**SPECIFICATIONS**

**EARTHWORK**

A.1 **Removing trees, hedges and the like**

The removal from site of trees, stumps and roots, hedges, bushes, scrub, undergrowth and the like shall be deemed to be included with the items for cutting down and grubbing up roots.

A.2 **Surface level**

The term "Surface level" shall mean the ground level after clearing site.

A.3 **Clearing site**

The description of clearing site shall be deemed to include clearing and removing from the site of all loose debris and rubbish, bushes, scrub, undergrowth, vegetation and small trees (i.e. not exceeding 600mm girth) and grubbing up their roots.

A.4 **Rock**

The term 'rock' shall mean any natural material, which cannot be dislodged by a pick and which can only be removed by the use of compressors or by blasting or wedging. This classification does not include materials such as loose rock, concrete or other materials that can be removed by means reasons of economy in excavating, the Contractor prefers to remove by drilling and wedging.

Unless specifically stated hereafter, the contractor must assume that permission to use explosives to remove rock will be refused and he must therefore price for removing rock by compressors etc. only.

**GENERALLY**

A.5 **Levels**

The levels shown on the various drawings relate to the ground floor finished floor levels.

The Contractor shall be responsible for setting up and maintaining a site datum level accurately ascertained from this work. Immediately following the issue of the Odder to Commence, the Contractor shall carry out and record a check level grid of the site which shall be agreed between the Architect and the Contractor within one week of the above Order being given; no alteration of levels shall be undertaken until agreement has been reached and the Architect's instructions have been received.

A.6  **Nature of the soil**

It will be deemed that the Contractor has inspected the drawings and site and has consulted all available information concerning subsoil conditions before submitting the Tender. In making information available on subsoil conditions, the Employer does not in any way absolve the Contractor from his responsibilities, nor is it guaranteed that similar conditions apply to any specific part of the site.

A.7 **Unauthorised excavations**

The Contractor is prohibited from making excavations other than those approved by the Engineer as necessary for the works.

A.8 **Borrow pits**

No borrow pits will be allowed to be opened on the Site.

A.9 **Blinding**

Blinding shall be of the same material as the hardcore bed, crushed and graded from 4mm upwards, free from clay, chemical or other pollution, pests, weed roots and rubbish.

A.10 **Hardcore**

Hardcore shall be good, clean, hard, broken stone broken before placing to pass a 100mm ring and free from all rubbish.

A.11 **Approved filling for filling under floors**

Approved filling for filling under floors shall be clean, dry pit or river sand excavated material or subsoil free from clay, roots and any impurities

A.12 **Soil for backfilling around foundations**

Soil for backfilling around foundations shall be dry, clean subsoil free from clay, vegetable soil, roots and rubbish.

**WORKMANSHIP**

A.13 **Generally**

The Contractor shall control the grading around the building so as to prevent water running into excavated areas or into completed sections of the works.

A.14 **Removal of obstructions**

In the event of any derelict foundations, walls, slabs, kerbs, etc., being discovered upon the site of the works, they shall, if below new foundations be completely removed to a level of 150mm below the level of the excavation indicated on the drawings. For graded or planted areas any such obstruction shall be removed to a depth of 600mm below the finished grade.

Filling voids caused by removal of such obstructions shall be executed in accordance with Clauses A.20 herein.

A.15 **Bottoms of excavations to be approved**

The Contractor shall give the Engineer at least 48 hours’ notice (this time shall be doubled if the site of the works is more than 100 kilometres from the nearest permanent office of the Architect or Engineer) when the excavations will be ready for inspection. The bottom of every excavation will be inspected by the Architect and the level thereof agreed between the Architect and the Contractor. If a good bearing bottom is not obtained at the level shown the Architect is to be informed. No concrete is to be laid until the bottom has been approved and the level thereof taken. Any concrete work or other work done before such approval shall, if so directed be removed and new work substitute after excavations have been approved, all at the Contractors expense. Notwithstanding such approval, any bottom, which becomes waterlogged or otherwise spoilt after approval, shall be cleaned out and reformed to the Architect's approval before any concrete is placed.

A.16 **Disposal of excavated material**

Vegetable soil shall be spread and levelled where directed by the Architect on site. Surplus excavated material were directed or required shall be removed from the site to a tip, the location of which shall first be approved by the Architect in writing. All fees and charges in connection there with shall be deemed to be included in the Contract Sum.

A.17 **Excavation below required levels**

Should any excavation be taken below the required levels or the depths necessary to obtain a suitable bottom, the Contractor will be required to fill in the excavation to the proper level with concrete of the same specification for the foundations at his own expense.

A.18 **Timbering, planking and strutting, etc.**

The Contractor shall provide all necessary timbering, planking and strutting, etc., to uphold the faces of excavations, which shall only be removed when it is safe to do so.

A.19 **Timbering, planking, strutting, etc., left in**

Where the Architect instructs or agreed that it is necessary for the safety of the works to leave in certain timbering, planking and strutting, etc., such timber shall be measured and agreed before covering up.

A.20 **Filling**

Return filling around foundations and filling to make up levels under floors and paving shall not be deposited until the formation level had been approved by the Architect. In no case shall fill be deposited on a muddy formation. Filling shall be deposited in layers not exceeding 250mm in depth before compaction and shall be compacted by rolling, pneumatic tamping or other approved means over the whole of the area. If necessary, the filling shall be allowed to dry or be moistened to the correct moisture content before compaction. The finished surface shall be approved by the Architect prior to further construction work thereon.

The Contractor shall afford every assistance to the specialist executing site sterilisation to enable each layer to be treated separately.

Filling around foundations in layers shall not proceed without each layer being so treated.

No excavation or foundation work shall be filled in or covered up until all measurements necessary for the adjustment of variations have been made. Walling shall not be built upon the foundations until four days after depositing of concrete.

A.21 **Consolidation of hardcore**

Hardcore shall be consolidated with a roller, vibrating roller, or mechanical punner to a compaction equivalent to that obtained with a 2.5 to 3 tonne roller, care being taken that no damage is done to the foundation walls.

Hardcore shall be blinded and have the interstices filled to receive concrete beds and the like with blinding as described herein. Before placing concrete hardcore beds shall be well watered though a sprinkler rose, and rolled, to prevent water absorption from the concrete.

Where described as blinded to receive building paper or polythene or any other membrane the blinding shall be finished and compacted with fine material which will not cause the membrane to puncture under wheel or foot traffic or by the placing or concrete thereon.

A.22 **Existing services**

Active existing services shall be adequately protected from damage. Where active services are encountered but not shown on the drawings, the Architect shall be advised, and subsequent protection, support or relocation shall be as directed by him.

A.23 **Protection**

The Contractor shall protect all graded and filled areas from the actions of the elements. Any settlement or washing that occurs prior to acceptance of the works shall be repaired and graded re-established to the required elevations and slopes.

A.24 **Anti termite treatment**

Anti termite treatment shall be carried out using 'Aldrin' or other chemical approved by the Architect in writing, diluted to a water emulsion containing a minimum of 0.50% of the chemical.

The treatment shall be applied to the whole area of the hardcore bed immediately prior to the placing of the concrete floor slab at the rate of 7 litres per square metre, and to the backfilling on both sides of all perimeter walls, at the rate of 80 litres per cubic metre of backfilling. Each compacted layer of backfilling shall be separately treated.

Treatment shall not be applied whilst it is raining or to surfaces of backfilling which are wet.

The Contractor's attention is drawn to the fact that 'Aldrin' is toxic to animal and human life, and he shall prevent contamination of water supply systems, shall cover up and protect treatment areas immediately after treatment and post written notices informing of the treatment at prominent points on the site of the building.

Immediately following treatment, the Contractor shall provide to the Architect for onward transmission to the Employer, a written five-year guarantee which guarantees:

(a) That the chemical used complies with this specification and has been used in the concentrations stated herein,

(b) That the guarantee shall be continuous for a period of five years from the date of treatment,

1. That should infestation by any termites appear before the end of the five-year period, the Contractor will return and retreat as necessary to eliminate the infestation entirely and at his own cost on each occasion that infestation appears within the five-year period,

The Contractor shall carry out annual inspections commencing three months after treatment and continuing to the end of the guarantee period to ascertain the presence be found, the Contractor shall retreat as necessary to eliminate any infestation entirely and at his own cost on each occasion that infestation is found.

A.25 **Method of measurement**

The prices throughout this Document are to include for digging in any type of ground including loose or compacted hardcore, rubble debris and the like, roots, or normal obstructions, with the exception of rock as defined herein and excluding any existing foundations, walls and similar hard substances. The Contractor must give notification to the Architect or his representatives as soon as he considers rock as defined herein or existing foundations are encountered so that its extent can be agreed with the Architect, Clerk of Works, or Quantity Surveyor before the work is carried out or covered up. Payment for such excavation will not be allowed unless this procedure is followed.

The foundation and removal of temporary spoil heaps and multiple handling or excavated material shall be deemed to be included in the prices for returning excavated material around foundations, earth filling and removing surplus excavated material from site.

Excavation for plain concrete foundations has been measured to the nett sizes required by concrete dimensions. Formwork has been measured to the sides of all reinforced concrete foundations or bases, together with the necessary working space allowance required under the provisions of S.M.M. Clause D5(f). Should the Architect direct or approve the pouring of concrete to reinforced foundations or bases against the face of excavations, such adjustment will be measured and valued in accordance with the Conditions of Contract.

Rates for excavation shall be deemed to include for levelling, trimming and compacting bottoms and any additional excavation required for planking and strutting.

CONCRETE WORK

QUALIFICATIONS OF THE RULES OF THE S.M.M.

B.1 **Beds or the like laid in bays**

Notwithstanding the provisions of S.M.M. Clause B.5(c), the descriptions of work laid in bays shall be deemed to include formwork between the bays.

B.2 **Steel bar reinforcement**

Notwithstanding the provisions of S.M.M. Clause B.16(b) and B.17(a), the descriptions of steel bar and fabric reinforcement shall be deemed to include bends, hooks, tying wire, distance blocks and ordinary spacers, unless otherwise described.

B.3 **Wrought formwork**

Notwithstanding the nomenclature of S.M.M. Clause B.19(f), formwork required to produce fair concrete surfaces is herein qualified by a description of the finish required.

B.4 **Formwork to grooves, chases, chamfers and mouldings**

Notwithstanding the provisions of S.M.M. Clause B.23(b), the descriptions of formwork shall be deemed to include forming chamfers not exceeding 50mm wide and forming splayed internal angles not exceeding 25mm wide.

B.5 **Making good**

Notwithstanding the provisions of S.M.M. Clause B.50 the descriptions of holes and mortices shall be deemed to include making good concrete.

**DEFINITIONS**

B.6 **Designations of concrete mixes**

The various mixes of concrete are designated in the subsequent measured items by the following criteria: -

Nominal mixes: By the weight proportions of whole bags of ordinary Portland cement to fine and coarse aggregates and by the maximum size of coarse aggregate. The Contractor shall regularly submit details giving specific gravities and moisture content of aggregate.

B.7 **Tamping**

The term "tamping" as used herein in conjunction with the phrase "treating surfaces of unset concrete" shall mean the final compaction and surface finish to be applied to unset concrete beds, or the like, with a steel shod beam tamper, either manually or mechanically operated unless otherwise stated. The resulting surface finish shall have a slightly ribbed appearance.

B.8 **Keying**

The term "keying" as used herein in conjunction with the phrase "treating surfaces of unset concrete" shall mean the preparation of beds, or the like, to receive in-situ pavings by raking with a standard horticultural rake whilst the concrete is still green and when the concrete is set and cured, protecting the raked surfaces with a layer of clean sand and removing the sand immediately before the in-situ paving is laid.

B.9 **Precast concrete units**

Unless otherwise described in the measured items, Precast concrete units are deemed to be basically rectangular in cross section and rough on exposed faces. Reinforcement bars shall have hooked ends. Bedding and pointing mortar shall be either cement-sand or cement-lime mortar, as appropriate, and units shall be deemed to be fixed by hoisting, bedding and building in unless otherwise described.

Nominally non-reinforced units shall contain any reinforcement the Contractor may wish to introduce for handling purposes.

**GENERALLY**

B.10 **Standards**

The whole of the concrete works and testing thereof shall comply with BS 8110 parts 1, 2 &3 and with the subsequent clauses of this Document and shall be carried out in strict accordance with the working drawings and instructions of the Architect and or Engineer.

A competent person shall be employed whose first duty it will be to supervise all stages in the preparation and placing of the concrete. All cubes should be made and site tests carried out under his direct supervision. This person shall also be responsible for keeping an accurate record of the dates on which concrete is poured.

B.13 **Cement**

Cement shall comply with British Standards as follows: -

Portland cement - B.S. 12

Rapid hardening cement - B.S. 12

Except as regards the addition of colorant to BS 1014 which should not exceed 5% of cement by weight.

Sulphate resisting Portland cement shall comply with BS 4027.

Rapid hardening cement may be used in lieu of ordinary Portland cement only with the prior approval of the Architect or Engineer provided that all conditions applying to its use are strictly observed. Any additional expenses in connection with the use of such cement shall be borne by the Contractor.

The use of high alumina cement will not be permitted. All cement shall be delivered to the site in sealed bags bearing the mark of the manufacturer. Re-bagged cement, cement in plain bags and cement in torn bags will not be allowed on the site.

Each consignment of cement shall be accompanied by the manufacturer's certificate showing that a representative sample of the consignment has been tested and complies with the appropriate specification. From time to time as requested by the Architect/Engineer, copies of the cement manufacturer's test certificates shall be delivered to the Architect/Engineer or his representative on the site promptly, but such documents shall not preclude the Architect/Engineer from rejecting any cement which does not in every way comply with the specification.

Any cement which has failed to pass the tests or has been damaged by water or contaminated in any way on site shall immediately be put into bags and removed from the site

B.14 **Aggregates**

Aggregates shall comply with British Standards as follows: -

Fine - B.S. 882 Table 2 Zones 1 to 3 only

Coarse - B.S. 882 Table 1

"All in" - B.S. 882 Table 3

Each type of aggregate shall be obtained from one approved source, capable of maintaining adequate supplies of consistently graded material throughout the Contract. Aggregates for exposed concrete shall be free from all impurities likely to cause discolouration and shall be on consistent colour throughout the work.

Fine aggregates and sand shall be clean, sharp, coarse, hard material and equal at all times to the samples which shall be deposited with and approved by the Engineer. The caustic soda test for organic impurities shall show a colour not deeper than that of the standard solution. The settling test for natural sand shall be made and after being allowed to settle for three hours the layer of silt deposit on the course material shall not exceed 10%.

The Contractor shall supply all necessary equipment for the testing of fine aggregates and sand for the use of the Engineer.

Coarse aggregates shall be hard, clean gravel or broken stone from approved quarries and shall be free from earth, decomposed stone, and extraneous matter. They shall conform to B.S. 882 Table 1 and shall be "Graded Aggregate" 19mm to 5 mm. Thin, elongated, friable, flaky or laminated pieces, mica or shale shall only be present in such small quantities as not to affect adversely the strength and durability of the concrete. The number of fine particles occurring in a free state or as loose adherent shall not exceed 1% when determined by the laboratory sedimentation test. After twenty-four hours in water, a previously dried sample shall not gain more than 10% in weight.

Each grade of aggregate shall be stored in the works in separate heaps so that there shall be no possibility of any inter-mixing. Any materials which have become inter-mixed shall be removed from the site forthwith by the Contractor.

If, in the opinion of the Engineer, the aggregate is dirty or adulterated in any manner, it shall be washed and/or screened by the Contractor to the satisfaction of the Engineer.

Graded samples of all types of aggregate each weighing 10kg, shall, after approval, be kept on site behind glass for visual checking of subsequent deliveries for grading, shape, and where applicable colour.

B.15 **Reinforcement**

Reinforcement shall comply with the following standards: -

(a) Mild steel rod reinforcement shall be hot rolled grade 250 complying with B.S. 4449.

(b) (i)Hot rolled deformed high tensile bars having a guaranteed minimum yield stress of 410 Newtons/sqmm

and other physical properties complying with BS 4449.

**Or**

(ii) Cold worked steel bars complying with BS 4461.

(c) Welded steel fabric reinforcement shall comply with B.S. 4483.

All reinforcement shall be in the "diameter" and metric range and the substitution of "square twisted" or imperial range shall be allowed but only at no extra cost to the Employer.

The Contractor will be required to submit at his own expense certified test data of the following characteristics; ultimate tensile stress, yield point stress, elongation, could bend test. Should such certificates not be submitted by the manufacturer, the Contractor shall have the requisite tests made at his own expense at an independent testing laboratory.

B.19 **Water**

Water shall be from the mains and kept free of any impurities and acid or alkaline substances in suspension or in solution, and shall be stored in proper storage tanks to the approval of the Engineer.

B.20 **Storage of materials**

**Cement** shall be kept dry and used in rotation of deliveries. If delivered in bags these shall be stored off the ground in a well-ventilated and weatherproof shed used exclusively for this purpose.

The shed is to be sufficiently large to contain a working stock and provided with partitions or such other means as may be necessary, to ensure the effectual separation of the various consignments and type of cement. Stacking of cement in bags over a height of ten bags will not be permitted. Cement may be delivered in bulk containers provided additional suitable arrangements are made for bulk storage on site to the approval of the Engineer.

**Aggregates** shall be stored at mixer positions on drained concrete paved areas, with stout dividing wall between different sizes and types of aggregates. It shall be allowed to stand for at least 24 hours before being used.

**Reinforcement** shall be stored by type, size and length, either off the ground or on clean surfaced areas, and shall be kept free from rust.

***B.21 Proportion of concrete mix***

The quantity of cement shall be measured by weight and each batch of concrete is to use one or more whole bags. The quantity of fine aggregate and coarse aggregate shall be measured separately by weight batching plant. Volume mixing will not be permitted.

For grading tests, the Contractor shall supply and deliver at his own cost to the Nominated Testing Authority, samples of the aggregates which the Contractor proposes to use, consisting of not less than 50 kilograms weight in coarse aggregate and not less than 25 kilograms weighting fine aggregate. It is the Contractor's responsibility to ensure that the subsequent deliveries of aggregate conform to the grading analysis of the approved samples.

The proportions of materials to be used for the preliminary cube tests, and subsequent batching, shall be ascertained by calculation from the results of the aggregate grading tests carried out by the Nominated Testing Authority.

Preliminary concrete cubes shall be made by the Contractor on site, as required by the Engineer, and tested by the Nominated Testing Authority. As a result of these tests definite weights of each material for batching shall be ascertained and agreed with the Engineer. Thereafter these proportions shall be adhered to throughout the works and may be varied only by instructions given by the Engineer.

The weights of damp aggregates must be adjusted to take into account the weight of water in the aggregates, and this in turn will affect the amount of water to be added to the mix.

Throughout the carrying out of the Contract, "Works Cube Tests" are to be made from concrete drawn from newly laid concrete or concrete about to be placed in position, such cubes being made when directed by the Engineer and in his presence. Such cubes shall be made in 150mm cube steel or cast-iron moulds and shall be marked and cured strictly in accordance with the Appendices of the Code of Practice, and shall be forwarded carriage paid in time for testing at the required age to a testing laboratory to be nominated by the Engineer.

Four cubes shall be made on each occasion, concrete for each cube being from a different batch. Two cubes shall be forwarded in time for testing at the age of seven days from casting and two cubes in time for testing in twenty-eight days. Each cube shall be marked with the date of casting and a distinctive reference number in accordance with a system agreed by the Engineer.

A record shall be kept of the position from which the concrete for each set of cubes was drawn, or to which it was about to be placed.

At least three sets of cubes shall be cast during each week concrete is being cast including sets of cubes for each quality of concrete used during the period.

Concrete is required to have the properties and give the strength in Newtons per square millimetre as follows: -

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Class** | **Quality** | **Mix size of coarse aggregate** | **Max. water cement ration by weight** | **Min. crushing strength of Works Test Cubes** | |
| 31.5/20 | 1:1:2 | 20 mm | 0.45 | 7 days | 28 days |
| 26.5/20 | 1:1.5:3 | 20 mm | 0.50 | 23 | 31.5 |
| 21/20 | 1:2:4 | 20 mm | 0.58 | 19 | 26.5 |
| 21/13 | 1:2:4 | 13 mm | 0.58 | 15.5 | 21 |
| 13.5/25 | 1:3:6 | 25 mm | 0.60 | 15.5 | 21 |
| 1:4:8 | 1:4:8 | 40 mm | 0.60 | 9 | 13.50 |
| 1:10 | 1:10 | "All-in" aggregate | | - | - |

The above properties and crushing strengths are to be considered as the minimum standard that will be accepted in the finish at works. The average crushing strengths should be least 15% higher than the minimum permissible values given in the above table.

If the strengths required in the table are not attained and maintained throughout the carrying out of the contract, the contractor will be required to increase the proportion of cement or substitute better aggregates at his own cost so as to give concrete which does comply with the requirements of this clause. The contractor may be required to remove and replace at his own cost any concrete which fails to attain the required strength as ascertained by the Works Cube Tests.

B.22 **Testing of materials generally**

The Contractor shall include in his Tender prices for the execution of his part of operations specified for testing herein and for supply of the requisite equipment; After initial testing and approval of materials, it is the Contractor's responsibility to ensure and to demonstrate by the submission of further similar samples when so required that subsequent deliveries conform to the quality, grading and (where applicable), colour of the approved samples.

B.23 **Testing of cement**

Before work commences and when subsequently directed, the Contractor shall take 6kg samples, in accordance with B.S. 12 procedure, of cement and deliver these in tins approved by the Engineer to an approved Testing Laboratory for testing.

Each consignment of cement to the site, which shall be accompanied by the manufacturer's advice note and forwarded without delay to the Engineer, shall be delivered to the site at least 7 days before it is intended to be use in the works so that the required tests may be carried out without retarding the progress of the works.

B.24 **Testing of aggregate**

Before work commences and when subsequently instructed, the Contractor shall take site samples, by methods given in B.S. 812 and deliver these to the nominated Testing Authority for testing.

B.25 **Testing of reinforcement**

Should the Engineer require reinforcement to be tested, it shall be tested at the Contractor's expense and representative test pieces of such reinforcement to be used in the works are to be sent to an approved laboratory for testing.

Manufacturer's test reports of reinforcement shall be supplied to the Engineer for all reinforcement to be used in the works.

If such tests reveal the steel not meeting the specified standards, the Contractor will carry out the rectifications in the reinforcement to the direction of the Engineer at his own expense.

B.26 **Testing of concrete in the field**

(i) **Trial mixture**

Prior to the commencement of the actual concerning work, a trial mix of the required concrete, as described herein shall be made by the Contractor and tested by an approved laboratory at the Contractor's expense, in order to check and establish the actual working crushing strength of the required concrete mix.

(ii) **Workability**

The total water content in the mixture determines its consistency and once a consistency of a trial mix has been approved it must remain constant throughout the Contract.

In order to help the concrete, maintain the desired consistency the slump of an approved trial mix shall be measured, thereafter all mixes must give the slump as the approved trial mix. The slump shall be determined by test as described in B.S. 1881 Parts 102-104,106,107 and DD 83 Part 2. In general, the approved slump shall be in the order to 75mm for hand compacted concrete and 35mm for vibrated concrete. The slump test shall be made on concrete actually being placed in the works at the commencement of each period of concrete placing and at such other times as instructed.

(iii) **Testing specimens**

The moulds for test cubes shall be of metal and true to shape to give a 150mm cube and shall be well oiled before filling. The mould shall be filled with concrete taken from that actually placed in the works, the concerted being selected by the Engineer from a point as near as possible to the position of placing. The filling of the moulds shall be done immediately after the selection of the sample concrete and in such a way that the concrete in the moulds be truly representative of that in the works.

The Concrete shall be placed in the moulds in three layers of equal thickness, each layer being rammed with 25 strokes of a steel bar 40mm diameter, (or equivalent), weighing 2kg. If the concrete in the works be consolidated by mechanical vibration, the test cube moulds shall be likewise vibrated after filling. Each cube shall be inscribed with the date of manufacture and identification mark.

A record shall be kept for each batch of cubes showing the position in the works which the concrete represents, the date of manufacture, the mixture and slump of the concrete, particulars of the cement and aggregate used, a statement of whether or not the cubes are vibrated and other information relating to the subsequent history of the cubes.

The moulds containing the test cubes shall be stored for 24 hours on the site in a damp lace free from vibration. At the end of this period the cubes shall be taken from the moulds and stored in damp sand for 20 days if they are to be tested at 28 days or for 4 days if they are to be tested at 7 days.

1. **Quality of specimens**

The test specimens shall have the compressive strength specified for each quality of cement at the appropriate age as given herein.

If the required strength is not obtained at 28 days, the Contractor will be required to cut out and reconstruct all work represented by the test specimen at his own expense with all despatch, always provided that the Engineer may first permit further tests, at the Contractor's expense, to prove the quality of the deposited concrete.

In the case of seven-day Works Cube Tests proving unsatisfactory, the work may be stopped, but shall not be liable to rejection until the result of the twenty-eight-day test is known.

In the event of the results of the twenty-eight-day Works Cube Tests proving unsatisfactory, the work represented shall be immediately liable to rejection. The Contractor may, however, be given the option of cutting three specimens from the completed work subject to the direction of the Engineer, and preparing there from test cubes or cores which shall be sent to the Testing Laboratory for testing as for Works Cube Tests.

Should the average strength of these specimens attain the specified minimum twenty-eight-day strength, the work will, subject to the Engineer's discretion, be accepted. Alternatively, the Engineer may instruct the Contractor to make a loading test as described hereinafter. The cost of all cutting, preparation of specimens, testing and making good the portions of the structure affected shall be borne by the Contractor. The cost of all delays on site due to concrete not attaining the desired strength, or caused by investigation of defects, cutting away and making good, shall be entirely the Contractor's responsibility.

B.27 **Damaged or unsatisfactory materials**

All materials which have been damaged, contaminated or have deteriorated, or which do not comply in any way with the requirements of the specification, shall be rejected and shall be immediately removed from the site.

No materials shall be stored or stacked on suspended floors without Engineer's prior approval.

Should any of the samples tested be found, in the opinion of the Engineer, in any respect unsatisfactory or likely to produce unsound work, the whole parcel, consignment or load from which samples were taken will be rejected, and the Contractor shall forthwith remove it from the site. Notwithstanding that any sample of the material may have passed the test, the Engineer may later reject such parcels, consignments or loads if he shall decide that the quality has deteriorated.

The Contractor at his own expense shall remove from the site, without delay, all rejected material. Any delay caused by such rejection will not in any way relieve the Contractor from his responsibility with regard to the completion within the time limit(s) specified. Any bag of cement that it opened shall be used on the same day or be discarded from the work.

**WORKMANSHIP**

B.28 **Plant and method**:

Before the commencement of any work, the Contractor shall submit the following for the Engineer's written approval: -

(i) The concreting method, including the size and type of machines for weighing and mixing concrete and the methods of transporting, placing and compacting.

(ii) Details of formwork proposals, clearly indicating the general method of construction and assembly, the methods of achieving surface finishes required herein, including linings, fixing of linings together with positions of joints and the make and type of mould oil proposed.

(iii) The proposed position and type of every construction joint not already shown on the Engineer's drawings.

Such approval by the Engineer shall not be deemed to relieve the Contractor of his obligations to comply with any of the provisions herein.

Concrete mixing and discharge from mixers shall be under permanent cover to the Engineer's approval.

B.29 **Measurement and mixing**

All cement is to be measured by weight, the 50kg bag of cement being used as a unit.

The amount of water shall be the minimum required to produce a dense cohesive concrete of adequate workability, to be determined by trial mixes. This amount shall be accurately gauged and adjusted from time to time to compensate for variations in moisture content of the aggregate by an approved method.

All concrete shall be mixed in a batch type mechanical mixer of approved type having a drum rotating about a horizontal or include axis. The speed of the drum is to be not more than twenty and not less than fourteen revolutions per minute.

Each mixer is to be fitted with a water measuring device capable of accurate measurement to five litres for one cubic meter mixers and prorate for smaller sizes and so arranged that the accuracy is not affected by variations in the pressure of the water supply line. The fine and coarse aggregate and the cement shall be mixed for at least four turns, after which the required amount of water shall be added gradually while the mixer is in motion and the concrete mixed for not less than one and a half minutes to uniform colour and consistency.

The volume of concrete mixed in any one batch is not to exceed the rated capacity of the mixer.

The whole of the mixed batch is to be removed before materials for a fresh batch enter the drum.

Concrete as mixed in accordance with the foregoing shall not be modified by the addition of further water or in any other manner. On the cessation of work, including all stoppages exceeding twenty minutes, or any change of type of cement used in the mix, the mixers and all handling plant shall be washed out with clean water.

At least one slump test shall be made each day concreting is in progress, under the supervision of the Engineer.

B.30 **Reinforcement**

Reinforcement shall be free from all loose mill scale, loose rust, oil, grease or similar defects, immediately before placing the concrete. It shall be bent cold exactly to detail using an approved bending machine. Hooks, bobs, bends, etc., where not, specifically detailed, are to be in accordance with B.S. 4466. Each bundle of bent bars shall be clearly tagged with the bar list number.

Reinforcement shall be placed in the exact position shown on drawings with all inter-sections tack welded or securely tied with 16-gauge soft iron tying wire. The designated cover shall be maintained by approved spacers, chairs, bolsters or ties fixed to the reinforcement. These shall be dense concrete left with a wire brushed surface or be dipped in grout before fixing. These blocks are particularly important where the surface of the concrete is exposed to the weather or dampness. The Contractor must ensure that the bars are securely fixed so as to maintain their indicated positions during the progress of pouring, tamping or vibration of concrete. Six chairs are to be provided around each column to hold top steel in position and chairs are to be made up of mild steel bars of adequate diameter. The cost of providing and fixing these steel chairs must be allowed for by the Contractor in his rates for reinforcement generally. No laps or splices in bars shall be made except those detailed on the drawings without prior approval of the Engineer.

The size and position of the reinforcing bars or mesh shall be approved by the Engineer before concreting commences. The insertion of reinforcement into concrete already placed, the lengthening of bars by welding and the re-bending of incorrectly bent bars will not be permitted.

For concrete having exposed surfaces, reinforcement shall be assembled and placed in such a manner as to avoid any damage to formwork faces.

Where reinforced concrete slabs or walls are constructed against tanking, care shall be taken in positioning reinforcement to avoid damage to tanking.

Unless otherwise shown upon the Engineer's drawings, or specified in BS 8110, the reinforcement bars shall be given the following cover to concrete.

In floor slabs, walls and similar thin panelling, a cover of 15mm, or the size of the bar, whichever is the greater. In beams and other such members, a cover of concrete of 25mm to the main reinforcement, or the size of the bar, whichever is greater.

In foundations and column bases, a cover of 50mm to main reinforcement, or the size of the bar, whichever is greater.

B.31 **Inspection of reinforcement**

When the placing of the reinforcement for a particular section of the works is completed and before concreting commences, the reinforcement will be inspected by the Engineer and no concrete shall be placed until the Engineer's approval has been given. The Contractor shall give the Engineer 48 hours’ notice of the time when the reinforcement will be ready for inspection. Where the distance of the site of the Works is more than 100 kilometres from the nearest office of the Engineer, this time shall be increased to 96 hours.

B.32 **Formwork**

Formwork shall be true to line, level, face and profile and be of robust construction adequately framed, braced, strutted, cramped, tied and propped to restrict deformation due to constructional loads to not more than 3mm, and to entirely eliminate deformation of the form faces by warping or buckling. Wire ties will not be permitted. Formwork shall be grout-tight under all conditions including vibration when specified or used.

Formwork shall be designed to allow prefabrication of conveniently sized elements to facilitate ease of handling and assembly, to permit striking without force shock or any damage whatever to the concrete member or formwork face and to permit the removal of sides without disturbing soffits and soffits without disturbing necessary props. Propping shall be carried down to an approved bearing, shall not be supported by timber floors and shall be arranged that formwork may be lowered smoothly.

Re-propping will not be permitted. Provision shall be made for cleaning out and draining.

Formwork shall be constructed of material or lined with material as may be necessary to achieve the finishes specified herein and in such a manner as to eliminate screw or nail imperfections.

Before each use, form faces shall be treated with the minimum amount of an approved mould oil necessary to obtain a clean release. Mould oil shall not come into contact with the reinforcement.

The use of cement retarders will not be permitted except where a key for other finished is required.

Before placing of the concrete, bolts and fixings shall be in position and cores and other devices used for forming openings, holes, pockets, recesses, ducts or other cavities shall be fixed to the shuttering.

Immediately prior to concreting, formwork shall be thoroughly cleaned out and re-checked. No placing shall commence until the Engineer has inspected the formwork and given his consent for concreting to proceed, but such consent shall not relieve the Contractor of his responsibility for its sufficiency. After striking formwork shall be cleaned, stacked and protected and before re-use shall be serviced, made good or replaced with new as may be necessary to maintain the finish and standard specified.

No surface intended to be horizontal or vertical shall slope more than 2mm in 1metre.Any rectification of work not constructed within the tolerance set out above, shall be entirely at the responsibility and expense of Contractor.

B.34 **Placing and compaction**

No traffic whatsoever, wheeled or foot, shall take place over reinforcement or placed concrete and the Contractor shall provide all necessary stools, walkways, platforms and barrow runs. Concrete shall be placed in its final position as rapidly as practicable by methods which preclude segregation or loss of ingredients and in any case, without 30 minutes from the time that water is added to the mix; compaction shall be completed before initial set commences. Partially set concrete shall not be re-worked or used. "Flowing" in formwork shall be avoided by placing and compacting in shallow layers in quick succession.

Concrete shall be placed into the forms as less a height as possible and shall in no case be dropped from a height of more than 1500mm except with the approval of the Engineer.

When chuting is used, the inclination of the chute must be such as to allow the concrete to flow without the use of excessive water and without segregation or loss of the ingredients. Details of nay proposed chuting plant must be approved by the Engineer before the plaint in delivered to the site.

If the Contractor wished to distribute concrete by means of pumps, full details of the system must be made available to the Engineer for approval. Concrete shall be thoroughly compacted and carefully worked, with suitable tools, into formwork and round reinforcement and fixtures so as to avoid displacement. A competent steel fixer shall attend throughout concreting to correct any unavoidable displacement.

Compaction shall be by means of vibrators, these shall be of an approved pattern, of the immersion type, clamp-on external vibrators in adequate numbers shall be used only where the density of reinforcement precludes immersion.

Attachment to reinforcement is expressly forbidden and accidental contact with reinforcement shall be avoided. Vibration shall be executed by a competent operative and shall not be carried out to the detriment of adjacent partly hardened concrete.

An accurate record is to be kept by the Contractor showing dates and times when various portions of the work were concreted. The concrete foreman must not vary the approved mix or water content without the permission f the representative of the Engineer. It may occasionally be found that in constricted structural members or where the proportion of reinforcement to concrete is high, the workability of the concrete must be increased locally in order to effect full compaction. Such increase in workability shall be achieved by an increase in the mortar content of not more than 10% of the concrete by weight in any single batch and must be made only with the approval of the representative of the Engineer.

The workability of the concrete must never be altered by the use of additional water or sand alone.

Foundations shall be placed their full depth in one operation and the top surface carefully levelled. Concrete placed in timbered excavations shall be well rammed close against the excavation face as the timber is withdrawn.

When the design of the work demands the placing of reinforced concrete against the sides of excavations without the use of formwork, the earth face in such locations shall be prevented from crumbling or washing into the concrete during placing and compaction by any efficient means, and care shall be taken to maintain the correct cover to the reinforcement.

All concreting shall be continuous to completion or to an approved construction joint.

Methods of placing and vibration generally are to comply with the specifications for vibrated concrete as laid down by the Cement and Concrete Association or the manufacturer of the vibrators used on the works.

During placing of all concrete, a workman shall be in constant attendance with a hose pipe to wash off any cement slurry which appears on the face of any previously poured concrete immediately it occurs.

Concrete shall not be poured informs to a depth exceeding 1500mm without the prior approval of the Engineer.

B.35 **Column Plinths**

Column kicker plinths not cast monolithically with the beam or slab will be allowed only at the discretion of the Engineer and special precautions must be taken if permission is granted especially in regard to the quality of the mix used, and the curing of the concrete.

B.36 **Blinding concrete**

No casting of any concrete on the ground shall take place until the ground has been passed as satisfactory by the Engineer. All ground to carry reinforced concrete shall be covered with a blinding layer of concrete 1:10 of the thickness shown on the drawings, or if not so shown, a minimum of 50mm.

B.37 **Waterproof concrete**

Wherever waterproof concrete is shown on the drawings it shall be mix 1:2:4 nominal and it shall be compacted by mechanical vibration so that a dense and homogenous mass of concrete is obtained throughout every pour of the structure.

The Contractor shall be allowed at his own cost to add an approved waterproofing additive to the mix using it strictly according to makers' instructions.

All permanent and construction joints shall be constructed in accordance with the drawings and specifications to achieve complete water tightness.

It shall be the Contractor's responsibility to ensure that all structures required to be constructed in waterproof concrete are completely watertight and any work found to be defective shall be made good to the Architect's satisfaction at the Contractor' expense.

Where waterproof concrete forms a water retaining structure, it is to be tested by filling with water for a period of not less than four days. Any percolation or porous concrete or leaking joint is to be made good at the Contractor's expense. Tanks and pools constructed below ground level are not to be backfilled prior to the satisfactory completion of this test.

B.38 **Construction joints**

All construction joints shall be straight, truly vertical or level, as the cast may be, of the profile shown and formed in the exact positions shown on drawings if not shown on the drawings, with prior approval of the Engineer. Vertical joints shall be formed against adequately secured rigid stop boards having splayed fillets, designed to pass the continuous steel reinforcement without temporary bending or displacement.

The rate and method of placing concrete and the arrangement of construction joint bulkheads shall be such that the concrete between construction joints shall be placed in a continuous operation.

Joints in reinforced slabs, joints and beams, shall be perpendicular to the axis or surface of the member jointed and at the centre of the span. If an intersection member occurs at that point, the joint shall be located at a point of minimum shear.

Construction joints in columns shall be as shown on the drawings. Whenever it becomes necessary to stop work, such stops shall be located at centre of slabs and of beams or as directed by the Engineer.

An adequate and acceptable key for succeeding work shall be formed by using stop boards which shall be constructed tightly to prevent any grout leak. As early as possible boards shall be removed and the surface thoroughly hacked ad brushed to remove all laitance. Any leakage past stop boards shall be hacked off as soon as the concrete has set. The surface shall be left clean and dry. Immediately prior to further concreting the joint face shall be socked with water and covered with sand cement mortar of proportions identical to that in the concrete to be placed, punned into the body of the set concrete.

For exposed finishes, care shall be exercised to preserve an unbroken line at the exposed edge of the joint.

In no circumstances shall the concrete be allowed to finish at a break running down a rough slope. Such cases, if found, will be treated as contrary to the specification and the Contractor will be required to cut out the member and re-cast. In the case of horizontal joints, any excess water and laitance shall be removed from the surface after the concrete is deposited and before it has set.

Before casting slabs, the haunching or seatings for the slab shall be thoroughly hacked, scorched and washed and covered with at least 5mm of mortar immediately before the slab is cast.

Any necessary construction joints in foundations shall be stepped and lapped 600mm. Joint faces shall be prepared and treated as described above.

B.39 **Striking times**

It shall be the Contractor's responsibility that no distortion, damage, overloading or undue deflection is caused to the structure by the striking of formwork, but the Engineer reserves the right to delay the time of striking in the interest of the work. Formwork shall not be struck until the concrete has sufficiently hardened. Approval of the Engineer shall not relieve the Contractor of his liability to make good any concrete damaged by premature removal or collapse of forms. In no circumstances shall forms be struck until the concrete reaches a cube strength of at least twice the stress to which the concrete may be subjected at the time of striking. The following striking times given in (24 hours) are the absolute minimum that will be permitted: -

|  |  |  |
| --- | --- | --- |
| **Forms** | **Ordinary**  **Portland**  **Cement** | **Rapid**  **Hardening**  **Portland**  **Cement** |
| Wall Columns Beam sides | 2 | 2 |
| Slabs - props left under | 4 | 2 |
| Beam soffits - props left under | 7 | 5 |
| Beam - props | 18 | 8 |

The time for removal of foams as set out shall not apply to slabs and beams spanning more than 10 metres. For such spans appropriate times shall be recommended or advised by the Engineer.

B.40 **Curing**

The curing of the concrete must receive particularly careful attention. The concrete shall be covered with a layer of sacking, canvas hessian or suitable absorbent material, and concrete, formwork and covering kept constantly wet for the first seven days after casting.

B.41 **Holes and chases and casting in**

No holes or chases shall be cut in reinforced concrete works. The Contractor shall ensure that all necessary holes and chases, including fixing holes for railings and balustrades etc., are carefully formed in the correct position by requisite measures prior to the placing of concrete.

All conduits, pipes, tubes and the like shall unless otherwise detailed, be run on top of the bottom reinforcement of the concrete work. It shall be the Contractor's responsibility to ensure full co-ordination with Sub-Contractors in the setting out for this purpose.

Generally, conduits, pipes and special fixtures shall be concreted in where required and in the exact positions demanded.

Concrete fixing blocks shall not affect the strength or cover of the structure nor effect finished work due to movement or other cause.

Details of the positions of all holes, chases and fixing blocks shall be submitted to the Engineer of his approval prior to putting the work in hand.

B.42 **Tests of completed structural members**

The Engineer shall instruct that a loading test be made on the works, or any part thereof, if in his opinion such a test be deemed necessary for one or more of the following reasons: -

(a) The site-made concrete test cubes failing to attain the specified strength.

(b) The shuttering being prematurely removed.

(c) Overloading during construction of the works, or part thereof.

(d) Concrete improperly cured.

(e) Any other circumstances attributable to alleged negligence on the part of the Contractor which, in the opinion of the Engineer, may result in the works, or part thereof, being less than the required strength.

If the loading test be instructed to be made solely, or in part, for one or more of the reasons mentioned above, the test shall be made at the Contractor's own cost. If a test be instructed to be made for any other reason than specifically stated above, the Contractor shall make the test and shall be reimburses for all cost relating thereto.

Leading tests are to be in conformity with Clause 605 of British Standard Code of practice CP11/2969.

If the result of the loading test be not satisfactory, the Engineer shall instruct that the part of the works concerned shall be taken down or removed and reconstructed to comply with this specification, or that such other remedial measures shall be taken as to make the works secure.

If the test be instructed to be made for one or more of the reasons (a) to (e) inclusive as herein before specified, the Contractor shall take down or remove and reconstruct the defective work, or shall take the remedial measure instructed, all at his own cost.

B.43 **Protection**

All in-situ and precast concrete shall be protected from rain and during hot, dry and windy weather approved hessian covering kept constantly damp shall be used to prevent premature drying out.

All in-situ and precast concrete shall be protected from damage by disturbance, shock vibrations, early loading or overloading. In addition, all exposed finishes shall be constantly protected from mechanical damage to arises or face and damage due to dropping, splashing and staining from any source including rusty scaffolding or reinforcement.

No materials or equipment of any kind shall be stored or stacked on suspended floors without the Engineer's prior approval.

B.44 **Precast Concrete**

Concrete shall all be cast in properly made strong moulds to form shapes required. For work described as "finished fair" the mould shall be lined with sheet iron or other approved material.

The coarse aggregate for precast concrete shall be of the sizes described.

The Concrete shall be of the mixes described and shall be thoroughly tamped in the moulds and shall not be removed from them until seven days after placing the concrete, but the sides may be removed after three days providing the moulds are such that the sides are easily removable without damaging the concrete.

The precast work shall be cast under sheds and shall remain under it for seven days in the moulds and a further seven days after removal from the moulds. During the whole of this period the concrete shall be shielded by sacking or other approved material kept wet. It shall then be removed from the sheds and stacked in the open for the least seven days to season.

Precast units shall be true and smooth on all faces (except where a key is required for applied finishes) all arises shall be true and clean with no broken edges.

All units shall be marked during manufacture to indicate

(a) The date of casting

(b) Identification lettering in accordance with the drawings

(c) Where necessary, the way up for building in

Ends of bar reinforcement shall be 25mm from internal faces and 40mm from external faces. Nominally non reinforced units may contain reinforcement at the Contractors option for handling purposes, the cost of which shall be deemed to be included in the Contract Sum.

B.45 **Surface finishes**

After removal of shuttering, unless instructed to the contrary, the face of exposed concrete is to be rubbed down immediately to remove fins or other irregularities. In the event of parts of the concrete being honeycombed, such portions are to be cut to a depth and shape required by the Architect and made up with fine concrete of equal quality in such a manner as shall be directed. The faces of concrete for which shuttering is not provided, other than slabs are to be smoothed with a wooden float to given a finish equal to that of the rubbed-down surface where shuttering is provided.

The top face of a slab which it is not intended to cover with other materials is to be levelled and floated before setting to a smooth finish at the levels or fails shown on the drawings or elsewhere. The floating must be carried out in such a way as well prevents an excess of mortar being brought to the surface of the concrete. The top of a slab intended to be surfaced with mortar, granolithic, or similar materials is to be brushed with a stiff broom while still green to remove any laitance and to provide a roughened surface.

(a) **Samples**

Before the execution of any specified finish, the Contractor shall prepare 1200mm square samples for the Engineer approval. No concreting in finish shall be attempted until the approval of a sample. Approved samples shall be retained until the completion of all such work and closely adhered to throughout the work. Rejected samples shall be demolished and removed.

(b) **Rendered or plastered surfaces**

Concrete surfaces to be rendered or plastered shall be thoroughly hacked to form a good key.

(c) **Fair faced surfaces**

Fair faced surfaces shall be free from honeycombing, stains, fins, lippings, nail hole or excessive air holes and shall be of a uniform colour and texture. This surface shall be obtained by the use of: -

(i) Writ forms, i.e. timber forms planed smooth on the surfaces in contact with concrete.

1. Forms lined with hardboard or plywood or other approved material: or

(iii) Smooth steel forms.

All imperfections shall be cut out, made good in cement mortar and rubbed down with Carborundum stone and finally bag rubbed with cement slurry to finish to a high standard without trace of shuttering marks, joints or other disfigurements.

(d) **Board marked finish**

Where so described or measured, faces of concrete shall be finished fair by means of 100m or 150mm (nominal) width tongued and grooved boarding of 25mm (minimum) thickness. The edges to all boards shall have a nominal 2mm chamfer to form controlled fins.

Such formwork to column faces shall be continuous length boards between construction joints.

End joints will be permitted to beam faces, etc. and shall be tongued, staggered and well distributed.

All imperfections shall be clearly showing grain and individual board marks, be free from honey-combing and excessive air holes, of uniform colour and to the entire satisfaction of the Engineer.

B.46 **Method of measurement**

Prices are to include for working concrete around pipes and electric conduits or cable, including provision for support of same while concrete is placed.

The prices for in-situ work are to include for filling into, or on to, formwork where necessary, and where concrete is described as reinforced for well tamping around reinforcement. Unless otherwise described, all formwork and reinforcement are measured separately.

Prices for precast concrete work; including items described as precast or in-situ, shall include for all moulds, for hoisting and for placing in position, bedding, jointing or building in with cement mortar.

All reinforcing bars are of round section unless otherwise stated and no allowance has, or will be, made for rolling margin.

Prices for holes shall include for them being on rake where so required and shall include the necessary holes through formwork.

The cost of all construction joints, as described herein and not specifically shown on the drawings and measured separately in this Document, shall be deemed to be included in the rates set against the other items in this Document.

The cost of providing all samples described herein shall be deemed to be included in the Contract Sum.

The cost of performing all tests described herein shall be deemed to be included in the Contract Sum except the nett invoiced cost of testing items or samples at authorised testing laboratories as instructed by the Architect or Engineer, which costs will be reimbursed from the Provisional Sum included elsewhere in this document.

**WALLING**

**GENERALLY**

C.1 **Testing:**

The Contractor shall, as and when required by the Engineer, submit and deliver samples of any materials for testing in accordance with the relevant current B.S. Specification. Samples of mortars, when required, are to be delivered in watertight boxes provided by the Contractor.

C.2 **Samples and sample panels:**

Samples of all types of blocks, bricks and stone required for the works shall be produced to the architect for his prior written approval before any orders are placed. After approval of samples, the Contractor shall erect a 1200mm x 1200mm sample panel of any brickwork, stone work or fair face block work required by the Architect. No work shall be commenced until written approval has been given to sample panels, which shall be maintained for the duration of the execution of the works to which the sample applies. The work executed shall not be inferior in any respect to the approved sample. Inferior works shall be taken down and removed if required by the Architect. The cost of providing samples and sample panels shall be deemed to be included in the Contract Sum.

**MATERIALS**

C.3 **Cement:**

Cement shall be as described in Concrete Work.

C.4 **Fine aggregate**

Fine Aggregate for concrete blocks shall be as described in Concrete Work

C.5 **Coarse aggregate**

Coarse Aggregate for concrete blocks shall be good, hard, clean aggregate from approved quarries. It shall be free from all decomposed materials and shall be graded up to 10mm and all as described for coarse aggregate in Concrete Works.

C.7 **Sand for mortar**

Sand for mortar shall comply with B.S. 1200.

C.8 **Concrete blocks:**

Concrete blocks for walling shall be provided by the Contractor complying with B.S. 6073 Type A, and made in approved block making machine of a composition as follows: -

|  |  |  |
| --- | --- | --- |
| Portland cement |  | 1 cubic metre |
| Fine Aggregate (graded up to 5mm) |  | 3 cubic metres |
| Coarse aggregate (graded up to 10mm) |  | 6 cubic metres |

Blocks shall be solid or hollow tow-hole type as specified and are to be made under sheds erected by the Contractor to the directions and approval of the Architect. Samples shall be approved by the Architect before any walling work is commenced.

The compressive strength of Type 'A' blocks (non-loading bearing) shall be not less than: -

|  |  |  |
| --- | --- | --- |
| Average of 10 blocks |  | 4.5 N/sq mm gross area |
| Lowest individual blocks |  | 2.8 N/sq mm gross area |

When load bearing, the compressive strength of blocks shall be: -

|  |  |  |
| --- | --- | --- |
| Average of 10 blocks |  | 7.0 N/sq mm gross area |
| Lowest individual block |  | 5.6 N/sq mm gross area |

All testing shall be in accordance with B.S. 6073.

The concrete is to be put into the machine's moulds in thin layers and all properly tamped therein. On removal from the machines the blocks are to be carefully deposited on racks under sheds erected by the Contractor to the direction and approval of the Architect and there left for three days and kept thoroughly wet the whole time, after which they shall be put out in the open on racks and protected with approved matting, sacking or straw and kept wet for a further five days, then kept in the same position and under same mat cover, but without wetting, for a further two days and then left in the open without matting or wetting for a further seven days to season.

The blocks must be left with good sharp edges. The blocks for use in the works shall be 225mm high and may vary in length from 300mm to 45omm and no variation above or below these lengths will be allowed except where required to form proper bonding at corners, around openings, sills, lintels, beams, etc., and the like positions and the Contractor must make or cut blocks to all the varying sizes required for these purposes and include this in his price.

Blocks to be subsequently covered with an in-situ finishing may be slightly rough in texture. Fair face blocks shall be perfectly smooth.

C.11 **Clay Bricks:**

All clay bricks shall be obtained from a manufacturing source specified by the Engineer in writing, or where not so specified, approved by him in writing, and complying with BC 3921,

All bricks incorporated into the works shall be properly burnt, clean, hard, of well-defined arris, uniform in shape and as near uniform in colour as possible. Bricks to be used for face work shall be selected to the Architect's approval.

C.15 **Storage of materials**

**Cements and limes** shall be stored off the ground, under cover and away from damp, and in such manner to enable them to be used in rotation in order of delivery.

**Sands** shall be stored separately according to type on clean, hard dry standing and protected from contamination.

**Sands for pointing** shall be stored separately, away from other sands and shall be obtained in sufficient quantity at one time to enable materials of the approved colour to be used for the whole of the work.

**Precast concrete blocks and louvre or grille blocks and clay bricks and blocks** shall be open stacked to permit ventilation and protected from the sun, rain and rising damp.

C.16 **Wetting blocks and bricks:**

Concrete blocks and louvre or grille blocks and clay bricks and blocks shall be wetted as necessary before and after laying. Walls shall be kept wetted for three days after building.

C.17 **Bonding walling:**

The blocks shall be properly bonded together and in such manner that no vertical joint in any one course shall be within 115mm of a similar joint in courses immediately above or below. Sufficient through bonders shall be provided as directed by the Architect. Alternative courses of walling at all angle and intersections shall be carried through the full thickness of the adjoining walls. All walling shall be built up entirely solid in blocks, without voids, allowance being made for joints 10mm thick only. All perpends, reveals and other angles of the walling shall be built strictly true and square.

C.18 **Generally:**

The Contractor shall provide all setting out rods.

All surfaces on which blockwork or brickwork is to be built shall be clean. All blockwork and brickwork shall be built uniform, true and level, with all perpends vertical and in line. No work shall rise more than 1 metre above adjoining works and all such risings are to be properly racked back in long steps to prevent cracks arising, and all walls shall be levelled around at each floor.

Joints generally are not to exceed 10mm in thickness. Cutting of blockwork against concrete soffits, etc., shall include for cutting to give normal 10mm joints and complete filling thereof with mortar.

All walls built in hollow concrete blocks, where finishing with an open top edge, (i.e. not against ceiling, beam, etc.), or at the underside of sills, shall be finished with a solid concrete block too course.

Where walling is to be fair faced in blocks, the blocks shall be selected and shall all have cleaned arises.

C.20 **Mortar mixing:**

All materials shall be accurately gauged by gauge boxes and mechanically mixed and used within 30 minutes of first mixing. Proportions shall be cement and sand (1:6) by volume.

Re-tempering of mortar will not be permitted. Gauge boxes and mixers shall be kept clean.

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**ROOFING**

D.3 **Examine roof coverings:**

Before delivering up the Works, examine the roof coverings and leave the roofs clean, watertight and drop dry.

**CORRUGATED OR TROUGHED SHEET ROOFING**

D.4 **Sheet roofing generally:**

All sheet coverings shall be laid away from the prevailing weather i.e. the exposed edge of the top most sheet to be on its leeward side.

D.5 Profiled aluminium sheet roofing:

(i) Profiled aluminium sheets are to comply with BS 4868 and are to be colour coated by the manufacturer after formation and of the gauges specified, laid with one and a half corrugation side laps and 150mm end, laps. Sheets are to be properly stacked on battens and if kept in the open are to be stacked inclined to facilitate run-off of rainwater.

(ii) Fixing corrugated steel sheeting is to be by means of 14-gauge drive screws in the case of a timber roof supporting structure, and 6mm galvanised hook bolts in the case of a steel supporting structure.

Both types of fixing to incorporate a bituminous felt washer backed by a cranked diamond shaped aluminium washer immediately below the screw head or nut whichever the case may be.

Each sheet is to have a minimum of two fixings and the holes for the bolts or screws are to be drilled through the crown of the corrugation and be of such size so as to give a 0.80mm clearance on the bolt or screw.

(iii) Colour coated roofing sheets are to be finished to an approved colour by spraying and oven curing at the manufacturer's works. Care is to be taken to avoid damage to the finish and small scratches and blemishes are to be touched up on site with paint supplied by the manufacturer of the sheets. Sheets with large scratches are to be returned to the supplier for refinishing or are to be replaced.

(iv) Accessories are to be obtained from the same supplier as the roof sheeting and are to properly match the colour of the roof sheeting.

D.6 **Asbestos cement sheet roofing:**

(i) Corrugated asbestos cement sheets, accessories and fixings shall comply with BS 5247 and be as manufactured by Asbesco Ltd. Sheets are to be stacked on a smooth, level foundation, under cover, on cross battens, two per sheet up to 1500mm long and three for sheets over 1500mm. Stacking is not to exceed 1200mm high without battens and a maximum of 3000mm with battens every 500mm.

(ii) Fixing asbestos cement sheeting is to be means of bolts, hook bolts or roofing screws with PVC caps and "Seal washers: all to be obtained from Asbesco Ltd.

All sheets are to be drilled and no other method for forming the holes through the crown of the corrugations will be allowed.

No fixing whether for a roof sheet or an accessory should be the nearer than 40mm to nay edge of the member.

In order to provide close fitting of the sheets two diagonally opposite corners of each sheet are to be mitred. For sheets laid from left to right, mitre the bottom right hand and top left-hand corners, and for sheets laid from right to left, mitre the bottom left hand and top right-hand corners

(iii) Side and end laps and accessories shall be bedded in approved bituminous sealer.

**BITUMINOUS FELT ROOFING**

D.7 **Approved Subcontractor:**

The Contractor is required to arrange for the work to be executed complete and to the entire satisfaction of the Architect but an approved Subcontractor.

**CARPENTRY AND JOINERY**

**QUALIFICATIONS OF THE RULES OF THE S.M.M.**

E.1 **Holes in timber**

Notwithstanding the provisions of S.M.M. Clause E.38 (a), where work is described as fixed with screws, holes in timber shall be deemed to be included.

E.2 **Fixing by bolting, etc.**

Notwithstanding the provisions of S.M.M. Clause A.3 (b) (iii), the term 'fixing up' used in conjunction with any method of fixing shall not be deemed to include any fixing materials but shall be interpreted as a definition of fixing method only.

E.3 **Fixing ironmongery**

Notwithstanding the provisions of S.M.M. Clause E.39 (a), fixing with bolts or other devices shall be deemed to be included where these are normally supplied with the ironmongery concerned.

E.5 **Finished sizes**

All members shall be finished to the sizes stated or shown on the drawing. The prices inserted by the Contractor shall be deemed to include for the nominal sizes necessary to produce the finished sizes stated.

E.6 **Selected**

The term 'selected' shall be deemed to include keeping the material so described clean for staining, polishing, or any similar finish.

E.7 **Hardwood or the like**

The term 'hardwood or the like', which is used as a statement of background to which ironmongery is to be fixed, shall be deemed to include plywood and other manufactured materials are faced with metal, laminated plastics or the like.

**MATERIALS**

E.8 **Terminology**

All technical terms shall be as defined in the relevant timber Ordinances.

E.9 **Timber generally**

Timber shall be from an approved sawmill, be sound, well-conditioned, properly seasoned to suit the particular use, straight grained, and free from defects or combination of defects rendering it unsuitable for the purpose intended, and containing not more than 15% moisture for joinery work or 18% moisture for carpentry work.

Structural timber is to be approved local softwood or hardwood as specified of strength grade tow supplied in long lengths, with a tolerance of 5mm on scantlings, but of uniform width and thickness. Boards and scantlings which are specified as 25mm or less in thickness are to hold up to the full size. Structural timber shall be deemed to be sawn on all faces unless otherwise state as wrote.

Joinery timber shall be approved prime select grade local hardwood as specified and shall be held to be wrote by machine dressing unless otherwise stated.

All timber for the Works is to be purchases immediately the Contract is signed and is to be open stacked for as long as possible before use or kiln drying.

All timber and assembled woodwork shall be protected from weather and stored in such a way as to prevent attack by terminate, insects or decayed fungi.

E.10 **Approval**

Any timber brought to the site and rejected by the Engineer, shall be removed from the site at the Contractor's expense.

Should any timber be found to contain disease, pest, borers, termites, or any other defect after incorporation in the work, and until the expiration of the maintenance period, notwithstanding that the timber may have been approved by the Architect when brought to the site, such timber shall be removed and replaced, together with all works disturbed, at the Contractor's expense.

No timber is to be incorporated in the building which has been used for formwork, planking, strutting, scaffolding, or any other form of plant.

E.11 **Species of timber**

The following timbers shall be used where specified and the common names used throughout this document correspond to the botanical names as follows:

|  |  |  |
| --- | --- | --- |
| **Common Name** |  | **Botanical Name** |
| Pine |  | Pinus Patula |
| Cypress |  | Cypressus lusitican |
| Podocarpus |  | Podocarpus spp. |
| African Mahogany |  | Khaya nyasica |
| Mninga |  | Pterocarpus Anglolensis |
| Mvule |  | Chlorophora excelsa |

E.12 **Plywood**

The plywood shall be from a manufacturing source approve by the Architect and shall comply in all respects with the requirements of B.S. 6566.

Grade 1 veneer plywood shall be using visible surface is to be wax polished, varnished, plastic lacquered or left untreated.

Grade 2 veneer plywood shall be used where subsequent painting is intended.

All plywood shall be WBP bonded, and of marine quality when specified.

Routine tests will be required from time to time to check the quality of plywood manufacture.

E.13 **Chipboard**

Chipboard shall comply with B.S. 5669.

E.14 **Blockboard**

Blockboard shall be from a manufacturing source approved by the Architect and shall comply in all respects with B.S. 3444. The grade of the veneer shall be as described in the measured items.

E.15 **Fibreboard**

Fibreboard shall be Celotex, or other equal and approve make, of the thickness specified and complying in all respects with the requirements of B.S. 1142 Part 3.

E.16 **Hardboard**

Hardboard shall comply with B.S. 1142 Part 2 and be tempered.

E.17 Laminated plastic sheet

Laminated plastic sheet shall comply with B.S. 3794 Class 1; from an approved manufacturer. Prior to fixing laminate plastic sheet, the Contractor shall obtain the Architects written approval to a sample.

E.18 **Pressure impregnated treatment**

All timber used in carpentry, grounds for fixing joinery, etc., is to be vacuum pressure impregnated with Tanalith C preservative to a dry salt nett retention of 10kg of Tanalith C per cubic metre of timber and stacked until be moisture content returns to 18% or 15% as above described.

Timber to be treated shall be machined to finished sections and cut to component lengths before impregnation.

Cut ends, notching, boring, and faces of timber sawn after treatment are to be swabbed liberally with Wolmanol end grain preservative, allowed to dry, and them applied in a similar manner a second time. The Contractor's prices for such timber must allow for this treatment.

E.19 **Screws, nails, bolts, etc.**

Screws, shall comply with B.S. 1210 and nails with B.S. 1202. Bolts shall be generally cup square with large washers and nuts.

Other fixing accessories are to comply with B.S. 1494.

E.20 **Adhesive**

Adhesive shall be synthetic resin type complying with B.S. 1204. Part 1, type WBP.

**WORKMANSHIP**

E.21 **Generally**

Workmanship shall comply with B.S. 1186 Part 2.

E.22 **Contractor to check discrepancies**

The Contractor shall be responsible for ascertaining from the site and for checking all dimensions before the joinery is put in hand. Any discrepancies between site dimensions and those shown on the Architect's drawings shall be reported immediately to the Architect for rectification.

E.23 **Storage**

Joinery shall be protected from the weather during transit and shall be stored under cover, clear of the ground, in clean, dry ventilated structures, before and after priming.

E.24 **Priming**

All joinery shall be delivered to the site unprimed and shall be primed, (as measured in Painting and Decorating), immediately after inspection, and before fixing

E.25 **Arrises**

All arrises exposed in the finished work shall be runned down with glass paper.

E.26 **Fabrication**

All joinery is to be purpose made and constructed to detail drawings, in a workmanlike manner, morticed and tenoned, dovetailed, tongued and grooved, glued, pinned, screwed, etc., as best suited to the particular part. All mortice and tenon joints are to be pinned with hardwood dowels or with brass pins in addition to wedging and gluing. All joinery shall be put together with waterproof adhesive.

All carpenter's work shall be accurately set out in strict accordance with he drawings and shall be framed together and securely fixed in the best possible manner with properly made joints. All necessary brads, nails and screws, etc, shall be provided as directed and approved.

E.27 **Fixing fibreboard, hardboard and chipboard**

Unless otherwise specified fibreboard hardboard and chipboard, shall be pinned to its backing, hands punched below the surface and puttied flush.

E.28 **Fixing laminated plastic**

Laminated plastic shall be fixed with an adhesive recommended by the manufacturers, and in accordance with their instructions.

E.29 **Plugs**

The centres of fixing plugs shall not exceed 600mm and shall be closer if the work so requires.

E.30 **Nailing and screwing**

Where items are described as 'fixed with screws' hey shall be brass screws of the appropriate gauge and length, countersunk and pelleted where applicable. In all other instances wrot timber shall be fixed with oval brads, round lost heads or cut clasp nails punched and puttied; carcassing timber shall be spiked, well driven and clenched.

E.31 **Joints in structural timbers**

Structural timbers shall as far as in practicable be in single lengths. Where joints are unavoidable, they shall be scarfed, spiked and bolted as required. Generally, scarfs shall be 450mm long.

Bolt holes should be drilled to diameters as close as possible to the nominal diameter of the bolt and in no case more than 1.6mm larger than the bolt diameter. Care should be taken to avoid placing a bolt in nay end split. A minimum of one complete thread should protrude from the nut. The minimum sizes of washers are given below: -

|  |  |  |
| --- | --- | --- |
| **Diameter of bolt** | **Minimum thickness of washer** | **Minimum size of square or diameter of washer** |
| 10 to 12mm | 3mm | 50mm |
| 16 to 22mm | 5mm | 65mm |
| 25 to 32mm | 6mm | 75mm |

E.32 **Lipping to block board**

All exposed edges of block board, including those to be covered with Formica, shall be lipped with a hardwood lipping to the size specified for the full thickness of the board to match the veneer of the general face. Lippings shall be fixed with pins of the appropriate gauge and length, punched and puttied. Where described as 'tongued', the edge of the blockboard shall be grooved to receive the lipping with shall be rebated twice to form the tongue.

E.34 **Flush doors**

Flush doors shall be of the sizes and thickness indicated on the drawings.

The doors, unless otherwise described, shall be semi-solid core having stiles, top and bottom rails, filled in with core slats at approximately 50mm centres, or slats to an egg crate pattern.

Doors intended for interior or exterior use shall be faced on both sides with 6mm exterior marine quality plywood with the grade of veneer as specified in the measured items.

All flush doors shall have lipped edges. The members of all doors shall be bonded with the same adhesive as is required for the bonding of the plywood with which they are faced.

No flush doors shall be incorporated in the works without first obtaining the Architect's approval of a sample.

E.35 **Inspection and testing**

The Architect shall be given facilities for inspection of all works in progress whether in workshops or on site. All timber as it arrives on the site may be inspected by the Architect and any timber brought on to the site and not approve by him must be removed forthwith, failing which he may arrange for the removal of the rejects and dispose of them as he may consider advisable at the Contractor's expense.

Notwithstanding approval having been given as above, any timber incorporated in the Works found to be in any way defective before the expiry of the maintenance period shall be removed and renewed at the Contractor's expense. The Contractor is to allow for testing of prototypes or special construction units and the Architect shall be at liberty to select any samples he may require for the purpose of testing, i.e. for moisture content, or identification of species, strength, etc. Where timbers need to be extended into a wall, they shall be thoroughly "brush treated" with "Tanalith" in addition to preservative treatment as already described above, and as much clear air space maintained around the timber where it adjoins the wall as possible.

E.36 **Casings and Protection**

All fixed joinery which is liable to become bruised or damaged in any way, shall be properly cased and protected by the Contractor until the completion of the Works.

E.37 **Clearing up**

The Contractor is to clear out and destroy or remove all cut ends shavings and other wood waste from all parts of the building and the Site generally, as the work progresses and at the conclusion of the works.

**IRONMONGERY**

E.38 **Generally**

The rates of r ironmongery shall include the cost of all fixing screws.

E.39. **References**

Where items of ironmongery are not specified by manufacturers catalogue reference, the Contractor shall submit for the Architects approval within one month of the date of possession of site, specifications including manufacturers catalogue reference numbers of the items he proposes to purchase.

Prior to fixing any item of ironmongery, the Contractor shall obtain the Architects approval of a sample.

E.40 **Fixing**

Joinery is to be countersunk for ironmongery and screws. Where woodwork is painted the ironmongery shall be fixed while the joinery is primed but before painting. All lock handles and the like shall be removed until after painting is complete when they will be fitted and adjusted and left in perfect working order.

E.41 **Keys and labels**

All locks are to be provided with two keys and no key is to pass the wards of any but its own lock. All keys are to be provided with a key ring and plastic tag on which is firmly written the position of the door.

E.42 **Method of measurement**

Fixing shall include all fitting, cutting, sinking, boring and morticing, easing and adjusting.

**METALWORK**

**QUALIFICATION OF THE RULES OF THE S.M.M.**

F.1 **Backgrounds**

Notwithstanding the provisions of S.M.M. Clause F.1 (a) (iii) the background or support to which metalwork is fixed shall be deemed to be any background compatible with the method of fixing given in the descriptions.

F.2 **Preparation for welding**

Notwithstanding the provisions of S.M.M. Clause F.1 (d) (iii), description of work required to be welded and ground to smooth finish shall be deemed to include the preparation of the members.

F.20 **Welding**

The work 'welded' is to be understood to include the normal trade methods of jointing metals using an oxyacetylene torch, rod and flux. The joints shall be made so that they will transmit the loads and resist the stresses to which they will be subjected. All excess metal is to be filed down and smoothed off to a workmanlike finish to the approval of the Architect. The materials employed in welding shall be selected with due regard to the character of the work and the metals being connected.

F.21 **Structural work generally**

The whole of the fabrication and erection of the structural metalwork shall be carried out in accordance with B.S. 4360 Part 2. The welding of steel to B.S. 4360 must conform to: -

B.S. 1140 - "resistance spot welding of uncoated and coated low carbon steel"

**or**

B.S. 5135 – "metal arc welding of carbon and carbon manganese steels"

as applicable.

For welding any particular type of joints, the Contractor shall provide evidence acceptable to the Architect that the welder has satisfactorily completed the appropriate tests as described in B.S. 449, Part 2, Chapter 6. Any welder's tests shall be made at the Contractor's expenses and shall include the cost of any fees incurred by the Employer for witnessing of, or marking such tests.

F.22 **Rejection**

Any portion of the work which, in the opinion of the Architect is not in accordance with the drawings or specification shall be rejected whether before or after delivery and must be removed from the site if delivered, within 24 hours from receipt of such notice of rejection at the Contractor's expense. Any delay caused by such rejection will not in any way relieve the Contractor from his responsibility with regard to the provisions of the Contract.

F.23 **Fabrication**

As much of the work fabrication of the structural metalwork as is reasonably practicable shall be completed in the manufacturer's works. Field connections shall be made in accordance with the approved drawings. The Contractor shall give four days' clear notice of structural metalwork ready for inspection at the manufacturer's works, to facilitate inspection before delivery.

F.24 **Joints and connections**

No variation of the number, type or position of the joints or connections shown on the drawings of structural metalwork shall be made without the consent of Architect. If such consent is desired the Contractor shall submit detailed drawings of the proposed joints for the approval of the Architect and no extra cost incurred by reason of such additions or alterations will be allowed to the Contractor.

F.25 **Painting at works**

Where described as primed at works, structural metalwork shall be freed of rust, mill scale, welding slag and flux residue and shall be dry immediately prior to painting with primer.

For joints with high strength friction grip bolts the contact surface shall be left unpainted but special care shall be taken after assembly to paint all edges and corners near the joints together with bolt heads, nuts and washers to prevent the ingress of moisture. For joints made with other bolts and rivets the contact surfaces shall each be given a coat of priming paint and for shop connections the contact surfaces shall be brought together while the paint is still wet.

For welded connections where the contact surfaces are not completely sealed the contact surfaces shall be painted to within 50mm of the edges that are to be welded. The primer shall be touched up with similar primer if damaged by subsequent handling.

F.26 **Welded members to be galvanised**

All welded members which are to be galvanised shall be galvanised only after all fabrication and welding is complete.

F.27 **Metalwork to be painted**

All metalwork which is to be painted shall be painted with one coat of primer before fixing.

F.28 **Fixing windows**

Windows shall be fixed entirely in accordance with the manufacturer's instructions. They shall be properly stored at the site off the ground under weatherproof cover.

F.29 **Method of measurement**

Joints in the running length of members of balustrades, etc., required by the fabricator for ease of transporting and fixing, shall be deemed to be included in the prices for such work

Except where otherwise described, holes, bolts, and cutting and pinning have been measured separately

**PLUMBING INSTALLATIONS**

G.1 **Jointing pipes**

Notwithstanding the provisions of S.M.M. Clause G.9 (b), the prices for all galvanised steel screwed pipes shall be deemed to include for jointing with hemp and red lead or 'Boss' white unless otherwise described and the prices for all cast iron pipes shall be deemed to include for jointing with a gasket of hemp and cold caulking compound unless otherwise described.

G.2 **Provision of holes**

Notwithstanding the provisions of S.M.M. Clause Q.1(g), the provision of holes shall be deemed to be included in the description of fixing.

**DEFINITIONS**

G.3 **Painting**

The preparation of surfaces shall be deemed to be included with the description for painting. Specific requirements relating to the preparation of surfaces are given in the WORKMANSHIP section of these Preambles. In the absence of specific requirement surfaces shall be prepared in the manner recommended by the manufacturer of the paint being used.

G.4 **Welding**

In the absence of specific requirements, the techniques and material employed in welding shall be selected with due regarding to the character of the work and the metals being connected.

G.5 **Backgrounds requiring plugging**

The term 'backgrounds requiring plugging' shall mean any or all of the backgrounds described in S.M.M. Clause Q.1 (h) (iv), and shall be deemed to include the associated plugging.

G.6 **Plugging**

The term 'plugging' shall mean provision and fixing of hardwood or approved proprietary plugs, or, at the Contractor's option, fixing by means of a cartridge operated rivet gun or other approved mechanical means.

G.7 **Surface finishes**

In the absence of specific requirements, the treatment and finish of pipe fittings shall be appropriate to the finish of the pipes with which they are associated.

G.8 **Pipe sizes**

The size of the pipe shall be the diameter of the bore.

**GENERALLY**

G.9 **Execution of plumbing work**

All plumbing work shall be executed in accordance with the best principles of modern practice by a firm of fully qualified and registered plumbers. The Contractor shall obtain the Architects written approval to the firm he proposes to employ before the plumbing work are commenced.

The Contractor shall obtain the Architects prior written approval to the position of all pipe runs, valve positions, control points, access points and the like for all plumbing installations.

At the time of practical completion, the Contractor shall prepare and hand to the Architect four copies of plans and diagrams showing the positions of all pipe runs, valve positions, control points, access points and the like for all plumbing installations. Such plans and diagrams shall be to the Architects approval, and practical completion of the plumbing installation shall be deemed to have taken place only after receipt by the Architect of such approved plans and diagrams.

All plumbing and drainage works shall be executed in accordance with the Regulations of the Local Authorities and Water Supply Companies. The Contractor shall give all notices and pay all fees required thereunder. The amount of such fees shall be deemed to be included in the Contract Sum, unless they are expressly included in these documents by way of a Provisional Sum or PC Sum.

**RAIN WATER INSTALLATIONS**

G.10 **Plastic pipes and fittings**

Plastic pipes, fittings and accessories shall be obtained from a manufacturing source approved by the Architect in writing to comply with B.S. 4576, heavy grade PVC, colour to be selected by the Architect, fixed true to line with straps, supplied by the manufacturer screwed to hardwood plugs with galvanised screws, and jointed all in accordance with the manufacturer's instructions. Rubber sealing rings shall comply with B.S. 2494 type 2.

G.12 **Rainwater outlets**

PVC rainwater outlets shall be manufactured to the sizes and profiles measured herein from heavy grade PVC, with a minimum 75mm wide flange all-round the top for fixing to roof surfaces; fully bedded in hot bitumen and jointed to the PVC rainwater pipes.

G.13 **Testing**

Rainwater installations shall be subjected to a water test and proved capable of withstanding a pressure of 1.05m head of water to the satisfaction of the Architect. Any defects are to be made good by the Contractor and the whole system left sound and perfect.

**SANITARY INSTALLATION**

G.27 **Pipework generally**

Pipes shall be in the maximum lengths possible to avoid unnecessary jointing. Pipes shall be fixed to sufficient falls to prevent air locks and to enable the system to be drained.

**Bin-taps** shall comply with B.S. 1010 and shall be of brass with fixed jumpers and where so described shall be chromium plated or shall have nozzle screwed for hose union and locking arm.

**Stop valves** shall comply with B.S. 1010 and shall be of brass with crutch handles or loose key whereas described. These in exposed positions shall have polished brass bodies.

**Gate, check and globe valves** shall comply with B.S. 5154 and shall be of copper alloy unless otherwise described. Cast iron gate valves shall be parallel slide pattern valves to comply with B.S. 5151.

G.30 **Tanks and cisterns**

Storage tanks shall be sectional pressed galvanised steel tanks of 4.5mm plate of approved manufacture complete with cover with inspection manhole. Tanks shall be assembled entirely in accordance with the manufacturer's written instructions.

Storage cisterns shall comply with B.S. 417, Part 2, Grade A, galvanised with one-piece galvanised covers.

G.31 **Testing**

Clean out storage cisterns and tanks, including removal of all swarf, fill and test the whole of the hot and cold-water installations, rectify all defects, drain and leave in a clean, serviceable condition.

F**LOOR, WALL AND CEILING FINISHINGPLASTERWORK**

H.1 **Generally**

Render, both internal and external shall be cement and sand in the proportions 1:4 finished to thickness specified.Plaster shall consist of an undercoat of 1 part cement to 4 parts and by volume and 5% lime putty, and a finishing coat of 1 part cement to 1 part sand to 5 parts lime putty. Each coat shall be finished to the thickness specified.

H.2 **Cement**Cement shall be ordinary Portland cement and shall comply with B.S. 12. White and coloured cements shall comply with B.S. 12 and be obtained from an approved manufacturer.

H.3 **Lime putty**Lime putty shall be prepared from hydrated lime complying with B.S. 890.

Hydrated lime shall be added to water, stirred to a creamy consistency and left to mature for at least 16 hours before use.Alternatively, ready slaked lime may be obtained from an approved source.The lime putty shall be protected from drying out.

H.4 **Sands**Sand for cement and lime mixes shall comply with B.S. 1199. Table I.

Sand for use with White Portland cement shall be silver sand and that for use in coloured cement mixes shall be of a suitable colour.

H.5 **Water**

Water shall be clean and kept free from all impurities.

H.6 **Storage of materials**

All plasters, lime and cement, shall be stored in a properly roofed, weatherproof, dry, well-ventilated shed, used exclusively for this purpose, with a wood floor not less than 150mm clear above the ground. All sands shall be stored separately, according to type, on clean, hard dry standing and shall be protected from contamination.

H.7 **Testing**

Samples of all materials, as directed, shall be taken from time to time as required by the Architect.

All defective materials shall be removed from the site without delay, at the Contractor's expense.

H.8 **Preparation of surfaces**

Surfaces to receive plastering shall be dry brushed to remove all loose particles, dust, laitance, efflorescence, etc., and any projecting fins on concrete surfaces shall be hacked off. All trances of mould oil shall be removed from concrete surfaces by scrubbing with water containing detergent and rinsing with fresh water.

Concrete surfaces shall be hacked over to provide adequate key.

Surfaces shall be wetted and re-wetted as required to equalise suction before the plaster costs are applied. In particular, dense hard concrete surfaces shall be wetted and re-wetted as required before bonding plaster is applied.

H.9 **Dubbing out**

Dubbing out shall be in the same mix as subsequent coats and shall not exceed 10mm in thickness in one particular application.

H.10 **Mixing of materials**

All materials shall be thoroughly mixed in the proportions described. No mixes of plasters, other than those described, shall be used.

Bunkers and gauge boxes shall be thoroughly cleaned after each mix and due care and attention shall be given at all times to their cleanliness.

Cement - lime - sand plasters shall be used within two hours of the gauging with cement.

All tools shall be kept clean and fresh plaster shall not be contaminated with set plaster.

H.11 **Period between coats**

Cement - lime - sand undercoats shall be allowed to dry out thoroughly before a further coat is applied.

H.12 **Finish**

All undercoats shall be scratched to provide an adequate key for the next coat. Unless otherwise described, all rendering shall be finished with a wood float, as shall all undercoats. All finishing coats shall be finished with a steel trowel.

H.13 **Junctions of wall and ceiling**

A neat definite cut shall be made with the edge of the trowel through all coats of the wall plaster at the junctions with ceilings.

H.14 **Arrises**

All arrises shall be pencil rounded unless otherwise specified.

**BEDS AND BACKINGS**

H.15 **Materials, storage, testing and mixing of materials**

Cement, sand, water, etc., storage, testing and mixing of materials shall be as described for plasterwork.

H.16 **Light weight roof screed**

Light weight roof screed shall consist of one-part cement to eight parts vermiculite aggregate, laid to falls as necessary and shall be covered with a minimum of 12mm cement and said (1:4) screed finished to suit the requirements of the particular finishing.

All junctions between horizontal and vertical surfaces to roofs shall be finished with a triangular angle fillet of the sizes described.

Light weight roof screed shall be cured properly for 7 days, and shall be thoroughly and completely dry before any finishing is applied.

H.17 **Cement and sand proportions**

Cement and sand shall be in the proportions of 1:3 or 1:4, as specified, by volume.

H.18 **Preparation of surfaces**

Walls shall be prepared as described for 'Plasterwork' Concrete floors or roofs to receive screeds or pavings shall be hacked where necessary to remove concrete mortar or plaster dropping and to expose the coarse aggregate and well brushed to remove all loose particles and dirt.

Concrete floors and roofs shall be wetted before screeds or pavings are laid, with a cement sand slurry (1:1) being scrubbed into the surface in front of the screed or paving laying.

H.19 **Laying**

Beds and backings shall be laid in bays of suitable lengths and widths and to falls where so shown with proper screeds and shall be kept wet and protected until set hard.

H.20 **Surface of beds and backings**

Screeded beds for in-situ floor finishings or floor finishings bedded in mortar, shall be left rough from the screeding board.

Floated beds for inflexible floor finishings bedded in mastic, shall be left with a plain untextured surface.

Trowelled beds for flexible finishings shall be finished smooth and free from score marks, grooves or depressions.

Screeded backings for in-situ wall finishings or wall finishings bedded in mortar, shall be scratched for key.

Floated backings for inflexible wall finishings fixed with adhesive shall be left with a plain surface.

Trowelled backings for flexible wall finishings shall be finished smooth and free from score marks or depressions.

Beds and backings for finishings by specialists shall be to the approval of the specialist Sub-Contractor.

**OTHER INSITU FINISHINGS**

H.21 **Materials, storage, testing and mixing of materials**

Cement, sand, water, etc., storage, testing and mixing of materials, shall be as described for 'Plasterwork'.

H.22 **Water proofers**

Water proofers shall be 'Silcrete' double strength premix, or other approve integral water proofer, used in accordance with the manufacturer’s instructions.

H.23 **Integral hardeners**

Integral hardener shall be "Fessed Plus’s or other approved, used in accordance with the manufacturer’s instructions.

**TILE, SLAB AND BLOCK FINISHINGS**

H.30 **Mortar for bedding and pointing**

All materials for mortar, their storage, testing and mixing shall be as described in 'Plasterwork'.

H.31 **Preparation of surfaces**

All surfaces to receive the finishings in this section shall be thoroughly cleaned, screeds to receive finishings bedded in mortar shall be well wetted before laying is commenced.

H.32 **Glazed ceramic wall tiles**

Glazed ceramic wall tiles shall comply with B.S. 6431 and shall be of the sizes and colours described, and having cushion edges.

The tiles shall be socked in clean water for at least half an hour before fixing, stacked on edge tightly together and end tiles turned glaze outwards and fixed as soon as the surface water has gone. The tiles shall be bedded in cement and sand, (1:3), with straight joints 1.5mm wide pined in white cement, after scratching the surface of the backing screed to form a key.

Alternatively, tiles shall be wiped clean and fixed dry with 'Richa fix', or other approved adhesive, all in accordance with the manufacturer’s recommendations with straight joints 1.5mm wide pointed in white cement.

H.33 **Concrete tiles**

Concrete tiles shall comply with B.S. 1197, shall be thoroughly soaked in water and allowed to drain before laying and shall be bedded and pointed in cement and sand (1:3), laid true and level or to even falls as specified.

**PLAIN SHEET FINISHINGS**

H.37 **Generally**

Plywood, blockboard, chipboard, fibreboard etc., and their fixing shall be as described in Joinery.

H.38 **Method of measurement**

The work 'wall' in the descriptions of plasterwork shall include walls and partitions of concrete, concrete blockwork, brickwork or clay tile blockwork.

Prices for in-situ finishings and beds or backings shall include hacking concrete or raking out blockwork or brickwork joints to form keys.

Prices for all finishings and beds and backings shall include for the following: -

(1) Working behind pipes, and around flush electrical boxes.

1. All dubbing out required on new work to reduce irregularities or cambers, and to form flat surfaces in the appropriate

undercoat.

(3) Any footwork required.

(4) Trowel cuts between ceiling and wall plaster.

**PAINTING AND DECORATING**

**MATERIALS**

J.1 **Colour range**

Painting and decorative schemes shall be carried out in colours selected by the Architect from the approved range of colours.

J.2 **Approval of brands**

The Contractor shall seek, in writing, approval from the Architect for all brands of paint he wishes to use.

J.3 **Quality of products**

Where a type of paint is produced by the manufacturer in more than one quality, only paints and materials of the first or best quality shall be used in the works. The container label shall indicate clearly the quality of the paint being used.

Where it is not evident that the first or best quality of paint is being used, the Architect will order the removal of such materials from site and rectification of any work executed with those materials, all at the Contractors expense.

J.4 **Delivery**

All paints, varnishes, distempers and other surface coatings shall be delivered in sound, sealed containers, labelled clearly by the manufacturer, the label or decorated container stating: -

(a) The type of products

(b) The brand name, if any

(c) The use for which it is intended

(d) The manufacturers batch number

(e) The quality of the contents where more than one quality is available

The label shall be a printed label; typewritten labels will not be accepted.

The batch deliveries shall be dated and used strictly in order of delivery.

No paints, other than water-based paints and bituminous paint, shall be delivered in containers exceeding 5 litres capacity.

J.5 **Same maker's materials used for coatings**

While materials for the works may be obtained from several makers, undercoats and finishing coast for a particular surface must be obtained from the same maker, (i.e. one maker's finishing coat must not be applied over another maker's undercoat).

J.6 **Information and facilities to supplies**

The Contractor shall supply the paint manufacturers with all relevant details of the materials required to comply with the descriptions in this Document and the manufacturers shall be given every facility for inspecting the work during progress in order to ascertain that the materials are being used in accordance with their instructions, and they are to be allowed to take samples of their products from the site if they so desire.

J.7 **Storage**

All materials shall be kept in a dry, clean store, protected from the elements.

J.8 **Remedying defects due to defective materials**

All materials, which in the opinion of the Architect are unsatisfactory, shall be immediately removed from the site, and any work executed with such defective materials shall be made good by the Contractor, at his own expense, to the satisfaction of the Architect.

J.12 **White spirit**

White spirit shall comply with B.S. 245.

J.13 **Size**

Size shall comply with B.S. 3357.

J.14 **Cement paint**

Cement paint shall be 'Snowcem', 'Cempexo', or other approved.

J.15 **Emulsion paint**

Emulsion paint (interior and/or exterior), shall have a P.V.A. base and shall be of an approved brand. The first coat shall be thinned in accordance with the manufacturer's instructions. Where described as applied externally, the paint shall incorporate an approved fungicide to prevent fungus growth.

J.16 **Black bituminous paint**

Black bituminous paint shall comply with B.S. 3416 Type 1 for general use, Type 2 for drinking water tanks.

J.17 **Primer for alkaline surfaces**

Primer for alkaline surfaces shall be a special primer obtained from the maker of the undercoat and finishing coat.

J.18 **Primer for aluminium**

Primer for new or weathered aluminium shall be zinc chromate priming paint in accordance with DEF 1039.

J.19 **Primer for bituminous surfaces**

Primer for bituminous surfaces to be finished with oil paint shall contain leafing aluminium flake.

J.20 **Primer for iron and steelwork**

Primer for iron and steelwork shall be: -

(a) Lead based priming paint complying with B.S. 2523

(b) Calcium plumbate priming paint complying with B.S. 3698 Type A.

J.21 **Primer for zinc or galvanised steel**

Primer for weathered or new zinc and galvanised surfaces shall be calcium plumbate paint complying with B.S. 3698 Type A

**WORKMANSHIP**

J.42 **Standard of workmanship**

Prior to the commencement of internal decoration, areas not exceeding 50 square metres in total area, and designated by the Architect, shall be completely decorated, and after approval shall be used as a standard for the whole of the works. Any additional cost involved in carrying out such decoration in advance of the general work shall be deemed to be included in

J.48 **Coatings to be dry**

All coating shall be allowed to dry thoroughly before succeeding coats are applied.

J.49 **Rubbing down**

All undercoats for oil paints and clear finishes shall be rubbed down to a smooth surface with abrasive paper, and all dust removed before the succeeding coat is applied.

J.50 **Differing colours of undercoats**

Each succeeding coat of priming and undercoating paint shall be sufficiently different in colour as to be readily distinguishable.

J.51 **Painting in unsuitable conditions**

No coatings shall be applied to surfaces affected by wet, damp, or other unsuitable conditions, or to any surface damp with moisture.

J.52 **Protection of wet surfaces**

Adequate care must be taken to protect surfaces while still we, by the use of screens and 'wet paint' signs, where necessary.

J.53 **Damage to adjoining surfaces**

Care must be taken when storing materials, preparing surfaces or painting, etc., not to damage or stain other work. The Contractor shall remove all such stains, make good, and touch up.

J.54 **Cleanliness**

All brushes, tools and equipment shall be kept in a clean condition and surfaces shall be clean and free from dust during painting.

Painting shall not be carried out in the vicinity of other operations which might cause dust.

The Contractor shall provide a suitable moveable receptacle, into which are to be placed all the liquids, slop washings, etc., which are on no account to be thrown down any of the gullies, manholes, sinks, lavatories, W.C.'s or any other sanitary fittings. All solid refuse or inflammable residues must be removed from the site, or burned.

J.55 **Removal of ironmongery, etc.**

All surface fixed ironmongery fittings, etc., except hinges, shall be removed before painting and refixed on completion.

J.56 **Method of measurement**

One coat of lead based pink primer has been measured to the backs of all timber frames, etc., which will ultimately be fixed in contact with concrete, blockwork, rendered or plastered surfaces.

**DRAINAGE**

K.1 **Preambles to other sections**

The preambles contained in other sections of this Document shall apply equally hereto where applicable, so far as is consistent with the clauses following.

K.3 **Drainage Bye-laws**

All of the works shall comply with the requirements of the drainage Bye-laws made by the Local Authority and shall be executed to the satisfaction of the Architect and the Local Authority.

K.4 **Inspections**

The Contractor shall give written notice to the Architect for the purpose of inspection and measurement, whenever sections of: -

(a) excavations are completed

(b) concrete beds are laid

1. drains are completed

and no further work shall be executed until each stage of the work has been inspected.

**MATERIALS**

K.11 **Setting out**

The Contractor shall set out all drains in accordance with the drawings, and provide all profiles, etc., necessary for the execution of the work.

K.12 **Excavation**

The bottoms of all excavations shall be trimmed and consolidated to the correct levels. Unauthorised excavations below the required levels shall be filled with concrete of the same composition as for drain beds, at the Contractor's expense.

Where the bottoms are insufficiently firm, the Contractor shall excavate until, in the Architect's opinion a firm bottom is obtained and the level shall be made up with concrete of the same composition as for drain beds. Particulars of such additional work shall be agreed with the Architect's representative before the work is covered up, otherwise no claim in this respect will be entertained.

K.14 **Backfilling**

Trenches for plastic pipes shall first be filled with selected screened excavated material carefully hand-tamped between the pipe and sides of the trench, followed by 150mm - 200mm of similar material before the general filling is carried out.

Trenches for concrete or cast-iron drains shall first be filled to a depth of 300mm with selected fine material carefully hand-packed around the pipe. On the account shall materials be tipped into the trench until the first 300mm has been completed.

K.23 **Testing**

All drains and manholes shall be tested for water-tightness and straightness to the satisfaction, and in the presence of, the Architect and the Local Authority. Drains shall be filled with water to a head of 1.50 metre and are to be tested in sections agreed with the Architect: -

(i) after jointing

(ii) after haunching and backfilling

(iii) after completion of the works

The Contractor shall provide all necessary testing apparatus and shall carry out such other tests as are required by the Architect and the Local Authority.

K.24 **Clean and flush all drains**

All drains, gullies, manholes, etc., shall be cored, cleaned and flushed on completion.

K.25 **Method of measurement**

Where not otherwise stated, the starting level for trench and manhole excavation shall be: -

(i) the formation level in areas where the site is excavated to reduce levels.

(ii) existing ground level in areas where no excavation is required, or where filling is required.

The depths of all the trenches in the following description lie within the same 1.50 metre stages as the average depths stated.

Princes for excavating pipe trenches shall be deemed to include keeping the free from general water (i.e. all water except spring or running water).

Notwithstanding the provisions of S.M.M. Clause K.7 (a) to (c) the descriptions of excavating manholes, yard gullies, septic tanks and soak pits shall be deemed to include grading bottoms, planking and strutting, return filling and compacting, disposal of surplus solid and keeping excavations free from water.

Prices for building pipes into manholes shall include for building-in on rake where necessary.

Prices for concrete beds, benching and coverings for pipes laid in trenches, shall be deemed to include for any necessary formwork. Formwork required for beds, etc., for pipes above ground, and for casing to vertical pipes, is referred to in the descriptions of such items.

Prices for all gullies shall be deemed to include for all necessary excavation, return filling, disposal or surplus excavated material, planking and strutting, and trimming and ramming bottoms.

K.12 **Blinding**

Blinding shall be 4mm gauge hard stone chippings, free from clay dust or other deleterious matter

**I. WALLING**

1. Pre-cast Louvre Block Walling:

i. To be pre-cast concrete mix 1:2:4 or 20 N/mm2 (aggregate 10mm) finished fair on all exposed surfaces built in cement and sand (1:5) mortar with 10-15 mm (as details) straight horizontal and vertical joints recess pointed both sides.

ii. Each block to be size 210mm x 230mm x 265mm high and consisting of 40 mm two ends, base and back plates.

1. Top cover cap to be size 270mm x 230 mm x 220 mm sloping to 120 mm and finished fair on all exposed surfaces.

All above as drawing appended.

1. Wall Ties

Unless otherwise shown on the drawings, wall ties (between concrete blocks where specified and generally between concrete columns and block work) shall be of 6mm dia mild steel twisted butterfly.

**II. ROOFING:**

A. Aluminium Zinc (ALU-ZINK)

i. Gauge: 28 for roofing sheets.

20 for barge boards, gutters, ridges and flashings.

ii. Span : Sheets shall be long span with profile to Project

Managers approval and as manufactured by Aluminum Africa (T) Limited or equal and approved.

: barge boards / gutters / ridges / flashings:

1. length of unit to manufacturer’s limitation
2. cross sectional dimensions to architects’

iii. Pre-painted: : Material (sheets, barge boards ridges,

gutters and flashings) shall be degreased, chromated, resin coated (2 coats prime + final) and oven heated to 250oC – all to manufacturer’s guaranteed production specifications.

iv. Color : dark green or blue to Project

manager’s approval

1. Fixing of sheets/ridges

a. : side overlap to manufacturer’s

recommendations.

b. by proprietary power-driven self-tapping

screws with washers etc. complete suitable for fixing at valleys to timber purlins and to

Z steel purlins.

1. Fixing of barge : with appropriate (to suit girth of units)

boards and other power-driven tap screws to manufacturer’s

elements recommendation.

vii. Spacing of fixtures : spacing for fixing v & vi to

manufacturer’s recommendation so as no fluttering of sheets occur.

viii. Infill : Proprietary cell Gumm infill running

length to suit roofing sheets profile both at ridges and eaves.

1. General:
2. Rates for sheeting / barge boards / ridge capping / gutters etc. shall be for net area/ length covered and shall include supply / fix, infill etc. complete in all respects.
3. Manufacturer’s guarantee for material and finishes (for each lot delivered to site) shall be obtained and handed over to the project manager for scrutiny and record.

**VI FLOOR, WALL AND CEILING FINISHES**

Aggregates shall be 50% (not exceeding) white and 50% quartzite subject to sample approval. Samples shall be prepared – well in advance – with light colored normal cement after ensuring its availability for the entire works. We may have to admit some percentage of white cement (approx. 10% of cement quantity).

b. Workmanship

Comply with CP 204 insitu floor finishes.

1. Mix proportions to CP 204

For bonded granolithic mix by weight 1:1:2 cement: fine

aggregate: coarse aggregate.

1. Water Cement ratio

Maintain constant strict supervision to ensure unchanging

water: cement ratio which is to be the minimum consistent with

thorough compaction.

1. Preparing For Laying

Ensure the base is suitable. Prepare base by mechanically hacking to remove laitance and expose tips of large aggregate. Approximately 12 hours before laying. Soak base with clean water. Shortly before laying, remove any water and scrub in neat cement grout mixed to creamy consistency.

1. Laying the Granolithic Concrete
   1. Minimum thickness 40 mm in one layer.
   2. Cover any cast-in pipes with strip of heavy gauge expanded metal lathing or light gauge steel reinforcing fabric 500 mm wider than the embedded pipe.
   3. Thoroughly compact without bringing laitance to the surface.
   4. After topping has been fully compacted, trowel surface at least 3 times at intervals during the next 6 to 10 hours to produce a uniform hard surface free from laitance and with as much coarse aggregate as possible just below the surface.
   5. Cast bays chequeen-board pattern with minimum 24 hours delay between casting adjacent bays.
   6. Form plain square bay joints carefully compacted at edges.
   7. Locate bay and movement joints above these in base.
2. Skirting and Upstands

Form by trowel or formwork as appropriate on well keyed backgrounds to required thickness and profiles. Thoroughly bond to the floor layer and form neat angles and junctions.

k Curing

As soon as trowelling is completed, maintain the concrete in damp conditions for at least seven days or until grinding commences, whichever is the later with waterproof sheeting covered and kept in close contact with the surface and lapped 100mm at edges. Thereafter, ensure drying out continues slowly. Protect from heat or any other conditions that might accelerate the drying.

1. **DEFECTS LIABILITY**

The Contractor shall include for the rectification of any defect occurring with any system for a period of 6 months from the issue of the practical completion certificate.

1. **SITE VISIT**

It is recommended the Contractor visits the site in order to acquaint himself with site condition, access and any other features that could affect the tender.

At commencement of the work, the Contractor shall investigate and report to the Engineer if all materials and equipment to be used in the work and not specified as supplied by others are available locally. If not available, the Contractor shall at this stage place order for all materials in question and copy the orders to the Engineers. Failure to do so shall in no way relieve the Contractor from supplying the specified materials and equipment in time materials supplied by others for installations and/ or connection by the Contractor shall be carefully examined before installation and connection. All defects noted shall immediately be reported to the Engineer.

The Contractor shall be responsible for verifying all dimensions relative to his work by actual measurement taken on the site.

After the completion of the work the Contractor shall, on a set of drawings, indicate all alterations and / or modifications carried out during the construction period