MAIN BUILDING SPECIFICATIONS

PREAMBLES
EXCAVATION AND EARTHWORK

Nature of Excavation

A. The Contractor must ascertain for himself the nature of the materials to be excavated and price the work accordingly as no allowance will be made beyond the Contract Sum for any alleged ignorance in this respect.

Commencing Levels

B. Unless specifically stated otherwise the commencing levels for excavation shall be deemed to be existing ground level or underside of reduced level excavation.

C. All measurements are based upon reduced level excavation being executed first and no adjustment will be made should a differing sequence of operations be adopted, unless specifically ordered by the Architect in writing.

Excavations

D. Excavations shall be to the widths and depths indicated the drawings or to such lesser or greater depths as the Architect may deem necessary and so instruct the Contractor in order to obtain satisfactory foundations.

E. Any difference in the quantity of works actually executed under such instructions and that provided in the Bills of Quantities shall be measured and valued by the Quantity Surveyor as a variation under the relevant Conditions of Contract.

F. If, however, the Contractor excavates to any greater depth or widths than are shown on the drawings or directed by the Architect, then the Contractor shall at his own expense fill in such extra depths and widths with concrete similar to that described for foundations to the satisfaction of the Architect.

Bottoms to Excavation

G. The Contractor shall report to the Architect as and when a secure bottom to the excavations has been obtained and the same is ready to receive concrete.

H. Any concrete or other work put in before excavations have been inspected and approved shall, if so directed, be removed and new work substituted after excavations have been approved all at the Contractor's expense.

I. If so directed, the Contractor shall water and well ram the bottoms of excavations to the satisfaction of the Architect.

Measurement of Excavation Work

A. Excavation work is measured net as before digging and the Contractor must allow for increase in bulk after digging.

Trenches for pipes, cables kerbs, etc., other than drain pipes

B. Prices for excavation of trenches for pipes, cables, kerbs, etc., shall include for grading and ramming bottoms to the levels required, all necessary planking and strutting, carefully returning, filling and ramming selected excavated materials and for carting away any surplus materials.

Rock

C. Any rock or other hard materials encountered in excavating to the required depth which, in the opinion of the Architect, can only be removed by wedges or compressor plant shall be paid for as an extra and the price shall include for trimming and levelling. No blasting will be allowed. Hard compacted murram which can be removed by pick will not be classed as rock notwithstanding that the Contractor may decide to remove it by wedges or compressor plant.

D. The Contractor must give notification to the Architect or his representative when such material is encountered and its extent must be agreed with Architect or Quantity Surveyor or their authorised representative before the work is carried out. No allowance will be made for rock excavation unless the foregoing procedure has been followed.

Rates for Excavation

E. The rates for excavation shall include for excavating by hand or machine in all types of materials except rock, as previously specified.

F. Excavations for plain concrete foundations have been measured to the **net sizes** required by concrete dimensions.

G. An allowance for working space and formwork has been measured to reinforced concrete foundation, but if the Architect's approval is given to pouring concrete against the face of the excavations these items will be measured and adjusted in the Final Account.

H. The rates for excavation must include for such excavating in all types of ground encountered including sand, murram, hard murram, tree roots and loose boulders.

Levelling

I. No item is measured for levelling and consolidating ground and rates for excavations must include for levelling and preparing the ground for concrete

or other works including ramming or rolling.

Disposal of Water

A The Contractor shall keep the excavations free from standing water and silt (or excavated materials softened by water) and he shall include for the cost of pumping, construction of temporary drains, soak away pits, etc., as deemed necessary to achieve this. An item has been included for this in the Bills of Quantities in each relevant section. The cost of pumping to dispose of any spring or running water has been covered by Provisional Sum. If spring or running water is encountered, the cost of any pumping ordered by the Architect will be paid for in accordance with the Dayworks Schedule.

Planking and Strutting

B. Sides of all excavations must be supported in order to prevent falls from or collapse of the earth face. The term "planking and strutting" is deemed to include any method or methods which the Contractor elects to adopt, uphold, protect and maintain the sides of excavations. The Contractor will be responsible for any consequences of his failure in this respect including clearing away fallen materials and any extra concrete or other works including formwork ordered by the Architect due to such failure. An item has been included in these Bills of Quantities in each relevant section.

Return, Fill in and Ram

C. Material returned around foundations externally shall be selected hard, dry excavated materials arising from the excavations free from vegetable soil, roots and rubbish carefully filled in, spread, watered and compacted in layers not exceeding 200 mm thick. Backfilling internally shall be hardcore, or selected hard dry granular materials as above to approval.

D. No excavations 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 deposition of concrete.

Cart Away

E. All surplus excavated material, where so directed, and all rubbish is to be removed from the site and the Contractor is to find his own dump and pay all charges.

Approval before Filling

F. No fill materials shall be placed before approval has been given by the Architect for filling to begin.

Measurement of Filling Generally

G. Filling is measured net as after consolidation.

Earth Filling

A. Levels specified to be made up with surplus soil, etc., are to be filled in with selected soil free from vegetable growth to the approval of the Architect and is to be laid in layers not exceeding 200 mm thick, each layer to be levelled, well rammed and consolidated and watered if necessary.

Hardcore Filling

B. Hardcore shall consist of clean hard broken stone or rubble graded to pass in all directions a 100 mm ring with sufficient sand added to fill the interstices. The hardcore shall be well packed, rammed and where possible, rolled with a heavy roller. Where rolling is impossible compaction shall be by hand or by mechanical tampers. Before any concrete is laid on hardcore, the hardcore shall be levelled and blinded with sand, rolled and well-watered through a sprinkler rose.

CONCRETE WORK

Code of Practice for Reinforced Concrete Work

C. All workmanship, materials and tests in connection with reinforced concrete work are to be conformity with B.S. Code of Practice B S 8110: 1985 - The Structural Use of Concrete.

Generally

D. A competent person shall be employed whose first duty it will be to supervise all stages in the preparation and placing of concrete. All cubes shall be made and site tests carried out under his direct supervision.

E. 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.

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

Samples

G. Samples of all materials are to be submitted for approval of the Engineer at least

one week before it is desired to commence deliveries. All condemned materials are to be removed from the site within 24 hours.

Cement

H. Cement used shall be ordinary Portland cement and shall be obtained only from manufacturers approved by the Engineer, and shall comply in every respect with B.S. 12. The Contractor at his own expense may use rapid hardening Portland cement (to B.S. 12) in order to speed up progress of the Works. If rapid hardening Portland cement is used, the prior approval of the Engineer shall be obtained in writing.

A. 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 Engineer, copies of the cement manufacturer's test certificates shall be delivered to the Engineer or his representative on the site promptly, but such documents shall not preclude the Engineer from rejecting any cement which does not in every way comply with the specification.

Cement Storage

B. The cement must be delivered in the manufacturer's sealed and branded bags and stored separately in dry, water-tight stores with their floors raised above ground level and shall be at all times carefully protected from moisture.

C. The cement shall be stored in such a way that each consignment may be identified and used in the order of its delivery. Cement may be delivered in bulk containers provided additional suitable arrangements are made for bulk storage on site to the approval of the Engineer.

Inferior Cement

D. 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.

Aggregate

E. Aggregates shall be granite or other equal and approved obtained from an approved source and shall comply with B.S. 882. They must be chemically inert, strong, hard, durable, free from adhering coating, salts, organic or other impurities and shall be washed or screened as directed.

Fine Aggregate and Sand

F. Fine aggregate and sand shall be clean, sharp, coarse, hard siliceous materials and equal at all times to the samples which shall be deposited with and

approved by the Architect or Engineer. It shall comply with the requirements of B.S. 882, Table 2, Zones 1,2 or 3. The caustic soda tests 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 coarse materials shall not exceed 10% for crushed stone and 3% for natural sand or crushed gravel.

G. The Contractor shall supply all necessary equipment for testing of fine aggregate and sand for use of the Clerk of Works.

Coarse Aggregates

A. Coarse aggregates shall be granite from approved quarries, clean, free from earth and extraneous matter, and shall conform to B.S. 882. The amount of fine particles occurring in a free state or as loose adherent shall not exceed 1% when determined by the laboratory sedimentation test.

B. After twenty-four hours in water, a previously dried sample shall not gain more than 1`0% in weight for crushed stone or 3% for natural sand or crushed gravel.

C. The four nominal aggregate sizes shall be 40 mm (1.5"): 20 mm (.75"): 10 mm (3/8"): 6 mm (1/4") : and the grading when analyzed as described in B.S. 812 shall be within the limits given in B.S. 882.

Aggregate Storage

D. 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.

E. The materials shall be stored on a timber or concrete floor and the piles shall be as large as possible, flat topped and drained.

Water

F. All water used on the Works shall be clean, free from earthy vegetable and organic matter and from acidic and alkaline substances in suspension or solution. It shall preferably be obtained from the water mains of the Ministry of Water and Energy Department or Water Authority and shall be stored in proper water storage tanks to the approval of the Architect or Engineer. Any approved water shall be tested in accordance with B.S. 3148.

Admixtures

G. Admixtures of any kind for accelerating the setting of cement, plasticiser, hardeners, water proof etc., shall be used only if approved or specified by the

Architect or Engineer.

Proportion of Concrete Mix

H. 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 in an approved weight batching plant. Volume mixing will not be permitted. The weight of damp aggregates must be adjusted to take into account the weight of water in the aggregates, and 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 into the mix.

A. Throughout the carrying out of the Contract "Work 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 Clerk of Works and in his presence. Such cubes shall be made in 150 mm or six inch cube steel or cast from mould and shall be marked and cured strictly in accordance with 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 Architect or Engineer.

B. Six cubes shall be made on each occasion, and cured in compliance with B.S. 1881 Part 3, 1983 concrete for each cube being from a difference batch. Three cubes shall be forwarded in time for testing at the age of seven days from casting and three cubes in time to 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 cube was drawn, or to which it was about to be placed.

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

D. Concrete is required to have the properties and give the strength in Newtons per square millimetre as set out in the table below which is to be considered as the minimum standard that will be accepted in the finished Works.

E. The workability of the fresh concrete should be such that concrete is suitable for handling, placing and compaction so that it surrounds the reinforcement, tendons and ducts and completely fills the formwork.

Grade	Quality	Max Size of Coarse Aggregate	Max Water Cement ratio by weight aggregate	Minimum crushing strength of Works Test Cubes

				7 days	28 days
30 36	1:1:2	20 mm	0.45	30	
25 26	1:1.5:3	20 mm	0.55	21	
25 26	1:1.5:3	10 mm	0.55	21	
20 21	1:2:4	20 mm	0.60	14	
20 21	1:2:4	10 mm	0.60	14	
15 12	1:3:6	10 mm	0.60	_	
10 10	1:3:6	10 mm	0.60	8	
7	1:4:8	40 mm	0.60	_	7
_	1:10	" All in Aggregate"	_	_	

A. 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 aggregate 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.

Unsatisfactory Concrete Work

B. Should in the opinion of the Engineer any of the results of the specified tests of concrete or materials be unsatisfactory, the Engineer may order the work to be stopped pending his further instructions. Executed work for which test cubes are unsatisfactory shall be liable to rejection and, if so directed by the Engineer, the work represented by the tests shall be cut out and re-executed at the Contractor's expense.

C. 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.

D. 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 in accordance with the requirements of Part 4 of B.S. 1881 Part 3, 1983.

E. 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.

Structural Test

F. If, in the Engineer's opinion, there is a doubt as to the strength of a structure, solely or in part, for the reason that the site-made concrete cubes fail to attain the specified strength, or because of one or more circumstances attributable to alleged negligence on the part of the Contractor to make a loading test on the Works or any part thereof. The nature of the test and the loading shall be in accordance with Clause 605 of C.P. 114. If the result of the test is satisfactory, except where the test has been made because test cubes fail, the Contractor shall be reimbursed for the cost of the test. If the result of the test is not satisfactory, the Contractor shall bear the cost of the test and the cost of correcting any defects in accordance with the instructions of the Engineer.

Formwork

A. The formwork shall be so constructed as to remain sufficiently rigid during the placing compaction of the concrete and shall be sufficiently tight to prevent loss of liquid from the concrete. Vertical strutting shall be carried down to such construction as is sufficiently strong to afford the required support without injury. All rubbish, chippings, shavings and sawdust shall be removed from the interior of the forms before the concrete is placed, and suitable washout holes shall be provided to facilitate this, and the formwork in contact with the concrete shall be clean and thoroughly wetted and treated with the approved mould oil. Care shall be taken that such oil is kept out of contact with the reinforcement and shall be used a sparingly as possible. 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, and in any case the minimum permissible times shall be as follows:-

Formwork (Cont'd)

Vertical faces of walls and columns	2 days

Sides of beams and lintels	2 days
Soffits of slabs (subject to the retention of Props until 21 days)	14 days
Soffits of beams and lintels (subject to the Retention of props until 21 days)	14 days

B. No formwork is to be removed if, in the opinion of the Engineer, the concrete has not hardened sufficiently. Approval of the Engineer shall not relieve the Contactor of his liability to make good any concrete which may be damaged by premature removal or collapse of forms. Notwithstanding any other clauses in this specification the responsibility for the safe removal of the formwork rests with the Contactor.

C. All formwork shall be removed without such shock or vibration as would damage the reinforced concrete.

D. Forms shall be true to lines and levels and braced and strutted to prevent deformation.

E. 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.

F. Concrete shall not be poured in horizontal layers to a depth exceeding 1500 mm in formwork, except where prior approval of the Engineer has been obtained.

G. Formwork is measured to the actual net surface of the concrete to be supported and the Contractor shall allow in his prices for any waste, fixing at the various levels, straight cuttings, splayed edges, notchings, fillets to form chamfered arises, extra materials, joints, overleaves for angles, extra labour for narrow widths and small quantities, props, stays, struts, hangers, brackets, edges, wiring, bolts, and everything necessary to keep all quite firm and rigid, and any other labour and materials necessary to fix, ease, adjust and remove the formwork as described.

Normal Finish to Faces of Structural Concrete

A. 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 Engineer and made up with fine concrete of equal quality in such a manner as shall be directed. The face of concrete for which shuttering is not provided, other than slab, is to be smoothed with a wooden float to give a finish equal to that of the rubbed-down surface where shuttering is provided. The top face of a slab which is to

not intend to cover with other materials is to be levelled and floated before setting to a smooth finish at the level or falls shown on the drawings or elsewhere. The floating must be carried out in such a way as will prevent an excess or mortar being brought to the surface of the concrete. The top face 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 laitence © and to provide a roughened surface.

Fairfaced Concrete

B. Where so described or measured, faced of concrete shall be finished fair by means of formwork lined with approved waterproof plywood so as to produce a perfectly true surface and shall have all imperfections in the concrete face 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.

Wrought Boarded Face Formwork to give a Board Mark Finish

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

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

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

F. All imperfections shall be cut out and made good in concrete of equal quality.

G. The resulting concrete shall show grain and individual board marks, be free from honeycombing and excessive air holes, of uniform colour and to the entire satisfaction of the Engineer.

Wall Ties

A. Where block walls abut columns or solid concrete walls two 6 mm diameter steel reinforcing bar ties are to be cast into the concrete at vertical intervals of 400 mm. Ties to be 300 mm long and project 150 mm into blockwork.

Holes, Pipes Etc.

B. The Contractor shall be responsible for the co-ordination with sub-contactors for incorporating any electrical conduits pipes, fixing blocks, chases, holes, etc.,

in the concrete members as required. The Contractor shall submit full details of these items to the Engineer for approval before the work is put in hand. Concrete fixing blocks may be embedded in the concrete provided that the strength or effective cover of any part of the structure is not adversely affected nor the finished work damaged by any movement of the blocks. All fixing blocks, chases, holes etc.., to be left in concrete shall be accurately set out and cast with the concrete. No openings, chases, holes or other voids shall be cut or formed in concrete without the approval of the Engineer.

Blinding Concrete

C. 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 50 mm minimum blinding layer of concrete 1:4:8. The cover for concrete under reinforcement shall be entirely above the blinding layer.

Mixing

D. Concrete is to be mixed in a batch mixer of approved type having a drum rotating about a horizontal or inclined 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 one gallon for one cubic yard mixers and pro rate for smaller sizes and so arranged that the accuracy is not affected by variations in the pressure of the water supply line.

E. The fine and coarse aggregate and the cement are to be mixed for at least four turns of the drum, after which the required amount of water is to be added gradually while the drum is in motion and the concrete then mixed for at least one and a half minutes and until a mix of uniform colour and consistency is attained.

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

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

H. On cessation of work, including all stoppages exceeding twenty minutes, the mixers and all handling plant are to be washed out with clean water.

A. Concrete mixed as above is not to be modified by the addition of water or otherwise in order to facilitate handling, or for any other purpose.

B. At least one slump test shall be made each day concreting is in progress under the supervision of the Clerk of Works. The slump shall not exceed 75 mm but

at 25 mm slump may be allowed by the Engineer in certain structural members.

Transporting

C. Concrete is to be handled from the place of mixing to the place of final deposit as rapidly as practicable by the methods which will prevent segregation or loss of ingredients and maintain the required workability. It should be deposited as nearly as practicable in its final position to avoid rehandling.

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

E. 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 any proposed chuting plant must be approved by the Engineer before the plant is delivered to the site.

F. If the Contractor wishes to distribute concrete by means of pumps, full details of the system must be made available to the Engineer for approval.

Placing and Consolidation

G. The concrete shall be placed before setting has commenced and in any case within thirty minutes from the time the water is added, and must not be subsequently disturbed. Concrete shall be thoroughly compacted during the operation of placing, and thoroughly worked around the reinforcement, around embedded fixtures, and into corners of the formwork. Mechanical vibration with an approved type insertion vibrator shall be used.

H. The use of mechanical vibration will not relive the Contractor of his responsibility for making good work which may be damaged by excessive or ill-applied vibration.

I. All methods of placing and consolidation of the concrete are to be such as not to cause any disturbance or movement to the formwork or reinforcement. After being placed in position, the concrete is to be left absolutely undisturbed by any movements or thrusts while setting.

J. An accurate record is to be kept by the Contractor showing dates and times when various portions of the work were concreted. The concreting foreman must not vary the approved mix or water content without the permission of the representative of the Engineer. It may occasionally be found that in constructed 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 cement 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.

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

Construction Joint

B. The form and location of all construction joints shall be approved by the Engineer before commencement of work.

C. The Centering to form the stop shall be fitted with splay fillets on the concrete face and will be firmly fixed and scribed around the reinforcing steel. If any concrete shall flow past the stop, it shall be hacked off as soon as the concrete has set. Before any new concrete is placed up against the stopped face, the concrete previously placed shall be hacked and scoured with a wire brush to remove the scum. The joint shall then be soaked with water and covered with a sand cement mortar of proportions in the same ration in the concrete used. In all cases of application of mortar the punning must be adequate to incorporate the mortar in the body of the concrete. 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 laitence shall be removed from the surface after the concrete is deposited and before it has set.

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

E Slabs to be cast using alternate bay construction, maximum size of single panel 40 square meters.

Column Plinths

F. Column kicker plinths 75 mm high 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 concrete.

Curing

G. The curing of the concrete must receive particularly careful attention. The concrete shall be covered with a layer of a sacking, canvas, hessian or suitable absorbent materials, and concrete, formwork and covering kept constantly wet for the first seven days after casting. Foundation concrete must be protected from falling earth and kept free from deleterious substances.

Dimensions of Finished Concrete

A. Except where specially noted, dimensions, levels, sizes, positions, and covers are to be exactly as dimensioned or specified with the following tolerances for concrete cast in situ.

(a) For sizes of beams or columns, slab or wall thicknesses, not less than specified, nor more than 5 mm above. Dimensions between column faces not to have a greater tolerance than 10 mm.

(b) For layout positions or dimensions horizontal or vertical 5 mm plus or minus.

(c) Levels of floor, ceilings, beams, lintels, etc., (top and bottom), 5 mm plus or minus and no surface intended to be horizontal must slope more than 2 mm in 1 meter.

(d) Errors in plumbing 5 mm plus or minus, and no line or surface intended to be vertical must slope more than 2 mm in 1 meter.

(e) For cover of concrete around reinforcement 3 mm plus or minus.

Permissible tolerance shall not be cumulative.

Steel Reinforcement

B. Mild steel rod reinforcement shall comply with B.S. 4449.

C. High tensile steel rod reinforcement shall be hot rolled deformed steel complying with B.S. 4661 grade 460.

D Welded steel fabric reinforcement shall comply with B.S. 4483.

E. The steel shall be stored so that it is kept clean and reasonably free from rust.

F. All metal for reinforcement is to be free from loose mill scale, loose rust, oil and grease, or other harmful matter immediately before placing of the concrete.

G All reinforcement is to be placed and maintained in the positions shown on the drawings. Some definite method of ensuring the amount of cover required by the designer must be agreed between the Contractor and the Engineer.

H. Reinforcement must be bent or straightened in a manner that will not injure the materials, and in accordance with B.S. 4466.

I. All bars are to be bent cold.

J. Starter bars are to be positioned accurately.

A. All crossings of bars are to be securely wired.

B. Bars at the top of slabs are to have substantial support.

C. The prices of all rod reinforcement are to include for cutting to lengths and for all bending, hooked ends, etc., and for placing in position with distance pieces where necessary to ensure the rigidity of the bars and for tying together with approved wire in order to prevent displacement during concreting.

D. The placing of all reinforcement shall be checked by the Engineer and in no circumstances is concrete to be deposited around any steel that has not been passed. At least forty eight (48) hours notice shall be given to the Engineer that reinforcement will be ready for inspection.

E. Where bending schedules are provided, the measured weight of reinforcement for purposes of payment will be taken from the bending schedules and the Contractor must make due allowance in his rates for rolling margins and all the foregoing items and labour including cutting to waste from random lengths.

Cover to Reinforcement

F. The thickness of the concrete cover to reinforcement shall conform in all respects to the B.S. Code of Practice B. S. 8110: 1995 unless specifically shown on the drawings. Some approved method of ensuring the correct amount of cover shall be used.

Spacing Blocks and Chairs etc.

G Properly formed spacing blocks of concrete with wire ties or other approved means shall be securely wired or attached to the reinforcing bars to ensure the maintenance of the proper cover of concrete.

H. These shall be dense concrete left with a wire brushed surface or 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 or pouring, tamping or vibration of concrete. Four chairs per drop are to be provided around columns to hold steel in positions and chairs are to be made up of 12 mm diameter mild steel bars. The cost of all such fixing steel must be allowed for the Contractor in his rates for reinforcement generally.

Precast Concrete

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

J. The coarse aggregate for precast concrete shall be 10 mm gauge where 1:1.5:3 mix concrete is specified.

A. The concrete shall be of the mixes described and shall be thoroughly tamped in the mould 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 mould are such that the sides are easily removable without damaging the concrete.

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

C All precast work shall be in lengths convenient for handling, unless otherwise described.

D Prices for precast concrete shall include for all moulds, hoisting and fixing to the levels required, bedding and pointing in cement mortar (1:3) and for finishing exposed faces fair and smooth where so described.

WALLING

Setting out Walling

E. The Contractor shall provide proper setting out rods and set out all work on same for courses, openings, heights, etc., and shall build the walls and piers etc., to the widths, depths and heights indicated on the drawings and as directed and approved by the Architect.

Cement

F Cement shall be described in Concrete Work.

Fine Aggregate

G. Fine aggregate for concrete blocks shall be as described for fine aggregate in Concrete Work.

Coarse Aggregate

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

Concrete Block

I. Concrete blocks for walling shall be provided by the Contractor complying with B.S. 2028 Type A, and made in approved block making machines or a composition as follows:-

Portland Cement	1 Cubic Meter
Fine Aggregate (graded up to 5 mm)	3 Cubic Meters
Coarse Aggregate (graded up to 10 mm)	6 Cubic Meters

A. Blocks shall be solid or hollow two-hole type as specified and are to be made under sheds erected by the Contractor to the directions and approval of the Architect. In hollow blocks of the volume of the cavities shall be not less than 45% and not more than 50% of the gross volume, and the dimensions of the cavities arranged so that each cavity is vertically continuous when the blocks are bonded. Samples shall be approved by the Architect before any walling work is commenced.

B. The compressive strength Type A blocks shall be not less than:-

Average of 13 hollow blocks	5.75 N/mm2 gross area
Lowest individual hollow block	4.0 N/mm2 gross area

C. 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 the approved matting, sacking or straw and kept wet for a further five days, then kept in the same position and under the 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. All blocks must be left with good sharp edges. The blocks for use in the Works shall be 190 mm high and may vary in length from 300 mm to 400 mm and no variation above or below these lengths will be allowed except where required to form proper bonding at corners, round 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.

Bonding Walling

D. The blocks shall be properly bonded together in such manner that no vertical joint in any one course shall be within 100 mm of a similar joint in the courses immediately above or below. Sufficient through bonders shall be provided as directed by the Architect. Alternate courses of walling at all angles and intersections shall be carried through the full thickness of the adjoining walls. All walling shall be built up entirely solid in blocks without void, allowance being made for joints 10 mm thick only. All perpends, reveals and other angles of the walling shall be built strictly true and square

Wall Reinforcement

E. Where so specified hollow block walls shall be reinforced vertically with 10 mm diameter mild steel bars built into the cavities of the blocks at 400 mm centres, unless otherwise specified, all bars in walls to have a minimum lap of 350 mm.

F. Prices for walling described as reinforced must include for all extra costs involved in slotting blocks over the vertical reinforcement.

Filling of Hollow Blockwork

A. All cavities where specified and shown above ground and all cavities below ground level shall be filled in solid with concrete of the mix described and placed and consolidated in sections not exceeding 1190 mm in height.

B In reinforced walls the filling shall be carefully compacted around the reinforcement.

Blocks to be Wetted

C. All concrete blocks and stone walling shall be well wetted before being laid and the top of walling where left off shall be wetted before re-commencing building. Walls to be kept wet three days after building.

Mortar

D. Mortar to be used for all walling work shall be composed of 1 part of Portland Cement to 1 part lime to 6 parts of fine aggregate measured by volume in specially prepared gauge boxes and thoroughly mixed dry on clean and watertight mixing platforms, with water added afterwards from a can with a fine rose until all parts are completely incorporated and brought to a proper consistency and then used within thirty minutes of mixing.

E No partially or wholly set mortar will be allowed to be used or re-mixed.

Fair Face Walling

F Where walling is to be finished with a fair face, the concrete blocks are to be selected for freedom from defects and the joints raked out as the Works proceed and flush pointed with a neat joint in cement mortar.

Joints for Walling

G The blocks shall be bedded and jointed in cement mortar as described with beds and joints 10 mm thick, full flushed up and grouted solid as the work proceeds. Joints shall be raked out where the surfaces or walling are to be plastered.

H. All walling shall be properly protected while mortar is setting as the Architect shall direct.

Building Walling

I. All walls throughout the Works shall be carried up evenly in 12 mm course, no part being allowed to be carried up more than 800 mm higher at one time than any other part and in such cases the jointing shall be made in long steps so as to prevent cracks arising and all walls shall be levelled around each floor.

Putlog Holes

A. Putlog holes shall be carefully, properly and completely filled up on completion of walling work.

Rough Cutting etc.

B. The Contractor shall allow in his prices for the walling which is measured net herein, for all ordinary rough cutting, bonding, plumbing angles, forming reveals and fitting up to under side of concrete beams, slabs and lintels etc.

Damp Proof Course

C. Damp proof courses shall be hessian based bituminous felt to B.S. 743 Type 5A laid on and including a levelling screed of cement and sand and lapped 230 mm at joints.

CARPENTRY

Terminology

D. All technical terms shall be as defined in the "Export of Timber Ordinance Export of Timber Rules 1965".

Timber Generally

E. The timber for carpentry and joinery shall be specified and obtained from an approved sawmills.

F. The timber for carpentry shall be Second or Select Grade for strength.

G. The timber shall be reasonably straight grained.

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

drying.

I All timber as it arrives on the site shall be inspected by the Architect, and any timber brought on to the site and not approved must be removed forthwith.

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

Species of Timber for Structural Work

K. The following softwoods shall be used for structural work;

Standard Common Name	**Botanical Name**
Podo	Podocarpus
Cypress	Cuppressues Lusitanica

A. Both to be second strength Grade P5 or equivalent. Whilst either timber is suitable, intermixing of species will not be accepted.

B. The Contractor is permitted to propose substitute species but these shall not be used without the written approval of the Architect and no adjustment shall be made to the basic rates for softwood trusses in the event of a substitute species being accepted.

Insect Damage

C. All timber shall be free from 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 timber attacked or suspected of being attacked, notwithstanding that the timber concerned may have already been inspected and passed as fit for use.

Seasoning of Timber

D. All timber shall be seasoned to a moisture content of not more than 18% for carpentry and 15% for joinery. The Contractor's price must include for any kiln drying that may be necessary to achieve these figures.

Pressure Impregnation

E. The softwood described as pressure impregnated shall be treated with the "CelcureA" "Tanalith C" full cell process. Timber must be seasoned to a moisture content not exceeding 25% before being treated. The treatment shall be to the minimum standard of:-

Solution concentration	2%
Absorption of preservative	520 Litres per cubic meter
Net dry salt retention	10.4 Kg per cubic meter

F. After treatment, the timber shall be seasoned to the specified moisture content.

G. Cut ends and faces of timber sawn, drilled and cut after treatment are to be swabbed liberally with approved preservatives until saturated, allowed to dry and then treated with a second coat and rates for timber must include for this. Approved preservatives are: Atlas A; Brunophan Nr 2; Cuprinol Clear or Water Repellant Clear; Ensele Woodtreat 55.

Inspection and Testing

H. 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 must be inspected by the Architect and any timber brought onto the site and not approved 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.

A. Notwithstanding approval having been given 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 of special construction units and the Architect shall be at liberty to select any samples he may required for the purpose of testing, i.e. for moisture content, or identification of species, strength, etc.

A. Where timbers need to be extended into a wall, they shall be thoroughly "brush treated" with Ensele 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.

Clearing Up

B. 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 Work.

Workmanship

C. All carpentry shall be executed with workmanship of the best quality. Scantlings and boardings shall be accurately sawn and shall be of uniform width and thickness throughout. All carpenter's work shall be left with sawn surfaces except where particularly specified to be wrought.

D. All carpentry shall be accurately set out in strict accordance with the drawings.

E All structural timbers shall be frame or jointed together as is most appropriate in the circumstances in accordance with the rules of good practice. Joints must be executed in strict conformity with the drawings.

F. All joints shall be secured with a sufficient number of nails disposed as shown on the drawings and rates must include for the jointing of timbers. Surfaces must be in good contact over the whole area of the joint before securing. Holes for nails must be pre-drilled undersize; holes for bolts must be bored slightly over size from both sides of the timber and washers must be used under the nut which must be tightened sufficiently to permanently secure the joint but not to crush the timber.

G. Actual dimensions of scantlings for carpentry shall not vary from the specified dimensions by more than 3 mm in deficiency or excess but must be uniform throughout. Boards 25 mm thick or less shall hold up to the specified size. All timbers shall be as long as possible and practicable, in order to eliminate joints.

Joints

H. All nails, screws, bolts, connectors, etc., are to be as specified under "Metalwork" and as shown on the drawings.

General

A. The provisions contained in the "Carpentry" section shall apply also to the Joinery Section where applicable.

Species of Timber

B. The following timber of First or Prime Grade for appearance shall be used for Joinery Work in conjunction with the term "hardwood" or "approved hardwood":-

Standard Name	Botanical Name
Podo (for grounds, etc. only)	Podocarpus spp.
African Mahogany	Khaya nyasica
Mninga	Pterocarpus Angolensis
Iroko (Mvula)	Chlorophora excelsa

C. The following may also be used as "local hardwood" (referred to hereafter) with the Architect's approval:-

Adina; East African Afrormosia; East African Afzelia

Generally

D. All joinery work shall be accurately set out on boards to full size for the information and guidance of the artisans before commencing the respective works, with all joints, iron work and other work connected therewith full delineated. Such setting out must be submitted to the Architect and approved before such respective works are commenced.

E. **All joinery work shall be cut and framed together as soon after the commencement of the building as is practicable,** but not to be wedged up or glued until the building is ready for fixing same. Any portions that warp, wind or develop shakes or other defects within six months after completion of the Works shall be removed and new fixed in their place together with all other work which may be affected thereby, all at the Contractor's own expense.

F. All work shall be properly morticed, tenoned, housed, shouldered, dovetailed, notched, wedged, pinned, bradded, etc., as directed and to the satisfaction of the Architect and all properly glued up with the best quality approved glue.

G. Joints in joinery must be as specified or detailed, and so designed and secured so as to resist or compensate for any stresses to which they may be subjected. All nails, springs, etc., are to be punched and puttied. Loose joints are to be made where provision must be made for shrinkage; with glued joints where shrinkage need not be considered and where sealed joints are required. Glue for load-bearing joints or where conditions may be damp must be of the resin type. For non-load-bearing joints or where dry conditions may be guaranteed casein or organic glues may be used. All exposed surface of joinery work shall be wrought and all arises "eased-off" by planning and sand-papering to an approved finish suitable to the specified treatment.

Dimensions

A. 3 mm reduction off specified sizes will be allowed for each wrought face except where described as (f) i.e. **finished** size in which case joinery shall hold up to the full dimensions. Dimensions of 25 mm or less shall hold up to the specified sizes.

Fixing Joinery

B. All beads, fillets and small members shall be fixed with round or oval brads or nails well punched in and stopped. All large members shall be fixed with brass screws, the heads let in and pellated to march the grain where natural finish timber is specified.

Mastic

C. Mastic where specified for bedding, joinery, sills, water bars, etc., is to be approved non-hardening plastic, polysulphides synthetic rubber or butyl composition filler or sealer.

Fiberboard

D. Fibre board shall be "Celotex" or equal and approved.

Plywood

E. Plywood shall be from an approved source and comply with B.S. 1455, first or second grade, as required and unless otherwise stated shall be "interior" quality. Where veneered plywood is specified, samples must be submitted for prior approval. Where stated to be "exterior" quality, this shall be waterproof (Bonding W.B.P.).

F. Routine tests will be required from time to time to check the quality of manufacture. Plywood used in structural members shall be bonded with a suitable adhesive.

Chipboard

G. Chipboard shall be approved medium density resin bonded wood chipboard equivalent to B.S. 2604 with sanded finish or thickness stated. Where faced with plastic sheeting the chipboard shall be counterbalanced.

Blockboard

H. Block board shall be laminated board to B.S. 3444. Where faced with plastic sheeting the block board shall be counterbalanced.

Flush Doors

A. Flush doors shall be from an approved source and manufacture, be solid core constructed generally in accordance with B.S. 459 finished with 6 mm veneer plywood (to Architect's approval) and lipped all round with hardwood 12 mm thick.

B. The thickness stated is the overall finished thickness.

Plastic Sheeting

C. Plastic sheeting shall be Formica or equal and approved laminated sheeting 1.5mm thick fixed with an approved adhesive. All colours are to be selected by the Architect.

Plugging Walls

D. All work described as plugged shall be fixed with brass screws to plugs formed by drilling concrete, walls, etc., with a proper tool of suitable size at 500 mm spacings and filling the holes completely with an approved proprietary plugging compound used in accordance with the manufacturer's instructions.

Protect Joinery

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

Bottom Edges

F. Bottom edges of doors shall be painted with one coat of approved primer before fixing.

Mosquito Screening

G. Mosquito screening shall be "Alcad" or equal and approved aluminium fine wire mesh screening.

Bird Screening

H. Bird screening shall be approved galvanized coffee tray wire.

Ironmongery

I. All ironmongery shall be fixed with screws to match. Before the woodwork is painted, handles shall be removed, carefully stored and refixed after completion of painting, and locks oiled and left in perfect working order. Prices for fixing locks must include for organizing masterkeying systems if required and all keys shall be labelled with door references marked on approved labels before handing to the Architect on completion.

STRUCTURAL STEELWORK

Standard of Construction

A. The whole of the structural steelwork and testing shall comply with the relevant clauses of B.S. 449, B.S 4360; 1980 and B.S. 5940 grade 43.

Fabrication by Specialist Firm.

B. The steelwork shall be fabricated by a specialist firm or under proper factory conditions to be approved by the Architect.

Contractor to Submit Drawings

C. The Contractor shall include for the preparation of all shop details from the drawing supplied by the Architect. All such details shall be approved in writing, by the Architect, before the work is put in hand. Every drawing shall show the number and sizes of all rivets and bolts, complete details of welds, type of electrodes, welding procedure, whether the welds are to be made in the shop or elsewhere and any other relevant information.

Accuracy of Drawings.

D. The Contractor shall be responsible for the correctness of his shop details and for shop fittings and site connections.

Erection Scheme

E. The Contractor shall submit to the Architect for approval, drawings showing the proposed erection scheme, together with all calculations for erection stresses, etc. The approval by the Architect will not absolve the Contractor in any way from his responsibility.

Dimensions to be verified

F. The Contractor shall take the dimensions from the site or buildings and he shall verify all dimensions given on the drawings before the work is put in hand.

Copies of Orders

G. A copy of all orders for materials shall be supplied by the Contractor to the Architect at the time of ordering, for identification purposes.

Damage

H. Any damage to materials on the site due to inadequate precautions being taken during the erection of the steelwork shall be made good to the satisfaction of the Architect at the Contractor's expense.

Materials

Quality of Steel

A. (i) All structural and rivet mild steel shall comply with B.S 4360 Part 2

(ii) Nil

(iii) Nil

(iv) All structural steel tubes shall comply with B.S. 1775 and B.S. 449

(v) Mild steel and medium tensile steel electrodes for metal-arc welding shall Comply with the requirements of B.S 2549.

(vi) High tensile steel electrodes for metal-arc welding shall comply with the Requirements of B.S. 2549.

(vii) All mild steel bolts and nuts shall have a tensile strength of not less than 432 N per Square Millimetre (28 tons per square inch) and a minimum Elongation of 17 percent as defined in Clause 2 of B.S. 916 or in B.S. 2708.

(viii) All high tensile steel bolts, nuts and washers shall have a minimum tensile Strength of 570 N per square millimetre (37 tones per square inch).

(ix) High strength friction grip bolts and washers shall comply with B.S. 3139, Part 1.

(x) All plan washers shall be of steel. Tapered or other specially shaped washers shall be made of steel or malleable case iron complying with B.S. 3410.

Marking of Steel

B. Each piece of steel shall be legibly marked with the maker's name or trade mark and with cast numbers or identification marks by which the steel can be traced to the cast from which it was made.

C. For rivet bars and small pieces securely bundled, a metal tag marked with the cast number will be sufficient.

Standard Dimensions

D. The dimensions and allied requirements of all structural rolled sections shall comply with B.S. 4. The dimensions, weight, tolerances etc., of all rivets, bolts, nuts, studs, etc., shall conform to the following standards. Rivets shall comply

with the requirements of B.S. 275 for dimensions

E. Black bolts, nuts, studs, lock nuts and washers shall comply with the requirements of B.S. 916 for dimensions and with B.S. 1580 for unified black bolts etc.

A. Turned bolts shall have the shank turned to the specified diameter allowing only a minus tolerance up to 0.13mm (0.005 inch).

Weight of Steel

B. For the purpose of measurement, the weight of mild steel shall be as given in B.S. 648 which will be the basis for measurement of variations. The weights per meter given on the drawings do not include the shelf angles riveted to webs, nor the plates riveted to the flanges of R.S. Js or other sections.

Conditions of Surfaces

C. All surfaces of steel work shall be clean, free from loose millscale and loose rust.

Tests and Inspection

D. Manufacturer's Mill Test Certificates for all structural steel shall be supplied to the Architect as and when required. Where and when directed by the Architect, the Contractor shall take and deliver samples of structural steel for testing to the Employer's Highways and Transportation Testing Station. Should the results of either test be unsatisfactory the whole consignment of steel which the sample represents shall be rejected and shall be replaced by other material of proper quality at the expense of the Contractor.

E. The Architect or his representative shall at all reasonable times, be given free access to the Works.

Metallic Coatings

F. i) Galvanized steelwork shall comply with B.S. 729 Part 1 entirely coated with zinc

after fabrication by complete immersion in a zinc bath in one operation and excess carefully removed. The finished surfaces shall be clean and uniform.

ii) Zinc sprayed steelwork shall comply with B.S. 2569 Part 1. The nominal thickness of zinc coating shall be not less than 0.102 mm (0.004 inches) and at no point less than0.076mm (0.003 inches).

Generally

G. The whole of the fabrication and erection of the steelwork shall be carried out

in accordance with B.S. 449

A. The welding of steel to B.S. 15, B.S. 968, B.S. 2762 and B.S. 4360 must conform to:

B.S. 1856 - "General requirements for the metal-arc welding of mild steel" Or

B.S. 2642 - "General requirements for the arc welding of steel to B.S. 968 and similar steel"

are applicable.

B. For welding any particular type of joint 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 6.

C. Any welder's tests shall be made at the Contractor's expense and shall include the cost of any fees incurred by the Employer for witnessing of, or making such tests.

D. The right is reserved to make non-destructive tests on the welding to determine if the welding conforms to the standards laid down in either B.S. 1856 or B.S. 2642 as applicable. This will normally consist of radiography on butt welds, ultrasonic examination of fillet welds or other tests as appropriate to the actual configuration of the weld in question.

Rejection

E. 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 or 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. If any welding is found to be defective the cost of all remedial measures shall be borne by the Contractor, including the cost of re-testing the subsequent inspection of welds as referred to in the P.C. Sum hereafter.

F. The Contractor is responsible for the good quality of all welding work and no exceptions will be made on the grounds that the Architect or his representative have inspected any part or parts of the work at some stage during production.

Fabricaton

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

Cast of Temporary Erection, etc.

A. Trial erection of principal or other units may be called for at the discretion of the Architect or his representative.

A. The cost of any necessary temporary erection, testing, packing, marking, carriage and delivery is deemed to be included by the Contractor in the Tender price.

Joints and Connections

B. No variation of the number, type or position of the joints or connections shown on the drawings shall be made without the consent of the 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.

Painting at Works

C. Where described as primed at works, steelwork shall be freed of rust, millscale, welding slag and flux residue and shall be dry immediately prior to painting with primer as Clause Q 14 a.

D. For joints with high strength friction grip bolts the contact surfaces shall be left unpainted but special care shall be taken after assembly to paint all edges and corners near the joints together with bolt head, nuts and washers to prevent the ingress of moisture.

E. 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.

F. For welded connections where the contact surfaces are not completed sealed the contact surfaces shall be painted to within 50mm of the edges that are to be welded.

G. The primer shall be touched up with similar primer if damaged by subsequent handling.

METALWORK

Mild Steel

H. Mild steel shall comply with B.S. 4360 Grade 1 and the sizes of all small sections shall be in accordance with B.S. 4 and 4A.

Galvanized Work

I. Iron and steel, where galvanized, shall comply with B.S. 729 Part 1 entirely coated with zinc after fabrication by complete immersion in a zinc bath in one operation and all excess carefully removed. The finished surface shall be clean and uniform.

Aluminium

J. Aluminium shall be of the alloys described in and shall comply with B.S. 1470. Aluminium sheet for flashings shall be soft-temper, super purity (S1 or S1A) and not less than 20 s.w.g. (0.9mm) in thickness.

Smithying, Shearing and Cutting

A. All smithying, welding, cutting and bending shall be soundly and neatly executed, care being taken not to overheat. All flame cut edges and welds shall be neatly ground off on completion.

Bolts

B. Mild steel bolts, nuts and washers shall comply with B.S. 916 for black bolts with hexagonal heads and nuts. High tensile steel bolts and nuts shall be in accordance with B.S. 3139 Part 1.

Anchor Bolts

C. Anchor bolts in concrete for steel works etc., are to be self drilling anchor bolts of one of the following types:-

Phillips redhead concrete anchors

Rawlplug super drilanchor

Spit self-drilling anchors

D. Rates are to include for fixing complete with washer. Mortices in concrete have not been measured for this item.

Shop Inspection

E. The Architect shall be granted full facilities and any necessary assistance for inspection or materials and assembled parts in the Contractor's (or his Sub-Contractor's) workshops. At least two weeks notice shall be given to the Architect in writing prior to the despatch of finished components to the site to enable the Architect to inspect and approve the materials and workmanship at the workshops. Approval of work at the workshop does not relieve the Contractor of this obligations to carry out the work complete at the site to the Architect's satisfaction in accordance with the Contract.

Marking

F. All components delivered to the site are to be marked in paint with the Mark number in accordance with any shop and erection drawings.

Storage

G. All components are to be stored at the site in proper racks provided for the purpose which provide full support to each member to obviate any deflection and distortion. Steelwork is to be stored at least 25cm clear of the ground and temporary protection is to be provided for protection against water and damage from any other source.

Erection

A. Rates for all metalwork are to include for the complete for the complete erection including any temporary supports required and any necessary templates and wedges.

Painting

B All steel is to be thoroughly de-rusted and degreased prior to despatch to the site and is to be given one coat zinc chromate primer at the works. Further painting treatment will be carried out at the site. Painting is measured separately and the cost thereof is not to be included in the rates for metalwork.

PLUMBING AND ENGINEERING INSTALLATION

Execution of the Works

C. The work shall be carried out strictly in accordance with:-

(a) "British Standard Code of Practice" C.P. 310: 1965: Water Supply

(b) "British Standard Code of Practice" C.P. 404: 1968: Sanitary Pipework above ground

(c) All other relevant British Standard Specifications and Codes of Practice

(d) Bye-laws of the Local Authority

(e) The working drawings

Extent of Work

D. The Contractor will be responsible for all below ground plumbing and drainage work and the installation of the Sanitary Fittings only, the remainder of the Plumbing and Engineering Installation will be executed by a Nominated Sub-Contractor.

Quality of Materials and Workmanship

E All materials, equipment and accessories are to be new and in accordance with the requirements of the current rules and regulations where such exist, or in their absence with the relevant British Standard Specification.

F. Uniformity of type and manufacture of equipment or accessories is to be preserved as far as practicable throughout the whole work.

G. The Contractor shall, if required by the Architect, submit samples of materials to the Architect for his approval before placing an order.

A. If in these Preambles the practice is adopted of specifying a particular item as "similar" to that of a particular firm's product, it is to be clearly understood that this is to indicate the type and quality of the equipment required. No attempt is being made to give preference to the equipment supplied by the firm whose name or product is quoted.

B. Where particular manufacturers are specified herein, no alternative makes will be considered and the Architect shall be allowed to reject any other makes.

C. The Contractor will be entirely responsible for all materials, apparatus, equipment, etc., furnished by him in connection with his work, and shall take all special care to protect all parts of finished work from damage until handed over.

D. The work shall be carried out by competent workmen under skilled supervision. The Architect shall have the authority to have any of the work taken down or changed which is executed in an unsatisfactory manner.

Galvanized Steel Tubes and Fittings

E Galvanized steel tubing shall comply with B.S. 1387 with plain galvanized malleable fittings complying with B.S. 143/1256.

F. Tubes and fittings shall be jointed by means of screwed threads to B.S. 21, by means of P.T.F.E., tape or hemp and "Bosswhite". All joints shall be

perfectly smooth inside without excrescences.

G. Where sleeves are required for pipework passing through concrete, blockwork or below concrete slabs, they shall be galvanized steel tube or drain pipes of sufficient diameter to give at least 25mm clearance all round the water main.

H Galvanized water mains below ground level or below slabs shall be double wrapped in "Denso" tape.

Brasswork

I Stop valves shall comply with B.S. 1010 and shall be with crutch handles or loose keys where so described on the drawings. Draincocks shall comply with B.S. 2879.

Testing

J Upon completion the whole of the water main shall be tested to a pressure not less than twice times the working pressure for a period of thirty minutes.

K. Notwithstanding the foregoing clauses, all water mains and fittings and installation thereof shall comply fully with the requirements of the Water Supply Authority.

Sanitary and Other Appliances

L The appliances shall be fixed in the positions shown on the drawings or as described by the Architect.

A. The Contractor shall include in his rates for providing all necessary screws, bolts, etc., together with all jointing materials required and also for temporarily erecting and securing fittings in the required position or service and discharge pipes, taking down, storing and fixing after completion of wall finishings permanently fixing and connecting to service and discharge.

B. Care shall be taken at all times and particularly after fixing, to protect appliances from damage.

C. Upon completion of the work, all appliances shall be cleaned of plaster, paint, etc., and carefully examined for defects.

Fire Fighting Equipment

D. The specified fire fighting equipment shall be supplied and installed by the Contractor in the positions shown on the drawings

E. Portable fire extinguishers shall comply with the following British Standards:-

(a)	Water type (soda acid)	:	B.S. 138: 1948
(b)	Foam type (chemicals)	:	B.S. 740: Part 1: 1948
(c)	Foam type (gas pressure)	:	B.S. 740: Part 2: 1952
(d)	Water type (gas pressure)	:	B.S. 1382: 1948
(e)	Carbon tetrachloride and Chlorobromethane	:	B.S. 1721: 1960
(f)	Carbon dioxide type	:	B.S. 3326: 1960
(g)	Dry powder type	:	B.S. 3465: 1962
(h)	Water type (store pressure)	:	B.S. 3709: 1964

F. Fire hose couplings and ancillary equipment shall comply with B.S. 336: 1965; rubber reel hose shall comply with B.S. 3169: 1959.

G. Underground fire hydrants and surface box openings for same shall comply with B.S. 750: 1964.

H. The installation of hydrants and fire extinguishers shall be in accordance with C.P. 402:101: 1952 and C.P. 402 part 3: 1964 respectively.

I. If nothing else is specified, fire extinguishers and hose reels shall be supplied in the colour "fire red" and be similar to manufacture "ANGUS".

FLOOR WALL AND CEILING FINISHINGS

Sand

A. Sand for backing, floor and wall finishes is to comply with B.S. 1199, Table 1.

Cement

B. Cement is to be as described for "Concrete Work:.

Lime

C. Lime is to be no-hydraulic hydrated lime to B.S. 890 Class "A" obtained from an approved source and run into putty at least 24 hours before use.

Workmanship

D. All concrete beds or slabs shall be thoroughly brushed clean, hacked if

necessary and well wetted and flushed over with a cement sand (1:1) grout immediately before screeds or pavings are laid.

E. Screeds and cement pavings shall be laid in accordance with the relevant B.S. Code of Practice. Working joints between bays of the floor finish should be placed in accordance with the Architect's instructions and will be plain butt joints placed over joints in the concrete bed under. Pavings shall be damp cured with sand or sawdust and kept damp for at least 7 days after laying.

F. All surfaces to be plastered or rendered must be brushed clean and well wetted before plaster is applied. Joints of walling shall be raked out and concrete hacked to form a key. Care shall be taken to see that paving and plastering do not dry out prematurely.

G. Adequate time intervals must be left between successive coats in two-coat work in order that the drying shrinkage of the undercoat may be substantially complete. All internal and external angles shall be pencil rounded.

In-Situ Paving Generally

H. Before laying in-situ floor finishes, the concrete beds are to be thoroughly hacked for key, cleaned off, thoroughly wetted with clean water and coated with a stiff cement slurry and rates for screed, granolithic and terrazzo paving are to include for this. They are also to include for all necessary curing and protecting until the building is handed over.

Cement and Sand Paving

J. The cement and sand paving shall be in proportions of 1:4 by volume and incorporating or treated with an approved hardener.

Polished Granolithic Paving

A. The aggregate for granolithic paving shall be in accordance with B.S. 1201 and shall be mixed in the proportions of 1:1:1.50 cement, fine and coarse aggregate respectively. The mix shall incorporate an approved hardener suitable for incorporation and not for surface treatment. The water cement ratio shall be kept as low as possible and shall not in any case exceed 0.45.The paving is to be laid to the full thickness described and to be finished with a wood float and with no extra cement trowelled into the surface which is to be laid true and level. The paving is to be thoroughly cured after laying by covering with polythene sheeting and periodically watered to keep it moist for at least one week after laying. The surface is to be polished with approved rotary carborundum discs mechanically operated coarse and fine grain and with cement and sand slurry to produce a blemish-free surface.

B. The granolithic shall be laid in bays not exceeding 3.50 square meters with ebonite dividing strips for the full depth of the paving and shall be executed by Specialist who have a thorough knowledge of the work.

Polished Terrazzo Paving

C. The ins-Situ terrazzo shall consist of white or coloured cement and marble aggregate; the colours of the cement and aggregate shall be selected by the Architect. The mix shall comprise three parts of 6mm nominal aggregate to one part coloured cement by volume. The aggregate shall be clean and granular and shall not contain flaky particles or dust. The underbed shall be cement and sand 1:4 by volume.

D. The terrazzo shall be laid in bays not exceeding 3.5 square meters with ebonite dividing strips for the full depth of the terrazzo and underbed, and shall be executed by Specialist who have a thorough knowledge of the work.

E. The terrazzo topping shall be laid to a minimum of 12mm thickness in a plastic condition while the under bed is still green and this should be watered to minimise absorption from the topping. The terrazzo must be well tamped into position and rolled with a suitable hand roller. The topping should be allowed to take an initial set and then any surface voids must be grouted up with neat cement of the same colour used in the mix. The surface should be cured by keeping moist by covering with damp sacking for at least 72 hours. When dry and hard the surface shall be machine polished by grinding with carborundum or other stone discs of suitable grade and with rotary polishing pads.

F. Rates must include for all necessary protection until the building is handed over to the Architect. The depths stated are for the full depth including topping and underbed.

P.V.C. Flooring and Skirting

G. P.V.C. floor tiles shall comply with B.S. 3260. The tiles and accessories shall be supplied in the sizes and thickness specified in colours selected by the Architect and are to be fixed to the screed base with a suitable adhesive supplied (or recommended) by the Manufacturer and used in accordance with his instructions. Rates for floor tiles shall include for thoroughly washing and cleaning on completion and for the application of one coat of water based wax polish.

Brushed Terrazzo Rendering

A. Brushed terrazzo rendering is to comprise two coats as described. The undercoat shall consist of cement and sand mixed in the proportion of (1:4) by volume and applied to a minimum thickness of 10mm finished with a wood float and scratched to provide key for top coat. The finishing coat shall consist

of one part white cement to two parts marble chippings or approved size applied to a minimum thickness of 10mm and the final surface wet brushed to expose the aggregate.

B. The Contractor will be required to produce a sample panel of rendering on site for the approval of the Architect.

Internal Plaster

C. Internal plaster shall be applied in two coats and adequate time intervals must be allowed between successive coats in order that the drying shrinkage of the undercoat my be substantially complete. The first coat must be well scratched, keyed and wetted to receive the finishing coat. The finishing coat shall be finished smooth with a steel float but care must be taken not to overwork the surface in order to minimize the incidence of shrinkage cracks. All internal and external angles shall be pencil rounded.

D. Internal plaster, unless otherwise described, shall be lime plaster of 12mm minimum overall finished thickness applied in two coats, the first coat consisting of cement, lime putty and sand mixed in the proportion of 1:2:9. The finishing coat shall be a skim coat comprising cement and lime putty in the proportion of 1:10.

E. Cement plaster is to be employed where specified on the drawings and is to be applied in two coats of approximately equal thickness to a total of 12mm minimum overall finished thickness. The composition of both boats shall be the same and shall comprise cement and sand (1:3) but a small percentage addition (not more than 10%) lime putty y may be permitted if the Architect considers that this will reduce the incidence of shrinkage cracks.

F. The Contractor shall cut out and make good all cracks, blisters and other defects and leave the whole of the plastering and rendering perfect at completion. When making good defects the plaster shall be cut out to a rectangular shape with edges undercut to form dovetailed key, and all finished flush with the face of surrounding plaster.

Wall Tiles

A. Glazed wall tiles shall be from an approved manufacturer and shall conform to the requirements of B.S. 1281. Tiles shall be white with slightly rounded or "cushion" edges and unless otherwise specifically described shall be size 400 x 400 x 10mm thick. Tiles shall be laid with continuous straight joint and internal angles shall be butt jointed. Rounded on edge tiles shall be used at all external angles and at edges of panels. Tiles shall be bedded in approved tiles adhesive and pointed in white cement.

A. Backing to tiles is to be cement and sand in the proportion of 1:4 rendering in

one coat to a minimum thickness of 12mm trowelled smooth. Backings have been measured separately.

Carpet Tiles

B. Carpet floor tiles shall be from an approved manufacturer and shall be subject to Architect's approval. Carpet tiles shall be of heavy duty grade, 100% stain proof miracle fibre with density of 920, g/sq.m (fibre) and 4500 g/sq.m (total) with fire resistance (S.A.B.S) of 3, lavender colour. The size shall be 500 x 500 x 9.50mm thick. Tiles shall be laid with continuous straight joint. Tiles shall be bedded in approved tiles adhesive.

C. Beds to tiles are to be cement and sand in the proportion of 1:4 rendering in one coat to a minimum thickness of 30mm trowelled smooth. Backings have been measured separately.

Floor tiles

Porcelain tiles

D. Porcelain floor tiles shall be from an approved manufacturer and shall be of black polished, cocowhite-polished or gardenia green matt. The size shall be size 400 x 400 x 10 x thick. Tiles shall be laid with continuous straight joint. Tiles shall be bedded in approved tiles adhesive.

E. Beds and backings to tiles is to be cement and sand in the proportion of 1:4 rendering in one coat to a minimum thickness of 30mm trowelled smooth. Beds and backings have been measured separately.

Laying of Marble, Granite, Porcelain or Ceramic Floor Tiles

F Before laying the tiles, level the flooring area, ensure the surface is rough and clean.

Laying Floor tiles with Traditional Mortar

G The cement thickness needed to lay tiles should be around 40 mm. The mixture for indoor is 1 volume of Portland cement and 3 volumes of sand. The mixture must be made with appropriate quantity of water in order to dampen the materials. Clean and wet the flooring area, making sure to leave completely clean. Spread the mixture and level with a ruler, in order to reach the 40 mm of thickness. Spread dry cement over the mixture, until the water that remains over the surface has been completely absorbed. Lay the tiles, already mixed from different boxes, with a wide joint and in the desired way. Wet tiles, then cover to achieve a perfect level.

Laying Floor tiles with Adhesive

H The bed needed for this kind of laying, should be around 30 mm. The flooring area should be steel or wood trowelled and levelled. Spread the adhesive with a spatula with ridges. It is very important to lay a good quantity of adhesive so that there is no free space between the tiles.

Mixing the Colour Shades of Floor tiles

A. Before laying the tiles at least 5 to 6 boxes must be laid over a dry surface in order to ensure that the different shades have a uniform look. The best result is obtained this way.

The Joints of Floor tiles

B. The tiles have to be laid with a minimum of at least a joint separation between tiles of 3 to 10 mm.

Setting the Joints of Floor tiles

C. The cord or wire system can be used in the 4 or 5 joints, ensuring they are all parallel with the reference joint. Plastic crosses used for this purpose, in different sizes, can be obtained in specialized shops, giving a much better finishing and final result.

Filling the Joints of Floor tiles

D. Apply a mixture composed of 2 volumes of Portland cement and 1 of fine washed sand, with enough water in order to amplify the handing. There are suitable preparations for different uses and in different colours now available, so as to achieve the desired effects. Spread the substance by use of a rubber or plastic spatula. Clean the tiles before the mixture dries. After the joints are completely dry, wash with plenty of water several times.

Concrete Tiles

E Concrete tile for finishing the roofs shall be 25mm thick of natural colour with bevelled top arises on all sides and shall comply with B.S. 1197. The tiles shall be laid to regular pattern with open joints. Care should be taken to ensure that the surface level is even and follows accurately the levels of the roof finish. All cement stains shall be carefully removed.

Precast Concrete Paving Slabs and Kerbs

F. Precast concrete paving slabs shall comply with B.S. 368. Precast concrete kerbs shall comply with B.S. 340 figure 5 and shall be finished true and smooth on all exposed faces.

G Precast paving shall be bedded on a compacted sand bed with 6mm wide joints filled and pointed with cement mortar coloured to match the colour of the slabs. The pavings shall be finished true and even and to the falls shown with no surface irregularities.

GLAZING

Method of Glazing

A. Notwithstanding reference in the descriptions of glazing method to glazing beads, or the like with associated fixings, and insulating strips, such components will be measured separately in accordance with the appropriate rules of the S.M.M.

B. The provision of glazing compounds and putties and springs, clips and other sundry fixings shall be deemed to be included with all items of glazing.

A. Distance pieces and setting blocks, in appropriate materials, shall be provided in accordance with good glazing practice and they shall be deemed to be included with all items of glazing.

MATERIALS

Glass generally

D. All glass shall comply in all respects with the appropriate section of B.S. 952. Plain sheet clear glass shall be O.Q.; plate glass shall be GG. All glass shall comply in all respects with the latest British Standards including the British Codes of Safety.

Putting for glazing to wood

E. Putty for glazing to wood shall comply with B.S. 544.

Samples

F. Samples not less than 150 mm square, are to be submitted to the Architect for approval before any glass is cut.

WORKMANSHIP

Glass to be kept free from moisture

G. All glass surfaces shall be kept dry during transit and storage. Glass becoming moist from condensation or other causes, shall be thoroughly dried and aired.

Rebates and beads

H. All glazing beads in wood shall be primed, (as measured in Painting and Decorating), before glazing is commenced.

Edges of glass

I. All glass shall have clean cut edges. The edges of louvres shall be rounded and polished.

Bead glazing

A. Glazing fixed by beads shall have both glass and beads bedded and back puttied, and the putty trimmed off flush. Where sealing strip is used, it shall pass round both faces of the glass and be trimmed off flush on both sides. Metal surfaces to receive sealing strip shall be treated with mineral oil before glazing.

Method of measurement

B Beads and sealing strips have been measured separately. Prices for glazing with beads are to include for taking out and re-fixing beads as required, which shall be deemed to be bradded unless otherwise described.

PAINTING

Execution by a Specialist Firm

C. All work under this section must be executed by a Specialist Firm, approved by the Architect.

Approved Paints

D. All paints shall be obtained from the same manufacturer and shall be one of the approved paints listed in the following schedule:-

Enamel Paints

E.

Name	**Manufacturer**
High Gloss Enamel	Gold Star Paints Ltd.
Eggshell Enamel	Gold Star Paints Ltd.
Dura Met Enamel	Gold Star Paint
Shield Gloss Enamel	Berger Paints Tanzania Ltd.
Epoxy Enamel	Berger Paints Tanzania Ltd.
Sado Seal	Sadolin Paints Ltd.
Super Gloss Enamel	Sadolin Paints Ltd.
PU Clear Lacquer (2 Sacq)	Berger Paints Tanzania Ltd.

Plastic Emulsion Paints

	Name	**Manufacturer**
F.	Wash 'n' Wear Silk	Gold Star Paints Ltd.
	Matt Emulsion	Sadolins Paints Ltd.
	Acrylic Sealer	Robialac Paints Tanzania Ltd.
	Universal Acrylic	Gold Star Paints Ltd.

A The Contractor must allow for providing the Architect with colour charts from the approved firm and for executing sample panels as required.

Generally

B All materials shall be delivered on site intact in the original drums or tins and shall be mixed and applied strictly in accordance with the manufacturer's instruction and to the approval of the Architect.

C. The only addition which will be allowed to be made locally will be liquid thinners and driers supplied or recommended by the manufacturers and none shall be thinned more than approved by the Architect.

Preparation

D All surfaces to receive treatment are to be clean and dry before paint application and surface irregularities are to be removed by filling or the use of suitable abrasives.

External Rendered Surfaces

E External cement slurry finished wall which are to be painted must be clean and must be thoroughly brushed and washed to remove any dust, loose flakes or other foreign matter and must be well wetted prior to the application of finish.

Plastered Surfaces

F Internal plastered surfaces which are to be painted are to be allowed to dry out thoroughly prior to paint application. All cracks and surface imperfections are to be cut back and filled with a patent filler in accordance with the manufacturer's instructions and rubbed down to a true and even surface.

Woodwork Preparations

G Large knots in woodwork are to be cut and replace with sound wood or

scorched back and after priming the surface made good with stopping. All knots are to be treated with two thin coats of patent knotting free from resin. After priming, all nails holes and other imperfections shall be filled with stopping and the whole surface rubbed down to a smooth even finish. The stopping must be "Sadofill" or other approved make.

Woodwork - Fittings

H Unless otherwise specified, fittings are to be treated with two cots of linseed oil.

Metalwork

A. All rust and loose scale on steel and iron work must be removed by wire brushing and rubbing with emery paper. Where patches of ingrained rust cannot be removed they are to be thoroughly rubbed down and treated with one coat of "Galvafroid" or other zinc rich paint in accordance with the manufacturer's instructions. One coat of zinc chromate primer will then be applied followed by two undercoat and one finishing coat of gloss paint as described for Woodwork above. The Contractor is tonote that where mild steel burglar bars are housed into wood frames, the full length or the bar is to be treated before fixing.

B. Galvanized metalwork is to receive one coat of white spirit or mordant degreasing solution washed off prior to the application of calcium plumbate primer followed by two undercoats and one finishing coat of gloss as previously described.

C. Galvanized metal work is to be painted only where instructions are given by the Architect as in some cases galvanized metalwork is to be left untreated.

DRAINAGE

Generally

Preambles to Other Sections

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

Notices

E The Contractor shall give all requisite noticed. Uncoloured plans will be supplied by the Architect at the Contractor's request.

Drainage Bye-Laws

F. 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 Local Authority.

Inspections

G. The Contractor shall give written notice to the Architect for the purpose of inspections and measurements, whenever section of:-

(a) Excavations are completed

(b) Concrete beds are laid

(c) Drains are completed and no further work shall be executed until each stage of the work has been inspected.

Levels of Existing Drains

A. The Contractor shall check the invert levels of existing drains, sewer and manholes before laying new drains, and shall notify the Architect immediately if the declared invert levels are found to be inaccurate

Pitch Impregnated Fibre Drain Pipes, Couplings and Fittings

B. Pitch impregnated fibre drain couplings and fittings shall comply with B.S. 2760.

UPVC Pipes and Fittings

C. UPVC pipe and fittings shall comply with B.S. 3506 Class O to be obtained from a manufacturing source approved by the Architect in writing.

Spun Cast Iron Drain Pipes and Cast Iron Fittings, Gullies etc.

D. Spun cast iron drain pipes shall be coated centrifugally cast (spun) iron pipes complying with B.S.1211 Class B.

E Fittings, gullies, etc., shall be of coated cast iron and shall comply with B.S. 1130.

Concrete Pipes and Fittings

F. Concrete pipes and fittings shall comply with B.S. 556. They shall be reinforced, and of sulphate resisting cement if specified.

Manhole Covers and Road Gratings

G. Manhole covers and road gratings and frames shall comply with B.S. 497.

Step Irons

H. Step irons shall be galvanized malleable cast iron complying with B.S. 1247.

Mesh Reinforcement

I. Mesh reinforcement shall be steel fabric complying with B.S. 1221 Part A or B.S. 4483.

Setting Out

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

Excavation

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

A. Where the bottom is 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.

Planking and Strutting

B. Care shall be taken not to undermine the foundations of the buildings and, if so directed by the Architect, planking and strutting shall be left in, or other means adopted to protect the foundations. Details of such additional items shall be agreed with the Architect's representative before the work is covered up, otherwise no claim in this respect will be entertained.

Backfilling

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

D. Trenches for concrete or cast iron drains shall first be filled to a depth of 300mm with selected fine materials carefully hand-packed around the pipe. On no account shall materials be tipped into the trench until first 300mm has been

completed.

E. Filling shall be continued in layers not exceeding 300mm thick, well rammed and, if necessary, watered.

Laying Drains

F. Drains shall be laid truly straight on line and gradient with sockets upstream and the full bore shall be unobstructed.

Pitch Impregnated Fibre Drains

G. All hard obstructions shall be removed from trench bottoms before laying pitch impregnated fibre pipes. The pipes shall be bedded in sand and laid and jointed in accordance with Appendix "C" to B.S. 2760.

UPVC Drains

H. UPVC drain pipes shall be laid and jointed with solvent welded joints entirely in accordance with the manufacturer's instructions.

I. Pipes shall be bedded in sand after all hard obstructions have been removed from trench bottoms.

Cast Iron Drains

A. Cast iron drains shall be laid on concrete beds where specified or shown on the drawings and shall be jointed with gasket of hemp, well caulked, to a depth of 30mm for 100mm pipes and 40mm for large pipes, and remainder of the socket shall be filled with molten lead or lead fibre solidly caulked.

B. Connection of iron to concrete drains shall be jointed as described for concrete drains.

C. Cast iron drains fixed to walls or beams shall be supported on brackets at 1,350mm centres.

D. Gullies, outlets, etc., on drains under concrete floors shall be set in position at correct levels before the floors are laid.

Concrete Drains

E. Concrete drains shall be jointed with one turn of tarred gaskin, well caulked and the remainder of the socket filled with cement and sand (1:3), finished with an angle fillet around the pipe. All surplus mortar shall be removed from the inside of the pipe with a badger. Where pipes are sulphate resisting, the jointing mortar shall contain sulphate resisting cement.

Concrete Beds, Haunches and Coverings

F. Where specified or shown on drawings, drains shall be laid on concrete, (105kg/sq.cm - 40mm aggregate), beds 100mm thick, 400mm wide for 100mm diameter drains and 450mm wide diameter drains. The concrete shall be haunched up both sides of the barrel to give lateral support.

G. Where drains, other than cast iron drains, are laid under buildings or pavings carrying vehicular traffic, they shall be completely surrounded in concrete, (105kg/sq.cm - 40mm aggregate), 150mm thick, (i.e. 400mm x 400mm overall for 100mm pipes and 450 x 450mm overall for 150mm pipes). Where directed, drain beds shall be reinforced.

H. Gullies shall be bedded and surrounded in concrete 105kg/sq.cm - 40mm aggregate minimum 150mm thick all round.

Sleeves

I. All drains passing through walls or foundations shall have sleeves of cast iron pipe of sufficient size to allow a clearance round the drain.

Benching

J. Benching in bottom of manholes shall be concrete (105kg/sq.cm - 40mm aggregate) to falls of not less than 10 degrees to channels finished with cement and sand (1:2), 25mm thick, trowelled hard and smooth with all angles rounded.

Bedding and Sealing Covers and Frames

A. Frames to manhole covers shall be bedded in cement mortar (1:3), and the covers in grease and sand.

Testing

B. All drains and manholes shall be tested for water tightness and straightness to the satisfaction, and in the present of, the Architects and the Local Authority. Drains shall be filled with water to a head of 1.50 meters 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

C. 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.

Clean and Flush all Drains

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

Method of Measurement

E. Where not otherwise stated, the starting level for trench 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.

F. The depths of all the trenches in the following description lie within the same 1.5m stages as the average depths stated.

G. Prices for excavating pipes trenches shall be deemed to include keeping them free from general water (i.e. all water except spring or running water).

H. Notwithstanding the provisions of SMM Clause V.7 (a) to (c) the descriptions of excavating manholes, yard gullies, septic tanks and soakpits shall be deemed to include grading bottoms, planking and strutting, return filling and compacting, disposal of surplus soil and keeping excavation free from water.

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

J. Prices for concrete beds, benchings and covering 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.

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

ELECTRICAL SPECIFICATIONS

ELECTRICAL INSTALLATION SPECIFICATIONS

General Requirements

In this section, general requirements for plant equipment, materials and workmanship, forming part of the Electrical Contract are defined and shall be applicable except where specified otherwise.

Codes and Standards

The standards and codes of practice listed here shall be considered as a guideline only and shall not relieve the Sub-Contractor from his contractual obligations to provide all equipment, components, Works and services in accordance with the laws, by laws and rules:

- 16th edition of I. E. E wiring Regulations in Building – BS7671:1992;
- IEC Standards;
- British Standards and Code of Practice;
- Tanzania Standards as published by the Tanzania Bureau of Standard;
- Any other Code and Standard and Approved by the Consulting Engineer.

Where the equipment or part of it complies with other internationally recognized standards which are less stringent than the above-mentioned standards, the differences are to be stated in writing and must accompany the tender submission.

Tanzania Laws, By Laws and Rules

The equipment, components and installation Works shall comply with all relevant statutory instruments and regulations current at the date of tender and in particular the following:

- Regulations under the Electricity Ordinance Cap 131 Sup 57.

- Factories Ordinance 1965.

- Any regulations issued by the Local Electricity Authority.

Operating Conditions

The equipment and all components shall be suitable for operation in ambient conditions of 5^0C to 40^0C and up to 98% relative humidity either in an unheated ventilated building or in open air.
All ratings of equipment and components shall be interpreted as site rating and NOT sea level or other ratings.

Supplies by Others

Materials, equipment or any apparatus supplied by others for incorporation into the installations by the Sub-Contractor shall be carefully examined on receipt. Should any defects be noted the Sub-Contractor shall immediately notify the Consulting Engineers prior to incorporating them into the Works.

Defects

Unless otherwise specified all material including equipment, fittings, cables etc. shall be new. Defective equipment or that damaged in the course of installation or test shall be replaced or repaired to the Approval of the Consulting Engineer. In the course of rectifying the defects, the Sub-Contractor shall bear the substitution of all associated builder's work and making good finishes.

Sub – Contractor's Proposals

All the Sub-Contractor's proposals and working drawings for and in connection with the Works shall be submitted early in the Contract period to facilitate co-ordination with Contractors and Sub-Contractors of other trades.

Labelling

All plants, apparatus, equipment, distribution boards, distribution cases, terminals and cables shall be securely and properly labelled, clearly showing the identification of the item and if applicable it's control function and the part of the system controlled. Labels shall be of Trifoliate sheet or equivalent, fixed with screws or rivets.

Specification of Equipment and Workmanship

LV Switchboards and Switchgear

The power supply will be 400 Volts, 50 Hz., three phase, 4 wire system or 230 Volts, 50Hz., 2 wire system as shall be specified in particular specifications. The switchgear shall be capable of withstanding the system fault level at the place of installation.

The switchgear shall be designed throughout to secure safety during operation, inspection, cleaning and maintenance and shall be so arranged as to minimize the risk of fire arising and spreading.

The switchboards shall be manufactured in accordance wit BS 162 which co-ordinates the requirements for electrical power, switchgear and associated apparatus. It is not intended that this standard should cover the requirements for specific apparatus for which separate British Standards exist. All equipment and materials used in the switchboard shall be in accordance with the appropriate British Standards.

Construction

The switchboard shall comprise the equipment shown on the drawings together with all MCCB's labels, small wiring and interconnections necessary for the satisfactory operation of the switchboard.

Switchboards shall be of the surface mounted, metal clad cubicle type with full front or rear access as defined in the Particular Specification, suitable for indoor use, sectionalised as necessary to facilitate transport and erection. The maximum height of the switchboard shall be as defined in the Particular Specification.

A suitable connection chamber containing all field terminals shall be provided at the top or bottom of the switchboard as appropriate.

Before manufacture, the Sub-Contractor shall submit to the Consulting Engineer for Approval detailed drawings showing the layout, construction and connection of the switchboard. All bus bar and bus bar connections shall consist of high conductivity copper and be provided in accordance with BS 159. The bus bar shall be clearly marked with the appropriate phase and neutral colours which should be Red, Yellow and Blue for the phases Black for neutral and Green or Green/Yellow for earthing conductors. The bus bar shall be arranged in the switchboard as such that extension to the left and right may be made in future should the need arise.

Small wiring, which will be neatly arranged and cleated shall be executed in accordance with BS 158 and the insulation of the wires shall be coloured accordingly for phase, neutral and earth connections.

Switches and Fuse Switches

These shall be in strict accordance with BS 5419.

All fuse switches shall comply with BS 5419 and shall have a fault rating at least equal to the fault rating of the switchboard in which they are installed. Cartridge fuse links to BS 88, category AC 46, Class Q1 and fusing factor not exceeding 1.5 shall be supplied with each fused switch.

Mounting arrangements shall be such that individual complete fuse switches may be disconnected and withdrawn when necessary without extensive dismantling work. When switches are arranged in formation all necessary horizontal and vertical barriers shall be provided to ensure segregation from adjacent units. Means of locking the switches in the 'OFF" and "ON" positions shall be provided together with suitable brass padlocks.

A hard-drawn high conductivity copper earthing bar shall be provided for the full length of the board and all fuse switch units and circuit breakers shall be bonded to this bar.

Distribution Boards

Where the requirement for fuses is indicated on the drawing the Distribution Boards shall be fitted with high quality fuse carriers and bases, removable insulated shields to provide adequate protection against accidental contact with live metal, and circuit indicating labels fixed inside the cover.

The Distribution Boards shall be complete with HRC fuses to BS 88:1982, Category 440 Volts. Where the requirement for miniature circuit breakers is indicated on the drawings, the Distribution Boards shall be fitted with moulded thermoplastic units of the combined thermal overload and magnetic short circuit tripping type to BS 3871: Part 1 1984 having clearly marked "ON" and "OFF" positions. MCB's of all ratings shall have a minimum short circuit current breaking capacity of 3000A for single breakers and 4000A for triple pole breakers.

Bus bar shall be rated as the nominated current for the main isolator in their entire length. These Distribution Boards may be part of the prefabricated switchboard or independent boards as shall be defined in the contract drawings.

Cables

Cable routes indicated on the drawings are for tender purposes only. The exact final routes shall be subject to Approval by the Consulting Engineer.

The Sub-Contractor shall include for the supply and installation of all jointing materials, cable supports, steel racking and making all the necessary cable joints. The cable shall be installed and tested in strict accordance with the appropriate clauses of the 16th Edition of the IEE Regulations – BS 7671:1992, the Factories Acts and BS 6346 – Insulated PVC Cables.

Cable Handling

Cables shall at all times be handled with care and every effort made to avoid damage. Unloading, rolling to position and mounting of cable drums shall be carried out

efficiently and carefully in the recognized manner and the cables shall be pulled from the top of the drums and twisting shall be completely avoided.

Provision of drum jacks rollers and other handling accessories shall be used. No make shift arrangements shall be allowed. In all cases, care shall be taken to avoid braking the rotation of the drum and the cable shall not be dragged over loose earth, concrete or any rough surface. Cables shall be adequately supported on rollers or man handled into position.

The Sub-Contractor shall take particular care to avoid damage to other services which may run adjacent to or across the route of the cable being installed.

Clearance and Depth

Cables shall be installed with a minimum clearance of 200mm from any equipment or pipe work including lagging associated with other services. Where this condition is unavoidable or difficult to maintain the Engineer shall be informed prior to the installation being commenced, otherwise the Sub-Contractor may be called upon to divert or adjust the route of any cable so affected.

Cables in trenches shall be laid at a minimum depth of 600mm for cables up to 1kV and 750mm for 11Kv cables and are to be on a 100mm bed of sifted soil or sand and a further 100mm shall be added before laying cable covers in position. The sand bedding and covering shall be carried out by the Sub-Contractor.

Cable Protection and Marking

Where laid in trenches the cables are to be completely protected by interlocking concrete or other Approved cable covers indelibly marked “DANGER – HATARI”, supplied and lay by the Sub-Contractor.

The Sub-Contractor shall supply concrete marker posts at each cable entry into a building, each change of direction, each road or pathway crossing and throughout the length of the cable at intervals not exceeding 50 meters.

Prior to fabrication of cable marker posts, the Sub-Contractor shall submit a sample to the Consulting Engineer for approval. The position of all cable marker posts shall be agreed with the Project Manager or Consulting Engineer before installation.
The Main Building Contractor shall supply and lay the pitch fibre ducts indicated on the relevant drawings, but it will be the responsibility of the Sub-Contractor to provide conduits and pipes for cables wherever they are specified.
After the installation of cables all ducts shall be adequately sealed to prevent the ingress of moisture and vermin. The sealing substance shall be of the non-hardening type.

Cable Sizes and Lengths

The Sub-Contractor's attention is drawn to the fact that all cable sizes and fuse rating given in the Specification and/or Sub-Contract Drawings are based on the use of cables with copper conductors unless specifically specified to the contrary.
The Sub-Contractor shall be deemed to have allowed in his prices for supplying sufficient cable lengths of each type and size to complete the system and for making allowance for any additional length for cutting and waste.

Vertical Cables

In the case of vertical cables the cleats shall be so designed and of sufficient number to grip the cable firmly to prevent creeping. No cable shall run without fixings and all cable hangers and racks shall be approved by the Consulting Engineer before installation.
Where cable routes are subject to numerous changes in level and directions, additional cable hangers shall be provided to satisfactorily negotiate all such obstruction.
Where cables are space some distance from a supporting surface, the cable racks shall be separately bolted to additional lengths of channel section which in turn shall be fixed to brackets bolted and fixed into the structure.

Cable Routes

Identification for cables installed within buildings shall be by means of discs supplied and attached to each cable at intervals not greater than 15metres and at all conspicuous positions such as within cable trenches, manholes and at all cable termination.

Discs shall be machine engraved from non-deteriorating black "Trifoliate" or similar material displaying white engraving indicating the design voltage, the designation of load and the number and cross sectional area of the cores.

The characters shall not be less than 3mm high and shall be clearly legible. Cables shall be colour correct to the 16th Edition of the IEE Wiring Regulations BS 7671:1992, throughout their entire length.

Cables shall not be installed within 300mm of a metal roof unless clipped to the lower side of wooden joists or otherwise protected from radiant heat. Cables passing through structural floors shall be tightly wrapped with asbestos tape and grouted in with hardwood filling below, shaped to suit the cables passing through.

Where cables are run vertically, heavy gauge sheet metal guards shall be supplied and fixed to the wall. The casing shall be fixed from floor level to the underneath side of the appropriate end dividing box or to a height of 1.5 meters above floor finish level.

Where cables run through service ducts or cable trenches they shall be fixed by means of purpose made hangers which shall be of the Unistrut pattern or Approved equivalent.

Hangers and cleats

Hangers shall be non-ferrous metal or steel and shall be treated with one coat of metal primer and two coats of anti-corrosive paint and shall be suitable for horizontal and vertical mounting either cast in or secured to the concrete structure using such brackets and adapters as are available from manufacturers. Hangers shall be spaced according to the 16th Edition of the IEE Wiring Regulations – BS7671: 1992 with current amendments or to the Manufacturer's recommendations, or as appropriate for the supports of the cables. The Sub-Contractor shall take particular are to avoid sagging or stress on any cable by wrongly positioned or in adequately spaced hangers.

Single and multi way cleats shall be of cast alloy. Interlocking pattern, for mounting either on the steel channels or directly on the concrete structure in the case of single way cleats. The sizes of the cleats shall be selected as such that all cleats can tighten down without exerting undue pressure or strain on the cables.

In the event that alterations to the system cable routes become necessary, Contract Drawings will be revised and any adjustments in lengths shall be measured there from and a variation order will be issued to the Sub-Contractor based on rates in the Schedule.

Trenches and Backfilling

Trenching and backfilling will be carried out by the Main Building Contractor but the Sub-Contractor shall be responsible for marking out the cable route and for the supervision of the backfilling in so far as the prevention of damage to cables in this process is concerned.

Conduit and Associated Fittings

Surface conduit shall be run in square symmetrical lines and shall be fixed by means of spacer bar saddles spaced at not more than 1000mm for 20 to 25mm diameter conduit and 1200mm for larger sizes, of steel conduit and 500mm for all PVC surface conduit. Surface conduit shall also be fixed on both sides of all boxes at a distance not greater than 300mm, the box itself being securely fixed. Where such an arrangement of boxes and saddles would prove to be both unsightly and unnecessary, short lengths of conduit not exceeding 500mm in length between boxes need not be secured further than by connection to the adjacent boxes.

Concealed conduit run in chases in walls shall be fixed by means of mild steel pipe hooks or non-metallic saddles spaced not more than 1000mm. Where conduit is concealed behind plaster it shall be chased to a depth of either 15mm below finished plaster level or installed flush with the structural wall level before application of plaster, whichever is the lesser depth.

Securing, Cleaning and Drying of Conduit

Conduit cast in situ shall be frequently secured to the steel reinforcement work, with heavy binding wire to prevent movement of the conduit and conduit boxes during the pouring and vibrating of the concrete.

Outlet boxes shall be filled with paper to prevent ingress of concrete, and all boxes shall be securely fixed to the shuttering with nails or by means which shall be visible as a marker on removal of shuttering, only where these marks can be concealed. Conduit shall be installed after the first grid of steel reinforcement work is securely fixed and all open ends of conduit shall be protected by couplings plugged with a suitable non-metallic stopping plug.

The number of right-angle bends in conduit cast in situ shall not exceed two between boxes. Where straight runs of conduit are installed, draw in boxes shall be provided at distance not exceeding 12 meters.

Immediately prior to wiring all conduit and fittings shall be dried and cleaned out by drawing through a cloth swab.

Clearance to Other Services

As for surface cables, conduit shall be installed in such a manner as to prevent interference with other services and shall be kept at least, 200mm clear of gas or water pipes etc. and heat in excess of 70^0C.

Hazardous Areas

When conduit runs enter specified areas requiring flameproof equipment, barrier boxes shall be inserted immediately before the conduit enters the flameproof area. All conduit installed within this area shall be solid drawn galvanized, as shall be conduit fittings and accessories and Certified as suitable for Group 2 hazards. Equipment shall comply with BS 889 and code of practice CP 1003 Part 3:167

PVC Conduit

The conduit shall be bent and formed strictly in accordance with the Manufacturer's instructions. Small sized conduit ranging from 16 to 25mm diameters shall be bent cold by inserting the correct size bending spring. It is essential for right angle bends that the conduit is bent past 90^0 to allow for 'spring back'.

Large sized conduit shall be pre-heated before inserting rubber cord to prevent kicking. Conduit badly formed or bent, or damage in any way, shall not be used.

Conduit Joining

Joins shall be made watertight by the use of Approval PVC jointing cement applied with a brush or rag. Approved cement shall be applied to the complete circumference of the conduit. Conduit shall be thoroughly cleaned at the ends to ensure a good adhesion to the ends of fittings. Approved PVC jointing cement shall not be permitted to enter into the conduit.

Conduit Fittings

All conduit fittings and accessories including couplers, ordinary clips, saddle pipe hooks, reducers, stopping plugs, locknuts, male and female bushes shall be manufactured dimensionally all, similar to BS 4568: 1970 where applicable. Solid tees, solid or inspection elbows or bends or inspection tees shall not be used unless the Approval of the Consulting Engineer has been granted. Where it eases the installation of cast in situ back entry boxes, the loop in system purpose made bends by manufacturer may be used. They shall comprise of a tight bend with a push socket at one end and a threaded socket at the other.

Expansion Couplings

A means of expansion shall provided in conduit runs in excess of 10m without any bend or set, in building expansion joints by means of expansion couplings. Any other method used shall be subject to Approval by the Consulting Engineers.

Laying of Conduit

Unless it is clearly specified or shown on the drawing, the method of installing conduit shall be subject to the Approval of the Consulting Engineer.

Small standard circular non-metallic conduit boxes, conforming dimensionally with BS31: 1979 with standard circular non-metallic lids and brass fixing screw shall be provided and fixed at all junctions.

Where ceiling roses occur and the ceiling box is recessed below the finished level of the ceiling, suitable extension rings to accommodate the ceiling rose must be provided. Where a non-metallic outlet box of thermoplastic material is used for the fixing or suspension of lighting fittings the box shall be fitted with genuine steel insert clip.

All spare ways in junction boxes etc., left for possible future extension shall be fitted with stopping plugs.

Flexible Conduit

Conduit connection to motors and equipment shall be made using a minimum of 500mm long waterproof flexible conduit of appropriate diameter. Unless otherwise stated in the specification of Works, the solid conduit shall terminate in a large adaptable box including sufficient coils of motor cables to enable 'Tong Test' readings to be taken in each conductor. Each continuity shall be maintained by means of a copper conductor, sized in accordance with the 16th Edition of the IEE Wiring Regulation (543-01-04)with subject to a minimum of 1.5mm^2 with green/yellow insulation.

Unless otherwise stated in the Specification of Works or drawings, all adapters are to be solid bronze or brass pattern with standard thread for conduit connection and a thread to receive the flexible conduit. The adapter is to be sweated solid to the flexible conduit and the grub-screw fully tightened.

Cable Trunking/Trays

PVC or galvanized steel trunking shall be of the colour and size called for in the particular Specification or in contract drawings. The gauge of the trunking shall be subject to

Approval of the Consulting Engineer. Where trunking is to be used for several services, then this shall have to be multi compartments.
Conditions applicable to conduit routing shall apply to the routing of the cable trunking. Covers for the trunking shall be pre-fabricated and only pre-fabricated bends, angles, end-pieces and any other trunking accessories shall be acceptable.

Open Trays

Open cable trays shall be straight flange design of heavy-duty design. It shall be manufactured by hot-dipped galvanized perforated steel to BS 2989: 1982. Only pre-fabricated bends tees and cross will be accepted.
Cable trays shall be appropriately fixed on robust and substantial brackets fixed into the walls or suspended on rods securely fixed to the structure together with a bracket arrangement as required to facilitate the support for the cable tray.
Suspension rods shall be minimum 8mm diameter hot dipped galvanized steel. Brackets or suspension supports shall be provided as necessary, the spacing of which shall not exceed 2.0meter. When cut, the cable tray shall be coated with cold galvanizing paint. Conditions applicable to conduit routing shall apply to the routing of cable trays.

Wiring

Wiring shall be carried out in an approved type of PVC insulated copper cables of the number of cores and size as shown in Contract Drawings.
The colour of the sheaths shall comply with the colour code requirements of the 16th Edition of the IEE Wiring Regulation – 514-06-01 applicable to the entire lengths of the cables.

Drawing and Fixing Cables

Cables shall be drawn in at accessories, distribution boards and switchgear only after the erection of the conduit, trunking or cable tray system. Under no circumstances shall it be permitted to draw cable into an incomplete section of the conduit/trunking installation.

The wiring connections shall be made at the terminals of main switches, and socket outlets etc., and fixed apparatus only. No joints shall be made in boxes unless approved.

Earth Continuity Conductors

When fitting and accessories require earthing, an earth continuity conductor shall be run throughout the conduit. The earth continuity conductor shall be PVC insulated copper wire of minimum size 1.5mm^2 and shall be continuous between terminals. All metal boxes shall be equipped with an earth terminal.

Each final sub-circuit that is required to be earthed shall be provided with it's own individual earth continuity conductor which shall be run from a terminal on the earth bar in the distribution board or consumer's control unit protecting the particular final sub-circuit.

Attention is drawn to the requirement to install earth continuity conductors when plastic conduit/trunking systems are used.

Final Sub-Circuits

Not more than six final sub-circuits shall run in conduit feeding outlet boxes without the Approval of the Consulting Engineer. Not more than eight cables running straight back to the distribution board shall be enclosed in any one conduit. The phase and neutral conductors of the same circuit or circuits shall in all cases be drawn in the same conduit/trunking.

Flexible Wires

Flexible cords shall be 250-Volt grade VR or PVC insulated and shall comply with BS 6007 and 6500. No flexible cord smaller than 1.5mm^2 shall be used. Flexible cords for pendant fittings shall be circular, heat resistant type, white finish.

Fire Alarm System

The fire alarm system shall be installed and commissioned in accordance with BS 5839. Part 1: 1988 and any current amendments to the standard.

The manual call points shall conform to BS 5839. Part 2 and shall be mounted at a height of 1.4m above floor finish level unless stated otherwise. Generally the call points shall surface mounted but if they are semi-flush they shall be at side profile of not less than 750square millimeters.

Heat and smoke detectors shall comply with BSEN54: Part 7 and BSEN52: Part 5 respectively. Wherever heat and smoke detectors are used simultaneously, they shall be "base compatible". Flame detectors shall be installed in accordance with this specification.

The control and indicating equipment for automatic systems shall comply with BSEN54 1998: Part 2. The equipment shall discriminate between manual call points and automatic signals and shall give fault indications for open or short circuit on trigger device wiring, open or short circuit on all alarm sounder wiring, mains failure, battery disconnection, battery charger failure, low battery capacity fuse failure and earth fault. The equipment shall be capable of response within a second of the operation of the manual call points.

The power supply shall be derived from AC mains backed up by battery which shall be automatically connected when the mains failure occurs. The power supplies circuit for the fire alarm system shall be exclusive to the system.

The fire alarm system connection to the main supply shall be via an HRC lockable switch fuse reserved solely for the purpose and shall be red and labelled "FIRE ALARMS DO NOT SWITCH OFF".

The installation of fire alarm system cabling shall be generally in accordance with he IEE Wiring Regulations whilst the part of the fire alarm system not connected directly to the mains supply are specifically excluded from these regulations but the general principles and good practice outlined in the IEE Regulations – BS7671: 1992 shall be followed. Cables shall be routed as far as possible in protected areas of low fire risks but where this is impossible, consideration shall be given to the effects of fire exposure on the type of cable used.

All conduits, trunking, channels or ducts used for fire alarm cables shall be reserved exclusively for this purpose and if used for other services they must be separated by

mechanically strong rigid and continuous partition of non-combustible materials. Where separation is not possible the fire alarm circuits shall be wired in M. I. C. C cable. Multicore flexible cables or cords for fire alarm circuits shall not be used for other circuits of lower or higher voltages.

Ducts, channels or trunking reserved for fire alarm circuits shall be marked and the cables shall be completely enclosed when the covers are in place. Consideration to the size and layout of ducts, chases etc. shall be given so that these may provide for future additions.

Fire alarm cables, ducts and trunking shall not be run in flue-like openings which are a potential fire hazard and where multcore cables are used consideration shall given to the installation of cables with spare conductors. Vertical ducts shall be continuous throughout the height of multi-storey buildings and allowance for lateral distribution on each floor shall be given.

Cable laid on surface, cavities or voids shall be separated from cables of other services by at least 300mm.

When cables, conduits, or conductors are installed in channels, ducts, trunking or shafts that pass through floors, walls, partitions or ceilings, internal fire barriers shall be provided to stop fire from spreading.

Earthing

Consumer's Earth

The Consumer's earthing terminal shall be at:

The main LV switchboard and/or

The LV switchboard at the intake position of an isolated building.

Where applicable, the Consumer's earth will be bonded to the earthing bus bar in the substation via the continuity of cable armour and sheaths or separate earth continuity conductors or both.

Bonding

All conduits, trunking, metal enclosures, the metallic sheathing of cables, the cases and enclosures of switchgear and fuse gear and apparatus of an electrical nature in each building shall be so bonded as to be directly connected to the respective Consumer earthing terminal.

Earthing arrangements and the resistance of the earth continuity conductor shall comply with the 16th Edition Chapter 54 of the IEE Wiring Regulations – BS7671: 1992.

Special Requirements

In situations such as bathrooms, kitchens, laundries or any situation where there is exposed metal and socket outlets or fixed appliances are installed, all metalwork including hot and cold water pipes, waste pipes, metal draining boards, the casings of electrical appliances etc., shall be effectively bonded to the earth continuity conductor in such a way that no potential difference can arise between these items.

The Sub-Contractor shall make tests as the work proceeds to ensure that this value is not exceeded. It is essential that such tests shall be carried out systematically when the concealed wiring system is being installed.

Testing

The Sub-Contractor shall test, during and at the completion of installation, and if required, again at the expiration of the maintenance period. Testing to be in accordance with the 16th Edition of the IEE Wiring Regulations – BS7671: 1992 clause 713, the Government Electricity Ordinance and the Electricity Supply Authority requirements and Engineering Instructions.

In the event of any test indicating failure to comply with the requirements, the fault shall be traced and cleared and the test shall be repeated after the fault has been rectified. Any subsequent cost shall be met by the Sub-Contractor. Wherever there is any equipment of an electrical nature supplied and installed in the system by others, the Sub-Contractor shall attend on and assist basis in balancing, adjusting, regulating, testing and

commissioning of the said equipment/system e. g. air conditioning plant etc to the Approval of the Consulting Engineer.

Continuity and Insulation Resistance

Test shall be made to verify the continuity of every protective conductor, ring final circuit conductors and every conductor shall be tested separately to verify that the said conductor is sound and correctly connected. The test shall include all conductors and any extraneous conductive parts used for equipotential bonding.

Insulation resistance tests shall be carried out using a test voltage not exceeding 500 Volts, DC with all lamps removed, all current using equipment disconnected or if practicable, all local switches controlling such lamps/equipment open. All electronic devices shall be completely isolated so that they are not damage by test voltage.

Test shall be done in accordance with the chapter 71, 16th Edition of the IEE Wiring Regulations – BS7671: 1992 Insulation resistance of any two electricity separated conductors shall not be less than 20 megohms.

Earth Electrode Resistance and Earth Fault Loop Impedance

The earth electrode resistance and earth fault loop impedance shall be measured and the results shall comply with those of the Electricity Supply Authority.

Polarity and Phase Rotation

Tests shall be carried out to verify that all fuses and single pole control devices have been connected in the phase conductor only and that the bayonet and Edson Screw lamp holders and the socket outlets are correctly wired. Phase sequence tests shall be done to ensure that correct phase sequence is maintained throughout the installation.

Testing and Commissioning on Site

The Sub-Contractor shall provide at his own cost all accurate instruments and equipment and all labour required to carry out the above tests. The instruments and equipment shall

be made available during final testing to enable the Consulting Engineer to witness such tests as he may require.

Testing and Commissioning on Site

The equipment included in this contract shall be tested at the Manufacturer's workshop (or elsewhere) by agreement for output and performance in accordance with the Manufacturer's recommendation or, if the equipment is not found sufficient, in accordance with the Engineer's Specifications.

Tests sheets shall be submitted to the Engineer immediately upon the completion of the tests at the workshop. The Sub-Contractor shall include for full commissioning and testing of the equipment, their controls and all auxiliary equipment as specified. The Sub-Contractor shall provide all necessary services, instruments, tools, fuel and material for the purpose of the required testing.

After connection of electrical power supplies all functional tests shall be made on the equipment and trial runs shall be made as required by the Manufacturers.

Tests and Commissioning

All equipment and installations provided under this contract shall be tested and commissioned in accordance with procedures given by the Manufacturer.

The Manufacturer's recommendations for testing and commissioning shall be submitted to the Engineers during the testing and commissioning period.

The Engineers shall be given adequate notice in writing of the date and time of the tests and commissioning and any representative for the employer shall, if so desired, be present at such tests and be given all reasonable facilities for his own inspection during the course of the tests and commissioning.

Test Results

The results of the tests shall be recorded on a test certificate as provided in the 16th Edition of the IEE Wiring Regulations – BS7671: 1992 Appendix 6. Extra results sheets as appear

in this document shall be completed. Test result sheets shall be submitted to the Consulting Engineer for Approval.

Completion Certificate

The Sub-Contractor, on completion of testing and commissioning of the installation/system shall submit to the Consulting Engineer all test results accompanied with the signed completion certificate as stipulated in Appendix 6 of 16th Edition of the IEE Wiring Regulations – BS7671: 1992 as reproduced in this document. The installation/system shall not be considered complete without this certificate. If the Sub-Contractor fails to issue these documents within a month from the date of practical completion, the Consulting Engineer may employ the services of others and deduct all costs from the Sub-Contractor's account.

Record, Drawings and Instructions

During the execution of the Works on Site the Sub-Contractor shall, in a manner Approved by the Engineer record on working or other drawings at Site all information necessary for preparing Records of the installed Contract Works.

Marked-up Drawings

Marked-up working or other drawings and other documents shall be made available to the Engineer as he may require for inspection and checking.

Record Drawings

Record drawings may, subject to Approval of the Engineer, include Approved Drawings as necessary and certified by the Sub-Contractor as a correct record of the installation of the Contract Works.

The Record Drawings shall include, but not restricted to the following:

Working Drawing

Working Drawings amended as necessary but titled "Record Drawings" and certified as a true record of the "as installed" Sub-Contract Work. Subject to the Approval of the Engineer any inappropriate working drawings may be omitted from incorporating into "as installed" record Drawings.

Diagrams

Schematic Diagrams of the individual plant, apparatus, switch and control boards to include those particular plant or apparatus and also where applicable those applicable to system operation as a whole.

Charts

The Sub-Contractor shall supply for fixing in Substation switch-room, generating set houses, plant rooms, pump houses, the office of the maintenance Engineer and other such places, suitable instruction charts, schematic diagrams of instrumentation and of electrical reticulation as may be requested by the Engineer provided that the charts, diagrams etc., relate to installations forming part of he Contract Works.

Marked-up drawings of the installation of the contract Works shall be kept up to date and completed by the date of Practical or Section Completion.

Submission of Record Drawings

Three copies of the Record drawings of the Contract Works and three sets of the installation charts and schematic diagrams in stiff backing, shall be provided not later than one month after practical completion.

Record Drawings shall be on Approved plastic materials.

All charts and diagrams shall be of suitable non-fading plastic material on a stiff backing and must be Approved by the Engineer before final printing.

If the Sub-Contractor fails to produce to the Engineer's Approval:

The Marked-up Drawing during the execution of the Contract Works, the Record Drawings etc., within one month of Sectional or Practical Completion the Employer shall be at liberty to have these drawings produced by others. The cost of obtaining the necessary information and preparing such drawings shall be deducted from the outstanding payments due to the Sub-Contractor.

Test Result Sheet

Confirmation of Preliminary Tests

Project Name:……..……

Contract No: ……

Description of Project:…….……

……...……

I/We (Contractor) ……of (address)

…….…..……

...……

……..…….

Hereby certify that the electrical installation for the above-mentioned project has been completed in accordance with the terms of the electrical Installation Contract and is now ready for final inspection and testing.

The results of the tests taken using the appropriate instruments are as indicated on the attached record sheet(s), all in accordance with the current Edition of the IEE Wiring Regulations.

Date: ……..

Contractor's Name and Signature (Electrical installation works):

…….

Results submitted to the Consulting Engineer in duplicate.

Schedule of Results

Switchboard identification:……..…….

Location:

……..…….Drawing

No.: ……..……..

Record Drawings Produced:..……..

Record Drawing Approved by Consulting

Engineer:.……

Switchboard marked according to Specification:

……

……

Protective conductor connected from: ……..

.…….……

Earth electrode resistance: …….ohms.

RCD's tested:

……

……

Comments:

……

……

……

……

Test Results

Circuit No.	Insulation Tests				Continuity Tests				Earth Loop Impedance
	L1-N	L2-N	L3-N	N-E	L1	L2	L3	N	E
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

16									
17									
18									
19									
20									
21									
22									
23									
24									

Sub-Contractor's Signature: …… Date: ……..

Engineer's Signature: …….. Date: ……..

Appendix 6

Forms of Completion and Inspection Certificate

Introduction

The forms of Completion, Inspection and Testing required shall be made out and signed by competent persons in respect of the design, construction, inspection and testing of the work.

Competent persons will, as appropriate to their function have a sound knowledge and experience relevant to the nature of the installation undertaken and to the technical standards set down in Wiring Regulations, be fully versed in the inspection and testing procedures contained in the Regulations and employ adequate testing equipment.

Completed forms will indicate the responsibility for design, construction, inspection and testing, whether in relation to new work or further work on an existing installation.

When making out and signing forms on behalf of a company or other business entity, individuals shall state for whom they are acting.

Additional forms may be required as clarification, if needed by non-technical persons, or in expansion, for larger or more complicated jobs.

FORMS OF COMPLETION AND INSPECTION CERTIFICATE

(as prescribed in the IEE Regulations for Electrical Installations)

(see Notes overleaf)

DETAILS OF THE INSTALLATION

Client:……..

Address:…….

DESIGN

I/We being the person(s) responsible (as indicated by my/our signature below) for the Design of the electrical installation, particulars of which are described on the particulars of installation CERTIFY that the said work for which I/We have been responsible is to the best of my/our knowledge and belief in accordance with the Regulations for Electrical Installations published by the Institution of Electrical Engineers, 16th Edition, amended to (3) (date……..) except for the departures, if any, stated in this Certificate.

The extent of liability of the signatory is limited to the work described above as the subject of this Certificate.

For the DESIGN of the installations:

Name (In Block Letters): Position:

For and on behalf of:…….

Address::

(2) Signature: (3) Date:

CONSTRUCTION

I/We being the person(s) responsible (as indicated by my/our signature below) for the Construction of the electrical installation, particulars of which are described on the particulars of installation CERTIFY that the said work for which I/We have responsible is to the best of my/our knowledge and belief in accordance with the Regulations for Electrical Installations published by the Institutional of Electrical Engineers, 16th Edition, amended to (3) (dated…….) except for the departures, if any, stated in this Certificate.

For the CONSTRUCTION of the installations:

Name (In Block Letters): Position:

For and on behalf of:

Address::

(2) Signature: (3) Date:

I

INSPECTION AND TEST

I/We being the person(s) responsible (as indicated by my/our signature below) for the Inspection and Test of the electrical installation, particulars of which are described on the particulars of installation CERTIFY that the said work for which I/We have responsible is to the best of my/our knowledge and belief in accordance with the Regulations for Electrical Installations published by the Institutional of Electrical Engineers, 16th Edition, amended to (3) (dated…….) except for the departures, if any, stated in this Certificate.

For the INSPECTION AND TEST of the installations:

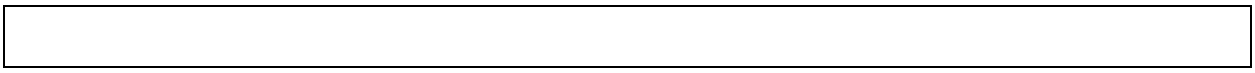
Name (In Block Letters): Position:

For and on behalf of:

Address::

(2) Signature: (3) Date:

(6) page 1 of ……pages



PARTICULARS OF THE INSTALLATION

(Delete or compete items as appropriate)

Type of Installation New/alteration/ additional to existing installation

Type of Earthing (312-03): TN-C TN-S TN-C-S TT IT ☐ ☐ ☐

(Indicate in the box)

Earth Electrode: Resistance …….ohms

Method of Measurement …….

Type (542-02-01) and Location …….

Characteristics of the supply at the origin of the installation (313-01):

Nominal voltage……..Volts

Frequency …….Hz

Number of phases …….

Ascertained by inquiry	Determined by calculation	measured

Prospective shot-circuit current……kA

Earth fault loop impedance (Z_0) ……ohms

Maximum demand……A per phase

Over current protective device – Type BS ……Rating ……A

Main switch or circuit breaker (460-01-02): Type BS ……..Rating ……A No. of poles …….

(If an r. c. d., rated residual operating current ……mA.)

Method of protection against indirect contact:

Earthed equipotential bonding and automatic disconnection of supply

Or

Other (Describe) ……

Main equipotential bonding conductors (413-02-01/02,547-02-01):

Size……..mm^2

Schedule of Test Results: Continuation ……pages

Details of departures (if any) from the Wiring Regulations (120-04,120-05) ……..

Comments on existing installation, where applicable (743-01-01):

Particular Specification: Job Description

These specifications shall strictly be read in conjunction with the preceding sections, except where stated otherwise elsewhere. The General Specification shall be treated as Particular Specification as far as this Contract is concerned except where stated otherwise elsewhere. Further more these Specifications shall be read in conjunction with the Bills of Quantities and the Contract Drawings.

Contract Drawings

The Consultant shall prepare the Contract Drawings. The Electrical Contractor shall inform the Electrical Consultant in case of any discrepancies between the Contract Drawings and the Specification for clarification during the tendering period. These Drawings shall be read in conjunction with this specification.

Scope of Work

The Electrical Contractor shall deliver on site and install all necessary materials, equipment accessories etc. for carrying out all the Electrical installation works for the proposed Headquarter office Building for Fire & Rescue Services Force, and setting them to work to the entire satisfaction of the Consulting Engineer.

The Scope of works shall comprise, but not restricted to the following

- Liasing with TANESCO for all necessary formalities in connection with construction of the service line cable and Metering.
- Supply and install Transformer complete with all protections and switchgear
- Supply and installation of mains distribution cables, panels, distribution boards and all necessary materials for the main distribution system
- Supply and installation of all necessary materials for the general lighting, power, computer power and telephone installations including trunking, conduits, cables and wiring accessories.

- Supply and install new standby generator to the building.
- Supply and install new fire alarm and detection system.
- Earthing system to be installed and tested accordingly.
- Testing and commission of the installation and setting them to work.

Standard Works

The standard of work shall be in accordance with the general and particular specifications, the drawings and requirements of the 16th Edition of the IEE Wiring Regulations – BS7671:1992.

The Electrical Contractor shall supply and install all required items including some accessories or auxiliary items whether or not these have been included in the drawings, specifications or Schedule of Works to ensure that the Work is properly done and successfully set to work.

Type of Installation

The Electrical-Contractor shall ensure that cables in any conduit/trunking are in compliance with the space capacity ratio. The Electrical-Contractor shall plan the conduit/trunking runs to confirm to the building structure and collaborate with the Main Contractor ensuring that all works required are done at a proper time and in proper place. Any mistake or omission shall be rectified at the expense of the Electrical Contractor.

Generally all the installations shall either be flush or in surface trunking unless specifically stated otherwise. Cables for power for general use, air conditions, computers, cookers, heaters and any other equipment shall be installed in concealed heavy duty PVC Conduits while the cables for telephone and computer signal will be installed in the separate compartments of the PVC trunking as specified elsewhere. Cables for fire detection and alarm system shall be installed in concealed PVC conduits.

Schedule of Unit Rates

The schedule of unit rates shall be read in conjunction with the specifications and drawings. The Tenderer shall insert unit rates against the items in Bills of Quantity and will be used as unit rates throughout the contract..

The unit rates shall include the whole of works in accordance with specifications, i. e., basic price, transport, insurance, delivery, storage, installation, testing, commissioning, setting to work, defects liability and any other contractual obligations.

The unit rates shall be used to assess the value for additions or omissions arising from authorized variations. The rates filled herein shall be the same as those used to arrive at the Tender Sum.

Schedule of Basic Prices

The Electrical Contractor shall include in Appendix any materials for reimbursement due to increased prices if the fluctuating tender is accepted. Only materials included in this list will be considered for reimbursement of increased costs.

The prices to be quoted are those ruling at the date of Tender, which for the purpose of this schedule shall be deemed to be ten days prior the date of return of tenders. The Electrical-Contractor may refer to published price lists from the suppliers in which case he shall supply.

ICT SPECIFICATIONS

ICT

GENERAL SPECIFICATIONS FOR MATERIALS AND WORKMANSHIP

1.0 GENERAL REQUIREMENTS

In this section, general requirements for plant, materials and workmanship, forming part of the Telecommunications Contract are defined and shall be applicable except where specified otherwise. The Telecommunications Contract covers the supply, installation, connecting, testing and commissioning of:

a) Cat. 6e Structured cabling;
b) PABX, electronic cards, telephone terminals and accessories; and
c) A Local Area Network (LAN)

Bidders are required to bid for the three components above as one package. Tenderers are free to associate with others to enhance their qualifications.

1.1 BIDDER ELIGIBILITY

Bidders are required to provide evidence to show that:

a) The bidding firm is registered by the Contractors Registration Board (CRB).

1.2 UNITS OF MEASUREMENTS

Basic and derived SI Units of measurements shall be employed in all correspondence, Technical Schedules, Drawings, Tests, Records, Operation and Maintenance Documentation and on all Labels, Instruments and Nameplates.

1.3 CODES AND STANDARDS

The plant and equipment to be supplied shall comply in all respects with the requirements of the latest issue of the Standards, International Recommendations and Codes of Practice specified, in additions to the Specification and all other requirements of the Contract.

Throughout this document, equipment and materials have been specified to be in accordance with the relevant Publications of the International and Local standards.

1.3.1 INTERNATIONAL STANDARDS

- International Standards Organization (ISO);
- British Standard Institution Specification (BSI);
- 16th edition of IEE wiring Regulations in Building - BS7671: 1992;
- CAT. 6e Structured Cabling Standard;
- EN 50173;
- IEC Standards;
- ITU-T and ITU-R Recommendations;
- Any other Code and Standard and Approved by the Employer.

1.3.2 TANZANIAN STANDARDS

- Tanzania Standards as published by the Tanzania Bureau of Standards (TBS).
- Tanganyika Electricity Ordinance Cap 131 Sup. 57 and orders made thereof.
- Tanzania Electric Supply Company Limited (TANESCO) Regulations and Engineering Instructions.
- Regulations published by the Tanzania Communications Regulatory Authority (TCRA).
- Any lawful regulations issued by the Telephone network operators in Tanzania.

1.4 OPERATING CONDITIONS

The equipment and all components shall be suitable for operation in ambient temperature conditions of -5 to +40 degrees centigrade and up to 98% relative humidity either in an unheated ventilated building or in open space.

All ratings of equipment and components shall be interpreted as at-site ratings and not sea level or other ratings.

1.5 SUPPLIES BY OTHERS

Materials, equipment or any apparatus supplied by others for incorporation into the installation by the Sub Contractor shall be carefully examined on receipt. Should any defects be noted the Sub Contractor should immediately notify the Engineer prior to incorporating them into the Works.

1.6 DEFECTS

Unless otherwise specified all material including equipment, fittings, cables etc. shall be new. Defective equipment or that damaged in the course of installation or in the course of rectifying the defects shall be rectified. The Sub Contractor shall bear the cost of replacing all defective parts and the cost of making good all the associated works.

1.7 WARRANTY

All equipment to be supplied on this contract shall be subject to a warranty period of 12 months, which shall be counted with effect from the date of commissioning.

1.8 SUB CONTRACTOR'S PROPOSALS

All Sub Contractor's proposals and working drawings for and in connection with the works shall be submitted early in the Contract period to facilitate co-ordination with Sub Contractors of other trades.

1.9 LABELING

All plant, apparatus, equipment, distribution boards, distribution cases, terminals and cables shall be securely and properly labeled, clearly showing the identification of the item and if applicable it's control function and the part of the system controlled. Labels shall be of trifoliate sheet or equivalent, fixed with screws or rivets.

1.10 PACKING AND MARKING

1.10.1 PACKING

The Sub Contractor shall pack all materials, equipment and supplies for transport of such goods from the Sub Contractor's Suppliers to the port of embarkation, and movement to and handling or hauling at the site, in an internationally accepted manner to withstand damage or loss from repeated rough handling and extremes of climate during transport to and storage at the site.

All bolts, nuts, washers and other small items that might be lost shall be boxed or bundled into double Hessian bags securely strapped and shall be dispatched in sets with a

contents slip inserted in the bags specifying the quantities and types of bolts, washers or other items contained therein. All other steelworks, if not boxes, shall be bundled with tension strapping in a least four positions on each bundle where possible.
Crates, cases, boxes drums, bags or other containers shall be limited to approximately 1,500Kg except where the unit weight of an item is in excess of 1,500Kg.

Contents of crates, cases, boxes drums or other containers shall be bolted securely or fastened in position with struts or cross battens and not with wood chocks wedged in place. All struts or cross battens shall preferably be supported by cleats fixed to the crates, cases, boxes, drums or other containers above and below to form ledges on which the battens may rest. As required, the crates, cases, boxes, drums and / or other containers shall be up-ended after packing to prove that there is no movement of the contents. Where parts are required to be bolted to the sides of the crates, cases, boxes drums, or other containers large washers shall be used to distribute the pressure and the timber strengthened by means of a pad. Wood wool shall be avoided as far as possible. Water proof paper and felt lining shall overlap at seams and the seams shall be secured together, but the enclosure shall be provided with screened openings foe ventilation if considered necessary.
Crates, cases, boxes, bags containing electrical and electronic materials shall be cushion packed and hygroscopic material in convenient packages enclosed therein.
A packing list in a waterproof envelope shall be placed on or every crate, case box, drum, bag or other container.

1.10.2 MARKING

Each and every crate, case, box, drum, bundle, or other container or loose piece shall be clearly marked on two (2) sides in black with a stencil and waterproof ink or oil paints by means of block letters not less than 30mm high as follows,

PROJECT NAME ----------

NAME OF SUB CONTRACTOR ……

CONTRACT VERIFICATION NO: ----------

PORT OF DESTINATION ----------

PACKING NO: (Numbered sequentially from 1 up to actual number of packages) ……..……

MADE IN ----------

GROSS WEIGHT ---------- Kg

SIZE OF PACKAGE (L x W x H) ---------- METRES

Crates, cases, boxes and any other container with breakable materials and those with materials required to be protected from weather shall be marked with respective symbol. These marks shall be protected against weathering by clear water-resistant varnish.

Bags, bundles, other containers and loose pieces, which cannot practically be marked as aforesaid,

2.0 GENERAL SPECIFICATIONS FOR THE PABX

2.1 GENERAL REQUIREMENTS

2.1.1 A modern IP PABX is required.

2.1.2 Bidders are required to produce documentary evidence to show that they are authorised by the manufacturers of the equipment to sell the equipment in Tanzania.

2.1.3 The PABX shall have been type approved by the Tanzania Communications Regulatory Authority (TCRA) or by any other authority currently empowered to grant type approval for telecommunications equipment in Tanzania.

2.1.4 The PABX shall be capable of operating from a single-phase 230V 50 Hz supply.

2.1.5 The bidder shall ensure adequate protection of the PABX from power supply anomalies such as power fluctuations and power surges.

2.1.6 The bidder shall ensure that the PABX is adequately earthed.

2.1.7 The bidder shall provide adequate protection against lightning.

2.1.8 The PABX must be capable of carrying telephony, data and voice mail.

2.1.9 It must be digital and of modular design both in hardware and software. The modules shall consist of the following cards:

a) A processor card,

b) Exchange line cards, and,

c) Extension line cards and,

d) A software module.

2.1.10 The system must be upgrade-able by use of cards and software modules at minimal cost and upgrade costs must be clearly indicated.

2.1.11 A flexible numbering scheme is required. It must be possible to assign any extension any number.

2.1.12 A flexible-software-driven call barring management system is required (see 7.11).

2.1.13 The PABX must be equipped with conference call facilities.

2.1.14 A personalized password facility must be available. Users must be able to 'lock' their extensions by use of a personalized password.

2.2 CONECTIVITY

2.2.1 It shall be possible to connect to the PABX either decadic or dial and keypad telephones.

2.2.2 It shall also be possible to connect DTMF Keypad telephones in conformity to ITU -T Q23.

2.2.3 It shall be possible to connect digital proprietary telephone terminals to the PABX over a distance of 1000 M on a standard 0.5mm pair cable.

2.2.4 It shall be possible to program several lines for any one group or department to use one directory number on the PABX.

2.2.5 It shall be possible to program any one digital station to supervise a number of other stations (one digital station to become a directory number for a department).

2.2.6 It shall be possible to program boss/secretary extension pairs.

2.2.7 The PABX must be capable of providing Direct Inward Dialling (DID) facilities on all the exchange lines.

2.2.8 The PABX shall be capable of networking (see notes on networking) with similar PABXs using the ITU-T Recommendation G 703.

2.2.9 The PABX shall be capable of providing selective call barring.

2.2.10 It shall be possible to program some extensions to become fallback extensions. In case of total power failure some designated exchange lines shall be automatically connected to some pre-programmed extensions; thus obviating total telephone communication failure to the offices.

2.3 SYSTEM FEATURES AND FACILITIES

2.3.1 A modem and remote maintenance facility shall be provided. In case a fault develops in the system, it shall be possible for the supplier or manufacture to perform remote diagnosis.

2.3.2 A printer and call charging system shall be provided. It shall be possible to charge telephone calls to the extension originating the call.

2.3.3 It shall be possible to interconnect computer terminals, local servers, VDUs. PCs, Printers and Modems.

2.3.4 The interface for 2.3.3 above shall be ITU-T V24/V28.

2.3.5 The system shall be capable of providing Integrated Voice Prompts in English. For economy, these can be digitised and customized messages operating on all stations connected to the system and on incoming DISA calls.

2.3.6 The voice prompt messages are used to inform the user of services available on the system and how to obtain the services, and to confirm system acceptance of user action.

2.3.7 TAKE-ALONG SERVICES shall include follow me, forward inside and outside, stopover and transplant.

2.3.8 Direct Inward System Access (DISA) shall be possible.

2.3.9 The PABX must be equipped with Direct Inward Line (DIL) facilities.

2.3.10 It shall be possible to program fallback extensions.

2.4 BILLING

2.4.1 A billing system is required. The sole purpose of providing a billing system is to control telecommunication costs. All telephone calls made out of the PABX must be automatically recorded and accounted for.

2.4.2 The billing system shall be capable of providing bills per extension per month. Any employee should be able to make and pay for calls if necessary.

2.4.3 Through convenient software the PABX system should be capable of recognizing the lines and services (telephone, data or voice mail) connected to each department of the customer. Billing shall, also, be possible per department.

2.4.4 The format for the billing information shall be of the type: calling extension,

number called, date (dd, mm, yy), duration of call (minutes), cost of call per minute and total cost of call.

2.4.5 The date information shall not be erased even in the event of a total power failure.

2.4.6 Each department will be billed separately for the services utilized by that department.

2.4.7 The system should be capable of billing at the PSTN rate plus.

2.4.8 The billing system should be capable of credit control by denying services at expiry of telecommunications budgetary allocations.

2.4.9 The system should be capable of printing department bills.

2.4.10 The system should be capable of printing bills for each exchange line for reconciliation with PSTN bills.

2.4.11 The billing system should not rely on PSTN pulses for billing.

2.5 The billing system must be tamper proof. Only authorized personnel should be able to access the billing information.

3.0 A GENERAL SPECIFICATION FOR THE LOCAL AREA NETWORK

3.1 The computer network shall be composed of a server, hubs and a number of desktop computers, computer printers and other computer accessories configured into a LAN.

4.0 GENERAL SPECIFICATIONS FOR HUBS (DATA SWITCHS)

4.1 APPLICABLE STANDARDS

Active (switching) hubs should conform to either of both of the following standards:

4.1.1 IEEE 802.3 10Base-T, IEEE 802.3u 100Base-TX

4.2 CONNECTORS

Port connectors should be shielded RJ45 ports or of an equivalent type.

4.3 COMPATIBLE CABLING

The hub should be compatible with either:

4.3.1 Ethernet: Cat. 6e UTP/STP, EIA.ITA-568 100 Ohm cabling, or

4.3.2 Fast Ethernet: Cat. 6e, UTP/STP, EIA/TIA-568 100 Ohm cabling.

4.3.3 The maximum cable length between a hub and a device should not exceed one hundred (100) meters, which includes the lead in cable lengths.

4.4 PROTOCOLS

The hub operating protocol should be CSMA/CD in accordance with the standards specified in 1 above.

4.5 DATA TRANSFER RATE

Data transfer rate should be either:

4.5.1 Ethernet: 10Mbps (Half-Duplex), 20Mbps (Full-Duplex); or

4.5.2 Fast Ethernet: 100Mbps (Half-Duplex), 200Mbps (Full Duplex)

4.6 DATA RAM BUFFERS

The hub should be capable of buffering 512KB per device at the specified data transfer rate.

4.7 FILTERING ADDRESS TABLE

Device addresses should consist of 8K entries per device.

4.8 POWER SUPPLY

Hubs are to be supplied by 240 VAC clean power from a UPS. The hubs should have inbuilt Power Supply Adapters whose input voltage is 240 VAC.

4.9 TEMPERATURE

Hubs must operate correctly at operating temperature range of between 0° and 40°C (32° ~ 104°F) at sea level.

4.10 HUMIDITY

Hubs should operate correctly in humidity ranging from 10% ~ 90% RH.

5.0 A GENERAL SPECIFICATION FOR STRUCTURED CABLING

5.1 All structured cabling and accessories must conform to the CATEGORY 6e Structured Cabling standard.

5.2 CAT 6e Structured Cabling is required for interconnecting telephones and computers.

5.3 Vertical and horizontal subsystems are required in accordance with the CAT. 6e standard.

5.4 A Patch Panel and Patch Cords are to be provided on each of floors ground, 1, 2, 3 and 4.

5.5 The Horizontal Cables shall terminate on the Patch Panels at one end, and on RJ 45 Dual connectors fixed in each office on cable trunking.

6.0 PARTICULAR SPECIFICATIONS FOR THE PABX

6.1 The PABX is to be installed in the room which has data cabinet.

6.2 The required capacity for the PABX is for thirty (24) exchange (TTCL) lines and one hundred (100) extensions.

6.3 The PABX shall be programmed in accordance with the Customer Data Tables at the end of these technical specifications.

6.4 The DID facility shall be enabled for all exchange lines. The Telecommunications Sub Contractor must liase with the PSTN operator (TTCL) to ensure that DID is enabled on all exchange lines. People calling into the PABX must be able to dial a number of digits plus an extension number to reach the desired extension without the assistance of an attendant.

6.5 A 200 pair MDF is to be installed next to the PABX. Bidders can opt to offer a Krone box instead of an MDF.

6.6 The exchange lines are to be connected to the MDF from where they are to be connected to the PABX via lightning arrestors.

6.7 All extension lines are to be connected to the PABX via the MDF.

6.8 Telecommunications outlets are shown in drawings.

6.9 In the Customer Data Tables, three classes of service are to be provided as follows:

6.9.1 Extensions marked with **A** shall be programmed to make local, STD. Cellular and international calls.

6.9.2 Extensions marked with **L** shall be programmed to permit local (Dar es Salaam) calls, and STD calls.

6.9.3 All other extensions are marked with I and they shall be programmed as intercom extensions.

6.10 Extension 31 shall be provided for security. This extension shall be able to call pre-programmed telephone numbers only. These numbers shall be emergency numbers such as police and fire. The Client can decide to include a telephone number of one of the bosses who are responsible for security.

6.11 Some extensions marked with **FB** shall be programmed to be fall back extension to be connected to selected exchange lines in the event of complete failure of the PABX.

9.16 The Telecommunications Sub Contractor for the PABX shall ensure that the Client is able to change the class restrictions as the Client may wish.

9.17 Conference calls must be programmed. The minimum configuration required is one external party with two (2) internal parties simultaneously.

9.18 DID must be programmed to be available on all exchange lines. The Telecommunications Sub Contractor is required to liase with TTCL to ensure that this facility is installed.

10 PARTICULAR SPECIFCATIONS FOR THE STRUCTURED CABLING NETWORK

10.1 The Electrical Sub Contractor shall supply and install all cable trunking as shown in the drawings. The Telecommunications Sub Contractor should liase with the Electrical Sub Contractor to ensure that all the trunking is in place.

10.2 All items to be supplied shall conform to the CAT. 6e Structured Cabling Standard.

10.3 A Patch Panel shall be installed in the Telecommunication Cabinet in the Telecommunications Room.

10.4 CAT. 6e Patch Cords of 1meter length shall be supplied with each Patch Panel. The number required shall be 24 Patch Cords per Patch Panel.

10.5 Telecommunications Outlets shall be installed on each floor as indicated in the drawings.

10.6 Four (4) pair CAT. 6e UTP horizontal cables shall be run from the Patch Panel to each of the respective telecommunications outlets in each office.

11 PARTICULAR SPECIFICATIONS FOR THE LAN

11.1 The LAN consists of a server and hubs. The Telecommunications Sub Contractor shall provide sufficient hardware and software capability for connecting desktop computers and printers. The computer locations are marked along the telephone extensions and have the same numbering scheme.

11.2 The hubs shall be installed in the Cabinet along with the telecommunications Patch Panels.

13 PARTICULAR SPECIFICATIONS FOR HUBS

13.2 Twenty-four port switch hubs are required.

13.3 The hubs shall conform to the General Specifications (6.0).

13.4 The hubs, which shall be installed in the Data Cabinet.

13.5 The hubs shall be connected to clean power from the UPS.

14 OTHER REQUIREMENTS

14.2 UPS

A 3 KVA UPS is required. The UPS will be connected to the PABX.

15 INSTALLATION TESTS AND MEASUREMENTS

15.2.1 The following installation tests and measurements shall be performed:

a) Before and after installation, the PABX, cables, telephones and accessories will be inspected by the Telecommunications Consultant for compliance with acceptable material quality and workmanship.

b) During installation, 'in station tests' shall be performed in accordance with the manufacturer's recommended procedures. The test data obtained must conform within limits to the factory test data.

c) After installation, installation, system, commissioning and acceptance tests will be performed.

d) Commissioning and acceptance tests shall include correct functioning of all line equipment, extension equipment, all features and facilities described in the manufacture's literature.

15.2.2 An engineer to be nominated by the interconnecting PSTN operator shall witness the acceptance tests. The Sub Contractor shall not be responsible for the attendance of the PSTN representative.

15.3 AS INSTALLED DRAWINGS AND INVENTORIES

15.3.1 The Sub Contractor shall produce three copies of the 'as installed' drawings indicating where the equipment has been installed.

15.3.2 The Sub Contractor shall produce three copies of the 'in station ' test data.

15.3.3 The Sub Contractor shall produce three copies of the inventory of all the equipment installed.

15.3.4 One set of each of the documents in 8.5.1 and 8.5.2 shall be handed over to the Client, another copy to the Telecommunications Consultants and the Sub Contractor can retain the last set.

16 STATEMENT OF COMPLIANCE

Where a pint by point statement of compliance is required, bidders are required to explain how they plan to meet the requirements of each point in the specifications. If a bidder has an alternative technology or method, which is considered to be better than that called for in the specifications, then the bidder should explain how

this alternative meets the requirement of the specifications. A statement of compliance, which simply states 'complied' without showing how compliance is achieved, will be considered as not responsive. During bid evaluation, each point carries a point, which shall determine the award or otherwise of the Contract.

17 SCHEDULE OF UNIT RATES

These unit rates will be used as the ruling rates for arithmetic checks during bid evaluation. If arithmetic errors are detected in the BOQ submitted by a bidder, then these unit rates will be used in disregard for the unit rates in the BOQ.

Item	Description	Unit	T Shillings
A:	**STRUCTURED CABLING**		
1	CAT. 6e RISER CABLE	1m	
2	CAT 6e HORIZONATAL CABLE	1m	
3	RJ 45 DUAL	each	
4	Patch Panel 24 pair	each	
5	Patch cords	each	
B	**PABX AND ACCESSORIES**		
1	Exchange line card	each	
2	Analog extension card	each	
3	Digital extension card	each	
4	Lightning arresters	each	
5	Digital telephones	each	
6	Analogue telephones	each	

We confirm that we have arrived at the Unit Rates and the Contract Sum therefore by using the following percentages:

Basic Price for Materials: ----------%

Preliminaries: ----------%

Overheads: ----------%

Labor: ----------%

Profit: ----------%

100%

All taxes and duties included confirm whichever is applicable

Yes	No.

Signed (NAME) ----------(Signature) ----------

Stamp…….

PLUMBING SPECIFICATIONS

PLUMBING AND FIRE FIGHTING INSTALLATION GENERAL SPECIFICATION

1. GENERAL

1.1 Execution of the works

The works shall be carried out strictly in accordance with:

(a) "British Standard Code of Practice" BS 1387:1990: Water supply.

(b) "British Standard Code of Practice" BS 4660, 4346: 1986: Sanitary pipework underground.

(c) All other relevant British Standard specification and Codes of Practice (hereinafter referred to as B.S. and C.P. respectively.

(d) By-Laws of the Local Authority.

(e) The working drawings.

(f) The Engineer's or Architect's instructions.

The drawings and specifications are to be read as a whole and are to explain each other. Work shown on the drawings and not described in the specifications or vice versa shall be dully executed under the contract.

It is the Contractors duty, before starting the work, carefully to examine the drawings and read the specifications and if necessary consult the Engineer in order to ensure himself that he fully understands the drawings and specifications. The drawings do not purport to show minor details of equipment or pipework, etc. but are intended to indicate the extent of the installation as designed, together with

sufficient information for the Contractor to prepare his own details for fitting and erection in accordance with the design.

1.2 **Extent of the Works**

The works include, unless otherwise specified, supply, installation, testing and commissioning and delivering up clean and in working order the installations shown on the drawings and specified in the specifications including all details such as:

Cold and hot water pipes, discharge (the term discharge pipe is in this specification used as a comprehensive all embracing description in place of the traditional soil and waster terms), drain and ventilating pipes, water meters, water heaters, valves, sanitary appliances including all necessary tapes and discharge fittings, fire fighting installations and equipment, thermal insulation etc. and all labour, materials, tools, instruments and scaffolding necessary to execute the work in a first class manner, even such labour or materials which are not specially mentioned in the project but are necessary for a satisfactory completion of the work.

Excluded from the work are, if nothing else is specified:

All building works such as accesses in concrete structures, plinths for machinery, ducts and chambers made from concrete blocks or concrete.

All cutting away and all making good will, if nothing else is specified, be carried out by the Contractor, but it will be the responsibility of the Contractor, to ensure that this work is kept to a minimum; he will also be responsible for the correct marking out of all chases and holes.

The Contractor shall also be responsible for ensuring that runs for floor or wall chases, holes to be cut or left will be marked out at the appropriate stage of the structural work.

The Contractor shall undertake all modifications demanded by the Authority in order to comply with current regulations, and produce all certificates, if any, from the Authorities without extra charge.

1.3 Extent of the Contractor's Duties:

At the 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 orders for the materials in question and copy the orders to the Architect and/or the Engineer. 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 installation and/or connection by the Contractor shall be carefully examined before installation and connection. Any defects noted shall immediately be reported to the Engineer.

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.

2. QUALIFICATION OF MATERIALS AND WORKMANSHIP

2.1 Materials and Workmanship generally.

All materials, equipment and accessories are to be new and in accordance with the requirements of the current rules and regulations where such exist, or in their absence with the relevant BS

Uniformity of type and manufacture of equipment or accessories is to be preserved as far as practicable throughout the whole work.

The Contractor shall, if required by the Architect or the Engineer, submit samples of materials to the Engineer for his approval before placing an order.

If in this specification the practice is adopted of specifying a particular item as "similar" to that of particular firm's product, it is to be clearly understood that this is to indicate the type and quality of the equipment required. No attempt is being made to give preference to the equipment supplied by the firm whose name or products is quoted. Alternate brands of equal and approved quality will be acceptable.

The Contractor will be entirely responsible for all materials; apparatus, equipment, etc. furnished by him in connection with his work, and shall take all special care to protect all parts of finished work from damage until handed over to the Employer.

The work shall be carried out by competent a workmen under skilled supervision. The Engineer shall have the authority to have any of the work taken down or changed, which is executed in an unsatisfactory manner.

2.2 Pipework and fittings

2.2.1 Tubing generally

All tubing exposed on faces of walls shall, unless otherwise specified, be fixed at least 25mm clear of adjacent surface with approved holder bate built into walls, cut and pinned to walls in cement mortar; where fixed to woodwork, suitable clips shall be used.

All tubing specified as fixed to ceilings, roofs or roof structures shall be fixed with approved mild steel hangers cut and pinned to ceilings, roofs or roof structures. Where 3 or more tubes are fixed to ceilings, roofs or roof structures close to each other, they shall be fixed in positions which leave the lower surface at the same horizontal level, unless otherwise specified.

Tubes shall be fixed to true lines parallel to adjacent lines of the building unless otherwise specified.

Where insulated, tubing shall be fixed with the insulation at least 25mm clear of adjacent surfaces.

Tube fixings and supports shall, if nothing else is specified, be arranged at intervals not greater than those given in the following tables:-

Unplasticized PVC Pipes

Diameter of pipe in mm	Maximum spacing of fixing in mm	
	Horizontal runs	Vertical runs
12	300	900
19	400	900
25	400	900
32	500	1,200
38	500	1,200
50	600	1,200
63	600	1,500
76	900	1,800
102	900	1,800
152	1,200	1,800

Each support shall take its due proportion of the weight of the tube or pipe and shall allow free movement for expansion and contraction.

All tubing specified as chased into walls shall have the wall face neatly cut and chased, the tubing wedged and fixed and plastered over.

Where tubing is laid in trench, care shall be taken to ensure that fittings are not strained.

All formed bends shall be made so as to retain the full diameter of the pipe.

Sleeves shall be provided where tubes pass through walls and solid floors to allow movement of the tubes without damage to the structure. The overall length of the sleeve shall be such that it projects at least 2mm beyond the finished thickness of the wall or partition.

Tubing shall be cut by hacksaw or other method, which does not reduce the diameter of the tube or form a bead or feather, which might restrict the flow.

2.2.2 Valves, cocks, taps, etc:

Draw-off taps and stop valves shall comply with B.S.1010:1959.

Copper alloy gate valves shall comply with B.S.1052:1964.

Copper alloy check valves shall comply with B.S.1953:1964.

Brass ball valves shall comply with B.S.1212:1953, copper floats for ballvalves shall comply with B.S.1968:1953 and plastic floats for same shall comply with B.S.2456:1954.
Sluice valves shall comply with B.S.1218:1946.

Manually operated mixing valves for ablutionary and domestic purposes shall comply with B.S.1415:1955.

Draining taps shall comply with B.S.2879: 1957.

Copper alloy screw-down stop valves shall comply with B.S.2060:1964.

Safety valves, stop valves and other safety fittings for air receivers and compressed air installations shall comply with B.S. 1123:1961.

Safety valves for thermal storage water heaters shall comply with B.S.759:1955.

All valves and cocks shall have the same flow area as the corresponding pipes and shall be accessible for operation and maintenance and suitably labeled by an approved method.
Stop valves shall be fixed in positions shown on the drawings, to all branch services for group control, or where else specified.

All valves, cocks and taps shall be of the correct pressure ratting according to the recommendations of the relevant B.S. or the Local Authority. At commencement of the contract, the Contractor shall if necessary ask the Engineer for guidance on this point.

Horizontal waste runs shall be installed to provide a natural "fall to the pipe. Obviously such a fall is dictated to some extent by the particular installation. 2/3 is an ideal fall, but in any event it should never be less than 2" or in other terms 51mm per 3,000mm.

2.3 Waste/Foul water Pipe Falls:

Waste or Foulwater pipe shall be uPvc class B

2.4 Thermal Insulation:

Thermal insulating material for hot and cold water supply installations shall conform to B.S.5422:1977, unless otherwise specified. The Contractor shall ensure that the thermal insulating materials used are conforming to the requirements of the Local Fire Authority.

All thermal insulating materials shall be delivered to the site in a dry condition and housed in a store until drawn upon for use.

All surfaces to be insulated shall be cleaned carefully before fixing the insulating material.

The installation of insulating materials shall be entrusted only to operatives skilled in the work. All insulating material, however fixed, shall be in close contact with the surface to which it is applied and all joints shall be sealed after ensuring that edges or ends of any section built up close to one another. Edges or ends shall be cut or sharpened on site as necessary. Supporting bands shall be either of non-corrodable material or adequately protected against rust.

Each pipe or item shall be insulated separately.

Fixing of insulating material shall suit the progress of other installation works in the building.

Insulation, where pipes are fixed exposed, shall be pre-formed rigid sections with approved finish. Where pipes are fixed in closed ducts, above false ceilings etc. Matts cut in suitable sections on the site shall be used, well secured with copper or galvanized wire finally covered with asphalt roofing paper.

Where subject to outside weather or other potentially damp or wet conditions, the insulation shall be adequately protected against moisture pick-up.

If nothing else is specified, the minimum thickness of insulating material for cold and hot water pipes shall be as specified in B.S.1588, Table I.

2.5 Sanitary Appliances:

Sanitary appliances shall be of first class quality to a Standard not less than the appropriate B.S.

The glazing to ceramic and fireclay shall be hard and smooth and without scratches, high spots, etc;

The installation of sanitary appliances shall be in accordance with C.P.305 (1952).

The appliances shall be fixed in the positions shown on the drawings or as directed by the Architect or the Engineer.

For all sanitary appliances, the necessary number of support, brackets, plugs, screws, washers, jointing material, etc; shall be provided.

Where supports, brackets, etc; are screwed to wall or structure rawl plugs or similar shall be used.

No trap for any appliance whatsoever shall be with less seal than 75mm.

Fixing shall, if required by the Architect or the Engineer, include for temporarily erecting appliances in the required position of service and discharge pipes, taking down, storing and permanently fixing after completion of wall finishing and connecting to service and discharge pipes.

Care shall be taken at all times and particularly after fixing, to protect appliances from damage.

Upon completion of the work, all appliances shall be cleaned for plaster, paint, etc. and carefully examined for defects.

2.6 Water Meters:

If the water supply is shown metered, the meter shall, if nothing else is specified, be provided and fixed by the Water Supply Authority on the request of the Contractor.

2.7 Fire Fighting Equipment.

The specified fire fighting equipment shall, if nothing else is specified, be supplied and installed by the Contractor in the positions shown on the drawings.

Portable fire extinguishers shall comply with the following B.S:-

(a)	Water type (Soda acid)	:	B.S.138:1948
(b)	Foam type (chemical)	:	B.S.740: Part 1:1948
(c)	Foam type (gas pressure)	:	B.S.740: Part 2:1952
(d)	Water type (gas pressure)	:	B.S.1382:1948
(e)	Carbon tetrachloride and Chlorobromomethane	:	B.S.1721:1960
(f)	Carbon dioxide type	:	B.S.3326:1960
(g)	Dry Powder Type	:	B.S.3465:1962
(h)	Water type (Storey pressure)	:	B.S.3709:1964.

In nothing else is specified, fire extinguishers shall be supplied in the colour "fire red" and be similar to manufacture "**NAFFCO**".

2.8 Rainwater Installations

Rainwater downpipe and gutter

1. Brackets, to be spaced at max 500 mm centers, create a 10mm gap between fascia and the back of the face of the spouting to allow water to spill to the exterior of

the building envelope.
2. Fixings: Min 3 Stainless steel screws per bracket
3. Outlet: Two outlets per gutter as per architectural drawings
    - Fixings: with min 4 stainless steel screws to fascia
4. Accessories: Gutter stop ends, joinery, rain head, solvent, all necessary accessories and fixings included.

Two way outlet flat grade

1. The two-way outlet is designed to be used at the junction of roofs and parapet walls, or wherever horizontal and vertical surfaces meet.
2. Roof construction: Flat roof - concrete slab, screed, waterproofing, and concrete tiles OR concrete slab, screed.
3. Type of grate/ Fittings: Flange and clamping collar for roof membrane.
4. Secure gratings: Gratings are secured with stainless steel fixings that require either a socket wrench or spanner for removal and replacement.
5. Outlet: Type and direction to suit pipe work with suitable adaptors and connections. PVC adaptors provide a quick and convenient connection to standard PVC pipe work.
   Accessories: All accessories included for complete and fully functional installation

2.9 Testing

The whole of the water and discharge installations shall be tested to the satisfaction of the Engineer and the Local Authority. The Contractor shall provide all necessary testing apparatus and facilities for testing the installations and any defective work shall be replaced immediately and shall be the subject of re-testing until found satisfactory.

Where pipes are to be lagged, chased into walls or otherwise concealed, the work shall be tested prior to lagging, making good chases, etc.

All hot and cold water installations, shall, if nothing else is specified, be tested not less than water pressure of 7kg/cm^2.

The test pressure shall be applied by means of a manually operated test pump or, in the case of long mains or mains of large diameter, by a power-driven test pump. Pressure gauges shall be recalibrated before the test.

The test pressure shall be maintained by the pump for about 24 hour and a leakage as specified in C.P. 310, Section 502 (j) shall be approved, but any visible individual leak shall be repaired.

Valves, cocks and taps shall be absolutely tight under the test pressure for the corresponding pipes as well as under a small pressure.
All discharge pipes shall be tested with air or smoke to a pressure equal to 40mm water gauge and the pressure remain constant for a period not less than 3 minutes.
The water seals of all sanitary appliances which are installed shall be fully charged and test
Plugs inserted into the open ends of the pipework to be tested. With the pressure applied, every trap shall retain not less than 25mm of seal.

All tests shall be repeated three times; the taps being recharged before each test and the maximum loss of seal in any one test, measured by a dipstick, should be taken as the significant result.

Tests shall, if necessary, be done in sections as work proceeds.

All tests shall be carried out in the presence of representative of the Local Authority and/or the Engineer or his representative.
Upon completion of the work, including re-testing if necessary, the installations shall be thoroughly flushed out and water pipes refilled with clean water ready for use.

2.10 Commissioning

Before handing over, the Contractor shall confirm that the installation has been examined, tested, is ready for use, that it will operate and can be maintained efficiently.

When handing over, the Contractor shall demonstrate to the Employer the methods of operation, limitations, the maintenance requirements and the safety precautions to be observed and shall also hand over any tools for operating, cleaning, testing and maintenance of the installation.

On acceptance the Contractor shall provide the Employer with operation and maintenance instructions and any other documents or information appropriate to the installation.

3.0 SERVICE AND MAINTENANCE

The Contractor shall include in the tender one copy of a proposal for a service and maintenance contract.

The service and maintenance contract shall include regular inspection of the plumbing equipment installations, any adjustment and replacements of worn out or damaged materials and cleaning.

4.0 FINAL DRAWINGS AND MANUALS

Upon practical completion of the works, the Contractor shall amend the working drawings to include and reflect the 'as installed' details of the installation, and shall submit four sets of the 'as installed' drawings and manuals for the Employers record and reference.

If the Contractor fails to produce to the Engineer approved either working drawing during the execution period of the contract works or the record drawing within one month of sectional or practical completion the Engineer shall be at liberty to have these drawing produced by others. The cost of obtaining the necessary information and preparing such drawings etc. will be deducted from outstanding payments due to the contractor.