

Hilfe zur Selbsthilfe



General Construction Works

SECTION VI : Technical Specifications

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1.0 BUILDING

1.1 GENERAL INFORMATION

1.1.1 MATERIALS GENERALLY

All materials used on the works shall be new and of the qualities and kinds specified herein and equal to approved samples. Deliveries shall be made sufficiently in advance to enable samples to be taken and tested if required. All materials which are not approved or which are damaged, contaminated or have deteriorated in any way or do not comply in any way with the requirements of this specification shall be rejected and shall be immediately removed from the site at the Contractors expenses.

1.1.1.1 MATERIAL FOR WHICH THERE IS A SOUTH SUDAN NATIONAL BUREAU OF STANDARDS SPECIFICATION.

The Works shall be constructed and tested in conformity with the standards indicated in these specifications. Wherever reference is made in the contract to specific standards and codes to be met by the materials, plant, and other supplies to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the contract. Where such standards are national or relate to a particular country or region, other authoritative standards which ensure a substantially equal or higher performance than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. The alternative standards and codes proposed shall be translated by the contractor into the English language prior to submission for approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 30 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the documents.

For convenience and for reference purposes, certain equipment, articles, materials, or processes are designated in the Specifications by brand name, trade name or catalogue name and number. Such designation shall be deemed to be followed by the words "or approved alternative" whether such words are shown or not. The contractor may offer other equipment, articles, material, or processes which have similar characteristics and which provide performance at substantially equivalent or better than to those specified, which will be accepted, subject to the Engineer's prior review and written approval. The burden of providing evidence as to comparative quality and suitability of alternatives shall be upon the Contractor and such evidence must be submitted to the Engineer at least 30 days prior to the date when the Contractor desires approval. No such alternative shall be used without prior written approval by the Engineer.

1.1.1.2 MATERIALS FOR WHICH THERE IS NO SOUTH SUDAN BUREAU OF STANDARDS SPECIFICATION

All Materials used in the works for which no South Sudann National Bureau of Standards specification has been published shall conform to the British Standard

specification for such materials. If there are no published standards as specified for any materials, the quantity of such material shall be generally of a standard equal to those for which there is a South Sudan Bureau of Standards or British Standard specification.

1.1.1.3 ALTERNATIVES TO PROPRIETARY BRANDS

Where materials are specified by their proprietary names or where catalogue numbers or descriptions specify fittings, the Contractor may offer materials or fittings of alternative manufacture, which are of equal quality. Such alternatives must be approved before being used in the works and the Contractor shall allow for this. But, prior to tendering he may submit to the Architect for approval the names of any suppliers or manufacturers whose products he intends to use, together with catalogue numbers and descriptions and/or samples but the decision of the Architect will be final.

1.1.1.4 SAMPLES

The Contractor shall furnish for approval with reasonable promptness all samples of materials and workmanship required by the Architect. The Architect shall check and approve such samples for conformance with the design concept of the works and for compliance with the information given in the Contractor Documents. The work shall be in accordance with approved samples. The following conditions shall apply in respect of samples:

- a) All Materials samples shall be delivered to the Architects Office with all charges in connection therewith paid by the Contractor.
- b) Duplicate final approval samples, in addition to any required for the Contractors use, shall be furnished to the Architect, one for office use and one for the site.
- c) Samples shall be furnished so as not to delay fabrication, allowing the Architect reasonable time for consideration of the sample submitted.
- d) Each sample shall be property labelled with the name and quality of the material, manufacturers name, name of project, the Contractors name and the date of submission and the specification number to which the sample refers.

1.1.1.5 MEASURING AND TESTING EQUIPMENT

The Contractor shall provide the following equipment for carrying out measuring and control tests on the site and maintain all the equipment in full working order.

- e) Straight edges 2m and 4m long for testing the accuracy of the finished concrete.
- f) A glass graduated cylinder for use in the site test of organic impurities in the sand.
- g) Slump test apparatus.
- h) 150mm steel cube moulds with base plates and tamping rod to BS 1881.
- i) Two 30m steel tapes.
- j) One dumpy or quickest level and staff.
- k) Micrometre
- l) Electronic distance metres
- m) Timber moisture content testing meter.

1.2 CONCRETE WORK

1.2.1 *GENERALLY*

All workmanship, materials, tests and performance in connection with the reinforced concrete work are to be in conformity with the British Standard Code of Practice (BS 8110; 1985, incorporating the latest amendments thereto), for “the Structural use of Reinforced Concrete in Buildings” and in accordance with local by-laws.

QUALITY, SAMPLES, TESTING AND APPROVAL

1.2.2 *MATERIALS*

Materials, commodities, components and equipment are to be new and unused unless otherwise specified. Handle, store, fix and protect all commodities with care to ensure that they are in perfect condition when incorporated into the work and handed over on completion.

1.2.3 *MANUFACTURERS RECOMMENDATIONS*

Handle, store and fix every commodity strictly in accordance with the printed or written recommendations of the manufacturer and/or supplier. Supply the Architect with copies of manufacturer recommendations. Inform the Architect if the manufacturer recommendations conflict with any other specified requirements and obtain his instructions before proceeding.

1.2.4 *STANDARDS*

Where commodities or workmanship are specified by reference to British Standard (BS) or Codes of Practice (CP) or international (ISO) or other standards, such standards are deemed to be the latest published at the time of tendering. The Contractor will be deemed to have read and understood the standards specified, and no claim for want of knowledge will be allowed. The substitution of commodities or standards of workmanship complying with other standards may be allowed at the discretion of the Engineer but application for permission for such substitution must be made in writing in sufficient time to allow adequate investigation. Obtain certificates of Compliance with standards and submit them to the Engineer on request.

1.2.5 *LOCAL CONDITIONS*

All materials, commodities, components, and equipment must be suitable for use in tropical climates.

1.2.6 *SINGLE SOURCES*

Where a choice of manufacturer is allowed for any particular commodity, obtain the quantity required to complete the work from a single manufacturer, or obtain the approval of the Architect to any change in the source of supply. Produce written evidence of the source of supply when requested by the Architect.

1.2.7 *SAMPLES*

Where samples of commodities or specimens of finished work are specified, submit samples or specimens to the Architect and obtain his approval before confirming orders or carrying out the work. Retain approved samples and specimens on site for comparison with the finished work. Finished work must conform in all respects with the samples or specimens approved. Remove samples and specimens when no longer required. The cost of supplying samples and specimens must be borne by the Contractor, but specimens may form part of the finished work where approved by the Architect.

1.2.8 *ARCHITECT/ENGINEER*

For purposes of the concrete structure the Structural Engineer, hereafter referred to as the Engineer, shall be deemed invested with the duties and be the representative of the Architect.

1.2.9 *CODE OF PRACTICE*

All workmanship, materials, tests and performances in connection with the reinforced concrete work are to be in conformity with the latest edition of the British Standard Code of Practice (BS 8110 for the Structural Use of Reinforced Concrete in Buildings) where not consistent with these Preambles.

1.2.10 *SUPERVISION*

A competent person approved by the Engineer shall be employed by the Contractor whose duty shall be to supervise all stages in the preparation and placing of the concrete. All cubes shall be made and Site tests carried out under his direct supervision in consultation with the Engineer.

1.2.11 *CONTRACTORS PLANT, EQUIPMENT AND CONSTRUCTION PROCEDURES*

Not less than 30 days prior to the installation of the Contractor's Plant and equipment for processing, handling, transporting string and proportioning ingredients, and for mixing transporting and placing concrete, the Contractor shall submit drawings for approval by the Engineer showing proposed general plant arrangements together with a general description of the equipment he proposes to use.

After completion of installation, the operation of the plant and equipment shall be subject to the approval of the Engineer.

Where these preambles, the Bills of Quantities of the Drawings require specific procedures to be followed, such requirements are not to be construed as prohibiting use by the Contractor of alternative procedures if it can be demonstrated to the satisfaction of the Engineer, that equal results will be obtained by the use of such alternatives.

Approval of plant and equipment, or their operation, or of any construction procedure, shall not operate to waive or modify any provision or requirements contained in these Preambles governing the quality of the materials or of the finished work.

1.2.12 *TOLERANCES*

On all setting out dimensions of 5m and over a maximum non-accumulative tolerance of plus or minus 5mm will be allowed on all setting out dimensions

under 5m a maximum non-accumulative tolerance of plus or minus 3mm will be allowed. On the cross-sectional dimensions of structural members, unless otherwise required by the Drawings, a maximum tolerance of plus or minus 3mm will be permitted.

The top surface of concrete floor slabs and beams shall be within 6mm of the normal level and line shown on the Drawings. Columns shall be truly plumb and non-accumulative tolerance of 3mm in each storey and not more than 15mm out of plumb in their full height will be permitted. The Contractor shall be responsible for the cost of all corrective measures required by the Engineer to rectify work that is not constructed within the tolerances set out above.

1.2.13 *MATERIALS IN GENERAL*

All materials which have been damaged contaminated or have deteriorated or do not comply in any way with the requirements of these preambles shall be rejected and shall be removed immediately from the site at the Contractors expense. No materials shall be stored or stacked on floors without prior approval from the Engineers.

The sources of supply for all materials used for concrete work shall be approved by the Engineer before these materials are delivered on the site. All materials shall comply with the requirements of the latest appropriate British Standard unless otherwise agreed with the Engineer, whose approval shall be obtained in writing.

The suppliers of materials shall give the Engineer access to their premises when directed for the purpose of obtaining samples of the materials for testing.

1.2.14 *SAMPLES*

Samples of materials shall be submitted as soon as possible after the contract is let. No deliveries in bulk shall be made until the samples are approved by the Engineer. All condemned materials shall be removed from the site within 24 hours. Every facility shall be provided to enable the Engineer to obtain samples and carry out tests on the materials and construction. If these tests show that any of the materials of construction do not comply with the specifications Contractor will be responsible for the costs of the tests and the replacement of defective materials and/or construction.

1.2.15 *CEMENT*

Cement unless otherwise specified, shall be Portland cement of a brand approved by the Engineer and shall comply with the requirements of BS 12 with the exceptions that it may contain reactive volcanic ash (of not more than 10% of the total weight) and the quantity of insoluble residue permitted in BS 12 may be exceeded. A manufacturer's Certificate of Test in accordance with BS 12 shall be supplied for each consignment delivered to the site.

Cement may be delivered to the site either in bags or in bulk.

If delivered in bags, each bag shall be properly sealed and marked with the manufacturers name and on the site shall be stored in a weather proof shed of adequate dimensions with a raised floor. Each consignment shall be kept separate and marked so that it may be used in the sequence in which it is received. Any bag found to contain cement which has set or partly set shall be completely discarded and not used in the works. Bags shall not be stored more than 1500mm in height.

If delivered in bulk, cement shall be stored in a weather-proof silo either provided by the cement supplier or by the contractor, and in either case the silo shall be subject to the approval of the Engineer.

1.2.16 *AGGREGATES*

Aggregates shall conform to the requirements of BS 582 and the sources and types of all aggregates are to be approved in all respects by the Engineer before work commences.

The grading of aggregates shall be within the limits set out in BS 582 and as later specified and the grading once approved shall be adhered to throughout the works and not varied without the approval of the Engineer. Fine aggregate shall be clean, coarse siliceous sand of good sharp hard quality and shall be free from lumps of stone earth, loam, dust, salt organic matter and any other deleterious substances. It shall be graded within the limits of Zone 1 or 2 of Table 2 of BS 882.

Coarse aggregate shall be good, hard, clean approved black-trap or similar stone, free from dust decomposed stone, clay earthy matter, foreign substances or friable thin elongated or lamed pieces. It shall be graded with the limits of Table 1 of BS 882 for its respective nominal size.

If in the opinion of the Engineer the aggregate meets the above requirements but is dirty or adulterated in any manner it shall be screened and/or washed with clean water the so directs at the Contractors expense.

Aggregate shall be delivered to the site in their prescribed sizes or grading and shall be stockpiled on paved areas or boarding platforms in separate units to avoid intermixing. In no account shall aggregate be stockpiled on the ground.

1.2.17 *WATER*

The water used for mixing concrete shall be from an approved source, clean, fresh and free from harmful matter, and comply with the requirements of BS 3148.

1.2.18 *READY-MIXED CONCRETE*

Ready-mixed concrete may only be used with the permission of the Engineer.

1.2.19 *EXPANSION JOINTING*

Expansion joint filler shall be Flexcell as manufactured by Expand Ltd., Chase Road, London NW 106 PS, or Resilex as manufactured by Evomastics Ltd., 4502 Edgeware Road London 1, or equal and approved.

1.2.20 *JOINT SEALER*

Sealers shall be either hot or cold applied. Hot applied sealers shall comply with BS 2499 Cold mastics shall be applied by gun and where more than 12mm deep shall include filling with loose packing yarn to within 2mm from outer face. All joint sealers are to be approved by the Engineer prior to their use.

1.2.21 CONCRETE STRENGTHS

Concrete mixes shall have the following minimum strengths as given by Works Cube Tests.

Minimum Crushing strength		
	7 days N/mm ²	28 days N/mm ²
Class 40	27	40
Class 35	24	35
Class 30	20	30
Class 25	17	25
Class 20	14	20

The average strength obtained from cube tests shall be 10% higher than the minimum strengths shown above.

Works cube tests will not be required for class 15 blinding concrete which shall comprise 136 nominal mix concrete by volume containing 10 cubic metres of fine aggregate and 0.20 cubic metres coarse aggregate per 50 gauge of coarse aggregate.

1.2.22 MEASURED PROPORTIONS OF CONCRETE

Cement

The quantity of cement shall be measured by weight. Where delivered in bags, each batch of concrete is to use one or more whole bags of cement.

Aggregates

For Class 40 to 25 concrete, aggregates shall be measured by weight in a weigh batching machine as described hereafter.

For class 15 concrete, aggregates may be measured by weight or by volume. Where volume approved gauge boxes of such a size as will give the contract proportions shall be used.

1.2.23 WEIGH BATCHING MACHINE

Weigh batching machines shall be of an approved type and shall be properly maintained and checked for accuracy at regular intervals.

1.2.24 CONCRETE CLASSES 40 TO 25

The weights of fine and coarse aggregate to be used in concrete Classes 40 to 25 shall be limited in accordance with the table below. The proportions of fine to coarse aggregate and cement which the Contractor proposes to use for each of the mixes specified shall first be approved by the Engineer. The Contractor will then be required to prepare Preliminary Test Cubes and have these cubes tested as described for Work Cube Tests. The test results should be submitted to the Engineer in sufficient time for further tests to be carried out should they prove unsatisfactory. Cube strengths in the preliminary tests must show crushing strengths at least 25% higher than the strengths specified for Work Cube Tests. If the Contractor is unable to produce specified cube strengths, he will be required at his own cost to increase the cement content of the mix.

Until satisfactory results are produced the Engineer may require at any time during the Contract the proportions of fine to coarse aggregate to be altered in order to produce a mix of greater strength or improved workability and

providing that the total proportions of aggregate to cement remain unchanged no claim for additional cost will be considered.

Concrete Class	Ratios of minimum Cement Content by weight to combined total weight of aggregate
Class 40	1:4.5
Class 36	1:5
Class 30	1:6
Class 25	1:7

1.2.25 *WATER PROOF CONCRETE*

Where waterproof concrete is specified Sealopruf Integral Waterproofing Compound and Sealoplaz Concrete Plasticiser as manufactured by sealocrete group sales Ltd., Atlantic Works, Hythe road London NW10 6RD, England, are to be added to the mixing water strictly in accordance with the manufacturers instructions and at the rate of 0.50 litres and 0.25 litres respectively to each 50kg bag of cement to which the aggregates have already been added and mixed. Not more than 25 litres of water per 50kg bag of cement are to be used unless otherwise approved by the Engineer.

1.2.26 *WATERBAR*

Water bar shall be PVC waterbar as manufactured by Expandite Limited or other approved type and shall be provided in the positions indicated on the Drawings. Joints shall be heat welded in accordance with the manufacturers instructions and whether the water bar is to be fixed vertically, metal clips as manufactured by the supplier of the water bar or of other approved design shall be provided to suspend the waterbar from the reinforcement.

Where waterproof concrete is used the contractor shall adhere strictly to the position and type of construction joints as detailed on the Drawings. Any deviation from this procedure or the provision of additional construction joints will require the prior approval of the Engineer and any additional waterbar so required will be at the contractor's expense.

Formwork shall be designed with sufficient timber formers and blocking pieces to supportive waterbar and the ensure that it is not displaced during concreting in the case of horizontal joints in vertical walling and similar members the formwork shall be so constructed as to permit the starter or upstand of concrete surrounding the lower half of the waterbar to be poured in the same operation as the slab or other concrete from which it springs. Formwork to walls or similar members where the waterbar is positioned at the base of the lift shall have sufficient openings not less than 300mm square at approximately 200mm above the level of the waterbar to permit checking that the waterbar is correctly positioned and not displaced during concreting. No concreting will be permitted to portions where upstand starters form an integral part until the formwork to the starter has been fixed and approved.

1.2.27 *TESTING EQUIPMENT*

The Contractor shall provide the following equipment for carrying out control tests on the site:

Straight edges 3 meters and 1 meter long for testing accuracy of the finished concrete.

A glass graduated cylinder for use in the long for testing accuracy of the finished concrete.

Sand test apparatus.

Four 150mm steel cube moulds with base plates and tamping rods to BS 1881.

1.2.28 *WORK CUBE TEST*

Work cubes are to be made at intervals as required by the Engineer in accordance with BS 8110 and the contractor shall provide a continuous record of the concrete work. The cubes shall be made in approved 150mm moulds in strict accordance with the Code of Practice. The cubes shall be made on each occasion. Each cube shall be marked with a distinguishing number (numbers) to run consecutively and the date and a record shall be kept on site giving the following particulars:

Cube No.:

Date made:

Location in work:

7-day test:

 Date

 Strength

28-day test:

 Date

 Strength

Cubes shall be forwarded, carriage paid, to an approved Testing Authority, in time to be tested two at 7 days and the remaining one at the discretion of the Engineer. No cube shall be despatched within 3 days of casting.

Copies of all Work Cube Test shall be forwarded to the Engineer and one shall be retained on the site.

If the strengths required above are not attained, and maintained throughout the carrying out of the Contract, the Contractor will be required to increase the proportion of cement and/or substitute better aggregates so as to give concrete which does comply with the requirements of the Contract. 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 Work Cube Test.

1.2.29 *MIXING AND PLACING OF CONCRETE*

The concrete shall be mixed only in approved power-driven mixers of a type and capacity suitable for the work, and in any event not smaller 0.400 28 cubic metre capacity.

The mixer shall be equipped with an accurate water measuring device. All materials shall be thoroughly mixed dry before the water is added and the mixing of each batch shall continue until there is a uniform distribution of the materials and the mass is uniform in colour.

The entire contents of the mixed materials shall not exceed the rated capacity of the mixer. Whenever the mixer is started, 10% extra cement shall be added to the first batch and no extra payment will be made on this account.

As a check on concrete consistency slump tests may be carried out and shall be in accordance with BS 1881. The Contractor shall provide the necessary apparatus and carry out such tests as are required. The slump of the concrete made with the specified water content, using dry materials, shall be determined and the water to be added under wet conditions shall be reduced as to give approximately the same slump.

The concrete shall be mixed as near to the place where it is required as is practicable, and only as much as is required for a specified section of the work shall be mixed at one time, such section being commenced and finished in one operation without delay. All concrete must be efficiently handled and used in the Works within twenty (20) minutes of mixing. It shall be discharged from the mixer direct either into receptacles or barrows and shall be distributed by approved means which do not cause separation or otherwise impair the quality of the concrete. Approved mechanical means of handling will be encouraged, but the use of chutes for placing concrete is subject to the prior approval of the Engineer.

Concrete shall be placed from a height not exceeding 1500mm directly into its permanent position and shall not be worked along the shutters to that position. Unless otherwise approved, concrete shall be placed in a single operation to the full thickness of slabs, beams and similar members, and shall be placed in horizontal layers not exceeding 1500mm deep in walls and similar members.

Concrete in columns may be placed to a height of 4 meters with careful placing vibration and satisfactory results. Where the height of the column exceeds 4 meters suitable openings must be left in the shutters so that this maximum lift is not exceeded.

Concrete shall be placed continuously until completion of the part of the work between construction joints as a specified hereinafter or of a part of approved extent. At the completion of a specified or approved part a construction joint shall be made where the works is stopped. A record of all such joints must be made by the Contractor and a copy supplied to the Engineer.

Any accumulation of set concrete in the reinforcement shall be removed by wire brushing before further concrete is placed.

The Contractor shall provide runways if not disturbed or subjected to vibrations and shocks during the setting period.

Mixing machines, platforms and barrows shall be clean before commencing mixing and be cleaned on every cessation of work.

Where concrete is laid on hardcore or other absorbent materials, the base shall be suitable and sufficiently wetted before the concrete is deposited.

1.2.30 *COMPACTION*

At all times during which concrete is being placed the Contractor shall provide adequate trained and experienced labour to ensure that the concrete is compacted in the forms to the satisfaction of the Engineer.

Concrete shall not be placed at a rate greater than will permit satisfactory compaction nor, to a depth greater than 400mm before it is compacted.

During and immediately after placing, the concrete shall be thoroughly compacted by means of continuous tamping, spacing, slicing and vibration. Vibration is required for all concrete of classes 40, 35, 30 and 25.

Concrete shall be taken to fill every part of the forms, to work the concrete under and around the reinforcement without displacing and to avoid disturbing recently placed concrete which has begun to set.

Any water accumulating on the surface of newly placed concrete shall be removed and no further concrete shall be placed thereon until such water is removed.

Internal vibrators shall be of a frequency of not less than 7,000 cycles per minute and shall have rotating eccentric weight of at least 0.50kg, with an eccentricity of not more than 12mm. Such vibrators shall visibly affect the concrete within a radius of 250mm from the vibrator.

Internal vibrators shall not be inserted between layers of reinforcement less than one and one half times the diameter of the vibrators apart. Contact between vibrators and reinforcement and vibrators and formwork shall be avoided.

Internal vibrators shall be inserted vertically into the concrete wherever possible at not more than 500mm and shall constantly be moved from place to place. No internal vibrator shall be permitted to remain in any one position for more than ten seconds and it shall be withdrawn very slowly from the concrete. In consolidating each layer of concrete the vibrating head shall be allowed to penetrate and re-vibrate the concrete in the upper portion of the underlying layer. In the area where newly placed concrete in each layer joins previously placed concrete more than usual vibration shall be performed, the vibrator penetrating deeply at close intervals along these contracts. Layers of concrete shall not be placed until layers previously placed have been vibrated thoroughly as specified.

Vibrators shall not be used to move concrete from one place to another in the formwork.

At least one internal vibrator shall be operated for every 1.5 cubic metres of concrete placed per hour and at least one spare vibrator shall be maintained on site in case of breakdown during concreting operations.

External formwork vibrators shall be of the high frequency and low amplitude type applied with the principal direction of vibration in the horizontal plane. They shall be attached directly to the forms at not more than 1200mm centres.

In addition to internal and external vibration the upper surface of suspended floor slabs shall be levelled by tamping or vibrating to receive finishes. Vibrating elements shall be of the low frequency and high amplitude type operating at a speed of not less than 3,000 rpm.

1.2.31 *CONSTRUCTION JOINTS*

Construction joints shall be permitted only at the positions pre-determined on the Drawings or as instructed on the Site by the Engineer. In general they shall be perpendicular to the lines of principal stress and shall be located at points of minimum shear, viz, vertically at, or near, mid-spans of slabs, ribs and beams.

Suspended concrete slabs are generally to be cast using alternate bay construction in bays not exceeding 20 metres in length. No two adjacent bays are to be cast within a minimum period of 48 hours of each other. The joints between adjacent bays are to be positions agreed with the Engineer.

Under no circumstances shall concrete be allowed to tail-off, but it shall be deposited against stopping-off boards.

Before placing new concrete against concrete already hardened, the face of the old concrete shall be thoroughly hacked, roughened and cleaned, and laitance and loose material removed there from, and immediately before placing the new concrete the surface shall be saturated with water and covered with a coat of mortar at least 25mm in thickness composed of cement and fine aggregate in the proportions used in the concrete.

1.2.32 *CURING AND PROTECTION*

Care must be taken that no concrete is allowed to become prematurely dry, and the fresh concrete must be carefully protected within two hours of placing from rain, sun and wind by means of hessian sacking, polythene sheeting, or other approved means. This protective layer and the concrete itself must be kept continuously wet for at least seven days after the concrete has been placed.

The Contractor will be required to provide complete coverage of all fresh concrete for a period of 7 days. Hessian or polythene sheeting shall be in the maximum widths obtainable and shall be secured against wind. The Contractor will not be permitted to use old cement bags, hessian or other material in small pieces.

Concrete in foundations and other underground work shall be protected from admixture with falling earth during and after placing.

Traffic or loading must not be allowed on the concrete until the concrete is sufficiently matured, and in no case shall traffic or loading be of such magnitude as to cause deflection or other movement in the formwork or damage to the concrete members. Where directed by the Engineer, props may be required to be left in position under slabs and other members for greater periods than those specified.

1.2.33 *FAULTY CONCRETE*

Any concrete which fails to comply with these Preambles, or which shows signs of setting before it is placed shall be taken out and removed from the site. Where concrete is found to be defective after it has set, the concrete shall be cut out and replaced in accordance with the Engineer's instructions. On no account shall any faulty honeycombed or otherwise defective concrete be repaired or patched until the Engineer has made an inspection and issued instructions for the repair. The whole of the cost whatsoever, which may be occasioned by the need to remove faulty concrete, shall be borne by the Contractor.

1.2.34 *ROD REINFORCEMENT*

The steel reinforcement shall comply with the latest requirements of the following British Standards.

Hot rolled bars for the reinforcement of concrete to BS 4449 (metric units).

Cold worked steel for the reinforcement of concrete to BS 4461 (metric units).

The contractor will be required to submit a test certificate of the rolling. Reinforcement shall be stored on racks above ground level. All reinforcement shall be free from loose mill scale or rust, grease paint or other substances likely to reduce the bond between the steel and concrete.

1.2.35 *FABRIC REINFORCEMENT*

To be electrically cross-welded steel wire mesh reinforcement to BS 4483(1969) and of the size and weight specified.

1.2.36 *FIXING ROD REINFORCEMENT*

Reinforcement shall be accurately bent to the shapes and dimensions shown on the Drawings and Schedules and in accordance with BS 4466(1969). Reinforcement must be cut and bent cold and no welded joints will be permitted unless so detailed.

Reinforcement shall be accurately placed in position as shown on the Drawings, and before and during concreting, shall be secured against displacement by using No. 18 SWG annealed binding wire or suitable clips at intersections, and shall be supported by concrete or metal supports, spacers or metal hangers to ensure the correct position and cover.

No concreting shall be commenced until the Engineer has inspected the reinforcement in position and until his approval has been obtained and the Contractor shall give two clear days' notice of his intention to concrete.

The Contractor is responsible for maintaining the reinforcement in its correct position, according to the drawings, before and during concreting. During concreting a competent steel bender must be in attendance to adjust and correct the position of any reinforcement which may be displaced. Vibrators are not to come into contact with the reinforcement.

1.2.37 *POSITION AND CORRECTNESS OF REINFORCEMENT*

Irrespective of whether any inspection and/or approval of the fixing of the reinforcement has been carried out as above, it shall be the Contractor's sole responsibility to ensure that the reinforcement complies with the details on the drawings or Schedules and is fixed exactly in the positions shown therein and in the positions to give the prescribed cover. The Contractor will be held entirely responsible for any failure or defect in any portion of the reinforced concrete structure and including any consequent delay, claims, third party claims etc, where it is shown that the reinforcement has been incorrectly positioned or is incorrect in size or quantity with respect to the detailed Drawings or Schedules.

1.3 *CARPENTRY AND JOINERY*

1.3.1 *GENERALLY*

All woodwork shall be carried out in accordance with the drawings and the principals of first class joinery construction. Unless specifically stated otherwise sizes shown on drawings are finished sizes and the Contractor must allow for wood faces.

MATERIALS

1.3.2 *QUALITIES OF TIMBER*

The qualities of timber stated herein after are in accordance with the latest South Sudan Government Grading Rules.

All timber described as Prime Grade is to be First Grade (Grade 1).

All timber described as selected Grade (Grade is to be second Grade (Grade 11).

All hardwood is to be Prime Grade (Grade 1).

All timber for permanent work in the building shall before use be approved by the Architect for quality in accordance with the foregoing specification for its respective grade. Any timber not so approved by the Architect shall be removed from the site forthwith.

1.3.3 *INSECT DAMAGE*

All timber whether graded or ungraded, and including shuttering, scaffolding and the like shall be free of live borer beetle or other insect attack when brought upon the site. The Contractor shall be responsible up to the end of the maintenance period for executing at his own cost all work necessary to eradicate insect attack of timber which becomes evident including the replacement of timbers attacked, or suspected of being attacked, notwithstanding that the timber concerned may have been inspected and passed as fit for use.

1.3.4 *SEASONING OF TIMBER*

All carpentry timbers are to be seasoned to an average moisture content of not more than 20%. All joinery timbers are to be seasoned to an average moisture content of not more than 15%. The Contractor is to make available on site a meter for testing moisture content of all timber delivered.

1.3.5 *PREPARATION AND PROTECTION OF TIMBER*

All timber necessary for the works is to be purchased immediately the contract is signed and when delivered is to be open stacked for such further seasoning as may be necessary. Preparation of the timber is to be commenced simultaneously with the commencement of the works.

All timber assembled woodwork is to be protected from the weather and stored in such a way as to prevent attack by decay, fungi, termites or other insects.

1.3.6 *SPECIES OF TIMBER*

Only those timbers specified to be used for the works, unless alternatives are authorized by the Architect in writing.

1.3.7 *PRESSURE IMPREGNATED TIMBER*

All timber described as pressure impregnated shall be impregnated under vacuum and pressure with Celcure or Tanalith wood preservative with an average absorption of not less than 6.7 kgs of dry salt per cubic meter. In case of resistant species where this retention cannot be obtained the timber shall be treated to refusal point. All treated timber shall not be exposed to wet conditions for at least 14 days after treatment has been carried out. All cuts ends, drilling or fabrications on the site producing new surfaces shall be thoroughly brushed or soaked with ACelcure B@ salts applied in accordance with the manufacturer's instructions.

Any other method of timber impregnation will only be allowed with the Architect's approval.

1.3.8 *HARDWOOD*

All hardwood will comply with the requirements of BS 1186 Part 1 and BS 4047. It shall show a straight and regular grain throughout.

Hardwood shall be free from wooly texture, soft heart, sap wood, splits, shakes, all evidence of insect or fungi attack and rot and all faults caused by compression failure. There shall be no waney edges. Hardwood shall be free from knots on exposed faces. Any hardwood showing visible imperfections will be rejected.

Preservatives shall not be used without the Architect's permission. Where indicated on the drawings, internal hardwoods will be treated with clear sealants as specified elsewhere.

1.3.9 *SOFTWOOD*

Softwood timber for carcassing work shall be either Podocarpus or Cypress to the approval of the Architect and shall be to the dimensions specified on the drawings.

Timber shall be classified in accordance with the Groups listed in this Clause:

All softwood shall comply with the requirements of BS 1186 Part 1. Timber shall be free from woolly texture, soft heat, sap wood, spits, shakes, pitch showing on the surface, sloping grain exceeding one in eight checks, knots exceeding 25mm diameter, loose knot or knot holes and any evidence of insect or fungi attack. There shall be no waney edges.

Where indicated on the drawings, the softwood will be treated with clear sealer or painted with gloss paint.

All softwood is to be pressure impregnated against insect attack before delivery to site. Any ends cut after treatment shall be given two liberal coats of preservative.

1.3.10 *TIMBER DOORS*

Doors are to be designed, manufactured, and fixed in accordance with the relevant British Standards summarized below:

BS 476 part 8 1972 Fire tests etc.

BS 4787 part 1 1972 Door dimensions

BS 1186 part 1 1971 Quality of timber and workmanship

BS 1227 part 1 A Hinges

BS 3827 Builder's hardware

Glossary

1.4 *METALWORK*

MATERIALS

1.4.1 *GENERALLY*

All material shall be the best of their respective kinds free from defects and all work is to be carried out in the most workmanlike manner and strictly as directed by the Architect. The materials in all stages of transportation, handling and stacking shall be kept clean and prevented from injury by breaking, bending or distortion and weather action.

1.4.2 *MILD STEEL*

Mild steel shall comply with BS 15

1.4.3 *BOLTS, NUTS AND WASHERS*

These shall be fabricated from materials which comply with BS 15 and each manufactured item shall comply with the appropriate BS.

1.4.4 *GALVANIZED SHEET STEEL*

To be No. 24 S.W.G of approved manufacture to BS 2989 of best quality mild steel sheets cold rolled close annealed patent flattened and hot dip galvanized.

1.4.5 *STAINLESS STEEL*

Stainless steel tube shall be authentic steel BS 3014 comparable to BS 1449 type 316S 16.

1.4.6 *METAL DOOR FRAMES*

Metal door frames are to be steel to comply with BS 1245 or profile to suit the wall thickness.

- a) Door frames are to be provided with the following:
- b) Two priming coats of paint
- c) Fixing lugs for building into walls
- d) Three galvanized steel hinges per door
- e) Adjustable lock strike plate
- f) Two shock absorber buffers

WORKMANSHIP

1.4.7 *WELDING*

All welding is to be in accordance with the requirements of BS 1856 and 938 and the electrodes shall comply with BS 639.

Fusion faces shall be free from irregularities which could interfere with the welding material. These faces shall also be free from any deleterious material such as rust, grease and paints.

Edges of welding shall be prepared by planning or machine flame cutting.

During welding all parts will be maintained in their correct position.

Welds shall be carried out with each run closely following the one prior with sufficient time between to allow for removal slag.

Each run of weld is to be inspected and the sub-contractor shall ensure that unsatisfactory welds are cut out or remade to the required standard.

The minimum size of fillet weld shall be 6mm.

All completed welds shall have a regular and smooth surface. The weld material shall be solid with complete fusion throughout the weld and to the face cut metals.

Any defects shall be cut out or made good to approval.

External faces of butt welds to be ground smooth.

1.4.8 *PAINTING*

All steel is to be wire brushed and any loose scale, dirt or grease shall be removed before any painting is commenced. One coat of red oxide primer Type A to BS 2523 shall be applied at the shop.

Any damage to the priming paint shall be made good to the Architect's satisfaction.

1.4.9 *FIXING OF STEEL DOORS*

Fixing of metal Doors shall include for assembling and fixing, including screwing to sub-frames or cutting mortices for lugs in concrete or walling and running

with cement mortar (1:4) bedding frames in similar mortar, pointing in mastic, bedding sills, transoms and mullions in mastic, making good finishings around both sides and fixing, oiling and adjusting all fittings and frames.

Adjacent sashes in horizontal sliding Doors shall be separated by a compatible spacer and the sashes shall be supported on bearing devices that facilitate movement.

Joints in frames shall be made either by welding or by mechanical means. Where necessary joints shall be sealed with flexible material. Joints to be flush joints within one of the tolerances given in BS 1474.

Hardware including its fixings shall be compatible with aluminium and shall be replaceable without removing the outer frame from its surround.

All screws, nuts, bolts, rivets, washers and other fastenings shall be of stainless steel or aluminium with the exception of those that are protected when the window is closed. Alternatively these may be made of steel which has been finished by one of the following methods:

Zinc plated and passivated according to BS 1706 Classification Nr 729.

Hot - dip galvanized according to the requirements of BS 729.

Sherardized according to the requirements of BS 729 Part 2 or,

Sprayed with metal coating according to BS 2569 Part 1.

Fixing devices not of aluminium may be made of steel finished by either method (a), (b) or (c) above.

The fixings shall be capable of withstanding the design wind load and any operating forces on the window.

Doors manufactured to standards set out in this specification shall each bear the name of trademark of the manufacturer and the number of the appropriate standard.

Fixing, assembling, bedding frames and painting shall be executed as described for 'Fixing of Steel Doors'.

1.5 FINISHINGS

1.5.1 *OTHER SPECIFICATIONS*

All other specifications of this contract where applicable are deemed to apply equally to the finishings specifications.

1.5.2 *SAMPLES*

The Contractor shall prepare at his own cost sample areas of the paving, plastering and rendering as directed until the quality, texture and finish required is obtained and approved by the Architect after which all work executed shall conform with the respective approved samples.

1.5.3 *FINISHED THICKNESSES*

The thicknesses of floors shall have a constant structural thickness and have level top surfaces. The finished floor surface will equally have a constant level and any adjustment needed to achieve this effect with the varying floor finish materials is to be made in the screeds beneath the same.

Slabs bearing on the ground may be cast to varying levels, and be of constant thickness with varying formation levels, or have varying thicknesses at the

option of the Contractor. This stipulation in no way relieves the Contractor of the requirements of the specification for structural work.

1.5.4 MATERIALS GENERALLY

All materials shall be of high quality, obtained from manufacturer's to be approved by the Architect.

Cement, sand and water shall be as described under concrete work and blockwork.

1.5.5 BONDING

Bonding compounds, etc., for use in applying plaster and similar finishes direct to surfaces without the use of backings or screeds are only to be used if approved by the Architect and are to be used strictly in accordance with the manufacture's printed instructions.

1.5.6 CHASES, OPENINGS AND HOLES

All chases, holes and the like which were not formed in the concrete shall be cut, and all service pipes shall be fixed and all holes and chases filled with mortar before paving and plaster work is commenced in no circumstances will the Contractor be permitted to cut chases, holes and the like in finished pavings or plaster work.

1.5.7 IN-SITU FINISHINGS

1.5.7.6 GENERALLY

The term plastering refers to the operation internally and rendering to the same operation externally but for ease of reference the term plastering has generally been used in this specification to described both operations.

1.5.7.7 MIXES

The methods of measuring and mixing plaster shall be as laid down under Concrete work and the proportions and minimum thickness of finished plaster shall be in accordance with the following:

Item Work	of Mix	Minimum Thickness and Finish
Internal plaster	1 part cement 4 parts sand 2 parts otherwise specified	16mm finish to walls and Ceilings: Lime Wood float finish unless otherwise specified.
External Render	1 part cement 4 parts sand	12 mm finish in two coats.
Tyrolene finish	Ditto	6 mm finished thickness in two coats on 10mm plastered backing

To obtain greater plasticity a small quantity of lime may be added to the mixes for external plastering at the Architect's discretion but in any case this is not to exceed 2 parts lime to 1 part cement.

With regard to the lime mortars gauged with cement, the addition just before use, of the cement to small quantities of the lime/sand mix shall preferably take place in a mechanical mixer and mixing shall continue for such time as will ensure uniform distribution of materials and uniform colour and consistency.

It is important to note that the quantity of water used shall be carefully controlled. Plaster may be mixed either in a mechanical mixing machine or by hand.

Hand mixed plaster shall first be mixed in the dry state being turned over at least three times. The required amount of water should then be added and the mix again turned over three times or until such time as the mass is uniform colour and homogeneous.

The plaster shall be completely used within thirty minutes of mixing and hardened plaster shall not be re-mixed but removed from the site.

1.5.7.8 PREPARATION OF SURFACES FOR PLASTER ETC.

Irregularities in the surfaces to be plastered or rendered shall be filled with mortar, without lime, twenty four hours before plastering is commenced. Joints in blockwork, etc., are to be well raked out before plastering to form a good key. Smooth concrete surfaces to be plastered shall be treated with an approved proprietary bonding agent or hacked to provide an adequate key for the plaster. All surfaces to be plastered or rendered shall be clean and free from dust, loose mortar and all traces of salts.

All surfaces shall be thoroughly sprayed with water and all free water allowed to disappear before plaster is applied.

As far as practical, plastering shall not be commenced until all mechanical and electrical services, conduits, pipes and fixtures have been installed.

Before plastering is commenced all junctions between differing materials shall be reinforced. This shall apply where walls join columns and beams, particularly where flush and similar situations where cracks are likely to develop and as directed by the Architect. The reinforcement shall consist of a strip of galvanised wire mesh 'Expamet' or equal approved 15cm wide which shall be plugged, nailed or stapled as required at intervals not exceeding 45mm at both edges. The surfaces to which such mesh shall be applied shall be primed with one coat bituminous paint prior to fixing the mesh.

1.5.7.9 APPLICATION OF PLASTER AND RENDER

After preparation of the surfaces a key coat of cement slurry shall be applied to the wetted surface to be plastered. When this coat is dry the plaster coat shall be applied, by means of a trowel, between screeds laid, ruled and plumbed as necessary. This coat which shall be to the required thickness shall be allowed to set hard and then cured as described. Surfaces are to be finished with a wood or steel float to a smooth flat surface free from all marks.

Tyrolene finish shall be applied with an approved machine to give a finish of even texture and thickness. The sprayed finish shall be applied in two separate coats allowing time for drying between coats.

Application in one continuous operation to build up a thick layer will not be permitted. The total finished thickness of the two sprayed coats shall be not less than 6mm. The sprayed finish shall not be applied until all repairs and making good to the undercoat are completed. Any plaster which adheres to

pipes, doors, Doors and the like shall be carefully removed before it has set. Curing shall take place after the application of the second coat. Where coloured Tyrolean is required this shall be obtained by the addition to the mix of any approved colour pigment.

All plastering and rendering shall be executed in a neat workmanlike manner. All faces except circular work shall be true and flat and angles shall be straight and level or plumb. Plastering shall be neatly made good around pipes or fittings. Angles shall be rounded to 6mm radius.

All tools, implements, vessels and surfaces shall be at all times kept scrupulously clean and strict precautions shall be taken to prevent the plaster or other materials from being contaminated by pieces of partially set material which would tend to retard or accelerate the setting time.

1.5.7.10 CURING OF PLASTER

Each coat of plaster is to be maintained in a moist condition for at least three days after it has developed enough strength not to be damaged by water.

1.5.7.11 CEMENT AND SAND SCREEDS

Screeds shall be mixed and formed as described.

1.5.7.12 SURFACE HARDENERS

Floor hardeners shall comprise an approved type guaranteed by the makers to produce a hard dense concrete with high abrasive resistance, impervious to the penetration of heavy oils, acid or alkali solutions and to be used strictly in accordance with the maker's instructions.

The first dressing of sodium silicate for granolithic flooring shall be one part of sodium silicate to six parts of water by volume.

Subsequent dressing shall be composed of one part of sodium silicate to four parts of water by volume, for all surfaces. The two liquids shall be well mixed together, sprayed over the flooring and spread evenly with a mop or soft brush, any excess being wiped off and the flooring allowed to dry for at least 24 hours after each dressing. After final drying, floors shall be washed with clean water.

1.5.7.13 RATES OF IN-SITU WORK

The rates for in-situ work shall include for raking out joints of blockwork or bonding coat or spraying cement slurry on new concrete surfaces to form key, for work in narrow widths, small and isolated areas, rounded arises, fair and chamfered edges, for making good up to boundaries of other work for making good and working around pipes, brackets etc., and for all other incidental labours.

Rates shall also include for masking before the application of spray finishes work executed overhead, temporary rules, supports, screeds and templates.

1.5.7.14 RATES

The rates of tile, slab and block finishings shall include for rounded edge tiles and angles, cutting and fitting up to boundaries and around pipes, braces, etc, and water; for work in narrow widths, small and isolated areas and for all other incidental labours.

1.6 PAINTING AND DECORATING

MATERIALS

1.6.1 *MANUFACTURERS*

Except where stated all materials shall be obtained from approved manufacturer. The Contractor shall state the name and address of the manufacturer whose materials be proposed to use. Once approval has been given the Contractor shall not obtain materials from other sources without the prior written agreement of the Architect.

1.6.2 *GENERAL*

Each succeeding coat of priming, undercoating and finishing (pigment) of clear coating shall be sufficiently differently different in colour as to be readily distinguishable.

All primers and paints in one system upon a particular surface shall be obtained from the same manufacturer.

The mixing of paints etc, of different brands before or during application will not be permitted.

1.6.3 *EMULSION PAINTS*

Emulsion paints shall be matt or satin finish vinyl emulsion paint.

The first (mist) coat shall be thinned in accordance with the manufacturer's instructions.

1.6.4 *GLOSS PAINT*

Gloss paint shall be hard gloss finish oil paint.

1.6.5 *LEAD BASED PAINTS*

The use of lead based paints will not be permitted.

1.6.6 *CLEAR FINISHES*

Clear finishes internally shall be clear polyurethane varnish (one pack).

1.6.7 *PRIMERS AND UNDERCOATS*

Unless otherwise specified, primers and undercoats shall be of the type recommended by the manufacturer of the finishing coats specified for a particular surface. Primer for external bare metal work surfaces shall comply with BS 2523.

1.6.8 *KNOTTING*

Shellac knotting shall comply with BS 1336.

1.6.9 *WHITE SPIRIT*

The white shall comply with BS 245

1.6.10 *TIMBER STAIN*

Timber stain shall be oil based pigmented stain. The application of this material shall be strictly in accordance with the manufacturer's instructions. Tint and degree of application shall be to the approval of the Architect.

1.6.11 *STOPPING*

The stopping shall be as follows:

Plasterwork shall be plaster based filler.

Concrete and brickwork shall be similar material to the background and finished in a similar texture.

Internal woodwork, plywood and blockboard shall be putty complying with BS 544

External woodwork shall be white lead paste complying with BS 2029.

Internal clear wood finishes the stopping shall be that recommend by the clear lacquer manufacturer.

1.6.12 *FILLERS*

The fillers for internal joinery shall be the type recommended by the paint manufacturer for use with his type of paint or lacquer.

Stopper and fillers shall be tinted to match the undercoat, and shall be compatible with both undercoats and primes.

All materials shall be used strictly in accordance with the manufacturer's instructions.

1.6.13 *TEXTURED COATING*

Textured coating is to be of proprietary manufacture approved by the Architect of an approved colour.

Technical information concerning the coating is to be submitted to the Architect before ordering, but the minimum qualities of the coating are to be as follows:

- a) Suitable for application internally and externally to plastered, rendered, concrete block, stone brick, asbestos and timber surfaces.
- b) Minimum durability of 10 years even in exposed conditions
- c) Maintenance free
- d) Built-in mould resistant fungicide

1.7 WORKMANSHIP

1.7.1 *GENERAL*

Workmanship generally shall be carried out in accordance with BS CP 231, unless otherwise specified.

Before painting is commenced floors shall be swept and washed over, surfaces to be painted shall be cleaned before applying paint as specified, and all precautions taken to keep down dust whilst work is in progress.

No paint shall be applied to surfaces structurally or superficially damp and all surfaces must be ascertained to be free from condensation, efflorescence, etc., before the application of each coat.

No painting shall be carried out externally during humid, rainy, damp, foggy or freezing conditions or conditions where surfaces have attained excessively high temperatures or during dust storms.

No new primed or undercoated woodwork and metalwork shall be left in an exposed or unsuitable situation for an undue period before completing the process.

No dilution of paint materials shall be allowed except strictly as detailed by the manufacturer's own instructions, either on the containers, or their literature, and with the special permission of the Architect. For external work dilution of paints will not be allowed whatsoever. For internal work where permitted by the Architect, under coats may be thinned by the addition of not more than 5% thinners. Gloss finish shall not be thinned at all.

Metal fittings such as ironmongery etc, not required to be painted shall first be fitted and then removed before the preparatory processes are commenced. When all painting is completed the fittings shall be cleaned as necessary and re-fixed in position.

1.7.2 *BRUSHWORK*

Unless otherwise specified, all primers and paints shall be brush applied. Written permission must be obtained from the Architect if an alternative method of application is to be used.

1.7.3 *STOPPING AND FILLING*

Unless otherwise specified by the manufacturer all primes and undercoats shall be stopped flush and rubbed down to a smooth surface with an abrasive paper and all dust removed before each succeeding coat is applied. Care shall be taken to prevent burnishing of the surface.

1.7.4 *STIRRING*

Unless otherwise specified by the paint manufacture all paint materials shall be thoroughly mixed and/or stirred before and during use, and suitably strained as and when necessary.

1.7.5 *INSPECTION*

No priming coats shall be applied until the surfaces have been inspected and preparatory work has been approved by the Architect. No undercoats or finishing coats shall be applied until the previous coat has been similarly inspected and approved.

1.7.6 *PAINT APPLICATION*

Each coat of paint shall be so applied as to produce a film of uniform thickness. All paint shall be applied in accordance with the manufacturer's instructions. Special attention shall be given to ensure that all surfaces including edges, corners, crevices, welds and revets receive a film thickness equivalent to that of adjacent painted surfaces.

1.7.7 *DRYING*

All coats shall be thoroughly dried before succeeding coats are applied. Allow a minimum of 24 hours between application on any one surface, unless otherwise specified by the manufacturer.

1.7.8 *PRIMED METALWORK*

If the priming coat of pre-primed metalwork has suffered damage in transit, or during erection on site, the affected areas shall be cleaned off by wire brushing, abrading and dusting off, the bared patches touched up with a primer of a similar type to that already applied.

1.7.9 *COPPER*

Copper scheduled for painting shall be lightly abraded with emery cloth, washed with white spirit and wiped dry with clean rags. Apply a coat of each primer immediately the cleaned surfaces have been approved.

1.7.10 *BRICKWORK, CONCRETE, ETC.*

All brickwork, blockwork, concrete, rendered and plaster surfaces scheduled to be painted shall be brushed down, all holes and cracks filled, all projections such as plaster, or mortar splashes etc., removed to leave a suitable dust free surface. All traces of mould oil shall be removed from concrete surfaces by scrubbing with water. Detergent and rinsing with clean water. All these surfaces shall be thoroughly dry before any primer or paints are applied. Apply a coat of alkali resisting primer where surfaces are to be finished with oil paints or alkyd resin type emulsion.

Asbestos cement surfaces scheduled for painting shall be brushed down to remove powdery deposits, and a coat of alkali resisting primer applied where such surfaces are to be finished with oil paints or alkyd resin type emulsion.

1.7.11 *COLOURS*

The colours will be selected by the Architect from the paint manufacturer's standard colour range.

1.7.12 *TOXIC WASH*

Concrete, blockwork, plaster and timber surfaces which are to be painted shall be washed down prior to painting with a toxic wash applied by brush or spray. A second wash shall be applied two days after the first wash. The surfaces shall then be allowed to dry out completely before application of paint.

1.7.13 *PROTECTION*

Proper care must be taken to protect surfaces while still wet by using of screens and 'wet paint' signs where necessary.

1.7.14 *DAMAGE*

Care must be taken when preparing surfaces, or painting etc. not to stain or damage other work. Dust sheets and covers to the satisfaction of the Architect

shall be used to protect adjacent work. Any such stains or damage shall be removed and made good at the Contractor's expense.

1.7.15 *CLEANLINESS*

All brushes, tools, pails, kettles and equipment shall be clean and free from foreign matter. They shall be thoroughly cleaned after use and before being used for different colours, types or classes of material. Painting shall be carried out in the vicinity of other operations that may cause dust. Waste liquids, oil soaked rag, etc. shall be removed from the building each day. Waste liquids shall not be thrown down in any sanitary fittings or drains.

1.7.16 *PERFORMANCE*

If while the work is in progress, the paint appears to be faulty, such as consistency of colour, drying time, or quality of finish, the work shall be stopped at once and the manufacturer consulted.

The manufacturer's of the materials shall be given every facility for inspecting the work during progress in order to ascertain that the materials are being used in accordance to their directions, and to take samples of their products from the site if they so desire for tests.

The finishing coats of the various paints or surface finishings shall be free from sags, brush marks, runs, wrinkling, dust, bare or 'starved' patches, variations in colour and texture, and other blemishes.

When the work has been completed, the finishes surfaces shall not be inferior in quality, colour and finish to the samples approved by the Architect, and imperfections in manufacture shall not be apparent through these finished surfaces.

In the event that the Architect is not satisfied that the quality of finish does not comply with the required standards and/or the sample panel the Contractor will be required to repaint at his own expense, such work to the satisfaction of the Architect. If in the opinion of the Architect it is necessary to remove completely the unsatisfactory paintwork this shall also be done under the direction of the Architect at the expense of the Contractor.

1.7.17 *PACKING, DELIVERY AND STORAGE*

All paints and surface coatings shall be delivered in sound sealed containers, labelled clearly by the manufacturers, the label or decorated container must state the following:

- a) The type of product
- b) The brand name and colour
- c) The use for which it is intend
- d) The manufacturer's batch number
- e) The BS number if applicable
- f) All labels shall be printed - containers bearing type written labels will not be acceptable.

Materials shall be stored under cover in accordance with the manufacturer's instruction and with local fire and safety regulations. The store itself must be maintained at a temperature of not less than 500F (100C) and must not be subjected to extreme changes of temperature.

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

1.7.18 *VINYL EMULSION PAINT*

Surfaces to be painted shall receive one mist coat followed by two full coats of vinyl emulsion paint. Application may be by means of rollers or brushes.

1.7.19 *GLOSS FINISH PAINT*

Surfaces to be painted shall be primed then painted with two undercoats followed by one coat gloss finish paint.

1.7.20 *CLEAR POLYURETHANE VARNISH*

Surfaces to be clear varnished shall be treated with two coats polyurethane varnish.

1.7.21 *TEXTURED COATING*

The manufacturer's instructions concerning application of the coating are to be strictly followed under the direction of the Architect.

All surfaces to receive textured coatings are to be clean and dry with surfaces scraped and brushed before application of the coating.

Application of the coating is to be with textured roller or fibre brush as directed by the Architect with a minimum spreading capacity of 1 kg/m². Under no circumstances is the coating to be thinned.

1.8 PLUMBING AND DRAINAGE INSTALLATION

1.8.1 *GENERAL*

1.8.1.15 *AUTHORITATIVE STANDARDS AND CODES OF PRACTICE*

The authoritative standards referred to in this Specification are the British Standards and Codes of Practice.

Should the contractor wish to substitute any other authoritative Standards or Codes of Practice for any referred to in the Specification, he must submit details of any such Standard or Code of Practice with two copies of the document for approval of the Engineer. Approval will only be given to use an alternative Standard or Code of Practice if the Engineer considers the proposed Standard or Code of Practice will produce work of a standard equal or better than that of the specified Standard or Code of Practice.

The whole of the plumbing works is to be executed by a registered plumber and drain layer in strict accordance with the Regulations of the Local Authorities and to the satisfaction of the Engineer.

1.8.1.16 *WORKING DRAWINGS*

For all work within buildings the Contractor shall produce drawings showing details of his proposals. The drawings shall be submitted to the Engineer for his approval and no work shall commence until the drawings have been approved.

1.8.1.17 AS CONSTRUCTED DRAWINGS

On completion of the works, the Contractor shall prepare drawings showing the work as constructed. The drawings shall be submitted to the Engineer for his approval. When the drawings have been approved, one negative and two prints shall be provided by the Contractor to the Client for his retention.

1.8.2 MATERIALS

1.8.2.18 PVC PRESSURE PIPEWORK

All PVC pipe for cold water services shall comply with the requirements of BS 3505 and all fittings shall comply with BS 4346.

PVC pipes and fittings shall be solvent welded using the pipe manufacturers approved cement.

1.8.2.19 PVC SOIL PIPEWORK

PVC soil pipework and fittings shall comply with the requirements of BS 4514.

1.8.2.20 STOP-COCKS, TAPS AND STOP VALVES

Stopcocks for underground use shall be plug cock pattern or screw down pattern complying with the requirements of BS 2580.

Taps and stop valves shall be screw down pattern and small comply with the requirements of BS 1010 fitted with washers complying with BS 3457. Hose taps and hose connections shall have outlet noses screwed in accordance with the requirements of BS 1010.

1.8.2.21 CISTERNS

Polythene or polypropylene cisterns shall comply with the requirements of BS 4213. Galvanised cisterns shall comply with the requirements of BS 1968 Class 'C' or BS 2456.

1.8.2.22 PRESSED STEEL STORAGE TANKS

Pressed steel storage tanks shall comply with the requirements of BS 1564 and shall be complete with cover, access manhole, ventilators, overflow, and drain. The whole of the tank steelwork and plates shall be galvanised before the tank steelwork and plates shall be galvanised before dispatch. After completion of erection the tank shall be painted with an approved etching primer and two coats of bitumen based aluminium paint externally and two coats of non-toxic black bitumen paint internally.

1.8.2.23 WASTE FITMENT TRAPS

Where standards or deep seal traps are specified they shall be of non-ferrous material in accordance with BS 1184 or PVC

1.8.2.24 WATER SERVICE INSTALLATIONS

All work shall be carried out in accordance with C.P. 342 and C. P. 310 and to the approval of the Engineer.

The pipes shall be supported in their final position and adjusted before any joints are made. Pipes in buildings shall be positioned as close as practicable to walls, ceilings and columns. Sufficient drain points and automatic air vents shall

be provided to ensure the system functions correctly. Valves and other user equipment shall be installed with adequate access for operation and maintenance.

Where valves and other operational equipment unavoidable installed beyond normal reach or in such a position as to be difficult to reach, extension spindles with brackets shall be provided. Screwed piping shall be installed with sufficient number of unions to facilitate easy removal of valves and fittings and to enable alterations of pipeworks to be carried out without the need to cut the pipe.

Allowance shall be made for expansion and contraction of pipework, precautions being taken to ensure that any forces produced by pipe movements are not transmitted to valves or equipment of plant. All screwed joints to piping and fittings shall be made with P.T.F.E tape.

1.8.2.25 SANITARY SERVICE INSTALLATIONS

Soil, waste and vent pipe systems shall be installed in accordance with BS 5572 and to the approval of the Engineer. All sanitary appliance shall be installed in accordance with BS 6465. All waste fittings shall discharge into a gully trap before passing to a sewer by way of a manhole.

Rodding and inspection facilities shall be provided within the drainage system in position where they are easily accessible. Where rodding facility is not in a position such that access is not easily available, a branch shall be extended so as to provide suitable rodding eye. Rodding eye shall be provided at the bottom of stacks.

Vent stacks shall be terminated above roof level and shall have a plastic or galvanised steel guard at the top.

1.8.2.26 JOINTING PIPES

Joints shall be made strictly in accordance with the manufacturer's instructions. The Contractor shall make use of the technical advisory services offered by manufacturers for instructing pipe jointers in the methods of assembling joints.

Before making any joints, all jointing surfaces shall be thoroughly cleaned and dried and maintained in such condition until the joints have been completely made or assembled.

Notwithstanding any flexibility provided in the pipe joints, pipes must be securely positioned to prevent avoidable movement during and after the making of the joint.

The space between the end of the spigot and the shoulder of the socket of flexibly jointed pipes when jointed shall be as recommended by the manufacturer or ordered by the Engineer.

After flexibly jointed pipes, other than PVC pipes have been jointed the gaps between the barrel of the pipes and the internal face of the socket shall be sealed with puddle clay, uncaulked rope yarn or other approved material. The rope yarn or other material must have been treated so as not to support bacterial growth.

Where loose collars are used to join pipes cut for closures, special tools shall be employed to keep the inside of the pipe flush and the collar concentric with the pipe while the joint is being made.

1.8.2.27 SOLVENT WELDED JOINTS

Only the solvent cement recommended by the manufacturer for his pipe joint system shall be used and his instructions on the making of the joint shall be closed followed.

Excess solvent cement shall not be applied to the inside of the pipe socket and all surplus solvent shall be removed from the joint and the pipe. Any solvent falling on the trench formations shall be removed by excavating the contaminated soil.

Solvent welded pipes jointed outside the trench shall not be lowered into the place until the elapse of time recommended by the manufacturer. The time allowed for curing shall be increased with lower temperature.

1.8.2.28 FIXING SANITARY-WARE AND FITTINGS

All sanitary-ware and fittings shall be left in a clean and good condition to the satisfaction of the Engineer.

All fittings shall be fixed in accordance with the manufacturer's instructions.

Lavatory basin brackets shall be cut and pinned to walls in cement mortar including making good rendering, tiling or plastering, etc.

1.8.2.29 PIPES BUILT INTO STRUCTURES

The outside surface of all pipes and special castings to be built into structures shall be thoroughly cleaned immediately before installation. Where ordered protective coating to metal pipes shall be removed from the sections to be built in while the external surfaces of fireclay and concrete pipes shall be roughened to form a key for concrete or mortar.

Sheathing to steel pipes shall be cut away from the sections to be built-in and after erection the protection shall be completed by applying approved bituminous material around the barrels of pipes at the junctions with structures.

Pipe passing through water retaining walls and floors shall, where possible, be built into the structure in-situ. Shuttering shall be formed closely to the outside of the pipes, and concrete shall be placed and compacted thoroughly round pipe and puddle flange, if any.

Where fixing in the course of construction is not possible, temporary openings in structures, formed to the dimensions shown by the Engineer, shall be left where indicated or directed to accommodate the subsequent erection of pipes and special castings.

In water retaining structures, they shall taper to a smaller dimension towards the external faces of structures and shall include where indicated a waterstop. In basements, dry chambers at pumping stations etc., temporary openings shall taper to a smaller dimension towards the internal faces of structures and shall also include, where indicated a waterstop.

Prior to in-filling, all surfaces against which fresh concrete is to be placed shall be prepared as specified, while the external surfaces of pipework shall be prepared as described in this clause.

1.8.2.30 TESTING OF PIPELINES

The Contractor shall provide all water, fittings, pipe stoppers, test pumps, pressure gauges and the necessary labour and tools for the hydraulic testing or pressure pipelines and air testing of drains and sewers.

Pipelines shall be tested hydraulically in sections during the course of construction.

Testing shall be applied to prove the structural soundness of the various units in the line, including pipes, valves and anchorages, and to prove the water tightness of the line.

The pipeline or pipework shall be filled with water in such a manner as to prevent any shock or water hammer and allow for the complete evacuation of air, and kept under observation for leakage at static head for twenty four hours. If there are no leakages the pressure shall be raised slowly to the required test pressure for the pipeline and maintained at that pressure for a period long enough for the Engineer to examine the whole section under test, or not less than 4 hours whichever is the longer period. Thereafter, for a period of 2 hours the leakage of water, as measured by the amount drawn into the pump to maintain the pressure must not exceed a rate of 0.1 litre per mm nominal internal diameter per kilometre length of main per 30 metres head for each 24 hours.

All pipes or joints which are proved to be in any way defective shall be cut out, remade and retested as often as may be necessary until a satisfactory test is obtained and any work which fails or is proved by test to be unsatisfactory in any way shall be cut out and re-done by the Contractor at his own expense. In addition to the tests in separate sections, on completion the main shall be tested in whole or in parts to the same pressure and by the same procedure as that outlined for individual sections.