41/828

# PREPARATORY WORK/REQUIREMENTS

- 220 MATERIALS GENERALLY
  - Not less than 2 weeks before starting work submit to the CA the name(s) of all supplier(s) of bituminous material.
  - At the time of delivery submit to the CA a test certificate for each manufacturing batch of bituminous material, certifying compliance with this specification and the relevant British
  - Standard and giving complete information on the composition of each mix.

#### LAYING

- 310 LAYING GENERALLY
  - Remove all loose material, foreign matter and standing water from surfaces to receive paving materials.
  - Form neat junctions with and prevent damage to adjacent work. Keep clean all channels, kerbs, inspection covers etc.
  - Keep new paving free from traffic until it has cooled to prevailing atmospheric temperature.
  - Do not allow rollers to stand on paving at any time.
  - Do not use pavings as a building platform or for storing, mixing or preparing materials.
  - Lines and levels of finished surface to be smooth and even, with regular falls to prevent ponding.
  - Finished surface of paving to have an even overall texture. Leave in a clean state on completion.

# 320 COLD WEATHER

Do not use frozen materials or lay paving on frozen or ice covered surfaces.

Do not lay coated macadam if the temperature of the laying surface is below 2 °C (or -1 °C on a rising thermometer).

Do not lay rolled asphalt if the temperature of the laying surface is below 5 °C or the air temperature is below 0 °C.

330 LEVELS of finished surface to be within ±6 mm of required levels (+6 mm -0 mm adjacent to gullies and manholes).

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> Q23 Gravel/ Hoggin/ Woodchip/ Resin bound roads/ pavings/ overlays

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# Q23 Gravel/ Hoggin/ Woodchip/ Resin bound roads/ pavings/ overlays

#### TYPES OF SURFACING

- 108 LOOSE GRAVEL Hardstanding to perimeter and floor areas of buildings
  - Sub-base: Existing prepared ground as clause Q20/142.
  - Membrane and detail: As clause Q20/160 and details on working drawing NPA03 WD20.
  - Edging and detail: As clause 200.
  - Blinding to sub-base: Required.
  - Surface course: Angular gravel free from clay, with sufficient grit to enable compaction.
    - Colour: Autumn Brown.
      - Size: Graded 6-10 mm.
      - Compacted thickness: 100 mm.
  - Completion: Compact to produce a firm, regular surface, stable in use.

#### 200 METAL EDGING STRIP TO GRAVEL AREAS

- Material: 2.5mm thick galvanised metal strip with incorporated 100mm spikes, connecting overlapped ends.
- Manufacture standard: To BS EN 10436-2009
- Dimensions: 2500mm long x 100mm deep.
- Fixings: 10mm diameter rebar pin and sleeve supports at 500mm centres. Pins minimum 400mm long.
- Finish: Polyester coated Slate grey 50-70 microns, zinc galvanised under coating average 20 microns.
- Installation: Loosen soil with spade or pick axe or drill out spike holes. Install geotextile membrane prior to inserting edging and pin and sleeve supports. Hammer in edging and pin and sleeves. Turn geotextile membrane up back of edging and glue to edging using mastic as clause Z

# LAYING

- 340 LAYING GENERALLY Channels, gullies, etc: Keep clear. Finished surfaces:
  - Lines and levels: To prevent ponding.
  - Overall texture: Even.
  - State at completion: Clean.

#### 350 COLD WEATHER WORKING

- Frozen materials: Do not use.
- Freezing conditions: Do not lay pavings.
- Cold bituminous surface dressings: Do not apply when ambient temperature is below 10°C.
- Other dressings or overlays: As manufacturers' recommendations.

# 360 DRAINAGE FALLS

Sealed surfaces:

- Falls and cross falls (minimum): 1:40.
- Camber (minimum): 1:50.
- Unsealed surfaces (minimum): 1:30.

Q23

370 LAYING GRANULAR SURFACES IN VEHICULAR AREAS Permissible deviation from required levels, falls and cambers (maximum): ±20mm. General: Spread and level in 150 mm maximum layers. As soon as possible compact each layer. Dry weather: Lightly water layers during compaction.

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> Q40 Fencing

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

#### Q40 Fencing

#### FENCING

100 PROPRIETARY FENCING

Fence type: Open mesh steel fencing to BS EN 1722-14 conforming to the Building Regulations for anti-trap and correspond(s) to the generic component/material "weld mesh" in the BRE Global Guide online generic specification(s) "Galvanised weld mesh fencing with metal posts" which achieve(s) a summary rating of A within commercial, domestic, residential, health, industrial, education.

Grades of metals - Section dimensions and properties to be to the appropriate British Standard. When not specified, select grades and sections appropriate for the purpose. Fasteners to be to the appropriate British Standard and, unless specified otherwise, to be of the same metal as the component, with matching coating or finish.

Fabrication of metalwork - Fabricate components carefully and accurately to ensure compliance with design and performance requirements.

Do not permit contact between dissimilar metals in components which are to be fixed where moisture may be present or occur.

Finished components to be rigid and free from distortion, cracks, burrs and sharp arrises. Moving parts must move freely and without binding. Unless specified otherwise, mitre corner junctions of identical sections.

Welding - Metal arc welding to BS 5135 and BS EN 1011-1, or other methods subject to approval. Fasteners/fixings - To be of corrosion resistant material or have a corrosion resistant finish.

Ensure fasteners and plugs (where used) have ample penetration into masonry. Decoration of metalwork -Fence panels posts are galvanised inside and out to BS EN 1461, Brackets supplied galvanised to BS EN 1461 as standard then polyester powder coated with Akzo Nobel Interpon coating in available colours Black RAL 9005. Green RAL 6005. White RAL 9010. Blue RAL 5010. Blue BS 20-C-40. Brown RAL 8017. Yellow RAL 1018. Grey RAL 7012. Red RAL 3020. Colour to be confirmed.

Concrete pad foundations for metal posts Standard: To BS 8500-2.

Mix GEN1 to BS 5328.

The concrete will be unreinforced

Nominal maximum size of aggregate: 20 mm.

Admixtures: An accelerator or retarder may not be used.

Each foundation shall be Set in concrete - 200 x 220 x 800mm Bolted base plated 300 x 300 x 350mm

NOTE: Surplus excavated soil to be removed from site.

- Height and width of fence panel: 2000mm x 3000mm.
- Mesh: Mesh centres 200x50mm 5mm wire Mesh panels with 'V' profile with 2 4 reinforcing folds subject to height are made using 5mm horizontal and vertical wires with 195 x 45mm aperture, welded at intersections which are Jakcoate treated as standard, employing a 150 g/m2 zinc alloy coating to provide a service life up to 4 times longer than galvanised products. Meshed panels to ground profile not less than 150mm and not more than 200mm above ground. Spandrel panel cuttings at bottom used to fill gaps on sloping ground below horizontal panels must be carefully treated at cut edges to avoid sharp or dangerous edges and should be continuously secured to the bottom of the full panel above. All cut sections of to be treated with suitable rust proofing and coated.
- Post setting: post dimensions 60 x 40mm: Post setting 3034mm.
   foundation size: Set in concrete 200 x 220 x 800mm
   Bolted base plated 300 x 300 x 350mm
- Accessories: Proprietary bolt fixings and isolation pads/washers. Loadings: Horizontal uniformity distributed line load0.74Kn/m: Uniformly distributed load applied to the infill 1Kn/m: Point load applied to the infill 0.5Kn/m

Q40

# 110 STEEL GATES/ GATE POSTS

Security metal gate and post system with 25 year service life Regular open mesh steel fencing to BS EN 1722-14 conforming to the Building Regulations for anti-trap and correspond(s) to the generic component/material "weld mesh" in the BRE Global Guide online generic specification(s) "Galvanised weld mesh fencing with metal posts" which achieve(s) a summary rating of A within commercial, domestic, residential, health, industrial, education.

Grades of metals - Section dimensions and properties to be to the appropriate British Standard. When not specified, select grades and sections appropriate for the purpose. Fasteners to be to the appropriate British Standard and, unless specified otherwise, to be of the same metal as the component, with matching coating or finish.

Fabrication of metalwork - Fabricate components carefully and accurately to ensure compliance with design and performance requirements.

Do not permit contact between dissimilar metals in components which are to be fixed where moisture may be present or occur.

Finished components to be rigid and free from distortion, cracks, burrs and sharp arrises. Moving parts must move freely and without binding. Unless specified otherwise, mitre corner junctions of identical sections.

Welding - Metal arc welding to BS 5135 and BS EN 1011-1, or other methods subject to approval.

Fasteners/fixings - To be of corrosion resistant material or have a corrosion resistant finish. Ensure fasteners and plugs (where used) have ample penetration into masonry.

Decoration of metalwork -Fence panels posts are galvanised inside and out to BS EN 1461, Brackets supplied galvanised to BS EN 1461 as standard then polyester powder coated with Akzo Nobel Interpon coating in available colours Black RAL 9005. Green RAL 6005. White RAL 9010. Blue RAL 5010. Blue BS 20-C-40. Brown RAL 8017. Yellow RAL 1018. Grey RAL 7012. Red RAL 3020. Colour to be confirmed. Tamper proof hinges. 60 x 40 mm rails, 60 x 60 mm stiles. Square section steel posts subject to size of gate. Supply as [right hand hanging] [left hand hanging], [opening outwards] [opening inwards] complete with key lock, handles and gate stop

- Materials and workmanship: As section Z11.
- Jointing: Welded.
- Fittings: tamper proof hinges. 60 x 40 mm rails, 60 x 60 mm stiles. Square section steel posts subject to size of gate. Supply as right hand hanging or left hand hanging, opening outwards or opening inwards complete with key lock, handles and gate stop, drop bolts for double gated and ferrules for open and closed positions, latch and hasps for padlocks. All padlocks should be suited to one key.

Loadings: Horizontal uniformity distributed line load0.74Kn/m: Uniformly distributed load applied to the infill 1Kn/m: Point load applied to the infill 0.5Kn/m

# 120 INSTALLATION GENERALLY

- Expertise: By an experienced fencing contractor.
- Alignment: Straight lines or smoothly flowing curves.
- Tops of posts: Following profile of the ground.
- Setting posts: Rigid, plumb and to specified depth, or greater where necessary to ensure adequate support.
- Fixings: All components securely fixed.

# 130 SETTING POSTS IN CONCRETE

- Standard: To BS 8500-2.
- Mix: Designated concrete not less than GEN1 or Standard prescribed concrete not less than ST2.
- Alternative mix for small quantities: 50 kg Portland cement to 150 kg fine aggregate to 250 kg 20 mm nominal maximum size coarse aggregate, medium workability.
- Admixtures: Do not use.
- Holes: Excavate neatly and with vertical sides.

Q40

- Filling: Unless specified otherwise position post/ strut and fill hole with concrete to not less than half the depth, well rammed as filling proceeds and consolidated.
- Backfilling of holes not completely filled with concrete: Excavated material, well rammed and consolidated.

# 140 MAKING GOOD GALVANIZED SURFACES Treatment of minor damage (including on fasteners and fittings): Low melting point zinc alloy repair rods or powders made for this purpose, or at least two coats of zinc-rich paint to BS 4652. Thickness: Apply the original layer.

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> Z Building fabric reference specification

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Z20 Fixings and adhesives

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#### Z20 Fixings and adhesives

30 FIXINGS THROUGH FINISHES Penetration of fasteners and plugs into substrate: To achieve a secure fixing.

100 FIXINGS AND FASTENERS GENERALLY

- Integrity of supported components: Select types, sizes, quantities and spacings of fixings, fasteners and packings to retain supported components without distortion or loss of support.
- Components, substrates, fixings and fasteners of dissimilar metals: Isolate with washers or sleeves to avoid bimetallic corrosion.
- General usage: To recommendations of fastener manufacturers and/ or manufacturers of components, products or materials fixed and fixed to.
- Fixings: To be in straight lines, at regular centres.
- 110 APPLYING ADHESIVES
  - Surfaces: Clean. Regularity and texture to suit bonding and gap filling characteristics of adhesive.
  - Support and clamping during setting: Provide as necessary. Do not mark surfaces of or distort components being fixed.
  - Finished adhesive joints: Fully bonded. Free of surplus adhesive.
- 120 ADHESIVE

Product type: Solvent Free MS Polymer mastic which can be used on both dry and wet surfaces bonding on most materials - without using a primer Does not contain any solvents or isocvanates, totally odourless Cures without shrinking, resists vibrations and remains flexible High tensile strength of 27kg per sq cm and unique binding - 265 N/cm3 U.V. and weather resistant, anti-fungal and anti-bacterial Flow: 5 bar/ 3 mm/ 23°C 140g/min Skin formation: 23°C 50% R.V. 8 minutes Tack-free: 23°C 50% R.V. 25 minutes Full hardening: 23°C 50% R.V. 24h - 6 mm 48h - 7 mm 72h - 8 mm E-modulus 100%: after 7 days: 170 N/cm<sup>2</sup> - after 1 months: 170 N/cm<sup>2</sup> - after 3 months: 180 N/cm<sup>2</sup>. Electric resistance: 2.6 x 10//BS10//ES O/cm Volume shrinkage after curing: < 3%Hardness - DIN 53505: 60 Shore A Tensile strength: after 7 days: 260 N/cm<sup>2</sup> - after 1 months: 280 N/cm<sup>2</sup> - after 3 months: 310 N/cm<sup>2</sup>. Tear strength - DIN 53504: 140N/cm<sup>2</sup> /1.40 Mpa The ambient temperature for application: between +5°C and +40°C Thermal stability: -30°C to +95°C /peak: 155°C max. 30 minutes Elongation at break - Din 53504: after 7 days: 333% - after 1 month: 301% - after 3 months: 292%. Air permeability (according to report 3P02093 of the SP TRI in Sweden: >0.2m3/m2 Non-toxic Chemical resistance: - good: water, seawater, aliphatic solvents, oils, greases, diluted organic acids, lyes - moderate: esters, ketones, aromatics. - poor: concentrated acids, chlorinated solvents, chlorine of swimming pools Pressure resistance (ISO 11432): 1,19 N/mm<sup>2</sup>

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> Z21 Mortars

SPECIFICATION Heritage Lottery Funded Consolidation Works at Former Glyn-Neath Gunpowder Works, Pontneddfechan for Brecon Beacons National Park Authority

# Z21 Mortars

To be read with Preliminaries/ General conditions.

# LIME:SAND MORTARS

- 310. LIME:SAND MORTAR MIXES Specification: Proportions and additional requirements for mortar materials are specified elsewhere. Coarse stuff to be prepared before delivery to site and allowed to mature for at least four weeks prior to use
- 325 AGGREGATE FOR LIME:SAND MASONRY MORTARS Type: Aggregate to match sieve analysis of existing lime based pointing.
- 327 KNOCKING UP LIME:SAND COARSE STUFF
   Knock-up coarse stuff by beating and ramming until the material is fully plastic and adheres to the underside of a trowel or by use of paddle mixer.
   Do not add water without the express approval of the CADW. When approval is granted, only lime water, as supplied by lime mortar supplier should be used

# 350 STORAGE OF LIME:SAND MORTAR MATERIALS

- Sands and aggregates: Keep different types/ grades in separate stockpiles on hard, clean, free-draining bases.
- Ready prepared nonhydraulic lime putty: Prevent drying out and protect from frost.
- Nonhydraulic lime:sand mortar: Store on clean bases or in clean containers that allow free drainage. Prevent drying out or wetting and protect from frost.
- Bagged hydrated hydraulic lime: Store off the ground in dry conditions.

# 400. MAKING HYDRAULIC LIME:SAND MORTARS

- Mixing hydrated hydraulic lime:sand: Follow the lime manufacturer's recommendations for each stage of the mix.
  - Water quantity: Only sufficient to produce a workable mix. Use paddle mixer.
- Working time: Within limits recommended by the hydraulic lime manufacturer." Mix in roller-pan or paddle-mixer preferable.
- Lime mortars mixed in drum mixers prone to balling. However, the following mixing procedure can reduce this problem.
- Mix proportions by volume in a gauging box or bucket.
  - Add 1 part sand
  - Followed by 1 part lime
  - Followed by 2 parts sand
  - Mix dry for at least 5 minutes
  - After 5 minutes slowly add water until desired consistency is reached, Important not to drown mix by adding too much water. Over watering will increase risk of shrinkage and will reduce final strength.
  - Once the desired consistency is reached mix for a further 20 minutes Do not add plasticisers.

# 410 WATER CONTENT

- Addition of water should be considered carefully, as it will directly affect the ultimate strength and durability of a mortar. The more water introduced in mortar mix, the weaker will be the final result. However to little water will prevent the chemical processes taking place and weaken the material. Generally, water should be added sparingly, until a useable consistency is achieved.
- Dry masonry background may affect mortar strength. Dry backgrounds can quickly 'suck' moisture from newly applied mortar. Dampening down masonry background prior to application.

Z21

# 420 HEALTH AND SAFETY

- Risk assessments should be carried out prior to starting work on site and measures taken to eliminate and/or reduce the exposure any risks identified. COSHH (Control of Substances Hazardous to Health) guidelines should be followed when using potentially harmful substances such as lime.
- Lime is a highly caustic product and can be irritating to eyes and skin. Slaking and mixing lime should be carried out in a well ventilated area.
- Personal protective equipment (PPE) should be worn at all times. The following PPE is advised for all work involving lime:
- Gloves: lime will irritate the skin.
- Breathing apparatus/masks: powdered lime dust is highly irritating if inhaled.
- Goggles: lime is highly irritating to eyes, splashes of lime can cause burns. As a further precaution, eye wash should always be available on site.