

**CIVIL SPECIFICATIONS**

**Supply, Delivery, Installing, Testing, Commissioning, Operating, Handing over and maintaining a solar PV off** grid **systems of for Children Autism Center-Aden**

**ADEN CITIES- YEMEN**

**GENERAL SPECIFICATIONS**

1. **PRELIMINARIES**

**1.1 GENERAL**

* + 1. **PRE-CONSTRUCTION WORK**

The Engineer and Contractor will carry out a joint condition-in survey using a digital photograph to record the condition of the site upon handover to the Contractor. This will determine the state of the site that the Contractor must hand back upon completion of the works.

The Contractor will carry out a detailed site setting out for the works.

A pre-Construction meeting will be held between the Engineer and the Contractor to review the following information:

* + - * Condition-in Survey
      * Site Survey
      * Work Method Statement
      * Work Program
      * Schedule of Materials and Installed Equipment

The Contractor must mobilize on the project site within 7 calendar days of the date of issue of the Notice to commence.

**Site restrictions**

*Site security limitations:* Comply with any restrictions on site area, access or working times advised by the Engineer.

*Access:* Access on to and within the site, use of the site for temporary works and constructional plant, including working and storage areas, location of offices, workshops, sheds, roads and parking, is restricted to the areas shown on the drawings or as agreed with the Engineer.

**Occupied areas of site or buildings**

For the parts of the site designated as occupied areas in the **occupied areas schedule**:

* Allow occupants to continue using the area for the required period.
* Make available safe access for occupants.
* Arrange work to minimise nuisance to occupants and ensure their safety.
* Protect occupants against weather, dust, dirt, water or other nuisance, by such means as temporary screens.

**Protection of persons and property**

*Temporary works:* Provide and maintain required barricades, guards, fencing, shoring, temporary roadways, footpaths, signs, lighting and traffic flagging.

*Access ways, services:* Do not obstruct or damage roadways and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Determine the location of such services. If damage occurs, immediately repair it at the Contractors cost.

*Property:* Do not damage property which is to remain on or adjacent to the site, including adjoining property encroaching onto the site. If damage occurs, immediately repair it at the Contractors cost.

**Existing services**

Attend to existing services as follows:

* If the service is to be continued, repair, divert or relocate as required.
* If the service is to be abandoned, cut and seal or disconnect, and make safe.

Submit proposals to the Engineer for action for existing services before starting this work. Minimise the number and duration of interruptions.

**Adjoining property**

*Records:* For properties described in the **Adjoining properties to be recorded schedule**:

* The Contractor is to inspect the properties with the Engineer and owners and occupants of the properties, before start of work.
* Make detailed records of conditions existing within the properties, especially structural defects and other damage or defacement.
* Arrange for at least 2 copies of each record, including drawings, written descriptions, and photographs, to be endorsed by the owners and occupants, or their representatives, as evidence of conditions existing before commencement of work.

Submit one endorsed copy of each record to the Engineer. The Contractor is to keep the other endorsed copy.

* + 1. **CONSTRUCTION PLANT Access**

Access route and site access point are as shown on the drawings or as agreed with the Engineer.

**Use of existing services**

Existing services may be used as temporary services for the performance of the contract subject to conditions stated in the **Existing services schedule**.

**Contractors Facilities and Work Practices**

The Contractor is required to provide adequate toilet and washroom facilities for his staff. These facilities shall be kept clean and serviceable at all times.

The Contractor is required to provide adequate first aid equipment on-site, failure of the Contractor to ensure the availability of first aid equipment on-site will result in an immediate ‘stop work’ order being issued. All costs and time delays resulting from any such ‘stop work’ order are entirely the Contractors responsibility.

A site office will be established by the Contractor at the work site. The location of the site office will be identified by the Engineer to the Contractor. The office will have a complete set of the contract documents.

The Contractor is to maintain a safe, healthy and tidy worksite at all times and all work activities are to be performed with protective and safety equipment appropriate for the task. The Contractor is entirely responsible for workplace safety and unsafe work practices will be identified and recommendations made for revised work methods as appropriate.

**Project signboards**

Provide project-specific signboards and the following:

* Location, size and wording as directed by Engineer.
* Maintain in good condition for duration of the work.
* Remove on completion.

Obtain approval before display of advertisements or provision of other signboards.

* + 1. **BUILDING THE WORKS Surveys**

*Setting out:* Set out the works from the dimensioned drawings

*Check surveys:* Check the set out regularly on site

*Final survey:* Confirm final set out of roads, services and buildings on the as constructed drawings after

Practical Completion

**Survey marks**

*Definition:* The term “survey mark” means a survey peg, bench mark, reference mark, signal, alignment, level mark or any other mark used or intended to be used for the purpose of setting out, checking or measuring the work.

Care of survey marks: Preserve and maintain the survey marks in their true positions. If the survey marks are damaged, immediately advise the Engineer and rectify the damage.

**Contractor's representative**

The contractor must employ a suitably experienced engineer as the Site Manager. This person must be on site during working hours, and fluent in English and technical terminology. The Contractor’s Site Manager will have the authority to make all decisions concerning the project

**Program of work**

The Contractor is to provide a construction program which has the following information:

* Sequence of work.
* Holidays.
* Activity inter-relationships.
* Periods within which various stages or parts of the work are to be executed.

Time scale: Working days.

Update the program weekly. Identify changes since the previous version, and show the estimated percentage of completion for each item of work.

**Site meetings**

Hold and attend weekly site meetings throughout the contract and ensure attendance of appropriate subcontractors, the Site Manager and Engineer. The meeting schedule may be modified by the Engineer.

The meeting will consider the following items:

* + Technical issues.
  + Commercial issues.
  + Program.
  + Quality of work.

The Contractor is to keep minutes of site meetings. Within 3 working days after each meeting, submit to each party written copies of the minutes.

**Items supplied by owner**

Materials and other items identified in the **Items to be supplied schedule** will be supplied free of charge to the Contractor for installation in the execution of the works. Unload and take delivery of them, inspect them for defects and then take care of them. If defects are found, advise. Return unused items to the owner

* + 1. **COMPLETION OF THE WORKS Final cleaning**

Before Practical Completion, clean throughout, including interior and exterior surfaces exposed to view.

Clean carpeted and soft surfaces. Clean debris from the site, roofs, gutters, downpipes and drainage systems. Remove waste and surplus materials.

**Reinstatement**

Before practical completion, clean and repair damage caused by installation or use of temporary work and restore existing facilities used during construction to original condition.

**Adjoining property**

At practical completion, for properties described in the **Adjoining properties to be recorded schedule** inspect the properties with the Engineer and owners and occupants of the properties, recording any damage that has occurred since the pre-commencement inspection.

**Post construction Works**

The Contractor will provide the following documentation after all site construction has been completed:

* + - * Warranty Statement
      * Material Test Certificates
      * As-Built Drawings

A condition-out survey will be conducted with the Contractor and Engineer at which damages caused by the Contractor will be identified. The Engineer will determine if the Contractor is to make repairs or if the damage will be deducted from the Contractor’s final invoice.

**Removal of plant**

Within 10 working days after practical completion, remove temporary works and construction plant no longer required. Remove the balance before the end of the defects liability period.

* + 1. **MISCELLANEOUS Compliance with the law**

The Contractor is responsible for compliance with all requirements of authorities. The owner, before entering

into the contract, has given the notices, paid the fees, and obtained the permits, approvals and other authorisations stated in the **Prior applications and approvals schedule**.

# GENERAL REQUIREMENTS

* 1. **GENERAL**
     1. **CONTRACT DOCUMENTS Drawings**

Large scale drawings take precedence over small scale drawings. Written or calculable dimensions take precedence over scaled dimensions. If there are any errors in dimensions, set out or size, immediately notify the Engineer.

**Bill Of Quantities**

If there are any errors in description of items or omissions in the BOQ, immediately notify the Engineer.

If there are any items which are unclear or are not available within the project program, immediately notify the Engineer.

**Services diagrammatic layouts**

Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable.

Before commencing work:

* Obtain measurements and other necessary information.
* Coordinate the design and installation in conjunction with all trades.

**Site Levels**

Spot levels and identified levels on drawings take precedence over contour lines and ground profile lines.

* + 1. **INSPECTION**

**Inspection Notification Schedule**

The Contractor is to notify the Engineer when the items identified in the **Inspection Notification Schedule**

are ready for inspection.

**Notice**

Minimum notice for inspections to be made on site is 24 hours for offsite personnel, 4 hours for onsite personnel e.g. on-site: 4 hours, off-site: 2 working days. Increase if your office is remote from the site.

If notice of inspection is required in respect of parts of the works that are to be concealed, advise when the inspection can be made before concealment.

* + 1. **SUBMISSIONS Samples**

Submit nominated samples for approval of the Engineer.

If it is intended to incorporate samples into the works, submit proposals for approval. Only incorporate samples in the works which have been approved. Do not incorporate other samples.

Keep endorsed samples in good condition on site, until practical completion.

**Shop drawings**

General: If required, submit dimensioned drawings showing details of the fabrication and installation of services and equipment, including relationship to building structure and other services, cable type and size, and marking details.

Diagrammatic layouts: Coordinate work shown diagrammatically in the contract documents, and submit dimensioned set-out drawings.

* 1. **PRODUCTS 2.2.1TESTS**

**Notice**

Give notice of time and place of nominated tests.

**Attendance**

The Contractor is to carry out and attend all tests were nominated in this specification. As a minimum, the Contractor will carry out the following tests:

* Flatness of the sub-base (allowed tolerance is 2 cm using the 4 Lm bar test), to be certified

on site.

* Flatness of the base of foundations (allowed tolerance is 2 cm using the 4 Lm bar test), to be certified on site.
* Testing of the granulometric composition and strength of all aggregates to be used.
* Testing of all concrete in accordance with the regulations and methods as stated in Concrete section of the specification.
* Bricks shall have certified crush strength of greater than 105kg/cm2.
* The Contractor will supply all necessary appliances and labour for testing of the complete water supply system at such time and as directed by the Engineer. Such testing shall as a minimum require the pressurizing of the complete water supply system to a pressure of not less than 4.5bar. The pipe work and fittings shall retain this pressure for a minimum of 1 hour following the commencement of the test.
* All drains shall be hydraulically tested to a minimum of 1500 mm head and no drains shall be covered up until such test has been made and repeated as necessary until passed to the approval of the Engineer. Access plugs and caps shall be removed, greased, refitted and made sound prior to the final testing.

**2.2.2MATERIALS AND COMPONENTS**

**Consistency**

For the whole quantity of each material or product use the same manufacturer or source and provide consistent type, size, quality and appearance.

**Manufacturers’ or suppliers’ recommendations**

Proprietary items: Select, if no selection is given, and transport, deliver, store, handle, protect, finish, adjust, prepare for use, and provide manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Proprietary systems/assemblies: Assemble, install or fix in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Project modifications: Advise of activities that supplement, or are contrary to, manufacturer’s or suppliers’ written recommendations and instructions.

**Proprietary items**

Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, but indicates the necessary properties of the item.

Alternatives: If alternatives are proposed, submit proposed alternatives and include samples, available technical information, reasons for proposed substitutions and cost. If necessary, provide an English translation. State if provision of proposed alternatives will necessitate alteration to other parts of the works and advise consequent costs.

**2.3 EXECUTION 2.3.1COMPLETION**

**Warranties**

Name the owner as warrantee in conformance with the **Warranty schedule**. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Commencement: Commence warranty periods at practical completion or at acceptance of installation, if acceptance is not concurrent with practical completion.

**2.3.2OPERATION AND MAINTENANCE MANUALS**

**General**

General: Submit operation and maintenance manuals for installations.

**Format – hard copy**

These will be A4 size loose leaf, in commercial quality files with hard covers, each indexed, divided and titled. Include the following features:

* Cover: Identify each binder with typed or printed title “*OPERATION AND MAINTENANCE MANUAL*”, to spine. Identify title of project and date of issue.
* Drawings: Fold drawings to A4 size and accommodate them in the files so that they may be unfolded without being detached from the rings.
* Text: Manufacturers’ printed data, including associated diagrams, or typewritten, single-sided on paper, in clear concise English.

Number of copies: 3.

# DEMOLITIONS

* 1. **GENERAL 3.1.1INTERPRETATION**

**Demolished materials classes**

*Salvaged for re-use:* Demolished materials scheduled for re-use in the works.

*Salvaged for disposal:* Demolished materials scheduled for re-use elsewhere.

*Demolished for re-use:* Non-scheduled demolished materials proposed by contractor for re-use in the works.

*Demolished for removal:* Other demolished materials.

**3.1.2INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* Adjacent structures before commencement of demolition.
* Propping of structures prior to demolition works.
* Structure after stripping and removal of roof coverings and other external cladding.
* Underground structures after demolition above them.
  1. **PRODUCTS 3.2.1DEMOLISHEDMATERIALS**

**Demolished materials**

Ownership: Ownership of demolished materials is described in the **Demolished materials classes table**. Reuse: If it is proposed to reuse demolished materials in the works, submit proposals.

Salvage: Recover without damage materials to be salvaged, for reuse in conformance with the **Salvaged materials for reuse schedule** or for disposal in conformance with the **Salvaged materials for disposal schedule**.

Removal: Remove from the site demolished materials which are the property of the contractor. Do not burn or bury on site.

Transit: Prevent spillage of demolishing materials in transit.

* 1. **EXECUTION 3.3.1SUPPORT**

**Temporary support**

If temporary support is required, certification for its design and installation is required from a professional engineer engaged by the contractor.

Until permanent support is provided, provide temporary support for sections of existing buildings which are to be altered and which normally rely for support on work to be demolished.

Support excavations for demolition of underground structures. Provide supports to adjacent structures where necessary, sufficient to prevent damage resulting from the works.

**Permanent supports**

If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

**3.3.2Protection**

**Encroachment**

Prevent the encroachment of demolished materials onto adjoining property, including public places.

**Weather protection**

If walls or roofs are opened for alterations and additions or the surfaces of adjoining buildings are exposed, provide temporary covers to prevent water penetration. Provide covers to protect existing plant and equipment and materials intended for re-use.

**Dust protection**

Provide dust-proof screens, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris.

**Security**

If a wall or roof is opened for alterations and additions, provide security against unauthorised entry to the building.

**3.3.3Demolition**

**Explosives**

Do not use explosives in the demolition process.

**3.3.4Hazardous materials General**

General: Hazardous materials that have already been identified are set out in the **Identified hazardous materials schedule**.

**Hazardous materials**

General: Give notice immediately hazardous materials or conditions are found, including the following:

* Asbestos or material containing asbestos.
* Flammable or explosive liquids or gases.
* Toxic, infective or contaminated materials.
* Radiation or radioactive materials.
* Noxious or explosive chemicals.
* Tanks or other containers which have been used for storage of explosive, toxic, infective or contaminated substances.

**3.4 Completion**

**Notice of completion**

Give at least 3 working days’ notice of completion of demolition so that adjacent structures may be inspected following completion of demolition.

Make good any damage arising out of demolition work. Obtain written acceptance from the owner of each adjoining property of completeness and standard of making good.

**Temporary support**

General: Clear away at completion of demolition.

4. **SITE PREPARATION**

**4.1 GENERAL 4.1.1AIMS**

**Responsibilities**

The aim of this work section is to clear the site and put in place adequate environmental controls to allow the commencement of earthworks and/or building works.

**4.1.2SUBMISSIONS**

**Execution**

Submit the methods and equipment proposed for the earthworks, including the following:

* Dewatering and groundwater control and disposal of surface water.
* Control of erosion and contamination of the site, surrounding areas and drainage systems.
* Dust control.
* Noise control.

**4.1.3Trees**

**Work near trees**

Keep the area within the drip line free of construction material and debris. Do not place bulk materials and harmful materials under or near trees. Do not place spoil from excavations against tree trunks. Prevent wind-blown materials such as cement from harming trees and plants.

Prevent damage to tree bark. Do not attach stays, guys and the like to trees.

If excavation is required near trees to be retained, give notice and obtain instructions. Open up excavations under tree canopies for as short a period as possible.

Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If it is necessary to excavate within the drip line, use hand methods such that root systems are preserved intact and undamaged.

Backfill to excavations around tree roots with backfill free from weed growth and harmful materials. Place the backfill layers, each of 300 mm maximum depth, compacted to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 300 mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Water trees as necessary, including where roots are exposed at ambient temperature > 35C.

* + 1. **Existing services Marking**

Before commencing earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching.

**Excavation**

Do not excavate by machine within 1 m of existing underground services.

* + 1. **ENVIRONMENTAL PROTECTION Dust protection**

Provide dust-proof screens, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris.

**Dewatering**

Keep groundwork’s free of water. Provide and maintain slopes and drains on excavations and embankments to ensure free drainage. Place construction, including fill, masonry, concrete and services, on ground from which free water has been removed. Prevent water flow over freshly laid work.

* + 1. **SITE CLEARING Extent**

Clear only the following site areas:

* + - * Areas to be occupied by works such as buildings, paving, excavation, regrading and landscaping.
      * Other areas designated to be cleared.

Contractor’s site areas: If not included within the areas specified above, clear generally only to the extent necessary for the performance of the works.

**Clearing and grubbing**

Remove everything on or above the site surface, including rubbish, scrap, grass, vegetable matter and organic debris, scrub, trees, timber, stumps, boulders and rubble.

Remove tree stumps and roots over 75 mm diameter to a minimum depth of 500 mm below subgrade under buildings, embankments or paving, or 300 mm below finished surface in unpaved areas. Holes remaining after grubbing shall be backfilled with sand material to prevent ponding of water. The material shall be compacted to the relative density of the existing adjacent ground material.

Old works: Remove old works, including slabs, foundations, paving’s, drains and manholes found on the surface unless identified on the drawings to remain intact.

# Topsoil

All topsoil shall be stripped over the area on which construction or grading takes place. This topsoil shall be carefully stockpiled to be reused for landscaping on completion of the building operations or otherwise disposed of as directed.

* + 1. **Disposal of materials Disposal**

General: Remove cleared and grubbed material from the site.

# EARTHWORKS

* 1. **GENERAL 5.1.1INTERPRETATION**

**Definitions**

For the purposes of this work section the definitions given below apply.

* + - Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.
    - Line of influence: A line extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement.
    1. **RECORDS OF MEASUREMENT Excavation and backfilling**

Do not commence backfilling or place permanent works in the excavation until the following have been

agreed and recorded:

* + - * Depths of excavations related to the datum.
      * Final plan dimensions of excavations.

Method of measurement: To be jointly agreed between the Engineer and Contractors Site Manager unless otherwise agreed.

**5.1.3INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* Excavation completed to contract levels or founding material.
* Filling completed to contract levels.

**5.1.4TOLERANCES**

**Tolerances**

Finish the surface to the required level, grade and shape within the following tolerances:

* Under building slabs and loadbearing elements: + 0, -40 mm.
* Pavement subgrades; + 0, - 60 mm.
* Other ground surfaces: 50 mm, provided the area will drain and matches adjacent construction where required.
  1. **PRODUCTS 5.2.1FILL MATERIALS**

**Fill material generally**

Fill material is to be inorganic, non-perishable material. Excluded materials:

* + - Organic soils.
    - Materials contaminated through past site usage.
    - Silts or silt-like materials.
    - Fill containing wood, metal, plastic, boulders or other deleterious material.

Classifications for structural fill are based on the intended use of the fill, and defined as follows:

Class I structural fill - used as support for shallow foundations, paved areas, and slabs each with loadings of 3660 kg/m2 or more, for storage tanks, truck turnarounds, and base course and sub-base course for roadway pavements.

Class II structural fill - used as support for shallow foundations, paved areas, and slabs each with loadings of less than 3660 kg/m2 and for parking areas, backfill around foundations, for the construction of embankments, and for roadways pavement subgrades.

Class III non-structural fill - used in areas where installation of structures or equipment is not planned and in open areas where grading is only required to reach levels noted on the drawings.

**Re-use of material recovered from excavation**

Re-use excavated material elsewhere on site if approved by the Engineer.

* 1. **EXECUTION 5.3.1REMOVAL OF TOP SOIL**

**General**

Remove topsoil to all areas to be cut, areas to be filled, areas to be occupied by structures, pavements, embankments and the like.

Maximum depth: 100-200 mm.

**Re-use of removed topsoil**

Re-use removed topsoil elsewhere on site as directed by the Engineer.

**5.3.2EXCAVATION**

**Extent**

Excavate over the site to give correct levels for construction, pavements, filling and landscaping.

Excavate for footings, pits and shafts, to the required sizes and depths. Confirm that bearing capacity is adequate.

**Proof rolling**

Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the extent of

any bad ground.

**Disposal of excess excavated material**

Remove excess excavated material from the site and dispose of legally.

* + 1. **BEARING SURFACES**

**General**

Provide flat bearing surfaces for loadbearing elements including footings. Step to suit changes in levels. Make the steps to the appropriate courses if supporting masonry.

* + 1. **REINSTATEMENT OF EXCAVATION General**

Where excavation is deeper than the required depth, fill and consolidate to the correct depth.

* + 1. **Supporting excavations Provision of supports**

Provide temporary supports to all excavations greater than 1.8m deep. Confirm type of supports and level of protection required with the Engineer.

**Removal of supports**

Remove temporary supports progressively as backfilling proceeds.

* + 1. **Adjacent structures Temporary supports**

Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works. This applies to all structures where the line of influence is interfered with by the proposed excavation works.

Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

**Permanent supports**

If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

* + 1. **PREPARATION FOR FILLING General**

Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements.

Shape to assist drainage. Compact the ground exposed after stripping or excavation.

* + 1. **Placing fill**

**General**

Layers: Place fill in maximum 15cm horizontal layers across the fill area. Mix: Place fill in a uniform mixture.

Protection: Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

* + 1. **COMPACTION REQUIREMENTS FOR FILL AND SUBGRADE**

**Density**

Compact the subgrade exposed by excavation to a minimum depth of 15cm. Compact each layer of fill to the required depth and density, as a systematic construction operation. Shape surfaces to provide drainage and prevent ponding.

Density of all layers of filling are to be approved by the Engineer before subsequent layers are placed. Maximum rock and lump size in layer after compaction: 2/3 compacted layer thickness.

**Moisture content**

Adjust the moisture content of fill during compaction in order to achieve the required density. Do not allow subgrade or fill layers to dry out after compaction before placing subsequent layers of fill. Do not over water filling to greater than moisture content of adjoining undisturbed ground.

# SERVICE TRENCHING

**5.1. GENERAL**

* + 1. **INSPECTION Notice**

Give sufficient notice so that inspection may be made at the following stages:

* + - * Service trenches excavated before laying the service.
      * Services laid in trenches and ready for backfilling.

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# 5.2. EXECUTION

* + 1. **Excavating**

**Excavation**

Excavate for underground services, to required levels and grades. Generally make the trenches straight between inspection points and junctions, with vertical sides and uniform grades.

**Trench widths**

General: Keep trench widths to the minimum required for laying and bedding of the relevant service and construction of pits.

**Trench depths**

If excavation is necessary below the zone of influence of the underside of adjacent footings, give notice, and provide support for the footings as instructed.

**Obstructions**

Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders which may interfere with services or bedding.

**Dewatering**

Keep trenches free of water. Place bedding material, services and backfilling on firm ground free of surface water.

**Excess excavation**

If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or sand stabilised with 1 part of cement to 20 parts of sand by weight.

* + 1. **Backfilling**

**General**

Backfill service trenches as soon as possible after the service has been laid and bedded, if possible on the same working day. Place the backfill in layers maximum150 mm thick and compact to approval of Engineer.

**Backfill material**

General fill with no stones greater than 25 mm occurring within 150 mm of the service, or other materials as required for particular services or locations.

Under roads and paved areas and within 4 m of building: Coarse sand, controlled low strength material or fine crushed rock.

In topsoil areas: Complete the backfilling with topsoil for at least the top 100 mm.

* + 1. **Reinstatement of surfaces General**

Reinstate existing surfaces removed or disturbed by trench excavations to match existing and adjacent work.

# LANDSCAPE – WALLS AND FENCES

* 1. **GENERAL**
     1. **inspection Notice**

Give sufficient notice so inspection may be made of the following:

* + - * Setting out before commencement of construction.
      * Filter fabric and subsurface drainage in place before backfilling.

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# PRODUCTS

* + 1. **Timber**

**Hardwood**

All hardwood in timber fences is to be best quality without any rot, significant knots, twists, or other defects which may affect its strength.

Preservative treatment: Provide only timbers with preservative treatment painted on the timbers surface where the timber is in the ground, or ensure that all timber is highly resistant to rot.

* + 1. **steel**

**Steel tubes and channels**

All steel tubes and channels used for posts, rails, stays are to be painted or galvanised to ensure the maximum lifetime for the item without significant maintenance. Refer to **Finishes Schedule**.

**Wire**

Chain wire, cable wire, tie wire and barbed wire are to be galvanised or other suitable metallic finish for maximum lifetime.

* + 1. **Concrete walls General**

Concrete walls and concrete foundations are to be constructed as shown on the drawings.

* + 1. **stonewalls**

**Walling stone**

Natural stone: Stone of uniform quality, sound and free from defects liable to affect its strength, appearance or durability.

Field stone: Local weathered uncut random sized natural stones. Quarried stone: Cut or uncut random or regular size stone.

* + 1. **Crib walls**

**GENERAL**

Type: Proprietary system of interlocking precast concrete units with selected backfill placed and compacted progressively to form a retaining wall.

* + 1. **Gabion walls**

**GENERAL**

Type: Proprietary system of rock filled wire baskets.

* + 1. **Brick walls**

**GENERAL**

Brick walls on stone or concrete foundations are to be constructed as shown on the drawings.

* + 1. **Earth block walls GENERAL**

Earth block walls on stone or concrete foundations are to be constructed as shown on the drawings.

* + 1. **Filter fabric General**

Type: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinyledenechloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.

**Protection**

Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

# EXECUTION

* + 1. **General**

**Set out**

General: Set out the wall and fence lines and mark the positions of posts, gates and bracing panels.

**Clearing**

Extent: Except trees or shrubs to be retained, clear vegetation within 1 m of the landscape walls. Grub out stumps and roots of removed trees or shrubs and trim the grass to ground level, but do not remove the topsoil.

**Excavation**

Excavate for foundations and footings.

**Earth footings**

Backfill with earth around posts, compacting firmly by hand or machine in 150 mm deep layers.

**Concrete footings**

In ground: Place mass concrete around posts and finish with a weathered top falling 25 mm from the post to ground level.

On slabs: Provide welded and drilled post flanges and fix with 3 masonry anchors per post.

Strip footings: Place mass concrete or reinforced concrete footings for walls. Refer to drawings for details.

* + 1. **Gates Types**

Gates are to be constructed with minimum 30 x 30mm steel tube frames for rigidity. Infill panels can be steel sheet, steel mesh, timber boards or other material as identified on the drawings.

**Hardware**

Provide the following:

* Drop bolt and ferrule to each leaf of double gates.
* Latch to one leaf of double gates.
* Provision for locking by padlock.
* Holding lugs for security bars to inside face of double gates with vehicle access.
* Minimum of 2 hinges for gates 1.2m high. 3 hinges for gates 1.2 to 2.1m high. 4 hinges for gates greater than 2.1m high.

**Hand access**

General: Where required, provide hand holes to give access from outside to reach locking provision.

* + 1. **Timber fencing**

**Timber picket fence**

Height (mm):As shown on drawings Maximum post spacing: 2400 mm. Member sizes (dressed):

* + - * Posts: 90 x 90 mm.
      * Rails: 70 x 40 mm.
      * Pickets: 70 x 19 mm.

Picket spacing: 125 mm maximum.

Footing type: Earth.

Footing size: 200 mm diameter x 600 mm depth.

**Installation**

General: Mortice posts, taper splice rails and nail twice in mortices. Set pickets and palings clear of the ground.

Picket fence: Nail twice to each rail.

* + 1. **Chain wire barriers Fence dimensions**

Maximum post spacing: 3000 mm.

**Component sizes**

Intermediate posts: 42.4 mm diameter, 2.6 mm wall thickness.

End, corner and gate posts: 60.3 mm diameter, 2.9 mm wall thickness. Chain wire: 3.15 mm diameter wire woven to form uniform mesh.

* Mesh generally: 50 mm.

Tie wire: 2 mm diameter. Post and rail barriers:

* Rails and gooseneck stay: 33.7 mm diameter, 2.6 mm wall thickness.

Railless barriers:

* Struts: 42.4 mm diameter, 2.6 mm wall thickness.
* Cable wires:

. Two strands: 3.15 mm diameter wire.

. One strand: 4 mm Heli coil wire.

Security barriers:

* Chain wire selvedge: Twisted and barbed.
* Barbed wire to security fencing post extensions: Barbs at 95 mm maximum centres.

**Installation**

Posts: Do not splice members except in posts when splice is embedded at least 150 mm into concrete. Fit tightly fitting steel caps to posts, except where fixed to overhead structure.

Chain wire: Lace chain wire to end and gate posts. Tie chain wire twice around members at 250 mm maximum intervals. Twist ends twice and cut off neatly.

Cable wire: Tension cable wire(s) to support chain wire after at least 24 hour curing of concrete footings. Footing type: Concrete.

- Footing size:

. Intermediate and end posts: 225 mm diameter x 600 mm depth.

. Corner posts and gate: 225 mm diameter x 900 mm depth.

Post and rail barriers:

* Rails: Connect rail(s) to posts using bolted split pipe fittings and purpose-made caps and brackets with rail apertures.
* Continuous rail type fences: Join the rails together in long lengths using purpose-made sleeves or socketed connections, and pass them through the apertures of caps and brackets on intermediate posts.

Railless barriers:

* Struts: Provide struts at ends, corners and gates.

Security barriers:

* Security fencing: Strain barbed wire between post extensions.

**Gates**

Frame tubes: 33.7 mm diameter, 2 mm wall thickness. Chain wire: Match fence.

Maximum width: 3600 mm. Security barriers:

* Barbed wire security gate extension supports: 26.9 mm diameter, 2 mm wall thickness.
* Barbed wire: Match fence.
  + 1. **stone walls**

**Construction**

Select the stones for their locations and lay them in the wall with the minimum of stonecutting.

Footings: Select the largest, flattest and most regular stones for footings, and set them in concrete blinding in accordance with drawings.

Copings: Select stones of reasonably uniform size and finish the top of the wall to a level line or cap with precast concrete sections.

**Retaining walls**

Construction: Where dry stone walls act as retaining walls, construct the stonework to be free draining through the wall. Batter back the wall face 50 – 70 mm for every 300 mm in height. Cap the top of the wall. Backfill progressively, with a layer at least 300 mm thick of porous material, such as coarse aggregate or crushed rock in the size range 20 – 40 mm. Install filter fabric to stop movement of silt into porous material.

Minimum thickness: 450 mm.

Where stone walls are mortared, batter back the wall face 50 – 70 mm for every 300 mm in height. Cap the top of the wall. Backfill progressively, with a layer at least 300 mm thick of porous material, such as coarse aggregate or crushed rock in the size range 20 – 40 mm. Install filter fabric to stop movement of silt into porous material. Install a slotted pipe drain at the bottom of the wall backfill to ensure all water is drained away from the wall face.

Minimum thickness: 450 mm.

* + 1. **Crib walls**

**CONSTRUCTION**

Construct walls in conformance with the manufacturer’s written requirements or specific design included in the drawings.

* + 1. **Gabion walls**

**Assembly**

Construction: Assemble the baskets and join them together by wiring along edges both horizontally and vertically before placing the rock fill. Fix the top of the basket by wiring to both the sides and the diaphragms.

* + 1. **Brick, earth block walls CONSTRUCTION**

Construct walls in conformance with the specific design included in the drawings. Construction of brickwork and earth blockwork to be in accordance with the relevant specification sections.

# LANDSCAPE – SOILS AND PLANTING

* 1. **GENERAL**
     1. **SUBMISSIONS**

**Suppliers**

Obtain statements from suppliers of plant materials, giving the following:

* + - * Particulars of the supplier’s experience in the required type of work.
      * Lead times for delivery of the material to the site.

# INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + - * lawns prepared before seeding
      * plant holes excavated and prepared for planting
      * set out of gravel paths prepared for filling

# PRODUCTS

* + 1. **TOPSOIL**

**Source**

Import topsoil unless the topsoil type can be provided from material recovered from the site.

**Additives**

Use additives to raise topsoil to the required standard approved by the Engineer.

# COMPOST AND FERTILISER

**Compost**

Provide well rotted vegetative material or animal manure, free from harmful chemicals, grass and weed growth.

**Fertiliser**

Provide proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or vendor, weight, fertiliser type, recommended uses and application rates.

# GRAVEL PATHS

Provide paths constructed with consolidated small gravel chippings and concrete edging pavers where shown on plans.

# EXECUTION

* + 1. **PREPARATION**

**Vegetative spoil**

Remove vegetative spoil from site. Do not burn.

# ROCKWORK

**Rock work**

General: Place rocks while ground formation work is being carried out. Provide site rock, otherwise provide imported rock. Bury rock two thirds by volume, with weathered faces exposed. Protect the weathered faces from damage.

Site rock: Stockpile for future placement and accessibility for lifting. Dispose of other rock off site. Imported rock: Provide rock which has been selected before delivery.

# SUBSOIL

**Ripping**

Rip parallel to the final contours wherever possible. Do not rip when the subsoil is wet or plastic. Do not rip within the dripline of trees and shrubs to be retained.

Ripping depths: Rip the subsoil to the following typical depths:

* Compacted subsoil: 300 mm.
* Heavily compacted clay subsoil: 450 mm.

**Planting beds**

Excavated: Excavate to bring the subsoil to at least 300 mm below finished design levels. Shape the subsoil to fall to subsoil drains where applicable. Break up the subsoil to a further depth of 100 mm.

Unexcavated: Remove weeds, roots, builder’s rubbish and other debris. Bring the planting bed to 75 mm below finished design levels.

**Cultivation**

Minimum depth: 100 mm.

Services and roots: Do not disturb services or tree roots; if necessary cultivate these areas by hand.

Cultivation: Thoroughly mix in materials required to be incorporated into the subsoil. Cultivate manually within 300 mm of paths or structures. Remove stones exceeding 50 mm, and weeds, rubbish or other deleterious material brought to the surface during cultivation. Trim the surface to design levels after cultivation.

**Additives**

Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil. Refer to the **Soil additives schedule.**

# TOPSOIL

**Placing topsoil**

Spread the topsoil on the prepared subsoil and grade evenly. Ensure that grassed areas may be finished flush with adjacent hard surfaces such as kerbs, paths and mowing strips.

Contamination: Where diesel oil, cement or other toxic material has been spilt on the subsoil or topsoil, excavate the contaminated soil, dispose of it off the site, and replace it with site soil or imported topsoil.

Finishing: Feather edges into adjoining undisturbed ground.

**Consolidation**

Compact lightly and uniformly in 150 mm layers. Produce a finished topsoil surface which has the following characteristics:

* Smooth and free from stones or lumps of soil.
* Graded evenly into adjoining ground surfaces.
* Ready for planting.

Refer to the **Soil additives schedule**. **Topsoil depths**

Spread topsoil to the following typical depths:

* Excavated planting areas: If using organic mulch, 200 mm.
* Irrigated grassed areas generally: 150 mm.
* Non-irrigated grass areas: 100 mm.

**Surplus topsoil**

Spread surplus topsoil on designated areas on site, if any; otherwise, dispose off site. Designated areas to be determined by the Engineer.

# GRASS SEEDING

**Preparation**

Prepare the areas to be sown. Spread the fertiliser evenly over the cultivated bed within 48 hours before sowing, and rake lightly into the surface. If a prepared area becomes compacted from any cause before sowing can begin, rework the ground surface before sowing.

**Sowing**

Do not sow if frost is likely before the plant has reached an established state, or in periods of extreme heat, cold or wet, or when wind velocities exceed 8 km/h. Provide even distribution. Lightly rake the surface to cover the seed.

**Rolling**

Roll the seed bed immediately after sowing. Roller weight (maximum):

* Clay and packing (heavy) soils: 90 kg/m width.
* Sandy and light soils: 300 kg/m width.

**Watering**

Before germination: Water the seeded area with a fine spray until the topsoil is moistened to its full depth. Continue watering until germination to keep the surface damp and the topsoil moist but not waterlogged.

After germination: Water to maintain a healthy condition, progressively hardened off to the natural climatic conditions.

**Germination**

Maintain sown areas until healthy grass covers the whole of the seeded area.

Reseeding: If germination has not been attained within one month, reseed the sown areas.

**Weeding**

Remove weeds that occur in sown areas. Where necessary spray with a selective weedkiller for broad leafed weeds. Do not spray grass seeded areas within 3 months of germination.

**Protection**

Protect the newly sown areas against traffic until well established. Protection method to be approved by the Engineer.

**Mowing**

Mow to maintain the grass height within the required range. Do not remove more than one third of the grass height at any one time. Carry out the last mowing within 7 days before the end of the planting establishment period. Remove grass clippings from the site after each mowing.

# PLANTS

**Plants**

Characteristics: Provide plants with the following characteristics:

* + - * Large healthy root systems.
      * Vigorous, well established, free from disease and pests.
      * Suitable for planting in the natural climatic conditions prevailing at the site.

Replacement: Replace damaged or failed plants with plants of the same type and size.

**Plant containers**

Supply plants in weed-free containers of the required size.

Open rooted stock: If trees are to be supplied as open rooted stock, ensure this is appropriate to the species, variety, size, and time of year for planting.

Refer to the **Plant Schedule**.

**Labelling**

Label at least one plant of each species or variety in a batch with a durable, readable tag.

**Storage**

Deliver plant material to the site on a day to day basis, and plant immediately after delivery.

# PLANTING

**Individual plantings in grassed areas**

Excavate a hole to twice the diameter of the root ball and at least 100 mm deeper than the root ball. Break up the base of the hole to a further depth of 100 mm, and loosen compacted sides of the hole to prevent confinement of root growth.

**Locations**

If it appears necessary to vary plant locations and spacing to avoid service lines, or to cover the area uniformly, or for other reasons, obtain directions from the Engineer.

**Planting conditions**

Do not plant in unsuitable weather conditions such as extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.

**Watering**

Thoroughly water the plants before planting, immediately after planting, and as required to maintain growth rates free of stress.

**Placing**

Remove the plant from the container with minimum disturbance to the root ball, ensure that the root ball is moist and place it in its final position, in the centre of the hole.

**Fertilising**

In planting beds and individual plantings, place fertiliser pellets around the plants at the time of planting.

**Watering basins for plants in grass**

Except in irrigated grassed areas and normally moist areas, construct a watering basin around the base of each individual plant, consisting of a raised ring of soil capable of holding at least 10 L.

# STAKESAND TIES

**Stakes**

Use Hardwood stakes, straight, free from knots or twists, pointed at one end.

Drive stakes into the ground at least one third of their length, avoiding damage to the root system. Stake sizes:

* For plants 2.5 m high: Three 50 x 50 x 2400 mm stakes per plant.
* For plants 1 – 2.5 m high: Two 50 x 50 x 1800 mm stakes per plant.

**Ties**

Provide ties fixed securely to the stakes, one tie at half the height of the main stem, others as necessary to stabilise the plant.

Tie types for plants < 2.5 m high: 50 mm sack webbing stapled to the stake.

# GRAVEL PATHS

**Pavement**

Use small size gravel in layers not exceeding 150mm thick to form paths where shown on drawings. Colour and type of gravel to approval of Engineer. Retain sides of path with either:

* + - * Precast decorative concrete paving edge strips, colour to approval of Engineer.
      * Concrete kerbs

# PLANTING ESTABLISHMENT

**Period**

The planting establishment period commences at the date of practical completion and finishes at the date of final certificate.

**Existing planting and grass**

Where existing grass or planting is within the landscape contract area, maintain it as for the corresponding classifications of new grass or planting.

**Recurrent works**

Throughout the planting establishment period, carry out maintenance work including, watering, mowing, weeding, rubbish removal, reseeding, staking and tying, replanting, cultivating, and keeping the site neat and tidy.

# 8. PAVEMENT BASE AND SUBBASE

* 1. **GENERAL**
     1. **INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + - * Prepared subgrade.
      * Proof rolling of base prior to sealing.

-

# TESTS

**Compaction control tests**

The placement and compaction criteria of fill shall be in accordance with K20-1CS.

**Frequency of compaction control tests**

Not less than the following (whichever requires the most tests):

* 1 test per layer per 25 lineal metres for 2-lane roads.
* 1 test per layer per 1000 m2 for carparks.
* 3 tests per layer.

# PRODUCTS

**8.2.1. BASE AND SUBBASE MATERIAL GENERAL**

Base and subbase materials shall comply with the **Base and subbase compliance table**.

**Base and subbase compliance table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course** | **Source** | | | | **Compliance requirement** |
| Base | Crushed | rock | or | natural |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course** | **Source** | | | | **Compliance requirement** |
|  | gravel | | | |  |
| Subbase | Crushed gravel | rock | or | natural |  |

# 8.3. EXECUTION

* + 1. **SUBGRADE PREPARATION**

**General**

Subgrade preparation to be undertaken in accordance with the *Earthwork* work section.

# SUBBASE AND BASE COMPACTION

**General**

Compact each layer of fill to the required depth and density, as a systematic construction operation. Unstable areas: Any unstable areas which develop during rolling or are identified by proof rolling shall be removed for the full depth of the layer and disposed of and replaced with fresh material.

**Compaction requirements**

Apply uniform and sufficient compactive effort over the whole area to be compacted. Use rollers appropriate to the materials and compaction requirements.

**Moisture content**

During spreading and compaction, maintain materials at the optimum moisture content to permit maximum compaction of the material.

Spraying: Maintain moisture content. Use water spraying equipment capable of distributing water uniformly in controlled quantities over uniform lane widths.

# PLACING BASE AND SUBBASE

**General**

Weak surfaces: Do not place material on a surface which has been so weakened by moisture that it will not support, without damage, the constructional plant required to perform the work.

Spreading: Spread material in uniform layers without segregation.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Layer thickness: 150 mm maximum and 75 mm minimum (after compaction). Provide equal layers in multilayer courses.

# CONCRETE PAVEMENT

**8.4. GENERAL**

* + 1. **INTERPRETATION**

**Definitions**

For the purposes of this work section the definitions given below apply.

* + - * Absolute level tolerance: Maximum deviation from design levels.
      * Relative level tolerance: Maximum deviation from a 3 m straight edge laid on the surface.

-

# INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + - * Concrete formwork, reinforcement and dowels in position.
      * Commencement of concrete placing.

-

# SUBMISSIONS

**Products – proposals**

Curing compounds: If it is proposed to use a liquid membrane-forming curing compound submit certified test results for water retention.

Curing by the covering sheet method: Submit details of the proposed covering material. Repair materials: Submit proposals for epoxy resin/grout and elastomeric sealant.

# TESTS

**General**

Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the works and in conformance with the **Tests schedule**.

**Compliance assessment tests**

Timing: Obtain materials samples at the time of delivery to the site.

Location: Sample from selected sample sites within designated uniform test lots, consisting of an area placed, or compacted or both in one day. Test lots must be uniform in terms of material properties and density.

Specimen type: A set of compression test specimens shall consist of four 200 x 200 x 200 mm cubes, each cube being one specimen.

The specimens within each set shall be tested at the following ages in conformance with the **Tests schedule.**

* One at 7 days for information.
* Two at 28 days. The 28 day strength shall be taken as the average of the two specimens. If one specimen in this test shows evidence of improper sampling, moulding or testing, it shall be discarded. The remaining specimen shall be considered the test result. Should both specimens show the specified defects, the entire test shall be discarded.
* The fourth shall be retained as a spare to be tested as required.

**Discharge slump tests**

Carry out slump tests at approximately one quarter and three quarter points of the load during discharge. Working slump: 100mm

Maximum slump: 125 mm. Note concrete with slump greater than this value will be rejected and removed from the site at the contractors cost.

**Flexural strength assessment of concrete**

Acceptance criterion: The average strength of any set of 3 consecutive project samples must not exceed the specified maximum value.

**Tests schedule**

|  |  |
| --- | --- |
| **Samples** | **ASTM C172** |
| Curing | ASTM C31 |
| Testing | ASTM C39 |
| Slump Determination | ASTM C143 |
| Air Content | ASTM C231 or C173 |

# 8.5. PRODUCTS

* + 1. **REINFORCEMENT**

All reinforcing shall be supported and wired together to prevent displacement by construction loads, or the placing of concrete, beyond the tolerances specified in ACI 301. Any tack or spot welding of reinforcement shall not be performed without approval from the Engineer.

Reinforcement shall be free of loose rust and of any other coating which may adversely affect the bond.

Splices in bar reinforcement shall be located and lapped as shown on the design drawings. Bars in lapped splices shall be in contact unless otherwise shown on the design drawings. Additional splices, if required,

shall be made only at locations, and in a manner approved by the Engineer. Welded splices shall not be used. All lap splices in bar reinforcement shall be fully in compliance with ACI 318-02.

Welded wire fabric used in concrete paving shall have lapped splices made so that the overlap between the outermost cross wires of each fabric sheet is at least 50 mm.

Unless specifically indicated on the design drawings, splicing by means of proprietary mechanical splices shall not be used.

Concrete spacers, metal or plastic bar spacers i.e. chairs, shall be used for obtaining proper spacing of reinforcement from the bottom and sides of formwork.

**Dowels**

Provide each dowel in one piece, straight, cut accurately to length with ends square and free from burrs. Fix in locations as shown on the design drawings.

# AGGREGATE

Aggregate size:

* + - * For fixed form placement: < 40 mm.
      * For slip form placement: To be a size compatible with the paving machine.

Washing: Wash aggregate as necessary or as directed to remove significant dust or achieve requirements for soluble salt content or concrete drying shrinkage.

# CEMENT

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

Cement shall be free from any hardened lumps and foreign matter. It shall have a minimum of 90% of particles by weight passing the 75-micron sieve, an initial setting time in excess of 30 minutes and a final setting time of less than 7 hours.

Cement shall be stored in a waterproof shaded area. The cement stacks shall be placed at a minimum distance of 300mm from the walls. The damp proof floor shall be constructed by raising it minimum 300mm above the ground.

Curing Compounds

: Obtain approval from the Engineer for all curing compounds prior to use.

Covering sheet materials: To be opaque polyethylene film, or burlap-polyethylene sheet, or equivalent material.

**Concrete**

Ready-mixed concrete shall comply with M-150 (1:2:4) for non-reinforced mass concrete and M-200 (1:1.5:3) for reinforced concrete and the requirements of these standards.

On site batch mixed concrete shall have characteristics and proportions of concrete ingredients which conform to those specified in M-150 (1:2:4) and M-200 (1:1.5:3).

Admixtures: Introduce in solution in a portion of the mixing water. Ensure a uniform distribution of the admixture in the batch within the mixing period.

Mixing time: Measure the mixing time after solid materials are in the mixer, provided that mixing water is introduced before a quarter of the mixing time has elapsed. Increase mixing time if necessary to obtain the required uniformity and consistence of concrete. Do not overmix such that additions of water are needed.

Transport: Transport and discharge the concrete without segregation.

Elapsed delivery time: Discharge truck mixed concrete within a time (t hours) determined as follows, where T is the temperature of the concrete in degrees Celsius:

t = 2 - 0.05T.

# 8.6. EXECUTION

* + 1. **PLACING**

**Rate**

Place at a rate of at least 25 linear metres of pavement per hour.

**Tolerances**

Edges abutting gutters: Within 5 mm of the level of the actual gutter edge. Rigid pavement surface:

* Absolute tolerance: ± 10 mm.
* Relative tolerance: 5 mm.

Concrete surface course: + unspecified, - 5 mm. Joint locations (rigid pavement): 15 mm.

**Cold weather**

Subbase: Ensure that the subbase surface is free of frost.

Cold weather concreting shall be in accordance with the following:

* + - 1. The guidelines of ACI 306R shall be followed when the Forecasted Mean Daily Temperature drops below 4°C for three consecutive days. The minimum concrete temperature when delivered at the site shall be in accordance with Table I.
      2. If water or aggregate is heated above 38°C, the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water and aggregate having a temperature greater than 38°C.
      3. Concrete shall only be poured when the ambient temperature is rising.
      4. All concrete shall be insulated from freezing for the greater of following:
         1. 3 days
         2. Until the concrete reaches an in-place compressive strength of 35 kg/cm2,
      5. All materials shall be free from frost.
      6. Accelerating admixtures shall not be used without approval from the Engineer. Maintain the concrete at a temperature of at least 10C for at least 24 hours after placing.

**Admixtures**

General: Do not add calcium chloride, salts, chemicals or other material to the mix to lower the freezing point of the concrete.

# TABLE I - MINIMUM COLD WEATHER TEMPERATURE

|  |  |  |
| --- | --- | --- |
| **AIR TEMPERATURE °C** | **MINIMUM CONCRETE TEMPERATURE °C** | |
|  | **For Sections With Smallest**  **Dimension Less Than 300 mm** | **For Sections With Smallest**  **Dimension 300 mm Or Greater** |
| -1 to 4 | 16 | 13 |
| -18 to -1 | 18 | 16 |
| Below -18 | 21 | 18 |

**Hot weather**

Avoid premature stiffening of the mix and reduce water absorption and evaporation losses. If the temperature of the surrounding air is higher than 32C:

* Mix, transport, place and compact the concrete as rapidly as possible, and cover with an impervious membrane or hessian kept wet until moist curing begins.
* Hold the concrete to a temperature 32C when placed.

Hot weather concreting shall be in accordance with the following:

1. Concrete temperatures shall be kept within desirable limits using methods recommended in ACI 305R.
2. For mass concrete, i.e., concrete sections having a minimum dimension of 750mm or greater, the maximum acceptable concrete temperature is 21°C at time of discharge.
3. For other concrete structures, the maximum acceptable concrete temperature is 32°C at time of discharge.
4. If ice is used as part of the mixing water, mixing should be continued until the ice is completely melted.
5. Retempering shall not increase the water content above that in the mix design.

**Placing in fixed forms**

Place concrete uniformly over the width of the slab or lane and so that the face is generally vertical and normal to the direction of placing. Hand spread concrete using shovels, not rakes.

Compact concrete using internal mechanical vibration of sufficient amplitude to produce noticeable vibrations at 300 mm radius. Insert vibrators into the concrete to the depth which will provide the best compaction, but not deeper than 50 mm above the surface of the subbase, and for a duration sufficient to produce satisfactory compaction, but not longer than 30 seconds in any one location.

**Slip form placing**

Spreading: Place the plastic concrete in a uniform layer over the width of the slab being placed. Do not damage the existing surface and edge of previously constructed concrete.

Vibration: Use suitable internal vibrators or surface type equipment with vibrating beam or beams of adequate power to fully compact the whole depth of the concrete.

Slab edges: Use supplementary immersion type vibrators next to slab edges if necessary to ensure that the sides of slabs present a uniform dense appearance free from honeycombing or areas deficient in fines over at least 95% of the surface.

**Finishing**

Immediately after placement and spreading and compaction of the plastic concrete, start finishing operations to achieve finish shown on the drawings.

**Curing**

Protect fresh concrete from premature drying and from excessively hot or cold temperatures. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period.

- Temperature: Maintain the concrete at a temperature > 5C for at least 7 days.

Curing compound method: Spray the entire surface including edges using a mechanical sprayer, at a uniform application rate of at least 0.35 L/m2. Respray defective areas within 30 minutes. Respray within 3 hours after heavy rain. Apply as a continuous coating without visible breaks or pinholes.

Covering sheet method: Immediately after finishing operations cover concrete using damp hessian or cotton mats overlapped at least 150 mm and anchored against displacement by wind or other interference. Keep

the mats continuously damp until covered by the covering sheet material. Repair tears and the like immediately.

- Joint sawing: Sheet materials may be removed for the minimum distance and period to permit joint sawing, provided the concrete is kept moist by other means.

Moist curing method: Immediately after finishing operations keep the concrete surface continuously damp by spraying constantly with water, fog, or mist, using suitable spraying equipment.

Minimum curing time: 7 days.

# JOINTS

Construct expansion, contraction and construction joints straight and plumb. Make transverse joints normal to longitudinal joints. Extend transverse expansion and contraction joints continuously from edge to edge of the pavement through interconnected slabs.

Transverse construction joints: To be as follows:

* Planned location: Terminate each day’s placing operation at a transverse construction joint located to coincide with a planned contraction or expansion joint.
* Unplanned joints: If placement is interrupted for 30 minutes or longer, form a tied transverse construction joint within the middle third of the distance between planned joints but no closer than 1.5 m to the nearest planned joint. If necessary remove placed concrete back to the required location.

Expansion joints: Provide formed full depth joints around structures and features which project through, into or against the pavement, and elsewhere as required.

# 8.7. COMPLETION

**Protection**

Keep traffic, including construction plant, off the pavement entirely during curing, and thereafter permit access only to necessary constructional plant vehicles until the pavement is at least 14 days old.

**Traffic on pavement**

General: Give notice before opening the pavement to traffic before the work is completed. Provide adequate means of protection.

# PAVERS – MORTAR BED

**9.1. GENERAL**

**9.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* Substrate immediately before tiling.
* Trial set-outs before execution.
* Control joints before sealing.

# 9.1.2. SUBMISSIONS

**Samples**

Submit labelled samples of pavers, grout and sealants, illustrating the range of variation in colour and finish.

**10 TOLERANCES Completed paving**

Conform to the **Surface level tolerances table**:

**Surface level tolerances table**

|  |  |  |
| --- | --- | --- |
| **Item** | **Level tolerance** | |
| **Absolute** | **Relative** |
| Vehicular pavements- mortar | ± 5 mm | 5 mm |
| Footpaths- mortar | ± 10 mm | <10 mm |

# 9.2. PRODUCTS

* + 1. **MORTAR**

**Materials**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

* + - * White cement: Iron salts content 1%.
      * Off-white cement: Iron salts content 2.5%.

Lime: Confirm source of Lime with Engineer to ensure highest quality Lime is used in the mortar. Protect from damage on site and store minimum 300mm above ground in waterproof storage facility.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts. River or pit sand should be sharp, angular, hard, clean uncoated particles free from clay and organic impurities.

Water: Water to be used for the mixing of mortar should be clean and free from oil, acid, alkali, salts, organic materials or other substances that are harmful to the mortar mix.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

**Bedding mortar**

Proportioning: Standard and ratio of mix for all mortar shall be M-400 (1:3), M-300 (1:4), M-250 (1:5) and M- 200 (1:6).Provide minimum water.

# GROUT

**Type**

Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints. Portland cement based grout: Mix with fine sand. Provide minimum water consistent with workability.

* + - * For joints < 3 mm: 1 cement:2 sand.
      * For joints 3 mm: 1 cement:3 sand.

**Pigments**

Pigments for coloured grout: Provide colourfast fillers compatible with the grout material. For cement-based grouts, provide lime-proof natural or synthetic metallic oxides compatible with cement.

**Water**

General: To be clean and free from any deleterious matter.

# PAVERS

**Concrete and clay segmental paving units**

Provide labelled samples of all pavers for approval of the Engineer prior to use. Ensure that the horizontal dimensions of each paver have a maximum variation of 3mm in 300mm. Any pavers outside this tolerance will be rejected and removed from the site. Ensure that all pavers are free from fault lines, cracked edges, surface flakes, mould marks or other defects before use.

**Stone paving units**

Provide labelled samples of all pavers for approval of the Engineer prior to use. Ensure that all stone pavers are free from fault lines, cracked edges, surface flakes or other defects before use.

# 9.3. EXECUTION

* + 1. **SUBSTRATES**

**Drying and shrinkage**

Before paving, allow at least the following times to elapse (for initial drying out and shrinkage) for these substrates:

* + - * Concrete slabs: 42 days.
      * Toppings on slabs: A further 21 days.

# PREPARATION

**Trial set-out**

Prepare a trial paving set-out to each area as follows to:

* + - * Maximise the size of equal margins of cut pavers.
      * Locate movement joints.
      * Note minor variations in joint widths to eliminate cut tiles at margins.

**Ambient temperature**

General: If the ambient temperature is < 5 or > 35°C, do not lay pavers.

**Substrates**

Ensure substrates are as follows:

* Clean and free of any deposit or finish which may impair adhesion or location of pavers.
* Excessive projections are hacked off and voids and hollows are filled with cement: sand mix not stronger than the substrate or weaker than the bedding.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scrabbling or the like to remove 3 mm of the surface and expose the aggregate; then apply a bonding treatment.

**Fixtures**

Before paving ensure that fixtures interrupting the surface are accurately positioned in their designed or optimum locations relative to the paving layout.

# PAVING GENERALLY

**Variations**

If necessary, distribute variations in hue, colour, or pattern uniformly, by mixing pavers or paving batches before laying.

**Paving joints**

Joint widths: Set out pavers to give uniform joint widths of 6 < 12 mm.

**Margins**

Provide whole or purpose-made pavers at margins where practicable, otherwise set out to give equal margins of cut pavers. If margins less than half paver width are unavoidable, locate the cut pavers where they are least conspicuous.

**Protection**

Traffic: Keep pedestrian and vehicular traffic off paving until the bedding has set and attained its working strength.

Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

# MORTAR BEDDING

**Preparation of pavers**

Suction: Soak porous pavers in water for half an hour and then drain until the surface water has disappeared.

**Bedding**

Use bedding methods and materials which are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

**Mortar beds**

Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, or cement-based thin bed adhesive, on to the tile back. Do not provide mortar after initial set has occurred.

Nominal thickness of 20mm for mortar bed unless noted otherwise on drawings.

# MOVEMENT JOINTS

**General**

Provide movement joints in the following locations:

* + - * Location:

. Over structural (isolation, contraction, expansion) joints.

. At internal corners.

. Around the perimeter at abutments.

. At junctions between different substrates.

. To divide large paved areas into bays, maximum 5 m wide, maximum 16 m2.

. At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.

* Depth of joint: Right through to the substrate.
* Sealant width: 6 – 25 mm.
* Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

**Movement joint materials**

Divider strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.

Sealant: Two-pack self-levelling non-hardening mould resistant, one-part silicone or polyurethane sealant applied over a backing rod. Finish flush with the tile surface.

Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

# GROUTED AND CAULKED JOINTS

**Grouted joints**

Commence grouting as soon as practicable after bedding has set. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout. Wash down when the grout has set. When grout is dry, polish the surface with a clean cloth.

# 9.4. COMPLETION

**Cleaning**

Completion: Leave pavements clean on completion.

# PAVERS – SAND BED

* 1. **GENERAL**

10.1.1. **INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + - Completed base preparation.
    - Completed trial set-out for segmental paving.

# 10.1.2.TOLERANCES

**Tolerances**

Conform to the **Surface level tolerances table**:

**Surface level tolerances table**

|  |  |  |
| --- | --- | --- |
| **Item** | **Level tolerance** | |
| **Absolute** | **Relative** |
| Vehicular pavements | ± 10 mm | 10 mm |
| Footpaths | ± 10 mm | 5 mm |

# PRODUCTS 10.2.1.MATERIALS

**Bedding sand**

Grading: All sand must pass through a sieve with 2.0mm apertures. Moisture content: Uniform in moisture content with spread.

Deleterious material: Free of deleterious material, such as soluble salts which may cause efflorescence.

**Joint filling sand**

Grading: All sand must pass through a sieve with 1.0mm apertures. Moisture content: The sand shall be dry when spread.

Deleterious material: Free of deleterious material, such as soluble salts which may cause efflorescence.

# 10.2.2.COMPONENTS

**Concrete and clay segmental paving units**

Provide labelled samples of all pavers for approval of the Engineer prior to use. Ensure that the horizontal dimensions of each paver have a maximum variation of 3mm in 300mm. Any pavers outside this tolerance will be rejected and removed from the site. Ensure that all pavers are free from fault lines, cracked edges, surface flakes, mould marks or other defects before use.

**Stone paving units**

Provide labelled samples of all pavers for approval of the Engineer prior to use. Ensure that all stone pavers are free from fault lines, cracked edges, surface flakes or other defects before use.

# EXECUTION 10.3.1.SUBGRADE PREPARATION

**General**

The subgrade shall be prepared in accordance with the *Earthwork* work section.

# 10.3.2.SUBBASE

**General**

The subbase shall be prepared in accordance with the *Pavement base and subbase* work section.

# 10.3.3.BASE

**General**

The base course shall be prepared in accordance with the *Pavement base and subbase* work section.

# BEDDING SAND

**General**

Preparation: Remove all loose material from the prepared base.

Spreading: Screed uncompacted sand over prepared base in a uniform manner to achieve a 30 mm thick layer. Maintain sand at a uniform loose density.

# LAYING PAVING

**General**

Pattern: Paving units are to be laid on the screeded sand bedding to the nominated pattern shown on the drawings.

Joints: Paving units are to be laid with a 2 – 3 mm gap between adjoining units. Cut courses: Do not use cut units with a plain dimension of less than 50 mm.

Control joints: Where paving units are to be placed over control joints in an underlying concrete base, a joint is to be provided in the pavers. The joint shall be 10 mm wide and filled with approved jointing material.

# COMPACTION OF BEDDING

**General**

After laying of the paving units the sand bedding shall be fully compacted using a vibrating plate compactor. Joint filling: All paving units are to be compacted to design levels prior to the commencement of joint filling.

# JOINT FILLING

**General**

Spread dry sand over the paving units and fill the joints by brooming. Undertake one or more passes with the vibrating plate compactor and refill the joints with sand. Repeat the process until the joints are completely filled.

Timing: Fill joints on the same day that pavers are compacted.

# PROTECTION OF THE WORK

**General**

Protection: All vehicular and pedestrian traffic shall be prevented from using the pavement until all compaction and joint filling is completed and all edge restraints are in place.

# 10.3.9.CLEANING

**Cleaning**

General: Leave pavements clean on completion.

# PAVEMENT KERB, CHANNEL AND LINEMARKING

* 1. **GENERAL 11.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + - Set out of kerbs and channels.
    - Set out of line marking prior to painting.

# 11.1.2.TOLERANCES

Kerbs and channels conform to the following:

* + - Absolute level tolerance: 10 mm.
    - Maximum deviation from design alignment: 50 mm.
    - Maximum deviation from a 3 m straightedge placed on horizontal, vertical, or sloping surfaces required to be straight: 5 mm.

Line marking to conform to the following:

* + - The location of markings shall not vary from the locations shown on the drawings by more than 50 mm.

# 11.1.3.INTERPRETATION

**Definitions**

General: For the purposes of this work section the definitions given below apply.

* Absolute level tolerance: Maximum deviation from design levels.
* Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface
* Channels and kerbs: Includes all forms of concrete gutters, dish drains, grated drains and mountable barrier kerbing.

# PRODUCTS 11.2.1.MATERIALS

**Concrete**

Ready-mixed concrete shall comply with M-150 (1:2:4) for non-reinforced mass concrete and M-200 (1:1.5:3) for reinforced concrete and the requirements of these standards.

On site batch mixed concrete shall have characteristics and proportions of concrete ingredients which conform to those specified in M-150 (1:2:4) and M-200 (1:1.5:3).

**Pavement marking paint**

Provide samples of pavement marking paint and technical specifications for approval by the Engineer prior to use on site.

# EXECUTION 11.3.1.LINEMARKING

**Setting out**

Set out the work to ensure that all markings are placed in accordance with the drawings.

**Surface preparation**

Clean dry surface: Pavement markings shall only be applied to clean dry surfaces. Clean the surface to ensure a satisfactory bond between the markings and wearing surface of the pavement.

Wet weather: Pavement marking shall not be carried out during wet weather or if rain is likely to fall during the process.

Provision for traffic: Provide for traffic while undertaking the work and protect the pavement markings until the material has hardened sufficiently so that traffic will not cause damage.

Mixing of paint: All paint shall be thoroughly mixed in its original container before use to produce a smooth uniform product.

**Application of paint**

Pavement markings shall be straight or with smooth, even curves where intended. All edges shall have a clean, sharp cut off. Any marking material applied beyond the defined edge of the marking shall be removed leaving a neat and smooth marking on the wearing surface of the pavement.

**Removal of pavement markings**

General: Remove pavement markings, no longer required, from the wearing surface of pavements without significant damage to the surface.

# 11.3.2.CHANNELS AND KERBS

**General**

Before placing any kerb and/or gutter, the foundation material shall be shaped and compacted to form a firm base. Where placed on pavement courses, the foundation shall be compacted to the requirements of the *Pavement base and subbase* work section.

Kerb and/or gutters may be constructed in fixed forms, by extrusion or by slip forming in accordance with the drawings. The foundation, concrete quality, curing and testing details shall be in accordance with the *Concrete Paving* work section.

**Tolerances**

The level at any point on the surface of the gutters shall be within ± 10 mm of design levels. When a straight edge 3 m long is laid on top of or along the face of the kerb or on the surface of gutters, the surface shall not vary more than 5 mm from the edge of the straight edge.

**Joints**

Contraction joints: Formed every 3 m of gutter length for a minimum of 50% of cross sectional area. The joint shall be tooled 20 mm in depth to form a neat groove of 5 mm minimum width.

Expansion joints: 15 mm in width for the full depth of the kerb and gutter. Joints shall be constructed at intervals not exceeding 15 m and where the gutter is attached to pits and retaining walls. Expansion joints shall consist of approved preformed jointing material.

Concrete pavement: Where kerbs and/or gutters are cast adjacent with a concrete pavement the same type of contraction, construction and expansion joints specified in the concrete base shall be continued across the kerb and/or gutter.

**Backfill**

Timing: After the new kerb and gutter has been constructed and not earlier than three days after placing, the spaces on both sides of the kerb and/or gutters shall be backfilled and reinstated in accordance with the drawings.

Material: Backfill material behind the kerb shall consist of granular material, free of organic material, clay and rock in excess of 50 mm diameter.

Compaction: Backfill material behind the kerb shall be compacted in layers not greater than 150 mm thick.

# CONCRETE GENERAL

* 1. **GENERAL**

**12.1.1. INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + - Base or subgrade before covering.
    - Membrane or film underlay installed on the base.
    - Completed formwork, and reinforcement, cores, fixings and embedded items fixed in place.
    - Surfaces or elements to be concealed in the final work before covering.
    - Commencement of concrete placing.

# 12.1.2.SUBMISSIONS

**Products – proposals**

Curing compounds: If it is proposed to use a liquid membrane-forming curing compound submit certified test results for water retention.

Curing by the covering sheet method: Submit details of the proposed covering material. Repair materials: Submit proposals for epoxy resin/grout and elastomeric sealant.

# 12.1.3.TESTS

**General**

Perform tests of the type and frequency necessary to adequately control the materials and processes used in the construction of the works and in conformance with the **Tests schedule**.

**Compliance assessment tests**

Timing: Obtain materials samples at the time of delivery to the site.

Location: Sample from selected sample sites within designated uniform test lots, consisting of an area placed, or compacted or both in one day. Test lots must be uniform in terms of material properties and density.

Specimen type: A set of compression test specimens shall consist of four 200 x 200 x 200 mm cubes, each cube being one specimen.

The specimens within each set shall be tested at the following ages in conformance with the **Tests schedule.**

* One at 7 days for information.
* Two at 28 days. The 28 day strength shall be taken as the average of the two specimens. If one specimen in this test shows evidence of improper sampling, moulding or testing, it shall be discarded. The remaining specimen shall be considered the test result. Should both specimens show the specified defects, the entire test shall be discarded.
* The fourth shall be retained as a spare to be tested as required.

**Discharge slump tests**

Carry out slump tests at approximately one quarter and three quarter points of the load during discharge. Working slump: 80mm

Maximum slump: 110 mm. Note concrete with slump greater than this value will be rejected and removed from the site at the contractors cost.

**Flexural strength assessment of concrete**

Acceptance criterion: The average strength of any set of 3 consecutive project samples must not exceed the specified maximum value.

**Tests schedule**

|  |  |
| --- | --- |
| **Samples** | **ASTM C172** |
| Curing | ASTM C31 |
| Testing | ASTM C39 |
| Slump Determination | ASTM C143 |
| Air Content | ASTM C231 or C173 |

# 12.2. PRODUCTS

**Reinforcement**

All reinforcing shall be supported and wired together to prevent displacement by construction loads, or the placing of concrete, beyond the tolerances specified in ACI 301. Any tack or spot welding of reinforcement shall not be performed without approval from the Engineer.

Reinforcement shall be free of loose rust and of any other coating which may adversely affect the bond.

Splices in bar reinforcement shall be located and lapped as shown on the design drawings. Bars in lapped splices shall be in contact unless otherwise shown on the design drawings. Additional splices, if required, shall be made only at locations, and in a manner approved by the Engineer. Welded splices shall not be used. All lap splices in bar reinforcement shall be fully in compliance with ACI 318-02.

Welded wire fabric used in concrete paving shall have lapped splices made so that the overlap between the outermost cross wires of each fabric sheet is at least 50 mm.

Unless specifically indicated on the design drawings, splicing by means of proprietary mechanical splices shall not be used.

Concrete spacers, metal or plastic bar spacers i.e. chairs, shall be used for obtaining proper spacing of reinforcement from the bottom and sides of formwork.

**Dowels**

Provide each dowel in one piece, straight, cut accurately to length with ends square and free from burrs. Fix in locations as shown on the design drawings.

**Formwork**

Construct formwork with timber or steel elements to support the concrete for full duration of critical curing period. Construct in a durable manner with sufficient props and fixings to ensure that the formwork remains in position at all times.

**Aggregate**

Aggregate size:

* For fixed form placement: < 40 mm.
* For slip form placement: To be a size compatible with the paving machine.

Washing: Wash aggregate as necessary or as directed to remove significant dust or achieve requirements for soluble salt content or concrete drying shrinkage.

**Cement**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

Cement shall be free from any hardened lumps and foreign matter. It shall have a minimum of 90% of particles by weight passing the 75-micron sieve, an initial setting time in excess of 30 minutes and a final setting time of less than 7 hours.

Cement shall be stored in a waterproof shaded area. The cement stacks shall be placed at a minimum distance of 300mm from the walls. The damp proof floor shall be constructed by raising it minimum 300mm above the ground.

**Curing products**

Curing compounds: Obtain approval from the Engineer for all curing compounds prior to use.

Covering sheet materials: To be opaque polyethylene film, or burlap-polyethylene sheet, or equivalent material.

**Concrete**

Ready-mixed concrete shall comply with M-150 (1:2:4) for non-reinforced mass concrete and M-200 (1:1.5:3) for reinforced concrete and the requirements of these standards.

On site batch mixed concrete shall have characteristics and proportions of concrete ingredients which conform to those specified in M-150 (1:2:4) and M-200 (1:1.5:3).

Admixtures: Introduce in solution in a portion of the mixing water. Ensure a uniform distribution of the admixture in the batch within the mixing period.

Mixing time: Measure the mixing time after solid materials are in the mixer, provided that mixing water is introduced before a quarter of the mixing time has elapsed. Increase mixing time if necessary to obtain the required uniformity and consistence of concrete. Do not overmix such that additions of water are needed.

Transport: Transport and discharge the concrete without segregation.

Elapsed delivery time: Discharge truck mixed concrete within a time (t hours) determined as follows, where T is the temperature of the concrete in degrees Celsius:

t = 2 - 0.05T.

# 12.2.1.POLYMERIC FILM UNDERLAY

**Location**

Provide a vapour barrier under slabs on ground including integral ground beams and footings.

**Installation**

Lay over the base, lap joints at least 200 mm and seal the laps and penetrations with waterproof adhesive tape. Face the laps away from the direction of concrete pour. Patch or seal punctures or tears before pouring concrete. Cut back as required after concrete has gained strength and forms have been removed.

**Base preparation**

According to base type, as follows:

* Concrete working base: Remove projections above the plane surface, and loose material.
* Graded prepared subgrade: Blind with sufficient sand to create a smooth surface free from hard projections. Wet the sand just before laying the underlay.

# 12.3. EXECUTION

* + 1. **PLACING- GENERAL**

**Cold weather**

Subbase: Ensure that the subbase surface is free of frost.

Cold weather concreting shall be in accordance with the following:

1. The guidelines of ACI 306R shall be followed when the Forecasted Mean Daily Temperature drops below 4°C for three consecutive days. The minimum concrete temperature when delivered at the site shall be in accordance with Table I.
2. If water or aggregate is heated above 38°C, the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water and aggregate having a temperature greater than 38°C.
3. Concrete shall only be poured when the ambient temperature is rising.
4. All concrete shall be insulated from freezing for the greater of following:
   1. 3 days
   2. Until the concrete reaches an in-place compressive strength of 35 kg/cm2,
5. All materials shall be free from frost.
6. Accelerating admixtures shall not be used without approval from the Engineer. Maintain the concrete at a temperature of at least 10C for at least 24 hours after placing.

**Admixtures**

General: Do not add calcium chloride, salts, chemicals or other material to the mix to lower the freezing point of the concrete.

# TABLE I - MINIMUM COLD WEATHER TEMPERATURE

|  |  |  |
| --- | --- | --- |
| **AIR TEMPERATURE °C** | **MINIMUM CONCRETE TEMPERATURE °C** | |
|  | **For Sections With Smallest**  **Dimension Less Than 300 mm** | **For Sections With Smallest**  **Dimension 300 mm Or Greater** |
| -1 to 4 | 16 | 13 |
| -18 to -1 | 18 | 16 |
| Below -18 | 21 | 18 |

**Hot weather**

Avoid premature stiffening of the mix and reduce water absorption and evaporation losses. If the temperature of the surrounding air is higher than 32C:

* Mix, transport, place and compact the concrete as rapidly as possible, and cover with an impervious membrane or hessian kept wet until moist curing begins.
* Hold the concrete to a temperature 32C when placed.

Hot weather concreting shall be in accordance with the following:

1. Concrete temperatures shall be kept within desirable limits using methods recommended in ACI 305R.
2. For mass concrete, i.e., concrete sections having a minimum dimension of 750mm or greater, the maximum acceptable concrete temperature is 21°C at time of discharge.
3. For other concrete structures, the maximum acceptable concrete temperature is 32°C at time of discharge.
4. If ice is used as part of the mixing water, mixing should be continued until the ice is completely melted.
5. Retempering shall not increase the water content above that in the mix design.

**Placing in fixed forms**

Place concrete uniformly over the width of the slab and so that the face is generally vertical and normal to the direction of placing. Hand spread concrete using shovels, not rakes.

Compact concrete using internal mechanical vibration of sufficient amplitude to produce noticeable vibrations at 300 mm radius. Insert vibrators into the concrete to the depth which will provide the best compaction, but not deeper than 50 mm above the surface of the subbase, and for a duration sufficient to produce satisfactory compaction, but not longer than 30 seconds in any one location.

**Elapsed delivery time**

General: Ensure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge below 10C or above 32C.

**Elapsed delivery time table**

|  |  |
| --- | --- |
| **Concrete temperature at time of discharge (C)** | **Maximum elapsed time (hours)** |
| 10 – 24 | 2.00 |
| 24 – 27 | 1.50 |
| 27 – 30 | 1.00 |
| 30 – 32 | 0.75 |

**Finishing**

Immediately after placement and spreading and compaction of the plastic concrete, start finishing operations to achieve finish shown on the drawings.

**Curing**

Protect fresh concrete from premature drying and from excessively hot or cold temperatures. Maintain the concrete at a reasonably constant temperature with minimum moisture loss for the curing period.

* Temperature: Maintain the concrete at a temperature > 5C for at least 7 days.

Curing compound method: Spray the entire surface including edges using a mechanical sprayer, at a uniform application rate of at least 0.35 L/m2. Respray defective areas within 30 minutes. Respray within 3 hours after heavy rain. Apply as a continuous coating without visible breaks or pinholes.

Covering sheet method: Immediately after finishing operations cover concrete using damp hessian or cotton mats overlapped at least 150 mm and anchored against displacement by wind or other interference. Keep the mats continuously damp until covered by the covering sheet material. Repair tears and the like immediately.

* Joint sawing: Sheet materials may be removed for the minimum distance and period to permit joint sawing, provided the concrete is kept moist by other means.

Moist curing method: Immediately after finishing operations keep the concrete surface continuously damp by spraying constantly with water, fog, or mist, using suitable spraying equipment.

Minimum curing time: 7 days.

# CORES,FIXINGS AND EMBEDDED ITEMS

**Adjoining elements**

For adjoining elements to be fixed to or supported on the concrete, provide for the required fixings. If required, provide for temporary support of adjoining elements during construction of the concrete.

**Protection**

Grease threads. Protect embedded items against damage.

Compatibility: Ensure inserts, fixings and embedded items are compatible with each other, with the reinforcement and with the concrete mix to be used.

Corrosion: If in external or exposed locations, galvanize anchor bolts and embedded fixings.

**Structural integrity**

Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, reposition but do not cut reinforcement, and maintain cover to reinforcement.

**Tolerances**

Maximum deviation from correct positions:

* Cores and embedded items generally: 10 mm.
* Other fixing bolts: 3 mm.

# COMPACTION

**Compaction**

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove air bubbles and to fully compact the mix.

Vibrators: Do not allow vibrators to come into contact with partially hardened concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the forms. Avoid over-vibration that may cause segregation.

**Placing**

Use placing methods which avoid segregation and loss of concrete, and which minimise plastic settlement. Maintain a generally vertical and plastic concrete edge at faces of a pour.

Layers: Place concrete in layers 300 mm thick, such that each succeeding layer is compacted before previous layer has taken initial set.

**Rain**

General: Do not expose concrete to rain before it has been placed and set.

**Vertical elements**

In vertical elements, limit the free fall of concrete to 1500 mm per 100 mm element thickness, up to a maximum free fall of 3000 mm, using enclosed vertical chutes or access hatches in forms.

# CONSTRUCTION JOINTS

**Location**

Do not relocate or eliminate construction joints, or make construction joints not shown on the drawings. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

**Joint preparation**

Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, and foreign matter. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

# EXPANSION JOINTS

**Joint filling**

Joint filling: Fill with jointing materials. Finish visible jointing material neatly flush with adjoining surfaces. Preparation: Before filling, dry and clean the joint surfaces, and prime.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

# CONCRETE FINISHES

**13.1. GENERAL**

**13.1.1. TOLERANCES**

**General**

Unformed surfaces: Confirm conformance with the **Tolerance classes table** for the class of finish nominated using a straight edge placed anywhere on the surface in any direction.

**Tolerances class table**

|  |  |  |
| --- | --- | --- |
| **Class** | **Measurement** | **Maximum deviation (mm)** |
| A | 3 m straight edge | 3 |
| B | 3 m straight edge | 6 |
| C | 600 mm straight edge | 6 |

# PRODUCTS 13.2.1.MATERIALS

**Surface hardeners, sealers and protectors**

Supply: If required by the project documentation, provide proprietary products in accordance with the manufacturer’s written requirements.

# EXECUTION 13.3.1.SURFACE MODIFIERS

**General**

Application: Apply to clean surfaces in accordance with the manufacturer’s requirements.

# UNFORMED SURFACES

**General**

Screed and level slab surfaces to finished levels, to tolerance class C.

**Finishing methods**

Broom finish: After floating draw a broom or hessian belt across the surface to produce a coarse even- textured slip-resistant transverse-scored surface.

Machine floated finish: After screeding and when the concrete has stiffened sufficiently, work the slab surface using a machine float. Hand float in locations inaccessible to the machine float. Cut and fill to tolerance class B and refloat immediately to a uniform, smooth texture.

Scored or scratch finish: After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface before final set.

Steel trowelled finish: After machine floating, use power trowels to produce a smooth surface relatively free from defects. Then, when the surface has hardened sufficiently, use steel hand trowels to produce the final finish free of trowel marks and defects, and uniform in texture and appearance, to tolerance class A.

Wood float finish: After screeding, machine produce the final finish using a wood float, to tolerance class B.

**Polished finishes**

Water blast: After steel trowelling, water blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate using medium pressure water jets. Ensure that aggregate is not removed to a depth greater than 10mm.

Applied finish: To a steel trowel finished surface, apply a proprietary liquid or dry shake material in accordance with the manufacturer’s written requirements.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy appearance.

**Surface finishes**

General: Provide surface finishes in conformance with the **Integral finish schedule**.

# FORMED SURFACES

**General**

Provide formed concrete finishes in conformance with the **Formed surface finishes schedule**. Damage: Do not damage concrete works through premature removal of formwork.

**Curing**

General: If forms are stripped when concrete is at an age less than the minimum curing period, commence curing exposed faces as soon as the stripping is completed.

**Finishing methods**

If exposed formed concrete elements are to have a finish other than off the form, provide details of proposed procedures. If not identified otherwise, all formed surfaces will be off form finish.

Exposed aggregate finish: Remove the vertical face forms while the concrete is green but set. Wet the surface and scrub using stiff fibre or wire brushes, using clean water freely, until the surface film of mortar is mechanically removed, and the aggregate uniformly exposed. Do not use acid etching. Rinse the surface with clean water.

Floated finishes:

* Sand floated finish: Remove the forms while the concrete is green. Wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.
* Grout floated finish: Remove the forms while the concrete is green. Dampen the surface and spread a slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

**Surface repairs**

Surface repair method: Before commencing repairs, submit proposals to the Engineer for approval.

# PRECAST CONCRETE

**14.1. GENERAL**

14.1.1. **DEFINITIONS**

**Definitions**

For the purposes of this work section the following definition applies:

- Precast units: Concrete elements manufactured in other than their final position including elements manufactured on site but excluding tilt-up panels.

# 14.1.2.INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

* Formwork dimensions and stability.
* Panel edge details and penetrations.
* Connection materials, reinforcement and inserts in place.

# 14.1.3.SUBMISSIONS

**Subcontractors**

Submit name and contact details of proposed manufacturer of precast concrete units.

**Design**

Veneered fabrication: If veneered fabrication is proposed submit proposals to the Engineer.

Contractor design: Provide verification by a professional engineer of compliance of the design with project documents.

**Shop drawings**

Submit shop drawings of precast units showing the proposed details for their design, manufacture, assembly, transport and installation, including the following:

* Project title and manufacturer's name.
* Shape or profile drawings (submit these before fabrication of moulds and tooling).
* Concrete mix and type of cement if special-class concrete.
* Veneer details, if applicable.
* Surface finish class and surface treatment, if applicable.
* Curing and protection methods.
* Marking plan.
* Equipment and methods for handling, transport and installation, including lifting inserts and pick-up points.
* Calculated maximum loadings on lifting and bracing inserts and attachments.
* Evidence of load capacity of lifting and bracing inserts and attachments in the form of test reports or calculations.

**Lifting**

Early lifting: If it is proposed to lift the units by their designated lifting points before 28 day strength has been achieved, submit evidence to demonstrate that the unit has adequate strength to carry its own weight without damage or residual cracking or deflection on removal of the lifting device.

Attachments for handling purposes: If it is proposed to locate lifting attachments, holes and other temporary fixings for handling purposes on visible faces of units, submit proposals.

Lifting units: If it is proposed to lift or support units at other than specified points, submit proposals.

# 14.1.4.PROTOTYPES

**General**

Provide prototypes in accordance with the **Prototypes schedule**.

Maintain prototypes on site, undamaged and protected from discolouration for comparison with manufactured precast units.

**Test panels**

Make separate test panels for surface finish, colour, or both, in conformance with the **Prototypes schedule**.

# 14.2. PRODUCTS 14.2.1.PRECAST UNITS

**Marking**

Identification: Identify units by marks which are as follows:

* Remain legible until after the unit has been fixed in place.
* Are not visible in the completed structure.
* Show the date of casting.
* Show the correct orientation of the unit.
* On other than units manufactured as a standard product, indicate the locations within the structure in accordance with the marking plan.

**Tolerances**

Fixings and embedded items in precast units: To be maximum of 5mm from design location unless agreed otherwise with the Engineer.

**Lifting devices**

Capacity: Design each lifting device for a working load at least 1.65 times the maximum calculated static load at that point and an ultimate load 4 times the maximum static load.

**Attachments**

Sealing: Recess lifting attachments such as ferrules, or other types of cast-in fixings, and provide plugs for sealing.

# 14.2.2.VENEERED CONSTRUCTION

**General**

Use a method which ensures that delamination of the veneer will not occur. Obtain approval from the Engineer prior to construction commencing.

# 14.3. EXECUTION 14.3.1.HANDLING

**Precautions**

Lift or support units only at designated or other approved points. Use handling methods which do not overstress, warp or damage the units. Protect the units against staining, discolouration and other damage until they are installed in their final location.

**Attachments**

Remove temporary attachments after erection. Seal or otherwise make good residual recesses.

# 14.3.2.INSTALLATION

**General**

Fixing: Fix the units securely and accurately in their final positions.

Ancillaries: Provide components and materials, including fasteners, braces, shims, jointing strips, sealant, flashings, grout and mortar, necessary for the installation of the units.

# EARTHBLOCK WALLING

* 1. **GENERAL 15.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Forms for blocks prior to casting blocks.
  + Completed blocks prior to use.
  + Damp-proof courses, in position.
  + Built-in items, in position.

# 15.1.2.TESTS

**Unit sampling**

Rate: For each test, sample units at the rate of 1 per 500, randomly selected.

**Unit tests**

Dry density: Field or laboratory test for block in the range of 1200 – 2000 kg/m3. Absorption:

* Application: Stabilised units for maximum absorption of 2.5% by weight.
* Sample size: 100 mm cube, cut from a sample unit.

Dimensional accuracy:

* Confirm size of block is within an acceptable range of variance not greater than10mm per 300mm length of block.

Robustness: Unit must remain intact, but corner chipping is permitted, consistent with the unit remaining suitable for wall construction.

Defects:

* Breakages (maximum): 50 x 50 x 50 mm broken off per unit.
* Cracks (maximum): 75 mm long, 3 mm wide, 5 mm deep.

-

# 15.1.3.SAMPLES

**General**

Colour and texture: Supply sample units indicating the range of likely variation. Label, and store on site under cover when accepted.

* Number: 4.
* Size: Full size.

Face work: Provide a sample panel.

* Size (minimum): 900 mm long x 600 mm high.
* Location to be determined on site.

# 15.1.4.TOLERANCES

**Tolerances**

Conform to the **Tolerances table**.

**Tolerances table**

|  |  |
| --- | --- |
| **Property** | **Tolerance criteria: Permitted deviation (mm)** |
| Horizontal position of any earth wall element specified or shown in plan at its base or at each storey level | 45 mm |
| Deviation with a storey from a vertical line through the base of the member | 35 mm per 3 m of height |
| Deviation from vertical in total height of building (from base) | 40 mm |
| Relative displacement between loadbearing walls in adjacent storeys intended to be in vertical alignment | 40 mm |
| Deviation (bow) from line in plan in any length up to 10 m | Single curvature: 45 mm |
| Deviation from design wall thickness | - 20 mm, + 40 mm |

# PRODUCTS 15.2.1.MATERIALS

**Soil particle sizes**

Sand: 0.06 – 2.0 mm.

Coarse aggregate: 2.0 – 25 mm.

**Soil particle size distribution**

Organic content: < 2%.

Clay and silt content: 10 – 30%.

Sand and coarse aggregate content: 30 – 80%.

**Water**

Clean, fresh, free from impurities.

**Crack-control agent**

Straw:

* Length: 40 – 60 mm.
* Ratio: 5 kg to 30 kg of straw/m3 of soil.

**Stabilising agent**

Type: Cement.

Standard: Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

**Mortar**

Earthen mortar: Same mix as for the units, but with added sand, and no straw or particles over 6 mm. Thoroughly soak and mix to prevent clay-balling.

Water repellent additive may be added to improve water resistance. Provide a submission to the Engineer for approval.

# 15.2.2.COMPONENTS

**Damp-proof courses**

Material: Embossed Polythene sheeting. Install sheeting at base of all walls to stop moisture rising up wall structures.

**Masonry units**

Formed size (h x w x l): 100 x 250 x 350 mm unless approved otherwise by the Engineer.

**Nailing blocks**

Solid timber, or hollow timber box filled with earthen mortar. Timber unseasoned or thoroughly pre- wetted.

**Steel components, including reinforcement**

All steel components to be galvanised for maximum durability after incorporation into the structure.

**Window and Door lintels**

Lintels: Use steel, concrete or timber lintels in accordance with the manufacturers’ technical literature or conform to the **Steel angle and T-lintels table**.

**Steel angle and T-lintels table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Maximum span (mm)** | **Wall height above 600 mm** | | | **Wall height above > 600 mm, 1800 mm** | | |
| **Angle lintel size** | **T-Lintel dimensions:**  **H x W x T (mm)** | **Bearing min. (mm)** | **Angle lintel size** | **T-Lintel dimensions:**  **H x W x T (mm)** | **Bearing min. (mm)** |
| 1000 | Two 75 x 50 x 5 Unequal angles | 81 x 150 x 6 | 100 | Two 125 x 75 x 8 Unequal angles | 136 x 150 x 6 | 200 |
| 2000 | Two 100 x 75 x 6 Unequal angles | 136 x 150 x 6 | 150 | Two 150 x 90 x 8 Unequal angles | 156 x 150 x 6 | 200 |
| 2400 | Two 125 x 75 x 8 Unequal angles | 156 x 150 x 6 | 150 | Two 150 x 90 x 10 Unequal angles | 160 x 150 x 10 | 250 |
| 2800 | Two 150 x 90 x 8 Unequal angles | 158 x 150 x 8 | 200 | Two 150 x 100 x 10 Unequal angles | 210 x 200 x 10 | 300 |
| 3000 | Two 150 x 90 x 10 Unequal angles | 160 x 150 x 10 | 200 | Two 150 x 100 x 12 Unequal angles | 210 x 200 x 10 | 300 |

**Timber lintels**

Size: Width of the wall and in conformance with the **Timber lintels height table**. Grade: Best quality of imported Russian timber or suitable approved local timber. Bearing: 300 mm (minimum).

**Timber lintels height table**

|  |  |
| --- | --- |
| **Maximum span (mm)** | **Lintel height (mm)** |
| 1200 | 150 |
| 1800 | 150 |
| 2400 | 200 |
| 3000 | 250 |

**Timber fixing plates**

Size: 200 x 50 mm (minimum).

**Holding-down bolts**

Type: 10 mm diameter threaded rod.

Termination: Horizontal 5 x 100 x 200 mm steel plate, weld-fixed, or with nuts. Depth of embedment:

- Length (minimum): 450 mm.

# EXECUTION 15.3.1.FABRICATION

**Mixing**

General: Moisten soil to liquid limit. Leave pit-mixed mud wet overnight. Stabilising: Add cement at 2.5 – 15% by mass.

Crack control: Add straw at 5 – 30 kg/m3.

Hot weather: If placement of walling is to proceed when surrounding outdoor shade temperature exceeds 32ºC, submit proposal.

**Forming**

Press mix into forms on a bed of sand on the ground or on concrete. Lift forms vertically and wash. Do not move units until cured.

**Curing**

General: Sun-dry the units for more than 7 days in situ (under shelter in hot, dry weather) after forming. Then tip the units on one side and sun-dry in situ for another 7 days.

Cement stabilised: Cover blocks with plastic sheet for at least 24 hours after casting.

**Storage**

Stack cured units close to point of use on boards off the ground. Stack on edge, 2 – 3 rows high. Orient stacks for equal exposure to sun and wind on both faces. Protect the tops of stacks against the weather.

# LAYING UNITS

**General**

Drying: Do not lay units until they are dry and at least 28 days after forming.

Unsterilized units: Sprinkle with water before laying. Relay disturbed units in fresh mortar.

Temperature: Do not lay when ambient temperature is or is expected to be < 5C within 48 hours of placement. Do not lay on frozen materials.

Daily progress: Establish leads at corners. Step back incomplete walls, do not tooth. Cover incomplete work at the top. Lay a maximum of 500 – 700 mm height per day.

Voids at dissimilar materials: Fill with earthen mortar.

Protection: Protect tops of walls from rain until the roof is in place.

**Joints**

Bedding: Full flush type, with no open head joints. Bond: Running bond. Overlap units 100 mm.

Type: Flush, 13 – 19 mm thick. Tool concave at exposed surfaces. Remove excess mortar. Control joints:

- Spacing as identified on drawings.

**Protection**

Unstabilised units: Do not locate unstabilised units within 100 mm of adjacent floor levels, within 225 mm of adjacent ground levels, within 100 mm of the top of unenclosed walls and parapets, around roof drains, and in other areas where there is risk of moisture.

# DAMP PROOF COURSES

**Location**

At the base of the earth walls above footings or slab (plinth).

**Walls on slabs**

Finish flush with outer face of slab and inner face of wall. Upturn on inside behind skirting and downturn at outer face of slab, at least 25 mm.

**Installation**

General: Lay in long lengths, in a single width. Lay full width at angles and intersections and lap at least 150 mm at joints. Step as necessary.

# FIXINGS AND EMBEDDED ITEMS

**Nailing blocks and nailers**

Installation: Build-in as the work progresses. Use nailing blocks to fix all window frames, door frames and other wall mounted fixtures.

Partitions: Nail timber framed partitions to nailing blocks.

# 15.3.5.REINFORCEMENT

**Installation**

Do not cut, weld or grind on site. Build-in as work progresses. Lap 450 mm at splices. Fold and bend at corners so that the longitudinal wires are continuous. Stop 200 mm short of control joints. Place in centre of the width of the wall, and in the bedding joint.

Cover (minimum):

* 75 mm for exposed surfaces.
* 25 mm for protected surfaces.

Vertical intervals (maximum): 500 mm, for full height of the wall.

# STEEL LINTELS

**Installation**

Do not cut, weld or grind on site. Build-in as work progresses. Keep lintels 10 mm clear of heads and frames. Install T-lintels with horizontal component at the bottom, centred in the width of the wall.

Propping: Temporarily prop lintels during construction and until the wall reaches its required strength.

# TIMBER LINTELS

**Installation**

Build-in as work progresses. Keep lintels 10 mm clear of heads and frames.

# PIPES AND CONDUITS

**Installation**

Installation: Lay conduits and water pipes in mortar joints as far as possible. Otherwise lay in chases. Cover (minimum): 100 mm, if built-in.

Chases: Maximum depth 50 mm. Run vertically, not horizontally. Do not chase in exposed face work. Thicken the walls for larger piping.

# BOND BEAMS

**Positions**

Provide a continuous bond beam to bearing walls, at framed floor and at roof bearing levels. Build-in as work progresses. Anchor the floor and roof structures to the bond beams. Bond beams may be concrete, timber or steel beams as identified on the drawings.

Position: Centre on the wall.

Bedding: Mortar levelling course.

# HOLDING DOWN BOLTS

**General**

Cover (minimum): 75 mm. Location: Refer to drawings for locations, length of holding down bolts.

**Installation**

Set in perpends and units split lengthwise, in alternating courses. Do not locate within 150 mm of end of wall. Locate in the centre of wall.

# FINISHES

**Appearance**

Marks and stains: Remove at completion. Efflorescence: Remove before sealing or rendering.

**Mud render**

General: Render the exteriors of walls made of unstabilised units. Preparation: Brush the substrate, score and moisten.

Mix: 3:1 clay: clean sand, with straw reinforcing, and enough water to make a paste. Render: Two coats, each 5 – 7 mm thick.

Finish: Polish the coating using sheepskin or small rounded stones.

# TEMPORARY WORK

**Face work sample panel**

If not incorporated, demolish panel.

Refer to the **Earth Block Walling Construction Schedule,** BOQ and drawings for details of locations and built in components.

# BRICKWORK

* 1. **GENERAL 16.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Set out of brickwork to lintels, arches and other architectural features.
  + Damp-proof courses, in position.
  + Lintels, in position.

# PRODUCTS 16.2.1.MATERIALS

**First Class Bricks**

First Class Bricks shall be made from good brick earth free from saline deposits, and shall be sand moulded. They shall be thoroughly burnt by coal without being vitrified, of uniform and good colour shall be regular and uniform in size, shape and texture with sharp square edges and parallel faces. They must emit a clear metallic ringing sound when struck one against another. They shall be free from flaws, cracks, chips, stones, and nodules of lime or canker. A First Class Brick shall not absorb more than 1/6th of its weight of water after being soaked for one hour.

**Second Class Bricks**

Second Class Bricks shall be as well burnt as First Class or may be slightly over burnt but not vitrified, and must give a clear ringing sound when struck one against another. Slight irregularities in size, shape or colour are acceptable provided irregular or uneven courses do not result. Second Class Bricks may have slight chips or flaws but must be free from lime or canker nodules. They shall not absorb more than 1/4th of their weight of water after being soaked for one hour.

**General**

Machine made pressed bricks shall be standard commercial products. The Engineer prior to use in the Works shall approve the use of machine made pressed bricks.

Bricks not meeting the above requirements shall not be used in brickwork.

First and Second Class Bricks should have the following dimensions after burning: 250mm x 120mm x 70mm. The unit weight of First and Second Class Bricks shall not be less than 1100 kg/m3.

The crushing strength of bricks shall be tested in a laboratory. The average crushing strength of First and Second Class Bricks shall not be less than 17MPa (N/mm2).

At the start of the works samples of the bricks shall be tested for crushing strength and water absorption, and brickwork shall only commence when the Engineer has approved the bricks. The Contractor may then only change the source of supply of bricks after samples from the new supplier have similarly been tested and approved.

**Mortar materials**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

* White cement: Iron salts content 1%.
* Off-white cement: Iron salts content 2.5%.

Lime: Confirm source of Lime with Engineer to ensure highest quality Lime is used in the mortar. Protect from damage on site and store minimum 300mm above ground in waterproof storage facility.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts. River or pit sand should be sharp, angular, hard, clean uncoated particles free from clay and organic impurities.

Water: Water to be used for the mixing of mortar should be clean and free from oil, acid, alkali, salts, organic materials or other substances that are harmful to the mortar mix.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

**Mortar**

Proportioning: Standard and ratio of mix for all mortar shall be M-400 (1:3), M-300 (1:4), M-250 (1:5) and M- 200 (1:6).Provide minimum water.

# 16.2.2.COMPONENTS

**Nailing blocks**

Solid timber, or hollow timber box filled with earthen mortar. Timber unseasoned or thoroughly pre- wetted.

**Steel components, including reinforcement**

All steel components to be galvanised for maximum durability after incorporation into the structure.

**Window and Door lintels**

Lintels: Use steel, concrete or timber lintels in accordance with the manufacturers’ technical literature or conform to the **Steel angle and T-lintels table**.

**Steel angle and T-lintels table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Maximum span (mm)** | **Wall height above 600 mm** | | | **Wall height above > 600 mm, 1800 mm** | | |
| **Angle lintel size** | **T-Lintel dimensions:**  **H x W x T (mm)** | **Bearing min. (mm)** | **Angle lintel size** | **T-Lintel dimensions:**  **H x W x T (mm)** | **Bearing min. (mm)** |
| 1000 | Two 75 x 50 x 5 Unequal angles | 81 x 150 x 6 | 100 | Two 125 x 75 x 8 Unequal angles | 136 x 150 x 6 | 200 |
| 2000 | Two 100 x 75 x 6 Unequal angles | 136 x 150 x 6 | 150 | Two 150 x 90 x 8 Unequal angles | 156 x 150 x 6 | 200 |
| 2400 | Two 125 x 75 x 8 Unequal angles | 156 x 150 x 6 | 150 | Two 150 x 90 x 10 Unequal angles | 160 x 150 x 10 | 250 |
| 2800 | Two 150 x 90 x 8 Unequal angles | 158 x 150 x 8 | 200 | Two 150 x 100 x 10 Unequal angles | 210 x 200 x 10 | 300 |
| 3000 | Two 150 x 90 x 10 Unequal angles | 160 x 150 x 10 | 200 | Two 150 x 100 x 12 Unequal angles | 210 x 200 x 10 | 300 |

**Timber lintels**

Size: Width of the wall and in conformance with the **Timber lintels height table**. Grade: Best quality of imported Russian timber or suitable approved local timber. Bearing: 300 mm (minimum).

**Timber lintels height table**

|  |  |
| --- | --- |
| **Maximum span (mm)** | **Lintel height (mm)** |
| 1200 | 150 |
| 1800 | 150 |
| 2400 | 200 |
| 3000 | 250 |

**Timber fixing plates**

Size: 200 x 50 mm (minimum).

**Holding-down bolts**

Type: 10 mm diameter threaded rod.

Termination: Horizontal 5 x 100 x 200 mm steel plate, weld-fixed, or with nuts. Depth of embedment:

- Length (minimum): 450 mm.

# EXECUTION

* + 1. **GENERAL**

**General**

Construction of masonry brickwork shall not commence until the Engineer has accepted the footings on which it is to be placed.

Brickwork shall be built plumb, curved or battered as shown on the Drawings or as may be required, by skilled masons and properly supervised workmen. Bricks shall be clean and if necessary, they shall be scrubbed. Bricks shall be soaked in water for at least one hour before use.

Unless otherwise specified bricks shall be laid in English Bond, with frogs downward. All horizontal joints shall be parallel and level. Vertical joints in alternate courses shall come directly over one another. Joint thickness shall be 6mm and shall in no case exceed 8mm. The height of four courses including 4 bed joints shall rise 300mm. Set out brickwork with joints of uniform width and minimise cutting of masonry units.

Walls shall always be carried up regularly along their entire length unless otherwise directed by the Engineer.

**Mortar mix**

Mortar mixing shall be done in a mechanical mixer unless the Engineer specifically permits hand mixing. If hand-mixing is done, the operation shall be carried out on a clean watertight platform and cement & sand

shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed for at least two minutes after addition of water.

Cement Mortar shall be mixed in such quantities as can be used in the work within 30 minutes. Mortar, which has taken initial set, shall not be used, nor shall it be re-mixed with fresh mortar.

Preparing lime putty:

* Using hydrated lime: Add lime to water in a clean container and stir to a thick creamy consistency. Leave undisturbed for at least 16 hours. Remove excess water and protect from drying out.
* Using quicklime: Run to putty as soon as possible after receipt of quicklime. Partly fill clean container with water, add lime to half the height of the water, then stir and hoe ensuring that no lime remains exposed above the water. Continue stirring and hoeing for at least 5 minutes after all reaction has ceased, then sieve into a maturing bin. Leave undisturbed for at least 14 days. Protect from drying out.

Mortar proportions (cement:lime:sand):As defined on the drawings.

Sand stockpile: Ensure sand is dry and stored undercover to avoid errors in volume batching during the mixing process.

**Protection from contamination**

Protect masonry materials and components from ground moisture and contamination.

**Building in**

Embedded items: Build in fixing blocks, brackets, lintels and accessories as the construction proceeds. Steel door frames: Fill the backs of jambs and heads solid with mortar as the work proceeds.

**Joining to existing**

If jointing to existing work is required, provide a straight joint. Do not tooth new masonry into existing work.

**Chasing**

Chasing of brickwork shall be to the B**rickwork chasing table** and subject to the following limitations:

- Parallel chases on opposite faces of a wall shall not be closer than 600 mm to each other.

**Brickwork chasing table**

|  |  |
| --- | --- |
| **Brick thickness (mm)** | **Depth of chase (maximum mm)** |
| More than 250 thick | 35 |
| 250 thick | 25 |
| 100 thick non load bearing walls only | 20 |

**Joint finish**

Lay brickwork on a full bed of mortar. Fill perpends solid. Finish:

* Externally: Tool to give a dense water-shedding finish for face brickwork or rake not more than 10mm to give a key for render finish.
* Internally: If wall is to be plastered, rake not more than 10 mm to give a key.

**Temporary support**

If the final stability of the brickwork or blockwork is dependent on structural elements to be constructed after the brickwork, provide proposals for temporary support or bracing for the approval of the Engineer.

# FACEWORK

**Cleaning**

General: Clean progressively as the work proceeds to remove mortar smears, stains and discolouration.

**Colour mixing**

Evenly distribute the colour range of units and prevent colour concentrations and “banding” unless specifically identified as a feature of the brickwork.

# DAMP-PROOF COURSES

**Damp-proof courses**

Material: Embossed Polythene sheeting. Install sheeting at base of all walls to stop moisture rising up wall structures.

**Location**

Provide damp-proof courses as follows:

* Walls built off slabs on ground: In the bottom course of the wall on top of the slab.
* Walls adjoining infill floor slabs: In the course above the slab. Project 40 mm and dress down over the membrane turned up against the wall.

**Installation**

Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints. Step as necessary, but not exceeding 2 courses per step. Sandwich damp-proof courses between mortar.

# CONTROL OF MOVEMENT

**Joints**

Provide joints as follows:

* Expansion joints for brickwork:

. Maximum length of continuous wall face: 8 m.

. Closest joint location to external corner: 2.5m

. Maximum vertical spacing: 8 m.

. Width of control joint: 10 mm 20 mm.

. Width of horizontal joint: 15 mm 20 mm.

Filler material: Provide compatible sealant and bond breaking backing materials which are non-staining to masonry.

* Bond breaking materials: To be non-adhesive to sealant, or faced with a non-adhering material.
* Foamed materials: To be closed-cell or impregnated, not water-absorbing.

Joint filling:

* Installation: Clean the joints thoroughly and insert an easily compressible backing material before sealing.
* Sealant depth: Fill the joints with a gun-applied flexible sealant for a depth of at least two-thirds the joint width.

Refer to the **Brickwork Construction Schedule**, BOQ and drawings for details of locations, types and extent of built in components.

# STONEWORK

* 1. **GENERAL 17.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + The prepared stone sample range.
  + Lintels in position.
  + Damp proof courses in position.

# 17.1.2.TOLERANCES

**Dimensions of stone units**

Maximum deviation from required dimensions:

* Loadbearing stone in cut blocks: 4 mm.
* Other stone used in foundations or not exposed to view: No size requirement unless noted otherwise in this work section.

# PRODUCTS 17.2.1.NATURAL STONE

**Stone types**

Sandstone defects: Minor shale laminates and minor concentrations of carbonaceous material (tea leaves) are acceptable in visible faces. Neither defect is acceptable in carved or moulded work.

Granite defects: Igneous stone (e.g. granite) obtained from quarry stone extracted in blocks sufficiently large to suit the project requirements, and containing no more than a small degree of micro cracking.

**Stone selection**

Grading: Select stone of the designated quality grade.

Matching: Within each grade, select stone for the best match of colour and pattern.

**Source of stone supply**

Ensure the stone quarry or supplier can provide all stone required for the project without the need to find alternative supplies.

# 17.2.2.MORTAR

**Mortar materials**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

* White cement: Iron salts content 1%.
* Off-white cement: Iron salts content 2.5%.

Lime: Confirm source of Lime with Engineer to ensure highest quality Lime is used in the mortar. Protect from damage on site and store minimum 300mm above ground in waterproof storage facility.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts. River or pit sand should be sharp, angular, hard, clean uncoated particles free from clay and organic impurities.

Water: Water to be used for the mixing of mortar should be clean and free from oil, acid, alkali, salts, organic materials or other substances that are harmful to the mortar mix.

Crushed stone: Fine aggregate consisting partly or wholly of crushed stone, made from material of the same type as the stone facing.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

**Mortar**

Standard and ratio of mix for all mortar shall be M-400 (1:3), M-300 (1:4), M-250 (1:5) and M-200 (1:6).Provide minimum water.

**Mortar mix**

Mortar mixing shall be done in a mechanical mixer unless the Engineer specifically permits hand mixing. If hand-mixing is done, the operation shall be carried out on a clean watertight platform and cement & sand shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed for at least two minutes after addition of water.

Cement Mortar shall be mixed in such quantities as can be used in the work within 30 minutes. Mortar, which has taken initial set, shall not be used, nor shall it be re-mixed with fresh mortar.

Preparing lime putty:

* Using hydrated lime: Add lime to water in a clean container and stir to a thick creamy consistency. Leave undisturbed for at least 16 hours. Remove excess water and protect from drying out.
* Using quicklime: Run to putty as soon as possible after receipt of quicklime. Partly fill clean container with water, add lime to half the height of the water, then stir and hoe ensuring that no lime remains exposed above the water. Continue stirring and hoeing for at least 5 minutes after all reaction has ceased, then sieve into a maturing bin. Leave undisturbed for at least 14 days. Protect from drying out.

Mortar proportions (cement:lime:sand):As defined on the drawings.

Sand stockpile: Ensure sand is dry and stored undercover to avoid errors in volume batching during the mixing process.

# EXECUTION 17.3.1.WORKMANSHIP GENERALLY

**Cutting**

Perform the necessary cutting and shaping of stone to designated profiles including weathering, jointing, chasing, forming grooves. Make the bed, face and back joints of the stone square and true where dimensioned stone is required.

**Carving and moulding**

Achieve a clean sharp finish. Carry out all work identified on the drawings to the approval of the Engineer.

# LAYING UNITS

**Bedding**

Remove dust and foreign material from the bedding surfaces. Water the face of the stone units so that full strength joints are achieved. Where possible, bed and joint the stone in one operation. Lay each stone on a full bed of mortar. Solidly fill and grout vertical joints as the work proceeds. Point up joints around flashings as necessary.

**Natural bed**

Lay loadbearing sedimentary stone with its natural bed at 90 degrees to the load, except for the following:

- Cladding panels: In non-loadbearing cladding panels, form each panel with its natural bed at right angles to the face.

**Temporary support**

Provide support as necessary to the stone while the mortar is curing, using bracing, joint spacers, or both.

Bracing and joint spacers: Non-damaging and non-staining softwood wedges soaked in water. Do not allow metal pinch bars to bear directly on the stone.

**Raking and toothing**

Raise advanced work no more than 1.5 m above the general level, and rake back. Do not tooth stonework for subsequent additions except where toothing is shown on the drawings.

**Bonding**

Bond the masonry so as to provide stability and monolithic structural action to the stonework assembly.

# STONE FOUNDATIONS

**Stone footings**

Construct the footing course entirely of through stones, and if stepping is necessary, overlap the stepped courses at least 300 mm.

**Subfloor stone foundation walls**

Minimum foundation wall thicknesses:

* Supporting masonry walls 100 mm thick: 300 mm.
* Supporting masonry walls 250 mm thick: 450 mm.
* Supporting masonry walls 370 mm thick: 600 mm.

Stone sizes:

* Maximum height: 350 mm.
* Minimum height: Generally 175 mm; through stones 300 mm.

Bond pattern: Provide through stones as follows:

* All stones in top and bottom courses.
* Elsewhere as header units.

Slab bearings: Provide continuous bearing at least 100 mm wide to the edge of suspended slabs.

# DAMP-PROOF COURSES

**Material**

Material: Embossed Polyethylene sheeting. Install sheeting at base of all walls to stop moisture rising up wall structures.

**Location**

Provide damp-proof courses as follows:

* Walls built off slabs on ground: In the bottom course of the wall on top of the slab.
* Walls adjoining infill floor slabs: In the course above the slab. Project 40 mm and dress down over the membrane turned up against the wall.

**Installation**

Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints. Step as necessary, but not exceeding 2 courses per step. Sandwich damp-proof courses between mortar.

# JOINTING AND POINTING

**Joints**

Size (mm): Not less than 3mm or more than 5mm for dimensioned stonework. Size may vary for non dimensioned stonework from 10mm to 30mm. Joint size should not exceed this without approval of the Engineer.

Jointing material: Mortar with a strength less than the stonework. Lime putty where identified on drawings for special dimensioned stonework.

Pointing material: Coloured mortar or mortar as above, refer to Schedule or drawings. Lime putty where identified on drawings for special dimensioned stonework.

# SEALANT JOINTING

**Preparation for jointing**

Immediately before jointing remove loose particles from the joint, using brushes or compressed air.

**Taping**

Protect the stonework surface on each side of the joint using 50 mm wide masking tape or equivalent means. On completion of pointing remove the tape and remove any stains or marks from the stonework surface.

**Jointing materials**

Use recommended jointing and pointing materials which are compatible with each other and with the contact surfaces and non staining to finished surfaces.

Priming: Apply the recommended primer to the surfaces in contact with sealant materials. Sealant colour: Refer to Schedule or drawings.

Foamed materials (in compressible fillers and backing rods): Closed cell or impregnated types which do not absorb water.

**Sealant application**

Apply the sealant to dry joint surfaces. Do not apply the sealant in unsuitable weather conditions (e.g. when the ambient temperature is outside the range 5 – 50C) or outside the recommended working time for the material or the primer.

**Joint finish**

General: Produce a smooth, slightly concave surface using a tool designed for the purpose.

# 17.4. COMPLETION

**Cleaning**

Cleaning: Leave the stonework clean on completion.

Refer to the **Stonework Construction Schedule**, BOQ and drawings for details of locations, types and extent of built in components.

# LIGHT STEELWORK

**18.1. GENERAL**

18.1.1. **INSPECTION**

**Notice**

Give notice so that inspection may be made of steel framing erected before lining or cladding.

# 18.1.2.SUBMISSIONS

**Design**

The Contractor is to confirm that all proposed member sizes are available for the project in accordance with the drawings and BOQ. If selected sizes are not available, seek alternatives and obtain approval from the Engineer.

# EXECUTION 18.2.1.CONSTRUCTION GENERALLY

**Fabrication**

Length: Cut members accurately to length so that they fit firmly against abutting members. Service holes: Form holes by drilling or punching if needed.

* + Bushes: Provide plastic bushes or grommets to site cut holes.
  + Swarf: Remove swarf and other debris from cold-formed steel framing immediately.

Site work: Do not fabricate on site where welded connections are required.

**Fastening**

Select from the following:

* Bolting.
* Self-drilling, self-tapping screws.
* Blind rivets.

**Welding**

Burning: Avoid procedures that result in greater than localised “burning” of the sheets or framing members. Protect other adjoining materials from damage during welding activities.

Other workers: Protect other workers on site from welding flash, sparks and other potential injuries during welding activities.

**Prefabricated frames**

Protect frames from damage or distortion during storage, transport and erection.

**Unseasoned timber**

Do not fix in contact with framing without fully painting the timber and/or the steel to avoid future rusting of the steel.

**Earthing**

Permanent earthing: Required.

Temporary earthing: Provide temporary earthing during erection until the permanent earthing is installed.

**Protection**

Coatings which have been damaged by welding or other causes shall be restored. Thoroughly clean affected areas to base metal and coat with zinc rich organic primer.

# 18.2.2.TRUSSES

**Fabrication**

Factory assemble trusses and transport to site where possible. Obtain approval from the Engineer if it is required to fabricate trusses on site.

**Marking**

Permanently mark each truss to show:

* Manufacturer.
* Tag or number.
* Location.
* Support points.

**Installation**

Fix to support structures, plumb to within H/200, where H is the height at the apex.

# COMPLETION

**Cleaning**

On completion of framing remove debris from any gaps between members.

# STEELWORK PAINTING

**19.1. GENERAL 19.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Surfaces after preparation prior to application of first coating.
  + Coating after application of final coat.

# 19.1.2.SAMPLES

**Painting and coating colour**

Submit a sample of the finished product for each different coating system. Size of each sample: 200 x 200 mm.

# PRODUCTS 19.2.1.GENERAL

**General**

All protective coatings must be handled, stored, mixed and applied strictly in accordance with the manufacturer’s instructions and Product Data Sheets.

# EXECUTION 19.3.1.PROTECTION

**Surroundings**

Provide protection of the surroundings to the coating works and ensure that no abrasive, overspray or paint waste debris is released either to air, ground or to any watercourse. Repair or clean damage as appropriate.

**Contamination**

Ensure protection of sensitive items during surface preparation and coating works. Do not permit surface preparation debris to contaminate coated surfaces which are not yet dry, nor cause damage to any other services or equipment.

**Stacking and handling**

Do not stack, handle or transport coated items until the coating has sufficiently cured so as to resist handling actions.

Stack and handle all steelwork using fabric slings or padded chains, used in a manner that ensures that no damage is caused to the coating system. Adopt soft packaging, carpet strips or other deformable materials between all steel items. Do not permit steel to steel contact in any situation.

Water ponding: Stack coated items so that water ponding does not or cannot occur whilst the items are in storage, transport or “laydown”.

**Repair of coating damage**

If damage occurs repair so as to ensure that the full corrosion protection ability of the system is reinstated.

# SURFACE PREPARATION

**General**

Coatings shall be applied only to properly prepared and cleaned surfaces.

**Surface preparation**

Ensure all surfaces are free from oil, grease, dirt, bird droppings or any other contaminants, particularly soluble contaminants.

Surface defects: Remove or correct other surface defects, including cracks, laminations, deep pitting, undercutting, weld spatter, slag, burrs, fins and sharp edges.

Remove all weld spatter by grinding or chipping.

**Priming**

Prime coat all surfaces with zinc rich primer on the same day as the completion of surface preparation works. In every case, the specified surface preparation standard, in both cleanliness and profile, shall be evident at the time that the primer coating is applied.

# COATING APPLICATION

**General**

Apply the coatings in accordance with the **Paint Finishes Schedule**..

**Final surface preparation or coating application**

Limits: If the following climatic/substrate conditions are present do not apply coating:

* The ambient air temperature is below 5°C or above 40°C.
* The substrate temperature is below 10°C or above 35°C.
* The surface to be coated is wet or damp.

Defects: Apply materials so as to produce an even coating free from film defects.

Detail: Stripe coat all welds, bolt holes, sharp edges and difficult to spray areas by brushing in with the prime coat and intermediate coat material prior to the full coating application.

**Subsequent coats**

Ensure that before any subsequent coating layer is applied, the surface condition of the preceding coat is complete and correct in all respects, including its cleanliness and freedom from defects. Correct any defects before the next coating layer is applied.

# LIGHT TIMBERWORK

**20.1. GENERAL**

20.1.1. **INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Timber framing after erection before lining or cladding.
  + Roof framing and connection to wall and ceiling structures.

# 20.1.2.SUBMISSIONS

**Design**

The Contractor is to confirm that all proposed member sizes are available for the project in accordance with the drawings and BOQ. If selected sizes are not available, seek alternatives and obtain approval from the Engineer.

# PRODUCTS. 20.2.1.TIMBER

**Timber grades**

Structural timbers:

* + - Appearance grade if exposed to view in the finished work: Use best quality timber free from twists, knots, splits and other visual or physical defects.
    - Structural grade if concealed in the building:

Lower quality timber with some visual defects acceptable but with minimal physical defects.

# 20.2.2.SHEET PRODUCTS

**Structural plywood panels**

All structural plywood panels used for construction purposes are to be approved by the Engineer. Refer to drawings and BOQ for details of locations and sizes. All structural plywood is to be tested before use to the satisfaction of the Engineer to ensure that it will be suitable for the proposed use.

Use branded or certified plywood products where possible.

**Hardboard or fibreboard panels**

All hardboard or fibreboard panels used for construction purposes are to be approved by the Engineer. Refer to drawings and BOQ for details of locations and sizes. All material is to be tested before use to the satisfaction of the Engineer to ensure that it will be suitable for the proposed use.

Use branded or certified products where possible.

# 20.2.3.COMPONENTS

**Steel post bases**

Minimum dimensions:

* Stirrup: 75 mm wide x 6 mm thick.
* Dowel: 20 mm diameter heavy tube.

Location: To timber posts supported off concrete slabs or footings. Finish: Galvanize after fabrication.

**Fasteners**

Material:

Use best quality steel bolts, washers and nuts for bolted connections. Washers to be used both sides of timber to avoid crushing of the timber at the connection point.

Use best quality screws to avoid damage to screw heads during tightening process.

Use best quality bright steel nails for internal work protected from the weather and galvanised nails for external fixings exposed to the weather.

Lightweight allow bolts and screws will not be permitted.

Installation: Pre drill holes in hardwood timber to avoid splitting the timber.

Do not split or otherwise damage the timber or fastener by hammering bolts or screws into the timber.

# EXECUTION

* + 1. **GENERAL**

**Protection from weather**

General: Provide temporary protection for members until permanent covering is in place.

# FLOOR FRAMING

**Bearers and joists**

Levelling: Level bearers and joists by packing for the full width of the member. Joints: Locate joints only over supports:

* Minimum bearing of bearers: 50 mm.
* Minimum bearing of joists: 30 mm.

Fixing: Secure bearers and joists to supports to provide restraint against lateral movement.

Joist restraint: If joist timber is unseasoned, the span 3000 mm, provide solid blocking between each joist in rows at 1800 mm centres and at the ends of the joists over the supports.

Members: Provide bearers and joists where shown on the drawings and in the BOQ.

**Flooring**

Provide flooring of structural plywood where shown on the drawings and in the BOQ.

# ROOF ANDCEILING FRAMING

**Wall plates**

Fix timber wall plates to top of masonry walls with either straps or bolts, or provide fixings cast into the ring beam as required.

**Ceiling framing**

Construct timber framed ceilings where shown on drawings with battens fixed to underside of trusses or ceiling joists as required.

**Additional support**

Provide a frame member behind every joint in fibre cement sheeting or plywood lining to ensure that the lining is fully supported.

**Roof cladding boards**

Provide roof cladding boards minimum of 20mm thick to full extent of roof structure to support flat metal sheet roofing where shown on drawings. Securely fix to structure and ensure that the top surface is as smooth as possible to avoid damage to the roof sheeting.

# TRUSSES

**Installation**

Support: Support trusses on bottom chord at two points only, unless designed for additional support. Plumb: Within H/200, where H is the height.

Vertical movement: Over internal walls provide at least 10 mm vertical clearance and use bracing methods which allow for vertical movements.

Construction: Construct trusses strictly in accordance with the drawings. If variations are proposed due to construction fabrication or installation issues, obtain approval from the Engineer before changing the design.

# COMPLETION

**Tightening**

Tighten bolts, screws and other fixings so that joints and anchorages are secure at all times.

**Clean up**

Remove all shavings, discarded chips and pieces of timber from the structure during construction and clean up all working areas prior to Completion.

# WATERPROOFING

**21.1. GENERAL**

21.1.1. **INTERPRETATIONS**

**Definitions**

For the purposes of this work section the definitions given below apply.

* + Substrates: The surfaces on which membrane systems are laid.
  + Bitumen: A viscous material comprising complex hydrocarbons which is soluble in carbon disulphide, softens when it is heated, is waterproof and has good powers of adhesion. It is produced as a refined by- product of oil.
  + Bond breakers: Layers which prevent membranes from bonding to the backgrounds.
  + Membranes: Impervious barriers to liquid water which may be:

. Liquid applied: Membranes applied in liquid or gel form and air cured to form a seamless film.

. Sheet applied: Membranes applied in sheet form with joints lapped and bonded.

* + Membrane systems: Combinations of membranes, flashings, drainage and accessories which form waterproof barriers and which may be:

. Loose-laid.

. Bonded to backgrounds fully or partially.

# 21.1.2.INSPECTION

**Notice**

Give sufficient notice so that inspection may be made as follows:

* Background preparation completed.
* Before membranes are finished, covered up or concealed.

# PRODUCTS 21.2.1.MEMBRANES

**Membrane systems**

To be proprietary membrane systems where possible having certification from an international testing organisation.

**Internal roof outlets for membrane roof**

Proprietary funnel shaped sump cast into the roof slab, set flush with membrane, with a flat removable grating and provision (e.g. clamp ring) for sealing the membrane into the base of the outlet.

# EXECUTION 21.3.1.PREPARATION

**General**

Prepare backgrounds as follows:

* Fill all cracks in backgrounds wider than 1.5 mm with a filler compatible with the membrane system.
* Fill voids and hollows in concrete backgrounds with a concrete mix not stronger than the background.
* Remove excessive projections.
* Remove deleterious and loose material.
* Leave the surface free of contaminates, clean and dust free.

**Moisture content**

Concrete backgrounds: Cure for > 21 days.

**Falls**

Verify that falls in backgrounds are > 1:100.

**Joints and fillets**

Internal corners: Provide 45° fillets. External corners: Round or arris edges.

Movement control joints: Prepare all background joints to suit the membrane system.

**Priming**

If required, prime the backgrounds with compatible primers to ensure adhesion of membrane systems.

# 21.3.2.APPLICATION

**Protection**

Protect membrane from damage during installation.

**Drains**

Prevent moisture from tracking under the membranes at drainage locations. Drains and cages: Provide grates or cages, to prevent blockage from debris.

Overflows: Turn the membranes into the overflow to prevent moisture from tracking behind the membrane.

**Sheet joints**

Bituminous sheet membranes:

* Side laps > 50 mm.
* End laps > 100 mm.

Synthetic rubber membranes:

* Factory–vulcanized laps > 40 mm.
* Field side laps > 50 mm for side laps.
* Field end-laps > 100 mm for end laps.

**Curing of liquid applied systems**

To the manufacturers’ instructions.

**Movement control joints**

Locate over movement control joints in the substructure.

Fillets and bond breakers: Provide of sufficient dimension to allow the membrane to accommodate the movement.

Bonded membranes: Carry movement joints in the substrate through the surface finish.

**Membrane terminations**

Edge protection: Provide upturns above the maximum water level expected from the exposure conditions of rainfall intensity and wind.

* Minimum height of 200mm for all upturns above membrane level unless noted otherwise on the drawings.
* Anchoring: Secure sheet membranes along the top edge.
* Edge protection: Protect edges of the membrane.
* Waterproofing above terminations: Waterproof the structure above the termination to prevent moisture entry behind the membrane using capping, waterproof membranes or waterproof coatings.

**Membrane vertical penetrations**

* Pipes, ducts, and vents: Provide separate sleeves for all pipes, ducts, and vents and have them fixed to the substrate. Minimum height of 200mm for all sleeves above membrane level unless noted otherwise on the drawings.

**Overlaying finishes on membranes**

Compatibility: If a membrane is to be overlayed with another system such as tiles, pavers, ballast, insulation, soil, and the like, provide an overlaying system that is compatible with and not cause damage to the membrane.

Ensure that no damage is caused to the membrane during the laying of the overlay material. If any damage occurs immediately stop work and repair the damage before proceeding with the overlay process.

Bonded or partially bonded systems: If the topping or bedding mortar requires to be bonded to the membrane, provide sufficient movement joints in the topping or bedding mortar to reduce the movement over the membrane. Geotextile product of the recommended grade.

# ROOFING

* 1. **GENERAL**

22.1.1. **INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of:

* + - Roof framing during construction.
    - Those parts of the roofing, vapour barrier, insulation and roof plumbing installation which will be covered up or concealed.

# 22.1.2.SUBMISSIONS

**Samples**

Submit samples of the following showing the range of variation available:

* Corrugated and flat metal roof sheeting
* Roof capping, flashings, gutters, downpipes

# 22.2. PRODUCTS

* + 1. **MATERIALS AND COMPONENTS**

**Fasteners**

Self-drilling screws: Corrosion resistant screws to approval of Engineer. Nuts and bolts: Corrosion resistant fastenings to approval of Engineer.

Fastenings to timber battens or purlins: Provide fastenings just long enough to penetrate the thickness of the timber without piercing the underside.

# CORRUGATED METAL ROOFING AND CLADING

**General**

Provide a proprietary system of preformed corrugated sheets and all purpose-made accessories required to complete the installation to roof framing or wall framing. Refer to **Corrugated Sheet Roofing Materials Schedule** for details.

# FLAT SHEET METAL ROOFING AND CLADDING

**General**

Provide a system of flat metal sheets and all purpose-made accessories required to complete the installation to roof framing or wall framing. Refer to **Flat Sheet Roofing Materials Schedule** for details.

# GLAZED ROOFING AND SKYLIGHTS

**General**

Provide a proprietary overhead glazing system fixed to glazing bars or directly to the roof framing. Provide all purpose-made accessories required to complete the installation. Refer to **Glazed Roofing Materials and Skylight Schedule** for details.

# ROOF VENTILATORS

**General**

Provide proprietary roof mounted ventilators and all purpose-made accessories required to complete the installation where shown on the drawings to ventilate the roof space.

Provide fabricated ventilators in walls as shown on the drawings to ventilate the roof space. Refer to **Roof Ventilators Schedule** for details.

# 22.3. EXECUTION 22.3.1.INSTALLATION

**Protection**

Keep the roofing and rainwater system free of debris and loose material during construction, and leave them clean and unobstructed on completion. Repair damage to the roofing and rainwater system.

If it is necessary to repair minor damage to metal roofing, do so immediately after the damage has occurred. The Contractor is take care to not damage other surfaces during the repair works.

**Thermal movement**

Provide for thermal movement in the roof installation and the structure, including movement in joints and fastenings.

# SHEET METAL ROOFING AND CLADDING

**Roofing sheet installation**

Fixings: Provide all fixings required to fix the roof sheeting to the framing so that the entire roof covering is waterproof and secure. All loose edges are to be fixed down to ensure that they cannot get loose in high winds.

Expansion joints: refer to drawings for locations of expansion joints in roofs and details of construction.

**Ridges and eaves**

Treat ends of sheets as follows:

* Project sheets 50 mm into gutters.
* Close off ribs of ribbed sheeting at bottom of sheets using mechanical means or with purpose-made end caps.
* Turn pans of ribbed sheeting up at tops and down into gutters by mechanical means.
* Provide pre-cut notched eaves flashings and bird proofing wire mesh where necessary.

**Ridge and eaves capping**

Finish off along ridge and side eaves edges with purpose-made ridge capping and eaves capping.

**End laps**

Where end laps are unavoidable in roof sheeting, and the sheet profile is not suitable for interlocking or contact end laps, construct a stepped type lap. Refer to details on drawings as required.

Length of lap (mm): Laps to ends of sheets should not be less than 150mm and sealed with a continuous line of silicone sealant between the sheets of roofing.

**Curved corrugated sheet**

Form by rolling from material recommended for curving. Minimise crimping or creasing across the face of the sheet. Trim off crimped or creased edges and ends.

K-Span roofing where identified on the drawings is to be strictly controlled during the installation process to ensure that the completed work is of a high standard.

**Cladding sheet installation**

Fixings: Provide all fixings required to fix the wall cladding sheeting to the framing so that the entire wall is waterproof and secure. All loose edges are to be fixed to ensure that they cannot get loose in high winds.

Expansion joints: refer to drawings for locations of expansion joints in walls and details of construction.

Flashings: Flashings are required at the top, sides and bottom of all metal wall cladding to ensure that the wall is waterproof in all weather conditions.

**Metal separation**

Prevent direct contact between incompatible metals, and between green hardwood and aluminium or coated steel, by either:

* Applying an anti-corrosion, low moisture transmission coating to contact surfaces.
* Inserting a separation layer.

-

# GLAZED ROOFING AND SKYLIGHTS

**Installation**

Fixing: Fix all glazed roof panels and skylights in accordance with the drawings.

Flashings: Flashings are required at the top, sides and bottom of all glazed roof panels and skylights to ensure that the roof is waterproof in all weather conditions.

# ROOF VENTILATORS

**Installation**

Fixing: Fix roof ventilators in accordance with the manufacturers construction details or in accordance with the drawings for fabricated ventilators.

# ROOF RAIN WATER GOODS

**General**

Provide the flashings, capping, gutters, rainwater heads, outlets and downpipes necessary to complete the roof system.

**Jointing sheet metal rainwater goods**

Butt joints: Make joints over a backing strip of the same material. Soldered joints: Do not solder aluminium or aluminium/zinc-coated steel.

Sealing: Seal fasteners and mechanically fastened joints. Fill the holes of blind rivets with silicone sealant.

Jointing system: Refer to the Gutter and Downpipe Schedule for specific jointing details for each type of element.

**Flashings and capping**

Installation: Flash roof junctions, upstands, abutments and projections through the roof. Preform to required shapes where possible. Cut, notch, bend or dress down as necessary to follow the profile of adjacent surfaces. Lap joints 150 mm in running lengths. Provide matching expansion joints at 6 m maximum intervals.

Upstands: Flash projections above or through the roof with two part flashings, consisting of a base flashing and a cover flashing, with at least 100 mm vertical overlap. Provide for independent movement between the roof and the projection.

Wall abutments: Provide over flashings where roofs abut walls, stepped to the roof slope in brickwork.

* In masonry: Build cover flashing at least 100mm into the wall at least 250mm above the roof level. Provide base flashing on roof and provide at least 100mm vertical overlap.
* In concrete: Turn cover flashing at least 30 mm into saw cut grooves at least 250mm above the roof level, wedge at 200 mm centres with compatible material and render over top of flashing. Provide base flashing on roof and provide at least 100mm vertical overlap.

Fixing to pipes: Solder, or seal with neutral cured silicone rubber and either of the following:

* Secure with a clamping ring.
* Provide a proprietary flexible clamping shoe with attached metal surround flashing.

**Gutters**

Prefabricate gutters to the required shape where possible. Form stop ends, bends and returns. Provide overflows to prevent back-flooding.

Gutter and sump support: Provide framing and lining to support valley gutters, box gutters and sumps. Line the whole area under the gutters and sumps.

Support: Steel straps as shown on drawings or as approved by the Engineer.

Lining: Timber boards or plywood as shown on drawings or as approved by the Engineer.

Valley gutters: Profile to suit the valley boarding. Nail or screw to the valley boarding at the top end to prevent the gutter creeping downwards.

Gratings and guards: Provide removable gratings over rainwater heads and sumps:

* Type: Wire mesh cages reinforced with steel bars where required due to size and expected snow loads.

Refer to drawings for details.

Expansion joints: Provide expansion joints in guttering longer than 30 m:

* Type: Refer to drawings for details.

**Downpipes**

Prefabricate downpipes to the required section and shape where possible. Connect heads to gutter outlets and, if applicable, connect feet to rainwater drains.

Access cover: Provide a removable watertight access cover at the foot of each downpipe stack if the downpipe is connected to rainwater drains.

Downpipe support: Provide supports and fixings for downpipes.

# ROOF MOUNTED EQUIPMENT ACCESS

**Walkway**

Product: Provide proprietary walkway system to locations as shown on drawings. Provide fabricated system constructed as shown on drawings. Fabricate in accordance with metalwork section of the specification.

Installation: Install proprietary systems in accordance with manufacturers details and as identified on drawings.

# 22.4. COMPLETION

**Roof Inspection**

The Contractor is to closely inspect the entire roof covering and metal cladding to walls at completion of the works.

Make good any defects or damage to the sheeting, capping or flashings. Remove all loose metal and other rubbish, spare nails, screws, filings and other debris.

Clean down the roof, gutters, downpipe outlets to ensure that it is good condition ready for occupation.

# WINDOWS AND WINDOW HARDWARE

**23.1. GENERAL**

**23.1.1. INTERPRETATION**

**Definitions**

For the purposes of this work section windows also includes louvres, either vertical or horizontal, set into frames.

# 23.1.2.INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

* Openings prepared to receive windows (where windows are to be installed in prepared openings).
* Fabricated window assemblies delivered to the site, before installation.
* Commencement of window installation.

-

# 23.2. PRODUCTS 23.2.1.LOUVRE ASSEMBLIES

**General**

Provide louvre blades mounted in a surround frame and able to withstand the wind pressure for that location without failure or permanent distortion of blades, and without blade flutter.

**Adjustable louvres**

Provide louvre blades clipped into holders which pivot, linked together in banks, each bank operated by an operating handle incorporating a latching device, or by a locking bar.

**Screens**

Provide metallic coated steel wire mesh screens behind louvres to prevent the entry of birds, rodents and windblown leaves and papers.

# INSECT SCREENS

**Aluminium/Mild steel framed screens**

Provide insect screens with mesh frame channel. Provide an extended frame section where necessary to adapt to window opening gear.

* + - * Mesh: Fix the mesh into the frame channel with a continuous resilient gasket, so that the mesh is taut and without distortion.

**Fixed screens**

Provide fixed screens to the window frames with a clipping device which permits removal for cleaning.

**Hinged screens**

Hinge at the side to give access to opening sash.

**Sliding screens**

Provide a matching aluminium head guide, sill runner, and frame stile sections for screens not part of the window frame.

- Hardware: Nylon slide runners and finger pull handle.

# SECURITY WINDOW GRILLES

**General**

Provide security grilles in accordance with the drawings or proprietary metal security grille screens, fixed to the building structure with tamper resistant fastenings.

# WINDOW HARDWARE

**Hardware**

Provide hardware of sufficient strength and quality to perform its function, appropriate to the intended conditions of use and climate and fabricated with fixed parts firmly joined.

# EXECUTION 23.3.1.INSTALLATION

**General**

Install windows so that the frames:

* + - * Are plumb, level and straight within acceptable building tolerances.
      * Are fixed or anchored to the building structure to resist the wind loading.
      * Will not carry any building loads, including loads caused by structural deflection.
      * Allow for thermal movement.

**Flashing and weathering**

Install moulds, sealant and cement pointing as required so that water is prevented from penetrating the building between the window frame and the building structure.

**Fixing and fasteners**

Materials: Use materials compatible with the item being fixed and of sufficient strength, size and quality to perform their function.

Concealed fixings: Provide a corrosion resistant finish.

Exposed fixings: Match exposed fixings to the material being fixed.

Support: Provide appropriate back support (for example blocking and backing plates) for hardware fixings. Window fastener spacing (nominal): 600 mm.

Window fasteners: Conceal fasteners where possible.

Packing: Pack behind fixing points with durable full width packing.

Prepared masonry openings: If fixing timber windows into existing prepared openings with fastenings through the frame face, make the fastener heads finish below the surface and fill the hole for a smooth surface finish.

**Joints**

Make accurately fitted tight joints so that neither fasteners nor fixing devices such as pins, screws, adhesives and pressure indentations are visible on exposed surfaces.

**Operation**

Ensure moving parts operate freely and smoothly, without binding or sticking and are lubricated.

**Supply**

Deliver window hardware items, ready for installation, in individual complete sets for each window.

* In a separate dust and moisture proof package labelled for the specific window.
* Including the necessary templates, fixings and fixing instructions.

Refer to the drawings and **Window Construction, Louvre Construction** and **Security Grille Construction Schedules** for details of windows. Refer to the **Window Hardware Schedule** for details of window hardware.

# COMPETITION

**Cleaning**

The Contractor is to clean all frames, glass, hardware at completion. Any damage to frames, or broken glass is to be repaired or replaced to the satisfaction of the Engineer.

**Adjustment**

Leave the hardware properly adjusted with working parts in working order and lubricated where appropriate.

# DOORS AND DOOR HARDWARE

* 1. **GENERAL 24.1.1.INTERPRETATION**

**Definitions**

For the purposes of this work section the definitions given below apply.

* + Door frame: Includes door trims.
  + Door set: An assembly comprising a door or doors and supporting frame, guides and tracks including the hardware and accessories necessary for operation.

. Fire-door set: A door set which retains its strength and limits the spread of fire.

. Smoke-door set: A door set which restricts the movement of smoke.

* + Flush door: A door leaf having two flat faces which entirely cover and conceal its structure. It includes doors with cellular and particleboard cores.
  + Joinery door: A door leaf having stiles and rails, framed together. A joinery door may also incorporate glazed panels.

. Louvered door: A joinery door in which the panel spaces are filled in with louvre blades.

# 24.1.2.INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

* Door frames standing in place before building in to brickwork.
* Door frames installed before fixing trim.

-

# 24.1.3.SUBMISSIONS

**Samples**

Submit samples of all hardware items for approval by the Engineer before use in the works.

**Subcontractors**

Automatic sliding door assemblies: Submit names and contact details of proposed supplier and installer.

**Product warranties**

Automatic sliding door assemblies: Submit a warranty from the supplier and installer for the system and its installation, for a period of at least twelve months from the date of completion.

Hardware: Submit the warranties offered by the manufacturer for the hardware items provided in the works.

**Keys**

Key codes: Submit the lock manufacturer’s record of the key coding system showing each lock type, number and type of key supplied, key number for re-ordering, and name of supplier.

Keys: For locks keyed to differ and locks keyed alike, verify quantities against key records, and deliver all keys and records to the Engineer at completion.

# PRODUCTS 24.2.1.FRAMES

**Aluminium frames**

To be assembled from aluminium sections, including necessary accessories such as buffers, strike plates, fixing ties or brackets, and suitable for fixing specified hardware.

**Timber frames**

To be constructed with best quality timber. Obtain approval from the Engineer for the timber selection before use. Construct as shown on the drawings and ensure that all joints are securely made to avoid distortion of the frame in use.

**Steel frames**

To be folded from metallic-coated steel sheet sections, joints to be continuously welded, including necessary accessories such as buffers, strike plates, spreaders, fixing ties or brackets, and suitable for fixing specified hardware.

Finish: Grind the welds smooth, prepare and paint the welded joints with primer. Then prime the entire frame.

Hardware and accessories: Provide for fixing hardware including hinges and closers, using 4 mm back plates inside the frame. Screw fix the hinges into the back plates.

Base metal thickness:

* General: ≥ 1.1 mm.
* Fire rated door sets: ≥ 1.4 mm.
* Security door sets: ≥ 1.6 mm.

# 24.2.2.DOORS

**Flush doors**

Solid core PVC flush doors:

* 4mm Plain / Printed / Prelim PVC sheets are used on both sides of 20mm multichannel hollow PVC panel infill material to cover the panel.
* Reinforced with 19mm x 19mm MS tube welded frame with unmatched screw holding capacity, strength & dimensionally stability.
* Lightweight, & 100% environmental friendly.

Cellular core flush doors:

* Provide a sub frame of 25 mm minimum width timber around openings for louvres and glazing.
* Provide additional material to take hardware and fastenings.
* Cut outs: If openings are required in flush doors (e.g. for louvres or glazing) make the cut outs not closer than 120 mm to the edges of the doors.

Solid core flush doors:

* Core of timber strips laid edge to edge, fully glued to each other and to facings each side of no less than two sheets of timber veneer.
* Single thickness of moisture resistant general purpose particleboard. Refer to drawings and **Flush Doors Construction Schedule** for details. **Joinery doors**

Fabricate joinery doors as shown on the drawings and in the **Joinery Doors Construction Schedule**.

**Construction**

Form rebates to suit standard rebated door hardware.

Louvre grilles: Construct by inserting the louvre blades into a louvre frame, and fix the frame into the door.

**Double doors**

Provide rebated meeting stiles unless the doors open in both directions. Chamfer square edged doors to prevent binding between the leaves.

# 24.2.3.DOORSETS

**Automatic sliding door assemblies**

Provide auto sliding door assemblies in accordance with the **Automatic door schedule**.

**Toughened glass door assemblies**

Provide toughened glass door assemblies with matching concealed hinges and patch fittings as appropriate. Ensure that all glass edges are protected during installation and polish on completion.

**Fire-resistant door sets**

Provide fire resistant doors and frames as matched sets for door openings required to have a fire rating. Provide copies of test certificates from recognised authorities proving the performance of the door sets.

**Smoke-resistant door sets**

Provide smoke resistant doors and frames as matched sets for door openings required to have a smoke stopping capability.

Provide copies of test certificates from recognised authorities proving the performance of the door sets or seals to frames.

**Security screen door sets**

Provide security screen door sets in accordance with the **Security screen doors construction schedule**.

# ANCILLARY MATERIALS

**Nylon brush seals**

To be dense nylon bristles locked into galvanized steel strips and fixed in a groove in the edge of the door or in purpose-made anodised aluminium holders fixed to the door

**Pile weather strips**

To be polypropylene or equivalent pile and backing, low friction silicone treated, ultra-violet stabilised.

**Door Seals**

To be proprietary items as identified in Schedules and to approval of Engineer.

# 24.2.5.HINGES

**Butt hinge sizes**

Refer to **Hinge table A** and **Hinge table B** in which length (l) is the dimension along the knuckles, and width

(w) is the dimension across both hinge leaves when opened flat.

* + - * Steel, stainless steel, brass, bronze butt hinges for timber doors in timber or steel frames: To **Hinge table A**.
      * Aluminium hinges for aluminium doors, or for doors of other materials in aluminium frames: To **Hinge table B**.

**Hinge materials**

Aluminium hinges: High tensile aluminium with fixed stainless steel pins in nylon bushes, and with nylon washers to each knuckle joint.

Doors fitted with closers: Provide low friction bearing hinges.

**Hinge pins**

Exterior or security doors opening out: Provide fixed pin hinges.

**Hinge table A**

|  |  |  |  |
| --- | --- | --- | --- |
| **Nominal hinge size l x w x t (mm)** | **Door leaves not exceeding any of the following** | | |
| **Mass (kg)** | **Width (mm)** | **Thickness (mm)** |
| 70 x 50 x 1.6 | 16 | 620 | 30 |
| 85 x 60 x 1.6 | 20 | 820 | 35 |
| 100 x 75 x 1.6 | 30 | 920 | 40 |
| 100 x 75 x 2.5 | 50 | 920 | 50 |
| 100 x 75 x 3.2 | 70 | 1020 | 50 |
| 125 x 100 x 3.2 | 80 | 1220 | 50 |

**Hinge table B**

|  |  |  |  |
| --- | --- | --- | --- |
| **Nominal hinge size l x w x t (mm)** | **Door leaf not exceeding mass (kg)** | **Minimum construction** | |
| **Knuckles** | **Screws/hinge leaf** |
| 100 x 70 x 3 | 30 | 3 | 3 |
| 100 x 80 x 3.5 | 50 | 5 | 4 |

**Number of hinges**

Provide 3 hinges for doors up to 2200 mm high, and 4 for door leaves between 2200 mm and 3000 mm high.

**Wide throw**

If necessary, provide wide throw hinges to stop doors binding on obstacles such as nibs or deep reveals.

# DOOR HANGING SYSTEMS

**General**

Provide sliding door tracks in conformance with the schedules.

# LOCKS AND LATCHES

**General Door Hardware**

Provide hardware of sufficient strength and quality to perform its function, appropriate to the intended conditions of use and climate and fabricated with fixed parts firmly joined.

**Bolts**

Provide bolts including barrel bolts and tower bolts with associated hardware, including lock plates, ferrules or floor sockets.

**Furniture**

Provide lock and latch furniture suitable for use with the lock or latch to which it is installed with the corresponding level of performance.

**Strike plates**

Use strike plates provided with the locks or latches.

**Fire rated door closers**

Provide closers tested and certified for use as components of fire door assemblies.

**Door Controllers Performance**

Provide door controllers, including door closers, floor or head spring pivots which are suitable for the door type, size, weight and swings required and the operating conditions, including wind pressure.

# EXECUTION 24.3.1.FRAMES

**General**

Install doors so that the frames:

* + - * Are plumb, level and straight within acceptable building tolerances.
      * Are fixed or anchored to the building structure to resist the wind loading.
      * Will not carry any building loads, including loads caused by structural deflection.
      * Allow for thermal movement.

**Flashing and weathering**

Install moulds, sealant and cement pointing as required so that water is prevented from penetrating the building between the door frame and the building structure.

**Aluminium frames**

Building in to masonry: Screw galvanized steel brackets twice to jambs and build in.

Fixing to masonry openings: Use proprietary expansion anchors and screw through jambs at each fixing.

**Frame fixing**

Brackets: Metallic-coated steel:

* Width: 25 mm.
* Thickness: 1.5 mm.

Jamb fixing centres: 600 mm.

**Fixing and fasteners**

Materials: Use materials compatible with the item being fixed and of sufficient strength, size and quality to perform their function.

Concealed fixings: Provide a corrosion resistant finish.

Exposed fixings: Match exposed fixings to the material being fixed.

Support: Provide appropriate back support (for example blocking and backing plates) for hardware fixings. Packing: Pack behind fixing points with durable full width packing.

Prepared masonry openings: If fixing timber door frames into existing prepared openings with fastenings through the frame face, make the fastener heads finish below the surface and fill the hole for a smooth surface finish.

**Joints**

Make accurately fitted tight joints so that neither fasteners nor fixing devices such as pins, screws, adhesives and pressure indentations are visible on exposed surfaces.

**Operation**

Ensure moving parts operate freely and smoothly, without binding or sticking and are lubricated.

**Supply**

Deliver door hardware items, ready for installation, in individual complete sets for each door.

* In a separate dust and moisture proof package labelled for the specific door.
* Including the necessary templates, fixings and fixing instructions.

Refer to the drawings and **Flush Doors, Joinery Doors, Security Screen Doors, Fire and Smoke Resistant Dorset Schedules** and **Automatic Door Construction Schedules** for details of frames and doors.

# COMPLETION

**Cleaning**

The Contractor is to clean all frames, doors, glass, hardware at completion. Any damage to frames and doors, or broken glass is to be repaired or replaced to the satisfaction of the Engineer.

**Adjustment**

Leave the hardware properly adjusted with working parts in working order and lubricated where appropriate.

# GLAZING

* 1. **GENERAL 25.1.1.INSPECTION**

**Notice**

Inspection: Give sufficient notice so that inspection may be made of the following:

- Glass products before they are installed.

# PRODUCTS 25.2.1.GLASS

**Glass and glazing materials**

Glass and glazing materials generally: Free from defects which detract from appearance or interfere with performance under normal conditions of use.

Glazing plastics: Free from surface abrasions, and warranted by the manufacturer for 10 years against yellowing or other colour change, loss of strength and impact resistance, and general deterioration.

Refer to **Annealed glass, Processed glass** and **Fabricated glass schedules** for specific details for the works.

# 25.2.2.GLAZING MATERIALS

**General**

Glazing materials (including putty, glazing compounds, sealants, gaskets, glazing tapes, spacers, setting blocks): Appropriate for the conditions of application and the required performance.

# Single glazing

Single glazing shall be executed with glass of the various types described herein. Ordinary (non-safety) glass may be pre-cut or cut on site.

# Wired glass

Wired glass shall be cut so that the wires embedded are truly vertical and horizontal (i.e. at right angles to the cut edges).

# Laminated glass

Laminated glass shall be factory cut before delivery to site. Site cutting will not be permitted.

**Jointing materials**

Provide recommended jointing and pointing materials which are compatible with each other and with the contact surfaces and non staining to finished surfaces. Do not provide bituminous materials on absorbent surfaces.

**Pile weather strips**

Materials: Polypropylene or equivalent pile and backing, low friction silicone treated, ultra violet stabilised.

Finned type: A pile weather seal with a central polypropylene fin bonded into the centre of the backing rod and raised above the pile level.

**Extruded gaskets and seals**

Type: Non cellular (solid) seals to exclude water from glass/frame junctions. Material:

* Rubber products to be neoprene, ethylene propylene diene monomer (EPDM) or silicone rubber.
* Flexible polyvinyl chloride (PVC)

**Priming**

Apply the recommended primer to the surfaces in contact with sealant materials.

**Movement joints**

Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

Foamed materials (in compressible fillers and backing rods): Closed-cell or impregnated types which do not absorb water.

Bond breaking: Provide backing rods, and other back-up materials for sealants, which do not adhere to the sealant.

# 25.2.3.MIRRORS

**Reflective surface**

Type: Silver layer deposited on the glass or glazing plastic.

# 25.3. EXECUTION 25.3.1.GLASS PROCESSING

**General**

Perform required processes on glass, including cutting, obscuring, silvering and bending. Form necessary holes, including for fixings, equipment, access holes and speaking holes. Process exposed glass edges to a finish that will reduce the risk of injury.

# 25.3.2.INSTALLATION

**General**

Install the glass so that:

* Each piece is held firmly in place by permanent means which enable it to withstand the normal loadings and ambient conditions at its location without distortion or damage to glass and glazing materials.
* Building movements are not transferred to the glass.
* External glazing is watertight and airtight.

Toughened glass: Do not cut, work, or permanently mark after toughening. Use installation methods which prevent the glass making direct contact with metals or other non-resilient materials.

Frameless installations: Join the vertical edges of adjacent glass panels with silicone jointing compound. External timber framed glazing: Glaze with putty. Do not dry bead into timber frames.

# FIXING MIRRORS

**Screw fixing**

Direct to wall plugs with dome-headed chromium-plated screws in each corner and at 900 mm maximum centres around perimeter. Provide polyethylene sleeves and washers to prevent contact between screw and glass. Do not over-tension the screws.

**Frame fixing**

Proprietary aluminium frames to mirror perimeter, corners mitred. Attach the frame to the wall with concealed screw fixings. Frames and finish to approval of the Engineer.

**Bead fixing**

Rebated timber beads to mirror perimeter, corners mitred. Screw fix the beads to the substrate.

# GLAZEDSHOWER SCREENS

**Type**

Proprietary system comprising frames of extruded aluminium, stainless steel, or PVC, assembled around safety glass to form fixed panels and sliding, hinged or pivoted doors.

**Water shedding**

Provide an assembly which sheds water to the inside without retaining it on the frame surfaces. Seal the edge of the frame to adjoining surfaces with a resilient strip.

**Sliding assemblies**

Hanging: Hang the sliding sash on stainless steel or nylon sheaves on overhead channel track formed in the frame head, and fit nylon or equivalent bottom guides.

Hardware: Pull handles on both sides of sash, or of leading sash in multiple sash arrangements.

# 25.4. COMPLETION

**Cleaning**

Replace damaged glass and leave the work clean, polished, free from defects, and in good condition.

# GLASS BLOCKWORK

* 1. **GENERAL 26.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Frame and expansion jointing installed, before reinforcing.
  + Perimeter and vertical reinforcing installed, before placing mortar and blocks.

# 26.1.2.SUBMISSIONS

**Samples**

Glass blocks: Ssubmit 2 blocks of each type showing size, colour, design and pattern of faces. Accessories: Submit samples of reinforcing, fasteners, expansion materials and sealant.

# PRODUCTS 26.2.1.MORTAR-JOINTEDPANELS

**Perimeter**

Frames:

* + Size: 100 x 50 x 6 mm.
  + Material: Aluminium channel.
  + Fixing: 10 mm masonry anchors with galvanized washers.
  + Drainage: Drill holes in web of sill channel.

Expansion jointing and sill channel lining: 10 mm (minimum) x width of the channel rebate.

**Glass blocks**

Refer to **Glass block schedule** for block types.

**Mortar**

Cement: Slow setting Portland cement with low shrinkage.

Hydrated lime: calcium, or pressure-hydrated dolomitic lime if > 92% of active ingredients are hydrated.

Sand: Clean sharp river mineral sand, salt free, no admixtures, no iron compounds. Water: Clean, potable.

Mortar and pointing mix by volume (cement:lime:sand): 1:0.25:3. As dry as practicable. Pigments: Powder oxides.

- Colour: Refer to **Glass Block schedule**

Reinforcement: 4.5 – 6 mm diameter, in lengths to suit full width or height of panel, as appropriate.

# FIRE-RATED PANELS

**Perimeter**

Frames:

* + - * Size: 150 x 75 x 9 mm.
      * Material: Mild steel channel.
      * Fixing: 10 mm masonry anchors with heavy galvanized washers.
      * Drainage: Drill holes in web of sill channel.

Expansion jointing:

* + - * Type: Ceramic fibre blanket, 38 mm (minimum) x width of channel rebate.

Sill channel lining: Ceramic fibre board, 12 mm (minimum) x width of channel rebate.

**Glass blocks**

Refer to **Glass block schedule** for block types.

**Mortar**

Cement: Slow setting Portland cement with low shrinkage.

Sand: Clean sharp river mineral sand, salt free, no admixtures, no iron compounds. Water: Clean, potable.

Mortar and pointing mix by volume (cement:sand): 1:3. As dry as practicable.

* Compressive strength (minimum): 10 MPa at 2 days, 35 MPa at 28 days.

Pigments: Powder oxides.

* Colour: Refer to **Glass Block schedule**

Reinforcement: 6 mm diameter, in lengths to suit full width or height of panel, as appropriate.

**Finish**

Sealant: Fire resistant non-setting non-staining waterproof elastomeric sealant, hardening only at the surface.

# SEALANT-JOINTED PANELS

**Perimeter**

Frames: Proprietary extruded aluminium frame.

* + - * Fixing: 12 gauge 40 mm long stainless steel pan head screws, with nylon masonry plugs where appropriate.

**Glass blocks**

Refer to **Glass block schedule** for block types.

**Panels**

Reinforcement: 50 x 3 mm flat bars.

Block-locating clips: Proprietary plastic clips designed to clip on the reinforcement and fit the glass block edges.

**Finish**

Grouting sealant: Silicone.

- Colour: Refer to **Glass Block schedule**

-

# 26.3. EXECUTION

**Ambient conditions**

General: Do not install below 5C. Maintain panels above 5C for the first 48 hours after construction.

**Perimeter**

Frames: Erect 4-sided frame mitred at corners, spaced 5 mm clear of the structure on packing. Fixing: 400 mm centres. Centre hole on each side circular, other holes slotted longitudinally 50 mm.

* Packing: 75 x 75 x 2 mm zinc-plated steel.
* Sill channel: Lay sill channel lining in rebate.
* Jamb and head channels: Adhesive-fix expansion jointing in rebates.

**Panels**

Laying blocks: By hand, may be knocked into position using a rubber or soft nylon hammer. Align block patterns consistently. Prevent mortar extrusion under load while setting.

Bond: Stack bond. Reinforcement:

* Frame: Two rods all round, hooked and connected with wire at the corners. Horizontal rods to be a tie rod assembly, with 6 mm diameter tie rods at 200 mm centres, spacing the main rods 40 – 45 mm apart.
* Joint: Two rods in at least every second horizontal joint, and every tenth vertical joint. Overlap 230 mm (minimum) at corners. Do not tie vertical rods to horizontal rods. Do not impinge on expansion joints. Tie joint reinforcement to frame reinforcement.
* Cover (minimum): 15 mm to outside face, 10 mm to inside face, 5 mm to blocks.

Joints:

* Widths (clear): 10 – 15 mm. For curved walls, 5 – 20 mm for vertical joints.
* Width tolerance: 3 mm.
* Placing mortar: Do not retemper mortar. Do not furrow joints. Fill channel frame and panel joints.
* Pointing: Point before mortar has hardened. Neatly tool to a smooth, dense concave joint. Remove excess mortar from glass surfaces using a damp cloth before mortar set occurs, without damaging the glass. Protect against premature drying, but do not moisten.

-

# SEALANT-JOINTED PANELS

**Perimeter**

Frames:

* + - * Assembly: Mitre frame at corners. Assemble with connection angles and cleats, drill, and fix frame to angles with blind rivets.
      * Fixing jamb frames: Position screws to clear the ends of the reinforcing bars. Fix screws with neoprene washers and through the packing, at 400 mm (maximum) centres, and pairs 100 mm from ends.
      * Fixing sill frame: Fix screws with neoprene washers and through the packing, at 800 mm (maximum) centres, and 100 mm from ends.
      * Packing: Locate to square the frame, maximum 10 mm, to sill and jamb frames only.

**Panels**

Laying blocks: Select and orient glass blocks to ensure consistent coursing dimensions. Lightly clean edges with steel wool.

Block-locating clips: Locate onto sill frame profile 20 mm from each corner and centred at every perpend, ribbed side up. Insert in perpends, including at jamb frames, centred at course centre line. Clip onto reinforcing bars 20 mm from the ends and centred at every perpend, ribbed side up. Insert above top course 20 mm from each corner and centred at every perpend.

Bond: Stack bond.

Joint reinforcement: Joint: Run reinforcement horizontally, and slot into the jamb frame channels on top of the glass block courses, except the top course, finishing 3 mm short of the jamb frame rebate faces.

Joints:

- Widths: 3 – 4 mm.

**Finish**

Jointing: Clean and dry substrates. Execute work neatly, without gaps and holes. Inject structural sealant into blockwork joints to a depth of 5 – 8 mm.

Grouting: Clean and dry substrates. Execute work neatly, without gaps and holes. Apply grouting sealant to mitred frame corner joints, and apply to blockwork joints, including at the perimeter frame, to both panel faces. Remove excess sealant from glass at completion, without damaging the glass.

# 26.4. MAINTENANCE

**Mortar-jointed and fire-rated panels**

Final clean: Wash using clean water. Remove dry powder using a clean soft dry cloth.

# INSULATION AND VAPOUR BARRIERS

* 1. **GENERAL 27.1.1.INTERPRETATION**

**Definitions**

General: For the purposes of this work section the definitions given below apply.

* + - Sarking-type material: Flexible reflective foil membrane material normally used for waterproofing, vapour proofing or thermal reflectance.
    - Mineral wool (including glass wool and Rockwool): Entangled mat of fibrous non-crystalline material derived from inorganic oxides or minerals, rock, slag or glass, processed at high temperatures from a molten state.
    - Vapour barrier: A material or system that adequately impedes the transmission of water vapour.

-

# 27.1.2.INSPECTION.

**Notice**

Give sufficient notice so that inspection may be made of the insulation to roof space in areas which will be covered up or concealed.

# PRODUCTS

**27.2.1.MATERIALS AND COMPONENTS**

**Bulk insulation**

Mineral wool blankets and cut pieces: Provided in bulk rolls for laying over roof structures or on roof slabs and batts to suit ceiling member spacing.

Polystyrene (extruded rigid cellular sheets): Provided in modular panels for fixing to walls and roof slabs.

Reflective insulation: Provided in bulk foil rolls for laying over roof structures and foil batts to suit ceiling member spacing.

**Sarking-type material**

Sarking: Reflective foil fixed as a membrane to reduce liquid water transfer in walls or roof structures but allow water vapour to move through the building envelope.

Vapour barrier: Reflective foil sealed as a membrane to stop all liquid water and water vapour transfer.

**Fasteners and supports**

Metallic-coated steel.

# 27.3. EXECUTION 27.3.1.GENERAL

**Bulk insulation**

Batts: Fit tightly between framing members. If support is not otherwise provided, fix over wire mesh stapled to the framing and stretch tight.

**Reflective foil laminate**

To timber: Metallic-coated flat head nails or staples at 300 mm maximum centres. To steel or aluminium: Double sided pressure sensitive tape.

Overlap (minimum): 150 mm and adhesive fix.

**Roof sarking locations**

Location: Provide sarking under metal sheet roofs. Fix over timber supports and run rolls across roof plane. Overlap each layer of foil so that any water will run down the slope and discharge into the gutter without dripping into the roof space.

# ROOF INSULATION

**General**

Location: The whole of the ceiling area, except the following:

* + - * Eaves, overhangs, roof lights, vents and openings.
      * Roofs to outbuildings, garages, and semi-enclosed spaces such as verandas, porches.

**Installation**

Refer to the drawings and **Insulation Schedule** for details of insulation requirements for the works.

# LINING

* 1. **GENERAL 28.1.1.INSPECTION**

**Notice**

Inspection: Give sufficient notice so that inspection may be made of the wall face or framing before installation of linings.

# 28.1.2.SUBMISSIONS

**Samples**

Plasterboard: Ssubmit two 300x300mm samples of each type.

Fibre cement sheet: Ssubmit two 300x300mm samples of each type. Accessories: Submit samples of accessories, fasteners, trims and cornices.

# 28.1.3.TOLERANCES

**Surface**

Flatness, twist and bow: ≤ 3.0 mm deviation from a 1.5 m straightedge placed in any position.

# PRODUCTS 28.2.1.MATERIALSAND COMPONENTS

**Plasterboard**

Plasterboard sheet lining to be best quality imported sheet material, size, type and thickness in accordance with the Project Schedule, to the approval of the Engineer.

**Fibre cement**

Fibre cement sheet lining to be best quality imported sheet material, size, type and thickness in accordance with the Project Schedule, to the approval of the Engineer.

**Fasteners**

Steel nails: Hot dip galvanized.

Screws: Coated steel cross head screws.

**Adhesives**

For plasterboard: Epoxy grout adhesive as supplied by the plasterboard sheet manufacturers. For cement sheet: Mastic adhesive.

**Sealants**

Fire rated sealant: Non-hardening sealant compatible with the materials to be sealed and having a fire rating equal to that of the partition it seals.

Acoustic sealant: Non-hardening sealant compatible with the materials to be sealed and having a specific gravity of not less than 1.5 gm/cubic centimetre and of 100% polyurethane mastic.

# EXECUTION 28.3.1.CONSTRUCTION GENERALLY

**Conditions**

Do not commence lining work until such time as the building or zone in question is enclosed and weathertight and all wet trades have been completed.

**Substrates or framing**

Before fixing linings check and, if necessary, adjust the alignment of wall faces or framing. Make good any damaged areas that may affect the fixing of the lining. Ensure that there are no projections from the face of the wall structure that may affect the installation of the lining material.

**Ceiling linings**

Do not install ceilings until at least 14 days after the timber roof structure is fully loaded where this is used for support of the ceiling.

**Accessories and trim**

Provide accessories and trim necessary to complete the installation.

**Adhesives**

Provide adhesives of types appropriate to their purpose, and apply them so that they transmit the loads imposed, without causing discolouration of finished surfaces.

# PLASTERBOARD LINING

**Supports**

Install timber battens or galvanized steel channels as follows:

* + - * Where framing member spacing exceeds the recommended spacing.
      * Where direct fixing of the plasterboard is not possible due to the arrangement or alignment of the framing or wall face.

**Installation**

Gypsum plasterboard: Install strictly in accordance with manufacturers recommendations. Framed construction: Screw or nail or combine with adhesive.

Masonry construction: Fix using adhesive direct to masonry.

Suspended ceilings: Fix using screw or screw and adhesive to ceiling members.

To steel channels: Fix using screw or screw and adhesive.

**Multiple sheet layers**

Application: Fire rated and acoustic rated walls.

Joints: Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before commencing succeeding layers. Stagger all sheet joints by minimum 200 mm.

**Joints**

Flush joints: Provide recessed edge sheets and finish flush using perforated paper reinforcing tape. Butt joints: Make joints over framing members or otherwise provide back blocking.

External corner joints: Make joints over metallic-coated steel corner beads.

Control joints: Install purpose-made metallic-coated control joint beads at not more than 12 m centres in walls and ceilings and to coincide with structural movement joints.

# FIBRECEMENT LINING

**Supports**

Install timber battens or galvanized steel channels as follows:

* + - * Where framing member spacing exceeds the recommended spacing.
      * Where direct fixing of the fibre cement is not possible due to the arrangement or alignment of the framing or substrate.

**Installation**

Run sheets across the framing members. In flush jointed applications, stagger end joints in a brick pattern and locate them on framing members, away from the corners of large openings. Provide supports at edges and joints.

Timber framed construction: Nail only or combined with adhesive. Steel framed construction: Screw only or combined with adhesive. Masonry construction: Fix using adhesive direct to masonry.

Suspended flush ceilings: Fix using screw or screw and adhesive to ceiling members or support frame. Ceilings and soffits: Provide battens where fixing to underside of rafters, roof trusses and purlins.

**Multiple sheet layers**

Application: Fire rated and acoustic rated walls.

Joints: Fill and flush up all joints and fixings in each layer and caulk up perimeters and penetrations before commencing succeeding layers. Stagger all sheet joints by minimum 200 mm.

**Joints**

Flush joints: Provide recessed edge sheets and finish flush using perforated paper reinforcing tape.

* Movement joints in walls: Position a stud parallel to the joint on each side.
* Movement joints in ceilings and soffits: Provide movement joints to divide ceilings into bays not larger than

10.8 x 7.2 m and soffit linings into bays not larger than 4.2 x 4.2 m or 5.4 x 3.6 m. Provide framing parallel to the joint on each side. Do not fix the lining to abutting building surfaces.

External corner joints: Make joints over metallic-coated steel corner beads.

Control joints: Provide purpose-made metallic-coated control joint beads at ≤ 7.2 m centres in walls and ceilings and to coincide with structural movement joints.

# CEILING ACCESS

**General**

Location: Provide personnel access ways to each separate ceiling space. Size (mm): Minimum of 600 x 600 mm

Material: Match adjacent ceiling lining.

Type: Plain cover supported on all sides by timber trim fixed to underside of ceiling.

# 28.3.5.CORNICES

**General**

Plasterboard cornice: Install plasterboard trims to the junctions between wall surfaces and ceilings as shown on the drawings.

Timber cornices: Install timber trims to the junctions between wall surfaces and ceilings as shown on the drawings.

# 28.4. COMPLETION

**General**

Ensure that all surfaces are protected, dry and free from damage until paint finishes are to be applied. All plasterboard and fibre cement surfaces must dry for at least 7 days before painting is to commence.

# PARTITIONS – SYSTEMS

* 1. **GENERAL 29.1.1.INTERPRETATION**

**Definitions**

For the purposes of this work section the definitions given below apply.

* + - Partition – fully demountable: A partition system in which any component may be demounted without damage, using only small hand tools, and subsequently reassembled without cutting, trimming or refinishing.
    - Partition – semi demountable: A partition system in which the major components are designed to be removed and reused but panels or linings, which are likely to be damaged during removal, are not.
    - Partition – non demountable: A partition system in which major components, such as panels or linings, are likely to be damaged during removal and may require cutting, trimming or structural repair before reuse.
    - Cool room panel system: A partition system fabricated to suit specific thermal conditions in which the insulated panels are designed to be removed and reused but panels or trims are likely to be damaged during removal.

# 29.1.2.INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following stages:

- Installation of framing / fixings before they are enclosed.

# 29.1.3.SUBMISSIONS

**Samples**

Submit samples as follows:

* A sample, at least 300 x 300mm, of each panel type.
* Floor and ceiling fixings and adjustments.
* Samples at least 100 mm long of each structural section, including posts, sills, transoms, door frames, ceiling channels and metal channel headrails, and each moulding, cover strip and bead.
* Skirting, skirting duct, skirting duct stop ends, returns and removable covers.

# 29.1.4.TOLERANCES

**General**

Deviation (from true grid lines and planes): up to 3 mm maximum in a 1500mm length. Misalignment (of adjoining surfaces at grid junctions): 3 mm maximum.

Flatness, twist and bow: Maximum 3 mm deviation from a 1500mm straightedge placed in any position.

# PRODUCTS 29.2.1.PARTITIONS

**General**

Provide proprietary non-load-bearing partition wall framing and lining comprising cold formed steel or extruded aluminium members, or both, in conformance with the **Partition construction schedule**.

**Building movements**

Provide clearances or movement joints so that partitions are not damaged by structural building movements such as long term slab deflection. Where fire resistance or acoustic properties are specified provide a resilient foam or mastic seal having properties equal to those required for the partition.

**Control joints**

General: Provide for control joints in sheet finishes where required by the structural frame.

# EXECUTION 29.3.1.PREPARATION

**General**

Prepare the base to receive the partitions. Ensure that all surfaces are flat without lumps or hollows that could affect the performance of the partition system.

**Set out**

Set out the partitions so that the partition grid, as expressed in panel joints and centrelines of frame members, coincides with the ceiling grid and the building grid, if applicable.

# 29.3.2.ERECTION

**Partition erection**

Install the partitions so they:

* Are plumb, level, on their correct alignments, and firmly fixed.
* Have adequate top support by fixing the top plate to the ceiling structure or slab soffit, or are stabilised by lapping and fastening intersecting or butting plates together.
* Have bottom plates fixed at 600 mm maximum centres generally, and 100 mm maximum from ends.

Install cool room panel systems to manufacturer’s recommendations and standard details where feasible. Ensure that all seal strips, cover strips, accessories, fixings needed to satisfactorily carry out the installation are provided and installed to the approval of the Engineer.

**Fixing**

Conceal fixings. For demountable items provide fixings capable of being repeatedly removed and replaced without damage to finishes.

Fixing to masonry: Provide masonry anchors of expansion or chemical grout type. Do not provide explosive- driven fastenings.

Fixing to suspended ceilings: Provide adequate top support to the partition without damage to the ceiling components.

**Protection**

Protect existing work from damage during the installation and make good any damage. Provide temporary coverings if necessary.

**Sound properties**

Preserve the sound reduction properties of partitions by sealing flanking sound transmission paths during installation, including junctions between partitions and other building surfaces, air gaps around door sets, recesses, such as pelmets and blind boxes and cut-outs for services. Avoid cut-outs next to or back-to-back with each other.

Sealing methods: Use appropriate sealing methods, such as durable resilient gaskets or closed cell foam strips. Provide solid resilient materials in preference to foamed materials whenever possible.

**Support**

Provide additional support in the form of framing for fixing hardware, fixtures and fittings.

# 29.3.3.SERVICES

**Services access**

Conceal associated building services, either within cavities in the partition structure, or within ducted skirtings supplied as part of the partition system, or both. Provide removable or demountable components of the partition system, for access to services concealed within partition cavities.

# ROOM DIVIDERS

* 1. **GENERAL 30.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Overhead tracks installed before dividers/door panels are hung and ceiling installed.

# 30.1.2.SUBMISSIONS

**Samples**

Submit 2 samples of each of the following where applicable:

* Sections proposed to be used for frames, louvres and slats.
* Colour range samples of facings and prefinished production material.
* Manufacturer’s standard door furniture items.

# 30.1.3.TOLERANCES

**Tolerances**

Deviation (from true grid lines and planes): up to 3 mm maximum in a 1500mm length. Misalignment (of adjoining surfaces at grid junctions): 3 mm maximum.

Flatness, twist and bow: Maximum 3 mm deviation from a 1500mm straightedge placed in any position.

# EXECUTION 30.2.1.COMPLETION

**Maintenance manual**

Submit manufacturer’s published recommendations for service use.

**Cleaning**

Temporary coating: On or before completion of the works, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

# 30.2.2.SELECTIONS

Refer to the **Folding Doors, accordion doors and operable walls Schedules** for details of room dividers for the works.

# SUSPENDED CEILINGS

* 1. **GENERAL 31.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the framing preparation ands tout of suspended ceilings before installation of panels.

**11 SUBMISSIONS Samples**

Submit samples as follows:

* + Ceiling material: Sheet, panel, tile, with insulation
  + Methods: Methods of jointing, fixing, height adjustment.
  + Suspension: Sections proposed for suspension system, including wall angles and trim.

# PRODUCTS 31.2.1.LININGS

**Fibrous plaster tiles**

Best quality imported fibrous plaster tiles with hard cast plaster face for decorative ceiling sections.

**Plasterboard panels**

Best quality imported glass fibre reinforced gypsum plasterboard panels or tiles. Refer to the **Suspended ceiling construction schedule**.

**Suspension system**

Refer to the **Suspended ceiling construction schedule**.

# EXECUTION 31.3.1.INSTALLATION

**Ceiling grid**

Set out the ceiling grid so that panel joints and centrelines of visible suspension members coincide with grid lines shown on the drawings. If not otherwise shown, set out so that opposite margins are equal.

Pattern and texture: Set out patterned or heavily textured materials to give consistency in direction of pattern or texture.

Special sized panels: Provide special sized purpose-made panels to fill non-standard margins, openings and penetrations.

**Cut tile edges**

General: Conceal, or finish to match prefinished edges.

**Lighting**

Fit lights within the ceiling grid system to ensure that distortion, overloading or excessive vertical deflection is prevented. Support lights on the ceiling primary grid members.

**Proprietary systems**

Provide suspended ceilings as complete proprietary systems, each fabricated by one manufacturer and installed by a specialist installer of demonstrated capacity.

**Protection**

Protect existing work from damage during the installation.

**Stability**

Install the ceilings level; and fix so that under normal conditions there is no looseness or rattling of ceiling components.

# 31.3.2.SUPPORTS

**Bracing**

General: Provide bracing to prevent lateral movement and to resist any imposed horizontal seismic force.

**External suspended ceilings**

Support external suspended ceilings on rigid members capable of carrying the imposed loads. Install members to minimise any eccentricity, and ensure that the upward and downward wind loads are carried through to the supporting structure.

**Movement joints**

Install the ceiling with control joints to correspond in location and direction to those in the structural frame.

**Finishes**

Repair damaged finishes by replacement or refinishing of the item. All repairs are to be completed so no sign of the damage is visible in the completed work.

**Support members**

Grid members: If required, notch grid members at the junction with the perimeter trim to ensure the panels lie flat on the perimeter trim.

Services: Do not suspend from services (e.g. pipework or ductwork) unless the service has been designed to accept the ceiling load. In locations where services obstruct the ceiling supports, provide bridging and suspension on each side of the services.

Spacing: Space the support members as required by the loads on the system and the type of ceiling, and allow for the installation of services and accessories, including ductwork, light fittings and diffusers. Provide additional support or suspension members for the fixing of such items.

**Suspension system**

Height adjustment: Provide height adjustment by means of a length adjustment device at each suspension point, permitting length variation of at least 50 mm.

# 31.3.3.PANELS

**General**

Fitting: Fit panels accurately and neatly, free from air leakage and staining.

Panel lock clips: If panels are exposed to wind loads or if required for security, insert locking clips at the junction of rails and panels.

**Accessories and trim**

Provide accessories and trim necessary to complete the installation.

Plasterboard trim: Provide purpose-made corner beads, casing beads and stop beads.

Metal Trim: Provide trims at junctions with other building elements and surfaces, such as walls, beams and penetrations, consistent with the style, materials and finishes of the ceiling system generally.

**Service penetrations**

Provide openings for, and fit the ceiling system up to, all services elements such as light fittings, ventilation outlets, detectors, sprinklers and loudspeakers.

# 31.3.4.ACCESSS PANELS

**Finish**

Match the ceiling panels in appearance and performance and mark the panel for easy identification.

# 31.4. COMPLETION

**Spares**

Supply spare matching tiles and accessories of each type for future replacement purposes. Store the spare materials on site where directed.

# JOINERY

* 1. **GENERAL 32.1.1.TOLERANCES**

**Responsibilities**

Fabricate and install joinery items. Items to be undamaged, plumb, level, straight and free of distortion and to the **Tolerances table**.

**Tolerances table**

|  |  |
| --- | --- |
| **Property** | **Tolerance criteria** |
| Plumb and level | 2 mm in 800 mm |
| Offsets in flush adjoining surfaces | < 1 mm |
| Alignment of adjoining doors | < 1.5 mm |

# 32.1.2.INSPECTION

**Notice**

Give sufficient notice so that inspection may be made of the following:

* Shop fabricated or assembled items ready for delivery to the site.
* Site erected assemblies on completion of erection.

# 32.1.3.SUBMISSIONS

**Samples**

Submit samples to the **Sample table** for approval by the Engineer.

# Sample table

|  |  |
| --- | --- |
| **Description** | **No. of samples** |
| Each type of board to be used complete with finish and edge stripping | 2 |
| Typical item of hardware indicating each finish | 2 |
| Stone benchtop indicating range of colours | 2 |
| Timber balustrade section | 1 |
| The finish to all stainless steel items | 2 |
| Complete timber bench cupboard door, including hardware | 1 |
| Complete drawer front, including hardware | 1 |

* 1. **PRODUCTS**
     1. **JOINERY MATERIALS AND COMPONENTS**

**Joinery timber**

Best quality Russian joinery timber to approval of the Engineer.

**Plywood**

Best quality imported plywood to approval of the Engineer.

**Decorative overlays**

Timber veneer or laminate to approval of the Engineer. Thickness (minimum):

* For horizontal surfaces fixed to a continuous background: 1.2 mm minimum.
* For vertical surfaces fixed to a continuous background: 0.8 mm.
* For edge strips: 0.8 mm.

**Stone facings**

Provide stone slabs to benchtops within the visual range of the approved samples.

**Timber veneers**

Provide veneers falling within the visual range of the approved samples.

# JOINERY ITEMS

**General**

Provide materials noted on drawings as follows:

* + - * Joinery components and their location, indicative construction details, trims, materials, dimensions and thicknesses, and finishes shall be as detailed.
      * All dimensions noted on drawings shall be confirmed on site before construction of the joinery.
      * Finishes selections and hardware are noted in the **Joinery Fixtures schedule**.

# KITCHEN ASSEMBLIES

**Plinths**

Material: Construct from exterior grade general purpose plywood unless already in place as a concrete plinth.

Thickness: 16 mm.

Fabrication: Form up with front and back members and full height cross members at not more than 900 mm centres.

Finish: Decorative laminated sheet or ceramic/ stone tile finish.

Installation: Fix to floor and secure to wall to provide level platform for carcasses.

**Carcasses**

Material: Select from the following:

* Melamine overlaid high moisture resistant particleboard.
* Approved solid timber sections.

Thickness: 16 mm minimum.

Joints: Select from the following:

* Proprietary mechanical connections.
* Screws and glue.

Shelves: Support on battens or fix directly into grooves in side walls of joinery units. Finish: Decorative laminated sheet or solid timber finish.

Fasteners: Conceal with finish.

Installation: Secure to walls at not more than 600 mm centres.

**Drawer fronts and doors**

Material: Refer to the drawings for specific details of joinery or select from the following:

* Melamine overlaid high moisture resistant particleboard.
* Approved solid timber sections with or without inset glass panels.
* Metal grille or sheet metal panels fixed over timber frames

Thickness: 16 mm minimum.

Maximum door size: 2400 mm high, 900 mm wide, 1.5 m2 on face. Finish: Decorative laminated sheet, solid timber finish or paint.

**Drawer backs, sides and bottoms**

Material: Select from the following:

* Melamine overlaid high moisture resistant particleboard.
* Approved solid timber sections.

Thickness: 12 mm minimum.

Finish: Decorative laminated sheet or solid timber finish.

**Laminated benchtops**

Material: High moisture resistant particleboard. Benchtop thickness: 33 mm.

Finish: Decorative laminated sheet.

Exposed edges: Extend laminate over shaped nosing, finishing > 50 mm back on underside or provide solid timber edge trim.

Installation: Fix to carcass at least twice per 600 mm length of benchtop.

Joint sealing: Clamp with proprietary mechanical connectors to ensure high quality connection between benchtop sections. Ensure joints in benchtops are clear of sinks to avoid water damage to joint.

**Stone or concrete benchtops**

Material:

* Thickness is to be minimum of 40mm unless noted otherwise on the drawings.
* Concrete benchtops may have a polished finish or be covered with ceramic tiles.

**Splashback:**

Material is identical to benchtop unless noted otherwise in **Fixtures Schedule**.

* Thickness is to be 16mm for high moisture resistant particleboard with laminate finish.
* Thickness is to be 20mm minimum for stone.
* Thickness is to be 40mm minimum for concrete. Alternatively use ceramic tile splashback for concrete benchtops.
* Waterproof silicone sealant is to be used as a continuous seal between the benchtop and splashback.

**Drawer and door hardware**

Hinges, drawer runners, door handles and locks are to be to the approval of the Engineer.

# TIMBER BALUSTRADES

Provide materials for the approval of the Engineer before installation. Ensure all dimensions are checked on site before construction starts. Refer to BOQ and drawings for extent of work.

# 32.3. EXECUTION 32.3.1.JOINERY

**General**

Joints: Provide materials in single lengths whenever possible. If joints are necessary make them over supports.

Framing: Frame and trim where necessary for openings, including those required by other trades.

**Accessories and trim**

Provide accessories and trim necessary to complete the installation.

**Fasteners**

Visibility: Do not provide visible fixings except in the following locations:

* Inside cupboards and drawer units.
* Inside open units.

Visible fixings: Where fastenings are unavoidable on visible joinery faces, sink the heads below the surface and fill the sinking flush with a material compatible with the surface finish. In surfaces which are to have clear or tinted timber finish provide matching wood plugs showing face (not end) grain. In surfaces which are to have laminate finish provide proprietary screws and caps finished to match.

Fixings: Screws with washers into timber or steel framing, or masonry anchors to brickwork.

**Adhesives**

Provide adhesives to transmit the loads imposed and to ensure the rigidity of the assembly, without causing discolouration of finished surfaces.

**Finishing**

Edge strips: Finish exposed edges of sheets with edge strips which match sheet faces or use solid timber trims as noted on the drawings.

Matching: For surfaces which are to have clear or tinted finish, arrange adjacent timber pieces to match the grain and colour.

Hygiene requirements: To all food handling areas and voids at the backs of units to all areas, seal all carcass junctions with walls and floors, and to cable entries, with silicone sealant for vermin proofing. Apply water resistant sealants around all plumbing fixtures and ensure the sealants are fit for purpose.

# DELIVERY AND STORAGE

**General**

Deliver joinery units to site in unbroken wrapping or containers so that its moisture content is not adversely affected. Do not store in areas of wet plaster. Keep storage to a minimum by delivering items only when required for installation.

Examine joinery units for completeness and repair defects before installing in place.

**Background**

Clean all background surfaces that will be permanently concealed behind joinery before installing in place.

# TIMBER BALUSTRADES

**General**

Provide a balustrade to the stair and landing, consisting of posts, handrail, infill panels, and associated mouldings as noted in the BOQ and drawings.

# 32.4. COMPLETION

**Cleaning**

Temporary coatings: On or before completion of the works, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

General: Remove all dust, marks and rubbish from all surfaces and internal spaces. Clean and polish all surfaces such as solid timber, anodised or painted metals, glass, stone, concrete, ceramic tiles and laminates.

Refer to the **Joinery Fixtures Schedule** for locations, type and finishes of joinery items.

# METALWORK

* 1. **GENERAL 33.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Shop fabricated or assembled items ready for delivery to the site.
  + Site erected assemblies on completion of erection.

# 33.1.2.SUBMISSIONS

**Samples**

Submit samples to the **Sample table** for approval by the Engineer.

# Sample table

|  |  |
| --- | --- |
| **Description** | **No. of samples** |
| Each type of metal item to be purchased | 2 |
| Typical joints of welded or fabricated items | 2 |
| Finished sample of each type of painted or anodised metalwork indicating range within colour specified and finish | 2 |
| The finish to all stainless steel items | 2 |

Manufacturer’s data: Submit manufacturer’s published product data and details for purchased items.

Stainless steel: For each batch of stainless steel supplied to the works, submit the certificate of compliance specified for the applicable standard.

# PRODUCTS

**33.2.1.MATERIALS AND COMPONENTS**

**Metals**

Performance: Provide metals suited to their required function, finish and method of fabrication, in sections of strength and stiffness adequate for their purpose.

**Rivets**

Use blind rivets where available in the required metal.

**Masonry anchors**

Proprietary types comprising screws or bolts in self-expanding sockets.

**Masonry plugs**

Screws in purpose-made resilient plastic sockets or fixed to timber plugs built into the wall surface.

# 33.3. EXECUTION 33.3.1.CONSTRUCTION GENERALLY

**Metals**

Provide metals so that they transmit the loads imposed and ensure the rigidity of the assembly without causing deflection or distortion of finished surfaces.

**Fasteners**

Materials: Provide fasteners in materials of mechanical strength and corrosion resistance at least equal to that of the lowest resistant metal joined.

To copper and copper alloys: Provide copper or copper-alloy fixing devices only.

To aluminium and aluminium alloys: Provide aluminium alloy or stainless steel fixing devices only. To stainless steel: Provide appropriate stainless steel materials only.

**Fabrication**

Workshop: Fabricate and pre-assemble items in the workshop wherever practicable.

Edges and surfaces: Keep clean, neat and free from burrs and indentations. Remove sharp edges without excessive radiusing.

Tube bends: Form bends in tube without visibly deforming the cross section. Colour finished work: Match colours of sheets, extrusions and heads of fasteners. Thermal movement: Accommodate thermal movement in joints and fastenings.

**Fabrication tolerances**

Structural work generally: 2 mm from design dimensions.

**Joints**

Fit joints to an accuracy appropriate to the class of work. Finish visible joints made by welding, brazing or soldering using grinding, buffing or other methods appropriate to the class of work, before further treatment.

Self-finished metals: Free of surface colour variations, after jointing. Joints: Fit accurately to a hairline where feasible.

**Marking**

Provide suitable and sufficient marks or other means for identifying each member of site-erected assemblies, and for their correct setting out, location, erection and connection.

**Splicing**

Provide structural members in single lengths where possible. Obtain approval of the Engineer for locations of joints where splices in metalwork cannot be avoided.

# WELDING AND BRAZING

**General**

Quality: Provide finished welds which are free of surface and internal cracks, slag inclusion, and porosity.

**Brazing**

General: Ensure brazed joints have sufficient lap to provide a mechanically sound joint. Do not used butt joints relying on the filler metal fillet only.

# STAINLESS STEEL FABRICATION

**Welding stainless steel**

All tube, angle or thick plate material is to be welded unless noted otherwise on the drawings. Ensure that welds do not discolour the final surface finish in the welding process.

**Riveting**

Riveting may be used only to join stainless steel sheet or strip less than 1 mm thick. Drill (not punch) the rivet hole, and drive the rivet cold. On completion, clean and passivate the riveted assembly.

**Soldering**

Do not solder stainless steel.

# METAL FIXTURES

**General**

Provide metal fixtures where noted on drawings and in the **Metal Fixtures Schedule** as follows:

* + - * Components such as toilet roll holders, towel rails, soap dishes and their location, indicative construction details, trims, materials, dimensions and thicknesses, and finishes shall be as detailed or described in the schedule.
      * All dimensions noted on drawings shall be confirmed on site.

# PIPE HANDRAILS, STAIRS,LADDERS AND BALUSTRADES

**Assembly**

Material: Refer to drawings and BOQ for details of member sizes and assembly of components.

**Fabrication**

Method: Welding.

Joints: Produce smooth unbroken surfaces at joints. Make end-to-end joints over an internal sleeve. Bends: Make changes of direction in rails by evenly curved pipe bends.

Free ends: Seal the free ends of pipes with fabricated or purpose-made end caps.

**Fixing to structure**

Provide fabricated predrilled or purpose-made brackets or post bases, and attach the pipework to the building structure with fixings, including bolts into masonry anchors, and coach screws or bolts into timber, of metal compatible with the pipework.

**Galvanizing**

If possible, complete fabrication before galvanizing; otherwise apply a zinc-rich primer to affected joint surfaces.

**Painting**

If possible, complete fabrication before painting; otherwise apply paint to affected joint surfaces after fixing on site. Make good all damaged painted surfaces before completion of the building works.

# CORNER GUARDS AND VEHICLE GUARDS

**Corner Guards**

Where corners of the structure are required to be protected from mechanical damage, provide metal corner guards as follows and as identified on the drawings or in the BOQ:

* + - * Consisting of angle sections or sections fabricated from metal sheet bent to the radius or angle of the corner.
      * Fitting close to adjoining surface finishes.
      * Solidly grouted up at the back to eliminate voids.
      * Securely fixed by a method which does not cause distortion in the guard surface, and consists of either concealed built in lugs, or flush countersunk head fixings into masonry anchors.
      * Paint finish in accordance with the **Finishes Schedule**. **Vehicle Guards**

Where external features such as lamp posts, fire hose reels or pedestrian walkways are required to be

protected from vehicle damage, provide metal guards as follows and as identified on the drawings and in the BOQ:

* + - * Consisting of steel pipe posts set in deep concrete pads with welded end caps or bent to form a rail and two posts.
      * Steel barrier rails securely bolted to the posts.
      * Heavy duty protection posts will be large diameter steel pipe posts filled with concrete.
      * Paint finish in accordance with the **Finishes Schedule**.

# WATER STORAGE TANKS AND STANDS

**Water Tanks**

Fabricate metal water storage tanks to sizes shown on drawings and as identified in the BOQ. Allow for all reinforcement of tank walls, floors, and around fixtures projecting from the tank.

Bolt together prefabricated plastic or metal water storage tanks to sizes shown on drawings and as identified in the BOQ.

Fabricate metal tank stands for the water storage tanks as identified on the drawings and in the BOQ. Refer to the **Metal Fixtures Schedule** for details.

# 33.4. COMPLETION

**Maintenance manual**

General: Submit manufacturer’s published recommendations for service use.

**Cleaning**

Temporary coatings: On or before completion of the works, or before joining up to other surfaces, remove all traces of temporary coatings used as a means of protection.

# STAINLESS STEEL BENCHING

* 1. **GENERAL 34.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the units when fabrication is complete, before delivery.

# 34.1.2.SUBMISSIONS

**Samples**

Submit samples to the **Sample table** for approval by the Engineer.

# Sample table

|  |  |
| --- | --- |
| **Description** | **No. of samples** |
| Typical joints of welded or fabricated items | 2 |
| The finish to all stainless steel items | 2 |

Stainless steel: For each batch of stainless steel supplied to the works, submit the certificate of compliance specified for the applicable standard.

**Site welding**

General: If site welding is proposed, submit details indicating location and process.

# PRODUCTS 34.2.1.MATERIALS

**Stainless steel**

Plate, sheet, strip, bar and pipe: To ASTM standards. Type: 304.

**Stainless steel sheet**

Surface finish: Fine brushed finish not including to underside of shelves, and door backs and drawer backs. Thickness: 1.2 mm minimum.

**Particleboard**

Use moisture resistant particleboard minimum thickness 12mm to splashback and 25mm to benchtop as substrate for support of flat sheet.

**Plywood**

Use external grade structural plywood minimum thickness 12mm to splashback and 25mm to benchtop as substrate for support of flat sheet.

# 34.2.2.COMPONENTS

**Fasteners**

Material: Stainless steel. Dimensional system: Metric.

Bolt and screw heads: Polished, pan type or countersunk.

**Hardware**

Material: Stainless steel.

Handles: Stainless steel unless noted otherwise.

**Sealants**

Type: Neutral cure one-part silicone.

Performance: Flexible. Resistant to growth of mould, bacteria and fungi. Colourfast.

**Adhesive**

Type: Spray contact adhesive.

# EXECUTION 34.3.1.FABRICATION GENERALLY

**Stainless steel welding**

Process: Gas tungsten arc welding. Weld type: Butt.

Surface finish: Grade I, 120 grit.

Welding materials: Compatible with metal being welded.

Weld quality: Free from imperfections such as cracks and pits. Grind and polish to give required surface finish. Continuous exposed welds.

Joints: Strength at least that of parent metal. Free from crevices and folds.

Joint position: At corners and edges as far as possible. Minimise joints in flat panels.

**Protection**

Provide temporary self-adhesive plastic film to stainless steel surfaces.

**Hardware fixing**

Drill and tap, or weld fix.

**Linishing grain direction**

Benches and shelves: Lengthwise.

Bowls: Horizontal to sides, parallel to bench grain to bottom. Mitre at bottom corners. Abutting surfaces: Parallel where possible.

# BENCH TOPS FABRICATION

**Bench tops**

Material: Stainless steel sheet. Thickness: 2 mm.

Refer to drawings for details of bench construction and nominal overall sizes. Confirm all dimensions on site before fabricating bench units.

Exposed corners: Radius exposed corners at least 5 mm, including back vertical corners of upstands. Internal back vertical corners: Fuse only from behind.

Wet bench perimeter: Except at wall flashing, provide a raised bead, with a fascia. Dry bench perimeter: Except at wall flashing, provide a fascia.

**Fascia**

Fascia height: 30mm unless noted otherwise.

Fascia return: Full depth of bench top unless noted otherwise.

**Drainer**

Drainer falls to sinks: 1:50, 450 mm long. Drainer surface: Plain.

**Wall splashback**

Type: Integral.

Height above bench: 300mm unless noted otherwise. Ends: Return for full width of bench top.

**Fixing to support frame**

Type: Screw fix benchtop to support frame through welded lugs on front and back frames at 600mm centres into plywood or particleboard substrate. Provide star washers under screw heads.

If no substrate is used, weld benchtop to frame on welded lugs on front and back frames at maximum 300mm centres.

# BOWL FABRICATION

**Bowls**

Type: Deep drawn stainless steel. Thickness:

* + - * Capacity < 75 L: 1.6 mm.
      * Capacity 75 L: 2 mm.

Internal radii: 25 mm minimum.

Minimum depth: 250 mm. Wastes:

* + - * Size (minimum): 50mm diameter.
      * Position: Centred in single bowls, adjacent in double bowls.
      * Plug: Heavy-duty commercial.

Fall to waste (minimum):

* + - * Capacity < 75 L: 10 mm.
      * Capacity 75 L: 25 mm.

# FRAME FABRICATION

**Bench top support frame**

Support: Provide sufficient support so that no load is placed on the waste pipe or water connections.

* + - * Design deflection (maximum): 3 mm.

Members: 31.8 x 31.8 x 1.6 mm stainless steel pipe. Seal ends.

Extent: Perimeter and at sides of bowls, with additional members spaced as follows:

* + - * 1.6 mm sheet: 350 mm maximum centres.
      * 2 mm sheet: 500 mm maximum centres.

Maximum unsupported area: 0.3 m2.

If 25mm plywood or particleboard substrate is used, the benchtop can be supported on front and back rails only, with additional members at 1200mm maximum centres.

Connections: Welded.

**Bench legs**

Members: 31.8 x 31.8 x 1.6 mm stainless steel pipe. Seal ends. Fixing to bench top support frame: Weld all around at junctions. Spacing: 1200 mm maximum.

Fixing to walls: Predrilled 100 x 50 x 2 mm stainless steel plate welded to legs at 600 mm high.

Feet: Nylon or chrome-plated aluminium, adjustable vertically ± 25 mm. Threaded section must not protrude from leg.

# SHELVING FABRICATION

**Under bench shelving**

Material: Stainless steel. Thickness: 1.6 mm.

Shelf support: 30 x 30 x 5 mm stainless steel angles.

- Extent: Perimeter, with additional angles spaced to give a maximum unsupported area of 0.3 m2.

Connections: Welded.

Fixing of support to legs: Welded.

If 25mm plywood or particleboard substrate is used, the shelf can be supported on front and back rails only, with additional members at 1200mm maximum centres.

Fixing of shelf to support: as for benchtop support.

**Over bench shelving**

Material: Stainless steel. Thickness: 1.6 mm.

Shelf support: 25.4 x 25.4 x 1.6 mm stainless steel pipe brackets minimum 300mm high above the shelf level. Seal ends.

* Spacing: 900 mm maximum with 25mm substrate or shelf fabricated with 30 x 30 x 5 mm stainless steel angles, 600mm with 12mm substrate.
* Fixing to wall: Two 50 x 50 x 5 mm stainless steel plates, fixed with at least two M8 bolts. Weld to top and bottom of the support brackets.

Fixing of shelf to support: Screw fix minimum of 3 times through tube into side of shelf or shelf angles. Seal between shelf and support.

# DRAWERS FABRICATIONS

**Drawers**

Material: Stainless steel. Thickness: 1.2 mm.

Construction: Welded.

Frames: Removable, and interchangeable with other drawer frames. Provide extension-type drawer slide mechanism and front panel. Provide rubber stops at rear.

Front panel: 20 mm thick double pan construction. Housing: Back and 2 sides, of a neat external appearance.

Runners: Incline to rear so drawers roll closed. Provide stop so drawer cannot be pulled out accidentally. Locks: Chrome-plated brass.

# INSTALLATION GENERALLY

**Welding**

Preference should be given to any other fixing method other than site welding. Obtain approval from the Engineer for any proposed site welding.

**Sealing**

Gaps < 5 mm wide: Apply sealant at the following locations:

* Butt joints between benches.
* Between benches, including flashings, and walls.
* Spaces and gaps under benches.

Gaps 5 mm wide: Close with stainless steel infill panels.

**Floor fixing**

8 mm diameter stainless steel dowels, sealed to floor with silicone sealant.

# 34.4. COMPLETION

**Protection**

General: Temporary self-adhesive plastic film: Remove from stainless steel surfaces.

# FIRE EXTINGUISHERS AND BLANKETS

**35.1. GENERAL 35.1.1.SAMPLES**

**General**

Provide samples of all fire extinguishers proposed for use in the project for approval of the Engineer.

# 35.1.2.AUTHORISED PRODUCTS

**General**

Provide equipment from Certified manufacturers only. Provide copies of the test certificates if requested by the Engineer.

# 35.2. PRODUCTS 35.2.1.EXTINGUISHERS

**Extinguisher type and location**

Provide portable fire extinguisher types and matching signs to the locations identified in the **Fire Extinguisher Schedule**.

# 35.2.2.BLANKETS

**Fire blanket type and location**

Provide fire blanket types and matching signs to the locations identified in the **Fire Blanket Schedule**.

# WINDOW COVERINGS

* 1. **GENERAL 36.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the building locations and surfaces prepared to receive window coverings before installation.

# 36.1.2.SUBMISSIONS

**Samples**

Submit 2 samples of each of the following where applicable, for approval by the Engineer:

* Sections proposed to be used for frames, louvres and slats.
* Finishes to prepared surfaces with trims.
* Colour range samples of fabrics, facings and production material.
* Manufacturer’s standard control system furniture items.

# PRODUCTS 36.2.1.MATERIALS

**Fire hazard**

Do not provide materials which, when subject to fire conditions, will emit excessive smoke or dangerous fumes.

# 36.2.2.INTERNAL

**Curtains and fabric shades**

Install curtains or shades to locations identified on drawings or in BOQ. Check all dimensions on site before fabricating track and making curtains. Refer to **Curtain Schedule**.

**Aluminium Venetian blinds**

Install aluminium blinds to locations identified on drawings or in BOQ. Check all dimensions on site before fabricating track and making blinds. Refer to **Aluminium Venetian Blind Schedule**.

Slat material: High tensile aluminium alloy. Thickness: 0.175 mm.

Cord: 1.5 mm thick polyester with braided jacket and safety tassel, and ladders for location and control. Top and bottom rails: 0.5 mm aluminium zinc coated steel powder coat finish.

**Plastic Venetian blinds**

Install plastic blinds to locations identified on drawings or in BOQ. Check all dimensions on site before fabricating track and making blinds. Refer to **Plastic Venetian Blind Schedule**.

Slat material: Extruded polystyrene. Thickness: 3 mm nominal.

Slat width: 50 mm nominal.

Cord: Internal 2.3 mm thick polyester.

Tape: To allow a 42 mm pitch between ladders and a 8 mm slat overlap.

Top and bottom rails: 0.5 mm aluminium zinc coated steel powder coat finish.

**Timber Venetian blinds**

Install timber blinds to locations identified on drawings or in BOQ. Check all dimensions on site before fabricating track and making blinds. Refer to **Timber Venetian Blind Schedule**.

Slat material: Approved timber Thickness: 5 mm nominal.

Slat width: 50 mm nominal.

Cord: Internal 2.3 mm thick polyester.

Tape: To allow a 42 mm pitch between ladders and a 8 mm slat overlap.

Top and bottom rails: 0.5 mm aluminium zinc coated steel powder coat finish.

**Vertical louvre blinds**

Install vertical blinds to locations identified on drawings or in BOQ. Check all dimensions on site before fabricating track and making blinds. Refer to **Vertical Louvre Blind Schedule**.

Type: Louvres supported by a carrier system which traverses on wheels and operates with a friction spring loaded clutch mechanism.

Louvre blades: Heavy duty fabric or vinyl coated fabric blades in single, straight lengths finishing 10 mm above floor or sill level, without twists, warp, bows, edge ripples or fraying. Fix a weight into a pocket formed in the bottom of each blade.

Spacing: Space the blades evenly with plastic spacers which lock into the carrier rail to provide a continuous linkage, and fix with sealed plastic slat holders carried by plastic rotation pivots. Connect the bottoms of the blades by a plastic link chain with reversers.

Tracks: Fabricated to suit size of blades for width of window or within a pelmet extending past the face of the window.

Operation: Dual continuous loop chains controlling the functions of tilting and drawing.

# EXECUTION

* + 1. **INSTALLATION**

**General**

Fixing: Secure the tracks with ceiling clamps or wall mounted brackets so that there are no fixings through the track.

# COMPLETION

**Maintenance manual**

Submit the manufacturers’ data as follows:

* Recommendations for service use, care and maintenance.
* List of manufacturers and suppliers of replacement parts. Tile type: e.g. Stone type or product identifier.

Rely on approved samples for general quality compliance.

-

# PLASTERING

* 1. **GENERAL 37.1.1.INTERPRETATION**

**Abbreviations**

For the purpose to this work section the abbreviations given below apply.

* + CRF: Cement render – finish.
  + CRM: Cement render – medium.
  + CRS: Cement render – stronger.
  + CRW: Cement render – weaker.
  + LF: Lime felting render- weaker.
  + GPF: Gypsum plaster – finish.

# 37.1.2.INSPECTION

**Notice**

Give sufficient notice so inspection may be made of the following:

* Backgrounds immediately before applying base coats.
* Finish treatments before decoration.

# PRODUCTS

**37.2.1.MATERIALS AND COMPONENTS**

**Accessories**

Beads: To be metal proprietary sections manufactured to be fixed to backgrounds and/or embedded in the plaster to form and protect plaster edges and junctions.

**Aggregates**

Sand: To be fine, sharp, well-graded sand with a low clay content and free from efflorescing salts.

**Bonding products**

To be proprietary products manufactured for bonding cement-based plaster to solid backgrounds.

**Cement**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

**Colouring products**

To be proprietary products manufactured for colouring cement plaster. Integral pigment proportion: 5% by mass of cement.

**Curing products**

To be proprietary products manufactured for use with the plaster system.

**Gypsum plaster**

To be a proprietary product containing calcium sulphate hemihydrate with additives to modify setting.

**Lime**

Confirm source of Lime with Engineer to ensure highest quality Lime is used in the mortar. Protect from damage on site and store minimum 300mm above ground in waterproof storage facility.

Preparing lime putty:

* Using hydrated lime: Add lime to water in a clean container and stir to a thick creamy consistency. Leave undisturbed for at least 16 hours. Remove excess water and protect from drying out.
* Using quicklime: Run to putty as soon as possible after receipt of quicklime. Partly fill clean container with water, add lime to half the height of the water, then stir and hoe ensuring that no lime remains exposed above the water. Continue stirring and hoeing for at least 5 minutes after all reaction has ceased, then sieve into a maturing bin. Leave undisturbed for at least 14 days. Protect from drying out.

**Mixes**

Select a mix ratio to suit the application in conformity to the **Mixes table**.

Measurement: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Plaster mixing: Machine mix for greater than 3 minutes and less than 6 minutes.

Strength of successive coats: Ensure successive coats are no richer in binder than the coat to which they are applied.

**Mixes table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mix type** | | **Application** | **Upper and lower limits of proportions by volume** | | | |
| **Gypsum** | **Cement** | **Lime** | **Sand** |
| Cement render coats | CRS | Dense and smooth concrete | - | 1 | 0 | 3 |
| in: | and masonry | - | 1 | 0.5 | 4.5 |
| •Single or multi-coat | Thrown finishing treatments |
| systems with integral | Tiled finishes |
| finishing treatments | Gypsum finishes |
| •Base coats in multi- | Cement finishes |
| coat systems with | CRM | Clay or concrete masonry | - | 1 | 0.5 | 4.5 |
| cement or gypsum |
| - | 1 | 6 |
| finishes |
| CRW | Lightweight concrete | - | 1 |  | 6 |
| masonry and other weak | - | 1 | 9 |
| backgrounds |
| Cement finish coats | CRF | Cement render base coats | - | 1 | 1 | 1.5 |
| - | 1 | 2 |
| Lime felting finish coats | LF | Cement render base coats |  |  | 1 | 3 |
| Gypsum finish coats | GPF | Cement render base coats | 3  1 | -  - | 1  1 | - 1 |

**Movement control joint products**

To be proprietary products manufactured for use with the plastering system and to accommodate the anticipated movement of the backgrounds and/or the plaster.

**Water**

To be clean and free from any deleterious matter.

Refer to the **Plastering Construction Schedule** for details of plastering and locations.

# 37.3. EXECUTION 37.3.1.PREPARATION

**Substrates**

Ensure substrates have:

* Any deposit or finish which may impair adhesion of plaster cleaned off.
* If solid or continuous, excessive projections hacked off and voids and hollows filled with plaster stronger than the first coat and not weaker than the background.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not plaster backgrounds showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scratching or hacking to remove 2 mm of the surface and expose the aggregate then apply a bonding treatment.

Painted surfaces: Remove paint and hack the surface at close intervals.

Untrue substrates: If the substrate is not sufficiently true to ensure conformity with the thickness limits for the plaster system or has excessively uneven suction resulting from variations in the composition of the background, apply additional coats.

**Beads**

Location: Fix beads as follows:

* Angle beads: At all external corners.
* Drip beads: At all lower terminations of external plaster.
* Mechanical fixing to background: at 300 mm centres.
* Movement control beads: At all movement control joints.
* Stop beads: At all terminations of plaster and junctions with other materials or plaster systems.

**Bonding treatment**

If bonding treatment is required, throw a wet mix onto the background as follows:

* Cement plaster: 1 part cement to 2 parts sand.
* Gypsum plaster: 1 part gypsum to 2 parts sand.

Curing: Keep continuously moist for 5 days and allow to dry before applying plaster coats. Thickness: From greater than 3mm but less than 6 mm.

**Embedded items**

If there are water pipes and other embedded items, sheath them to permit thermal movement. Ensure embedded items will have a suitable level of corrosion resistance prior to embedment**.**

# 37.3.2.APPLICATION

**Plastering**

General: Provide plaster finishes as follows:

* Resistant to impacts expected in use.
* Free of irregularities.
* Consistent in texture and finish.
* Firmly bonded to substrates for the expected life of the application.
* As a suitable substrate for the nominated final finish.

Base coats: Scratch-comb each base coat in two directions when it has stiffened.

**Finishing treatments**

Plain:

* Bag: To be a finish mainly free from sand by rubbing the finish coat with a Hessian pad when it has set firm.
* Carborundum stone: To be a smooth finish free from sand by, rubbing the finish coat with a fine carborundum stone when it has set hard.
* Steel trowel: To be a smooth dense surface by steel trowelling which is not glass-like and is free from shrinkage cracks and crazing.
* Wood or plastic float: To be an even surface by wood or plastic floating the finish coat on application.

**Incidental work**

Return plaster into reveals, beads, sills, recesses and niches. Plaster faces, ends, and soffits of projections in the background, such as string courses, sills, and other wall features. Trim around openings. Plaster exposed inside of built-in cupboards.

**Joining up**

If joining up is required, ensure joints will not be visible in the finished work after decoration.

**Movement control joints**

Provide movement control joints in the finish to coincide with movement joints in the background. Ensure that the joint in the background is not bridged during plastering.

* Depth: Extend the joint right through the plaster and reinforcement to the background.
* Width: 3 mm, or the same width as the background joint, whichever is greater.

Damp-proof courses: Do not continue plaster across damp-proof courses.

V-joints: Provide V-joints, cut right through the plaster to the background, at the following locations:

* Abutments with metal door frames.
* Abutments with other finishes.
* Junctions between different backgrounds.

**Plaster thickness**

Conform to the **Plaster thickness table**.

**Plaster thickness table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Plaster** | **Application** | **Upper limit of thickness (mm)** | | | |
| **Single coat systems** | **Multi-coat systems** | | |
| **Base coat(s)** | **Finish coat** | **System** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Plaster** | **Application** | **Upper limit of thickness (mm)** | | | |
| **Single coat systems** | **Multi-coat systems** | | |
| **Base coat(s)** | **Finish coat** | **System** |
| Cement render base coats and cement or  gypsum finish coats | On smooth dense concrete | 12 | 10 | 4 | 13 |
| On clay and concrete brickwork and other backgrounds | 15 | 13 | 4 | 16 |

**Temperature**

If the ambient temperature is less than 10ºC or more than 30ºC ensure that the temperature of mixes, backgrounds and reinforcement are, at the time of application, greater than 5ºC or less than 35ºC.

# 37.3.3.TOLERANCES

**General**

Conform to the **Tolerances table**.

**Tolerances table**

|  |  |
| --- | --- |
| **Property** | **Tolerance criteria: Permitted deviation (mm)** |
| Features1: Verticality in 2000 mm | 3 |
| Features: Horizontality in 2000 mm | 3 |
| Soffits: Horizontality in 2000 mm | 5 |
| Walls: Verticality in 2000 mm | 5 |
| Walls: Flatness2 in 2000 mm | 4 |
| 1 Features: Conspicuous horizontal or vertical lines including external corners, parapets, reveals, heads, sills, movement control joints and mouldings. | |
| 2 Flatness: Measured under a straightedge laid in any direction on a plane surface. | |

**12 COMPLETION Curing**

General: Prevent premature or uneven drying out and protect from the sun and wind.

Keeping moist: If a proprietary curing agent is not used, keep the plaster moist as follows:

* Base coats and single coat systems: Keep continuously moist for 2 days and allow to dry for 5 days before applying further plaster coats.
* Finish coats*:* Keep continuously moist for 2 days.

-

# CEMENTITIOUS TOPPINGS

* 1. **GENERAL 38.1.1.INTERPRETATIONS**

**Abbreviations**

For the purposes of this work section the abbreviations given below apply.

* + - BCS: Bonded – cement and sand.
    - BFC: Bonded – fine concrete.
    - FFC: Floating – fine concrete.
    - MGR: Monolithic – granolithic.
    - SFC: Separated – fine concrete.

# 38.1.2.TOLERANCES

**General**

Thickness:

* Thickness < 15 mm: ± 2 mm.
* Thickness ≥ 15 < 30 mm: ± 5 mm.
* Thickness ≥ 30 mm: ± 10 mm.

Flatness: Measured under a 3000 mm straightedge laid in any direction on a plane surface:

* Grade A: < 3 mm.
* Grade B: ≥ 3 < 5 mm.
* Grade C: ≥ 5 < 10 mm.

-

# PRODUCTS

**Admixtures**

Introduce in solution in a portion of the mixing water. Ensure a uniform distribution of the admixture in the batch within the mixing period.

**Aggregates**

Coarse aggregate: To be nominal single size.

Fine aggregate: To be fine, sharp, well-graded sand with a low clay content and free from efflorescing salts.

**Bonding products**

To be proprietary products manufactured for bonding cement-based toppings to concrete backgrounds.

**Cement**

Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

**Colouring products**

To be proprietary products manufactured for colouring cement toppings. Integral pigment proportion: 5% by mass of cement.

**Coloured chips**

To be marble chips of selected colour or proprietary products manufactured for distribution in cement toppings.

**Concrete**

On site batch mixed concrete shall have characteristics and proportions of concrete ingredients which conform to those specified in M-150 (1:2:4).

**Curing products**

To be proprietary products manufactured for use with cement-based toppings and with the floor finish to be laid on the toppings.

**Mixes**

Provide concrete as follows or select mix proportions to the **Mixes table**.

* Air entrainment: ≤ 3%.
* Nominal coarse aggregate size: ≤ 0.3 x topping thickness.
* Slump: 80 mm.

Water quantity: Use the minimum necessary to achieve full compaction and prevent excessive water being brought to the surface during compaction.

**Mixes table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mix type** | | **Thickness (mm)** | **Upper and lower limits of proportion by mass (mm)** | | |
| **Cement** | **Fine aggregate** | **Coarse aggregate** |
| Bonded – cement and sand | BCS | 35 | 1 | 3 | 0 |
| 1 | 4.5 | 0 |
| Bonded – fine concrete | BFC | 40 | 1 | 3 | 1 |
| 1 | 3 | 2 |
| Floating – fine concrete | FFC | 100 | 1 | 3 | 1 |
| 1 | 3 | 2 |
| Monolithic – granolithic | MGR | Floors and treads: 25 Risers and skirtings: 13 | 1 | 2 | 1 |
| Separated – fine concrete | SFC | 70 | 1 | 3 | 1 |
| 1 | 3 | 2 |

**Movement control joint products**

Provide products manufactured for use with cement based toppings and accommodate the anticipated movement of the backgrounds and/or the toppings.

**Sealing products**

Provide proprietary products manufactured for the sealing of movement joints in cement-based toppings.

**Slip-resistance products**

Provide proprietary products manufactured to improve the wet-slip resistance of toppings.

- Silicon carbide granules:

. Granule size: 300 < 600 µm.

. Colour: Black.

**Surface treatment products**

Provide proprietary products manufactured for use with cement- based toppings to change the characteristics of the surface of the finished topping.

**Reinforcement**

All reinforcing shall be supported and wired together to prevent displacement by construction loads, or the placing of concrete, beyond the tolerances specified in ACI 301. Any tack or spot welding of reinforcement shall not be performed without approval from the Engineer.

Reinforcement shall be free of loose rust and of any other coating which may adversely affect the bond.

**Water**

General: To be clean and free from any deleterious matter.

Refer to the **Cementitious Toppings Construction Schedule** for details of toppings and locations.

# EXECUTION 38.3.1.PREPARATION

**Backgrounds**

Ensure backgrounds have:

* + - Any deposit which may impair adhesion of monolithic or bonded toppings cleaned off.
    - Excessive projections hacked off and voids and hollows filled with a mix not stronger than the background nor weaker than the topping.
    - Hardened concrete roughened by scratching or hacking to remove 2 mm of the surface and expose the aggregate.

**Bonded toppings**

Before laying topping wash the subfloor with water and use a bonding product or treat as follows:

* + - Keep wet for ≥ 2 hours.
    - Remove surplus water and brush on neat cement or a clean slurry of cement and water.
    - Place the topping while the slurry is wet.

# 38.3.2.APPLICATION

**Laying**

Spread the mix and compact and level the surface to finished levels.

Monolithic toppings: Lay while concrete subfloor is plastic and surface water is no longer visible. Toppings over 50 mm thick:

* Lay in two layers of equal thickness.
* Place a layer of reinforcement between the layers of toppings. Lap reinforcement 100 mm and tie. Do not create four way laps.

**Floating and trowelling**

Machine float finish:

* After levelling, consolidate the surface using a machine float.
* Cut and fill and refloat immediately to a uniform, smooth, granular texture.
* Hand float in locations inaccessible to the machine float.

Flatness: Grade B.

Steel trowel finish: After machine floating finish as follows:

* When the surface has hardened sufficiently, use steel hand trowels to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Flatness: Grade A.

Wood float finish: After machine floating finish as follows:

* Use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Flatness: Grade A.

**Floor finish dividers**

Finish cementitious toppings at junctions with differing floor finishes with a corrosion resistant metal dividing strip suitable fixed to the background, with top edge flush to the finished floor. If changes of floor finish occur at doorways make the junction directly below the closed door.

**Monolithic toppings**

Coved skirtings: Form coves in the topping material, and finish the top to a neatly struck line. Mitre internal and external angles.10 mm radius to top of skirting. 25mm radius to junction between floor and skirting.

**Movement control joints**

Provide movement control joints to divide toppings into bays as follows

* Form in situ using square edge steel forms and trowelling a 3 mm radius to edges.
* Form a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a pre moulded strip.
* Install a movement control joint product.

Bay sizes:

- Area: ≤ 15 m2.

* Length to width ratio: ≤ 1:1.5.

Joints in background: Provide movement control joints in toppings to coincide with joints in the background.

**Slip-resistance treatment**

Stair treads: Form two grooves and fill with a silicon carbide two-part resin.

* Dimensions: 10 mm deep, 15 mm wide, length width of tread less 100 mm.
* Position:

. First groove: Centre 35 mm from tread nose.

. Second groove: Centre 60 mm from step nose.

Plane surfaces: Apply silicon carbide granules after floating and before the topping surface has set, and trowel into the surface so that the granules remain exposed.

- Application rate: 1 kg/m2 evenly distributed.

**Surface colouring**

Apply the colouring product or coloured marble chips after floating and before the topping surface has set and trowel into the surface so that it is even in colour distribution.

**Temperature**

If the ambient temperature is less than 10ºC or more than 30ºC ensure that the temperature of mixes, backgrounds and reinforcement are, at the time of application, greater than 5ºC or less than 35ºC.

# COMPLETION

**Curing**

General: Prevent premature or uneven drying out and protect from the sun and wind.

Curing: Use a curing product or, as soon as it has set sufficiently, keep the toppings moist by covering with polyethylene film for seven days.

# TILING

* 1. **GENERAL 39.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Floor preparation and set out of floor tiles before fixing.
  + Wall preparation and set out of wall tiles before fixing.
  + Control joints before sealing and grouting.

# 39.1.2.SUBMISSIONS

**Samples**

Submit labelled samples of tiles, including fittings, accessories, grout and sealants, illustrating the range of variation in colour and finish.

# 39.1.3.INTERPRETATIONS

**Definitions**

For the purposes of this work section the definitions given below apply.

* Substrates: The surfaces on which tiles are bedded.
* Bedding: Mixtures of materials which are applied to substrates in a plastic state and dry and cure to adhere tiles to substrates.

. Adhesive bedding: Tiling adhered by adhesives.

. Mortar bedding: Tiling adhered in a cementitious mortar bed.

* Pavers: Slabs made from clays, stone, precast concrete and/or other inorganic raw materials generally over 20 mm thick used as coverings for floors and supported over continuous substrates.
* Tiles: Thin slabs made from clays and/or other inorganic raw materials used generally as coverings for floors and walls and adhered to continuous supporting substrates.

. Natural stone: Tiles cut from natural stone.

. Industrial cast: Tile products of reconstituted stone. Also known as manufactured stone.

. Cementitious: Manufactured cement based pre-finished tiles.

. Terrazzo – cementitious: Manufactured cementitious terrazzo tiles formed in a suitable machine to give sufficient compaction and density to the finished surface, and moisture cured before grinding and honed at the place of manufacture. Thickness usually 35 mm.

- Wet areas: Areas within buildings with water supply and drainage systems.

# 39.1.4.TOLERANCES

**Completed tiling**

Conform to the **Tolerances table**.

**Tolerances table**

|  |  |
| --- | --- |
| **Property** | **Tolerance criteria** |
| Alignment: Deviation of the finished tiles from a 3 m straight edge laid against any joints | < 4 mm |
| Flatness: Deviation of any plane surface under a 3 m straight edge laid in any direction on an area of uniform grade | < 4 mm |

# PRODUCTS

**39.2.1.TILES AND ACCESSORIES**

**Tiles**

Coves, nosing’s and skirtings: To be matching stop-end and internal and external angle tiles moulded for that purpose.

Exposed edges: To be purpose-made border tiles with the exposed edge glazed to match the tile face. If such tiles are not available, round edge with grout.

# 39.2.2.ADHESIVES

**Type**

General: Provide adhesives to the **Wall tiling schedule** and to the **Floor tiling schedule** and compatible with the materials and surfaces to be adhered.

Prohibited uses: Do not provide the following combinations:

* Cement-based adhesives on wood, metal, painted or glazed surfaces, gypsum-based plaster.
* Organic solvent-based adhesives on painted surfaces.
* Organic PVC-based adhesives and organic natural rubber latex adhesives in damp or wet conditions.
* PVA (polyvinyl acetate) based adhesives in wet areas or externally.

# 39.2.3.MORTAR

**Materials**

Cement: Cement shall conform to the requirements of ASTM specification C-150 Type 1 or similar approved standard for normal Portland cement.

* White cement: Iron salts content 1%.
* Off-white cement: Iron salts content 2.5%.

Lime: Confirm source of Lime with Engineer to ensure highest quality Lime is used in the mortar. Protect from damage on site and store minimum 300mm above ground in waterproof storage facility.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

**Bedding mortar**

Proportioning: Select proportions from the range 1:3 – 1:4 cement: sand to obtain satisfactory adhesion. Provide minimum water.

Terra cotta tiles: Use proprietary polymer modified mortar.

**Water**

General: To be clean and free from any deleterious matter.

# 39.2.4.GROUT

**Type**

Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints.

Terra cotta tiles: Use proprietary polymer modified grout.

Portland cement based grout: Mix with fine sand. Provide minimum water consistent with workability.

* For joints < 3 mm: 1 cement:2 sand.
* For joints 3 mm: 1 cement:3 sand.

**Pigments**

Pigments for coloured grout: Provide colourfast fillers compatible with the grout material. For cement-based grouts, provide lime-proof natural or synthetic metallic oxides compatible with cement.

# 39.3. EXECUTION

Provide tiling systems to walls, floors and other substrates as follows:

* Consistent in colour and finish.
* Firmly bonded to substrates for the expected life of the installation.
* Resistant to expected impacts in use.
* Set out with joints accurately aligned in both directions and wall tiling joints level and plumb.
* To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

# 39.3.1.SUBSTRATES

**Drying and shrinkage**

Before tiling, allow at least the following times to elapse (for initial drying out and shrinkage) for these substrates:

* Concrete slabs: 42 days.
* Concrete blockwork: 28 days.
* Toppings on slabs and rendering on blockwork: A further 21 days.

# 39.3.2.PREPARATION

**Ambient temperature**

If the ambient temperature is less than 5 or more than 35°C, do not lay tiles.

**Substrates**

Ensure substrates are as follows:

* Clean and free of any deposit or finish which may impair adhesion or location of tiles.
* If solid or continuous, excessive projections are hacked off and voids and hollows are filled with cement: sand mix not stronger than the substrate or weaker than the bedding.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scratching or hacking to remove 3 mm of the surface and expose the aggregate; then apply a bonding treatment.

# TILING GENERALLY

**Sequence**

General: Fix wall tiles before floor tiles.

**Cutting and laying**

Cutting: Cut tiles neatly to fit around fixtures and fittings, and at margins where necessary. Drill holes without damaging tile faces. Rub edges smooth without chipping.

Laying: Return tiles into sills and openings. Butt up to returns, frames, fittings, and other finishes.

**Variations**

Distribute variations in hue, colour, or pattern uniformly, by mixing tiles or tile batches before laying.

**Protection**

Floor tiles: Keep traffic off floor tiles until the bedding has set and attained its working strength. Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

# SETTING OUT

**Tile joints**

Set out tiles to give uniform joint widths within the following limits:

* + - * Ceramic floor tiles: 4 to 6 mm.
      * Quarry floor tiles: 6 to 12 mm.
      * Terrazzo and stone pavers to floor: 2 to 3 mm.
      * Large and/or irregular floor tiles: 6 to 12 mm.
      * Mounted mosaics: To match mounting pattern.
      * Ceramic wall tiles: 3 to 5 mm.
      * Terrazzo and stone wall panels: 2 to 3 mm.

**Margins**

Provide whole or purpose-made tiles at margins where practicable, otherwise set out to give equal margins of cut tiles. If margins less than half tile width are unavoidable, locate the cut tiles where they are least conspicuous.

**Fixtures**

If possible position tiles so that holes for fixtures and other penetrations occur at the intersection of horizontal and vertical joints or on the centre lines of tiles. Continue tiling fully behind fixtures which are not built in to the tiling surface. Before tiling ensure that fixtures interrupting the tile surfaces are accurately positioned in their designed or optimum locations relative to the tile layout.

# FALLS AND LEVELS

**Grading**

Grade floor tiling to even and correct falls to floor wastes and elsewhere as required. Make level junctions with walls. Where falls are not required lay level.

Fall, general: 1:100 minimum.

Fall, in shower areas: 1:60 minimum.

# 39.3.6.BEDDING

**Preparation of tiles**

Adhesive bedding: Fix tiles dry; do not soak.

Mortar bedding: Soak porous tiles in water for half an hour and then drain until the surface water has disappeared.

Terra cotta tiles: Use pre sealed tiles or apply a breathable sealer and lay dry. If a final sealed finish is selected, use a compatible laying sealer.

**Bedding**

Use bedding methods and materials which are appropriate to the tile, the substrate, the conditions of service, and which leave the tile firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

**Thin adhesive beds**

Provide only if the substrate deviation is less than 3 mm when tested with a 3 m straight edge. Cover the entire tile back with adhesive when the tile is bedded.

Thickness: 1.5 – 3 mm.

**Thick adhesive beds**

Provide on substrates with deviations up to 6 mm when tested with a 3 m straight edge, and with tiles having deep keys.

Nominal thickness: 6 mm.

**Adhesive bedding application**

Apply adhesive by notched trowel to walls and floors and direct to tiles if required, to provide evenly distributed coverage after laying.

Wall tile spacers: Do not use spacer types that inhibit the distribution of adhesive.

Curing: Allow the adhesive to cure for the period nominated by the manufacturer prior to grouting or allowing foot traffic.

**Mortar beds**

For floor tiles: Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, or cement-based thin bed adhesive, on to the tile back. Do not provide mortar after initial set has occurred.

- Nominal thickness: 20 to 40 mm.

# MOVEMENT JOINTS

**General**

Provide movement joints to the **Movement joints schedule** and as follows:

- Location:

. Over structural (isolation, contraction, expansion) joints.

. Close to external corners in large tiled areas.

. Around the perimeter of the floor.

. At junctions between different substrates.

. To divide large tiled areas into bays, maximum 5 m wide, maximum 16 m2.

. At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.

* Depth of joint: Right through to the substrate.
* Sealant width: 6 – 10 mm.
* Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

**Movement joint materials**

Divider strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Sealant: Two-pack self-levelling non-hardening mould resistant, one-part silicone or polyurethane sealant applied over a backing rod. Finish flush with the tile surface.

Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

# GROUTED AND CAULKED JOINTS

**Grouted joints**

Commence grouting as soon as practicable after bedding has set. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout. Wash down when the grout has set. When grout is dry, polish the surface with a clean cloth.

Edges of tiles: Grout exposed edge joints.

**Mosaic tiles**

Grouting mosaics: If paper faced mosaics are to be bedded in cement mortar, pre-grout the sheeted mosaics from the back before fixing. After fixing, rub grout into the surface of the joints to fill any voids left from pre- grouting. Clean off surplus grout. When grout has set, wash down. If necessary use a proprietary cement remover.

**Sealant joints**

Provide joints filled with sealant and finished flush with the tile surface as follows:

* Where tiling is cut around sanitary fixtures.
* Around fixtures interrupting the tile surface, for example pipes, brackets, bolts and nibs.
* At junctions with elements such as window and door frames and built-in cupboards.

Width: 5 mm.

Depth: Equal to the tile thickness.

# JOINT ACCESSORIES

**Floor finish dividers**

Finish tiled floors at junctions with differing floor finishes with a corrosion resistant metal dividing strip suitably fixed to the substrate, with top edge flush with the finished floor. Where changes of floor finish occur at doorways make the junction directly below the closed door.

# 39.4. COMPLETION

**Cementitious terrazzo tiled surfaces**

In situ grind and polish the completed installation with equipment nominated by the tile supplier.

**Spare tiles**

Supply spare matching tiles and accessories of each type for future replacement purposes. Store the spare materials on site where directed by the Engineer.

Quantity: At least 1% of the quantity installed.

**Cleaning**

Clean tiled surfaces using an appropriate tile cleaning agent, and polish.

# VINYL FINISHES

* 1. **GENERAL 40.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the substrate immediately before fixing vinyl finishes.

# 40.1.2.SUBMISSONS

**Samples**

Range: Submit labelled samples of vinyl finishes illustrating the range of colour, pattern or texture as seen in the finished work.

Minimum size per sample:

* Sheet: 450 x 450 mm.
* Linear accessories (coving, skirting, stair nosing, protection strips, and the like): A piece 300 mm long.

Welded joints: Submit a sample joint 300 mm long.

**Identification**

Labelling: Label each sample, giving brand, product name, and manufacturer’s code reference

# PRODUCTS 40.2.1.MARKING

**Identification**

Deliver materials to the site in the manufacturer’s containers legibly marked to show the following:

* Manufacturer’s identification.
* Product brand name.
* Product type.
* Dimensions and quantity.
* Handling and installation instructions.

# 40.2.2.SHEETS ANDTILES

**Edges of sheets and tiles**

Ensure edges are firm, unchipped, machine-cut accurately to size and square to the face, and that tile edges are square to each other.

**Polyvinyl chloride (PVC)**

Resilient floor covering, jute or polyester felt backing: To BS EN 650. Resilient floor covering, with foam layer: To BS EN 651.

# EXECUTION 40.3.1.PREPARATION

**Substrates**

Ensure substrates conform to the **Substrate tolerance table** and are as follows:

* + - Clean and free of any deposit or finish which may impair adhesion or location and functioning of movement joints.

**Substrate tolerance table**

|  |  |  |
| --- | --- | --- |
| **Property** | **Length of straight edge laid in any direction** | **Max. deviation under the straight edge** |
| Flatness | 3000 mm | 4 mm |
| Projections | 100 mm | 1 mm |

Cleaning concrete surfaces: Mechanically remove the following surface treatments:

* + - Sealers and hardeners.
    - Curing compounds.

Concrete substrate correction: Remove projections and fill voids and hollows with a levelling compound compatible with the adhesive*.*

Moisture content: Do not commence installation unless the following periods have elapsed:

* + - Concrete slabs: 42 days.
    - Toppings on slabs: A further 21 days.

**Working environment**

Do not start work before the building is enclosed, wet work is complete and dry, and good lighting is available. Protect adjoining surfaces.

# 40.3.2.SHEET AND TILE INSTALLATION

**Sheet set out**

Set out sheets to give the minimum number of joints. Run sheet joints parallel with the long sides of floor areas, vertically on walls.

**Tile set out**

Set out tiles from the centre of the area. Wherever possible cut tiles at margins only, to give a cut dimension of at least 100 mm x full tile width. Match edges and align patterns. Arrange the material so that variation in appearance is minimised.

**Joints**

Non-welded: Butt edges together to form tight neat joints showing no visible open seam.

**Junctions**

Scribe neatly up to returns, edges, fixtures and fittings. Finish flush with adjoining surfaces.

**Rolling**

Where rolling is required, roll the finish in 2 directions before the adhesive sets, using a 70 kg multi-wheeled roller.

**Cleaning**

Keep the surface clean as the work proceeds.

# 40.3.3.VINYL SHEETING

**Welded joints**

Heat welding: After fixing, groove the seams using a grooving tool and weld the joints with matching filler rod and using a hot air welding gun. When the weld rod has cooled, trim off flush.

Cold welding: Apply seaming compound 100 mm wide to the substrate centrally under the seam. Roll the seam until the compound is forced up into the joint. Clean off flush using a damp cloth.

Epoxy jointing: Join seams with epoxy adhesive.

# 40.3.4.STAIRS

**Vinyl**

Preformed: Provide purpose-made vinyl stair finish combining riser, nosing and tread in the one element. Lay each step consecutively with the joint at the bottom of each riser.

Formed in situ: Fit the sheet vinyl to each tread, and to the riser above, in one piece, coved in the angle. Accurately scribe, cut and fit to stair nosing’s and perimeters.

**Stair nosing’s**

Aluminium: Purpose-made extruded anti-slip aluminium nosing.

Vinyl: Purpose-made moulded anti-slip section, matching the stair finish. Refer to the **Stair Finishes Schedule**.

# 40.3.5.JOINTS AND ACCESSORIES

**Junctions**

Finish junctions flush with adjoining surfaces. Where changes of floor finish occur at doorways locate the joint on the centreline of the closed door leaf.

**Cover strips**

Provide edge cover strips at junctions with different floor finishes and to exposed edges.

Metal cover strip: Extruded tapered strip 25 mm wide, of the same thickness as the sheet or tile. Fix with masonry anchors at 200 mm maximum centres.

UPVC cover strip: Feather-edge strip matching the floor finish, fixed with contact adhesive.

**Movement joints**

Location: Provide movement joints as follows:

* Over structural (isolation, contraction, expansion) joints.
* At junctions between different substrates.

Depth of joint: Right through to the substrate. Sealant width: 6 – 10 mm.

Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

**Vinyl skirting**

Feather edge: Moulded PVC skirting section. Flat skirting: Flat PVC skirting section.

Fixing: Fix to walls with contact adhesive. Minimum height: 100 mm.

**Coves and nosing’s**

Coved skirtings: Carry the flooring material up over a profiled coving section to form skirting, weld all joints. Minimum radius of 20mm to coving.

# 40.4. COMPLETION

**Protection**

Keep traffic off floors until bonding has set or for 24 hours after laying, whichever period is the longer. Do not allow water in contact with the finish for 7 days.

Reinstatement: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

**Spare materials**

General: Supply spare matching covering materials and accessories of each type for future replacement purposes. Store the spare materials on site where directed.

Quantity: At least 1% of the quantity installed.

**Cleaning**

Clean the finished surface. Buff and polish. Before handover, mop and leave the finished surface clean and undamaged on completion.

Refer to the **Sheet and Tile Schedule** for details and locations of vinyl finishes.

# CARPETS

* 1. **GENERAL 41.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the following:

* + Subfloor prepared to receive the carpet installation.
  + Fixings, edge strips, and underlay installed ready to lay carpet.

# 41.1.2.SUBMISSIONS

**Samples**

General: Submit labelled production run samples illustrating the range of colour and pattern available in the required carpet types.

Sample size:

* Carpet: 1 m long x roll width or 1 m wide, whichever is less.

Edge strip: Submit a 300 mm length of each type. Accessories: Submit one sample of each of the following:

* Carpet gripper.
* Heat-bonding tape.
* Bonding adhesive.

# PRODUCTS 41.2.1.CARPET

**Batching**

Carpet laid in a single area and of a single specified type, quality, colour and design, must come from one manufacturing batch and dye lot.

**Insect resistance**

Insecticide: Provide carpets and underlays composed entirely of materials either inherently resistant to insect attack, or treated against insect attack, including by moth and carpet beetle.

# 41.2.2.MATS

**Coir mats**

Provide a mat made to fit each designated mat recess to the **Mats schedule**.

# 41.2.3.ADHESIVE AND TAPES

**Adhesives**

Compatible with the floor covering material, and suitable for bonding it to the subfloor. Friction compound: Suitable for holding tiles in position without permanent sticking.

**Hot-melt adhesive tapes**

Commercial grade glass fibre and cotton thermoplastic adhesive coated tape 60 mm wide on a 90 mm wide metal foil base and backed with silicon-coated release paper.

# 41.2.4.STRIPS

**Preformed gripper strips**

Commercial grade plywood carpet gripper strip with 3 rows of rust-resistant angled pins of length appropriate to the carpet type.

Size (minimum): 33 mm wide x 7 mm thick.

Location: At edges, except where edge strips are used. Provide double gripper strips to edges where recommended.

**Edge strips**

Type: Heavy duty edge strip appropriate to the floor covering type (tackles or adhesive fixed), capable where necessary of accommodating different levels of adjacent floor finishes.

Form: Metal moulding or extrusion, with vinyl inserts.

Location: At exposed edges of the carpet, and at junctions with differing floor finishes or finishes of a different thickness. Where edge strips occur at doorways, locate the junctions directly below the closed door.

# EXECUTION 41.3.1.SUBSTRATE

**Substrates**

General: Ensure substrates conform to the **Substrate tolerance table** and are as follows:

* + - Clean and free of any deposit or finish which may impair adhesion or location and functioning of movement joints.

**Substrate tolerance table**

|  |  |  |
| --- | --- | --- |
| **Property** | **Length of straight edge laid in any direction** | **Max. deviation under the straight edge** |
| Flatness | 3000 mm | 8 mm |
| Smoothness | 200 mm | 2 mm |

Concrete substrate correction: Remove projections and fill voids and hollows with a levelling compound compatible with the adhesive.

Moisture content: Do not commence installation unless the following periods have elapsed:

* + - Concrete slabs: 42 days.
    - Toppings on slabs: A further 21 days.

Fixtures: Remove door stops and other fixtures, and refix in position undamaged on completion of the installation.

# LAYING CARPET

**Setting out**

Lay the carpet in continuous lengths without cross joins in the body of the area. Where unavoidable cross joins occur at doorways, locate the joins directly below the closed doors.

Partition layout: Confirm that permanent partitions have been installed before starting carpet laying.

**Fixing underfelt**

Glue continuously to concrete at edges and joints with a 100 mm wide strip to each piece, and at 600 mm centres both ways with 150 mm diameter patches.

**Seaming methods**

Woven carpet: Machine or hand sew. Do not provide glued taped seams. Tufted carpet: Seam with hot-melt adhesive tape.

**Fixing**

Permanent stick method: Immediately after laying, and again one hour later, roll the carpet from the centre diagonally towards each edge using a 65 kg multi-wheeled roller. Do not roll foam-backed carpet.

Dual bonded underlay: Fix with adhesive between carpet and underlay, and between underlay and subfloor. Gripping system: Preformed gripper strip and tackles edge strip. Space fixings at 150 mm maximum centres.

**Cutting laid carpet**

Method: Where penetrations through laid carpet are necessary for electrical, telephone or other outlets, cut the carpet either by cross cutting or by cutting rectangular or circular openings.

# LAYING ON STAIRS

**Fixing method**

To concrete stairs: Adhesive fixing.

**Laying method**

Closed rise types: Apply the floor covering continuously to the treads and risers.

# COMPLETION

**Cleaning**

Progressively clean the work. Remove waste, excess materials and adhesive.

Final cleaning: When the installation is complete, clean the carpet as necessary to remove extraneous matter, marks and soiling and to lift the pile where appropriate.

Protection: provide fabric drop sheets. Do not use plastic sheeting. If wheeled traffic is to follow carpet installation protect with hardboard sheets butted and fixed with adhesive tape.

Refer to the **Carpet and Laying Schedule** for types and locations of carpets.

# PAINTING

* 1. **GENERAL 42.1.1.INSPECTION**

**Notice**

Give sufficient notice so that inspection may be made of the substrate immediately before application of paint finishes.

# 42.1.2.SUBMISSIONS

**Clear finish coated samples**

Submit pieces of timber or timber veneer matching the timber to be used in the works, prepared and coated in accordance with the paint system.

**Opaque coated samples**

Provide approx. 600x600mm samples on representative substrates of each paint system showing surface preparation, colour, gloss level and texture.

# PRODUCTS 42.2.1.PAINTS

**Combinations**

Do not combine paints from different manufacturers in a paint system.

Clear timber finish systems: Provide only the combinations of putty, stain and sealer recommended by the manufacturer of the top coats.

**Delivery**

Deliver paints to the site in the manufacturer’s labelled and unopened containers.

**Tinting**

Provide only products which are colour tinted by the manufacturer or supplier.

**Putty**

Non-timber substrates: Oil-based or polymeric based. Timber finishes: Lacquer or water based only.

# EXECUTION 42.3.1.PREPARATION

**Order of work**

Other trades: Before painting, complete the work of other trades as far as practicable within the area to be painted, except for installation of fittings and laying flooring materials.

Clear finishes: Complete clear timber finishes before commencing opaque paint finishes in the same area.

**Protection**

Fixtures: Remove door furniture, switch plates, light fittings and other fixtures before starting to paint, and refix in position undamaged on completion of the installation.

Adjacent surfaces: Protect adjacent finished surfaces liable to damage from painting operations.

**“Wet paint” warning**

Place notices conspicuously and do not remove them until paint is dry.

**Restoration**

Clean off marks, paint spots and stains progressively and restore damaged surfaces to their original condition. Touch up damaged decorative paintwork or misses only with the paint batch used in the original application.

**Substrate preparation**

Prepare substrates to receive the painting systems.

Cleaning: Clean down the substrate surface. Do not cause undue damage to the substrate or damage to, or contamination of, the surroundings.

Filling: Fill cracks and holes with fillers, sealants, putties or grouting cements as appropriate for the finishing system and substrate, and sand smooth.

Clear finish: Provide filler tinted to match the substrate.

Clear timber finish systems: Prepare the surface so that its attributes will show through the clear finish without blemishes, by methods which may involve the following:

* Removal of discolorations, including staining by oil, grease and nailheads.
* Puttying.

# 42.3.2.PAINTING

Provide coating systems to substrates as follows and as scheduled:

* Consistent in colour, gloss level, texture and thickness.
* Free of runs, sags, blisters, or other discontinuities.
* Fully adhered.
* Resistant to expected impacts in use.
* Resistant to environmental degradation within the manufacturer’s stated life span.

**Drying**

Ensure that the moisture content of the substrate is at or below the recommended maximum level for the type of paint and the substrate material.

**Paint application**

Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Apply subsequent coats after the manufacturer’s recommended drying period has elapsed.

**Priming before fixing**

Apply one coat of wood primer (2 coats to end grain) to the back of the following before fixing in position:

* Timber door and window frames.
* Bottoms of external doors.
* Associated trims and glazing beads.

**Spraying**

If the paint application is by spraying, use conventional or airless equipment which does the following:

* Satisfactorily atomises the paint being applied.
* Does not require the paint to be thinned beyond the maximum amount recommended by the manufacturer.
* Does not introduce oil, water or other contaminants into the applied paint.

**Sanding**

Clear finishes: Sand the sealer using the finest possible abrasive and avoid cutting through the colour. Take special care with round surfaces and edges.

**Repair of galvanizing**

For galvanized surfaces which have been subsequently welded, prime the affected area.

# 42.3.3.SELECTIONS-PAINT SYSTEMS

**Paint system description**

Choose from the following paint systems and substrates and paint in accordance with manufacturers recommendations and **Painting Schedules**:

**Paint Systems:**

Flat water based: Interior

Low gloss water based: Interior

Flat or low gloss water based: Exterior Semi-gloss water based: Interior

Semi-gloss water based: Exterior Gloss water based: Interior Gloss water based: Exterior Semi-gloss, oil based: Interior Full gloss, oil based: Interior

Full gloss, oil based: Exterior Texture finish, water based: Interior Texture finish, water based: Exterior Varnish clear: Interior

Varnish tinted: Interior

Opaque timber finish, water based: Exterior Paving paint - Semi gloss oil based

Roofing paint, oil based

Low flame spread specialised coating

# Substrate Types:

Existing paintwork (oil based) Existing paintwork (water based) Concrete

Cement render Fibre cement Brickwork

Set plaster

Glass reinforced gypsum plaster Plasterboard (paper faced)

Iron and steel Aluminium

Metallic-coated steel

Oil-based air-drying primed metal Organic or inorganic zinc primed metal Timber

Particleboard UPVC

**Number of coats**

Unless specified as one coat or two coat systems, each paint system consists of at least 2 coats.

**Color selection**

As nominated in the **Painting schedules**.