



PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE FACILITIES

BILL OF QUANTITIES

VOLUME IV OF IV (Mechanical Engineering Works)

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APRIL, 2022

PART A:
**GENERAL MECHANICAL
SPECIFICATIONS**

PART A: GENERAL MECHANICAL SPECIFICATION

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GENERAL MECHANICAL SPECIFICATION

1. **General**

This section specifies the general requirement for plant, equipment and materials forming part of the Sub-contract Works and shall apply except where specifically stated elsewhere in the Specification or on the Contract Drawings.

2. **Quality of Materials**

All plant, equipment and materials supplied as part of the Sub-contract Works shall be new and of first class commercial quality, shall be free from defects and imperfections and where indicated shall be of grades and classifications designated herein.

All products or materials not manufactured by the Sub-contractor shall be products of reputable manufacturers and so far as the provisions of the Specification is concerned shall be as if they had been manufactured by the Sub-contractor.

Materials and apparatus required for the complete installation as called for by the Specification and Contract Drawings shall be supplied by the Sub-contractor unless mention is made otherwise.

Materials and apparatus supplied by others for installation and connection by the Sub-contractor shall be carefully examined on receipt. Should any defects be noted, the Sub-contractor shall immediately notify the Engineer.

Defective equipment or that damaged in the course of installation or tests shall be replaced as required to the approval of the Engineer.

3. **Regulations and Standards**

The Sub-contract Works shall comply with the current editions of the following:

- a) The Kenya Government Regulations.
- b) The United Kingdom Institution of Electrical Engineers (IEE) Regulations for the Electrical Equipment of Buildings.
- a) The United Kingdom Chartered Institute of Building Services Engineers (CIBSE) Guides.
- d) British Standard and Codes of Practice as published by the British Standards Institution (BSI)
- e) The Local Council By-laws.
- f) The Electricity Supply Authority By-laws.
- g) Local Authority By-laws.
- h) The Kenya Building Code Regulations.
- i) The Kenya Bureau of Standards

4. **Electrical Requirements**

Plant and equipment supplied under this Sub-contract shall be complete with all necessary motor starters, control boards, and other control apparatus. Where control panels incorporating several starters are supplied they shall be complete with a main isolator.

The supply power up to and including local isolators shall be provided and installed by the Electrical Sub-contractor. All other wiring and connections to equipment shall form part of this Sub-contract and be the responsibility of the Sub-contractor.

The Sub-contractor shall supply three copies of all schematic, cabling and wiring diagrams for the Engineer's approval.

The starting current of all electric motors and equipment shall not exceed the maximum permissible starting currents described in the Kenya Power and Lighting Company (KPLC) By-laws.

All electrical plant and equipment supplied by the Sub-contractor shall be rated for the supply voltage and frequency obtained in Kenya, that is 415 Volts, 50Hz, 3-Phase or 240Volts, 50Hz, 1-phase.

Any equipment that is not rated for the above voltages and frequencies shall be rejected by the Engineer.

5. **Transport and Storage**

All plant and equipment shall, during transportation be suitably packed, crated and protected to minimise the possibility of damage and to prevent corrosion or other deterioration.

On arrival at site all plant and equipment shall be examined and any damage to parts and protective priming coats made good before storage or installation.

Adequate measures shall be taken by the Sub-contractor to ensure that plant and equipment do not suffer any deterioration during storage.

Prior to installation all piping and equipment shall be thoroughly cleaned.

If, in the opinion of the Engineer any equipment has deteriorated or been damaged to such an extent that it is not suitable for installation, the Sub-contractor shall replace this equipment at his own cost.

6. **Site Supervision**

The Sub-contractor shall ensure that there is an English-speaking supervisor on the site at all times during normal working hours.

7. **Installation**

Installation of all special plant and equipment shall be carried out by the Sub-contractor under adequate supervision from skilled staff provided by the plant and equipment manufacturer or his appointed agent in accordance with the best standards of modern practice and to the relevant regulations and standards described under Clause 2.03 of this Section.

8. Testing

8.01 General

The Sub-contractor's attention is drawn to Part 'C' Clause 1.38 of the "Preliminaries and General Conditions".

8.02 Material Tests

All material for plant and equipment to be installed under this Sub-contract shall be tested, unless otherwise directed, in accordance with the relevant B.S Specification concerned.

For materials where no B.S. Specification exists, tests are to be made in accordance with the best modern commercial methods to the approval of the Engineer, having regard to the particular type of the materials concerned.

The Sub-contractor shall prepare specimens and performance tests and analyses to demonstrate conformance of the various materials with the applicable standards.

If stock material, which has not been specially manufactured for the plant and equipment specified is used, then the Sub-contractor shall submit satisfactory evidence to the Engineer that such materials conform to the requirements stated herein in which case tests of material may be partially or completely waived.

Certified mill test reports of plates, piping and other materials shall be deemed acceptable.

8.03 Manufactured Plant and Equipment – Work Tests

The rights of the Engineer relating to the inspection, examination and testing of plant and equipment during manufacture shall be applicable to the Insurance Companies or Inspection Authorities so nominated by the Engineer.

The Sub-contractor shall give two week's notice to the Engineer of the manufacturer's intention to carry out such tests and inspections.

The Engineer or his representative shall be entitled to witness such tests and inspections. The cost of such tests and inspections shall be borne by the Sub-contractor.

Six copies of all test and inspection certificates and performance graphs shall be submitted to the Engineer for his approval as soon as possible after the completion of such tests and inspections.

Plant and equipment which is shipped before the relevant test certificate has been approved by the Engineer shall be shipped at the Sub-contractor's own risk and should the test and inspection certificates not be approved, new tests may be ordered by the Engineer at the Sub-contractor's expense.

8.04 Pressure Testing

All pipework installations shall be pressure tested in accordance with the requirements of the various sections of this Specification. The installations may be tested in sections to suit the progress of the works but all tests must be carried out before the work is buried or concealed behind building finishes. All tests must be witnessed by the Engineer or his representative and the Sub-contractor shall give 48 hours notice to the Engineer of his intention to carry out such tests.

Any pipework that is buried or concealed before witnessed pressure tests have been carried out shall be exposed at the expense of the Sub-contractor and the specified tests shall then be applied.

The Sub-contractor shall prepare test certificates for signature by the Engineer and shall keep a progressive and up-to-date record of the section of the work that has been tested.

9. **Colour Coding**

Unless stated otherwise in the Particular Specification all pipework shall be colour coded in accordance with the latest edition of B.S 1710 and to the approval of the Engineer or Architect.

10. **Welding**
10.01 **Preparation**

Joints to be made by welding shall be accurately cut to size with edges sheared, flame cut or machined to suit the required type of joint. The prepared surface shall be free from all visible defects such as lamination, surface imperfection due to shearing or flame cutting operation, etc., and shall be free from rust scale, grease and other foreign matter.

10.02 **Method**

All welding shall be carried out by the electric arc processing using covered electrodes in accordance with B.S. 639.

Gas welding may be employed in certain circumstances provided that prior approval is obtained from the Engineer.

10.03 **Welding Code and Construction**

All welded joints shall be carried out in accordance with the following Specifications:

a) **Pipe Welding**

All pipe welds shall be carried out in accordance with the requirements of B.S.806.

b) **General Welding**

All welding of mild steel components other than pipework shall comply with the general requirements of B.S. 1856.

10.04 **Welders Qualifications**

Any welder employed on this Sub-contractor shall have passed the trade tests as laid down by the Government of Kenya.

The Engineer may require to see the appropriate certificate obtained by any welder and should it be proved that the welder does not have the necessary qualifications the Engineer may instruct the Sub- contractor to replace him by a qualified welder.

PART B:
PARTICULAR SPECIFICATIONS FOR
PLUMBING AND DRAINAGE

PARTICULAR PLUMBING AND DRAINAGE SPECIFICATIONS

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PARTICULAR PLUMBING AND DRAINAGE SPECIFICATIONS

2.1 GENERAL

This section specifies the general requirements for plant, equipment and materials forming part of the plumbing and drainage installations.

2.2 MATERIALS AND STANDARDS

2.2.1 Pipework and Fittings

Pipework materials are to be used as follows:

a) Galvanized Steel Pipework

Galvanized steel pipe work up to 65mm nominal bore shall be manufactured in accordance with B.S. 1387 Medium Grade, with tapered pipe threads in accordance with B.S. 21. All fittings shall be malleable iron and manufactured in accordance with B.S. 143.

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

Galvanized steel pipe work, 80mm nominal bore up to 150mm nominal bore shall be manufactured to comply in all respects with the specification for 65mm pipe, except that screwed and bolted flanges shall replace unions and couplings for the jointing of pipes to valves and other items of plant. All flanges shall comply with the requirements of B.S. 10 to the relevant classifications contained hereinafter under Section 'C' of the Specification.

Galvanizing shall be carried out in accordance with the requirements of B.S. 1387 and B.S. 143 respectively.

Copper Tubing

All copper tubing shall be manufactured in accordance with B.S. 2871 from C.160 'Phosphorous De-oxidized Non-Arsenical Copper' in accordance with B.S. 1172.

Pipe joints shall be made with soldered capillary fittings and connections to equipment shall be with compression fittings manufactured in accordance with B.S. 864.

Short copper connection tubes between galvanized pipe work and sanitary fittings shall not be used because of the risk of galvanic action.

If, as may occur in certain circumstances, it is not possible to make the connection in any way than the use of copper tubing, then a brass straight connector shall be positioned between the galvanized pipe and the copper tube in order to prevent direct contact.

P.V.C. (Hard) Pressure Pipes and Fittings

All P.V.C. pipes and fittings shall be manufactured in accordance with B.S. 3505: 1968.

Jointing

The method of jointing to be employed shall be that of solvent welding, using the pipe and manufacturer's approved cement. Seal ring joint shall be introduced where it is necessary to accommodate thermal expansion.

Testing

Pipelines shall be tested in sections under an internal water pressure normally one and a half times the maximum allowable working pressure of the class of pipe used. Testing shall be carried out as soon as practical after laying and when the pipeline is adequately anchored. Precautions shall be taken to eliminate all air from the test section and to fill the pipe slowly to avoid risk of damage due to surge.

A.B.S. Waste System

Where indicated on the Drawings and Schedules, the Sub-contractor shall supply and fix A.B.S. waste pipes and fittings.

The pipes, traps and fittings shall be in accordance with the relevant British Standards, including B.S. 3943, and fixed generally in accordance with manufacturer's instructions and B.S. 5572: 1978.

Jointing of pipes shall be carried out by means of solvent welding, the manufacturer's instructions and B.S. 5572: 1978.

Jointing of pipes shall be carried out by means of solvent welding. The manufacturer's recommended method of joint preparation and fixing shall be followed.

Standard brackets, as supplied for use with this system, shall be used wherever possible. Where the building structure renders this impracticable the Sub-contractor shall provide purpose made supports, centers of which shall not exceed one meter.

Expansion joints shall be provided as indicated. Supporting brackets and pipe clips shall be fixed on each side of these joints.

e) **PVC Soil System**

The Sub-contractor shall supply and fix PVC soil pipes and fittings as indicated on the Drawings and Schedules.

Pipes and fittings shall be in accordance with relevant British Standards, including B.S. 4514 and fixed to the manufacturer's instructions and B.S. 5572.

The soil system shall incorporate synthetic rubber gaskets as provided by the manufacturer whose fixing instructions shall be strictly adhere to.

Connections to WC pans shall be effected by the use of a WC connector, gasket and cover, fixed to suit pan outlet.

Suitable supporting brackets and pipe clips shall be provided at maximum of one metre centres.

The Sub-contractor shall be responsible for the joint into the Gully Trap on Drain as indicated on the Drawings.

2.2.2 **Valves**

a) **Draw-off Taps and Stop Valves (Up to 50mm Nominal Bore)**

Draw-off taps and valves up to 50mm nominal bore, unless otherwise stated or specified for attachment or connection to sanitary fitment shall be manufactured in accordance with the requirements of B.S.1010.

b) **Gate Valves**

All gate valves 80mm nominal bore and above, other than those required for fitting to buried water mains shall be of cast iron construction, in accordance with the requirements of B.S. 3464. All gate valves required for fitting to buried water mains shall be of cast iron construction in accordance with the requirements of B.S.1218.

All gate valves up to and including 65mm nominal bore shall be of bronze construction in accordance with the requirements of B.S. 1952.

The pressure classification of all valves shall depend upon the pressure conditions pertaining to the site of works.

c) **Globe Valves**

All globe valves up to and including 65mm nominal bore shall be of bronze construction in accordance with the requirements of B.S.3061.

The pressure classification of all globe valves shall depend upon the pressure conditions pertaining to the site of works.

2.2.3 **Waste Fitment Traps**

a) **Standard and Deep Seal P & S Traps**

Where standard or deep seal traps are specified they shall be manufactured in suitable non-ferrous materials in accordance with the full requirements of B.S. 1184.

In certain circumstances, cast iron traps may be required for cast iron baths and in these instances bath traps shall be provided which are manufactured in accordance with the full requirements of B.S.1291.

b) **Anti-Syphon Traps**

Where anti-syphon traps are specified, these shall be similar or equal to the range of traps manufactured by Greenwood and Hughes Limited, Deacon Works Littlehampton, Sussex, England.

The tradename for traps manufactured by this company is 'Grevak'.

2.2.4 **Pipe Supports**

a) **General**

This sub-clause deals with pipe supports securing pipes to the structure of buildings for above ground application.

The variety and type of support shall be kept to a minimum and their design shall be such as to facilitate quick and secure fixings to metal, concrete, masonry or wood.

Consideration shall be given, when designing supports, to the maintenance of desired pipe falls and the restraining of pipe movements to a longitudinal axial direction only.

The Sub-contractor shall supply and install all steelwork forming part of the pipe support assemblies and shall be responsible for making good damage to builders work associated with the pipe support installation.

The Sub-contractor shall submit all his proposals for pipe supports to the Engineer for approval before any erection works commence.

b) **Steel and Copper Pipes and Tubes**

Pipe runs shall be secured by clips connected to pipe angles, wall brackets, or trapeze type supports. 'U' bolts shall not be used as a substitute for pipe clips without the prior approval of the Engineer.

An approximate guide to the maximum permissible supports spacing in metres for steel and copper pipe and tube is given in the following table for horizontal runs.

Size Tube Nominal Bores	to B.S. 659	Copper Tube to B.S. 1387	Steel
15mm	1.25m	2.0m	
20mm	2.0m	2.5m	
25mm	2.0m	2.5m	
32mm	2.5m	3.0m	
40mm	2.5m	3.0m	
50mm	2.5m	3.0m	
65mm	3.0m	3.5m	
80mm	3.0m	3.5m	
100mm	3.0m	4.0m	
125mm	3.0m	4.5m	
150mm	3.5m	4.5m	

The support spacing for vertical runs shall not exceed one and a half times the distances given for horizontal runs.

c) Expansion Joints and Anchors

Where practicable, cold pipework systems shall be arranged with sufficient bends and changes of direction to absorb pipe expansion providing that the pipe stresses are contained within the working limits prescribed in the relevant B.S. specification.

Where piping anchors are supplied, they shall be fixed to the main structure only. Details of all anchor design proposals shall be submitted to the Engineer for approval before erection commences.

The Sub-contractor when arranging his piping shall ensure that no expansion movements are transmitted directly to connections and flanges on pumps or other items of plant.

The Sub-contractor shall supply flexible joints to prevent vibrations and other movements being transmitted from pumps to piping systems or vice versa.

2.2.5 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 B.S. Specifications.

2.2.6 Pipe Sleeves

Main runs of pipework are to be fitted with sleeves where they pass through walls and floors. Generally the sleeves shall be of P.V.C. except where they pass through the structure, where they shall be mild steel. The sleeves shall have 6mm – 12mm clearance all around the pipe or for insulated pipework all around the installation. The sleeve will then be packed with slag wool or similar.

2.3 **INSTALLATION**

2.3.1 **General**

Installation of all pipework, valves, fittings and equipment shall be carried out under adequate supervision from skilled staff to the relevant codes and standards as specified herein. The Sub-contractor shall be responsible to the Main Contractor for ensuring that all builders work associated with his piping installation is carried out in a satisfactory manner to the approval of the Engineer.

2.3.2 **Above Ground Installation**

a) **Water Services**

Before any joint is made, the pipes shall be hung in their supports and adjusted to ensure that the joining faces are parallel and any falls which shall be required are achieved without springing the pipe.

Where falls are not shown on the Contract Drawings or stated elsewhere in the Specification, pipework shall be installed parallel to the lines of the buildings and as close to the walls, ceilings, columns, etc., as is practicable.

All water systems shall be provided with sufficient drain points and automatic air vents to enable them to function correctly.

Valves and other user equipment shall be installed with adequate access for operation and maintenance. Where valves and other operational equipment are unavoidably installed beyond normal reach or in such position as to be difficult to reach from a small step ladder, extension spindles with floor or wall pedestals shall be provided.

Screwed piping shall be installed with sufficient number of unions to facilitate easy removal of valves and fittings, and to enable alterations of pipework to be carried out without the need to cut the pipe.

Full allowances shall be made for the expansion and contraction of pipework, precautions being taken to ensure that any force produced by the pipe movements are not transmitted to valves, equipment or plant.

All screwed joints to piping and fittings shall be made with P.T.F.E. tape.

The test pressure shall be maintained by the pump for about one hour and if there is any leakage, it shall be measured by the quantity of water pumped into the main in that time. A general leakage of 4.5 litres per 25mm of diameter, per 1.6 kilometres per 24 hours per 30 metres head, may be considered reasonable but any visible individual leak shall be repaired.

b) **Sanitary Services**

Soil, waste and vent pipe system shall be installed in accordance with the best standard of modern practice as described in B.S. 5572 to the approval of the Engineer.

The Sub-contractor shall be responsible for ensuring that all ground waste fittings are discharged to a gully trap before passing to the sewer via a manhole.

The Sub-contractor shall provide all necessary rodding and inspection facilities within the draining system in positions where easy accessibility is available.

Where a branch requires rodding facilities in a position to which normal access is unobtainable, then that branch shall be extended so as to provide a suitable purpose made rodding eye in the nearest adjacent wall or floor to which easy access is available.

The vent stacks shall terminate above roof level and where stack passes through roof, a weather skirt shall be provided. The Sub-contractor shall be responsible for sealing the roof after installation of the stacks.

The open end of each stack shall be fitted with a plastic coated or galvanised steel wire guard.

Access for rodding and testing shall be provided at the foot of each stack.

c) **Sanitary Appliances**

All sanitary appliances associated with the Sub-contract works shall be installed in accordance with the best standard of modern practice as described in C.P. 305 to the approval of the Engineer.

TESTING AND INSPECTION

2.4.1 Site Tests – Pipework Systems

a) Above Ground Internal Water Services Installation

All water service pipe system installed above ground shall be tested hydraulically for a period of one hour to not less than one and half times to design working pressure.

If preferred, the Sub-contractor may test the pipelines in sections. Any such section found to be satisfactory need not be the subject of a further test when system has been completed, unless specifically requested by the Engineer.

During the test, each branch and joint shall be examined carefully for leaks and any defects revealed shall be made good by the Sub-contractor and the section re-tested.

The Sub-contractor shall take all necessary precautions to prevent damage occurring to special valves and fittings during the tests. Any item damaged shall be repaired or replaced at the Sub-contractor's expenses.

b) Above Ground Soil Waste and Ventilation System

All soil, waste and ventilating pipe system forming part of the above ground installation, shall be given appropriate test procedures as described in B.S. 5572, 1972.

Smoke tests on above ground soil, waste and ventilating pipe system shall not be permitted.

Pressure tests shall be carried out before any work which is to be concealed is finally enclosed.

In all respects, tests shall comply with the requirements of B.S. 5572.

2.4.2 Site Test – Performance

Following satisfactory pressure test on the pipework system operational tests shall be carried out in accordance with the relevant B. S. Code of practice on the systems as a whole to establish that special valves, gauges, control, fittings, equipment and plant are functioning correctly to the satisfaction of the Engineer.

All hot water pipework shall be installed with pre-formed fibre glass lagging to a thickness of 25mm where the pipe runs above a false ceiling or in areas where the ambient temperature is higher than normal with the result that pipe "sweating", due to condensation will cause nuisance.

All lagged pipes which run in a visible position after erection shall be given a canvas cover and prepared for painting as follows:

- i) Apply a coating of suitable filler until the canvas weave disappears and allow to dry.
- ii) Apply two coats of an approved paint and finish in suitable gloss enamel to colors approved by the Engineer.

All lagging for cold and hot water pipes erected in crawlways, ducts and above false ceiling which after erection are not visible from the corridors of rooms, shall be covered with a reinforced aluminium foil finish banded in colours to be approved by the Engineer.

In all respects, unless otherwise stated, the hot and cold water installation shall be carried out in accordance with the best standard of modern practice and described in C.P.342 and C.P.310 respectively to the approval of the Engineer.

The test pressure shall be applied by means of a manually operated test pump or, in the case of long main or mains of large diameter, by a power driven test pump which shall not be left unattended. In either case precautions shall be taken to ensure that the required pressure is not exceeded.

Pressure gauges should be recalibrated before the tests.

The Sub-contractor shall be deemed to have included in his price for all test pumps, and other equipment required under this specification.

The test pressure shall be one and a half times the maximum working pressure except where a pipe is manufactured from a material for which the relevant B.S. specification designates a maximum test pressure.

2.5 **STERILISATION OF COLD WATER SYSTEM**

All water distribution system shall be thoroughly sterilised and flushed out after the completion of all tests and before being fully commissioned for handover.

The sterilisation procedures shall be carried out by the Sub-contractor in accordance with the requirements of B.S. Code of Practice 301, Clause 409 and to the approval of the Engineer.

PART C:

**PARTICULAR SPECIFICATION
FOR
PORTABLE FIRE EXTINGUISHER AND
HOSE REEL INSTALLATIONS**

PART C: PARTICULAR SPECIFICATION FOR PORTABLE FIRE EXTINGUISHERS AND HOSE REEL INSTALLATIONS

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PARTICULAR SPECIFICATIONS FOR PORTABLE FIRE EXTINGUISHER AND HOSE REEL INSTALLATIONS

3.1 GENERAL

The particular specification details the requirements for the supply and installation and commissioning of the Portable Fire Extinguishers and Boosted Hose Reel system. The Sub-contractor shall include for all appurtenances and appliances not necessarily called for in this specification or shown on the contract drawings but which are necessary for the completion and satisfactory functioning of the works.

If in the opinion of the Sub-contractor there is a difference between the requirements of the Specifications and the Contract Drawings, he shall clarify these differences with the Engineer before tendering.

3.2 SCOPE OF WORKS

The Sub-contractor shall supply, deliver, erect, test and commission all the portable fire extinguishers and Hose Reel which are called for in these Specifications and as shown on the Contract Drawings.

3.3 WATER/CO₂ EXTINGUISHERS

These shall be 9-litre water filled CO₂ cartridge operated portable fire extinguishers and shall comply with B.S. EN 3/BS 1449 and to the requirements of B.S.1004. Unless manufactured with stainless steel, bodies shall have all internal surfaces completely coated with either a lead tin, lead alloy or zinc applied by hot dipping. There shall be no visibly uncoated areas.

The extinguishers shall be clearly marked with the following:

Method of operation.

The words 'WATER TYPE' (GAS PRESSURE) in prominent letters.

Name and address of the manufacturer or responsible vendor.

The nominal charge of the liquid in imperial gallons and litres.

The liquid level to which the extinguisher is to be charged.

The year of manufacture.

A declaration to the effect that the extinguisher has been tested to a pressure of 24.1 bar (350 p.s.i.).

The number of British Standard 'B.S.' 1004 or B.S. 1449.

3.4 PORTABLE CARBON DIOXIDE FIRE EXTINGUISHERS

These shall be portable carbon dioxide fire extinguishers and shall comply with B.S. EN 3/BS 1449 and B.S. 1004.

The body of extinguisher shall be a seamless steel cylinder manufactured to one of the following British Standards; B.S. 401 or B.S. 1288.

The filling ratio shall comply with B.S. 5355 with valves fittings for compressed gas cylinders to B.S.341. Where a hose is fitted it shall be flexible and have a minimum working pressure of 206.85 bar (3000 p.s.i.). The hose is not to be under internal pressure until the extinguisher is operated.

The nozzle shall be manufactured of brass gunmetal, aluminium or stainless steel and may be fitted with a suitable valve for temporarily stopping the discharge if such means are not incorporated in the operating head.

The discharge horn shall be designed and constructed so as to direct the discharge and limit the entrainment of air. It shall be constructed of electrically non-conductive material.

The following markings shall be applied to the extinguishers:-

The words "Carbon Dioxide Fire Extinguisher" and to include the appropriate nominal gas content.

Method of operation.

The words “Re-charge immediately after use”.

Instructions for periodic checking.

The number of the British Standard B.S. 3326: 1960 or B.S. 5423.

The manufacturer’s name or identification markings

3.5 DRY CHEMICAL POWDER PORTABLE FIRE EXTINGUISHER

The portable dry powder fire extinguishers shall comply with BS EN 3/BS 1449 and BS 1004. The body shall be constructed to steel not less than the requirements of BS 1449 or aluminium to BS 1470 : 1972 and shall be suitably protected against corrosion.

The dry powder charge shall be not-toxic and retain its free flowing properties under normal storage conditions. Any pressurizing agent used as an expellant shall be in dry state; in particular compressed air.

The discharge tube and gas tube if either is fitted shall be made of steel, brass, copper or other not less suitable material. Where a hose is provided it shall not exceed 1,060mm and shall be acid and alkali resistant. Provision shall be made for securing the nozzle when not in use.

The extinguisher shall be clearly marked with the following information

The word “Dry Powder Fire Extinguisher”

Method of operation in prominent letters.

The working pressure and the weight of the powder charge in Kilogramme.

Manufacturers name or identification mark

The words “RECHARGE AFTER USE” if rechargeable type.

Instructions to regularly check the weight of the pressure container (gas Cartridge) or inspect the pressure indicator on stored pressure types when fitted, and remedy any loss indicated by either.

The year of manufacture.

The Pressure to which the extinguisher was tested.

The number of this British Standard BS 3465 or BS 5423: 1977.

When appropriate complete instructions for charging the extinguisher shall be clearly marked on the extinguisher or otherwise be supplied with the refill.

3.6 AIR FOAM FIRE EXTINGUISHER

These shall be of 9 litres capacity complete with refills cartridges and wall fixing brackets and complying with B.S. EN 3/BS 1449 and BS 1004 with the following specifications:-

Cylinder: To B.S. 1449

Necking: To be 76mm outside diameter steel EN 3A 2³/₄ X 8TPI female thread.

Head cap: To be plastic moulding acetyl resin.

CO2 Cylinder: To be 75gm P.V.C coated.

Internal Finish: To be polythene lining on phosphate coating.

External finish: To be phosphated - One coat primer paint and one coat stove enamel
B.S 381 C.

3.7 FIRE BLANKET

The fire blanket shall be made from cloth woven with pre-asbestos yarn or any other fire proof material and to measure 1800 x 1210 mm and shall be fitted with special tapes folded so as to offer instantaneous single action to release blanket from storing jacket to BS 1721.

3.8 BOOSTED HOSE REEL SYSTEM

3.8.1 General

The Particular Specification details the requirements for the supply, installation and commissioning of the hose reel installation. The hose reel installation shall comply in all respects to the requirements set out in C.O.P 5306 Part 1: 1976, B.S 5041 and B.S 5274. The System shall comprise of a pumped system.

3.8.2 Hose Reel Pumps

The fire hose reel pumps shall consist of a duplicate set of multi-line centrifugal pumps from approved manufacturers. The pumps shall be capable of delivering 2.3 lit/sec at a running pressure of 2.1 bar.

The pump casing shall be of cast iron construction with the impeller shaft of stainless steel with mechanical seal.

3.8.3 Control Panel

The control panel shall be constructed of mild steel 1.0mm thick sheet, be moisture, insect and rodent proof and shall be provided complete with circuit breakers and a wiring diagram enclosed in plastic laminate.

The pump shall be controlled by a flow switch therefore, the control panel shall include the following facilities:

‘On’ push button for setting the control panel to live.

Green indicator light for indicating control panel live.

Duty / Stand-by pump auto change over.

Duty pump run green indicator light.

Stand-by pump run green indicator light.

Duty pump fail red indicator light.

Stand-by pump fail red indicator light.

Low water condition pump cut-out with red indicator light.

The pumps are to be protected by a low level cut-out switch to prevent dry pump run when low level water conditions occur in the water storage tank.

3.8.4 Hose Reel

The hose reel to the installation shall consist of a recessed, swing-type hose reel as Angus Fire Armour Model III or from other approved manufacturers.

The hose reel shall comply with B.S EN 671-1:1995 and EN 694 and is to be installed to the requirements of C.P. 5306 Part 1: 1976.

The hose reel shall be supplied and installed complete with a first-aid non-kinking hose 30 metres long with a nylon spray / jet / shut-off nozzle fitted. A screw down chrome - plated globe valve to B.S 1010 to the inlet to the reel is to be supplied.

The orifice to the nozzle is to be not less than 4.8mm to maintain a minimum flow of 0.4 lit / sec to jet.

The hose reels shall be installed at 1.5 metres centre above the finished floor level in locations shown in the contract drawings.

3.8.5 Pipe Work

The pipe work for the hose reel installation shall be galvanised wrought steel tubing heavy grade Class C to B.S 1387: 1967 with pipe threads to B.S 21.

3.8.6 Pipe Fittings

The pipe fittings shall be wrought steel pipe fittings, welded or seamless fittings conforming to B.S. 1740 or malleable iron fittings to B.S 143.

All changes in direction will be with standard bends or long radius fittings. No elbows will be provided.

3.8.7 Non-return Valves

The non-return valves up to and including 80mm diameter shall be to B.S. 5153 : 1974.

The valves shall be of cast iron construction with gunmetal seat and bronze hinge pin.

3.8.8 Gate Valves

The gate valves up to and including 80mm diameter shall be non-rising stem and wedge disc to B.S 5154: 1974 with screwed threads to B.S. 21 tapes thread

Sleeves

Where pipe work passes through walls, floors or ceilings, a sleeve shall be provided one diameter larger than the diameter of the pipe, the space between them to be packed with mineral wool, to the Engineer's approval.

Earthing

The hose reel installation shall be electrically earthed by a direct earth connection. The installation of the earthing shall be carried out by the Electrical Sub- contractor.

Finish Painting

Upon completion of testing and commissioning the hose reel installation, the pipe work shall be primed and finish painted with 2 No. coats of paints to the Engineer's requirements.

Testing and Commissioning

The hose reel installation shall be flushed out before testing to ensure that no builder's debris has entered the system. The installation is to be then tested to one and half times the working pressure of the installation to the approval of the Engineer. Simulated fault conditions of the pumping equipment are to be carried out before acceptance of the System by the Engineer.

3.8.13 Instruction Period

The Sub-contractor shall allow in his contract sum for instructing of the use of the equipment to the Client's maintenance staff. The period of instruction may be within the contract period but may also be required after the contract period has expired.

The period of time required shall be stipulated by the Client but will not exceed two days in which time the Client's staff shall be instructed on the operation and maintenance of the equipment.

PART D:

**GENERAL SPECIFICATIONS
FOR
SOLAR WATER HEATING INSTALLATIONS**

PART D: GENERAL SOLAR WATER HEATING SPECIFICATIONS

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SOLAR HEATING SYSTEM

GENERAL SOLAR WATER HEATING SPECIFICATIONS

1.1.0 QUALITY OF MATERIALS AND WORKMANSHIP

1.1.1 General

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

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

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

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

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

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

The works shall be carried out strictly in accordance with:

- a) British Standard B.S. 5918, Domestic hot water supply and solar water heating system
- b) “British code of Practice” C.P. 310: Water Supply
- c) British Standard code of Practice” C.P. 342: Centralized Hot water supply
- d) All other relevant British standard Specifications and Codes of Practice (hereinafter referred to as B.S and C.P respectively.)
- e) By-Laws of the Local Authority
- f) The “Specification” and the “Particular Specification”
- g) The tender/working drawings
- h) The engineer’s Instructions.

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

1.1.2 Solar Panel – Construction

Solar panels shall be flat plate solar collectors. The structure of the collector and its components must withstand local extreme environmental conditions including winds, storm etc.

1.1.2.1 Solar Panel – External Construction

- a) Glazing material shall be transparent and non-reflective to solar radiation. Total surface heating area of the solar panel shall be as specified elsewhere. The top of the panel shall be a single transparent glazed glass sheet. The glazed glass shall be as low-iron tempered glass or equivalent. The thickness of the glazed glass shall be 3 mm. The glazing and the holding construction shall have thermal characteristics to withstand extreme local temperatures and also thermal shock due to storms etc. Gasket for the glazing shall be EPDM gasket or similar.

During accidental breakage of the glazing, the glazed glass sheet shall be replaceable at site.

- b) Solar panel collector casement shall be rigid, structurally sound and corrosion resistant. Sides and bottom of panel shall be 24 gauge galvanized mild steel sheet or 2mm aluminium sheet.

Galvanized mild steel sheet shall be etched primed and applied with two coats of approved oil-base paint. 4 mm to 6 mm breathing hole shall be provided on the galvanized mild steel casing for the removal of moisture content formed due to condensation within the panel.

- c) The panel/glass construction shall be weatherproof. Pipework joints and collector interconnection shall be water proof. Approved silicone gasket or similar to be used at the panel connections.

1.1.2.2 Solar Panel - Internal Construction

- a) **Absorber** - Shall be located directly beneath the glass sheet and fully cover the internal area of the panel. Absorber shall be made of copper sheet or aluminium with a selective surface chemically treated similar to the black chrome finish or similar. The selective surface shall achieve 95% absorptivity of solar radiation and 15 to 20% emissivity of infra-red radiation. The absorber and the selective surface shall not be affected during life span of the absorber.

- b) **Heat Exchanger**

Copper tubes and fittings shall be utilized for internal panel pipework and in accordance with B.S. 2871 or similar. All joints and connections between the riser and header tubings shall be leak proof and stand to hydraulic pressure tests.

The collector to be pressure tested to withstand a pressure of 8 kg/cm². whichever is greater. In general, collectors shall be pressure tested at 15 times the rated operating gauge pressure of 8kg/cm², which ever is greater.

A certificate of pressure testing to be issued when required and requested by the Engineers.

- c) **Insulation**

The underside of the absorber, inclusive headers and the outer casing internal sides shall be insulated with 50 mm fibre glass insulation, minimum density 64 kg/m³. The insulation shall be non-combustible and shall withstand maximum continuous operating temperature of 200°C (and minimum operating temperature of -50°C).

1.1.2.3 Hot Water Solar Cylinder

- a) The hot water solar cylinder shall have a nominal capacity as specified on the contract drawing and particular specification to the designed highest water level. The hot water cylinder shall have a separate feed tank attached to it.
- b) The cylinders and the feed tanks shall comply with B.S. 417, 699, 2777, 4214, 1565, 1566 and 3198. Refer also Water Storage tanks as specified elsewhere. The Cylinder and tanks shall be supplied complete with screwed BSPF parallel thread flanged connections for flow, return, vent, overflow and drain pipes.
- c) Cylinder shall be provided with a magnesium electrode as corrosion protection, weight: minimum 1.5 kg. and have an inspection cover to facilitate renewal of the electrode.
- d) The cylinder shall be galvanized, after manufacture in accordance with the requirements of BS. 729 Part 1 and pressure tested in accordance with the above B.S.A certificate of pressure testing to be issued when required and requested by the Engineers/Project Manager's Representative. Refer also to "Protection of Metal surface" as specified elsewhere in the specification.

- e) **Insulation**
The cylinder shall be insulated on all the sides with 100 mm fibreglass, or 100 mm thick foam injected polyurethane. At the inspection cover the insulation shall be easily removable.
- (f) **Cladding**
The insulation shall be fully laded with 24 gauge galvanized M.S. Sheet.

1.1.2.4 Flow and Return Pipework

Pipework shall be galvanized mild steel medium duty and in accordance with BS. 1387, and insulated as specified.

1.1.3 INSTALLATION

1.1.3.1 Solar panel

a) Location

The solar panel shall where physically possible be installed facing south. Where it is not practical for the solar panel to face due south, the maximum allowance variation shall be 45°.

b) Angle of Inclination

The solar panels for maximum efficiency should be fitted at an angle equal to the latitude of the installation area. Minimum angle of inclination should be 5°.

c) Solar panel shall be mounted on angle frame and rise to flow outlet according to manufacturer's specifications.

1.1.3.2 Solar Cylinder

a) For Standard Thermosyphon

The solar cylinder shall maintain a minimum horizontal distance of 300 mm above the highest point of the solar panel installation

b) For low Thermosyphon

The solar cylinder shall maintain a flow line up grade of 1:20 minimums where the low profile thermosyphon system is utilized.

1.1.3.3 Flow and Return Pipework

(a) Joints

All joints between ferrous and copper piping shall be made with dielectric pipe unions for the prevention of electrolytic corrosion.

(b) Penetration through Roof decking.

Where pipes penetrate the roof decking, they shall be provided with a sleeve that fits around the pipe making a weatherproof joint between roof and pipe.

(c) Insulation

All pipework between solar panel and storing tank to be insulated with 25 mm fibreglass where exposed to weather, covered with 24 gauges galvanized M.S. sheet cladding and weatherproofed.

All insulation for supply and return pipework in roof space shall be covered with cotton canvas.

All insulation shall be in accordance with BS. 1334 unless otherwise specified.

1.3.3.4 Drain, overflow and Vent Pipework

- (a) The drain and overflow pipework from the solar cylinder shall terminate approximately 75 mm away from the nearest drain outlet.
- (b) Vent pipe from the solar cylinder shall terminate approximately 150 mm over the top water level in the solar cylinder feed tank.
- (c) Provided drain valve for the solar panel. Drain valve shall be firmly clamped in order to avoid leaks at the joints during operation.

1.3.3.5 Valves

- (a) Copper alloy gate valves complying with BS.1952 shall be installed on flow and return pipework prior to it being connected to the solar cylinder.
- (b) The solar cylinder and panel shall be supplied with stop valves for draining and to comply with BS 1010.

1.3.3.6 Inter connection of solar panels

Shall be done utilizing Neoprene tubing or Stainless Steel connector or equivalent, fitted with clamps and able to withstand the working pressure.

1.3.3.7 Precaution

Solar panel glass shall be adequately protected against cracking and the protection removed only when the solar system is commissioned.

1.1.4 Alternate Solar Heating System

Should the contractor intend utilizing an alternate equivalent solar heating system to the one specified under this contract, he shall when submitting his tender provide the Engineer with all necessary information such as material used, construction detail, installation procedure etc. for his approval.

1.1.5 Test and Efficiency Certificates

The Contractor shall provide test and efficiency certificates for the solar panels proposed for the installation in accordance with methods outlined in ASHRAE 23-77.

Certificates for the following tests shall be provided:

1. No flow 30 day exposure
2. Peak exposure test
3. Solar collector Thermal Shock/Water spray test
4. Solar Collector Thermal Shock/Cold Fill test
5. Solar Collector leak and pressure test
6. Thermal efficiency/performance test.

The Contractor shall also provide documentary evidence regarding the absorber sheet, the selective coatings and its optical performances (absorptivity and emissivity factors).

1.1.6 Pipework above Ground

Before any joint is made, the pipes shall be hung in their supports and adjusted to ensure that the joining faces are parallel and any falls which shall be required are achieved without springing the pipe.

Where falls are not shown on the contract drawings or stated elsewhere in the specification, pipework shall be installed parallel to the lines of the building.

All water systems shall be provided with sufficient drain points and automatic air vents to enable them to function correctly. Valves and other user equipment shall be installed with adequate access for operation and maintenance.

Where valves and other operational equipment are unavoidably installed beyond normal reach or in such a position as to be difficult to reach from a short step ladder, extension spindles with floor or wall pedestals shall be provided.

Screwed piping shall be installed with a sufficient number of unions to facilitate easy removal of valves and fittings, and to enable alterations of the pipework to be carried out without the need to cut the pipe.

Full allowance shall be made for the expansion and contraction of pipework, precautions being made to ensure that any forces produced by pipe movements are not transmitted to valves, equipment or plant.

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

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

All tubing specified as fixed to ceilings, roofs or roof structures shall be fixed with approved mild steel hangers cut and pinned to ceilings, roofs or roof structures.

Where three or more tubes are fixed to the ceilings, roofs or roof structures close to each other, they shall be fixed in positions, which leave the lower surfaces at the same horizontal level, unless otherwise specified.

Tubes fixed to steel work shall be fixed with clips and tap screws.

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

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

Pipe runs shall be secured by pipe clips connected to pipe hangers, wall brackets or trapeze type supports. 'U' bolts shall not be used as a substitute for the pipe clips without prior approval of the Engineer.

An approximate guide to the maximum permissible supports spacing in meters for the steel and copper pipe is given in the following table for horizontal runs.

<u>Size</u> <u>Nominal Bores</u>	<u>Maximum support</u> <u>Spacing</u>
15mm	2.0m
20mm	2.5m
25mm	2.5m
32mm	3.0m
40mm	3.0m
50mm	3.0m
65mm	3.5m
80mm	3.5m
100mm	4.0m

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

The support spacing for vertical runs shall not exceed one and a half times the distances given for the horizontal runs.

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

Sleeves passing through the structure shall be of mild steel. Elsewhere they shall be of PVC. The sleeves shall have 5-15mm clearance all round the pipe, or for insulated pipework, all round the insulation. The sleeves shall be packed with slag wool or similar.

Unless anything else is stated in the specification, the tenderer must include in his tender for all protective and finish painting of the works including colour coding of special requirements, if any, are specified in the text of the particular specification. The painting shall be carried out by skilled painters.

1.1.6.1 Galvanised Mild steel Tubing

Galvanized mild steel tubing shall be in accordance with B.S 1387 with screwed and socketed joints.

Fittings for the same shall be galvanized malleable iron to B.S 143 & 1256 threads to BS 21.

Joints shall be made with fine hemp and an approved jointing compound or with Teflon sealing tape. Compound containing red lead must be used, unless otherwise specified.

All changes of direction shall be obtained by use of proper fittings. Formed bends shall not be accepted.

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Long screw connectors and flat-faced unions shall not be used, unless otherwise specified.

Where chased into walls or cast in concrete, galvanized mild steel tubing carrying hot water shall be wrapped with hair felt secured by copper wire.

The fixing of galvanized mild steel tubing shall be done using:

- a) Malleable iron "school board" pattern brackets for building in or screwing to structure or
- b) Malleable pipe rings, with either back plate, plugs or girder clips or
- c) Purpose made straps to Engineer's Approval.

1.1.6.2 Copper Tubing

Copper tubing shall be light gauge conforming to B.S. 2871 and the fittings shall be capillary or compression fittings to B.S. 864 of approved manufacture.

Joints on tubing up to and including 50 mm diameter, shall be compression or capillary joints or direct joints using zinc-free self-fluxing silver brazing alloys. Joints on tubing above 50 mm diameter shall be welded or brazed joints.

Copper tubing shall be jointed to steel cisterns by the use of copper-alloy connector having a shoulder to bear on the outside of the cistern and secured by a back nut inside. Washers shall be used both inside the cistern.

Where chased into walls or cast in concrete, copper tubing shall be wrapped with corrugated cardboard or hair felt secured by copper wire.

The fixing of copper tubing shall be done by using :-

- a) Copper-alloy holderbats for building in, or screwing to structure.

Or

- b) Strap clips of copper, copper-alloy or other suitable material.

Or

- c) Gunmetal holderbats similar to "YORKSHIRE",

Iron or steel supports shall not be used for copper tubing.

All bends and sets shall be formed without diminishing the internal diameter in any part or causing fracture or weakness of the tube walls.

1.1.6.3 Valves, Cocks, Taps Etc.

Gate Valves

All gate valves up to and including 65mm nominal bore and above, other than those required for fitting to buried water mains shall be of bronze construction in accordance with the requirements of B.S. 5154. The pressure classification of all gate valves shall depend upon the pressure conditions pertaining to the site of the works.

The pressure classification of all gate valves shall depend upon the pressure conditions pertaining to the Site of Works.

Globe Valves

All globe valves up to and including 65 mm nominal bore shall be of bronze construction in accordance with B.S. 2060.

All globe valve 80 mm nominal bore and above shall be of cast iron construction in accordance with the requirements of B.S. 3961.

The pressure classification of all globe valves shall depend upon the pressure conditions pertaining to the Site of Works.

Check or Non-Return Valves

All check or non-return valves up to and including 65 mm nominal bore shall be of the swing check type of bronze construction in accordance with B.S. 1953.

All check or non-return valves 80 mm nominal bore and above shall be of the swing check type of cast iron construction in accordance with the requirements of B.S. 4090.

The pressure classification of all check or non-return valves shall depend on the pressure conditions pertaining to the Site of work

Ball Float Valves

All ball valves for use in connection with hot and cold water services shall be of the Portsmouth type in accordance with the requirements of B.S. 1212, constructed from bronze or other corrosion resistant materials. These valves fall into three pressure classification as follows:-

- (i) Low pressure – 3.588 bar maximum
- (ii) Medium pressure – 7.725 bar maximum.
- (iii) High pressure – 12.620 bar maximum.

The pressure Classification required for each ball valve will be designated in the description of its associated equipment.

Safety Valves

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

Draw-Off Taps and Stop Valves (up to 50 mm nominal bore)

Draw-off taps and stop valves up to 50 mm nominal bore, unless otherwise stated or specified, for attachment or connection to sanitary fittings shall be manufactured in accordance with the requirements of B.S. 1010.

Mixing valves for shower fittings and other appliances shall be manufactured in accordance with the requirements of B.S. 1415 from bronze or other corrosion resistant materials.

1.1.6.4 Thermal Insulation

Insulation shall be installed by tenderer specializing in this type of work.

All primary hot (flow and return pipes) and secondary hot water and circulation pipes shall be insulated. Thermal insulating material for hot water supply insulation shall conform to B.S. 1334 unless otherwise specified. Materials shall have fire retardant qualities.

Insulation shall be fiberglass, minimum density 64 kg/m³. Premolded fittings shall be used, or if unavailable, metered sections or built-up blanket insulation shall be used.

Insulation shall be fastened in concealed locations with aluminium bands or soft annealed wires and shall be fastened in exposed locations with aluminium bands, 30 mm. (12 inches) o.c.

Each pipe item shall be insulated separately.

Insulation must be carried through or around hangers.

All insulating materials, however fixed, shall be in close contact with the surface to which it is applied and all joints shall be sealed after ensuring that edges or ends of any section built up close to one another. Edges or ends shall be cut or sharpened on site as necessary.

All surfaces to be insulated shall be cleaned carefully before fixing the insulating material. Whereby subject to outside weather or other potentially damp or wet conditions, the insulation shall be adequately protected against moisture pick-up with weatherproof jacketing. Elsewhere, the insulation shall be finished with open weave glass cloth and finish coats of adhesive or paint to approval.

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

All thermal insulating materials shall be delivered to the site in a dry condition and housed in a store until drawn upon for use. If nothing else is specified, the minimum thickness of insulating material for hot water pipes shall be 25 mm.

Equipment, such as tanks, shall be insulated with 50 mm fibre glass board and finished with open weave glass cloth and finish coats of adhesive or paint to approval.

1.1.7 Water Storage Tanks

1.1.7.1 Cold Water Storage Tanks

Where specified as galvanized mild steel, water storage tanks shall comply with B.S. 417. Galvanizing shall take place after manufacture.

Pressed steel sectional water storage tanks shall comply with B.S. 1564, and shall be similar in manufacture to "BRAITHWAITE".

Water storage tanks shall be mosquito proofed by means of well fitting bolted cover bedded on a thick gasket of felt or bitumen.

Overflow pipes from tanks shall discharge into air or floor gullies where nearby positioned, with splay cut ends mosquito proofed by means of wire gauze tightly bound on with stout galvanized wire or soldered on.

1.1.7.2 Thermal Storage Water Heaters

The pressure and low pressure types domestic electric water heaters shall comply with B. S. 843; high pressure types shall be of a Standard not less than the appropriate B.S.

Domestic heaters shall, if nothing else is specified, be supplied with 50 mm thick fibre glass lagging.

Electric thermostatically controlled immersion heaters shall comply with B.S. 3456: Section 2:21 and C.P. 324.202.

Purpose made storage water heaters of the specified size shall comply with B.S.853 and shall be to the specified working and test pressure. The heaters shall be provided with all necessary bosses, coils, etc. and shall be hot dip galvanised after manufacture.

1.1.7.3 Pressure Vessels

Pressure vessels shall be manufactured in accordance with B.S. 1500 A for the specified pressure and be fitted with all necessary openings and connections.

1.1.8 Protection of metal surfaces

Machinery, equipment, etc. shall be tropicalized and with protective treatment fully suitable for application and in the prevailing climatic conditions.

Full details of tropicalization and comprehensive paint treatments, to a dry film thickness of nowhere less than 200 microns, shall be submitted for the approval of the Consultant.

All metalwork shall be protected by either:-

- (a) Hot dip galvanizing; where painted treatment shall be 50 microns epoxy primer or 5-10 microns wash-primer; 30 microns modified alkyd undercoat and 30 microns enamel finish,

Or

- (b) Metallic lead epoxy primer, epoxy micaceous iron oxide, micaceous iron oxide modified alkyd undercoat and enamel finish, layers minimum 30 microns each.

Surfaces of metalwork shall be thoroughly brushed down with wire brushes to remove all scale, rust, etc., and structural steelwork shall be grit blasted before protective treatment.

All paint shall be applied fully in accordance with the manufacturer's instructions.

All water tanks inclusive covers, machinery casings, claddings and whosoever specified shall be protected by hot dip galvanizing.

Hot dip galvanized coatings shall be executed in accordance with British Standard BS 729.

The values for coating weight shall be as follows to B.S 729:-

5 mm thick and over - 610 to 630 g/m (87 –90 um)

Under 5 mm but not less than 2 mm - 460 to 490 g/m (66 – 70 um)

Under 2 mm but not less than 1 mm - 335 to 350 g/m (48 – 50 um)

Grey and malleable iron castings - 610 to 630 g/m (87 – 90 um)

Threaded work and other articles

which are centrifuged - 305 to 315 g/m (44 –45 um)

For conversion to coating thickness unit weight of zinc shall be assumed 7 g/cm³. The values stated shall be taken as minimum average values for a set of samples. Individual minimum values shall be introduced as the above mentioned minus 10%.

When galvanized coats are damaged, e.g. threaded pipe connections made on site, the exposed parts shall be repaired with same paints as for additional coating. Colour grey.

1.1.9 Instrumentation

Instrumentation shall be provided as indicated on the drawings and specified in the specifications.

Pressure gauges shall be installed on the pipe at both sides of pumps.

Pressure gauges shall be fitted with shutoff cock, read in the pressure range of system, minim 12 cm. (4 1/2 inch) dial, adjustable angle face, white face with black figures and pointer.

Thermometers shall be installed with separable sockets. Bronze sockets shall be used in nonferrous systems and stainless steel in ferrous systems.

Thermometers shall be mercury actuated, 12 cm (4 1/2 inch) dial, adjustable angle face with black figures and pointer.

Where recording thermometers are required, they shall have chart 25 cm.(10 inches) in diameter, shall operate with one pen on 24 hour charts, with a range 10°C to 105°C (50°F to 220°F).

1.2 COMMISSIONING AND MAINTENANCE

1.2.1 Commissioning and Testing

The tenderer for solar heating system shall be responsible for testing and commissioning of the solar installation. The testing and commissioning shall be done in the presence of the Engineer. The tenderer shall be held responsible for any damage to the builders work, during the installation, initial system testing etc.

When installation is completed, an acceptance test shall be carried out on the tenderer's own expense.

All hot water pipes, including flow and return, solar absorbers, cylinders, cisterns, tanks, calorifiers, pumps, etc. shall be thoroughly sterilized and flushed out after the completion of all tests and before being fully commissioned for handover.

The sterilization procedure shall be carried out by the tenderer or specialists employed by the tenderer in accordance with the requirements of B.S. Code of Practice 310, Clause 409, to the approval of the Engineer.

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

The whole of the solar heating installation shall be tested to the satisfaction of the Engineer and the Local Authority.

The tenderer shall provide all necessary testing apparatus and facilities for testing the installations and any defective work shall be replaced immediately and shall be the subject of re-testing until found satisfactory.

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

The complete solar heating installations, including flow and return pipes shall, if nothing else is specified, be tested to a cold water pressure of not less than 1.5 times the working pressure, minimum 8 kg/cm².

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

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

Valves, cocks and taps shall be absolutely tight under the test pressure for the corresponding pipes as well as under a small pressure.

Upon completion of the work, including re-testing if necessary, the installations shall be thoroughly flushed out and water pipes refilled with clean water ready for use.

Any defects revealed by the tests shall be made good by the tenderer and the test repeated to the approval of the Engineer.

In all other respects, test shall comply with the requirements of B.S. Code of Practice 304.

Following satisfactory pressure tests on the pipework system, operational tests shall be carried out in accordance with the relevant B.S. Codes of practice on the systems as a whole to establish that special valves, gauges, controls, fittings, equipment and plant are functioning correctly to the satisfaction of the Engineer.

1.2.2 Spare Parts

The tenderer shall submit with the tender a guarantee that he will hold a sufficient number of spare parts for the maintenance of the equipment.

If specific requirements for supply of spare parts are specified in the bill of quantities or schedule of prices, these spare parts shall be supplied to the client/employer, when the installations are handed over.

The tenderer shall submit with his tender a priced list of any optional extras, which he recommends should be purchased for the plants and are not supplied as standard with the unit.

1.2.3 Defects Liability and Contractual Maintenance Period

The tenderer shall maintain the complete installation in the total defects liability period and shall be responsible for the initiation and execution of the clients/employer planned programme of maintenance during this period.

During this maintenance period the tenderer shall carry out all necessary adjustments and repairs, cleaning and lubricating, ect. A report of any work shall be submitted to the Client and incorporated in the maintenance records.

The tenderer shall be held responsible for and shall make good all defects in materials that appear during the maintenance period; he shall supply expendable items, such as gaskets, filters, indicator lamps, etc. The period of liability shall not end until all defects which appear during the maintenance period have been rectified.

The tenderer shall allow in his Contract price for this maintenance and inspection service and shall provide for all tools, instruments, plant and scaffolding, and the transportation thereof, as required for the correct and full execution of these

obligations, and the provision, use or installation of all materials whether they are normal maintenance materials such as oils, greases, sandpaper, etc. and parts which are periodically renewed such as relay contracts or parts which are faulty for any reason whatsoever excepting always Acts of God such as a storm, tempest or flood, lightning and earthquake; civil revolt, acts of war and vandalism.

1.2.4 Maintenance Manual

Upon completion the tenderer shall furnish to the Client four copies of a manual size A4 of loose leaf type containing all the following items:-

- a. Description of equipment
- b. Full operation and maintenance instructions
- c. Valve operation
- d. Fault-finding chart
- e. Emergency procedure
- f. Maintenance and service periods
- g. Lubricating instruction
- h. Colour code legend
- i. Schedule of primary and secondary spares
- j. Record drawing – Folded to size A4.

The manual must be specially written and not standard manufacturers manual unless approved by the Engineer.

Tags giving instructions are not permitted. All instructions must be written into the manual with reference to the drawings.

All valves, terminals and controls on the plant shall be labeled to correspond with the maintenance and operation manuals.

1.2.5 Maintenance and Service After Expirations of the Contractual Maintenance Period

The tenderer shall if required, enter into a maintenance and service agreement with the employer for the complete installation, for a period of up to five years from the day of expiration of the contractual maintenance period.

The terms of any such agreement shall not be less beneficial to the Client, than the terms of agreement for other similar installations.

SOLAR WATER HEATING SYSTEM

2.0 TECHNICAL QUESTIONNAIRE

The following information shall be supplied by tenderer regarding the solar flat plate collectors proposed:

- 1. Manufacturer/Trade Mark
.....
.....

- 2. Construction Details of the Collector:
Aperture Dimensions & Area (m & m²)
.....
Gross Dimensions & Area (m & m²)
.....
Dimensions and Area absorbing surface (m & m²)
.....

- 3. Solar Panel
Collector Casement material
Thickness
Corrosion Treatment

- 4. Glazing
Material
Thickness
Physical Properties

- 5. Insulation
Material
Thickness (mm)
Thermal properties

- 6. Absorber
Material Absorber plate
Material for tubes for heat exchange
Selective Coating
Absorption Factor
Emissivity Factor

- 7. Solar Cylinder
Material
Thickness
Insulation Material
Thickness
Cladding Material

- 8. Normal Operating Temperature Range °C

9. Minimum and Maximum Transfer Fluid Flow
Rate kg/sec

10. Collector's Performance Efficiency:.....

11. WARRANTY:
The Sub-contractor shall state the equipment warranty period
.....

12, Any other alternative system. Give remarks on its difference to the one described. Additional paper to be attached if the text is much
.....
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PART E:

**TECHNICAL SPECIFICATION FOR AIR-
CONDITIONING &
MECHANICAL VENTILATION**

GENERAL SPECIFICATIONS FOR AIR-CONDITIONING & MECHANICAL VENTILATION

1.0 General

This section covers the supply and installation of ventilation and air-conditioning equipment and fittings.

The following specification is the General Specification for the Mechanical Ventilation sub-contract, and shall be read in conjunction with the Bills of Quantities, and the Drawings.

Where proprietary materials are specified, the sub-contractor may propose alternatives for the consideration of the Engineer, but the written approval of the Engineer must be obtained prior to the use of such an alternative.

The centrifugal fan type shall have blades of die-cast aluminum.

1.1 Supply Centrifugal Fan Unit

The Contractor shall supply, install, test and commission In-line centrifugal supply fan unit as set out in the equipment schedules shown in the end of this Specification.

The unit shall be selected to suit the type of roof structure on which it will be mounted all to the approval of the Engineer.

The unit shall be fully tropicalized for temperatures up to 50°C and relative humidity up to 100%.

A flat square wire guard shall be supplied to close off the opening in the gable where this is required.

Birds guards shall be provided to prevent entry of birds via air discharge openings.

Motor and fan, and housing shall all be suitably isolated with respect to vibration.

The motor shall be the totally enclosed type, single phase. It shall be metric, ball bearing, squirrel cage induction type, for direct on-line starting. All motors shall have Class F insulation, the motor ratings shall comply generally with B.S. 5000:1973 and IEC 34.1, with protection to IEC 34.5 Group IP54. The motors shall be provided with overheat protection. The motor bearings shall be prefabricated for 30000 hours running or five years' intermittent use. Where lubricators are fitted, the motors shall be re-lubricated after two years.

Unit to be capable of 2m³/sec against a total pressure drop of 200pa.

Fan to be as 'Woods' centrifugal at 1380rpm.

1.2 Filtration

The extract fan shall be fitted, on its upstream side, suitable filter complete with housing.

Panel or unit filters shall only be used up to air flow of 6m³/sec. Dry replaceable media types shall be used, and shall be sized according to the manufacturers' instructions. Advancement of the media shall be controlled by a pressure differential switch. Sizing of the unit shall be such that the media requires replacement approximately every six months.

2.0 **DUCTWORK**

2.1 **General Requirements**

The general Contractor shall prepare and submit detailed ductwork drawings to the Engineer for approval in accordance with Clause 1B.6 of this Specification.

All duct sizes indicated on the Drawings refer to inside dimensions.

Ductwork joints shall be square with all sharp edges removed.

Sheet metal shall be rigidly supported and braced to prevent vibration.

Ducts and hangers shall be installed straight, plumb and level.

Ductwork shall be routed directly with a minimum of directional changes and abrupt transition.

Adequate space shall be provided around ducts to ensure proper support and to allow the installation of the specified insulation.

Diverting vanes shall be installed at branches connected into the main duct without a neck.

Fairings shall be provided where pipes or structures penetrate ducts. When the fairing is longer than 500mm the original velocity shall be maintained. When the fairing is shorter than 500mm the velocity may be increased by not more than 10 percent.

Turning vanes shall be provided in elbows whose center lines radius is less than 150 percent of the duct width, or where indicated on the Drawings.

Duct bracing and supports indicated are the minimum acceptable.

Additional bracing or supports shall be installed to eliminate any distortion or vibration when the systems are either in operational or under test.

All connections between ductwork, including flexible connections, fittings and equipment, shall be made with gradually tapered transition fittings.

2.2 **Ductwork**

In general all HVAC ductwork, stack heads, register boots, supply air transitions, plenums etc., shall be galvanized steel metal of the gauges and construction hereinafter specified.

All ductwork shall be installed in compliance with the most recent editions of NFPA 90 and 90A and all relevant codes and ordinances. Transitions shall be fabricated with a combined angle not greater than 2.12.1.5 degrees.

Branch take-off fittings (top, bottom and side) shall be fabricated with a throat area equal to 1.5 times the cross sectional area of the branch duct.

All angular turns shall be made with a duct centre lines radius equal to 1.5 times the cross sectional area of the branch duct.

All angular turns shall be made with a duct centre line radius equal to 1.5 times the width of the duct. Were, due to space limitations, it becomes necessary to make turns with a shorter radius, air foil type turning vanes shall be used.

2.3 Galvanized Sheet Metal Ductwork

Where construction methods, sheet metal gauges, duct fabrication and installation techniques etc., are not specifically detailed herein or indicated on the drawings, such work shall be fabricated in strict accordance with the latest recommendation methods, gauges, procedures, etc., described in the most recent editions of the ASHRAE Guide and Handbook, the SMACNA Standards of Low/High pressure Ductwork and the DW/142.1 standard of HVACA 1982.1.

2.4 Specification

Duct shall be installed in accordance with the Drawings and the following HVAC, ASHRAE and SMACNA Specification.

REFERENCE	TITLE	SCOPE
HVAC Ref. No. DW/142.1	Specification for sheet metal and black medium and high pressure/velocity air systems.	Galvanized steel
DW/161	Code of practice for Recommendations for identification of air distribution systems	Methods of identification of source and destination of air, direction of flows classification by means of standard symbols.
DW/143	Practical guide to ductwork leakage testing	Leakage testing procedure.
SMACNA	Low/and high pressure duct	Construction Specification
ASHRAE	1983 Equipment Volume Duct Chapter 1-Duct Contraction.	construction

2.5 Materials:

Galvanized ductwork shall comprise strip mill cold-reduced sheet, continuously hot-dipped galvanized to BS 2.1989: Grade Z2.1 or Z3.

2.6 Protection:

Galvanized ductwork shall be protected by one coat of mordant solution or calcium plumbate primer followed by two coats of bituminous paint.

Galvanized ductwork in contact with aluminum sections(grilles etc), shall, before fastening to ducts, be protected with one coat of primer and two coats of zinc chromate paint.

All aluminum sections shall be anodized to BS 1615. Mild steel shall be protected by one coat of red oxide paint followed by two coats of bituminous paint.

Ductwork: Thickness, stiffening and spacing of supports.

The stiffening of ducts shall be provided by the types of cross joints indicated in the tables plus intermediate stiffeners

where necessary to comply with the spacing requirements.

An approved type of sealant shall be used on all cross joints.

Sheet thickness requirements are given in the following tables. In all cases the larger dimension determines the sheet thickness and stiffening. For plant connections, apparatus, casing and special applications (fire dampers etc), the next thickness of sheet up shall be used and additional stiffening shall be provided.

Rectangular - Low Velocity - Steel Duct Work

Maximum spacing between joints/stiffeners.

Minimum angle section for Intermediate Stiffeners	Length Nominal		Without	With Beading or cross-breaking (mm)	(mm) beading or cross-breaking (mm)
	(mm)	(mm)			
Up to 400		0.6	Unlimited	Unlimited	None
400-600		0.6	1500	Unlimited	2.15 x 2.15 x 3
601-800		0.8	1500	Unlimited	2.15 x 2.15 x 3
801-1000		0.8	12.100	1500	2.15 x 2.15 x 3
1001-1500		1.0	800	12.100	40 x 40 x 4
1501-2000		1.0	800	800	40 x 40 x 4
2001 - 3000		1.2.	600	50 x 50 x 5	

For ducts galvanized after manufacture

Upto 300	1.2	As equivalent sizes above
301 and over	1.6	As equivalent sizes above

2.7 Air Leakage:

The air leakage rate shall not exceed 1.53 liters per second per square metro of surface area for Class A positive, and leaks shall not be audible. The air leakage from a chosen test section shall be the proportion of the length of section under test to the total length of all ducts in the distribution system.

2.8 Air Leakage Test Procedure:

The HVAC Specification DW/143 sets out a method for testing which shall be employed by the Engineer. The Contractor shall be familiar with the testing method employed.

2.9 Protection and Cleaning

During construction all open ends of ductwork shall be covered with one layer of canvas.

All foreign materials shall be removed from the ducts and ductwork shall be cleaned inside and outside.

Ducts shall be cleaned before operating fans and filters. Fans shall not be operated unless filters are installed. After testing all cleanable filters shall be washed and renewable media shall be replaced.

2.10 Testing

After completion of the duct systems and before insulation is installed, the entire system shall be tested under operating conditions for performance and leakage.

Testing shall be carried out in the presence of the Engineer.

2.11 Volume Dampers

Volume control dampers shall be supplied and installed with locking levers and quadrants, indicating their position in main ducts and in all branch ducts supplying three or more air outlets and all fresh air intakes, and where shown on the Drawings.

Volume Control dampers shall be of the splitter, butterfly, or louver type. Damper blades shall be not less than eighteen gauge thick, reinforced with 2.15mm angles 3.2.1mm thick along unsupported sides longer than 300mm. Angles shall not interfere with the operation of the damper nor cause additional turbulence. Stops shall be angles of equal dimensions to the reinforcing angles. The maximum dimension of any damper blade shall be 800mm. Duct shall be stiffened at damper locations as necessary.

Door shall be supplied for access to all damper quadrants installed in ducts located in suspended ceilings etc. Location and detailed installation drawings shall be supplied for all access doors. Doors shall be attached to frames with concealed hinges. Locks shall be of the flush type, screw driver operated with bronze cams.

Upon completion of the ductwork, dampers shall be adjusted and set to deliver the amounts of air indicated on the Drawings.

2.12 Fire Dampers

Fire dampers shall be provided and fixed within the thickness of all fire barrier walls with a fire rating equivalent to the barrier. Each fire damper shall be operated by a fusible link set at 72.1 degrees C and fitted with an access door for inspection and replacement.

Details of the construction and operation of all fire dampers shall be submitted to the Engineer for approval before manufacture commences. Operation of all fire dampers shall be tested on Site after installation.

All fire dampers arranged to close by gravity shall be suitable weighted, arranged in the direction of the air flow and provided with an effective stop.

Fire dampers of the fire/shield curtain type, spring operated, shall also be permitted. The damper casing shall be completely airtight and of not less than 1.2.15mm thick galvanized sheet steel. The continuous series of ribbed interlocking blades shall be formed from not less than 0.8mm stainless steel and the spring shall be of not less than 0.2.15mm stainless steel.

The fire dampers shall comply with the Standards for safety UL555:1970, issued by the Underwrite's Laboratories inc., of the U.S.A.

2.14 Fusible Link Attachment

This shall consist of an adjustable, accessible, fusible link designed to melt at 72.1 degrees C, and attached to an opposed blade damper assembly, spring-controlled to close fully when the link melts. The link shall not

interfere with normal damper operation.

2.15 Turning Vanes

Turning vanes shall be fabricated of the same material as the ducts in which they are installed.

Turning vanes for low and medium pressure systems shall comprise 1mm (2.10 gauge) galvanized steel.

Turning vanes shall be either double vanes or shop fabricated turning vanes constructed to the same standard. Samples of shop fabricated units shall be submitted to the Engineer for approval.

2.16 Dissimilar Metals

Connections between dissimilar metals shall be avoided by dielectric insulation. Joints between dissimilar metal duct sections shall be formed with companion flanges separated by a compressed asbestos gasket.

All units, bolts, screws and other hardware used in the sheet metal construction shall be fabricated of materials identical or similar to the duct construction, to prevent galvanic corrosion.

2.18 Flexible Ducts

Flexible ducts connecting the low pressure duct system to the linear slot diffusers, shall consist of a continuous vinyl-coated, spring steel wire helix fused to, and supporting, a continuous layer of vinyl-coated fibreglass mesh. A 13mm thick insulating and sound attenuating blanket of fibreglass wool shall encase the duct, and be sheathed with a moisture barrier consisting of vinyl impregnated and coated fibreglass fabric. The materials shall be incombustible.

Flexible duct connections shall be effected in one continuous length, with a double ply cuff at each end secured to ductwork spigots by a worm drive screw clamp, as supplied by the manufacture to the flexible ducts.

2.19 Plenum Boxes

Plenum boxes shall be constructed from rigid 50mm by 5mm steel angle and 1.2.1mm thick galvanized sheet steel.

A hinged access door, at least 450mm, with quick-release fasteners, shall be provided in the side of each plenum box.

The sides, top and bottom of the plenum box shall be lined with 2.15mm thick rock wool or fibreglass insulation, neoprene coated and suitable for velocities up to 12.1m/sec. The lining shall be secured with an approved adhesive and pinned into place by means of nylon hangers, or similar, at 2.100mm centres.

2.20 Air Outlets

a) General Requirements.

All outlets shall be sealed around the edges to prevent air leakages.

Supply air with a velocity in excess of 0.2.15m or less above finished floor level. Room air shall be mixed with the primary air by induction to effect subsequent equalisation of the room temperature without stratification.

Where supply or return outlets are installed in a continuous line, intermediate frames and margins shall be omitted. Guides shall be provided for each element to ensure that adjoining lengths shall be mitred for full alignment.

With outlets used with fan coil units, the Contractor shall co-ordinate the outlet dimensions, arranged and pressure drop with the fan coil unit, to ensure that they will be compatible.

Unless shown otherwise on the Drawings air outlets in ceiling shall be provided with a finish to match the colour of the adjacent false ceiling; other air outlets shall be provided with a natural anodized aluminum finish, all to the approval of the Engineer.

b) Ceiling Mounted Supply/Return Linear Diffusers

The Contractor shall supply and install, in the location shown on the drawings, multi-slot supply and return linear diffusers.

These shall be similar to those manufactured by Martingale Technical Systems Limited, 2.10, St. John's Road, Penn, Bucks, HP10 8HW, England.

Tel. 0494813843/9, Tlx. 837012.1 MARGAL, Fax 0494815150. The slot diffusers shall be suitable for horizontal discharge by the adjustment of the blades. The diffusers shall be constructed of extruded aluminum with the from necessary fixings such as splice plates,

hugging clips and suspension brackets and care shall be taken to ensure the cross joins between the supply and return air diffusers. The supply diffusers shall be supplied with galvanized mild steel plenum boxes for connection to the ductwork system by way of side entry spigots.

Diffusers shall be of streamlined design, with a complete absence of abstraction in the air stream resulting in a low sound level rating. Diffusers shall be designed such that they may be balanced without the use of dampers, deflectors or return vanes.

The diffusers deflectors shall be fabricated from thermosetting plastic which is nonflammable. directionally stable and has a high resistance to cracking and blemishing. A metal back plate shall be provided for each diffuser.

The inlet spigot sizes shall be as shown on the drawings. The diffusers shall be provided with a hit and miss volume control, grid pattern air straightener and air deflection blades.

The diffusers shall be connected to the ductwork system by flexible ducting sized to suit the diameter of the entry spigots.

The selection shown on the drawings is for quotation purposes only and the Contractor shall check the air performance of the diffusers prior to placing any orders. The selection shall be based on the ceiling heights shown on the drawings and an air temperature differential (room minus air supply) of 11°C.

The noise rating in NC for a horizontal projection supply linear. Diffusers of one slot and 1800mm long shall not exceed 2.12.1NC when supplying 33 liters per second active metro.

The pressure drop with the damper in the 100 percent open position shall not exceed 15 Pa for the supply air.

c) Supply and Extract Air Registers

Each supply air register shall have two sets of separately adjustable louvres, (one set horizontal, the other vertical) and shall be complete with an opposed blade multi-leaf damper. The louvres and the volume dampers shall be constructed from extruded aluminum sections with a metallic aluminum finish to the approval of the Engineer.

Extract air registers shall be supplied and fitted as shown on the drawings and shall be similar to the supply air registers except that the rear set of blades shall be omitted. Registers shall be as manufactured by "WOODS" OF ENGLAND

d) Transfer Grilles

Transfer grilles shall be supplied and fitted as shown on the drawings. Grilles shall be fabricated from aluminum alloy inverted "V" louvre extrusions. They shall be of the non-vision type and of appearance to match the surrounding finishes, all to the satisfaction of the Engineer. The grilles shall be supplied with a telescopic frame permitting installation from 2.18 to 60mm thick. Transfer grilles installed on walls shall be double faced. These shall be manufactured by Trax.

e) Discharge Louvres

Exhaust louvres shall be white anodized aluminum unless indicated otherwise on the Drawings. Louvres shall be weatherproof, with fixed blades set at 30 degrees, and shall have a free area of 85 percent. These shall also be manufactures by Trax.

f) Intakes

Sand trap louvres shall be provided on all air intakes. The sand shall have an efficiency of 80 percent on the 2.10 to 2.100 micron test (AC coarse) dust distribution and 50 percent on the 1 to 70 micron test (AC fine) dust distribution. Louvres shall be of mill finish aluminum with 1.5mm thick lades and 2.1.0mm thick casing. Self emptying sand drain holes shall be provided. The air pressure drop through the louvres shall not exceed 30 Pa. Galvanized wire bird screens shall be provided on all intakes.

g) Accessories - Regulation and Distribution

At each supply diffuser, register and grille, the Contractor shall provide accessories to ensure a positive regulation of the air volume and a uniform distribution of the air flow over the entire outlet. The following shall be supplied as a minimum:

- Supply diffusers
- For distribution : an adjustable frame and blades.
- For regulation : an adjustable splitter or louvre blades
- Supply Grilles and Registers

The Contractor shall provide either lever-operated radium blades attached to a pivoting frame and mounting bracket, or individually adjustable blades in a gasketed frame mounted at the outlet, for each outlet, all to the approval of the Engineer.

h) Supply/Extract Square Ceiling Diffusers

The square supply diffusers shall be aluminum louvre-faced surface mounted, suitable for 4-way blow with integral opposed blade volume damper.

The Contractor shall check and make sure that the diffusers will fit in with the ceiling construction, particularly as to the edge flanged detail and overall size. They shall be as manufactured by Koolair.

3.0 Thermometers and Pressure Gauge.

3.1 General

Pressure gauges shall be mounted at the sensing point unless otherwise indicated.

The instrument shall be selected such that the normal range of operating temperatures and pressures falls within the middle-third of the instrument range. Compound gauges shall be employed when operating pressure is near or below atmospheric.

Temperature sensing devices shall be located in a portion of the fluid stream where it is possible to measure the average fluid temperature without obstructing the flow. Pipes of 42.1mm diameter and less shall be increased by at least one pipe size at the point of insertion.

Extension necks shall be provided where thermometers and pressure gauges are located in insulated piping, vessels, ductwork, casing and equipment.

3.2 Thermometers

Mercury-in-steel type thermometers, with a 100mm dial and a length of copper covered steel capillary tubing to connect the dial with the bulb, shall be supplied and installed as specified. Each thermometer shall be provided with a back flange or arranged for flush mounting.

Mercury-in-glass type thermometers with metal guard shall be supplied and installed as specified and as approved by the Engineer.

Unless otherwise specified, thermometer bulbs shall be of steel type, screwed 2.10mm NB British Standard pipe and supplied with stainless steel separable sockets suitable for screwing, brazing or welding into the pipe carrying the medium to be measured.

A red mark on each thermometer scale shall indicate the working temperature at the point of measurement.

3.3 Pressure gauge

Gauges shall be of the Bourdon tube type with a 115mm diameter cast iron, cast aluminum or steel case with moisture-proof and dustproof blowout discs. Panel mounted gauges shall have steel or aluminum hinged rings; direct mounted gauges shall have black numerals on a white background.

Bourdon Tube : Phosphor bronze, beryllium copper or stainless steel.

Socket : Stainless Steel.

Accuracy : Not less than 1% of scale range.

Gauges for combined pressure and vacuum services shall have a compound seal..

3.4 Sound Attenuation and Vibration Isolation Materials

3.5 Sound Attenuation

Where required by the Specification the supply and return air sheet metal ductwork each air handling unit and all plenum supply and return ducts, shall be lined internally on all four sides with 2.15mm thick glass fibre of density not less than 48kg/cu.m up to the walls of sound attenuation to reduce the noise emitted by the fans. The interlay clear dimensions of the duct complete with linear shall not less than the sizes indicated on the Drawings. The glass fibre lining shall be fixed to the sides of the duct using an approved adhesive and shall be secured by means of a galvanized perforated plate liner.

The ductwork shall also be thermally insulated on the outside.

The inside surface of the lined sections of ductwork shall be as smooth as possible so that the resistance to air flow is not appreciably greater than the unlined duct. All lined sections of ductwork shall be inspected and approved by the Engineer before erection on Site.

Where attenuation are fitted on the return supply sides of the units acoustic insulation may be omitted, provided that the noise transmitted by the plant does not exceed the space noise levels specified.

The attenuators indicated in the schedules are for quotation purpose only and the Contractor shall check and provide a detailed acoustic design for approval by the Engineer prior to the or ordering of any attenuator. The Contractor shall submit an acoustic analysis of the air-conditioning systems based on the proposed equipment and shall make any adjustments to the specified parameters. i.e. systems external resistance etc as may be required.

3.6 Equipment Isolation

All mechanical equipment, piping, duct, etc shall be mounted on or suspended from approved foundations or supports. All floor mounted equipment shall be erected on either a 100mm high reinforced concrete plinth or on steel beams. Where vibration isolation equipment is used the plinths or beams shall be extended to support the isolation system.

Vibration isolation systems shall limit the static deflections as required and indicated on the Drawings with a minimum isolation efficiency of 0.96. The vibration isolation system shall be installed in accordance with the manufacture's instructions. All vibration isolation systems exposed in the following manner; All steel parts shall be hot dipped galvanized; all bolt shall be cadmium plated and springs shall be cadmium plated and neoprene coated.

All of the above equipment, including mounting, hangers, structural steel bases, concrete formwork and flexible pipe connectors, shall be furnished by a single manufacturers of vibration isolation equipment.

3.7 Piping Isolation

All ceiling-suspended and floor-supported piping that is connected to mechanical equipment shall be isolated from the building structure for a distance of 15 metros from the equipment, in the following manner.

Ceiling-suspended piping shall be isolated by a combination of spring and neoprene-in-shear hangers. The first four hangers located adjacent to mechanical equipment, shall be capable of supporting the

pipng at a fixed elevation during installation irrespective of load changes.

Floor-supported piping shall be located on concrete plinths and shall be isolated by a heavy duty neoprene pad as indicated on the Drawings. Base elbows used to support piping risers shall be isolated by means of heavy duty neoprene pads.

3.8 Duct Isolation

All duct runs shall be isolated from the building structure for a distance of 16 metros from the mechanical equipment in the following manner. Ceiling-suspended duct work shall be isolated by double deflection neoprene-in-shear hangers. Floor-supported ductwork shall be isolated by double deflection neoprene-in-shear mountings. Thrust restraints which are similar to spring shall be installed to resist thrust caused by air pressure. The spring shall be selected for the same deflection as the equipment. All air handling equipment with a total static pressure of 750 Pa and above shall be isolated with flexible canvas or rubber duct connections together with thrust restraints.

3.9 Flexible Connectors

Flexible connectors shall be installed at the suction and discharge ends of all rotating mechanical equipment, including pumps, water chillers, and air handling units. The connectors shall be installed horizontally unless otherwise shown on the Drawings or approved by the Engineer. The pipe connectors shall be of the rubber hose or metal hose type with flanges suitable for the working pressure and temperatures of the respective systems.

3.10 Piping and Duct Penetrations

All piping and ducts which penetrate floor, walls and shafts shall have the gap between sleeves or timber frames sealed with fibrous materials and caulking to the approval of the Engineer, to prevent the transmission of airborne noise.

3.11 Attenuators

Each attenuator shall provide an insertion loss, under operating conditions, of not less than that indicated in the final acoustic design analysis, which is to be produced by the Contractor. Manufacturers shall specify the insertion losses expected from the attenuators offered. Under the operating conditions, and this information shall be derived from tests carried out in accordance with BS 4718:19971.

Each attenuator shall have a pressure loss at the design flow and temperature of not less greater than that shown in the Schedules. The manufacture's quoted pressure losses shall be derived from tests carried out in accordance with BS 4718:1971.

Each attenuator shall have a pressure loss at the design flow and temperature of not greater than that shown in the Schedules. The manufacturer's quoted pressure losses shall be derived from tests carried out in accordance with BS 4718:1971. Where the attenuator is known the supplier shall indicate the expected effect of turbulence due to adjacent duct elements on the quoted pressure losses.

Suppliers of attenuators shall provide, with the certified insertion loss data, information relating to the attenuator generated octave band sound power levels (12.15 kHz) at the operating conditions. The outer casing of all duct attenuators shall be constructed in accordance with the current HVCA ductwork specification. Unless otherwise indicated in the Schedule. the casing shall conform to the Medium & Low" pressure code in terms of its thickness, seams and materials.

All attenuators shall be fitted with drilled angle flange connections, unless alternative connections are

specified in the Schedules or instructed by the Engineer. Flanges shall conform to the relevant HVCA code or its equivalent.

Account elements in rectangular attenuators of height greater than or equal to 900mm shall incorporate fair leading and trailing edges (not square ends), and the inert, rot-proof and non-combustible mineral wool or glass fibre acoustic medium shall be packed to a density of not less than 48kg/m³ and retained by a perforated steel sheet facing. The manufacturer shall note any particular requirements, e.g. painting, special materials, etc., that are indicated on the schedules of Drawings. Splitter shall be constructed such that no ingress of acoustic medium shall occur into the gas stream under the operating conditions.

Where acoustic elements from splitters within the attenuator, the usual arrangements shall be with the splitters vertical and half-width splitter fixed to each side wall of the casing. However, it is the responsibility of the supplier to ensure that the parallel splitter elements in the attenuator are located near bends, bifurcations, etc. Horizontal splitters shall be suitable stuffed to prevent flexing and restriction of the airways.

For circular attenuators, all internal acoustic elements shall comprise mineral or glass fibre as the acoustic medium, as specified above for rectangular attenuators, retained by a perforated metal facing.

When attenuators are manufactured in modules, each unit shall be shop assembled and this Specification together with the manufacturer's own guarantee and performance rating, shall apply to the unit as a whole. Attenuator units shall be delivered to site with blocked ends to prevent ingress of rubble, etc. prior to installation, and to reduce the risk of damage the direction of airflow through the attenuator shall be clearly marked on the casing.

Attenuators for high temperature application (e.g. diesel or turbine exhausts, boiler flues, etc) shall have their casing manufactured from an approved gauge of sheet steel, and adequate precautions taken to cater for expansion and thermal shock. The internal elements and non-combustible mineral or glass fibre cloth behind the perforated metal facing. For every high temperatures, steel wool or equivalent materials shall be used as the acoustic medium.

Acoustic and aerodynamic requirements of the Specification re met. It is the Contractor's responsibility to ensure that the Engineer is advised of the actual sizes being offered where these differ from the Schedule.

3.12

Acoustic Weather Louvre

All acoustic weather louvres shall provide an insertion loss, under the operating conditions, of not less than that indicated in the relevant acoustic hardware schedules. In addition, the static pressure loss, under maximum operating duty, shall not exceed that shown in the Schedules.

The louvres shall be constructed from an appropriate gauge of galvanized mild steel, or aluminum, supporting louvre blades of like materials. The acoustic material in the blades shall have a density of 60-100kg/m³ and be inert, rot and vermin proof, non-hygroscopic and incombustible mineral fibre, faced with mineral fibre tissue and retained on the lower blade face by perforated galvanized mild steel or aluminum. When the louvres are manufactured in sections, each unit shall be shop assembled as a whole unit and this specification, together with the manufacture's own guarantee and performance ratings, shall apply to the unit as a whole.

Acoustic weather louvres shall be supplied with an integral bird screen of galvanized mild steel or aluminum mesh, fixed to its internal face. The mesh pitch shall be a maximum of 25mm. The louvres between the outside of the louvre frame and the wall or duct shall be made good and

sealed with a heavy duct ground an4/4/or a non-hardening, dense mastic.

4.0 Electrical Services

Suitably rated control panels shall be supplied and installed as part of this sub-contract to meet the starting and operating characteristics of the fan units.

The panels shall be either wall or floor mounted to suit the specific area and requirements. Power supplies to these panels shall be extended from adjacent isolating switches to be provided under the electrical services sub-contract. Complete co-ordination shall be maintained with the electrical services Contractor to ensure supply and termination details are satisfactorily carried out to suit the plant and installation requirements.

4.1 Motor Control Panels

All starters, control equipment and the like shall be enclosed in purpose made sheet panels. The panels shall be installed within the plant rooms to suit the dimensions of the actual panels. All details of the panels and layouts within the plant shall be to the approval of the Engineer and shall include:

- Triple pole isolating switch removable neutral link and HRC fuses.
- Control circuits fuses of the HR cartridge type.

- Under voltage release, adjustable and complete tower to allow for voltage associated with the KP & LC supply and motor starting.

- Over voltage protection, details to be agreed.

- Ammeter of the moving iron mounted on panel with selector switch.
- Pilot lamp, green.
- Rotary switch for HAN4/4/OFF/AUTO operation, where required.
Removable neutral link of heavy section copper.
- Motor winding over-temperature release. The Contractor shall provide this feature in conjunction with the specified thermistor protection.
- Duty selection switches.
- Manual stop-start button units to operate in conjunction with rotary switch.
- Hours run meter/counter.

The Contractor shall allow me to present for the contractor to reclose automatically on the restoration of the mains voltage. This requirement shall be subject to further discussion with the Employer to suit the standby Diesel plant and the mode of operation of essential and non-essential supplies.

All starter panels shall include sufficient miniature circuit breaker, with neutral bar, to supply auxiliary or associated equipment. One 30TP and one spare 155P MCBs shall be included as spares.

All starter panels, motor starters and controllers shall comply with BS 587. Enclosures shall be rigid, at least 1.6mm thick, with rolled corners stiffened as necessary, dust-proof, vermin-proof, damp and corrosion protected with a grey colour stone enamel or other approved finish, fully tropicalised, with washable air filters. Instruments, gauge, ammeters, indicator lamps, etc shall be flush mounted. Panel doors shall include isolating switches to prevent them being opened unless the switches are in the off position. Each door shall be provided with a lock, and three sets of keys for all panel door locks shall be handed over to the Engineer.

Terminal for all outgoing main and control cables shall be marked and positioned so that the cables may be carried to the outlet from the panel without crossing or being carried round the panel. Terminal numbers and markings shall correspond to those used on connected equipment and wiring diagrams. All internal

interconnecting wiring between individual units and the terminal chamber shall be carried out by the panel manufacturer.

Each panel shall be provided with a main isolator so that the whole panel may be completely isolated.

The sub-contractor shall determine all motor starter requirements and associated auxiliaries and controls prior to manufacture and shall submit the design and circuit diagrams to the Engineer for approval.

Contractor shall determine all motor starter requirements and associated and controls prior to manufacture and shall submit the design and circuit diagrams to the Engineer for approval.

Contractors shall be of air-break type BS 5424 part 1 an4/4/or BS 587, and shall be provided as follows:

- Magnetic blow-outs and air chutes on each pole.
- Renewable hard drawn copper contacts.
- Auxiliary contacts for remote control
- Continuously rated operating coils (Max 240V)
- Thermal overload protection device incorporating single phasing protection.

Starters shall be rated as follows.

Ordinary duty - For motors which will run continuously for periods in excess of two hours.

Intermediate duty - For motors under automatic control other than time control. When the intervals of operation are greater than two hours.

Starters shall be of the following types:-

- Up to and including 400W motor: Single phase on/off with overload protection.
- Over 3.75 kW and upto 15kW: Star Delta starter.
- For starters incorporating reduced voltages starting the changeover of voltage shall be automatic.

Terminals shall be accessible and shall be provided with adequate clearance between phases and between phases and earth. Where starters are not enclosed in a composite panel, an integral isolating switch as specified for control panels shall be provided. Where electric motors are either not visible from the control panel or are located more than 10m distance they shall be provided with a local lock-off stop control circuit switch, or a main circuit isolator where there is no control circuit. A weatherproof lock-off stop control circuit switch shall be provided for motors located externally or otherwise exposed to the weather.

4.2 Motors

Motors shall comply with BS 816 Part 1 and shall be arranged for conduit entry.

Motors shall be fitted with locating type bearings an4/4/or heavy thrust bearings at the non-drive end and collar type at the drive end. Motors shall be of the totally enclosed fan cooled type, tropicalised to BS 5000 Part 99 suitably finished to resist corrosion by fluid or fumes. The rating of all motors shall be chosen to provide continuously the maximum power requirements of the plant. The motors shall be of the standard induction type. They may be of the squirrel cage, horizontal or vertical spindle type of all to the approval of the Engineer.

Vertical spindle type motors shall be provided with substantial canopies of approved design.

The locked motor currents shall be stated on the name plate of each motor and shall be not more than six times the full load current.

Thermistors shall be fitted to all motors above 5kw. They shall be fitted during manufacture and their ends shall be brought out at additional terminals on the connector block of the motor.

All motors shall be rated 3 phases. 415 volt or single phase, 240 volt, high power factor continuous maximum rating complying with BS 5000 Part 99 and Class F insulating complying with BS 2757 unless otherwise specified. All motors larger than 400kw shall be three phase.

All three phase motors shall be supplied with six stud terminals with each end of the stator phase windings connected, terminals shall be of suitable size to accept the cable lugs of the feeding cables. Terminal blocks shall be mounted on the side of the motor case in an approved box complete with lid, gasket and tapped ET entry hole.

Rubber installation shall not be used on coil connections. Each motor shall be fitted with cable terminals and glands to accept the specified types of cable.

No motor shall run at a speed higher than 1500 rpm unless otherwise specified. Motors driving through Vee-belts shall be fitted with slide rails. The power factor shall be less than 0.9 lagging. All motors shall be from the same manufacturer as far as possible.

4.3 Cabling and Wiring

The Contractor shall carry out all power and control wiring including LV and ELV or any other voltage for the control equipment and alarm systems and interconnecting wiring between starter panels, remote control items, and motor units are required.

Cabling shall be carried out in PVC insulated, PVC sheathed, single wire armoured and PVC sheathed overall cable, using compression type glands provided with means of securing armoured wires within the body of the gland, under armour moisture seal and outer sheath seal.

Each core termination shall be fitted with a plastic ferrule engraved with an identification corresponding to the wiring diagrams.

Multicore control cables to the remote stop, start allow water cut-out/alarms shall be 0.62mm² PVC/SWAPVC where external to the pump station and PVC/PVC or similar, where internal. All cables, whether internal or external being suitably protected.

All conductors shall be copper and the installations, both internal and external being carried out in accordance with the regulations and by-laws previously stated. Trenching and the fixing of cables shall be in accordance with locally specified standards details of which have been specified within the sub-contract documents for the electrical services. These details can be made available upon request should the sub-contractor not be familiar with these requirements.

Details of the rating, types and methods for all cables and wiring to be supplied under this sub-contract shall be submitted with the tenders, wiring, PVC single core shall be run in either galvanized conduit or galvanized trunking of suitable sizes where surface in plant rooms and heavy gauge PVC were cast into walls, slabs etc.

4.4 Testing and Commissioning

The sub-contractor shall be responsible for testing and commissioning the air conditioning mechanical ventilation systems to ensure they are in proper working order to the satisfaction of the Engineer, all in accordance with the requirements set out below. A full test shall be carried out, and the following taken.

- (a) Volumes in all major ducts and for all extract diffusers and diffusers and supply grilles.
- (b) Noise rating in the above rooms, and from all mechanical ventilation fans.
- (c) Total flow rates for every mechanical ventilation system installed under this Contract.
- (d) Running current for each electric motor in amperes (recorded against the manufacturer's full load current).
- (e) Air static pressure differential across each fan, filter, coil etc.

The operation of all controls, safety devices, alarms and standby equipment shall be demonstrated in liaison with the electrical services Contractor.

SPECIFICATION FOR AIR CONDITIONING UNITS

5.0 General

This part of the sub-contract comprises the supply, delivery and complete installation of single split direct expansion units and a modular multi-system as outlined in the Bills of quantities.

The design data for the lift motor room is as follows:-

Mean ambient temperature:	:	28°c
Altitude	:	1750m above sea level
Room Temperature	:	23°c

5.1 Indoor Units

The indoor units shall incorporate a quiet cross-flow fan, liquid crystal display wired remote controller, air purifying filter employing static electricity to remove particles and Airflow direction louvers. All the controls shall be by use of microprocessor,

The unit shall have the following parameters:-

Cooling capacity:- as specified in the bills of quantities

Air Flow rate (High Speed): - as specified in the bills of quantities

Fan speed:- 3 speeds and Auto

Limiting Noise level 41 dB(A) at high speed.

The units shall be mounted as shown as per tender drawings. Condensate removed from the air shall drain into the drip pan and then drain by gravity through condensate drainpipe to the ground.

All units shall be as specified in the bills of quantities

5.2 Outdoor Unit

The unit shall comprise of several modules interconnected together and shall be running sequentially depending on the cooling load demands. The modules and their arrangement shall be as specified in the bills of quantities and shall be sized to match the indoor units.

The outdoor units shall have the following parameters: -

Sound level (limit) - 49 dB(A) at 1 meter

The modules shall be complete with integral isolator, compressors, condenser fans, LP/HP cut-outs, auto restart after power failure and weather proof.

5.7 **Components**

a) **Compressors**

These shall be rotary with three-phase motors having internal current/thermal overload device and pressure relief valve.

b) **Condenser**

These shall be forced-draught type with acrylic-dipped copper tubes mechanically expanded into aluminum fins spaced at approximately. 10 per 25mm.

c) **Fans**

These shall be of the forward curved centrifugal type and shall be made of aluminum, reinforced fibre or rigid plastic material.. The fan shall have variable speeds to enable the user to reduce both air volume and noise levels.

d) **Operating Controls**

These shall comprise an ON/Off switch, combined with fan speed controller and a compressor selector to give a range of options such as: off; fan only; fan & low cool, fan 7 high cool.

There shall be a bimetallic, single-pole single-throw (SPST) thermostat with sensing phial clipped in the return air stream behind the air filter. This shall cycle the compressor but the evaporator fan shall be unaffected as long as the unit is switched "ON".

e) **Safety Controls**

These shall comprise either externally or internally mounted compressor motor overloads, to safeguard against thermal or electrical overloads.

f) **Central Remote Controller.**

The controller shall be connected to the outdoor unit. The remote shall control the entire indoor units installed and shall be connected to the outdoor unit.

g) **Noise Level**

Fan and motor assemblies shall be complete with anti-vibration mountings and shall operate quietly, with the noise level at 1 metro not exceeding noise curve NR 49dB(A).

h) **Refrigerant piping**

The refrigerant piping shall be neatly installed and clipped on the wall. The pipes shall also be neatly boxed or put in a trunking to the approval of the engineer.

i) **Installation Requirements**

Suitable aperture and supporting frame to be fitted in a wall shall be made. The unit shall be properly balanced and supported in a manner that prevents noise or "drumming" regardless of the type of structure in which it is supported.

j) Mounting Brackets

The air-conditioners shall be held in position by two mounting brackets, fixed to the wall. The Contractor shall ensure that any damage to the wall is made good-inside and out around the frame, and repaint as necessary. The Contractor shall ensure that the unit is perfectly level from side to side and that from to back it is sloping slightly to the rear of the baseplate.

k) Power Supply

The power point serving the system shall be as close as possible to the modules and slightly lower to the side on which the power cable enters the front of the chassis and of the fused switch type.

With the indoor air filters in place, the power supply shall be switched on to start the unit working steadily through the full operating sequence permitted by the controls. The Contractor shall ensure that the control switch operates in every position which can be selected.

l) Testing and Commissioning

The sub-contractor shall test and commission the unit to the entire satisfaction of the Engineer and the Employer. In particular he shall check the full load amperage drawn using a clip-on ammeter to confirm that this does not exceed values shown on the nameplate. The sub-contractor shall adjust the supply air grille to produce effective distribution throughout the room, free from draughts and pockets of stagnant air. Control knobs shall be checked and confirmed to be tight. The differential between the temperatures of the air entering the return grille and that leaving the discharge grille shall be ascertained to be what the manufacturer recommends.

The Contractor shall produce operation and maintenance manuals to be given to the Engineer for onward transmission to the Employer.

m) Maintenance Contract

The contractor shall provide all necessary technical brochures and operation manuals to the Client upon completion of works. He shall also quote for maintenance of these units after the 6 months liability period is over.

The scope of maintenance works shall include but not be restricted to all normal servicing of the unit which shall be carried out as stipulated in the maintenance contract agreement to be entered between the Client and the Contractor.

PART F:

BILLS OF QUANTITIES

PART D: BILLS OF QUANTITIES

CLAUSE NO.	DESCRIPTION	PAGE
1.	GENERAL NOTE TO TENDERERS	E/3
2.	STATEMENT OF COMPLIANCE	E/4

1. General Note to Tenderers

- 1.1 The total of the prices in the summary of prices shall include for the whole of the Contract works in accordance with the specifications as defined before and shall be carried forward to Form of Tender.
- 1.2 Any prices omitted from any item, section or part of the price schedule shall be deemed to have included in another item, section or part.
- 1.3 The prices shall include for all obligations under the Contract including and not limited to:
 - a) Supply of any materials, equipment, apparatus, fittings, spares and tools
 - b) Insurance
 - c) Clearing and forwarding
 - d) Delivery, handling and storage at site
 - e) Packing for storage
 - f) Replacing any defective or damaged item
 - g) Installation
 - h) Testing
 - i) Painting
 - j) Commissioning
 - k) Maintenance during the defects liability period
- 1.4 The unit rates shall include import duty and VAT where applicable, and shall be expressed in Kenya Shillings.
- 1.5 Any tenderer whose firm uses the title “Engineer” or “Engineering” must provide evidence of registration of at least one of the directors by the Engineers Registration Board of Kenya to avoid disqualification.
- 1.6 Any tenderer who fails to price the General items will be deemed to have allowed 5% of his tender price to cover these items.

2. **Statement of Compliance**

- a) I confirm compliance of all clauses of the General Conditions, General Specifications, Particular Specifications, Technical Specifications in this tender.
- b) I confirm I have not made and will not make any payment to any person, which can be perceived as an inducement to win this tender.

Signed:*for and on behalf of the Tenderer*

Date:

Official Rubber Stamp:

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
A	Water Closet - Pan				
i)	Water Closet - Pan as IDEAL STANDARDS, white in colour. Complete with seat and cover, outlet connector and all other necessary fixing accessories. or equal and approved	20	NO.		-
	Water Closet - Flush Valve				
ii)	Water Closet - Flush Valve as DOCOL: Dual Flush Escutcheon Plate: C.P #00449506, chrome finish face plate. Complete with back entry flush pipe inlet connectors, and all other necessary fixing accessories. or equal and approved	20	NO.		-
B	Toilet Roll Holder				
	Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	22	NO.		-
C	Robe / Coat Hook				
	Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	22	NO.		-
D	Wash Hand Basin				
i)	Countertop wash hand basin as IDEAL STANDARDS, nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	24	NO.		-
	Wash Hand Basin Tap				
iii)	Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	24	NO.		-
E	Mirror				
i)	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	24	NO.		-
ii)	Plain size bevelled 6mm thick glass plate mirror size 2000 x 800mm. Complete with foam lining and dome headed chrome plated fixing Screws	2	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Soap Dispenser				
F	Wall mounted soap dispenser as "Mediclinics DJ0111C" with a capacity of 1.1L and in AISI 304 Stainless Steel material, having a press action soap release mechanism complete with fixing screws. Allow for initial soap supply. or equal and approved.	10	NO.		-
	Paper Dispeser				
G	Paper Dispeser as "Mediclinics DT2106CS" in AISI 304 Stainless Steel material, with a capacity of 400-600 C/Z towels. or equla and approved	10	NO.		-
	Automatic Hand Drier				
H	Automatic hand drier as "Mediclinics M09ACS" in AISI 304 Stainless Steel material, operating on an infra-red automatic sensing system with heating element safety cut-out complete with a 30 seconds safety timer. or equal and approved.	10	NO.		-
	Cleaner's Sink				
I	Cleaners sink with bucket grating, 580 x 400 x 200mm, as "Associated Steel Limited" in Stainless Steel. Complete with traps and fixings, and a ½ inch single back inlet wall mounted Bibtap as "Twyford SF2302CP" with chrome finish. or equal and approved.	2	NO		-
	Urinals				
J					
i)	Urinal bowl as IDEAL STANDARDS, in Vitreous China with fixings. Complete with fixing accessories. or equal and approved.	12	NO		-
ii)	Urinal wall mounted division as IDEAL STANDARDS, white in colour in Vitreous China, complete with fixings accessories. or equal and approved.	12	NO		-
ii)	Urinal Automatic Flushing Senor fitting as TAPIS: Infra Red Electronic Urinal Flushvalve, AC & DC; #MC-8512, to be connected with concealed connector pipe and spray rose. c/w all necessary fixing accessories. or equal and approved.	12	NO		-
	Accessible / PWD Toilet				
K	Accessible / PWD Toilet as "Twyford AVALON DOC.M VALUE PACK", wheel chair accessible WC facility with Doc.M value cistern, fittings and standard lever - 6 litre flush, Doc.M seat ring, stainless steel hinge, Doc.M handrinse basin, 2 tap including fixings, tap hole stopper for handrinse basin, spray mixer lever operated tap, 5 Doc.M support rails, pan fixings and cistern cover clips. Complete with all outlet connectors and traps. or equal and approved.	2	NO		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS</p> <p>COLD WATER SUPPLY</p> <p>Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	100	LM		-
		72	LM		-
		56	LM		-
		38	LM		-
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	72	NO.		-
		62	NO.		-
		42	NO.		-
		28	NO.		-
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	72	NO.		-
		62	NO.		-
		42	NO.		-
		28	NO.		-
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	54	NO.		-
		36	NO.		-
		28	NO.		-
		28	NO.		-
		28	NO.		-
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	68	NO.		-
		50	NO.		-
		50	NO.		-
		50	NO.		-
		50	NO.		-
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PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
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PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	48	NO.		-
	b) 32mm ditto	48	NO.		-
	c) 40mm ditto	24	NO.		-
	d) 50mm ditto	24	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	24	NO.		-
	b) 32mm ditto	24	NO.		-
	c) 40mm ditto	16	NO.		-
	d) 50mm ditto	16	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	12	NO.		-
	b) 32mm ditto	16	NO.		-
	c) 40mm ditto	6	NO.		-
	d) 50mm ditto	6	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	60	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 5,000 litres diameter 2,050mm and 1,850mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	2	NO.		-
K	Water Meters				
	32mm diameter water meter as "Kent". or equal and approved.	1	NO		-
L	Meter Chamber				
	Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
M	Sterilization				
	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	48	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	136	LM		-
	c) 50mm ditto	68	LM		-
	d) 40mm Ditto	56	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	28	NO.		-
	b) 40mm ditto	36	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	10	NO.		-
	b) 40mm ditto	38	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	6	NO.		-
	b) 100 x 40mm ditto.	4	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	8	NO.		-
	b) 40mm diameter inspection plugs	15	NO.		-
F	100mm diameter vent cowl	4	NO.		-
G	100mm diameter Water Closet connectors	20	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	12	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	1	NO.		-
J	100mm diameter gully trap complete with chamber and cover.	5	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	8	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
IV	FIREFIGHTING INSTALLATIONS				
	<u>HOSEREEL SYSTEM</u>				
	Supply, install, test and commission the following equipment and fitting as described:- Tenderers must allow in pipework prices for all couplings, union, nipples, sockets, connectors, joints etc. in running lengths of pipes and also where necessary for fixing clips, holderbats plugged and screwed.				
A	Hosereel System Pipework				
	i) 25mm diameter pipe GMS Class B to BS 1387	32	LM		-
	ii) 50mm ditto	56	LM		-
B	Elbows				
	i) 25mm elbows malleable iron galvanized.	4	NO.		-
	ii) 50mm ditto.	8	NO.		-
C	Tees				
	50mm diameter malleable iron tee	12	NO.		-
D	Reducers				
	i) 25 x 20mm malleable galvanized iron reducing bush	4	NO.		-
	ii) 50 x 25 mm ditto	4	NO.		-
E	Valves				
	i) 25mm bronze gate valve to BS 5154	2	NO.		-
	ii) 50mm ditto.	4	NO.		-
	iii) 25mm air relief valve screwed as CRANE.	2	NO.		-
F	Hosereels				
	Swinging type hosereel complete with 30m long hose of 20mm diameter, 25mm internal diameter rubber fire hose with nylon spray/jet and shut off nozzle, and mounting brackets conforming to BS 5274	2	NO.		-
G	Hosereel Pipework Painting				
	Wire brush, clean and paint complete installation with one coat of red oxide primer, under coat and gloss coat including banding and colour coding to British standards	1	ITEM		-
H	Hose Reel Pumps				
	Fire Hose Reel Pump set (2 No. Pumps - Duty & Standby) with a capacity of 2m ³ /hr at 2 Bar c/w control panel as NAFFCO or approved equivalent.	1	SET		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
I	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	2	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	2	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	<p>RAIN WATER DRAINAGE Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.</p>				
A	100mm diameter uPVC Grey pipe (heavy duty)	100	LM		-
B	100mm diameter uPVC sweep bend	25	NO.		-
C	100mm diameter Aluminium Fulbora	25	NO.		-
D	100mm diameter uPVC discharge shoe	25	NO.		-
E	100mm diameter uPVC puddle flange	25	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
A	Water Closet - Pan				
i)	Water Closet - Pan as IDEAL STANDARDS, white in colour. Complete with seat and cover, outlet connector and all other necessary fixing accessories. or equal and approved	6	NO.		-
	Water Closet - Flush Valve				
ii)	Water Closet - Flush Valve as DOCOL: Dual Flush Escutcheon Plate: C.P #00449506, chrome finish face plate. Complete with back entry flush pipe inlet connectors, and all other necessary fixing accessories. or equal and approved	6	NO.		-
	Toilet Roll Holder				
B	Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	8	NO.		-
	Robe / Coat Hook				
C	Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	8	NO.		-
	Wash Hand Basin				
i)	Countertop wash hand basin as IDEAL STANDARDS, nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	6	NO.		-
ii)	Wall Hung wash hand basin as IDEAL STANDARDS, c/w Semi-Pedestal, of nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	2	NO.		-
	Wash Hand Basin Tap				
E iii)	Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	8	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Mirror				
i)	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	10	NO.		-
ii)	Plain size bevelled 6mm thick glass plate mirror size 2,000 x 800mm. Complete with foam lining and dome headed chrome plated fixing Screws	2	NO.		-
G	Soap Dispenser Wall mounted soap dispenser as "Mediclinics DJ0111C" with a capacity of 1.1L and in AISI 304 Stainless Steel material, having a press action soap release mechanism complete with fixing screws. Allow for initial soap supply. or equal and approved.	10	NO.		-
H	Paper Dispeser Paper Dispeser as "Mediclinics DT2106CS" in AISI 304 Stainless Steel material, with a capacity of 400-600 C/Z towels. or equla and approved	6	NO.		-
I	Automatic Hand Drier Automatic hand drier as "Mediclinics M09ACS" in AISI 304 Stainless Steel material, operating on an infra-red automatic sensing system with heating element safety cut-out complete with a 30 seconds safety timer. or equal and approved.	4	NO.		-
J	Cleaner's Sink Cleaners sink with bucket grating, 580 x 400 x 200mm, as "Associated Steel Limited" in Stainless Steel. Complete with traps and fixings, and a Bibtap, ½ inch, as TAPIS: Long neck wall type Bib Tap, Ref No. 11062G9 with chrome finish. or equal and approved.	1	NO		-
K	Urinals				
i)	Urinal bowl as IDEAL STANDARDS, in Vitreous China with fixings. Complete with fixing accessories. or equal and approved.	3	NO		-
ii)	Urinal wall mounted division as IDEAL STANDARDS, white in colour in Vitreous China, complete with fixings accessories. or equal and approved.	2	NO		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
iii)	Urinal Automatic Flushing Senor fitting as TAPIS: Infra Red Electronic Urinal Flushvalve, AC & DC; #MC-8512, to be connected with concealed connector pipe and spray rose. c/w all necessary fixing accessories. or equal and approved.	3	NO		-
	Accessible / PWD Toilet				
L	Accessible / PWD Toilet as "Twyford AVALON DOC.M VALUE PACK", wheel chair accessible WC facility with Doc.M value cistern, fittings and standard lever - 6 litre flush, Doc.M seat ring, stainless steel hinge, Doc.M handrinse basin, 2 tap including fixings, tap hole stopper for handrinse basin, spray mixer lever operated tap, 5 Doc.M support rails, pan fixings and cistern cover clips. Complete with all outlet connectors and traps. or equal and approved.	2	NO		-
	Shower Fittings				
M	Chrome plated shower knob as COBRA, to be connected to concealed pipework, and instantaneous water heater, suitable for salty and hard water as LORENZETTI. or equal and approved.	5	NO		-
	Towel Rail				
N	Towel Rail Bar, 650mm as DALI, Ref. No. TMA11, chrome finish. or equal and approved	5	NO.		-
	Soap Tray Holder				
O	Soap Tray Holder as TWYFORD "VC9808WH" white in colour and in Viterous China. Recessed into wall. Or equal and approved	5	NO.		-
	Doc M Compliant Shower Seat				
P	Folding shower seat with back support, for Doc.M compliant showering Polyester coated aluminium frame with vinyl seat AND White in colour fixed to solid wall with appropriate fixings as "TWYFORD AV8800WH".	1	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS</p> <p>COLD WATER SUPPLY</p> <p>Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	120	LM		-
		88	LM		-
		68	LM		-
		46	LM		-
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	88	NO.		-
		74	NO.		-
		50	NO.		-
		32	NO.		-
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	88	NO.		-
		74	NO.		-
		50	NO.		-
		32	NO.		-
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	64	NO.		-
		42	NO.		-
		32	NO.		-
		32	NO.		-
		32	NO.		-
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	80	NO.		-
		60	NO.		-
		60	NO.		-
		60	NO.		-
		60	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	56	NO.		-
	b) 32mm ditto	56	NO.		-
	c) 40mm ditto	30	NO.		-
	d) 50mm ditto	30	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	30	NO.		-
	b) 32mm ditto	30	NO.		-
	c) 40mm ditto	18	NO.		-
	d) 50mm ditto	18	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	6	NO.		-
	b) 32mm ditto	6	NO.		-
	c) 40mm ditto	4	NO.		-
	d) 50mm ditto	4	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	22	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 5,000 litres diameter 2,050mm and 1,850mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	2	NO.		-
K	Stand Pipe				
	15mm diameter hose bib tap suitable for connecting hose pipe complete with threaded adaptors. The tap to be complete with 1meter long 20mm diameter GMS pipe class B, bends support, etc. The chrome plated bib tap to be as Cobra ref.108 hose bib taps or equal and approved.	4	NO.		-
L	Water Meters				
	32mm diameter water meter as "Kent". or equal and approved.	1	NO		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
M	Meter Chamber Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
N	Sterilization Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	32	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	330	LM		-
	c) 50mm ditto	80	LM		-
	d) 40mm Ditto	85	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	64	NO.		-
	b) 40mm ditto	42	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	64	NO.		-
	b) 40mm ditto	42	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	40	NO.		-
	b) 100 x 40mm ditto.	42	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	12	NO.		-
	b) 40mm diameter inspection plugs	28	NO.		-
F	100mm diameter vent cowl	12	NO.		-
G	100mm diameter Water Closet connectors	6	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	28	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	14	NO.		-
J	100mm diameter gulley trap complete with chamber and cover.	27	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	18	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
IV	FIREFIGHTING INSTALLATIONS				
	<u>HOSEREEL SYSTEM</u>				
	Supply, install, test and commission the following equipment and fitting as described:- Tenderers must allow in pipework prices for all couplings, union, nipples, sockets, connectors, joints etc. in running lengths of pipes and also where necessary for fixing clips, holderbats plugged and screwed.				
A	Hosereel System Pipework				
	i) 25mm diameter pipe GMS Class B to BS 1387	24	LM		-
	ii) 50mm ditto	96	LM		-
B	Elbows				
	i) 25mm elbows malleable iron galvanized.	12	NO.		-
	ii) 50mm ditto.	24	NO.		-
C	Tees				
	50mm diameter malleable iron tee	28	NO.		-
D	Reducers				
	i) 25 x 20mm malleable galvanized iron reducing bush	44	NO.		-
	ii) 50 x 25 mm ditto	44	NO.		-
E	Valves				
	i) 25mm bronze gate valve to BS 5154	3	NO.		-
	ii) 50mm ditto.	6	NO.		-
	iii) 25mm air relief valve screwed as CRANE.	6	NO.		-
F	Hosereels				
	Swinging type hosereel complete with 30m long hose of 20mm diameter, 25mm internal diameter rubber fire hose with nylon spray/jet and shut off nozzle, and mounting brackets conforming to BS 5274	3	NO.		-
G	Hosereel Pipework Painting				
	Wire brush, clean and paint complete installation with one coat of red oxide primer, under coat and gloss coat including banding and colour coding to British standards	1	ITEM		-
H	Hose Reel Pumps				
	Fire Hose Reel Pump set (2 No. Pumps - Duty & Standby) with a capacity of 4m ³ /hr at 2 Bar c/w control panel as NAFFCO or approved equivalent.	1	SET		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
I	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	3	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	3	NO.		-
ii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	3	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	3	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	3	NO.		-
	Total C/F to Collection Page				-

**PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS**

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	RAIN WATER DRAINAGE Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	100mm diameter uPVC Grey pipe (heavy duty)	200	LM		-
B	100mm diameter uPVC sweep bend	50	NO.		-
C	100mm diameter Aluminium Fulbora	50	NO.		-
D	100mm diameter uPVC discharge shoe	50	NO.		-
E	100mm diameter uPVC puddle flange	50	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
VII	LABORATORY FITTINGS & PIPEWORK				
	LABORATORY FITTINGS				
	Pressure Regulator				
A	Second stage gas pressure regulator as Rego 2503 V.9 complete with connections and brackets for supply pipe. ~ 15mm/20mm dia. Or equal and approved	9	NO.		-
	Gas Outlet (Tap)				
B	Low pressure LP gas outlet with a safety drop lever to prevent accidental "turn on" 2 CFM at 2 p.s.i, 4mm diameter outlet and ¼" BSP tail with backnut. The outlet shall be as Vultex Labline 2-way bench mounted with 2 cocks spaced at 90° angle Model No. VL 2601/D	15	NO.		-
	Laboratory Sink				
C	Laboratory Sinks are of size 552x400x231mm deep manufactured from black polypropelene material. The sink to be complete with 38mm diameter BSP waste, black nut and Butyl Rubber gasket. The Sink to be as "Vulcathene Laboratory Sinks model No.602" or approved equal.	11	NO.		-
	Laboratory Sink Tap				
D	Vultex Labline' Cat. No. VG800078 mixer tap with swivel swanbeck on 178mm centres with aerator. Or equal and approved.	11	NO.		-
	Emergency Shower				
E	Emergency Shower for use where accidental splashing of acid, chemical or radioactive chemical demands instant attention. Automatic in action, the shower sends down torrential cascade of water as soon as the user pulls the chain. 1 1/4" non-concussive valve with chain and rubber, 305mm diameter shower head with pipe and wall stays. Metal work chrome-plated. As "Armitage Shanks" or equal and approved.	5	NO.		-
	Emergency Eye Wash Fountain				
F	All chrome-plated metal eye wash fountain which instantly provides a gentle stream of water to wash the eyes in the event of an accident. The unit shall be as "Armitage Shanks" or equal and approved.	6	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	LABORATORY GAS PIPEWORK Supply, deliver, install test and commission the following: Laboratory gas supply pipework shall be Copper pipes, be solid drawn, seamless, deoxidized, non arsenical, half hard, tempered and degreased copper pipe conforming to standards BS 2871. Tenderers must allow in their prices for all couplings, connectors, holding brackets expansion joints as required in the running lengths of pipes. The copper tubing to be concealed in 25mm diameter heavy duty black PVC Conduit pipe and chased to wall				
	<u>Geochemistry Lab</u>				
A	Copper Pipes				
	i) 8mm Diameter Copper Pipes	36	LM		-
	ii) 10mm ditto	36	LM		-
	iii) 12mm ditto	18	LM		-
	iv) 15mm ditto	18	LM		-
	v) 20mm ditto	18	LM		-
B	Elbow and Bends				
	i) 8mm Diameter Bend/Elbows	36	NO.		-
	ii) 10mm ditto	18	NO.		-
	iii) 12mm ditto	10	NO.		-
	iv) 15mm ditto	8	NO.		-
	v) 20mm ditto	6	NO.		-
C	Tees				
	i) 8mm Diameter Tees	14	NO.		-
	ii) 10mm ditto	10	NO.		-
	iii) 12mm ditto	8	NO.		-
	iv) 15mm ditto	6	NO.		-
	v) 20mm ditto	6	NO.		-
D	Reducers				
	i) 10x8mm Diameter Reducer	12	NO.		-
	ii) 12x10mm ditto	12	NO.		-
	iii) 15x12mm ditto	10	NO.		-
	iv) 20x15mm ditto	6	NO.		-
E	Unions				
	i) 8mm Diameter Union	24	NO.		-
	ii) 10mm ditto	16	NO.		-
	iii) 12mm ditto	12	NO.		-
	iv) 15mm ditto	10	NO.		-
	v) 20mm ditto	6	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	i) 8mm Diameter Socket	16	NO.		-
	ii) 10mm ditto	12	NO.		-
	iii) 12mm ditto	10	NO.		-
	iv) 15mm ditto	8	NO.		-
	v) 20mm ditto	6	NO.		-
G	Gas Isolation Valves				
	i) 8mm diameter Isolation Valve	6	NO.		-
	ii) 10mm ditto	4	NO.		-
	iii) 12mm ditto	2	NO.		-
	iv) 15mm ditto	2	NO.		-
	v) 20mm ditto	2	NO.		-
H	GMS Pipework (Complete with fittings)				
	i) 25mm GMS pipes	36	LM		-
	ii) 32mm ditto	36	LM		-
	iii) 40mm ditto	18	LM		-
	iv) 50mm ditto	18	LM		-
	LABORATORY DRAINAGE PIPEWORK				
	Supply, deliver and fix the following vulcathene pipes by "VULCATHENE-DURAPIPE-S&LP" as described. All vulcathene pipework and fittings- branches, tees, reducing tees, etc. are to be formed in accordance to the manufacturer's printed instruction. The installations to have the various sizes of connectors, adaptors, sockets, reducers holdbats, clips etc. as required for satisfactory functions.				
A	Vulcathene Pipes				
	i) 40mm Diameter Vulcathene Pipes	38	LM		-
	ii) 50mm ditto	38	LM		-
	iii) 100mm ditto	46	LM		-
B	Bends/Elbows				
	i) 40mm Diameter Sweep Bend/Elbow	36	NO.		-
	ii) 50mm ditto	24	NO.		-
	iii) 100mm ditto	24	NO.		-
C	Tees				
	i) 40mm Diameter Tee	36	NO.		-
	ii) 50mm ditto	24	NO.		-
	iii) 100mm ditto	24	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
D	Boss Connectors				
	i) 100x40mm Diameter Boss Connector	22	NO.		-
	ii) 100x50mm ditto.	24	NO.		-
E	Inspection Plugs/Access caps				
	i) 40mm Access Cap	22	NO.		-
	ii) 50mm ditto	24	NO.		-
	iii) 100mm ditto	24	NO.		-
E	Reducer				
	i) 50x40mm Reducer	22	NO.		-
	ii) 75x50mm ditto	24	NO.		-
	iii) 100x75mm ditto	24	NO.		-
F	Dilution Trap				
	'Vulcathene' Cat. No. W612 Dilution Recovery Trap capacity 4.5 litres complete with 76mm liquid trap seal and made of heat resistant material. Or equal and approved	11	NO.		-
G	Dilution Chamber				
	Standard 1,000x1,000mm Dilution Chamber, to Engineers approval	4	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 2: LABORATORY INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
VI	LABORATORY FITTINGS & PIPEWORK	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
A	Water Closet - Pan				
i)	Water Closet - Pan as IDEAL STANDARDS, white in colour. Complete with seat and cover, outlet connector and all other necessary fixing accessories. or equal and approved	6	NO.		-
	Water Closet - Flush Valve				
ii)	Water Closet - Flush Valve as DOCOL: Dual Flush Escutcheon Plate: C.P #00449506, chrome finish face plate. Complete with back entry flush pipe inlet connectors, and all other necessary fixing accessories. or equal and approved	6	NO.		-
B	Toilet Roll Holder				
	Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	6	NO.		-
C	Robe / Coat Hook				
	Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	10	NO.		-
D	Wash Hand Basin				
i)	Countertop wash hand basin as IDEAL STANDARDS, nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	8	NO.		-
ii)	Wall Hung wash hand basin as IDEAL STANDARDS, c/w Semi-Pedestal, of nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	2	NO.		-
E	Wash Hand Basin Tap				
	Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	10	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Mirror				
F	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	10	NO.		-
	Soap Dispenser				
G	Wall mounted soap dispenser as "Mediclinics DJ0111C" with a capacity of 1.1L and in AISI 304 Stainless Steel material, having a press action soap release mechanism complete with fixing screws. Allow for initial soap supply. or equal and approved.	4	NO.		-
	Paper Dispeser				
H	Paper Dispeser as "Mediclinics DT2106CS" in AISI 304 Stainless Steel material, with a capacity of 400-600 C/Z towels. or equla and approved	4	NO.		-
	Automatic Hand Drier				
I	Automatic hand drier as "Mediclinics M09ACS" in AISI 304 Stainless Steel material, operating on an infra-red automatic sensing system with heating element safety cut-out complete with a 30 seconds safety timer. or equal and approved.	2	NO.		-
	Shower Fittings				
J	Chrome plated shower knob as COBRA, to be connected to concealed pipework, and instantaneous water heater, suitable for salty and hard water as LORENZETTI. or equal and approved.	4	NO		-
	Towel Rail				
K	Towel Rail Bar, 650mm as DALI, Ref. No. TMA11, chrome finish. or equal and approved	4	NO.		-
	Soap Tray Holder				
L	Soap Tray Holder as TWYFORD "VC9808WH" white in colour and in Viterous China. Recessed into wall. Or equal and approved	4	NO.		-
	Cleaner's Sink				
M	Cleaners sink with bucket grating, 580 x 400 x 200mm, as "Associated Steel Limited" in Stainless Steel. Complete with traps and fixings, and a Bibtap, ½ inch, as TAPIS: Long neck wall type Bib Tap, Ref No. 11062G9 with chrome finish. or equal and approved.	1	NO		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
N	Urinals				
i)	Urinal bowl as IDEAL STANDARDS, in Vitreous China with fixings. Complete with fixing accessories. or equal and approved.	3	NO		-
ii)	Urinal wall mounted division as IDEAL STANDARDS, white in colour in Vitreous China, complete with fixings accessories. or equal and approved.	3	NO		-
iii)	Urinal Automatic Flushing Senor fitting as TAPIS: Infra Red Electronic Urinal Flushvalve, AC & DC; #MC-8512, to be connected with concealed connector pipe and spray rose. c/w all necessary fixing accessories. or equal and approved.	3	NO		-
O	Kitchen Sink				
i)	Single Bowl Single Drain (SBSD) stainless steel sink as FRANKE complete with 40mm diameter chrome plated bottle traps and all its fixing accessories. Or equal and approved	1	NO.		-
ii)	Kitchen Sink Mixer tap as TAPIS Hanna: Single Lever Sink Mixer, Ref. No. #WAX56A18C, chrome finish. Or equal and approved	1	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS</p> <p>COLD WATER SUPPLY</p> <p>Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	54	LM		-
		44	LM		-
		34	LM		-
		24	LM		-
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	44	NO.		-
		38	NO.		-
		24	NO.		-
		16	NO.		-
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	44	NO.		-
		38	NO.		-
		24	NO.		-
		16	NO.		-
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	32	NO.		-
		22	NO.		-
		16	NO.		-
		16	NO.		-
		16	NO.		-
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	40	NO.		-
		32	NO.		-
		32	NO.		-
		32	NO.		-
		32	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	28	NO.		-
	b) 32mm ditto	28	NO.		-
	c) 40mm ditto	16	NO.		-
	d) 50mm ditto	16	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	16	NO.		-
	b) 32mm ditto	16	NO.		-
	c) 40mm ditto	10	NO.		-
	d) 50mm ditto	10	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	8	NO.		-
	b) 32mm ditto	6	NO.		-
	c) 40mm ditto	4	NO.		-
	d) 50mm ditto	4	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	30	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 5,000 litres diameter 2,050mm and 1,850mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	1	NO.		-
K	Water Meters				
	32mm diameter water meter as "Kent". or equal and approved.	1	NO		-
L	Meter Chamber				
	Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
M	Sterilization				
	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	28	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	75	LM		-
	c) 50mm ditto	50	LM		-
	d) 40mm Ditto	24	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	12	NO.		-
	b) 40mm ditto	12	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	8	NO.		-
	b) 40mm ditto	18	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	6	NO.		-
	b) 100 x 40mm ditto.	6	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	4	NO.		-
	b) 40mm diameter inspection plugs	10	NO.		-
F	100mm diameter vent cowl	4	NO.		-
G	100mm diameter Water Closet connectors	6	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	8	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	2	NO.		-
J	100mm diameter gully trap complete with chamber and cover.	6	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	5	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	FIREFIGHTING INSTALLATIONS				
	<u>HOSEREEL SYSTEM</u>				
	Supply, install, test and commission the following equipment and fitting as described:-				
	Tenderers must allow in pipework prices for all couplings, union, nipples, sockets, connectors, joints etc. in running lengths of pipes and also where necessary for fixing clips, holderbats plugged and screwed.				
A	Hosereel System Pipework				
	i) 25mm diameter pipe GMS Class B to BS 1387	16	LM		-
	ii) 50mm ditto	120	LM		-
B	Elbows				
	i) 25mm elbows malleable iron galvanized.	32	NO.		-
	ii) 50mm ditto.	96	NO.		-
C	Tees				
	50mm diameter malleable iron tee	24	NO.		-
D	Reducers				
	i) 25 x 20mm malleable galvanized iron reducing bush	12	NO.		-
	ii) 50 x 25 mm ditto	12	NO.		-
E	Valves				
	i) 25mm bronze gate valve to BS 5154	2	NO.		-
	ii) 50mm ditto.	5	NO.		-
	iii) 25mm air relief valve screwed as CRANE.	1	NO.		-
F	Hosereels				
	Swinging type hosereel complete with 30m long hose of 20mm diameter, 25mm internal diameter rubber fire hose with nylon spray/jet and shut off nozzle, and mounting brackets conforming to BS 5274	2	NO.		-
G	Hosereel Pipework Painting				
	Wire brush, clean and paint complete installation with one coat of red oxide primer, under coat and gloss coat including banding and colour coding to British standards	1	ITEM		-
H	Hose Reel Pumps				
	Fire Hose Reel Pump set (2 No. Pumps - Duty & Standby) with a capacity of 4m ³ /hr at 2 Bar c/w control panel as NAFFCO or approved equivalent.	1	SET		-
Total C/F to Next Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
I	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	5	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	5	NO.		-
ii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	5	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	5	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	5	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 3: WORKSHOP INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
A	Water Closet - Pan				
i)	Water Closet - Pan as IDEAL STANDARDS, white in colour. Complete with seat and cover, outlet connector and all other necessary fixing accessories. or equal and approved	8	NO.		-
	Water Closet - Flush Valve				
ii)	Water Closet - Flush Valve as DOCOL: Dual Flush Escutcheon Plate: C.P #00449506, chrome finish face plate. Complete with back entry flush pipe inlet connectors, and all other necessary fixing accessories. or equal and approved	8	NO.		-
B	Toilet Roll Holder Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	9	NO.		-
C	Robe / Coat Hook Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	30	NO.		-
D	Wash Hand Basin				
i)	Countertop wash hand basin as IDEAL STANDARDS, nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	12	NO.		-
E	Wash Hand Basin Tap Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	12	NO.		-
F	Mirror				
i)	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	12	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
ii)	Plain size bevelled 6mm thick glass plate mirror size 2,000 x 800mm. Complete with foam lining and dome headed chrome plated fixing Screws	1	NO.		-
	Soap Dispenser				
G	Wall mounted soap dispenser as "Mediclinics DJ0111C" with a capacity of 1.1L and in AISI 304 Stainless Steel material, having a press action soap release mechanism complete with fixing screws. Allow for initial soap supply. or equal and approved.	5	NO.		-
	Paper Dispeser				
H	Paper Dispeser as "Mediclinics DT2106CS" in AISI 304 Stainless Steel material, with a capacity of 400-600 C/Z towels. or equla and approved	5	NO.		-
	Automatic Hand Drier				
I	Automatic hand drier as "Mediclinics M09ACS" in AISI 304 Stainless Steel material, operating on an infra-red automatic sensing system with heating element safety cut-out complete with a 30 seconds safety timer. or equal and approved.	5	NO.		-
	Shower Fittings				
J	Chrome plated shower knobs (Hot & Cold) as COBRA, to be connected to concealed pipework. Complete with fixed shower head, suitable for Solar Water Heating System, and spout. or equal and approved.	17	NO		-
	Towel Rail				
K	Towel Rail Bar, 650mm as DALI, Ref. No. TMA11, chrome finish. or equal and approved	17	NO.		-
	Soap Tray Holder				
L	Soap Tray Holder as TWYFORD "VC9808WH" white in colour and in Viterous China. Recessed into wall. Or equal and approved	17	NO.		-
	Doc M Compliant Shower Seat				
M	Folding shower seat with back support, for Doc.M compliant showering Polyester coated aluminium frame with vinyl seat AND White in colour fixed to solid wall with appropriate fixings as "TWYFORD AV8800WH".	1	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
M	Cleaner's Sink Cleaners sink with bucket grating, 580 x 400 x 200mm, as "Associated Steel Limited" in Stainless Steel. Complete with traps and fixings, and a Bibtap, ½ inch, as TAPIS: Long neck wall type Bib Tap, Ref No. 11062G9 with chrome finish. or equal and approved.	1	NO		-
O	Accessible / PWD Toilet Accessible / PWD Toilet as "Twyford AVALON DOC.M VALUE PACK", wheel chair accessible WC facility with Doc.M value cistern, fittings and standard lever - 6 litre flush, Doc.M seat ring, stainless steel hinge, Doc.M handrinse basin, 2 tap including fixings, tap hole stopper for handrinse basin, spray mixer lever operated tap, 5 Doc.M support rails, pan fixings and cistern cover clips. Complete with all outlet connectors and traps. or equal and approved.	1	NO		-
P	Dhobi Sink Stainless Steel Dhobi Sink, size 500mm X 500mm X 400mm as "Associated Steel Limited". Complete with traps and fixings, and a Bibtap, ½ inch, as TAPIS: Long neck wall type Bib Tap, Ref No. 11062G9 with chrome finish. or equal and approved.	12	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS COLD & HOT WATER SUPPLY Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	148	LM		-
		108	LM		-
		84	LM		-
		58	LM		-
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	108	NO.		-
		92	NO.		-
		62	NO.		-
		42	NO.		-
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	108	NO.		-
		92	NO.		-
		62	NO.		-
		42	NO.		-
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	80	NO.		-
		54	NO.		-
		42	NO.		-
		42	NO.		-
		42	NO.		-
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	102	NO.		-
		76	NO.		-
		76	NO.		-
		76	NO.		-
		76	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	70	NO.		-
	b) 32mm ditto	70	NO.		-
	c) 40mm ditto	36	NO.		-
	d) 50mm ditto	36	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	36	NO.		-
	b) 32mm ditto	36	NO.		-
	c) 40mm ditto	24	NO.		-
	d) 50mm ditto	24	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	6	NO.		-
	b) 32mm ditto	10	NO.		-
	c) 40mm ditto	4	NO.		-
	d) 50mm ditto	4	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	60	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 5,000 litres diameter 2,050mm and 1,850mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	2	NO.		-
K	Water Meters				
	40mm diameter water meter as "Kent". or equal and approved.	1	NO		-
L	Meter Chamber				
	Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
M	Sterilization				
	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	72	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	150	LM		-
	c) 50mm ditto	84	LM		-
	d) 40mm Ditto	96	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	40	NO.		-
	b) 40mm ditto	48	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	24	NO.		-
	b) 40mm ditto	36	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	18	NO.		-
	b) 100 x 40mm ditto.	12	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	12	NO.		-
	b) 40mm diameter inspection plugs	48	NO.		-
F	100mm diameter vent cowl	10	NO.		-
G	100mm diameter Water Closet connectors	8	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	16	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	2	NO.		-
J	100mm diameter gulley trap complete with chamber and cover.	11	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	11	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	FIREFIGHTING INSTALLATIONS				
	<u>HOSEREEL SYSTEM</u>				
	Supply, install, test and commission the following equipment and fitting as described:-				
	Tenderers must allow in pipework prices for all couplings, union, nipples, sockets, connectors, joints etc. in running lengths of pipes and also where necessary for fixing clips, holderbats plugged and screwed.				
A	Hosereel System Pipework				
	i) 25mm diameter pipe GMS Class B to BS 1387	52	LM		-
	ii) 50mm ditto	94	LM		-
B	Elbows				
	i) 25mm elbows malleable iron galvanized.	34	NO.		-
	ii) 50mm ditto.	68	NO.		-
C	Tees				
	50mm diameter malleable iron tee	34	NO.		-
D	Reducers				
	i) 25 x 20mm malleable galvanized iron reducing bush	34	NO.		-
	ii) 50 x 25 mm ditto	34	NO.		-
E	Valves				
	i) 25mm bronze gate valve to BS 5154	3	NO.		-
	ii) 50mm ditto.	4	NO.		-
	iii) 25mm air relief valve screwed as CRANE.	2	NO.		-
F	Hosereels				
	Swinging type hosereel complete with 30m long hose of 20mm diameter, 25mm internal diameter rubber fire hose with nylon spray/jet and shut off nozzle, and mounting brackets conforming to BS 5274	2	NO.		-
G	Hosereel Pipework Painting				
	Wire brush, clean and paint complete installation with one coat of red oxide primer, under coat and gloss coat including banding and colour coding to British standards	1	ITEM		-
H	Hose Reel Pumps				
	Fire Hose Reel Pump set (2 No. Pumps - Duty & Standby) with a capacity of 2m ³ /hr at 2 Bar c/w control panel as NAFFCO or approved equivalent.	1	SET		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
I	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	2	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	2	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
VI	RAIN WATER DRAINAGE Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	100mm diameter uPVC Grey pipe (heavy duty)	160	LM		-
B	100mm diameter uPVC sweep bend	20	NO.		-
C	100mm diameter uPVC Fulbora	20	NO.		-
D	100mm diameter discharge shoe	20	NO.		-
E	100mm diameter uPVC puddle flange	20	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
VII	SOLAR WATER HEATING SYSTEM Supply, delivery, installation, testing and commissioning of the following solar hot water system appliances complete with all the accessories including all connections to the services, jointing to water supply, overflows, supports and all plugging and screwing to walls and frames. The hot water cylinder shall be installed as directed by the Project Engineer.				
	<u>Centralised and Indirect Solar Water Heating System</u>				
	Hot Water Storage Tank				
A	Hot water storage cylinder, of 1,000 Ltrs capacity, complete with 2 No. 3kW electric booster element with thermostat and time switch controller, heat transfer medium (glycol) circulation pump, pressure release valve, automatic air eliminator, other safety valves, controller and all other necessary interconnectors. The system shall be a closed loop type with indirect water heating system using glycol as heat transfer medium. As Dayliff or an approved equivalent. The storage cylinder shall be high pressure fabricated from 5mm thick stainless steel plate manufacture, suitable for vertical mounting. Or equal and approval	4	NO		-
B	Supporting Frames - Hot Water Storage Tanks Allow for Supporting Frames of the Hot Water Tanks for flat/ inclined ground installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
C	Solar Collector Panels Solar collector panel, Size 2m x 1m made from extruded or thermally bonded copper or aluminium tubes and coated with solar absorbing paint, insulation, 5mm thick glass and painted sheet metal casing and frame. The panel shall be as Dayliff or approved equivalent.	28	NO.		-
D	Supporting Frames - Solar Collector Panels Allow for Galvanised mounting frame for the Solar Collector Panels for flat/ inclined roof installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
E	Thermostatic Mixing Valve Thermostatic mixing valve to blend hot water with cold water to ensure constant, safe shower and bath outlet temperatures, preventing scalding.	2	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Hot Water Circulation Pump				
F	Hot water Circulation pump set (duty & standby) as GRUNDFOS Model No. UPA 120 with a capacity of 2m ³ /hr at 10m head water gauge. Complete with a Temperature Differential Controller such that when the temperature of circulating fluid goes down below a certain level, then the controller shall switch on the electric heating element. Or equal and approved	2	SET		-
	Electrical Booster Time Switch				
G	The auxilliary electric water heater elements shall be controlled by a time switch that they switch such that they come "ON" during peak hours only. The time switch must be capable of switching the heater "ON" and "OFF" at least two times per day. The time switch though electrically operated shall be capable of keeping time for a minimum 48 hours of electric power failure.	2	NO.		-
	Plumbing Works				
H	Allow for plumbing pipework and fittings to connect to the existing hot water supply plumbing pipework in the facility. Tenderers must allow in their pipework prices for all the gate valves, non-return valves, couplings, unions, connectors, joints, bypass bends, loop expansion bends and sockets in running lengths of pipes.	60	LM		-
	Pipework Insulation				
I	Allow for insulation for pipework, bends, tees and other fittings. To approval. The thermal conductivity of the insulate shall not exceed 0.033 W/m.K at 10°C mean.	60	LM		-
	Electrical Works				
J	Allow for all wiring to the pumps and sensors and any other electrical equipment. Note: Electrical supply shall be brought to within five (5) metres of equipment	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
VI	SOLAR WATER HEATING SYSTEM	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
A	Water Closet - Pan				
i)	Water Closet - Pan as IDEAL STANDARDS, white in colour. Complete with seat and cover, outlet connector and all other necessary fixing accessories. or equal and approved	12	NO.		-
	Water Closet - Flush Valve				
ii)	Water Closet - Flush Valve as DOCOL: Dual Flush Escutcheon Plate: C.P #00449506, chrome finish face plate. Complete with back entry flush pipe inlet connectors, and all other necessary fixing accessories. or equal and approved	12	NO.		-
B	Toilet Roll Holder Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	13	NO.		-
C	Robe / Coat Hook Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	30	NO.		-
D	Wash Hand Basin				
i)	Countertop wash hand basin as IDEAL STANDARDS, nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	12	NO.		-
E	Wash Hand Basin Tap Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	12	NO.		-
F	Mirror				
i)	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	12	NO.		-
Total C/F to Next Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
ii)	Plain size bevelled 6mm thick glass plate mirror size 2,000 x 800mm. Complete with foam lining and dome headed chrome plated fixing Screws	1	NO.		-
	Soap Dispenser				
G	Wall mounted soap dispenser as "Mediclinics DJ0111C" with a capacity of 1.1L and in AISI 304 Stainless Steel material, having a press action soap release mechanism complete with fixing screws. Allow for initial soap supply. or equal and approved.	5	NO.		-
	Paper Dispeser				
H	Paper Dispeser as "Mediclinics DT2106CS" in AISI 304 Stainless Steel material, with a capacity of 400-600 C/Z towels. or equla and approved	5	NO.		-
	Automatic Hand Drier				
I	Automatic hand drier as "Mediclinics M09ACS" in AISI 304 Stainless Steel material, operating on an infra-red automatic sensing system with heating element safety cut-out complete with a 30 seconds safety timer. or equal and approved.	5	NO.		-
	Shower Fittings				
J	Chrome plated shower knobs (Hot & Cold) as COBRA, to be connected to concealed pipework. Complete with fixed shower head, suitable for Solar Water Heating System, and spout. or equal and approved.	17	NO		-
	Towel Rail				
K	Towel Rail Bar, 650mm as DALI, Ref. No. TMA11, chrome finish. or equal and approved	17	NO.		-
	Soap Tray Holder				
L	Soap Tray Holder as TWYFORD "VC9808WH" white in colour and in Viterous China. Recessed into wall. Or equal and approved	17	NO.		-
	Doc M Compliant Shower Seat				
M	Folding shower seat with back support, for Doc.M compliant showering Polyester coated aluminium frame with vinyl seat AND White in colour fixed to solid wall with appropriate fixings as "TWYFORD AV8800WH".	1	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
M	<p>Cleaner's Sink Cleaners sink with bucket grating, 580 x 400 x 200mm, as "Associated Steel Limited" in Stainless Steel. Complete with traps and fixings, and a Bibtap, ½ inch, as TAPIS: Long neck wall type Bib Tap, Ref No. 11062G9 with chrome finish. or equal and approved.</p>	1	NO		-
O	<p>Accessible / PWD Toilet Accessible / PWD Toilet as "Twyford AVALON DOC.M VALUE PACK", wheel chair accessible WC facility with Doc.M value cistern, fittings and standard lever - 6 litre flush, Doc.M seat ring, stainless steel hinge, Doc.M handrinse basin, 2 tap including fixings, tap hole stopper for handrinse basin, spray mixer lever operated tap, 5 Doc.M support rails, pan fixings and cistern cover clips. Complete with all outlet connectors and traps. or equal and approved.</p>	1	NO		-
P	<p>Dhobi Sink Stainless Steel Dhobi Sink, size 500mm X 500mm X 400mm as "Associated Steel Limited". Complete with traps and fixings, and a Bibtap, ½ inch, as TAPIS: Long neck wall type Bib Tap, Ref No. 11062G9 with chrome finish. or equal and approved.</p>	12	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS COLD & HOT WATER SUPPLY Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	148	LM		-
		108	LM		-
		84	LM		-
		58	LM		-
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	108	NO.		-
		92	NO.		-
		62	NO.		-
		42	NO.		-
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	108	NO.		-
		92	NO.		-
		62	NO.		-
		42	NO.		-
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	80	NO.		-
		54	NO.		-
		42	NO.		-
		42	NO.		-
		42	NO.		-
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	102	NO.		-
		76	NO.		-
		76	NO.		-
		76	NO.		-
		76	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	70	NO.		-
	b) 32mm ditto	70	NO.		-
	c) 40mm ditto	36	NO.		-
	d) 50mm ditto	36	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	36	NO.		-
	b) 32mm ditto	36	NO.		-
	c) 40mm ditto	24	NO.		-
	d) 50mm ditto	24	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	6	NO.		-
	b) 32mm ditto	10	NO.		-
	c) 40mm ditto	4	NO.		-
	d) 50mm ditto	4	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	60	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 5,000 litres diameter 2,050mm and 1,850mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	2	NO.		-
K	Water Meters				
	40mm diameter water meter as "Kent". or equal and approved.	1	NO		-
L	Meter Chamber				
	Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
M	Sterilization				
	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	72	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	150	LM		-
	c) 50mm ditto	84	LM		-
	d) 40mm Ditto	96	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	40	NO.		-
	b) 40mm ditto	48	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	24	NO.		-
	b) 40mm ditto	36	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	18	NO.		-
	b) 100 x 40mm ditto.	12	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	12	NO.		-
	b) 40mm diameter inspection plugs	48	NO.		-
F	100mm diameter vent cowl	10	NO.		-
G	100mm diameter Water Closet connectors	12	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	16	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	2	NO.		-
J	100mm diameter gully trap complete with chamber and cover.	11	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	11	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	FIREFIGHTING INSTALLATIONS				
	<u>HOSEREEL SYSTEM</u>				
	Supply, install, test and commission the following equipment and fitting as described:-				
	Tenderers must allow in pipework prices for all couplings, union, nipples, sockets, connectors, joints etc. in running lengths of pipes and also where necessary for fixing clips, holderbats plugged and screwed.				
A	Hosereel System Pipework				
	i) 25mm diameter pipe GMS Class B to BS 1387	52	LM		-
	ii) 50mm ditto	94	LM		-
B	Elbows				
	i) 25mm elbows malleable iron galvanized.	34	NO.		-
	ii) 50mm ditto.	68	NO.		-
C	Tees				
	50mm diameter malleable iron tee	34	NO.		-
D	Reducers				
	i) 25 x 20mm malleable galvanized iron reducing bush	34	NO.		-
	ii) 50 x 25 mm ditto	34	NO.		-
E	Valves				
	i) 25mm bronze gate valve to BS 5154	3	NO.		-
	ii) 50mm ditto.	4	NO.		-
	iii) 25mm air relief valve screwed as CRANE.	2	NO.		-
F	Hosereels				
	Swinging type hosereel complete with 30m long hose of 20mm diameter, 25mm internal diameter rubber fire hose with nylon spray/jet and shut off nozzle, and mounting brackets conforming to BS 5274	2	NO.		-
G	Hosereel Pipework Painting				
	Wire brush, clean and paint complete installation with one coat of red oxide primer, under coat and gloss coat including banding and colour coding to British standards	1	ITEM		-
H	Hose Reel Pumps				
	Fire Hose Reel Pump set (2 No. Pumps - Duty & Standby) with a capacity of 2m ³ /hr at 2 Bar c/w control panel as NAFFCO or approved equivalent.	1	SET		-
Total C/F to Next Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
I	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	2	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	2	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
VII	SOLAR WATER HEATING SYSTEM Supply, delivery, installation, testing and commissioning of the following solar hot water system appliances complete with all the accessories including all connections to the services, jointing to water supply, overflows, supports and all plugging and screwing to walls and frames. The hot water cylinder shall be installed as directed by the Project Engineer.				
	<u>Centralised and Indirect Solar Water Heating System</u>				
	Hot Water Storage Tank				
A	Hot water storage cylinder, of 1,000 Ltrs capacity, complete with 2 No. 3kW electric booster element with thermostat and time switch controller, heat transfer medium (glycol) circulation pump, pressure release valve, automatic air eliminator, other safety valves, controller and all other necessary interconnectors. The system shall be a closed loop type with indirect water heating system using glycol as heat transfer medium. As Dayliff or an approved equivalent. The storage cylinder shall be high pressure fabricated from 5mm thick stainless steel plate manufacture, suitable for vertical mounting. Or equal and approval	4	NO		-
B	Supporting Frames - Hot Water Storage Tanks Allow for Supporting Frames of the Hot Water Tanks for flat/ inclined ground installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
C	Solar Collector Panels Solar collector panel, Size 2m x 1m made from extruded or thermally bonded copper or aluminium tubes and coated with solar absorbing paint, insulation, 5mm thick glass and painted sheet metal casing and frame. The panel shall be as Dayliff or approved equivalent.	28	NO.		-
D	Supporting Frames - Solar Collector Panels Allow for Galvanised mounting frame for the Solar Collector Panels for flat/ inclined roof installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
E	Thermostatic Mixing Valve Thermostatic mixing valve to blend hot water with cold water to ensure constant, safe shower and bath outlet temperatures, preventing scalding.	2	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Hot Water Circulation Pump				
F	Hot water Circulation pump set (duty & standby) as GRUNDFOS Model No. UPA 120 with a capacity of 2m ³ /hr at 10m head water gauge. Complete with a Temperature Differential Controller such that when the temperature of circulating fluid goes down below a certain level, then the controller shall switch on the electric heating element. Or equal and approved	2	SET		-
	Electrical Booster Time Switch				
G	The auxilliary electric water heater elements shall be controlled by a time switch that they switch such that they come "ON" during peak hours only. The time switch must be capable of switching the heater "ON" and "OFF" at least two times per day. The time switch though electrically operated shall be capable of keeping time for a minimum 48 hours of electric power failure.	2	NO.		-
	Plumbing Works				
H	Allow for plumbing pipework and fittings to connect to the existing hot water supply plumbing pipework in the facility. Tenderers must allow in their pipework prices for all the gate valves, non-return valves, couplings, unions, connectors, joints, bypass bends, loop expansion bends and sockets in running lengths of pipes.	60	LM		-
	Pipework Insulation				
I	Allow for insulation for pipework, bends, tees and other fittings. To approval. The thermal conductivity of the insulate shall not exceed 0.033 W/m.K at 10°C mean.	60	LM		-
	Electrical Works				
J	Allow for all wiring to the pumps and sensors and any other electrical equipment. Note: Electrical supply shall be brought to within five (5) metres of equipment	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
VI	SOLAR WATER HEATING SYSTEM	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
A	Water Closet - Pan				
i)	Water Closet - Pan as IDEAL STANDARDS, white in colour. Complete with seat and cover, outlet connector and all other necessary fixing accessories. or equal and approved	7	NO.		-
	Water Closet - Flush Valve				
ii)	Water Closet - Flush Valve as DOCOL: Dual Flush Escutcheon Plate: C.P #00449506, chrome finish face plate. Complete with back entry flush pipe inlet connectors, and all other necessary fixing accessories. or equal and approved	7	NO.		-
B	Toilet Roll Holder Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	8	NO.		-
C	Robe / Coat Hook Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	12	NO.		-
D	Wash Hand Basin				
i)	Countertop wash hand basin as IDEAL STANDARDS, nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼" waste fitting, 1 ¼" chrome plated bottle trap. or equal and approved.	18	NO.		-
E	Wash Hand Basin Tap Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	18	NO.		-
F	Mirror				
i)	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	18	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
ii)	Plain size bevelled 6mm thick glass plate mirror size 2,000 x 800mm. Complete with foam lining and dome headed chrome plated fixing Screws	1	NO.		-
	Soap Dispenser				
G	Wall mounted soap dispenser as "Mediclinics DJ0111C" with a capacity of 1.1L and in AISI 304 Stainless Steel material, having a press action soap release mechanism complete with fixing screws. Allow for initial soap supply. or equal and approved.	7	NO.		-
	Paper Dispeser				
H	Paper Dispeser as "Mediclinics DT2106CS" in AISI 304 Stainless Steel material, with a capacity of 400-600 C/Z towels. or equla and approved	7	NO.		-
	Automatic Hand Drier				
I	Automatic hand drier as "Mediclinics M09ACS" in AISI 304 Stainless Steel material, operating on an infra-red automatic sensing system with heating element safety cut-out complete with a 30 seconds safety timer. or equal and approved.	7	NO.		-
	Shower Fittings				
J	Chrome plated shower knobs (Hot & Cold) as COBRA, to be connected to concealed pipework. Complete with fixed shower head, suitable for Solar Water Heating System, and spout. or equal and approved.	4	NO		-
	Towel Rail				
K	Towel Rail Bar, 650mm as DALI, Ref. No. TMA11, chrome finish. or equal and approved	4	NO.		-
	Soap Tray Holder				
L	Soap Tray Holder as TWYFORD "VC9808WH" white in colour and in Viterous China. Recessed into wall. Or equal and approved	4	NO.		-
	Cleaner's Sink				
M	Cleaners sink with bucket grating, 580 x 400 x 200mm, as "Associated Steel Limited" in Stainless Steel. Complete with traps and fixings, and a Bibtap, ½ inch, as TAPIS: Long neck wall type Bib Tap, Ref No. 11062G9 with chrome finish. or equal and approved.	1	NO		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
N	Urinals				
i)	Urinal bowl as IDEAL STANDARDS, in Vitreous China with fixings. Complete with fixing accessories. or equal and approved.	5	NO		-
ii)	Urinal wall mounted division as IDEAL STANDARDS, white in colour in Vitreous China, complete with fixings accessories. or equal and approved.	5	NO		-
iii)	Urinal Flushvalve, as DOCOL, Anti Vandal Urinal Flush Valve : C.P #17015006 to be connected with concealed connector pipe and spray rose. c/w all necessary fixing accessories. or equal and approved.	5	NO		-
O	Accessible / PWD Toilet				
	Accessible / PWD Toilet as "Twyford AVALON DOC.M VALUE PACK", wheel chair accessible WC facility with Doc.M value cistern, fittings and standard lever - 6 litre flush, Doc.M seat ring, stainless steel hinge, Doc.M handrinse basin, 2 tap including fixings, tap hole stopper for handrinse basin, spray mixer lever operated tap, 5 Doc.M support rails, pan fixings and cistern cover clips. Complete with all outlet connectors and traps. or equal and approved.	1	NO		-
P	Kitchen Sink				
i)	Single Bowl Single Drain (SBSD) stainless steel sink as "Associated Steel Limited" complete with 40mm diameter chrome plated bottle traps and 1No Kitchen Mixer tap as Twyford "Sola 1/2" Lever Bib Tap Mixer" and all its jointing accessories. Or equal and approved	1	NO.		-
ii)	Kitchen Sink Double Bowl Single Drain (DBSD) stainless steel sink as "Associated Steel Limited" complete with 40mm diameter chrome plated bottle traps and 1No Kitchen Mixer tap as Twyford "Sola 1/2" Lever Bib Tap Mixer" and all its jointing accessories. Or equal and approved	1	NO.		-
iii)	Kitchen Sink Single Bowl No Drain (SB) stainless steel sink as "Associated Steel Limited" complete with 40mm diameter chrome plated bottle traps and 1No Mixer tap as Twyford "Sola 1/2" Lever Bib Tap Mixer" and all its jointing accessories. Or equal and approved	1	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
iv)	Kitchen Sink Mixer tap as TAPIS Hanna: Single Lever Sink Mixer, Ref. No. #WAX56A18C, chrome finish. Or equal and approved	3	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS COLD & HOT WATER SUPPLY Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	100	LM		-
		72	LM		-
		56	LM		-
		38	LM		-
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	72	NO.		-
		62	NO.		-
		42	NO.		-
		28	NO.		-
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	72	NO.		-
		62	NO.		-
		42	NO.		-
		28	NO.		-
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	54	NO.		-
		36	NO.		-
		28	NO.		-
		28	NO.		-
		28	NO.		-
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	68	NO.		-
		50	NO.		-
		50	NO.		-
		50	NO.		-
		50	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	48	NO.		-
	b) 32mm ditto	48	NO.		-
	c) 40mm ditto	24	NO.		-
	d) 50mm ditto	24	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	24	NO.		-
	b) 32mm ditto	24	NO.		-
	c) 40mm ditto	16	NO.		-
	d) 50mm ditto	16	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	4	NO.		-
	b) 32mm ditto	6	NO.		-
	c) 40mm ditto	2	NO.		-
	d) 50mm ditto	2	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	45	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 5,000 litres diameter 2,050mm and 1,850mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	1	NO.		-
K	Water Meters				
	32mm diameter water meter as "Kent". or equal and approved.	1	NO		-
L	Meter Chamber				
	Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
M	Sterilization				
	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	56	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	56	LM		-
	c) 50mm ditto	68	LM		-
	d) 40mm Ditto	82	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	54	NO.		-
	b) 40mm ditto	36	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	54	NO.		-
	b) 40mm ditto	36	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	32	NO.		-
	b) 100 x 40mm ditto.	36	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	32	NO.		-
	b) 40mm diameter inspection plugs	36	NO.		-
F	100mm diameter vent cowl	16	NO.		-
G	100mm diameter Water Closet connectors	22	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	10	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	14	NO.		-
J	100mm diameter gully trap complete with chamber and cover.	6	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	6	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
IV	FIREFIGHTING INSTALLATIONS				
	<u>HOSEREEL SYSTEM</u>				
	Supply, install, test and commission the following equipment and fitting as described:-				
	Tenderers must allow in pipework prices for all couplings, union, nipples, sockets, connectors, joints etc. in running lengths of pipes and also where necessary for fixing clips, holderbats plugged and screwed.				
A	Hosereel System Pipework				
	i) 25mm diameter pipe GMS Class B to BS 1387	42	LM		-
	ii) 50mm ditto	76	LM		-
B	Elbows				
	i) 25mm elbows malleable iron galvanized.	28	NO.		-
	ii) 50mm ditto.	56	NO.		-
C	Tees				
	50mm diameter malleable iron tee	28	NO.		-
D	Reducers				
	i) 25 x 20mm malleable galvanized iron reducing bush	28	NO.		-
	ii) 50 x 25 mm ditto	28	NO.		-
E	Valves				
	i) 25mm bronze gate valve to BS 5154	2	NO.		-
	ii) 50mm ditto.	4	NO.		-
	iii) 25mm air relief valve screwed as CRANE.	2	NO.		-
F	Hosereels				
	Swinging type hosereel complete with 30m long hose of 20mm diameter, 25mm internal diameter rubber fire hose with nylon spray/jet and shut off nozzle, and mounting brackets conforming to BS 5274	2	NO.		-
G	Hosereel Pipework Painting				
	Wire brush, clean and paint complete installation with one coat of red oxide primer, under coat and gloss coat including banding and colour coding to British standards	1	ITEM		-
H	Hose Reel Pumps				
	Fire Hose Reel Pump set (2 No. Pumps - Duty & Standby) with a capacity of 2m ³ /hr at 2 Bar c/w control panel as NAFFCO or approved equivalent.	1	SET		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
I	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	2	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	2	NO.		-
vi)	Emergency fire blanket of dimensions 1200mm x 1200mm	2	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	RAIN WATER DRAINAGE Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	100mm diameter uPVC Grey pipe (heavy duty)	100	LM		-
B	100mm diameter uPVC sweep bend	25	NO.		-
C	100mm diameter Aluminium Fulbora	25	NO.		-
D	100mm diameter uPVC discharge shoe	25	NO.		-
E	100mm diameter uPVC puddle flange	25	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
VI	SOLAR WATER HEATING SYSTEM Supply, delivery, installation, testing and commissioning of the following solar hot water system appliances complete with all the accessories including all connections to the services, jointing to water supply, overflows, supports and all plugging and screwing to walls and frames. The hot water cylinder shall be installed as directed by the Project Engineer.				
	<u>Centralised and Indirect Solar Water Heating System</u>				
	Hot Water Storage Tank				
A	Hot water storage cylinder, of 1,000 Ltrs capacity, complete with 2 No. 3kW electric booster element with thermostat and time switch controller, heat transfer medium (glycol) circulation pump, pressure release valve, automatic air eliminator, other safety valves, controller and all other necessary interconnectors. The system shall be a closed loop type with indirect water heating system using glycol as heat transfer medium. As Dayliff or an approved equivalent. The storage cylinder shall be high pressure fabricated from 5mm thick stainless steel plate manufacture, suitable for vertical mounting. Or equal and approval	2	NO		-
B	Supporting Frames - Hot Water Storage Tanks Allow for Supporting Frames of the Hot Water Tanks for flat/ inclined ground installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
C	Solar Collector Panels Solar collector panel, Size 2m x 1m made from extruded or thermally bonded copper or aluminium tubes and coated with solar absorbing paint, insulation, 5mm thick glass and painted sheet metal casing and frame. The panel shall be as Dayliff or approved equivalent.	14	NO.		-
D	Supporting Frames - Solar Collector Panels Allow for Galvanised mounting frame for the Solar Collector Panels for flat/ inclined roof installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
E	Thermostatic Mixing Valve Thermostatic mixing valve to blend hot water with cold water to ensure constant, safe shower and bath outlet temperatures, preventing scalding.	1	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Hot Water Circulation Pump				
F	Hot water Circulation pump set (duty & standby) as GRUNDFOS Model No. UPA 120 with a capacity of 2m ³ /hr at 10m head water gauge. Complete with a Temperature Differential Controller such that when the temperature of circulating fluid goes down below a certain level, then the controller shall switch on the electric heating element. Or equal and approved	1	SET		-
	Electrical Booster Time Switch				
G	The auxilliary electric water heater elements shall be controlled by a time switch that they switch such that they come "ON" during peak hours only. The time switch must be capable of switching the heater "ON" and "OFF" at least two times per day. The time switch though electrically operated shall be capable of keeping time for a minimum 48 hours of electric power failure.	1	NO.		-
	Plumbing Works				
H	Allow for plumbing pipework and fittings to connect to the existing hot water supply plumbing pipework in the facility. Tenderers must allow in their pipework prices for all the gate valves, non-return valves, couplings, unions, connectors, joints, bypass bends, loop expansion bends and sockets in running lengths of pipes.	60	LM		-
	Pipework Insulation				
I	Allow for insulation for pipework, bends, tees and other fittings. To approval. The thermal conductivity of the insulate shall not exceed 0.033 W/m.K at 10°C mean.	60	LM		-
	Electrical Works				
J	Allow for all wiring to the pumps and sensors and any other electrical equipment. Note: Electrical supply shall be brought to within five (5) metres of equipment	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
VII	LPG INSTALLATIONS Supply, delivery, installation, testing and commissioning of the following LPG system complete with all the accessories necessary for proper functioning of the system..				
A	LPG GAS CYLINDERS - 50 Kg complete with pressure regulators and hoses	4	No.		-
B	Cylinder manifold complete with regulator and valves	1	No.		-
C	Testing and Commissioning	Item	Sum		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
VI	SOLAR WATER HEATING SYSTEM	-
VII	LPG INSTALLATIONS	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
	Water Closet Suite				
A	Water Closet pan as IDEAL STANDARDS, white in colour, with 6 litres flash, push button. Complete with seat and cover. Water Closet to be complete with fixing brackets and outlet connector. or equal and approved	8	NO.		-
	Toilet Roll Holder				
B	Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	8	NO.		-
	Robe / Coat Hook				
C	Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	8	NO.		-
	Wash Hand Basin				
D ii)	Wall Hung wash hand basin as IDEAL STANDARDS, c/w Semi-Pedestal, of nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼ " waste fitting, 1 ¼ " chrome plated bottle trap. or equal and approved.	8	NO.		-
	Wash Hand Basin Tap				
E	Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	8	NO.		-
	Mirror				
F	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	8	NO.		-
	Hand Towel Rail				
G	Hand Towel Rail as DALI, 300mm bar rail "#40688001". or equal and approved	8	NO.		-
Total C/F to Next Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Shower Fittings				
H	Chrome plated shower knobs (Hot & Cold) as COBRA, to be connected to concealed pipework. Complete with fixed shower head, suitable for Solar Water Heating System, and spout. or equal and approved.	8	NO		-
	Towel Rail				
I	Towel Rail Bar, 650mm as DALI, Ref. No. TMA11, chrome finish. or equal and approved	8	NO.		-
	Soap Tray Holder				
J	Soap Tray Holder as TWYFORD "VC9808WH" white in colour and in Viterous China. Recessed into wall. Or equal and approved	8	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS COLD & HOT WATER SUPPLY Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	70 50 37 26	LM LM LM LM		- - - -
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	50 41 27 18	NO. NO. NO. NO.		- - - -
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	50 41 27 18	NO. NO. NO. NO.		- - - -
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	36 24 18 18 18	NO. NO. NO. NO. NO.		- - - - -
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	45 34 34 34	NO. NO. NO. NO.		- - - -
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	32	NO.		-
	b) 32mm ditto	32	NO.		-
	c) 40mm ditto	16	NO.		-
	d) 50mm ditto	16	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	16	NO.		-
	b) 32mm ditto	16	NO.		-
	c) 40mm ditto	10	NO.		-
	d) 50mm ditto	10	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	8	NO.		-
	b) 32mm ditto	3	NO.		-
	c) 40mm ditto	2	NO.		-
	d) 50mm ditto	2	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	25	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 5,000 litres diameter 1,690mm and 1,480mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	1	NO.		-
K	Water Meters				
	32mm diameter water meter as "Kent". or equal and approved.	1	NO		-
L	Meter Chamber				
	Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
M	Sterilization				
	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	23	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	28	LM		-
	c) 50mm ditto	45	LM		-
	d) 40mm Ditto	54	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	36	NO.		-
	b) 40mm ditto	24	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	36	NO.		-
	b) 40mm ditto	12	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	16	NO.		-
	b) 100 x 40mm ditto.	16	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	22	NO.		-
	b) 40mm diameter inspection plugs	24	NO.		-
F	100mm diameter vent cowl	5	NO.		-
G	100mm diameter Water Closet connectors	5	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	16	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	1	NO.		-
J	100mm diameter gulley trap complete with chamber and cover.	4	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	4	NO.		-
Total C/F to Collection Page					-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	FIREFIGHTING INSTALLATIONS				
	<u>HOSEREEL SYSTEM</u>				
	Supply, install, test and commission the following equipment and fitting as described:-				
	Tenderers must allow in pipework prices for all couplings, union, nipples, sockets, connectors, joints etc. in running lengths of pipes and also where necessary for fixing clips, holderbats plugged and screwed.				
A	Hosereel System Pipework				
	i) 25mm diameter pipe GMS Class B to BS 1387	25	LM		-
	ii) 50mm ditto	44	LM		-
B	Elbows				
	i) 25mm elbows malleable iron galvanized.	16	NO.		-
	ii) 50mm ditto.	33	NO.		-
C	Tees				
	50mm diameter malleable iron tee	16	NO.		-
D	Reducers				
	i) 25 x 20mm malleable galvanized iron reducing bush	48	NO.		-
	ii) 50 x 25 mm ditto	48	NO.		-
E	Valves				
	i) 25mm bronze gate valve to BS 5154	2	NO.		-
	ii) 50mm ditto.	3	NO.		-
	iii) 25mm air relief valve screwed as CRANE.	1	NO.		-
F	Hosereels				
	Swinging type hosereel complete with 30m long hose of 20mm diameter, 25mm internal diameter rubber fire hose with nylon spray/jet and shut off nozzle, and mounting brackets conforming to BS 5274	2	NO.		-
G	Hosereel Pipework Painting				
	Wire brush, clean and paint complete installation with one coat of red oxide primer, under coat and gloss coat including banding and colour coding to British standards	1	ITEM		-
H	Hose Reel Pumps				
	Fire Hose Reel Pump set (2 No. Pumps - Duty & Standby) with a capacity of 4m ³ /hr at 2 Bar c/w control panel as NAFFCO or approved equivalent.	1	SET		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
I	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
ii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	2	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	2	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	2	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
VII	SOLAR WATER HEATING SYSTEM Supply, delivery, installation, testing and commissioning of the following solar hot water system appliances complete with all the accessories including all connections to the services, jointing to water supply, overflows, supports and all plugging and screwing to walls and frames. The hot water cylinder shall be installed as directed by the Project Engineer.				
	<u>Centralised and Indirect Solar Water Heating System</u>				
	Hot Water Storage Tank				
A	Hot water storage cylinder, of 600 Ltrs capacity, complete with 2 No. 3kW electric booster element with thermostat and time switch controller, heat transfer medium (glycol) circulation pump, pressure release valve, automatic air eliminator, other safety valves, controller and all other necessary interconnectors. The system shall be a closed loop type with indirect water heating system using glycol as heat transfer medium. As Dayliff or an approved equivalent. The storage cylinder shall be high pressure fabricated from 5mm thick stainless steel plate manufacture, suitable for vertical mounting. Or equal and approval	1	NO		-
B	Supporting Frames - Hot Water Storage Tanks Allow for Supporting Frames of the Hot Water Tanks for flat/ inclined ground installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
C	Solar Collector Panels Solar collector panel, Size 2m x 1m made from extruded or thermally bonded copper or aluminium tubes and coated with solar absorbing paint, insulation, 5mm thick glass and painted sheet metal casing and frame. The panel shall be as Dayliff or approved equivalent.	4	NO.		-
D	Supporting Frames - Solar Collector Panels Allow for Galvanised mounting frame for the Solar Collector Panels for flat/ inclined roof installations that ensures high durability in all weather conditions fixed on slab/roof to support the Solar panels to approval	1	ITEM		-
E	Thermostatic Mixing Valve Thermostatic mixing valve to blend hot water with cold water to ensure constant, safe shower and bath outlet temperatures, preventing scalding.	1	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Hot Water Circulation Pump				
F	Hot water Circulation pump set (duty & standby) as GRUNDFOS Model No. UPA 120 with a capacity of 2m ³ /hr at 10m head water gauge. Complete with a Temperature Differential Controller such that when the temperature of circulating fluid goes down below a certain level, then the controller shall switch on the electric heating element. Or equal and approved	1	SET		-
	Electrical Booster Time Switch				
G	The auxilliary electric water heater elements shall be controlled by a time switch that they switch such that they come "ON" during peak hours only. The time switch must be capable of switching the heater "ON" and "OFF" at least two times per day. The time switch though electrically operated shall be capable of keeping time for a minimum 48 hours of electric power failure.	1	NO.		-
	Plumbing Works				
H	Allow for plumbing pipework and fittings to connect to the existing hot water supply plumbing pipework in the facility. Tenderers must allow in their pipework prices for all the gate valves, non-return valves, couplings, unions, connectors, joints, bypass bends, loop expansion bends and sockets in running lengths of pipes.	40	LM		-
	Pipework Insulation				
I	Allow for insulation for pipework, bends, tees and other fittings. To approval. The thermal conductivity of the insulate shall not exceed 0.033 W/m.K at 10°C mean.	40	LM		-
	Electrical Works				
J	Allow for all wiring to the pumps and sensors and any other electrical equipment. Note: Electrical supply shall be brought to within five (5) metres of equipment	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 7: VILLAS INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
VI	SOLAR WATER HEATING SYSTEM	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 8: GATE HOUSE INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	SANITARY FITTINGS Supply, deliver, install, test and commission the following sanitary fittings including all the necessary fittings and jointing. Where brand names are mentioned it is only intended as a guide to the type and quality expected. Other equal and equivalent brands shall be accepted upon approval by the Engineer.				
	Water Closet - Close Coupled				
A	Water Closet - Close Coupled as IDEAL STANDARDS, c/w cistern with 6 litres flash, push button. Complete with seat and cover, outlet connector and all other necessary fixing accessories. or equal and approved	1	NO.		-
	Toilet Roll Holder				
B	Toilet roll holder as TWYFORD "VC9806WH" white in colour and in Vitreous China. Recessed into wall. Or equal and approved	1	NO.		-
	Robe / Coat Hook				
C	Robe / Coat Hook, Triple, as DALI, Ref. No. #HK313, chrome finish. or equal and approved.	1	NO.		-
	Wash Hand Basin				
D	Wall Hung wash hand basin as IDEAL STANDARDS, c/w Semi-Pedestal, of nominal size 550 x 430mm, white in colour and in Vitreous China, comprising of 1 center tap hole, 1 ¼ " waste fitting, 1 ¼ " chrome plated bottle trap. or equal and approved.	1	NO.		-
	Wash Hand Basin Tap				
E	Delay action push tap as DOCOL, Ref. No. #CBSTPDCZZ05, Chrome plated and deck mounted. With flow restrictor (+ or - 3 seconds) of flow after button is pressed. or equal and approved.	1	NO.		-
	Mirror				
F	Plain size bevelled 6mm thick glass plate mirror size 600 x 600mm. Complete with foam lining and dome headed chrome plated fixing Screws	1	NO.		-
	Soap Dispenser				
G	Wall mounted soap dispenser as "Mediclinics DJ0111C" with a capacity of 1.1L and in AISI 304 Stainless Steel material, having a press action soap release mechanism complete with fixing screws. Allow for initial soap supply. or equal and approved.	1	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 8: GATE HOUSE INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Shower Fittings				
J	Chrome plated shower knob as COBRA, to be connected to concealed pipework, and instantaneous water heater, suitable for salty and hard water as LORENZETTI. or equal and approved.	1	NO		-
	Towel Rail				
K	Towel Rail Bar, 650mm as DALI, Ref. No. TMA11, chrome finish. or equal and approved	1	NO.		-
	Soap Tray Holder				
L	Soap Tray Holder as TWYFORD "VC9808WH" white in colour and in Viterous China. Recessed into wall. Or equal and approved	1	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 8: GATE HOUSE INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
II	<p>PLUMBING INSTALLATIONS</p> <p>COLD WATER SUPPLY</p> <p>Supply, deliver, install test and commission the following: PP-R pipes and fittings to DIN 8077-78 Standards and relevant local standards. Tenderers must allow in their pipework prices for all the couplings, connectors, joints, bypass bends, caps and pipe clips in running lengths of pipes. Jointing & installation methods shall be as per manufacturers' recommendations only. All pipe diameters are external diameters.</p> <p>PolyproPylene Random (PP-R) pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.</p>				
A	<p>PP-R Pipes</p> <p>a) 25mm PPR pipes</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	6 6 4 4	LM LM LM LM		- - - -
B	<p>Elbow and Bends</p> <p>a) 25mm Bend/Elbows</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	6 6 4 4	NO. NO. NO. NO.		- - - -
C	<p>Tees</p> <p>a) 25mm Tees/Equal Tee</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	6 6 4 4	NO. NO. NO. NO.		- - - -
D	<p>Reducers</p> <p>a) 25x20mm ditto</p> <p>b) 32x25mm ditto</p> <p>c) 40x25mm ditto</p> <p>d) 40x32mm ditto</p> <p>e) 50x32mm ditto</p>	4 4 4 4 4	NO. NO. NO. NO. NO.		- - - - -
E	<p>Unions</p> <p>a) 25mm diameter union</p> <p>b) 32mm ditto</p> <p>c) 40mm ditto</p> <p>d) 50mm ditto</p>	6 4 4 4	NO. NO. NO. NO.		- - - -
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 8: GATE HOUSE INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
F	Sockets				
	a) 25mm Socket	4	NO.		-
	b) 32mm ditto	4	NO.		-
	c) 40mm ditto	4	NO.		-
	d) 50mm ditto	4	NO.		-
G	Male/Female Adaptors				
	a) 25mm Male/Female Adaptor	4	NO.		-
	b) 32mm ditto	4	NO.		-
	c) 40mm ditto	2	NO.		-
	d) 50mm ditto	2	NO.		-
H	Isolation Valves (Pegler)				
	a) 25mm gate valve	2	NO.		-
	b) 32mm ditto	2	NO.		-
	c) 40mm ditto	1	NO.		-
	d) 50mm ditto	1	NO.		-
I	Flexible Tubes				
	15mm diameter 300mm long flexible tubings required complete with backnuts and angle valve as Grohe, Ref. No.22940000. or equal and approved	2	NO.		-
J	Domestic Storage Water Tank				
	Plastic storage water Tank of capacity 1,000 litres diameter 1,690mm and 1,480mm high as "Kentainers" or equal and approved. The tank to be complete with 40mm diameter inlet with high pressure ball valve and 50mm diameter overflow pipe and 50mm wash out and float switch regulator	1	NO.		-
K	Water Meters				
	25mm diameter water meter as "Kent". or equal and approved.	1	NO		-
L	Meter Chamber				
	Meter chamber size 1000x1000x800mm deep with 100mm concrete (1:3:6) base 100mm block sides rendered all round in cement and sand (1:4) and with approved hinged and flanged cast iron cover and frame including all necessary excavation, disposal and formwork.	1	NO.		-
M	Sterilization				
	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 8: GATE HOUSE INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
III	DRAINAGE INSTALLATIONS Supply, deliver and install the following UPVC, MUPVC, soil and waste systems respectively to B.S 5255 with fittings fixed to Manufactures Printed instructions and manufactured by reputable manufacturers. Tenderers must allow in their pipework prices for all the couplings, clippings, connectors, joints etc. as required in the running lengths of pipework and also where necessary, for pipe fixing clips, holder bats plugged and screwed for the proper and satisfactory functioning of the system.				
A	Pipes				
	a) 100mm dia UPVC Grey pipe (heavy duty)	6	LM		-
	b) 100mm dia UPVC Golden Brown (heavy duty)	6	LM		-
	c) 50mm ditto	8	LM		-
	d) 40mm Ditto	8	LM		-
B	Bends				
	a) 100mm diameter UPVC sweep bend	6	NO.		-
	b) 40mm ditto	4	NO.		-
C	Tees				
	a) 100mm diameter sweep tee	6	NO.		-
	b) 40mm ditto	4	NO.		-
D	Boss Connectors				
	a) 100x50mm diameter boss connector	4	NO.		-
	b) 100 x 40mm ditto.	4	NO.		-
E	Inspection Plugs/Access caps				
	a) 100mm access cap	4	NO.		-
	b) 40mm diameter inspection plugs	4	NO.		-
F	100mm diameter vent cowl	2	NO.		-
G	100mm diameter Water Closet connectors	4	NO.		-
H	Four-way 100x50mm floor trap c/w HD plastic grating.	4	NO.		-
I	Four-way 100x50mm floor trap c/w HD stainless steel grating	2	NO.		-
J	100mm diameter gully trap complete with chamber and cover.	2	NO.		-
K	Standard 600x450mm Inspection Chamber complete with HD cover.	2	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 8: GATE HOUSE INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
V	FIREFIGHTING INSTALLATIONS				
	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	1	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	1	NO.		-
iii)	9 Ltr water fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	1	NO.		-
iv)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	1	NO.		-
v)	9" (225mm) manual operated alarm bell (Gong)	1	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 8: GATE HOUSE INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	SANITARY FITTINGS	-
II	PLUMBING INSTALLATIONS	-
III	DRAINAGE INSTALLATIONS	-
IV	FIREFIGHTING INSTALLATIONS	-
V	RAIN WATER DRAINAGE	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 9: GENERATOR ROOM INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
I	FIREFIGHTING INSTALLATIONS				
	FIRE EXTINGUISHERS & ACCESSORIES				
i)	5 Kg carbon dioxide gas fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	3	NO.		-
ii)	6 Kg dry powder fire extinguisher complete with pressure gauge, initial charge and mounting brackets.	3	NO.		-
iii)	Fire Safety Signage, Fire Point signs and Fire Action Plan signs, to Engineer's approval.	3	NO.		-
iv)	6 Kg automatic dry powder fire extinguisher, ceiling mounted, complete with pressure gauge, initial charge and mounting brackets.	3	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

COLLECTION PAGE

BILL NO. 9: GENERATOR ROOM INSTALLATIONS

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
I	FIREFIGHTING INSTALLATIONS	-
II	RAIN WATER DRAINAGE	-
	Total C/F to Summary Page	-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 10: EXTERNAL WATER RETICULATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	<p>WATER BOOSTER PUMPS & PIPEWORK Supply, deliver, install test and commission the following:</p> <p>Water Booster Pump</p>				
A	Water Booster pumpset comprising 2 No. pumps (Duty and Stundby) with automatic changeover, each of capacity 20m ³ /hr at 35m total head as GRUNDFOS CR 20-3, 4.0kW, 5.5ph. Complete with pressure vessel, pressure switch and gauge, overload protection and all necessary controls all mounted on common base plate. NB: Alternatives shall be supplied with the written approval of the Engineer	1	SET		-
	<p>Control Panel</p>				
B	Control panel for above pumps with contactors, over voltage and under voltage protection relays, MCBs, timer, start/stop push buttons, internal buttons with automatic changeover, 'running' and 'trip' neon lights control system and button for change from automatic to manual operation. There shall also be an adjustable time delay switch to ensure pumping cycles are controlled to not more than 6 per hour, float switch cable, low level cut-out switch in low level tank and regulator.	1	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 10: EXTERNAL WATER RETICULATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	WATER RETICULATION PIPEWORK Supply of HDPE, PN 16 materials - All Polyethylene material shall be 16.0 KG/SQ.CM (unless otherwise stated) suitable for butt fusion jointing and the rate shall include for supply and delivery to the work site of all pipes, jointing fittings & specials including all other associated accessories (to suite PN 16 flange), required for complete installation to relevant local standards. Or approved equivalent HDPE pipe has been used as a guide to the type and quality expected. Equal and approved brands shall be accepted only with the Engineers approval.				
A	HDPE Pipes				
	i) 50mm HDPE Pipes	120	LM		-
	ii) 63mm ditto	102	LM		-
	iii) 75mm ditto	105	LM		-
	iv) 100mm ditto	630	LM		-
B	Elbow and Bends				
	i) 50mm Bend/Elbows	92	NO.		-
	ii) 63mm ditto	76	NO.		-
	iii) 75mm ditto	44	NO.		-
	iv) 100mm ditto	106	NO.		-
C	Tees				
	i) 50mm Tees/Equal Tee	50	NO.		-
	ii) 63mm ditto	76	NO.		-
	iii) 75mm ditto	44	NO.		-
	iv) 100mm ditto	124	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 10: EXTERNAL WATER RETICULATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
D	Reducers				
	i) 50x40mm Reducer	36	NO.		-
	ii) 63x50mm ditto	32	NO.		-
	iii) 75x63mm ditto	24	NO.		-
	iv) 100x75mm ditto	48	NO.		-
E	Unions				
	i) 50mm diameter Union	60	NO.		-
	ii) 63mm ditto	48	NO.		-
	iii) 75mm ditto	50	NO.		-
	iv) 100mm ditto	120	NO.		-
F	Sockets				
	i) 50mm Socket	120	NO.		-
	ii) 63mm ditto	120	NO.		-
	iii) 75mm ditto	72	NO.		-
	iv) 100mm ditto	174	NO.		-
G	Male/Female Adaptors				
	i) 50x40mm Male/Female Adaptor	78	NO.		-
	ii) 63x50mm ditto	78	NO.		-
	iii) 75x63mm ditto	42	NO.		-
	iv) 100x75mm ditto	108	NO.		-
H	Isolation Valves (Pegler)				
	i) 50mm Isolation Valves	12	NO.		-
	ii) 63mm ditto	12	NO.		-
	iii) 75mm ditto	8	NO.		-
	iv) 100mm ditto	24	NO.		-
I	Pressure Reducing Valves (PRV)				
	i) 25mm Isolation Valves	20	NO.		-
	ii) 32mm ditto	8	NO.		-
	iii) 40mm ditto	8	NO.		-
	iv) 50mm ditto	12	NO.		-
J	Stand Pipe				
	15mm diameter hose bib tap suitable for connecting hose pipe complete with threaded adaptors. The tap to be complete with 1meter long 20mm diameter GMS pipe class B, bends support, etc. The chrome plated bib tap to be as Cobra ref.108 hose bib taps or equal and approved.	20	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 10: EXTERNAL WATER RETICULATION INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
	Excavation				
K	Excavate trench for HDPE & fire hydrant water reticulation pipework not exceeding 1500mm depth and 750mm width on average, part refill and ram, and surplus cart away.	957	LM		-
	Water Line Markers				
L	Standard pre-cast concrete water line marker, post marked "WL", set in concrete (1:3:6) base, including form work, excavations, back-filling and disposal. Plate to be painted blue with gloss oil paint and engraved letters in black. All to the satisfaction of the engineer.	30	NO.		-
	Bulk Water Meters				
M					
i)	40mm Bulk Water Meter as KENT. or equal and approved.	1	NO		-
ii)	50mm ditto	1	NO		-
	Sterilization			-	
N	Allow for sterilization including flushing out water and chlorine of the water supply line and water storage tank to the satisfaction of the Engineer	1	ITEM	-	-
	Total C/F to Summary Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 11: EXTERNAL FIRE HYDRANT SYSTEM INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	EXTERNAL FIRE HYDRANT SYSTEM Supply, install and commission Fire hydrant system as shown on the drawings and as per the details below Supply, deliver and install galvanised mild steel tubing to BS 1387 Class C, socket joints to BS 143 and galvanised malleable iron fittings including fixing and joints. Tenderers must allow in their pipe work prices for all the couplings, connectors, joints etc. required in the running length of pipe work and also where necessary, for pipe fixing clips, holder bats, plugs, screws, brackets and pipe sleeves through Structural members.				
	PIPING /FITTINGS				
A	Tubing:				
	i) 100 mm diameter Tubing	630	LM		-
	ii) 65 mm ditto	72	LM		-
B	45° & 90° Bends/ Elbows:				
	i) 100 mm diameter Bends/ Elbows	96	NO.		-
	ii) 65 mm ditto	30	NO.		-
C	Tees:				
	i) 100 x 100 x 100 mm diameter Tee	24	NO.		-
	ii) 100 x 100 x 65 mm ditto	12	NO.		-
D	Reducing Bushes				
	i) 100 X 65 mm diameter Reducing Bush	12	NO.		-
E	Air Release Valve 25mm diameter Air Release valve (6 to 8 bar) as "TYCO" or equal and approved	6	NO.		-
F	Hydrants Valve 65 mm bore Flanged Bib nose model LV-05 hydrant valve as "EVERSAFE". Complete with a suitable hydrant key and hydrant cover key for operating the fire hydrant valve. or equal and approved	6	NO.		-
G	Gate Valves: 100 mm Ø, Cast Iron Gate Valve as "HATTERSLEY" or equal and approved	6	NO.		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 11: EXTERNAL FIRE HYDRANT SYSTEM INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	Total B/F from Previous Page				-
H	<p>Breeching Inlet 2-way breeching inlet, model BL2 as "EVERSAFE" or equal and Approved. Particular specification: Body material--copper/iron Outlet--flanged 100mm diameter Inlet--2 x 65 mm diameter male inst. non return valves & 25 mm drain valve. Caps--plastic Finishing--red. Complete with a breaching inlet cabinet</p>	3	NO.		-
I	<p>Fire Equipment Cabinet Lockable Galvanised Steel Fire hose cabinet (with hooks and partitions to accommodate 2 delivery hoses, 1 branch pipe and 2 portable fire extinguishers) to the approval of the Engineer. Cabinet to be 1000 mm wide x 400mm deep x 1200 m high anchored to the ground with motar. Construction to be done using 50mm x 50mm x 3mm angle iron frame and covered using 3mm thick GMS sheet</p>	6	NO.		-
J	<p>Indicator Plate Standard pre-cast concrete fire hydrant marker, post marked "FH", set in concrete (1:3:6) base, including form work, excavations, back-filling and disposal. Plate to be painted Yellow with gloss oil paint and engraved letters in black. All to the satisfaction of the engineer.</p>	20	NO.		-
K	<p>Hose Pipe:</p>				
i)	Hydrant hose as "VIKING" to BS 6391, 1983 type 30402 measuring 23m x 64mm Nominal diameter	6	NO.		-
ii)	Jet Nozzle complete with Branch pipe as "EVERSAFE" with the following specifications: Material: Aluminium alloy to BS 1490 Code No: JSN - 001-AL Finishing: Natural Inlet Size: Male Instantaneous BS 336 Flow Rate at 65 PSI: 210L/ Min (12 mm dia.) 510 L/Min (19 mm dia.) Throw Range at 65 PSI: 16 m (12 mm dia.) 22 mm (19 mm dia.)	6	NO.		-
L	<p>Fire Pump Supply and install packaged fire pump set as NAFCO or equal and approved, comprising of two pumps and a Jockey pump. One pump to be duty and the other pump standby. One pump is to be Electrically driven and the other diesel driven and to be complete with delivery check valves, delivery stop valves, start pressure switch, etc. The pump to be as NPH series Standard model as 350GPM against a pressure of 5 bar. The pump to be as NPS350/7-EDJ100-103 and conform to NFPA-13 2002 Edition.</p>	1	NO.		-
	Total C/F to Collection Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

BILL NO. 12: GENERAL ITEMS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	<p>These items consist of preliminaries and general Conditions as described in Part A of this document.</p> <p>The contractor shall ensure pricing of items below is not limited to items described below but includes all clauses of Part A of this document.</p>				
A	Allow for liaising and obtaining all the necessary licenses/permission and/or certificates from local authorities to complete works	1	ITEM		-
B	Acquire and submit a Performance Bond for 5% of the sub-contract sum, as a Performance Guarantee.	1	ITEM		-
C	Acquire and submit relevant insurances i.e Contractors All Risk (CAR) Insurance and Work Injury Benefits Act (WIBA) Insurance for the sub-contract work.	1	ITEM		-
D	Allow for presentation of all the required samples as per specifications, Bills of Quantities and Drawings.	1	ITEM		-
E	Allow for preparation and printing of approved Working Drawings for use on site, throughout the project implementation period, in A1 paper size	1	ITEM		-
F	<p>Prepare and submit As-Installed Drawings for routes, types, sizes and arrangement of all pipework and installed equipment, as follows:-</p> <p>5 No. final hard copies of As-Installed drawings in A1 size and soft copy in Autocad® 2013 in CD-RW ~ Services Engineers, Architect, Main Contractor (1 copy each) and Client (2 copies)</p>	1	ITEM		-
G	Prepare and submit Operating Instructions and Maintenance Manuals for all items installed i.e pumps, fans, control panels etc.	1	ITEM		-
	Total C/F to Summary Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS

SUMMARY PAGE

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
1	BILL NO. 1: LECTURE AND ADMIN UNIT INSTALLATIONS	-
2	BILL NO. 2: LABORATORY INSTALLATIONS	-
3	BILL NO. 3: WORKSHOP INSTALLATIONS	-
5	BILL NO. 4: GENTS ACCOMMODATION INSTALLATIONS	-
6	BILL NO. 5: LADIES ACCOMMODATION INSTALLATIONS	-
7	BILL NO. 6: STUDENT KITCHEN & DINING INSTALLATIONS	-
8	BILL NO. 7: VILLAS INSTALLATIONS	-
11	BILL NO. 8: GATE HOUSE INSTALLATIONS	-
12	BILL NO. 9: GENERATOR ROOM INSTALLATIONS	-
13	BILL NO. 10: EXTERNAL WATER RETICULATION INSTALLATIONS	-
14	BILL NO. 11: EXTERNAL FIRE HYDRANT SYSTEM INSTALLATIONS	-
15	BILL NO. 12: GENERAL ITEMS	-
TOTAL FOR INSTALLATION WORKS CARRIED TO GRAND SUMMARY PAGE		-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
AIR CONDITIONING AND MECHANICAL VENTILATION INSTALLATIONS

BILL NO. 1: SERVER ROOM AIR CONDITIONING

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE (KSHS)	AMOUNT (KSHS)
	AIR CONDITIONING & MECHANICAL VENTILATION Supply, deliver and install the following Air Conditioning System comprising of the Indoor and Outdoor Units as here below described and to positions indicated on the contract drawings and as instructed by the Engineer: - Server Room & Meeting Room				
A	High Wall Unit - 7.0 kW High Wall unit with a rated cooling capacity of 7.0 kW (24,000 Btu/hr) . The unit to run on R410A refrigerant and be capable of air filtration, directional air flow and error autodiagnosis. Complete with Outdoor Unit To have the following features: Floor standing white indoor & outdoor unit c/w mounting brackets Voltage protection of the units Wireless Remote controller c/w batteries The unit to be as TOSHIBA / BOSCH or equal and approved.	4	NO.		-
B	Refrigeration Pipework				
i)	Hard drawn heavy gauge copper piping of various sizes from 1/2" to 1 5/8" Dia complete with 25mm thick Closed Cell Rubber Insulation and aluminium foil cladding of appropriate gauge, necessary bends, reducers, 'Y' joints, distributors, support brackets, etc, for SUCTION LINE. or equal and approved insulation material	75	LM		-
ii)	Hard drawn heavy gauge copper piping of various sizes from 1/4" to 7/8" Dia complete with 25mm thick Closed Cell Rubber Insulation, and aluminium foil cladding of appropriate gauge, necessary bends, reducers, 'Y' joints, distributors, support brackets, etc, for LIQUID LINE. or equal and approved insulation material	75	LM		-
C	Condensate Drain Pipe 32mm diameter high pressure pipe as condensate drainage pipe work complete with necessary bends, reducers, tees, supports, hangers & fixtures and with 20mm thick Closed Cell Rubber Insulation, and aluminium foil cladding of appropriate gauge. or equal and approved insulation material	60	LM		-
D	Electrical Works Allow for all electrical and control wiring including cabling to and from the indoor units to outdoor units (for item above items), c/w voltage surge protection device. To approval of the Project Engineer	1	ITEM		-
	Total C/F to Next Page				-

PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES
AIR CONDITIONING AND MECHANICAL VENTILATION INSTALLATIONS

SUMMARY PAGE

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
1	BILL NO. 1: SERVER ROOM AIR CONDITIONING	-
	TOTAL FOR SERVER ROOM AIR CONDITIONING	-

**PROPOSED KENGEN GEOTHERMAL TRAINING CENTRE (GTC), OLKARIA, NAIVASHA
BILL OF QUANTITIES FOR MECHANICAL SERVICES**

MAIN SUMMARY PAGE

ITEM NO.	DESCRIPTION	TOTAL (KSHS)
1	PLUMBING, DRAINAGE AND FIREFIGHTING INSTALLATIONS	-
2	AIR CONDITIONING & MECHANICAL VENTILATION	-
TOTAL FOR MECHANICAL INSTALLATIONS CARRIED TO GRAND SUMMARY IN VOLUME II		-

Total Amount in words

.....

Tenderer's Name and Stamp

Signature: **Date:**

PIN No.: **VAT No.:**

Witness: **Address**

Signature: **Date:**