Kenya Power

STANDARD SPECIFICATIONS SUBSTATIONS CIVIL WORKS

SCOPE OF WORKS

The works shall entail -

- Construction of 15X 7M control building.
- Construction of cable trenches & covers.
- Access road in concrete paving blocks finish
- Levelling the switchyard and spreading 150mm thick 1(inch) ballast.
- General drainage works and rehabilitation
- Construction of oil sumps and interceptor
- Making good all disturbed areas.
- Construction of masonry perimeter wall and gate.

CIVIL AND BUILDING WORKS SPECIFICATIONS

All materials, plants and other supplies to be permanently incorporated in the works shall be new, unused, of the most recent or current models and incorporating all recent improvements in designs and materials unless provided otherwise in the contract.

1.0 GENERAL SPECIFICATIONS

The following shall apply to all sections hereinafter:

1.1 Alternations, Additions and Extensions

In all alterations or extensions to existing Buildings and/or external works, new works is to match up in all respects to the existing work unless otherwise specified, shown on the Drawing or approved before hand by the Employer/Engineer.

1.2 Units Of Measurements and Standardization

The internationals system of the units (SI) shall be used in the connection with this contract and all materials fittings, component items of plant and equipment supplied for incorporation in the works shall be standardized accordingly. SI unit shall be used in all correspondence, documentation, calculations, drawings, measurement etc.

1.3 Surveying Instruments

The contractor shall supply and keep on site such surveying instruments as are necessary for the complete and accurate setting out and construction of the works. The instrument shall be in excellent condition and accurate in all respects. They shall be available for use by the Employer/ Engineer if so required.

1.4 Setting Out

The Engineer will establish a line from which he contractor shall set out the works.

1.5 The contractor shall provide on site sufficient labour, plant, materials and all other things necessary to carry out the works to satisfactory completion.

1.6 Safeties and Cleanliness of Plant and Materials

The Contractor shall at all times maintain good housekeeping at the site to avoid any accidents.

1.7 Contractors Area

An area will be allocated by the Employer, to the contractor for his offices, the storage of plant and any necessary fabrications during the execution of the contract.

1.8 Site Electricity Supply

The contractor will make his own arrangements to have electricity power supplied to the site for his use and pay all bills.

1.9 Site Water Supply

The contractor will make his own arrangements to have water supply on site for his use and pay.
Contractor will provide any piping or water storage necessary for the execution of the contract works. The contractor will pay all water bills during the execution of the contract.

2.0 Ground Conditions

The contractor shall satisfy himself as to the ground conditions on site i.e. nature of strata, obstructions, possibility of flooding and shall allow for provisions necessary to carry out the work most suitably. If in the Engineer's opinion any plant or method of working is considered unsuitable, the contractor shall carry out the work by alternative method approved by the Engineer at no cost to the Employer.

2.1 Materials

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

2.2 Manufacturers' Recommendations

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

2.3 Standards

Where commodities or workmanship are specified by reference to British Standards (B.S.) or Codes of Practice (C.P.) OR International (I.S.O.) or other standards, such stands are deemed to be latest published at the time of tendering. The contractor will be deemed to have read and understood the stands specified, and no claim for want of knowledge will be allowed. The substitution must be made in writing in

sufficient time to allow adequate investigation. Obtain Certificates of Compliances with standards and supply to the Employer/Engineer on request.

2.4 **Local Conditions**

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

4.1.4 PARTICULAR SPECIFICATION CIVIL WORKS

4.1.4.1 General

4.1.4.1.1 Location of the Works

The locations of the sites are as described under the relevant clauses in scope of works in Volume 2.

4.1.4.1.2 Type of Works

As specified in the Bill of quantities and drawings

4.1.4.1.3 Switchgear Building

As specified in the Bill of quantities and drawings

4.1.4.1.4 Sequence of Construction

The Contractor must complete all the civil works in time to provide a clean and complete site for the mechanical and electrical erection.

The Contractor shall be responsible for timely delivery of materials to site and for compliance with the specified or agreed construction programme.

4.1.4.1.5 Drawings

The Drawings issued with these documents are for tendering purposes only and specific to this project as per KPLC standards. The contractor must provide approved set of as built drawings after completion

4.1.4.1.6 Use of Site

The Contractor will restrict his activities to within the Sites. Access for others to work on the site concurrently with this Contract shall be maintained as far as possible. Where it is necessary for persons on foot or in vehicles, including other Contractors, to cross the site whilst work is in progress, the Contractor shall provide warning signs on either side of the Work and flagmen if necessary to guide such persons safely across the Site. The cost of maintaining access for others and assisting the passage of others across the Site shall be deemed to be covered by and included in the rates entered by the Contractor in the Price Schedules.

4.1.4.1.7 Plan of Operations and Temporary Works

The Contractor shall, in accordance with Conditions of Contract and before commencing work on Site, submit to the Project Manager a fully detailed programme showing the order of procedure and method by which he proposes to carry out the construction and completion of the Civil Engineering works, and particulars of the organisation and staff proposed to direct and administer the performance of the Works.

The information to be supplied to the Project Manager shall include Drawings showing the general arrangements of his temporary offices, camps, storage sheds, buildings and access roads, and details of Constructional Plant and Temporary Works proposed.

4.1.4.1.8 Contractor's Office and Accommodation, etc.

The Contractor shall be responsible for his offices, accommodation, storage and workshops. The Contractor may fence this area for his own security for the duration of the Contract but any such fence erected together with all buildings, plant and materials shall be removed, all holes filled in and the site left in a tidy and level condition upon completion of the Contract.

4.1.4.1.9 Dealing with Water

The Contractor shall keep the whole of the Works free from water and he will be deemed to have included in his rates in the Price Schedules for all pumping, shoring, temporary drains, and sumps and other measures and provisions necessary for such purposes and for clearing away and making good to the satisfaction of the Project Manager damage caused thereby.

The Contractor shall keep all existing drainage channels clear and shall not obstruct the passage of water to or away from any such drainage channels.

4.1.4.1.10 Liason with Police and Other Officials

Contractor shall cooperate closely with the Police and other officials of the area concerned regarding their requirements in the control of workmen, movement of traffic, or other matter.

4.1.4.1.11 Explosives and Blasting

The Contractor shall use explosives for blasting in connection with the work only at such times and places and in such a manner as the Project Manager may approve, but such approval shall not relieve the Contractor from his responsibility for injury, loss, inconvenience and annoyance to persons, the Work and adjoining structures, roads, places and things and injury or damage to animals and property consequent on the use of such explosives. The Contractor shall be entirely liable for any accident that shall occur and shall save the Project Manager harmless and indemnified from all claims arising from such use of explosives.

The Contractor shall keep in his office at the Site copies of Laws applying to the transport, storage and use of explosives and shall also submit to the Project Manager a copy of any instructions or notices which the Contractor may issue to his staff or workmen or post about the site in compliance with such Laws.

The Contractor shall submit to the Project Manager details of the explosives, which he proposes to use, and of his proposals for the transport and storage of explosives.

4.1.4.1.12 Works Executed by the Project Manager or by Other Contractors

The Project Manager reserves the right to execute on the site, works not included under this Contract and to employ for this purpose either his own employees or other contractors.

The Contractor shall ensure that neither his own operations nor trespass by his own employees shall interfere with the operations of the Project Manager or his Contractors employed on such works and the same obligations shall be imposed on the Project Manager or his contractors in respect of work being executed under the Contract.

The Contractor shall provide unhindered access to all parts of the site to the Project Manager, authorised representatives of the Project Manager and of public bodies and corporations, and to contractors employed by the Project Manager, and he shall make available to such authorised persons the use of all temporary access tracks in or about the site.

Where works are being carried out concurrently in one area careful co-ordination of operations will be required so that interference can be minimised. The Project Manager shall have the power to regulate and rearrange the order of execution of the Works under this Contract to achieve the best co-ordination practicable. The Contractor's programme shall take into consideration all information on co-ordination available at the time of its preparation and it shall be flexible enough to allow for subsequent changes that may become necessary. The rates tendered for the Works shall include the costs of complying with the requirements of this Clause.

4.1.4.1.13 Water Supplies for the Works

The Contractor shall make his own arrangements for the supply of potable water for his staff on site and water for the Works.

The Contractor must make all arrangements including the supply of pumps and motors, labour and the like to abstract water and must pay royalty to the owners. These costs shall be included in his prices.

If the Contractor fails to obtain permission to utilise existing water sources, he may have to drill boreholes near the sites at suitable locations.

The Contractor shall obtain the Employer's or the Project Manager's prior approval before utilising any water source for the Works.

4.1.4.1.14 Employer's Approval of Finished Works

The Contractor shall obtain the approval of the Project Manager for each section and each stage of construction. Approval of any section of any stage will not be given, and the Contractor shall not proceed with any subsequent stage, until all tests required by the Project Manager have been carried out, and the results have shown that the section complies with the Specification. Any works rejected by the Project Manager as not complying with the Specification shall be replaced by the Contractor at his own expense.

4.1.4.1.15 Preservation of Trees

No tree shall be removed without prior permission of the Project Manager who will limit the removal of trees to the minimum necessary to accommodate the permanent Works.

4.1.4.1.16 Survey Beacons

During the progress of the Works, the Contractor shall not remove, damage, alter or destroy in any way any permanent beacons or survey beacons. Should the Contractor consider that any survey beacon will be interfered with by the Works, he will notify the Project Manager, who, if he considers necessary, will make arrangements for the removal and replacement of the beacon.

If the Contractor removes or disturbs a beacon without the prior permission of the Project Manager he shall be liable for the full cost of its replacement together with the full cost of re-establishing the data relevant to it.

4.1.4.1.17 Basic Survey and Setting Out

The Contractor will survey the sites in detail, and the exact locations shall be agreed with the Project Manager.The details of beacons and benchmarks shall be provided in the site survey drawings.

The Works are located on the drawings and the Contractor shall appoint a suitably qualified Surveyor to set out the Works from the beacons and shall plot cross sections at 10 m intervals and submit to the Project Manager for approval.

No separate payment will be made for any work in connection with the setting out of the Works, nor any other Works required by the Contractor to ensure the accurate location and construction of the Works.

4.1.4.2 EARTHWORKS

4.1.4.2.1 Bush Clearing

The areas of the platform and borrow pit shall be cleared of all trees, vegetation and roots. These shall be neatly stockpiled within 3 km of the site at locations agreed with the Project Manager and shall remain the property of the land owner.

4.1.4.2.2 Access and Internal Roads

An access road as shown in the drawing from the main road to the substation site shall be provided, and join the substation road in the substation at the gate. Loading and off loading bay for transformers, and access to the control building through paving walk path slabs shall be provided.

Access road.

The contractor should put in consideration the accessibility to the substation from the main road, by ensuring that the gradient of the slope and the turning angles are easily attainable by any vehicle to and from the substation. The main road tee-off works to the Substation works shall also be approved by the local Council

The Access road, shall be compacted to 100% MDD and 150mm thick rolled approved murram finish compacted to 100%MDD, on a well compacted and formed approved hardcore base well compacted in layers of 150mm thick and shall attain 95% compaction density. The access road shall be 150mm above the existing ground level unless otherwise stated where the road is used for draining purposes. Appropriate sized culverts shall be installed. Cable ducts MUST be provided as marked at road crossings.

Internal Roads

Substation road and walk paths shall be compacted to 95% MDD after grading shall have a well done paving block finish that can withstand load weight of not less than 80mm, 49N/mm². The roads shall also be lined with a kerbline and channels and shall be constructed to a fall that will allow proper drainage of the road.

a) Existing Bitumen Standard Access and Internal Roads

Existing roads shall be reinstated to their original standard of materials and construction.

b) Quality Control

Tests shall be performed by the contractor on soils and gravels undergoing compaction under the supervision of and at frequencies determined by the Project Manager and shall include:

- Determination of the Atterberg Limits in accordance with BS 1377.
- Determination of particle size distribution in accordance with BS 1377.
- Determination of dry density / moisture content relationship in accordance with BS standard compaction and modified AASHTO T180 as appropriate.
- California Bearing ratio (CBR) in accordance with AASHTO T193.
- Field dry density as set out in BS 1377.

CONSTRUCTION OF SUB-BASE AND BASES

18.4.1 General

The term "gravel" used throughout this section shall be deemed to include; lateritic gravel, Quartizitic gravel, some forms of weathered rock, soft stone, coral rag and conglomerate.

A "grade" base will be made up of one of these natural gravels, or of sand or clay sand, or of a combination of these materials, without the addition of any stabilizing agent.

18.4.2 Material requirements

Unless otherwise specified or directed by the Engineer, the material shall comply with the following requirements:-

California bearing ratio:

a).The material for base shall have CBR of least 80.

b).The material for sub-base shall have a CBR of at least 30.

c)Unless otherwise specified, the CBR shall be measured at a dry density corresponding to 95% MDD (heavy compaction) and after 4 days.

18.4.3 Requirements for gravel:

In addition to the CBR requirements, the gravel material shall comply with the following specification:-

Gravel for			Base	Sub-base
Plasticity Index	-	Maximum	15	25
Loss Angels value	-	Maximum	30	70
Aggregate Crushing value	-	Maximum	35	75

Quarry waste

Quarry waste shall mean material to the same specification as crusher dust, except as follows:- The material may have up to 35% of stones not larger than 38mm provided that the material passing the 5mm sieve is within the limits specified.

Quarry waste shall be clean and completely free from earth, organic or other foreign matter.

i). The plasticity index taken on material passing the No. 36 sieve shall not exceed 16%

4.1.4.2.3 Removal of Top Soil

The top soil within the areas of platform and shall be stripped to an approximate depth of 300 mm and stockpiled at locations agreed with the Project Manager for later use on embankment slopes.

Overburden in the borrow pit shall also be stripped to a depth specified by the Project Manager and stockpiled for later use in rehabilitation.

4.1.4.2.4 Order of Work

The construction of cuttings, side drains and embankments shall proceed in a methodical and orderly manner. It shall be solely the Contractor's responsibility to arrange his methods and programme of work so as to ensure that the earthworks are carried out by the most efficient and economical method possible with the type of plant employed on the Works.

All trimming of cuttings, and embankments, drains and shoulders to the specified slopes and shapes, shall be carried out concurrently with the earthworks that are being carried out at that particular site and level.

4.1.4.2.5 Fill Material

"Fill-material" shall mean material deposited in accordance with these specifications from any of the classes specified in order to build up an earthworks construction to formation level as shown on the Drawings or as ordered by the Project Manager. The Contractor shall obtain the fill material from a source approved by the Project Manager.

Fill materials will generally be obtained from cuttings. If the material obtained from this source is insufficient or unsuitable extra material shall be obtained from borrow areas. All fill material (other than rock fill in lower layers) shall pass 75mm BS sieve size.

The following materials are generally unsuitable for construction of fills.

- All materials containing more than 5% by weight of organic matter (such as top soil, materials from swamps, plants and vegetable matter)
- All expansive soils such as black cotton soils with swells of more than 3% as measured in the CBR test.
- All clay soils with plasticity index exceeding 50.
- All materials having a moisture content of 105% of the optimum moisture content (standard compaction)

Rock fill can be used provided that boulders greater than 0.2 M^3 in volume or 600 mm in size are not used and that this material is not placed within the top 600 mm to formation level. The best materials from cuttings or borrow areas should be reserved for the upper layers of the fill.

Compaction of fill

Materials other than rock fill shall be placed in layers of compacted thickness not exceeding 300 mm. Thicker layers can only be permitted where very heavy compacting equipment is available and trial sections have proved that the required compaction will be readily achieved over the layer depth. The minimum layer thickness shall be twice the maximum particle size of the compacted material.

Fill material shall be compacted throughout to a dry density of at least 95% MDD at OMC (standard Compaction AASHTOT99) except the top 300 mm of the fill which shall be compacted to 100% MDD (AASHTO T99).

Where rock fill is used it should be placed in the bottom of the embankment. The largest sizes but shall be placed in layers of 1.0 meter thick. The interstices shall then be filled with smaller rocks and approved filler material. The whole layer shall then be compacted until the interstices are completely filled or until the required settlement is obtained. Heavy vibratory rollers are generally the most suitable machines for compacting rock fill.

The specified compaction shall be achieved over the full width of the embankment.
Any area inaccessible to the roller shall be consolidated and compacted using approved mechanical tampers.

Compaction of In situ Sub grades

After removing the top soil and/or 600 mm of expansive soils and before placing fill, improved sub grade or gravel wearing course, the upper 300 mm of in situ sub grade will be compacted to 100% MDD standard compaction. Compaction in cuts without improved sub grade will likewise be compacted to 100% MDD standard compaction

4.1.4.2.6 Spoil Material

"Spoil-material" shall mean material excavated in accordance with these specifications from any of the classes specified, and which, being obtained from the excavation of side drains, cuttings or below the road, embankment is unsuitable for the requirements of the Works. Spoil material shall

be removed from the Site to a spoil tip which should be to a site acceptable by respective local authorities and shall be approved by the Project Manager.

4.1.4.2.7 Expansive Material

When expansive material is encountered, it shall be removed to a depth 600 mm below the formation or the existing ground level, whichever is greater. Material removed shall be stockpiled for later use in slope protection or spoiled to a tip as instructed by the Project Manager.

4.1.4.2.8 Surplus Material

"Surplus-material" shall mean material excavated in accordance with these specifications from any of the classes specified and which is temporarily surplus to the fill requirements and shall be carted to a designated stockpile for re-use later elsewhere in the Works, or to an approved spoil tip.

4.1.4.2.9 Side Drains

Where side drains are required excavating the lines, slopes and widths as designed by the Contractor and approved by the Project Manager shall shape them. The side drains shall be finished off so that the formation levels and camber or super elevation of the formation, level and cross fall of the shoulders, and shape and invert levels of the side drains are everywhere in accordance with the Drawings.

Any excess depth or width excavated from the side drains shall be backfilled and made good to the satisfaction of the Project Manager at the Contractor's expense.

All other types of drains are specified separately in this Specification.

4.1.4.2.10 Excavation in "Rock"

a) Excavation Level

Unless otherwise directed, the formation of the platform can be founded on rock. However, rock shall be excavated to an average level 150 mm below the formation and in no place less than 100 mm below the formation.

b) Backfilling for Surfaces

Any excess excavation in rock below the formation shall be backfilled and compacted. Excess excavation in the invert of drains shall not be backfilled, but the rock surfaces shall be trimmed, and all loose particles removed, to allow free drainage of water.

c) Excess Excavation of Slopes

Where side slopes are over-excavated no backfilling will be required but the slopes shall be trimmed to a neat shape and safe angle as is acceptable to the Project Manager. The sloping sides of all cuttings shall be cleared of all rock fragments, which move when prised with a crowbar.

d) Hard Material

The provisions of this Clause do not apply to hard and common materials, which materials shall be excavated to the lines and levels shown on the Drawings or as instructed, within the permitted tolerances.

4.1.4.2.11 Setting Out and Preparation for Earthworks

The Contractor shall set out the earthworks and the tops of cuttings and toes of embankments at intervals 10 m. Reference pegs shall be provided clear of the earthworks and at right angles to the centre lines, from which the centre lines and levels can be re-established at any time.

Before the construction of any earthworks in the fills, the levels of the existing ground shall be agreed between the Contractor and the Project Manager. If the Contractor fails to take the requisite levels then the ground levels determined by the Project Manager shall be taken as correct.

4.1.4.2.12 Construction of Earthworks to Formation

All earthworks up to formation shall be formed and completed to the correct lines, slopes, widths and levels shown on the Drawings and with the sub grade parallel to and at the correct depth below the profile, camber, cross fall or super elevation shown for the finished level, unless otherwise directed by the Project Manager.

Embankments and fills shall be constructed only of suitable material obtained from the excavation of cuttings. If the Contractor encounters material which he considers unsuitable for earthworks, then he shall forthwith inform the Project Manager, who shall instruct the method of use or disposal of such material. If insufficient material can be obtained from the cuttings, additional material may be borrowed from approved borrow pits.

The Project Manager may direct that certain soils be excluded from certain layers and other soils set apart or obtained from borrow and used only for these layers, in which case the Contractor shall comply with the Employer's or the Project Manager's directions and shall allow in his price for such selection of materials.

4.1.4.2.13 Unsuitable Material Information

Where, in the opinion of the Project Manager, unsuitable material occurs in cuttings, the Contractor shall excavate it to the depths and widths directed and replace it with selected fill material to form an improved formation.

4.1.4.2.14 Spreading and Compaction of Embankment and Fills

Embankments and fills shall be laid out and compacted to achieve a stable platform with sufficient bearing capacity and stability.

4.1.4.2.15 Drainage of Works

All cuttings, embankments and borrow pits shall be kept free of standing water and drained during the whole of the construction.

Should water accumulate on any part of the earthworks, either during construction or after construction, until the end of the maintenance period, giving rise to soaking or eroding conditions in the earthworks, the Project Manager may order the Contractor to remove and replace at the Contractor's expense any material which has been so affected.

All drains shall be maintained throughout the Contract in proper working order.

The Contractor must allow in his price for draining the earthworks satisfactorily at all stages during the construction and arrange his methods and order of working accordingly.

4.1.4.2.16 Sub-grade Layer

During this process the sub grade layer shall be graded to level, parallel to the cross fall or chamber and profile shown on the approved design drawings or directed by the Project Manager and to agreed tolerance.

4.1.4.2.17 Tolerances

The following tolerances will be permitted in the finish of the formation to roads and platform:

a) The level of the formation should be within +/- 100 mm and - of that specified.

b) On the final trimmed slope of earthworks a variation of + or - one fifth of the specified slope will be allowed.

c) The tolerances permitted in the overall width of the bottom of cuttings shall be plus or minus 150 mm in the distance between centre lines and the toe of cuttings slopes, and plus 150 mm in the case of embankments.

4.1.4.2.18 Protection of Embankment Slopes

The top soil and expansive material removed from the Works shall be placed on embankment slopes as directed by the Project Manager. The slopes shall be trimmed to form a gradient not less than 1 on 5 unless otherwise directed.

4.1.4.2.19 Grassing of Slopes

The surface of embankment slopes, after placing of top soil, shall be planted with grass. Unless instructed otherwise by the Project Manager, the type of grass shall be indigenous. While planting, the area shall be irrigated for as long as necessary to ensure that the grass is properly established and has completely covered the ground. Grass should only be planted in the rainy season.

4.1.4.2.20 Borrow Pits

Where it is necessary to borrow material for construction, suitable pits shall be provided by the Contractor to the approval of the Project Manager.

All borrow pits must be carefully cross sectioned before and after excavation in order to determine the quality of earth excavated.

After removal of material for use, the area must be rehabilitated by the Contractor so that it will not prove a hazard to man or beast or a source of erosion. The sides of the excavation must first be sloped and then any previously stockpiled top soil spread as far as possible.
At some borrow pit locations, further cleaning and fencing etc., may be required.

4.1.4.2.21 Soil Sterilisation

In order to stop the growth of vegetation and incidence of ants, the Contractor shall apply an approved herbicide before any spreading of stone over the platform area.

Insecticide to be used around Switchgear building.

4.1.4.2.22 Earth Electrode

The Contractor shall install earthing electrodes in trenches as outlined in the Specifications for Earthing in chapter 4.1.Particular specifications.

4.1.4.2.23 Platform Areas

The substation platform areas shall be at least 1.5 times the area required by to equipment to be installed.

4.1.4.3 MATERIALS FOR THE WORKS

4.1.4.3.1 General

All materials shall comply with appropriate local or regional standards unless otherwise required hereinafter. Such standards shall be to the approval of the Project Manager.

The Contractor shall before placing any order for materials or manufactured articles for incorporation in the Civil Works, submit for the approval of the Project Manager the names of the firms from whom he proposes to obtain such materials, etc., together with a list of the materials and manufactured articles giving the origin, quality, weight, strength, description, etc., which he proposes that the firms should supply. No materials or manufactured articles shall be ordered or obtained from any firm of which the Project Manager shall not have previously approved.

All materials shall be delivered to the site a sufficient period of time before they are required for use in the Works to enable the Project Manager to take such samples as he may wish for testing and approval. Any materials condemned as unsuitable for Works shall be removed from the Site at the Contractor's expense.

The Contractor may propose alternative materials to those specified, provided that they are of equivalent quality and, subject to the Employer's or the Project Manager's approval such materials may be used in the Works.

4.1.4.3.2 Standards

Concrete pipes, porous concrete pipes, cast iron manhole covers and gratings, bricks, concrete kerbs, bituminous surfacing, cement, steel and aggregates shall comply with local or regional standard to be approved.

4.1.4.3.3 Filter Backfill for Sub-soil Drains

This shall be graded crushed stone as for platform surfacing (below).

4.1.4.3.4 Stone for Pitching

Stone for pitching to drains, inlets and outlets of culverts, to embankments and around structures shall consist of sound un-decomposed rock. Precast concrete tiles may also be used.

4.1.4.3.5 Stone for Platform Surfacing

The stone shall be hard and durable crushed rock with a maximum particle size of 60 mm and not more than 15% shall pass a 9.5 mm sieve.

The stone layer to be spread uniformly over the finished surface of the platform shall have a thickness of 100 mm.

4.1.4.4 DRAINAGE AND STORM WATER

4.1.4.4.1 Drainage

The Contractor shall provide sub-soil and storm water drainage, including drainage of cable ducts. The drainage system shall be to the approval of the Project Manager.

4.1.4.5 FENCING

4.1.4.5.1 Fencing

The Contractor shall construct fencing along the perimeter of sub-stations, including gates where necessary and shall comply with the requirements of the following Clauses.
All the substation fences unless otherwise stated in the scope of works, shall be of dressed Natural stone. electric fence shall be installed on top of the perimeter wall

4.1.4.5.2 Dimensions:

This shall apply to chain link fences;

Height of the stone fence: 2 400 mm
Height of chain link fabric: 2 000 mm

Barbed wire:3 wires above fabric, height of 300 mm, on supporting arms facing outwards from Site at 450 angle.

Maximum distance between posts: 3 000 mm, except where interrupted by gate.

Terminal posts:including end, corner and straining posts; 89 mm outside diameter 114 mm outside diameter at gates.

Embedment lengths of terminal posts:

- Corner and straining posts 1 100 mm
- End posts 1 200 mm
- Gate posts 1 400 mm

Tension bars and bands: locate at terminal posts to fix fabric, bottom wire and barbed wire.

Top rail: "extra-strong" pipe, 43 mm outside diameter.

Braces: "extra-strong" pipe, 43 mm outside diameter for attaching end and gate posts to adjoining posts. Use two braces at corner and restraining posts.

Gate width: free distance between 2 gate posts, 1 500 mm for single gate, 5 000 mm double gates.

Double gates: one leaf for normal traffic, other leaf to remain closed by means of drop bolt locking into centre rest, inoperable from exterior.

Gates: able to open in either direction to 900.

Gate hardware: three hinges, latch with padlock accessible from either side of gate, latch catch.

Top of posts and uprights: weatherproof tops.

4.1.4.5.3 Materials

Fabric: ASTM A 392, 2 000 mm high, 3.8 mm diameter (No. 9 gauge) steel wire, 50 mm diamond pattern, twisted and barbed finish at top, knuckled wires at bottom, zinc coated.

Pipes: ASTM A 120, steel pile, hot-dipped zinc coated after welding, diameter and weight size as shown on drawings, unthreaded ends, free from burrs.

Fence fittings: ASTM F 626, hot-dipped zinc coated according to ASTM A 123.

Barbed wire: ASTM A 121, 2.51 mm diameter wire in strand (No.12-1/2 gauge), 2 strands with 4-point barbs spaced at 125 mm, Class 3 zinc coating.

Bottom wires: 5 mm (No. 6 gauge) steel wire, 500 g/m2 zinc coating. This shall be surrounded by a concrete beam (C20) as shown on the drawings.

Fence fittings: ASTM F 626, steel tension bars and bands, nuts and bolts, weather proof tops of commercial aluminium alloy, malleable cast iron, or rolled or pressed steel, cast iron and steel fittings hot-dipped galvanised with 500 g/m2 according to ASTM A123.

Concrete: 20MPA at 28 days

4.1.4.5.4 Installation

Install fencing and gates according to ASTM F 567 unless otherwise indicated, and to drawings and this Specification.

Level ground surface so that space between finished ground surface elevation and bottom of fabric does not exceed 50 mm.

Plumb and align posts to within 10 mm.

Install posts of a gate at same elevation regardless of difference in ground level.

Set posts in concrete footings in form of truncated cone, according to ASTM F 567, and as follows:

FOUNDATIONS	ORDINARY SOIL		SOLID ROCK	
(Dimensions)	Line Posts	Terminal Posts	Line Posts	Terminal Posts
Depth	1000 mm	1600 mm	300 mm	500 mm
Diameter at top	250 mm	300 mm	150 mm	150 mm
Diameter at bottom	350 mm	400 mm	150 mm	150 mm

Make joints in fabric at terminal posts.

Fasten as follows:

a) Every 450 mm along top rail, braces and bottom wire;
b) Every 300 mm on line posts.

Secure barbed wire to terminal and gate posts with tension bands, and to gate uprights with hooks.

Install bottom wire in middle of last line of mesh.

4.1.4.6 CONCRETE AND BUILDING WORKS

4.1.4.6.1 Earthworks

Soil Investigations

The Contractor shall be required to perform sub-soil tests within the area if the switchyard to the depth and by the method of test specified by the Project Manager. The details of performing the test, tools and equipment to be used for, shall be submitted to the Project Manager for approval.

The sub-soil tests shall be carried out by any method as stated hereafter under the supervision of a qualified person, who shall be subject to approval of the Project Manager.

Excavation

Excavation for concrete foundations shall be carried out in strict accordance with the requirements of the Project Manager and to fit in with the programme of construction.

Shoring and Timbering of Excavation

The Contractor shall be entirely responsible for the safety of all excavations, for the prevention of injury to workmen and for the stability of the faces of the excavation.

The adjacent road surfaces must remain trafficable, and cracking or cave-ins must be avoided. All shoring and timbering shall be done to the approval of the Project Manager, who may order such shoring or timbering to be strengthened or altered if he considers this necessary in the interests of the work or to safeguard against accidents to workmen or cave-ins. For the purpose of measurement the following categories of shoring shall apply:

Dewatering

The whole Works shall be constructed in the dry and the Contractor shall be held responsible for keeping all excavations free from water, whatever the source or cause may be, and shall properly deal with and dispose of water by use of sufficient temporary works, plant and appliances so as to ensure that the whole Works is executed in a satisfactory dry and safe manner, and costs for all dewatering operations shall be included in the price for civil works.

Excavation to be Approved

In no case shall broken stone for under drainage or concrete be placed in an excavation until the surface on which such materials are to be placed has been approved by the Project Manager.

The Contractor shall advise the Project Manager whenever the bottom of any excavation is ready for inspection or whenever it is necessary to cover up the work. In default of such notice the foundation shall on the order of the Project Manager be uncovered by the Contractor and reinstated without extra charge.

Disposal of Excavated Material

All material excavated under this Contract shall be disposed of in accordance with the instructions issued by the Project Manager. Selected material required for back-filling shall be removed to a tip found by the Contractor and the Contractor shall be responsible for ensuring that the required amount of spoil is set aside.

Other Services

Where trenches pass near or across other services, the Contractor shall take every precaution against damaging such services. These services shall be properly supported in the trench until back-filling is complete and the back-filling shall be thoroughly compacted under and around such services.

Backfilling

Back-filling shall be carried out either with selected spoil as set aside, or with imported selected spoil, or other material to the approval of the Project Manager.

No back-filling shall be done until all the formwork has been removed together with pieces of timber, cement bags, vegetation and or other rubbish.

All back-filling shall be compacted in layers not exceeding 150 mm thick and shall be sprayed with water to bring the moisture content to the optimum for dense compaction.

Compaction shall be to approved standard.

5.6.4 Tolerance

All in-situ concrete shall be dimensionally accurate to within the following non-accumulative tolerances:-

a) Between the centre lines of principal member columns or beams .....+/- 5mm

b) Up to 5 metre centres .....+/- 5mm

c) Over 15 metre centres ..... +/- 5mm
(Note:- The +/- 5mm is floor to floor).

d) In storey height .....+/- 5mm floor to floor.

e) In plumpness of columns and walls ...+/- 10 mm on any storey or overall the structure.

f) In level of floors .....+/- 5 mm/ - 3 mm of the true prescribed horizontal surface level.

g) In cross sectional dimensions of column, beams and walls ..... +/- 5 mm/ - 3 mm

h) In any dimensions up to 2 metres overall +/- 10 mm/ - 3 mm

i) Cover to reinforcement..... + 5 mm/ - 0 of the stated covers.

5.6.5 Miscellaneous Items

Holes, chases, indentations and the like shall be provided where indicated on the drawings. All such shall be formed in the concrete and not cut after concrete has hardened.

Should the Contractor or any Sub-contractor require additional holes of the like, these requirements shall be submitted to the Architect at least two days prior to concreting, for his approval.

Pipes, conduits, fixing bolts and other such cast-in items shall be provided where indicated on the drawings.

Should the Contractor or any Sub- contractor require additional cast-in items, these requirements shall be submitted to the Architect at least two days prior to concreting, for this approval.

5.6.6 Ready Mixed Concrete

Ready Mixed Concrete shall be used only with the approval of the Architect. When such approval is given, it shall be supplied in accordance with B.S. 5328, except where this conflicts with this specification, wherein this specification shall prevail.

Truck mixer units and their mixing and discharge performance shall comply with the requirement of B.S. 4251.

The use of ready mixed concrete shall not relieve the Contractor of any of his obligations, and the appropriate clauses of this specification shall apply equally to the ready mixed concrete.

Concrete test cubes and slump tests shall be taken on site at the point and time of discharge in accordance with this specification irrespective of any cubes that the supplier may take at his own risk.

4.1.4.6.2

Material

Aggregates

a) Shall conform to BS 882.

b) Shall be heaped separately on hard, self draining surfaces.

c) Normal size of coarse aggregate shall be 20 mm.

Water

Shall be fit to drink

Reinforcement

Shall conform to BS 4449.

Cement shall

a) Conform to BS 12.

b) Be either normal Portland or P.C. 15.

c) Be used within 6 weeks of manufacture.

d) Be stored in a manner to exclude any moisture.

e) Be stored in a manner to ensure use of the earliest consignment.

f) Different types of cement from different manufacturers shall not be mixed for a single cast or structural element.

g) If concrete is to be exposed Item 4.f to apply for whole project.

Additives shall not be used

Before concreting

Design Mixes

Not less than 2 weeks before the start of concrete work, the Contractor shall submit to the Project Manager for his approval a statement of proposed mix proportions for the various grades required in the project. (Note: the grade is the characteristic strength or the cube strength below which not more than 5% of the result may be expected to fall when tested at 28 days).

The statement shall include proportions of cement, fine and coarse aggregate, and water, the maximum and minimum slump and the target strength for each grade.

A certificate by recognised laboratory that the proposed mix will meet the requirements must accompany the statement.

The proportions stated may not later be altered without the written approval of the Project Manager.

Cost of mix designs to be borne by the Contractor.

Formwork

Formwork shall be sufficient to leave the concrete finishes specified on drawings and to be within the tolerances specified in the following table and to provide an acceptable surface for applied finished, where required.

Line and Level	1 mm per metre not exceeding 5 mm
Pockets, Sleeves etc.	+/- 5 mm
Bases	+/- 50 mm

The concrete shall have a smooth finish free of projections, voids, etc. The type of ties to be used shall be such that the required finish is achieved and does not become marred by subsequent corrosion. Ties to be set out to definite pattern to the Employer's or the Project Manager's approval. Rubbing down is allowed only after the Employer's or the Project Manager's approval of the surface to be treated.

Reinforcement

Shall not be heated or re-bent without the Employer's or the Project Manager's permission.

Shall be free from any material likely to impair bond or initiate corrosion.

Shall be bent and fixed according to the Project Manager bending schedules.

Shall be tied with soft iron wire.

Shall be supported to maintain the following minimum cover during concreting.

a) The greater of the diameter of the bar or 40 mm for external un-plastered face.

b) The greater diameter of the bar or 15 mm for internal face.

Shall be inspected by the Project Manager.

NOTE: Holding down bolts shall be supplied under the civil works part or by the main contractor if he so decides, and in any case be included in the turnkey price.

Construction Joints

Shall be avoided if possible, but if inevitable shall be pre-planned in consultation with the Project Manager and temporary stop ends inserted. Before placing of concrete against a construction joint, the formed face shall be hacked down to expose the coarse aggregate, kept continuously wet for 24 hours. Vertical faces should be covered with cement/water slurry and horizontal faces should be covered with 15 mm layer of cement/sand grout. New concrete should then be placed immediately.

Camber

To formwork shall not be at the expense of the overall depth of the concrete.

Weather

Concrete shall not be placed if temperatures above 30 degrees Celsius or below 0 degrees Celsius are expected during concreting

Batching

shall

a) Be by mass in accurately calibrated scales or be volume in soundly constructed gauge boxes making due allowance for bulking of the fine aggregate.

b) Be in proportion to whole sacks of cement.

Mixing

shall

a) Be in a machine in good condition, large enough to carry the whole mix, controlled by a competent experienced operator.

b) Be for sufficient time to ensure complete mixing of the ingredients.

Placing

shall

a) Be under the control of a competent, experienced overseer.

b) Be in a manner to prevent separation of the ingredients.

c) Be a continuous process until the pour is complete.

Compaction

a) Shall be by immersion (poker) vibrator in the hands of experienced operators.

b) Concrete shall not be moved by vibrator.

c) Shall be sufficient to remove all air pockets and honey-combing and to ensure complete dense concrete cover to all reinforcement.

Testing

a) Making of concrete cubes by Contractor under Project Manager's supervision. Contractor shall arrange for transport of cubes to approved testing laboratories. Cubes to be in sets of 3.

Curing

a) Shall commence early on the morning following the placing of the concrete.

b) Shall be effected by keeping the concrete in a permanently wet state.

c) Membranes shall not be used.

d) Shall continue for a minimum of seven (7) days or such longer time as may be required by the Project Manager.

Stripping of Formwork

a) To soffits shall not be struck until 7 days after placing of concrete (but see below for (props).

b) To vertical faces shall not be struck until 14 days after placing concrete.

c) Props to soffits shall not be struck until 14 days after placing concrete.

d) Shall not be stripped without the Employer's or the Project Manager's approval who has the power to vary the above items.

Patching

a) To defective work shall not be undertaken before the item has been shown to the Project Manager.

b) Is a sign of poor workmanship. The Project Manager shall have the right to reject the complete element if an unreasonable amount of patching has to be done, or if patching will spoil the appearance of the finished concrete.

Records

Are to be kept by the Contractor, showing date and time of each concrete pour, the weather conditions, the temperature, the number of the cubes which represent the concrete, the slump and any other items which the Contractor and/or the Project Manager consider relevant. These records are to be made available for the Project Manager inspection when required.

FOUNDATIONS

Foundations to Transformers and for circuit breakers, switches and insulators pedestals shall be at a depth not less than 1200 mm from the existing ground level.

4.1.4.6.3 BUILDER'S WORK

Setting out Walling

The Contractor shall provide proper setting out rods and set out all work on the 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 Project Manager.

Materials

a) Cement
   Cement shall be as described in concrete Works, Part 6B.

b) Fine Aggregates
   Fine aggregates for concrete blocks shall be as described for fine aggregate in Concrete Works.

c) Coarse Aggregate
   Coarse aggregate for concrete blocks shall be good, hard, clean aggregates from an approved quarry. It shall be free from all de-composted materials and shall be graded up to 7 mm, and all as described for coarse aggregate, Concrete Works.

Concrete Blocks

Concrete blocks for walling shall be provided by the Contractor complying with B.S. 6073, and made in approved block manufacturing machines.

Minimum thickness of blocks in external walls shall be 150 mm, and in internal walls the thickness shall be minimum 100 mm.

Blocks in external walls shall be hollow type. The volume of the cavities shall be 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. Blocks in internal walls shall be of the solid type. Samples of the proposed block types shall be approved by the Project Manager before any walling work is commenced.

Blocks shall be cast under sheds in suitable block manufacturing machines either power driven or hand operated. The form shall be of steel, and accurately made to size to give the required shape and squareness of block. The concrete shall be vibrated during casting to achieve a dense and uniform concrete. The material shall contain only sufficient water to obtain full chemical reaction of the cement and to give proper workability of the constituents.

The ratio of combined aggregate to cement shall not exceed 3:1. The Contractor shall present his proposal for mix recipe supported by test results for the Project Manager's approval.

Concrete shall have a minimum 28 days strength of 25 N/mm2 in accordance with B.S. 1881. Mixing shall take place in mechanical mixers so as to thoroughly mix the constituents to a uniform consistency before casting.

On removal from the machine the blocks shall be carefully deposited on edge on boarding or a clean concrete floor under sheds so as to prevent drying out by the sun for 3 days. During this time blocks shall be kept constantly damp. The blocks may then be laid on edge in the open and kept damp by spraying or covering with wet hessian or by other means for a further 5 days. The blocks may then be stacked if required, but not more than one metre high, and in such a way as to prevent damage to the edges and corners.

No blocks may be used in building or be transported to site before having reached required 28 days strength criterion. All concrete blocks shall be of even texture and properly mixed ingredients and all portions of the block shall be properly set and hardened concrete.

Blocks shall be free from cracks or blemishes and shall be true to shape and size with clean sharp edges and corners and with corners truly square. Damaged blocks shall immediately be removed from the site. No dimension of a block shall deviate individually by more than 3 mm from the correct size. The average length, width and height of a sample of 15 blocks should neither be longer nor less than 2 mm than the correct size.
Dressed natural stone blocks at least 200mm width may be used as alternative to the concrete blocks.

Cement Mortar
The cement mortar is to be mixed in the proportions of 1 Cement, 4 Sand, and thoroughly incorporated with a sufficiency of water. Any cement mortar which has been left for more than one hour shall not be used in the Works.

Building Walling
All blockwork shall be laid in raking stretcher bond solidly bedded, jointed and flushed up in mortar. Where wall faces are to be plastered the joints shall be raked out to form a key. The blocks shall be thoroughly wetted for at least 24 hour before laying. Walls shall be carried up evenly course by course. During laying an open joint not less than 15 mm wide shall be left between the ends of all concrete lintels, whether pre-cast or cast in-situ and the blocks adjacent to these ends. These open joints shall be left as long as possible during construction and not filled until plastering or other works render such filling necessary. All such joints shall be properly filled in before the completion of the work. External walls shall be reinforced with two 8 mm high yield steel bars in every third horizontal mortar joint.

Blockwork which is not to be rendered or plastered shall be finished with a fair face and the blocks shall be selected for even texture and unmarked faces, regular shape and square unbroken arrisses. The blockwork shall be pointed as the work proceeds with a neat joint. Where blockwork is the be rendered or plastered the joint shall be raked out 10 mm deep as the work proceeds to form an adequate key.

galvanised steel ties with fishtailed end cast into the concrete spaced at alternate courses and extending not less than 150 mm into the block joints. All mortar joints are not to exceed 15 mm or less than 12 mm.

Lintels
Concrete lintels shall be used for all openings and shall be reinforced with two 12 mm high yield steel bars. Lintels shall have a minimum bearing of 500 mm at the ends.

Structural Steelworks Switchgear building
Structural steelwork shall be shop-fabricated from structural shapes of medium grade carbon steel in suitable lengths for easy transport and erection. The structural members shall be jointed or fixed on site by bolting or welding. Site welds should be minimised.

All workmanship and fabrication shall be in accordance with the best practice and shall generally comply with the requirements of B.S. 449. The greatest accuracy shall be observed to ensure that all parts fit together correctly on erection within the tolerances stated in this section. Steelworks shall include all materials, bolts and attachments, cleats, brackets, gussets, etc.

Where required in the Contract, the Contractor shall design the steelwork to comply with the information given on the Contract Drawings. Loading and factors of safety shall comply with relevant codes and regulations. Shop drawings shall be prepared using welding symbols to B.S. 499

where appropriate. design calculations and shop drawings must be submitted to the Project Manager for his approval prior to fabrication of members. The approval of shop drawings and calculations by the Project Manager shall not relieve the Contractor of the full responsibility for any discrepancies, errors, omissions or failure arising therefrom.

All steelwork shall be transported, handled, stored on Site and erected so that members are not damaged or subjected to excessive stresses. Fabrication and erection shall comply with B.S. 5950 Part 2.

ROOFING

9.1.0 ROOFING SHEETS PRE-PAINTED MILD STEEL/G.C.I. SHEETING

9.1.1 Generally

Pre-painted corrugated mild steel sheeting shall be No. 24 Gauge of best quality in accordance with B.S. 3038, and shall conform to Uganda Bureau of Standards.

9.1.2 Laps

Sheets shall be laid with 150 mm end laps and side laps of 30 mm corrugations on the side away from the prevailing wind.

9.1.3 Fixing of steel and timber

The sheets shall be fixed to mild steel angle purlins with 6 mm diameter pre-painted mild steel hook bolts 50 mm longer in the shank than the depth of the steel purlins to which they are fixed each with one diamond shaped bitumen washer, one, pre-painted steel washer, and one pre-painted steel nut. The sheets shall be fixed to timber purlins by using 14 gauge drive screw with bituminous felt washer backed by cranked diamond shaped aluminium washer.

9.1.4 Holes

Holes for bolts or screws shall be punched from the inside of the sheet and through the ridges of corrugations NOT in the hollows. A clearance of 0.80 mm on the bolt or screw must be allowed.

9.1.5 Ridges, Valleys, Flashings

The ridges, valleys, flashings etc. shall be formed of No. 24 gauge pre-painted mild steel sheeting of a quality equal to the sheeting on each side at 450 mm centres maximum with 6 mm diameter seam bolts 20 mm long each with one diamond shaped bitumen washer, one pre-painted steel washer and one pre-painted steel nut.

Ridges and valleys shall not be less than 375 mm girth.

9.1.6 Bolts and Screws

All fixing bolts and screws shall comply with B.S. 1494.

Materials, accessories and fixings shall be ordered from an approved supplier and the Contractor shall as and when required by the Project Manager, submit and deliver samples of nay materials for inspection and testing.

Roof sheeting shall be hot dip galvanised troughed mild steel sheeting and shall be of minimum thickness 0.6 mm. The sheeting shall have approved plastic coating on face side. Type and brand of such sheeting shall be proposed by the Contractor with his Tender together with supporting specifications.

The sheets shall be laid with 200 mm end laps and double corrugation side laps away from the prevailing wind. The sheets shall be fixed to lightgauge steel purlins with galvanised coach screws and seating washers.

Holes for screws shall be carefully drilled in the ridges of the corrugations. Great care shall be exercised to avoid damage and disfiguration to the surface coating of the sheets. At eaves and exposed edges the corrugations shall be closed with purpose made corrugation closers.

Maximum load acting on the building in accordance with local or regional standards.

Switchgear building - ceiling

All rooms included 11 kV switch-gear is assumed to have ceilings consisting of protective RCC slab 150mm.

Roof Drainage

Gutters and down pipes shall, unless otherwise shown on the drawings, be approved plastic coated steel of diameters 200 mm and 150 mm respectively. One down pipe shall be provided for approximately every 50 m2 roof area.

Joints shall be lapped 150 mm in the direction of the flow and soldered. Slip joints shall be provided to allow for expansion. All hangers, brackets, and fastenings should be of the same metal as the gutter or of compatible materials. Gutters and down pipes including supports shall be designed for a concentrated load of 100 kg. Screens or strainers shall be provided to prevent debris from clogging the down pipes.

Metalwork

Unless otherwise specified, metalwork shall be carried out in accordance with the provision of B.S. 5950 and other relevant BSI standards.

All steel shall unless otherwise specified, be hot dip galvanised.

Prior to fabrication the Contractor shall submit shop drawings to the Project Manager for approval.

Metal Doors

Metal doors shall comply to the standard drawing issued.

a) General

Metal doors shall be supplied by approved manufacturers.

All doors shall be painted as specified under Painting and Decorating. All locks shall be master-keyed with three master keys supplied in addition to three regular keys for each door or gate.

Doors shall be measured by the number of doors of specified dimensions. The rate shall include all supplies, site works, painting and hardware.

b) Doors

Door frames shall be pressed steel frames made from minimum 2 mm thick steel sheeting and reinforced where door closers are fixed.

Thresholds shall be made from rolled steel sheeting approximately 100 mm wide and 12 mm high.

Door shall be filled with mineral wool acoustic insulation and lined both sides with steel sheeting minimum 1.25 mm thick. Total thickness of door shall be 45-55 mm.

All doors shall have fire rating Class A 30.

Placing of doors in accordance with Switchgear building drawing.

Internal door frames are to be built to walls truly vertical and square with six ties per frame.

External door frames are to be built in to walls truly vertical and square with eight/ten ties per frame.

All door frames are to be from an approved manufacturer and illustrated in the Manufacturer's Catalogue.

Door frames are to be complete with 100 mm, loose pin steel hinges welded in position and adjustable striking plate.

Frames shall generally be built-in during construction of the walls and securely fixed. A gap shall be left between the top of the frame and the soffit of the lintel during construction. Frames shall be adequately strutted to prevent distortion and shall be protected from damage during other work.

Door frames and similar components shall be fixed with countersunk screws or bolts with heads set into the frames.

Walls shall be built as close as possible to the frames and the gap filled solid with mortar at each course. Render shall be neatly brought up to the frame and well tamped into any remaining cavities. The junctions between window frames or external door frames and external finish or blockwork shall be caulked tight with approved mastic or mortar wherever required, and neatly pointed. Mastic so used shall have long-term resistance against weather, insects and ultra-violet light.

Doors wider than 800 mm shall have three 100 mm hinges. Other doors may have two hinges except where specified or detailed otherwise.

Door stops shall be fitted by screwed fixings where necessary.

The following type of timber doors shall be used unless otherwise instructed by the Project Manager and shall be of approved manufacture, true to shape and free from twists or warps:

internal doors shall be hollow core doors consisting of skeleton frames covered with 4 mm plywood for painting. They shall be 47 mm thick overall unless otherwise approved.

Aluminium or Steel Windows

Unless otherwise indicated windows shall consist of steel subframe with clear glass. Windows shall be from an approved supplier and the details thereof shall be approved by the Project Manager. Windows shall be operable and provided with corrosion resistant metal insect screens.

Frames shall generally be built-in during construction of the walls and securely fixed.

Placing of windows in accordance with Switchgear building drawings. Widows are to be built in to walls truly vertical square with six ties per frame.

All aluminium or steel windows are to the from an approved manufacturer and illustrated in the Manufacturer's Catalogue.

Windows are to be fitted complete with casement fastening, stays etc.
All windows shall have approved burglar bars, and approved means of opening/locking.

Door and Window Furniture
Ironmongery shall be strongly made, well finished, good quality "stock pattern" articles. Ironmongery for windows and doors shall be galvanised or other approved manufacture for external use. Samples of all items shall be submitted to the Project Manager for approval before they are used for the Works.

All doors shall be lockable. External doors shall have approved security locks.

Three keys for each lock, clearly labelled, shall be handled over to the Project Manager and all ironmongery shall be cleaned, oiled, adjusted and left in perfect working order.

MV Switch-gear, Room
Openings for pressure release

In the MV switch-gear room it is necessary to arrange for openings for pressure release in case of explosion in one of the switch-gears.

To avoid damage in the room/building any pressure shall be released through the openings as described.

Location of these openings must be beneath the ceiling on both longitudinal walls in the switch-gear room. The Contractor must calculate number and size of this pressure openings, and submit his proposal for approval.

Switchgear building finishes
Switchgear building: External/internal colour in accordance with approval of the employer. As per kplc colour codes. all fascia, lintels and skirting to be painted as per codes

CONCRETE SWITCH GEAR PLINTHES

All concrete shall be class 25(20) vibrated unless otherwise specified. The vibration shall be carried out by experienced operators and with immersion type vibrations to the Architect's satisfaction. Concrete classes will be a specified in the bills. All plinths should be 300mm above ground level and 150mm above ballast spread.

Ballasting shall be done at the yard 150mm thick.polythene sheeting to be underlain to suppress emergence of weeds. Ballast aggregate within the range of 30-50mm will be used. All plinths shall be plastered with smoothing with neat 'NIRU' coat.

Where bolts have been grouted, accurate is setting out to be done both diagonally and linearly. Tolerances over 2mm for bolts will not be accepted. Bolt threads to be covered during concreting and proper cleaning with wire brush to any concrete on the bolts.

Placing of concrete shall be carried out in layers not exceeding 500 mm deep and in sequence from one end of the form to the other.

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

Concrete structures shall NOT be loaded until the concrete is at least 21 days old or 28 days in the case of cantilevers. With the prior approval of the Architect the structure may be loaded before this time but in no case will loading be greater than the final design loading be permitted.

4.1.4.6.4 PLASTER AND FLOOR COVERINGS

6.1.1.6.4.1 FLOOR COVERINGS

The switchgear and control room shall have terrazzo floor finish and skirting to employer's approval. The office room shall have ceramic tile floor finish and skirting

6.1.1.6.4.2 PLASTER COVERINGS

Materials

Cement and water to be as before described. The sand to be screened through a sieve of 10 to 15 and meshes to 1 cm and to be washed if directed.

Mixing

All materials for mixing are to be used in proper gauge boxes and they are to be strike measured and not tamped down in boxes. Proper non-absorbent stages are to be used for mixing and storing mortar. No foreign matter must be mixed with the mortar.

The materials are to be mixed dry before adding water through a fine hose spray. No cement mortar which has taken its initial set will be allowed to be used.

Plaster Thickness

Unless otherwise specified all wall plasters should not be less than 13 mm thick and not more than 19 mm thick.

Cement Plaster

Cement plaster for external use to be composed of one part cement to four parts sand and for internal use to be one part cement to five parts sand.

Form Key

Rake out joints and roughen if necessary to form key for plaster.

For concrete surfaces, hack and apply 1:1 cement sand slush to form key. Continuously wet for 7 days and then apply plaster.

All brickwork and concrete works should be brushed down to remove dust and any other loose material.

Wetting

All internal and external brick or concrete surfaces are to be wetted well before plastering.

All cement plaster must be kept wet for at least 7 days.

Repairing Defects

All defective plaster, cracks, hollows, etc., are to be cut out to a rectangular shape, the edges undercut to form a dovetail key and to be made good to finish flush with the edge of the surrounding plasterwork.

All patches will be to the approval of the Project Manager and if the defects can not be made good satisfactorily then the whole surface is to be removed and re-plastered at the Contractor's expense.

4.1.4.6.5 GLAZING AND PAINTING

Glass

All glass is to be of approved manufacture, free from bubbles, waveness, scratches or other imperfections and is to be well bedded, puttied and backputtied and secured with glazing pins or clips in steel sashes or with sprigs in wood sashes.

All glass shall be carefully cut to the required sizes so that all panes of figured or textured glass are uniform in appearance with the pattern parallel to the edges and wired glass shall be so cut that the wires are parallel to the edges.

Putty

Putty for glazing to steel sashes is to be of approved proprietary brand.. Rebates are to be thoroughly back puttied before glazing and all putty is to be carefully trimmed and cleaned off so that back putty finishes level with the top of sections internally, external putty covers sight lines exactly and finished straight and true. Rough surfaces to putty will not be allowed and any defective putty will be cut out and replaced at the Contractor's expense.

Rebates of wood sashes are to be given one coat of priming immediately before glazing.

Mirrors

Glass mirrors are to be of the thickness specified, of selected quality glass, silvered on back, with protective sealing coat and arrised edges, unless otherwise described.

Generally

Allow for removing and replacing all cracked, broken or defective glass and leave thoroughly clean and perfect at completion.

Materials for Decoration

All paints, primers, varnishes, emulsions, stopping, etc., to be of approved manufacture.

The contractor is to use proprietary ready mixed paints obtained from an approved supplier.

When a coat of proprietary paint is applied, the manufacturer's priming and previous coats suitable for the particular type are to be used.

All materials must be brought on to the site in unopened tins, and no dilution or adulteration will be permitted, unless approved by the Project Manager.

Emulsion Paint

Emulsion paint shall be PVA (Polyvinyl Acetate) alkali-resisting formulated with high washability and capable of resisting a 8 000 scrub test. The first coat to be specially formulated base coat for direct application to the specified surface.

Fillers

Higher grade cellulose fillers are to be used internally and premixed filler to be used externally.

High Gloss Paints

Primers for application to bare metal to be red oxide primer for iron and steel. For galvanised metal to be an approved zinc chromate or galvanised iron primer. For application on wood or plaster etc., to be an approved alkali primer.

Finish enamels

Finish enamels to be synthetic enamel high capacity paint with high coverage and high gloss finish unless otherwise described.

Workmanship

All surfaces are to be free from moisture, dust, grease and dirt and rubbed down smooth according to approved practice.

All plaster to be free from efflorescence and treated with one coat of petrifying liquid, approved sealer or alkali primer if required. Hardwall plaster to be glass papered before decorating.

Rectifying defects to decorated surfaces due to dampness, efflorescence, chemical reaction, etc., will be to the Contractor's account, as these surfaces must be checked and the appropriate precautions taken before applying the decoration.

Metalwork must be scraped free of rust, primed as described and finished as later specified.

Galvanised sheet iron, pipes, etc., are to be cleaned down to remove manufacturer's ammoniated dichromate protective covering, primed as described and finished as later specified.

Coated pipes are to be cleaned down, stopped and primed with one coat of aluminium primer and finished as later specified.

All knots in woodwork to be treated to prevent bleeding. Large or loose knots to be cut out and be replaced with sound wood, or cut back and filled. Small knots to be treated with two thin coats of Shellac in methylated spirits. Woodwork to be glass papered to a smooth surface with all sharp arrises removed, all cracks, crevices, holes, etc., to be scraped out, primed as described and stopped with hard stopping, faced up and rubbed down to an even surface and finished as later specified.

All metal and woodwork to have the specified number of coats in addition to the priming coat.

Every coat of paint must be a good covering coat and must dry hard and be well rubbed down to a smooth surface before the next coat is applied, otherwise the Contractor will be required to apply extra coats at his own expense.

Each coat of paint to be of a distinctive colour: sample colours are to be prepared for the final coat which is to be an approved colour scheme and must not be applied without the permission of the Project Manager. After undercoats are on, the painter shall check all work and grainfill as necessary with filler as described.

NOTE:

a) All paints specified are to be obtained from an approved manufacturer and used in strict accordance with their instructions. Their representative will check the paints being used and the method of application and will advise accordingly.

b) This section of the work to be carried out by an approved firm of decorators who must allow for the very best finish possible and of the highest quality obtainable.

c) The prices must allow for the removal and refitting of all beads, fittings, fastenings, ironmongery, etc., removed for decoration purposes to be carried out by skilled tradesmen of the appropriate trade.

4.1.4.6.6 SUBSTATION BUILDING SIZES.

Proposed substation control buildings should be in conformity with relevant building codes with regard to room size and safety, and as per KPLC design standards. The building must meet the requirements described in the scope of work and take into consideration future expansion. The

buildings will be classified as 16pannel, 13pannel, metering rooms.PS24 Panel room shall be 13 panel standard control room as shown in drawings.

4.1.4.6.7 IRONMONGERY AND METALWORK

General

All ironmongery shall be of the best respective types required and no alternative articles will be accepted unless approved. Articles described as brass must be solid brass and not brass finish. Chromium plated articles must be plated satin finish on solid brass or other approved metal.

Where items for ironmongery are required to be fitted to steel door frames, etc., the Contractor must ensure that the Manufacture makes provisions for the correct fitting or lock striking plates, hinges, cleat holes, bolt keeps, etc.

Locks and Keys

Locks are to be two lever unless otherwise described. All locks are to be provided with two keys which must be handed over to the owner on completion of the Works with identification labels attached.

Steel

Steelwork for general building construction is to be of approved manufacture complying generally with the appropriate British Standards and free from all defects, oil, dirt, loose rust, scale or other deleterious matter.

METALWORK

STANDARDS AND CODES OF PRACTICE

The requirements of the following British Standards and Codes of Practice shall be observed:-

13.1.1 British Standards

a)	B.S. 4 part 1	Structural steel, hot rolled screws
b)	B.S. 4 part 2	Structural steel, hot rolled hollow sections.
c)	B.S. 325	Black cup and countersunk bolts and nuts.
d)	B.S. 916	Black bolts screws and nuts.
e)	B.S. 4174	Self tapping screws and metallic drive screws.
f)	B.S. 405	Metal washers for general engineering purposes.
g)	1161 and addendum	Aluminium and aluminium alloy sections for general engineering purposes.
h)	B.S. 938	Metal ore welding of structural steel tubes.
i)	B.S. 1856	Metal ore welding of mild steel.
j)	B.S. 729 part 1	Hot dip galvanized coating iron and steel articles.
k)	B.S. 1474	Wrot aluminium and aluminium alloy

l)	B.S. 990 parts 1+2	Steel windows (domestic and similar buildings)

Codes of Practice

a)	C.P. 499	Metal railings and balustrades.
b)	C.P. 117	Composite construction in structural steel and concrete.
c)	C.P. 2008	Protection of iron and steel structures from corrosion.
d)	C.P. 3012	Cleaning and preparation of metal surfaces.
e)	NOTE:	The contractor's attention is drawn to Section "P" of the Standard Method of Measurement.

MATERIALS AND WORKMANSHIP

Iron and steel where galvanised shall comply with the requirements of B.S. 729, part 1 entirely coated with fine fabrication by complete immersion in a zinc bath in one operation and all excess carefully removed.

The finished surfaces shall be clean and uniform.

All work in aluminium shall comply with the requirements of the standard mentioned above.

All smiting and bending shall be soundly and neatly executed, care being taken not to overheat.

All strap bolts and similar work shall be forged neat and clean from the anvil.

All welded connections shall be ground to a smooth finish and rates shall be deemed to allow for this.

Steel windows shall comply with the requirements of the standard mentioned above and shall be fixed in accordance with the manufacturer's instructions.

All mild steel except galvanised shall be cleaned of rust and scale, painted one coat red lead priming paint before delivering to site and the rates shall include for this.

PLUMBING AND ENGINEERING INSTALLATIONS

STANDARDS AND CODES OF PRACTICE

The requirements of the following British Standards and Codes of Practice shall be observed:-

British Standards

a)	B.S. 416	Cast Iron spigot and socket soil, waste and ventilating pipes (sand cast and spun) and fittings.
b)	B.S. 2871 part	Copper and Copper Alloy Tubes (for water, gas and sanitation)

c)	B.S. 864 part	Capillary and compression fittings of copper and copper alloy.
d)	B.S. 1184	Copper and Copper Alloy Traps
e)	B.S. 4576	Unplasticised P.V.C. rainwater goods.
f)	B.S. 3974	Pipe supports.
g)	B.S. 1494	Fixing accessories for building purposes (gutter bolts, pipe brackets)
h)	B.S. 1212 part 1+2	Ball valves (excluding floats)
i)	B.S. 2456	Floats for ball valves (plastic) for cold water.
k)	B.S. 1125 W.C. flushing cisterns.	
l)	B.S. 417 part 1+2	Galvanised mild steel cisterns, covers, tanks and cylinders.
m)	B.S. 2760	Pitch-impregnated fibre pipes and fittings.
n)	B.S. 1387	Steel cubes and tubulars.
o)	B.S. 4514	Unplasticised P.V.C. solid and ventilating pipe, fittings and accessories.
p)	B.S. 3505	Unplasticised P.V.C. pipes for cold water services
q)	B.S. 143 and 1256	Malleable cast iron and cast copper alloy,screwed pipe fittings.
r)	B.S. 78 part 2 and B.S. 1180	Cast iron spigot and socket pipes (vertically cast) and spigot and socket fittings.
s)	B.S. 1010 part 1+2	Draw-off taps and stop valves for water services.

Codes of Practice

a)	C.P. 304	Sanitary pipework above ground.
b)	C.P. 310 Water supply	
c)	C.P. 305	Sanitary appliances.

d) NOTE: 01. The contractor's attention is drawn to Section"Q" of the Standard Method of Measurements.

02. The whole of the work shall be executed by an approved licensed sub-contractor.

PIPEWORK AND FITTINGS

Black steel and pipework up to 65 mm nominal bore shall be manufactured in accordance with B.S. 21. All fittings shall be of malleable iron and manufactured in accordance with B.S. 143.

Pipe joints shall be screwed and socketed and sufficient coupling and unions shall be allowed so that fittings can be disconnected without cutting the pipe. Running niples and long screws shall not be permitted unless exceptionally approved by the architect.

All black steel pipework - 80 mm nominal bore up to 150 mm nominal bore, shall be manufactured to comply in all respects with the specifications for 65 mm pipe, except that screwed and bolted flanges shall replace union and couplings for the pointing of pipes to valves and other items of plant.

All flanges shall comply with the requirements of B.S. 10, to relevant classifications contained hereinafter.

4.1.4.6.8 ELECTRICAL INSTALLATION

Scope of Works

This section of the specification relates to the supply, installation, testing and commissioning of the complete electrical services within the switchgear building, including:

1. LV Switchgear
2. Lighting
3. Small Power

The switchgear building consists of a switchgear room.

A full specification of the electrical equipment proposed by the contractor shall be included in the Bid.

The Employer reserves the right to reject any of the contractor suppliers if he feels the product does not meet with the contract specification.

Electrical Services General Description

The complete electrical installation shall comply with all local standards and rates.

Should there be any conflict between local standards and what has been specified the sub-contractor should draw it to the attention of the Project Manager.

Lighting

a. Luminaries shall be fluorescent lamps except for the toilets and outdoor lighting (except switchyard and perimeter lighting) where GLS lamps can be utilised. In switchgear room: 250 lux is required. In offices 500 lux is required.
b. All luminaries shall be supplied, installed and tested by the electrical sub-contractor.
c. All metal work on the luminaries shall be connected to an insulated earth protective conductor.
d. Lighting Control Switches
e. Outdoor lighting shall be controlled from an automatic photo cell.
f. Lighting control switches shall be flush pattern with white finished plates.
g. Grid switches shall have 5 or 10 amp rating, generally where fluorescent discharge luminaries are controlled switches have 10 amp rating where as with low energy PL lamp, 5 amp switches shall be installed.

Socket Outlets and Accessories

Reference should be made to the Standards given above for details on the socket outlets and accessories.

Socket outlets to be mounted at 300 mm above floor level.

Conduit cast into the building structure shall be of the heavy duty PVC type. PVC conduits shall not be fixed to the surface of the structure.

AC Installation

The Contractor shall supply and install wiring and insulator for the AC units, including final connection to the unit. fire extinguishers and smoke detectors shall be fixed as per specialist instruction.

4.1.4.6.9 JOINERY

STANDARD AND CODES OF PRACTICE

The requirements of the following British Standards and codes of Practice shall be observed:-

British Standards

a)	B.S.	565	Glossary of terms relating to timber and woodwork.
b)	B.S.	4471	Dimensions for softwood
c)	B.S.	1186 Part 1+2	Quality of timber and workmanship in joinery
d)	B.S.	373	Methods of testing small clear specimen of timber
e)	B.S.	4512	Methods of test for clear plywood
f)	B.S.	1142 part 3	Fibre building board (Insulation board softwood)
g)	B.S.	3444	Blockboard and laminated board
h)	B.S.	1445	Plywood manufactured from tropical hardwoods
i)	B.S.	3794	Decorative laminated plastic sheets
j)	B.S.	459 part 2	Flush doors
k)	B.S.	459 part 3	Fire check flush doors and wood and metal frame (1.5 hour and 1 hour types)
l)	B.S.	1567	Wood door frame and linings
m)	B.S.	584	Wood trims (softwood architrave skirtings, quadrants, etc)
n)	B.S.	1204 parts 1+2	Synthetic resin adhesive (phenolic and type MR-Moisture amino plastic) for wood Resistant Type INT - Interior
o)	B.S.	1210	Wood screws

p)	B.S.	1494 part 2	Fixing accessories for building purposes (bolts, screws, staples, etc)
q)	B.S.	4174	Felt tapping screws and metallic drive screws.

Codes of Practice

a)	C.P.	201	Timber flooring
b)	C.P.	201 parts 1+2	Flooring of wood and wood products
c)	C.P.	151	Doors and windows including frames and linings

d) **NOTE:** The contractor's attention is drawn to Section "M" of the Standard Method of Measurements.

11.2.0 DEFINITIONS

Selected

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

Hardwood or the like

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

MATERIALS

Terminology

All technical terms shall be as defined in the Glossary of Terms used in Timber Standards, KS 02 1976 and, where applicable, the British Standard Code of Practice No. 112.

Timber Generally

Timber shall be sound, well conditioned, properly seasoned, containing not more than 15% moisture for joinery work or 18% moisture for carpentry work, and complying with the following performance specification:-

Performance Specifications

These specifications refer to all conifer (soft-wood) and broad leaved (hard-wood) species and apply to timber sections incorporated in the building after they have had a sufficient time to season. The period required for green timber to season fully after installation under cover shall be assumed to be one month for each 25 mm thickness.

Unless noted elsewhere, timber shall conform to the listed specifications as follows:-

a)	F	Grade	Furniture and high class joinery
b)	GJ	Grade	General joinery

c)	S75	Grade	Structural grade having grade stress value of 75% of basic stress.
d)	S50	Grade	Structural grade having grade stress value of 50% of basic stress.
e)	C	Grade	A general construction grade for non-stressed construction.
f)	L	Grade	A low grade for low quality work.

Defects shall not exceed those specified in Tables, 1, 2 & 3 of KS 02-17.

WORKMANSHIP

The timber for joinery shall be as specified in the Export Timber Ordinance of 1951 and obtained from an approved sawmill. All such timber shall be Prime Grade and reasonably straight, grained and shall be purchased immediately the contract is signed. It shall be open stacked on site for such further seasoning as may be required.

Timber which in the opinion of the architect does not satisfy the specification in character or condition or is not suitable for the requirements of the work because of the blemishes it contains shall not be used.

The following timber shall be used:-

a) Podocarpus

b) Mvule

c) Cedar

d) Elgon Olive

a) Elgon Teak

b) Camphor

c) Mahogany

d) Meru Oak

e) Pamba Coffee

f) Nkalati

All timber shall be wrot by machine dressings. Non-exposed faces and machine marks shall be removed with hand plane and sanded out, unless otherwise specified.

The dimensions and thickness stated in the Bills of Quantities are the finished sizes (unless otherwise stated) and the contractor will allow for all necessary waste.

The joinery shall be worked strictly in accordance with drawings, and is to be framed up and put together as soon as possible and stored in the drying room, for as long as possible before being wedged up. All joints and angles are to be glued and where necessary cross tongued with hardwood tongues and surfaces finished clean and smooth, with machine marks sand-papered out before fixing.

Should any of the joinery work shrink, warp, wind or deflect unduly before the end of the maintenance period of the contract, the work is to be taken down and rectified at the contractor's sole expense.

Tolerance in thickness shall conform with the following extracts from the Government of Kenya Grading Rules:-

Hardwood Grading: (First and Second Grades):-

a) 1.6 mm over size on pieces up to 25 mm in thickness

b) 3 mm oversize on pieces over 25 mm and up to 51 mm in thickness

c) 6 mm over size on pieces over 51 mm in thickness; undersize will not be permitted.

d) Softwood Grading: Appearance Grades (First and Second Grades); undersize will not be allowed.

e) Oversize: All timber to be sawn oversize b 1.6 mm per 25 mm of thickness and width. Not more than 3 mm in thickness and not more than 6 mm in width.

Seasoning of timber shall be to moisture content of not more than 15%.

Pressure impregnation treatment shall be as for "Carpentry".

Where joinery is described as screwed, this is deemed to include sinking the head of the screw and pellating with similar timber, and to grain in with the finished joinery.

All hardwood joinery shall be finished for oil paint/varnish, unless otherwise stated.

The rates shall be deemed to allow for all nails and screws and fixing, all labour, cuttings, notching, halving, morticing, tenoning and wedges except where otherwise provided.

All work described as plugged shall be fixed with screws to plugs formed by drilling concrete walls, etc., with the proper tool of suitable size at 750 mm spacing and filling the holes completely with "philplug" rawl plastic or rawl plugs in accordance with the manufacturer's instructions. Alternatively and where so agreed by the architect, hardwood dovetailed fixing slips in preservative and cut and primed or bedded in cement mortar (1:3) may be used.

The rates are to allow for all surfaces of joinery where in contact with walling or plaster, or where otherwise unexpected being treated before fixing with two coats of approved wood preservative.

Laminated plastic sheeting shall be "formica" manufactured by M/s Thomas de la Rue and Co. or equal and approved, 1.6 mm thick and accurately fixed with approved type water-proof impact adhesive and in the colours selected by the architect.

Blockboard shall comply with the standard as mentioned above.

Plywood shall comply with the standard as mentioned above and faced both sides unless otherwise stated.

Fibreboard shall be 12.7 "Celotex" or other equal approved softboard.

All joinery work shall be accurately set out and framed together soon after commencement of the building as is practicable but not to be wedged up or glued until the building is ready for fixing the same. Any portions that warp, wind or dent shall be removed and new ones fixed in their place together with other work which may be affected thereby all at the contractor's expense.

All work shall be properly morticed, tennoned, housed, shouldered, dovetailed, notched, primed, bradded, etc. as directed and to the satisfaction of the architect and all glued up with the best quality glue.

Joints in joinery shall be as specified or detailed, and so designed and secured as to resist or compensate for any stresses to which they may be subjected. All nail strings, etc. are to be punched and puttied. Loose joints are to be where provisions for shrinkage is necessary; glued joints where shrinkage need not be considered and where conditions may be damp must be of the resin type. For non-load-bearing joints or where dry conditions may be guaranteed resin or organic glues may be used. All exposed surfaces for joinery shall be wrot and all arises "cased off" by planning and sand papered to an approved finish suitable to the specified treatment.

3 mm reduction of specified sizes will be allowed to each wrot face except in members 25 mm thick or less or where, described as finished sizes in which case joinery shall hold up the full dimensions.

In fixing 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 screws. Brass screws shall be used for fixing of all hardwoods, to the heads in and pellated over with wood pellets to match the gain.

Rates shall include for bedding frames, cills, etc in mortar or dressing surfaces of walls, etc in lieu.

Round wood plugs shall not be used, and screws or plugs shall be spaced at 750 mm centres.

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 at his own expense until completion of works.

Bottom edges of doors shall be painted or polished with two coats of approved primer before fixing.

PARTICULAR SPECIFICATIONS

Chipboard

Chipboard shall comply with B.S. 5669.

Blockboard

Blockboard shall be approved imported or local manufacture complying in all aspects with B.S.1142 of the thickness specified and softwood faced both sides unless otherwise described. Samples of blockboard veneered with hardwood as specified, shall be submitted to the Architect for his approval before any orders are placed.

Fibreboard

Fibreboard shall be "Celotex", or other equal and approved make, 12mm thick and complying in all aspects with the requirements of B.S. 1142.

Hardboard

Hardboard shall be tempered and of approved manufacture, in accordance with B.S.1142, suitable for painting, prepared and fixed in accordance with the makers' instructions.

Medium Density Fibreboard (MDF)

MDF shall be used wherever possible in place of blockboard or chipboard. The MDF used shall be to the thickness specified, shall be flat, smooth, straight, without any imperfections, surface distortion, broken or chipped edges. MDF used in damp locations (i.e. toilets) shall be moisture resistant MDF.

Laminated Plastic Sheeting

Laminated plastic sheeting shall be 1.5mm "Formica" or other approved sheeting complying with B.S.3794 Class 1, in colours to be selected by the Architect.

Prior to fixing laminated sheeting, the Contractor shall obtain the Architect's written approval to a sample.

Pressure Impregnated Treatment

All timber so described is to be vacuum pressure impregnated with "Celcure A" preservative to a dry salt nett retention of 10.5 kg "Celcure A" per cubic metre of timber and stacked until the moisture content returns to 18% or 15% as above described. Timber to be treated shall be machined to finished sections and cut to component lengths before impregnation. Cut ends, notchings, borings and faces of timber sawn after treatment are to be swabbed literally on cross cut ends with "Walmanol" end grain preservative, allowed to dry, and then applied in a similar manner a second time.

SANITARY APPLIANCES

All sanitary appliances supplied and installed as part of the sub-contract works shall comply with the general requirements of B.S. Code of Practice 305 and the particular requirements of the latest applicable B.S. Specifications.

Plastic Pipes

P.V.C. pipe work and fittings for the use above ground in connection with internal building services shall be in the Terrain soil, waste and ventilation system to B.S. 4514 in modified PVC. The sub-contractor is referred to Product Catalogues in respect of Terrain Plastics Systems for the Building Industry before and after submission of tenders as no claims for want of knowledge will be entertained.