Section A Technical Specifications
GENERAL AND CIVIL WORKS

GENERAL PROVISIONS

11.1 SCOPE AND APPLICATION

This specification shall apply to the Civil Engineering works required in the construction of the works as described in this document.

The works specified under this contract shall include all general and ancillary works and work of any nature that is deemed necessary for the due and satisfactory construction, completion and maintenance of the works to the full extent and meaning of the Drawings and Specifications, whilst complying with all general Conditions of Contract whether specifically mentioned or not in the clause of the specifications.

The Works detailed in the main contract are only indicative of the Scope of Works associated with this contract and the Engineer may, where necessary, substitute some of the Works with others within the project areas without substantially altering the overall Scope of the Works. Any other activity not listed but deemed to be necessary by the Engineer shall be carried out subject to the Engineer's formal instructions. Works shall be measured and paid using the relevant rates and prices in the Bill of Quantities.

The works will also include for any operations necessary for the safe and convenient passage of traffic at all times.

11.2 CLAUSE NUMBERS

Unless otherwise stated all clause, numbers refer to the clauses in this specification.

11.3 REQUIREMENTS OF SPECIFICATIONS, STANDARDS, BRAND NAMES

The Contractor shall fulfill all requirements and obligations under all clauses of the specification. Neither the following clauses of this specification, any descriptions therein, nor the quantities, shall limit the obligations of the Contractor under the conditions of contract. Where items are not included in the Bill of Quantities for any such requirements or obligations, the cost of such requirements or obligations shall be deemed to be spread over all the items of the Bills of Quantities.

All ISO, British, or other Standards (including Codes of Practice) mentioned herein shall be deemed to form part of this specification. All references to such standards shall be to the latest edition or revision thereof unless otherwise stated. Where a specific British or other standard is referred to in this specification, another standard will be acceptable, provided that it ensures a quality of material and workmanship equal to or better than the Standard referred to. If the Contractor intends to use such alternative standard, he shall notify the Engineer thereof, submitting with his notice 2 copies (in English) of the proposed standard, and shall not order any material or perform, any work unless and until he has obtained the Engineer's approval of such Standard.

Brand names, where used in the Specification or on the Drawings, are only intended to define a standard of quality and performance and the Contractor may use alternative products of at least equal quality and capacity.

Where the term “or similar” is used it shall be construed as “or equivalent”.

When alternatives are offered, the Contractor shall submit to the Engineer for approval a statement detailing the alternatives, and shall include full technical descriptions, drawings, and specifications, and shall provide such full information as is required to enable the Contractor to demonstrate to the Engineer that the alternative is equivalent to the item specified. Any further information that the Engineer may require shall be produced by the Contractor when called for.

11.4 APPROVAL OF SUPPLIERS OF SERVICES, MATERIALS AND GOODS

All materials to be provided shall be new, unused of the most recent manufactures and incorporate all recent improvements in design and materials unless otherwise provided in the Contract.

Before entering into any sub-Contract for the supply of any materials or goods the Contractor shall obtain the Engineer’s approval in writing of the sub-contractor from whom he proposes to obtain such materials of goods. Should the Engineer at any time be dissatisfied with such materials or goods or with the method or performance of such sub-Contractor’s work or place of business, the Engineer shall be empowered to cancel his previously given approval of such sub-contractor. The Contractor shall then obtain the said services, materials or goods from such other sub-contractor as may be approved by the Engineer and shall bear any additional cost thereof.

If during the Contract, through any reason, a supplier should increase the cost of materials above that of other equally reputable suppliers, the Engineer may, at his own discretion, ask the Contractor to change his supplier or he may only authorise payment for materials at the rates of other suppliers.

11.5 CONTRACTOR’S ORDERS FOR MATERIALS

11.5.1 General

Without prejudice to any other clause in the specification, the Contractor shall before ordering any building materials, ironwork, pipes or other articles for use and installation in the works, seek the approval of the Engineer of the names of the persons or firms from whom he desires to obtain any such articles.

11.6 SAMPLES AND TESTING

A minimum of two (2) samples, or as otherwise specified, shall be submitted to the Engineer for review of those products and materials for which samples are required.

Samples shall be submitted a minimum of thirty days prior to the date for approval required by the Contractor for procurement of the materials.

Samples shall be submitted with complete information concerning manufacturer's data, applicable standards, test results, and location of installation on the project.

Materials for which the Engineer has approved samples shall be used only in those areas and locations for which the approval was granted.

Materials for which samples have been rejected shall not be delivered to the site, or if delivered, shall be removed promptly.

Approval by the Engineer as to the placing of orders for materials or as to samples or tests shall not prejudice any of the Engineers power under the Contract.

All costs in connection with conducting tests by an approved laboratory shall be included and covered by the Provisional Sum allowed in the Bill of Quantities for the following categories of tests:

(a) Tests conducted at the premises of the Contractor, Sub-contractor, manufacturer or supplier which are normally or customarily carried out at such premises for the items or materials being supplied for the Works;

(b) Tests which are normally or customarily conducted on the items or materials being supplied for the Works by the Contractor, Sub-Contractor, supplier or manufacturer but which have to be conducted at an approved laboratory because the necessary testing facilities are not available on the premises of the Contractor, Sub-Contractor, supplier and manufacturer;

(c) Tests on locally obtained materials or items either on the Site or at an approved laboratory for the purpose of obtaining the approval of the Engineer to the classification, use and compliance with the Specifications of such items or materials;

(d) Routine quality control tests conducted by the Contractor to ensure compliance with the Specifications;

(e) Regular testing of concrete and other materials as specified in the relevant Sections of the Technical Specifications;

(f) Standard shop and Site acceptance tests, including trial assemblies, of mechanical equipment.

11.7 TEST CERTIFICATES

Should the Engineer not inspect any materials or goods at the places of manufacture the Contractor shall obtain Certificates of Tests performed on such materials or goods by an agency approved by the Engineer and shall send such Certificates to the Engineer. Such Certificates shall certify that the materials or goods concerned have been tested in accordance with the requirements of the specification and shall give the results of all the tests carried out. The Contractor shall provide adequate means of identifying the materials and goods delivered to the site with the corresponding certificates.

All costs incurred in complying with this Clause shall be deemed to be included in the tendered rates and prices.

11.8 CONTRACTOR'S WORK PROGRAMME

A Programme for the performance of the works as a whole and showing the proposed construction shall be submitted by each Bidder with his Bid.

Pursuant to Clause 2 of the Conditions of Contract, the Contractor shall, with 30 days after acceptance of the Bid, draw up the work programme, showing in detail the order in which the various parts of the works are to be constructed, with dates of commencement and completion and, where necessary, intermediate stages of works and the dates thereof.

The Contractor shall pay particular attention to detailing the dates on which he will require the delivery, of pipes and accessories for pipe laying and all electrical and mechanical parts that will be built in or could otherwise affect the progress of his work.

The programme must, where required by the Engineer, be accompanied by sketches showing in plan and section the different stages of the programme. The said programme shall take into account the seasonal rainfall and flow of surface water.

After approval by the Engineer, the work programme shall be binding on the Contractor. Changes in the programme may be made by the Contractor only after prior approval has been obtained from the Engineer, which approval shall not be reasonably withheld.

The programme shall fully take into account and allow the need to coordinate procedures to allow for erection and installation of mechanical and electrical works and borehole construction in a methodical manner.

The Engineer shall be entitled at any time to demand changes in the work programme as he deems necessary for the proper and expedient performance of the works. This could also include realignment of pipelines as dictated by the conditions on site.

11.9 DRAWINGS

11.9.1 General

The whole of the works shall agree in all particulars with the levels, dimensions and details contained in the Construction Drawings.

The Contractor shall carefully check the Drawings supplied to him and shall bring any errors or discrepancies discovered therein to the attention of the Engineer, who will issue the necessary instructions for corrections.

Where dimensions and levels are shown on the Drawings or mentioned in the documents forming part of or issued under the Contract these shall be verified by the Contractor on the site and he will be held responsible for pointing out promptly any errors or discrepancies in such dimensions or levels. The Engineer will issue the necessary instructions for corrections.

Failure to discover and/or to notify the Engineer of any errors or discrepancies in the Drawing shall not relieve the Contractor of the responsibility for unsatisfactory work or faulty construction resulting there from the obligations of rectifying and making good such work or construction at his own expense and to the complete satisfaction of the Engineer.

11.9.2 Bid Drawings

Bid Drawings are the drawings prepared by the Employer's Consultant for the purpose of the Bid and furnished to the Bidders together with the other Bid Documents. The Bid Drawings show all relevant features of the works in sufficient detail to enable the Bidder to assess correctly the nature and scope of the work requested from him and to price the Bills of Quantities forming part of the Bid Documents. The Bid Drawings could also be used for the construction of the works subject to Clause 11.9.3.

11.9.3 Construction Drawings

Construction Drawings are Bid Drawings confirmed for construction or any revisions to Bid
Drawings and additional drawings that may be prepared by the Employer's Consultant for the purpose of construction of the works. However, pipe laying drawings shall, where so instructed by the Engineer, be prepared by the Contractor in accordance with Clause 70.5.

The Construction Drawings will be supplied to the successful Bidder on the award of the Contract and thereafter in the course of construction and shall be binding on him in the performance of the works.

The Contractor shall not be entitled to any extra payment or compensation, apart from payment for the quantities of work actually done, because of any deviation of the final Construction Drawings from the Tender Drawings.

11.9.4 Additional Construction Drawings

The Engineer may at any time during the Contract period issue such additional Construction Drawings as he may deem necessary for the proper performance of the works.

11.9.5 Records and As-Built Drawings

After the work has been completed and prior to obtaining the Certificate of Completion, the
Contractor shall furnish “as-built” drawings in one transparent and five blue print (or latest technology) copies prepared during construction, showing the works as constructed, together with all other information that may either be required or be useful for the operation and maintenance of the works in the future.

For the purpose of preparing the “as-built” drawings, the Contractor shall, where possible, use transparent reproducible copies of the Construction Drawings supplied by whoever prepared the original Drawings.

11.9.6 Drawings and Documents to be Returned

Before the Engineer shall issue the Final Certificate, the Contractor shall return to the Engineer all Drawings, Specifications, Bills of Quantities (BQ’s) and any other documents which may have been supplied to the Contractor for the purpose of the work, if required by the Engineer.

11.10 SUBSOIL INVESTIGATIONS

If and to the extent site investigations have been conducted on the site, the results of such investigations will be made available to the Contractor for inspection, at the Employer’s office.
Where, on the Drawings or in the investigation logs there appear the works “Rock” or “Hard Rock” they merely indicate the presence of a hard material and not necessarily the presence of a stratum of rock.

All the information on subsoil conditions are only furnished to assist the Bidder in preparing his Tender. The Bidder must draw his own conclusions from the available information, and no guarantee is given as to the accuracy of this information, nor should the Contractor assume that it is complete or sufficient for the purpose of the Contract.

No claim for extra payment based on misrepresentation will be considered or allowed.

The bottom of pits or holes shown on the drawings merely indicate the depths to which they have been excavated and do not indicate the lower limits of the strata.

Any other subsoil investigations which the Contractor may undertake for the purpose of gaining additional information on subsoil conditions, locating borrow areas, etc., will be entirely at his own cost.

For those cases where the Contractor is instructed by the Engineer to carry out specific subsoil investigations, a provisional sum has been provide in the Bills of Quantities to reimburse the Contractor for such subsoil investigations.

11.11 CONTRACTOR'S YARD

11.11.1 General

The Contractor's Yard shall be used by the contractor for his equipment, offices, stores, plant, workshops, latrines, and messing accommodation. The erection of temporary buildings or structures on the site will not be allowed without the permission in writing of the Engineer.

At the beginning of the Contract the Contractor's yard shall be fenced off. By the end of period of Maintenance, the area and its environs shall be cleared of all construction equipment, materials, buildings and the like and shall be re-graded and reinstated as directed by the Engineer.

11.11.2 Building for Temporary Use by Contractor

The Contractor shall maintain, in perfectly usable and watertight condition, such temporary and permanent buildings as required for the performance of the works. These shall include accommodation for his employees and the stores for employer supplied pipes and accessories. Before erecting any structure for his temporary use the Contractor shall present the necessary drawings, showing its location and nature, to the Engineer for his approval.

Prior to Tendering, The Contractor must ascertain all the requirements for the above, especially with regard to labour accommodation.

11.11.3 Temporary Sanitary Conveniences

The Contractor shall provide all proper sanitary conveniences for his men at the various sites of works and along the pipeline routes. The conveniences shall be disinfected with lime or otherwise and all-night soil shall be cleared out daily; this, together with any organic refuse produced at the works shall be removed and buried by the Contractor in such manner and in such places as may be directed from time to time. All arrangements shall be submitted to the Engineer for approval and may be modified by him from time to time as he deems necessary.

11.11.4 Cost

The cost of providing Contractor's temporary facilities shall be deemed to be uniformly spread over the rates for all items in the Bill of Quantities.

11.12 OCCUPATION OF LAND FOR TEMPORARY WORKS

Where it is necessary for any reason whatsoever to enter onto land which does not form part of the site, the Engineer shall be informed of the details, and the Contractor shall make his own arrangements with the land owners and occupiers and shall obtain written permission to occupy the land and the Engineer's approval.

When permission has been obtained and work is carried out, care shall be taken to ensure that no unnecessary damage is caused to the land and that all reasonable precautions are taken to prevent soil erosion and mosquito breeding. On completion of the work, the land shall be reinstated and left in a tidy condition and protected against erosion, all as approved by the Engineer.

11.13 PAYMENTS OF COMPENSATION

In the case of the land made available to the Contractor free of charge, the Engineer may require the Contractor to make direct payment to the owner or other person or persons in respect of any required compensation. On receipt of such written instruction from the Engineer, the Contractor shall forthwith pay the required amount, which will be reimbursed through the next Interim Payment Certificate.

Under no circumstances is land to be interfered with, whether for Permanent or Temporary works, until the official evaluation of all compensation has taken place and permission to proceed has been received from the Engineer.

11.14 CONTRACTOR'S EQUIPMENT

All Contractor's Equipment used in the performance of the works shall be of such type, size and of such method of working as the Engineer approves. If for any reason whatsoever the Engineer shall be of the opinion that any excavator, mechanical digger, roller, pile hammer, concrete mixer, vibrator, welder or other machine or appliance employed or proposed to be employed by the Contractor for the purpose of the works shall not be used, or that any such machine or appliance as aforesaid is unsuitable for use in the works or any part of them, then such equipment shall be immediately withdrawn from use. In particular the Engineer may prohibit or suspend the use of machinery which in his opinion is likely to: remove more material than is necessary; damage or render unsuitable any structure; break or damage pipes, conduits, cables or any other property or work of any kind. Similarly, the Engineer may prohibit use of machinery causing a nuisance by noise or otherwise.

Any change of the method of performing the work as a consequence of such order shall be at the cost of the Contractor who shall have no cause for claim against the Employer on account of having to carry out the work by different methods or for the idleness or removal of any constructional plant.

The cost of providing Contractor's Equipment for all purpose shall be uniformly spread over all the items of the Bill of Quantities.

11.15 WATER SUPPLY

Water will be required for the purpose of washing aggregates, making mortar and concrete and for other uses in and about the Works, as well as for testing, flushing and chlorinating of pipelines. The Contractor shall make his own arrangements for obtaining supplies of water of approved quality, and shall erect and maintain all required pumps, pipes, valves, cocks, tanks, mobile tanks, hoses, roses and all other appliances required to distribute the water as necessary to the various parts of the Works.

If necessary, the Contractor will make arrangements to pump water from rivers and other sources and provide temporary treatment facilities. The Contractor shall provide at all times and at his own expense, for his own labour and for the Engineer and his staff, a supply of potable water, which shall be kept cool in proper hygienic conditions.

The cost of supplying water for purposes other than testing, flushing and chlorinating of pipelines, as well as providing, operating and maintaining all pumps, tanks and other installations as described in this Clause shall be uniformly spread over all items of the Bills of Quantities.

The cost of supplying water for testing, flushing and chlorinating of pipelines, shall be included in the respective items of the Bills if Quantities for these operations.

The cost of supplying water shall in each instance include the cost of water at the source of supply and its distribution and conveyance to where it is used, including connecting up, laying of pipes, metering, pumping, use of tankers and the like.

The Contractor shall not assume that water will be available for his use from the public mains at the times and in the quantities required by him.

Where permitted to connect up to existing mains and pipelines for the purpose of obtaining water, the Contractor shall comply with all regulations and requirements of the competent authority. The Contractor shall himself obtain all related permits and make all arrangements as may be required for the performance of the connection.

The Contractor shall be solely responsible for the supply of all water required in the works for whatever purpose and no claims for extra payment or extension of time based on the lack or insufficient or delayed supply of water will be considered or maintained.

11.16 ELECTRIC POWER SUPPLY

The Contractor shall make his own arrangements for all electric power supply which will be needed for the execution of the work. The Contractor shall also supply electricity for the lighting, ventilating and/or air conditioning of the Engineer's office and laboratory.

The Contractor shall provide, erect, operate and maintain in good condition a diesel driven electric generator, large enough to supply the Contractual requirements. Sufficient stand-by is essential to ensure the required electric power at all times.

The Contractor shall also install, connect and maintain in good condition all cables, conductors and other electrical plant and equipment required to perform his contractual obligations. All such plant and installation as described above shall comply with the relevant requirements and regulations of the Kenya Power and Energy Regulatory Commission (ERC), and shall be maintained to the approval of the Engineer.

The cost of providing electric power supply for all purposes shall be uniformly spread over all items of the Bills of Quantities.

11.17 SURVEYING

11.17.1 Benchmarks

Prior to the commencement of the work, the Engineer shall provide a number of benchmarks (BM) located on the site as shown on the Drawings. The Contractor shall locate and where necessary re-establish the permanent benchmarks shown on the drawings and install additional permanent BM where directed by the Engineer to facilitate the setting out and checking the works.

Before starting any work, the Contractor shall check the alignment of the benchmarks in the presence of the Engineer and shall notify the Engineer of any error or misalignment which may be discovered during such checking. After the benchmarks have been thus checked and any errors corrected, the Contractor shall certify his acceptance of the Benchmarks to the Engineer in writing.

The Contractor shall be responsible for maintaining and regularly checking the elevation and position of all bench marks for the duration of the Contract. Where it is found that an existing benchmark is interfering with the progress of works, the Contractor may seek the Engineer's approval to relocate the benchmark. The Contractor shall submit to the Engineer in writing the coordinates of the new benchmark.

11.17.2 Preservation of Benchmarks

Benchmarks shall, where possible be preserved, or else be relocated. Where benchmarks could be destroyed, they shall be accurately tied in to permanent concrete reference points before work is commenced.

11.18 SURVEY AND SETTING OUT

11.18.1 Setting Out

Based on the benchmarks mentioned above, the Contractor shall set out the work using the data shown on the Drawings or as per the Engineer's instructions. The Contractor shall then reference these points with permanent beacons of a type approved by the Engineer. Each point shall have not less than three reference beacons which shall be placed where they will not be disturbed by the works and the method of referencing shall be agreed with the Engineer. The Contractor shall supply the Engineer with records in an acceptable form including such drawings, sketches, measurements and reference as may be necessary for the location or relocation of relevant points and shall keep such records up to date by formal notice to the Engineer. The reference beacons shall be used as benchmarks and their levels shall be agreed with the Engineer. The levels of all benchmarks shall be checked by the Contractor at monthly intervals and he should immediately notify the Engineer whether or not there are any discrepancies.

11.18.2 Agreement of Topography

Prior to commencing any work, the Contractor shall check the topography of the site of the said work and shall inform the Engineer of the results. The agreed final topography shall be used in the calculation of quantities.

11.20 PHOTOGRAPHS

The Contractor shall provide progress photographs taken as, when, and where, directed by the Engineer, at intervals of not more than thirty days. The photographs shall be sufficient in number and location to record the exact progress of works.

The quality of photos shall be 14MP commercial quality and shall be taken as a set of photos of the same view pre-construction and a set of work accomplished during the month as follows:

- Work not yet covered up
- When inspections are scheduled
- The beginning of installation of major items of work or equipment
- After installation of major items of work or equipment
- Other significant construction activities

The photos shall be submitted in each Monthly Progress Report a maximum of 3 photos per page. They shall include a description of the item photographed e.g. Location of MH 5 - Line 1 and the date the photograph was taken. The Contractor will also submit a CD containing the photographs properly logged i.e. including the description of the photograph and date of the photo.

11.21 PROJECT AND DIRECTION SIGNBOARD

The Contractor shall supply, erect, and maintain adequate signboards at locations to be determined by the Engineer. The project signboards shall start 150 cm high above the ground and 240 cm wide and shall be lettered according to instructions provided by the Engineer. Direction signboards shall be erected in sufficient numbers, as directed by the Engineer.

11.22 FIRE FIGHTING EQUIPMENT

Suitable firefighting equipment shall be provided and maintained on site to deal with any outbreak of fire. All possible precautions shall be taken to provide for the safe storage of petroleum, explosives, gas bottles, and all other dangerous goods.

Permits shall be obtained for the storage of such materials wherever this is required by the regulations of the competent authorities.

11.23 FIRST AID EQUIPMENT

The Contractor shall provide and maintain on the site first aid equipment consisting of the following:

a. Complete first aid kit with medicines, bandages, splints, etc.

b. Motor car to be always available for emergency transportation.

c. Stretches for carrying injured persons are to be provided and maintained at the site.

11.24 SAFETY EQUIPMENT

The Contractor shall provide and ensure all his staff, Resident Engineer and his staff as well as visitors to site have proper safety gear when on site at all times. The following gear should be made available:

a. Work overalls.

b. Gumboots.

c. Gas masks

d. Workman's gloves

e. Safety glasses/ goggles

f. Ear muffs as required

g. Helmets

11.25 CONSTRUCTION SAFETY SIGNS AND BARRIERS

The Contractor shall erect construction safety signs and barriers as and where directed by the Engineer. The signs and barriers shall be maintained in good condition and kept clean at all times.

11.26 PACKING, MARKING AND DELIVERY

Prior to dispatch from the Contractor's works, the equipment and materials shall be thoroughly protected against corrosion and incidental damage, including the effects of vermin, strong sunlight, rain, high temperature and humid and salty atmosphere or sea spray.

The equipment and materials shall be packed to withstand rough handling in transit, and packages shall be suitable for export to and storage in the tropics, including possible delays on exposed quaysides. The Contractor shall be held responsible for the materials and equipment being packed so that it reaches destination intact and undamaged. The Contractor shall provide, and include in the Contract price the cost of all necessary packing cases and crates, properly strengthened by battens (which shall be considered as non-returnable), packing materials (to include but not limited to the use of polythene or similar water-proof wrapping, silica, etc. wherever necessary), hoop iron banding and labour.

All crates and packages shall be correctly and adequately marked as follows:

a. Name of the Project.

b. Contract Number.

c. Designation of Materials and Equipment.

d. Item Number.

e. All Shipments shall be marked with a blue colour code.

11.27 PROVISIONAL SUMS

Provisional sums shall be expended as directed by the Engineer. The employer will retain any unused portions.

11.28 PROGRESS REPORTS

The Contractor shall furnish the Engineer, at no extra cost to the Employer, at regular monthly intervals 3 (Three) copies in a form determined by the Engineer, with Progress Reports containing the following information:

(a) Physical progress for the report month and estimated progress for the next month, report of manpower materials supply and consumption, equipment and machinery on site

(b) Completion schedules (target and actual) based on the approved construction programme

(c) Updated curves for physical progress at different sections of the Works

(d) Any report which may be specifically requested by the Employer and/or the Engineer.

These monthly reports shall be submitted not later than 5 (five) days after the end of the report month.

Besides, the Contractor shall keep a daily Log Book at each site to record weather condition, work executed, material, manpower and equipment utilization, and causes of unsatisfactory performance and unusual events. A weekly summarized report should be submitted to the Engineer. In addition, a supervisor's Memo-Book should be kept at each site to facilitate convenient communication between the two parties.

SUB-SECTION 1 COMMON REQUIREMENTS

1.1 SCOPE OF CONTRACT

The Contract shall include the design, manufacture, inspection and works testing, supply and delivery, unloading, supervision of erection, complete installation, commissioning, tests on completion, training of local operators, production of record drawings, installation, operating and maintenance manuals, setting to work of low head water turbines directly coupled to pumps, electric motor driven pumping plant, water treatment plant and all associated equipment, pipe work and fittings, electrical equipment and cabling at the Site, finishing, painting and remedying of defects for a period of one year.

The Contractor shall provide sufficient tools and lifting equipment to enable all installation work to be undertaken for completion of the Contract. These said tools should not be used as part of the supply of Special Tools specified elsewhere.

The Contract shall also include the supply of spare parts necessary for undertaking normal maintenance for a period of three years.

The Plant is required to be complete in all respects as specified herein and shall include all items of plant, machinery, fittings, etc., necessary whether such items are specifically The Contractor shall prepare and submit to the Engineer, in addition to the specified Working Drawings, all details, drawings and technical data required by the Engineer to enable him to ascertain the foundation requirements, supports and fixings to be built into the Civil Works.

The Contractor shall give all facilities to the Engineer for inspection and testing, during manufacturing and installation of mechanical and electrical Plant.

The altitude range for the works is between 1,000 to 1,500 mASL and the temperature ranges between 22 degrees Celsius to 38 degrees Celsius.

1.2 DEFINITIONS

In construing the Conditions and the Specification relating to the Plant, the following words and expressions shall have the meanings herein assigned to them unless there is something in the subject matter or context inconsistent with such construction:

"BS" and "BSCP" shall mean the Edition of the relevant British Standard Specification and British Standard Code of Practice respectively current twenty-eight days prior to the date set for the submission of Tenders.

"C.E.E." shall mean the International Commission of Rules for the approval of Electrical Equipment

"IEC" shall mean the International Electro technical Commission

"ISO" shall mean the International Organization for Standardization

"KPLC" shall mean Kenya Power Distribution Network Company

"IEE" shall mean the Institution of Electrical Engineers (British)

"Tender Drawing" shall mean a drawing prepared by the Engineer for Tendering purpose only

"Working Drawing" shall mean a working drawing submitted by the Contractor to the

Engineer for approval, all as specified in the Conditions of Contract

"Contract Drawing" shall mean a drawing, which has been approval by the Engineer and issued as part of the Contact

"Certified Manufacturer's Drawing" shall mean a drawing, which is prepared by the manufacturer, and certified by the manufacturer as showing the exact dimensions and details of the equipment as it will be supplied for the Contract

"Special Tools" shall mean both special tools and appliances necessary for the duties specified

1.3 REGULATION, STANDARDS, MATERIALS AND WORKMANSHIP

All work carried out under this Contract shall comply with the latest requirement of any duly constituted authorities having authority over the work.

All materials shall comply with the appropriate ISO, British Standard Specification, C.E.E Standards, Kenyan Standard and the recommendations of the IEC as specified. Where an alternative specification to those from such standards and recommendation are to be used, these will be specifically referred to hereinafter and the Contractor must seek the approval of the Engineer or show confirmation that they are equal or more stringent to the quoted standard..

All references to such standards shall be to the latest edition or revision thereof unless otherwise stated. Where a specific ISO, British or other Standard is referred to in this Specification, other Standard will be acceptable if they ensure an equal or higher quality of material and workmanship than the Standard referred to at no extra cost to the Employer. If the Contractor intends to use such alternative Standard, he shall notify the Engineer thereof, submitting with his notice two copies (in English), of the proposed Standard and shall not order any material or perform any work unless and until he has obtained the Engineer's approval of such Standard.

All materials and equipment incorporated in the Works shall be to the approval of the Engineer.

The names of the manufacturers of materials and equipment proposed for incorporation in the Works together with performance, capacities, certified test reports and other significant information pertaining to the same, submitted for approval to the Engineer, who shall have power to reject any parts which in his opinion are unsatisfactory or not in compliance with the Specification. Parts so rejected shall be replaced by the Contractor at no extra cost to the Employer.

All materials and equipment shall be the most suitable for the purpose specified and shall be new and of first class quality, free from imperfections and selected for long life and minimum maintenance.

No second-hand materials whatsoever will be acceptable. The Contractor may be required to produce certified invoices.

All articles and materials specified to conform to ISO, British or other standards shall be clearly and indelibly marked with the appropriate standard number specified, except where marking is impractical when the relevant advice/delivery notes shall include the ISO, British or other standard number with which they are to comply.

All set, fixing and wood screws, studs and the like used through the whole of the electrical installations shall be brass or serialized or other material resistant to corrosion.

1.4 DESIGN AND STANDARDIZATION

The Contractor shall be responsible for the design and submission of calculation of all Mechanical and Electrical works specified in respect of capacity, hydraulic consideration, strength, voltage drop, fault levels, protection and discrimination. The Contractor's design shall be subject to the approval of the Engineer, which approval shall not in any way relieve the Contractor of his obligations under the Contractor.

The Works in the Contract shall be designed to facilitate inspection, cleaning, and repairs, where continuity of operation is the first consideration. All Plant supplied shall be designed to ensure satisfactory operation under working conditions. All plant containing rotating parts shall be capable of operating at speeds up to the maximum duty specified without vibration or excessive noise.

The plant shall be designed on the basis that all butt welds are made at the manufacturer's work site. Welding shall only be used for fillet welding of loose flanges to make up pipe lengthen.

All motors, fluorescent lighting and other electrical plants shall have a power factor of not less than 0.92 lagging after correction and minimum 0.8 before correction.

Corresponding parts throughout the contract works shall be submitted to the Engineer to prove inter changeability who may require they are actually changed to prove their interchangeability..

Suitable provisions by means of eyebolts or other means are to be provided to facilitate handling of all items with a mass greater than 70kg.

1.5 PACKING TRANSPORT AND STORAGE OF MATERIALS AND PLANT

Before dispatch from the manufacturer's works, the plant and equipment shall be thoroughly cleaned, protected against damage, deterioration, corrosion and ingress of dirt. The packing shall be suitable for transport by sea and shall withstand prolonged exposure to a hot atmosphere and storage on site.

All packages shall be clearly and conspicuously marked with the contractor's identification mark and the Employer's reference mark. And should be consigned to the Employer c/o the Contractor.

All separate component parts of the Plant shall be identified by metal tags tied by wire and referenced to drawings, installation instructions, packing lists, etc. Details of the referencing system shall be submitted to the Engineer for approval.

All items shall be adequately protected from damage and deterioration always, including the period of storage and erection at the Site.

All wooden cases and support timbers within cases shall be proofed with suitable antitermite solution. Straw or similar organic materials shall not be used for packing.

1.6 CONTRACT PERIOD AND PROGRAMME

As required by the Conditions of Contract, the Contractor shall provide within the agreed days of the Commencement Date, a fully detailed programme for the completion of the Electro-Mechanical Works. This programme shall be based on Data Schedule, and shall indicate the programmed dates for the commencement and completion of the following:

- Submission of foundation drawings for approval
- Submission of Working Drawings for approval
- Placing orders for materials, plant and equipment
- Manufacture of ordered plant, materials, and equipment.

- Inspection and Testing by the Engineer at the manufacturer's works
- Delivery to Site
- Erection on Site
- Tests on Completion
- Commissioning Period
- Defects and liability period

The above activities shall be scheduled for each individual plant installation. The programme shall also the planned rate of progress for each month.

The programmed dates shall be coordinated with the civil works and the power supply authorities, and shall be subject to approval by the Engineer.

1.7 TENDER DRAWINGS

The Contractor shall refer to and examine all Tender Drawings appropriate to any part of the Contract, and to provide and co-ordinate all work accordingly.

Positions of Plant, pipe work, cables, columns, outlets, and other items as shown on the Drawings are approximate and the Contractor shall allow for minor adjustments to final positions as may become necessary during installation. It shall be the responsibility of the Contractor to verify dimensions.

Drawings shall, in general, not be scaled off. However, where the Contractor is measuring cable lengths or similar items, he shall determine the appropriate scale of the drawings and measure to suit his own requirements. The lengths, sizes and ratings of all cables shall be submitted for approval.

The Contractor is not at liberty to modify or alter the disposition of items supplied by others from that shown on Tender Drawings. Apart from this reservation, the drawings are issued only to give general guidance and any proposed modifications will only be considered providing the general principles are followed.

The Engineer may supply to the contractor such further drawings as may be necessary for the manufacture, erection, completion and maintenance of the plant and the contractor shall execute. obey and be bound by the same and shall not be entitled to any extra payment in respect of any work shown or directed to be done by such further drawings unless the Engineer shall have given written instructions for the same.

1.8 WORKING DRAWINGS

The Contractor shall prepare fully dimensioned scale drawings of builder's work arising from the installation of mechanical and /or electrical plants, for approval of the Engineer.

The Contractor shall give to the Engineer full particulars of loading, including moments, details of any anti-vibration measures; and dimensions and positions of foundations and plinths and /or fixings necessary for the support and accommodation of all such plant, so that adequate provision may be ensured.

The Contractor must prepare full working drawings of all plant and services for the complete installation, including cable layouts, diesel plant drawings, and electrical layouts within buildings, road-lighting and floodlighting column locations. All drawings shall be submitted to the Engineer for approval before any works are commenced. Where possible service reserves shall be established such that a regular approved layout is achieved for all services, these being dimensioned from fixed points within each compound.

Where the items of Plant offered by the Contractor vary in size and/or configuration from that shown on the Tender Drawings, the Contractor shall submit for approval, the proposed layout for his particular Plant. In this regard, the Contractor is not at liberty to effect major alterations to structures, nor major relocations of Plant, but will be expected to arrange his installation within the space provided. All dimensions affecting accommodation of the Plant supplied under this Contract, and points at which services other than those covered under this Contract are required, shall be clearly indicated on drawings to be submitted to the Engineer by the Contractor. These drawings shall show such other details of Plant, not given in the Tender or Tender Drawings, as the Engineer may require for the purpose of preparing detailed drawings for installation of the Plant and for the purpose of making any necessary modifications to the Works being provided under other contracts.

Any proposed deviations from the arrangements shown on the Drawings shall be clearly stated in the Tender, and will only be considered if the above principles are followed. The information under this Clause is required within 8 weeks of the award of the Contract.

The Contractor shall also, in accordance with his approved programme submitted with his Tender, commence to submit before proceeding with manufacturer's working drawings large scale Plant room layouts, ductwork detailed drawings, pipe work and pipe work support and expansion details "certified" fully dimensioned and detailed manufacturer's drawings of Plant including all necessary wiring diagrams detailing connections, current loading in cables and external wiring requirements, schematic diagrams of the electrical control systems etc. These drawings shall show leading dimensions and design sizes of all Plant.

All these drawings shall either be cleared for general acceptance or commented on by the Engineer for amendment until finally accepted. The accepted drawings shall constitute Contract Drawings and the Plant shall be manufactured to these Contract Drawings in every particular case. The acceptance by the Engineer of any drawing does not relieve the Contractor of his responsibility under the Contract, and will not commit the Engineer or make the Engineer liable for any mistake of the manufacturer or deficiencies in strength of any part or in the capacity or efficiency of the Plant for carrying out, in accordance with this Specification, the work for which it is designed.

The Contractor shall supply to the Engineer two copies of all drawings in English, including associated electrical wiring diagrams for comment and four further copies of all accepted Contract Drawings.

1.9 CONTRACT DRAWINGS

Following approval of the Contractor's Drawings by the Engineer they shall constitute Contract Drawings and the Plant shall be manufactured in accordance with the approved drawings. The acceptance by the Engineer of any such drawings shall not relieve the Contractor of his responsibility under the Contract and shall not commit the Engineer nor make the Engineer liable for any mistakes or the manufacturer's deficiencies in strength or efficiency in operation of any part or item for its specified purpose.

The Engineer reserves the right to amend or add to the Contract Drawings as may be necessary or expedient as stated.

The Contractor shall keep available on site copies of all drawings on which he shall periodically update the details to facilitate the production of the Record (As Built Drawings) at the completion of the whole of the works.

Two sets of negatives and of paper prints shall be provided by the Contractor after approval of the drawings and supporting information.

1.10 RECORD DRAWINGS (AS-BUILT DRAWINGS)

Record drawings in A1 size shall be prepared and compiled by the Contractor after the Works have been completed and handed over and shall constitute a permanent record

of the whole of the Works as finally built and installed. Five copies shall be produced in the form of black lines on a durable translucent film from which paper prints can be taken by others as required (the drawings could be made using acceptable latest technology).

A print of the appropriate wiring connection diagram shall be fixed to the inside of the hinged front of each control cabinet, switchboard panel or distribution switchboard. Nonflammable transparent material shall protect the print. . Where insufficient space is available, the print shall be reduced in size. A copy of the print shall also be provided with the Record Drawings and inserted in the Operating and Maintenance Instructions. In addition, block diagrams of the panel components shall also be fixed to the inside front covers so that operators and maintenance personnel are made aware of the function of each component.

1.11 AMBIENT CONDITIONS

All Plant, materials and installation techniques shall be suitable for the climate conditions and altitude prevailing at the Site as mentioned in Section 1.1.

1.12 SCHEDULES OF TECHNICAL INFORMATION

The Contractor shall complete all the Data Schedules of technical information contained in the Tender Documents particularly any departure or deviations from the Specification and names of manufacturers of supply of the Plant, Should he fail to do so, then the Tender may not receive full consideration, and may be liable to rejection.

1.13 COPIES OF ORDERS

Copies of all orders for all major Plant items, materials and subcontract works placed with suppliers and subcontractors shall be provided in triplicate to the Engineer. The orders shall give or shall be accompanied by full details of the material, Plant or work ordered.

Copies of all orders shall be provided in the English language or with an English translation where the actual order is placed in any other language.

1.14 STANDARDIZATION

Corresponding parts and units shall be interchangeable wherever possible. Where required by the Engineer, the contractor shall demonstrate the parts can actually be interchanged.

1.15 FOUNDATIONS AND BUILDING WORKS

In general, all building, structures and foundation upon which plant will be erected will be constructed by the Contractor. The Contractor shall plan his work accordingly by:

- Submitting all his foundation requirements within the specified times, and
- Arranging for the supply of all foundation bolts, trench covers kerbs and other cast in components in advance of the delivery of Plant.

1.16 INSPECTION AND TESTS AT MANUFACTURER'S WORKS

The Employers representative, Engineers and his duly authorized representative shall have access to the Contractor's premises at all reasonable times to inspect and examine the material and workmanship of the mechanical and electrical components. If part of the Plant is being manufactured on other premises, the Contractor shall obtain

permission for the Engineer or his duly authorized representative, to inspect as if the Plant was manufactured on the Contractor's own premises. Such inspection, examination, or testing, if made, shall not relieve the Contractor from any obligation under the Contract.

Where the Plant is a composite unit of several individual pieces manufactured in different places, it shall be assembled and tested as one complete working unit, at the manufacturer's works, to the relevant British or other approved, equal standard where applicable.

The Contractor shall submit his proposed programme of tests for the Engineer's approval three weeks before the commencement of testing.

The Contractor shall give the Engineer a three weeks' notice in writing of the date on any the place at which any Plant will be ready for testing as provided in the Contract and the Engineer shall thereupon at his discretion notify the Contractor of his intention to inspect such part of the Plant and shall then, on giving twenty four hours' notice in writing to the Contractor, attend at the place so named within seven days of the date by which the Contractor has stated in his notice the said Plant will be ready for testing. The Contractor shall forward to the Engineer six duly certified copies of the test readings and characteristic performance curves for items such as pumps, fans, etc.

Whether at the premises of the Contractor, or of any subcontractor, the Contractor, except where otherwise specified, shall provide, free of charge, such labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonable demanded, to carry out efficiently such tests of the Plant, in accordance with the Contract, and shall give facilities to the Engineer, or to his authorized representative, to accomplish such testing. Where inspection or testing is to be carried out for subcontractors' works, a representative of the Contractor shall be present.

Works tests shall also be carried out such that due consideration is given to the site conditions under which the Plant is required to function. The test certificates shall give all details under which the tests were done.

As and when any Plant shall have passed the tests referred to in this clause, the Engineer shall issue to the Contractor a notification to that effect.

The Contractor shall not pack for shipment any part of the Plant until he has obtained from the Engineer his written approval to the release of such part for shipment after tests required by the Engineer in terms of this clause have been completed to his satisfaction.

1.17 ERECTION AND CHECKING OF WORK

The Contractor shall be solely responsible for transport to the Site, handling and transport about the Site and the erection of the Plant. As each part of the Plant is erected, it shall be subject to approval by the Engineer.

All parts shall be tested on Site as required, notwithstanding the tests carried, by the Engineer to prove compliance with the Contract irrespective of any tests, which may have been carried out at the manufacturer's works.

1.18 SUPERVISION AND LABOUR

The Contractor shall provide all skilled and unskilled labour for the completion of the works. The Contractor is required to maintain a competent supervising Engineer and staff on site throughout the erection and instruction periods, and thereafter as may be required during the defects liability period.

1.19 SPECIALIST SUBCONTRACTORS

Where Subcontractors are not nominated, the Contractor shall appoint specialist Subcontractors for any sections of the Works in which he himself has no experience, recognised and approved operator.

1.20 SPECIAL TOOLS

The Contractor is to provide one complete set of any special tools and appliances necessary for the operation, testing, maintenance and dismantling of the various sections of the Plant whether of a mechanical or electrical nature.

Tools for each different type of equipment shall be new and unused and kept in a wallmounted strongbox or boxes each fitted with a suitable lock and two keys. Such tools shall be provided for each and every separate location of the Works and shall not be used by the Contractor during the erection of the Plant. The cost of these tools shall be included in the Contractor's Tender. The strongbox is to be clearly marked or labelled with its description. Each tool shall be identified and a list of tools shall be affixed inside the box lid. Racks shall be provided as necessary to separate the various items.

A provision has been made for the Contractor to provide schedule such tools and appliances in the Data Schedules and for him to price for such tools and appliances as allowed for in the Schedule of Prices.

1.21 INSTALLATION, OPERATING AND MAINTENANCE MANUALS

The Contractor shall supply to the Engineer illustrated operating and maintenance manuals. The manuals shall be in one or more volumes in order to separate literature from drawings, etc., as necessary.

The manuals shall be in English. They shall include the following information for the operating personnel:

a) Description of all systems installed, including electric lighting and power installation, electronic installations, mechanical installation, air systems, automatic controls systems, etc. An identification system should be established and shown on drawings and in the manuals.

b) Description of all Plant supplied including manufacturers' leaflets, which are to be scheduled for easy of reference.

c) Schedule of all Plant supplied, giving duties, electrical loads, etc.,

d) Schedule of all equipment suppliers (and their local agents) including names, addresses, telephone, telex and Fax numbers.

e) Fully detailed instructions for the installation testing and commissioning of all plant, which will be undertaken by the contractor including detailed schedules of checks to be carried out prior to putting the equipment into operation.

f) The Start-Up Operation and shut down instructions for all equipment and systems,

g) Full maintenance instructions for all equipment including planned maintenance schedules or charts giving daily, weekly, monthly, quarterly, half yearly and annual maintenance instruction, together with recommended lubricants and spares. This should also include details of routine maintenance work that will be within the competence of the normal maintenance staff, and notification of maintenance work that will have to be done the manufacturer, his agent or other specialist operator.

h) Spare parts list.

i) Fault finding charts.

j) Record drawings of all systems installed including general arrangements, conduit and wiring trunking systems, Plant rooms details, air and water systems flow

sheets, wiring diagrams, control schematics and valve charts, etc., to a reduced scale.

k) Certified supplier's drawings of all equipment supplied, which are to be scheduled for easy reference.

l) Copies of performance curves.

m) Copies of all test certificates (carried at manufacturer's works and at the site).

A copy of each manual, at least in draft form shall be submitted four weeks before shipping the equipment to which it refers. The draft manual submitted shall include details of all items of plant and equipment unless separate submission of details of particular items is already approved by the Engineer.

Six copies of each set of manuals shall be issued to the Engineer before the Plant is shipped.

The final version, modified as necessary to accommodate any changes on site and all test results and certificates as specified, shall be presented as soon as possible thereafter.

Each manual shall be durable and permanently bound within a stiff binder. The cover of each binder shall be finished with a black waterproof and greaseproof material and the title printed in gold block lettering on the front and on the spine.

1.22 SPARE PARTS

The Tender shall submit with his Tender the completed relevant Data Schedule, listing the recommended spare parts and their prices which are considered necessary for the maintenance of the Plant for two years normal operation. When considering the proposed list he must bear in mind the availability of such Plant in Kenya.

A Provisional Sum has been allowed in the Schedule of Prices for the supply of spare parts. The Engineer shall decide on which of the recommended spare parts shall be supplied. The prices of the spare parts shall be valid for two years from the award of contract, and the Engineer will give instructions on which spares shall be provided within this period.

The spare parts shall at least include the following items;

- Complete set of spare fuses or MCB's as required
- Spare coils and contactors for starters Recommended spares for control systems Bearing for pumps, turbines, motors, etc.
- Spare overloads and contacts for starters
- Recommended spares for generator sets and control panels
- Any other spares recommended by manufacturers of specialized equipment

All spare parts shall be new, unused and strictly interchangeable with the parts for which they are intended to be replacements and shall be treated and packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be clearly marked or labelled on the outside of its packing with its description and purpose, and when more than one spare is packed in a single case or other container, general description of its containers and other packages shall be marked and numbered in an approved manner for purposes of identification.
All cases, containers or other packages are liable to be opened for such examination as the Engineer may require and packing shall be designed to facilitate opening and subsequent repacking.

1.23 LABELS AND PLATES

Identification labels of "Traffolyts" or similar approved material engraved black on white unless otherwise agreed, with not less than 5 mm "lino" style letters shall be fixed on or adjacent to all equipment, valves, controls switches and distribution gear, by means of at least two brass screws or rivets or other approved means.

Danger or warning tables shall be engraved white on red.

Glue, as the only means of attachment is unacceptable.

All labels shall be in English.

The labels shall bear the identification shown on the drawings, such as indication, designation function and, where necessary, phase voltage, current, pressure and temperature.

Plastic adhesive strip labels or adhesive die stamped tapes will not be permitted.

1.24 DUST, INSECT AND VERMIN PROOFING

All Plant, which is affected by ingress of dust, shall be effectively dust proofed.

All Plant shall be vermin proofed, where no protection is afforded in its normal manufactured form, to ensure that no mechanical breakdown shall occur due to interference or damage by vermin. All materials used in construction or for connections shall be resistant to attacks by insects, microbiological life or other local fauna and such materials shall be to the approval of the Engineer.

Where cables are laid in trenches, the trenches shall be treated with an approved additive to prevent termite activity, or a termite barrier provided.

Where panels or components are sealed, adequate provision shall be made to dissipate heat so those electrical components are not subject to any form of de-rating resulting from unacceptable temperature rises.

1.25 ALTERNATIVES

The Contractor's main Tender shall comply fully with the Specifications.

The Contractor is however at liberty to include alternative items of Plant, subject to approval by the Engineer, which do not completely comply with the requirements of the Specifications provided that the requirements of the following two paragraphs are fulfilled.

The Contractor shall submit manufacturer's detailed descriptions of alternatives and he shall draw attention to any aspect of each component, which does not fully comply, with the requirements of this specification. These detailed descriptions, including and departure from the requirements of the Specification may, after approval by the Engineer, be included among the Contract documents and each item shall be in accordance with the description of it. Approval of a manufacturer's description shall not include approval of any departure from the requirements of the Specification unless the departure is specifically approved by the Engineer in writing.

Where Plant differs from that specified, the tenderer should submit with his Tender drawings showing any amendments of system design necessary to suit the Plant. The Engineer will either approve these drawings or issue others if he approves the components concerned.

1.26 TESTING AND COMMISSIONING

1.26.1 General

As many tests as (where the test has failed) in the opinion of the Engineer are possible shall be arranged together. Four copies of the Contractor's records of all tests shall be furnished to the Engineer.

All material which is specified for tests at the Manufacturer's works must satisfactorily pass such tests before being painted or otherwise coated.

All test instruments shall be to approval and shall be calibrated by a competent as may be approved by the Engineer.

Full witnessed testing and inspections will be carried out on our plant and equipment, including:

- All pumps
- All turbines
- All motors
- Valves, Actuators Penstocks
- Standby diesel plant
- Chemical dosing plant
- Electrical Switchgear and Motor Control Panels
- Electrical reticulation and installations
- Other items as may be required shall be inspected and tested.

All major items of plant shall be offered for inspection prior to their being dispatched from the manufacturer's or his Subcontractor's works.

The Engineer shall be entitled at all reasonable times during manufacture to inspect, examine and test on the Contractor's premises the materials, workmanship and performance of all plant to be supplied under the Contract. If the plant or any part thereof is being manufactured at a plant other than the Contractor's he shall obtain for the Engineer permission to inspect, examine and test such plant as is required. Any such examination, inspection or testing does not relive the Contractor of his obligation under the Contract.

Where the Contract provides for testing on the premises of the Contractor or any subcontractor, the contractor shall provide free of charge all assistance, labour, materials, electricity, fuel, water, stores, apparatus, and instruments as may be required and reasonably demanded for carrying out of the tests.

If after inspecting, examining or testing any plant the Engineer should decide that such plant thereof is defective or not in accordance with the Contract he may reject the said plant or part thereof by giving the Contractor, within a reasonable time, written notice of such a rejection, stating therein the reason for rejection.

1.26.2 Tests at Manufacturers Works

All electrical and mechanical plant shall be tested at the manufacturer's works in accordance with the requirements of the current relevant British Standards.

In particular the following tests shall be carried out for specific items:

- Control Panels and Switchgear
- The following tests shall be carried out for each control panel before the panel is dispatched from the manufacturer's works:
  - ✓ Visual inspection
  - ✓ Inspection of provisions for cable entries
  - ✓ Checking access, type of cable gland, etc.
  - ✓ High voltage power frequency pressure test at 2 kV for 1 minute, followed by an insulation test.
  - ✓ The relays with variable controlled supply to ensure relays close at 85% nominal voltage and hold closed down to 65% nominal voltage
  - ✓ Test tripping of relays occurs at 60% nominal voltage
  - ✓ Observe any special tests applicable to the installation
  - ✓ Injection testing of current transformers for correct polarity and ratio, and protection relays for correct operation.
  - ✓ Functional testing including simulation of operation of sequence controls (e.g. level controls, etc.)
  - ✓ Checking of time delay settings and protection relay setting
  - ✓ Checking of fuses, MCB's and MCCB's etc. for correct type and rating ✓ Check inter-locks ✓ Insulation tests.
  - ✓ Any other tests required by the Engineer or his Representative.

Electric Motors
Electric motors having a rating of 11 KW or less shall be tested in accordance with BS 4999 Table 60.3.1.4 column 5 designated "Routine Check".

Motors having a rating of more than 11 KW shall be tested in accordance with BS 4999 Table 60.3.1.4 column 3 designated "Basic".

All rotational and temperature rise tests shall be performed with the motor set up in normal working position, i.e. either horizontal or vertical in accordance with the particular drive application.

Motors shall not be dispatched for works assembly with associated mechanical plant until test certificates have been approved by the Engineer.

Electrical motors rated 11 KW and above shall be tested for vibration in accordance with the principles contained in ISO 3945, and BS 4999 Part 50.

As required by the British Standards, the tests shall include, as applicable:

- Detailed load tests or type tests on each motor to determine temperature rise, efficiency, speed and power factor, at different loads ranging from no-load to 110% of the continues maximum rating of the motor.
- Open-circuit test
- Short-circuit or locked-rotor test
- Voltage or pressure tests
- Over-speed test
- Capacity/Amperage Test
- Power Factor Test
- Insulation test

High voltage and insulation resistance test shall be made when the apparatus are hot.

The power and power factor measuring instruments shall be connected in such a position as to allow for all losses in the complete system and not for the motor alone.

Pump sets

Each pump shall be tested individually with its own motor over its full working range.

Each pump shall be run, and tests carried out in accordance with BS 5316 Part 1, or other standards as approved by the Engineer, to ensure that performance, power absorbed, and efficiency meet the guaranteed characteristics as shown in the Data Schedules.

Each pump set shall be tested for efficiency at each head/ quantity/ speed duty/

The pumps shall be tested complete with all shaft bearings, thrust bearings, and directly driven auxiliaries, or where this is impracticable, the Contractor shall state what allowances shall be made for the losses incurred by these items and shall demonstrate the accuracy of these allowances to the satisfaction of the Engineer.

The speed of the pump shall be stated when recording various readings of head/ quantity pertaining to the pump. Head/quantity curves and pump efficiency / quantity curves shall be drawn as may be necessary. In addition, the curve of overall efficiency of the pump set and power absorbed against the quantity pumped shall be drawn. If necessary, the values of motor efficiencies obtained during the motor works tests may be used. The curve produced shall be used to demonstrate that the Plant will be able to meet the full range of operating conditions at site.

The pump set shall be free from cavitation and vibration over the whole working range.

Pump castings shall be subject to a pressure test of 1.5 times the maximum pressure obtained with the delivery valve closed. The positive suction head shall be considered in determining this pressure.

The Contractor shall satisfy the Engineer as to the mechanical reliability of the plant and its capability of fulfilling the whole of the conditions. The contractor shall detail the type of apparatus available for testing, and the method of measuring pump discharge. He shall satisfy the Engineer as to the accuracy of the instruments used in the tests and shall, if required, carry out calibration tests.

Valves, actuators, and penstocks

All parts, which shall be subject to pressure in service, shall be subject to a hydrostatic test to a pressure not less than 1.5 times the maximum possible working pressure. Valves and actuators shall be tested at the "closed valve head" of the pump plus 10% on one side of the valve and zero pressure on the other. The valves shall be operated for two opening and closing cycles under the action of the actuators against the required pressure. Valves without actuators shall be similarly tested to ensure drop tightness. Penstocks shall be subjected to on and off seating tests where applicable.

Diesel Generating Sets

Each set shall be tested for output and performance in accordance with the requirements of BS 649 and BS 5000 Part 99. Tests shall include all function tests, operation of all safety devices, load tests and temperature tests. Care must be taken to derate the test results to site conditions.

Cable and wiring

All cable and wiring shall be fully factory tested. A sample of each cable rating/size shall be tested in the presence of the Engineer, the tests being those required by the British or International Electrotechnical Commission or equal or more stringent other National Standards Institution.

1.26.3 Test Certificates

Test certificates and reports shall be submitted in triplicate to the Engineer within three weeks of works testing of the following equipment:

- Motors
- Control Panels and Switchgear
- Armoured Cables
- Distribution Boards
- Motors
- Diesel Generating Plant
- Pumps
- Turbines.
- Other as may be identified

1.26.4 Tests After erection on Site

All Plant shall pass such tests on site as are required by the Engineer to prove compliance with the contract independently of any tests which may already have been carried out at the Manufacturer's works. All electrical pressure tests made at the Manufacturer's works shall be repeated at voltages to be approved by the Engineer, and all pump performance tests shall be repeated on Site.

The Contractor shall prepare all on site test results and certificates for all items as required by the IEE Regulations and relevant British Standards. These certificates and test results shall be provided in triplicate with copies included within the operation and maintenance manuals.

The Contractor shall maintain on Site marked up copies of all changes to the installations as they proceed. These changes shall be agreed with the Engineer on a weekly basis and shall be included on the Record Drawings produced by the Contractor for all installed equipment as specified elsewhere.

All skilled labour, supervision, apparatus, electricity, water, fuel and the like for tests, and instruments required for carrying out the tests efficiently will be the responsibility of and at the expense of the Contractor. The accuracy of the instruments shall be demonstrated if required.

Tests on completion shall be carried out to ensure that the Plant is complete, has been correctly installed, is reliable in operation under the conditions at site and is able to operate over its whole working range. In addition, the efficiency and performance of the Plant shall be checked as far as possible over the whole works

Range and the values obtained will be compared with those obtained during the tests at the Contractor's premises.

The Contractor shall include for all tests that may be require by any statutory Authority.

On completion, all plant and pipe work systems shall be properly balanced, left in working order and instructions given on the efficient operation and maintenance of the plant to the Engineer satisfaction.

If, in the opinion of the Engineer, the Plant does not comply with this Specification, the defect shall be remedied at no cost to the Employer.

1.26.5 Continuous Test Period

The Plant shall be tested, under normal operating conditions over a continued period of 30days. The Plant shall, at the discretion of the Engineer, be divided into sections for the purpose of these tests but each and every section shall be tested for the full period of 30 days continuous operation. Where sections of Plant form an integral operation the section of the Plant shall be tested together to ensure the correct and proper functioning of the water pumping, storage, and flow systems,

The Contractor shall arrange to run all Plant before submission for final testing to ensure that the period will not be interrupted for adjustment or breakdown.

1.27 INSTRUCTIONS AND TRAINING OF LOCAL STAFF

The Contractor shall allow operator's access to the Site during the erection and commissioning of the systems as part of their training programme. There shall be in addition to this, a period of three weeks minimum of official instructions and training after the end of the commissioning period and prior to hand over of the complete systems.

The Contractor shall make available for instruction, competent staff and all information necessary for the effective execution of the training programme. The Contractor must instruct and train the trainees in such a way that the operation, maintenance and if necessary, repairs to the systems can be handled competently by the respective personnel. The engineer or his chosen representative may attend some of these sessions and if necessary instruct the Contractor to either change mode of instruction or the instructor.

1.28 WORKS EXECUTED BY THE EMPLOYER OR BY OTHER CONTRACTORS

The Employer 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 whose contracts may be either a subcontract under this contract, or an entirely separate contract. The Contractor shall ensure that neither his own operations nor trespass by his employees shall interfere with the operation of the Employer, or his contractors employed on such works and the same obligations shall be imposed on the Employer or other contractors in respect of work being executed under this contract.

1.29 SEQUENCE OF OPERATIONS AND DELAYS TO OTHER CONTRACTORS

The Contractor shall be deemed to have included in his pricing of the Tender for costs associated with works carried out outside normal working hours where such works have been necessary to meet the requirements outlined in Section 28 above.

1.30 CONTRACTOR'S SITE OFFICES, WORKSHOPS, STORAGE AND WORKING AREAS

The contractor shall have stated in his tender the additional areas that he requires for his workshops, storage and working areas. The Employer reserves the right to allocate the areas of the land smaller than the Contractor may require. In such cases the Contractor shall make his own arrangements for obtaining the use of the additional areas that he requires. The location of all offices, stores, and the like shall be to the approval of the Engineer.

1.31 USE OF SITE

The lands and other places outside the site, which are under the control of the Employer, shall not be used except with the approval of the Engineer.

The Contractor shall at any time remove any vehicles, wagon, barge or vessel or any other obstruction under his control that may be required to be moved by the Engineer

for any purpose. The Contractor shall move such obstruction promptly on instruction given.

The Contractor shall maintain access for the inspection, operation, and maintenance of any of the Employer's plant or works, which lies within the site or elsewhere.

The Contractor shall maintain access for the inspection, operation, and maintenance of any of the Employer's plant or works, which lies within the site or elsewhere.

The Contractor shall not use any portion of the site for any purpose not connected with the works unless the written permission of the Engineer has been obtained.

Except with written permission of the Engineer, to be given when necessary for the execution of the Works, the contractor’s employees will not be permitted to enter any of the Employer's buildings or lands or sites under the control of other contractors or the Engineer. The Contractor shall warn his employees that any person found within such buildings or sites without authority is liable to be removed from the works in accordance with the Conditions of Contract.