PROPOSED MILK PROCESSING/PASTEURIZING UNIT AND WATER BOTTLING PLANT

AT

LIMURU

PLUMBING, DRAINAGE & FIRE FIGHTING SERVICES

SUB-CONTRACT CONDITIONS, SPECIFICATIONS AND BILLS OF QUANTITIES

NAME OF TENDERER

CLIENT:

ARCHIDIOCESE OF NAIROBI
P.O BOX 27043 - 00100
NAIROBI.

ARCHITECTS:

TRIOSCAPE SPACE PLANNING LTD.
P. O. BOX 66652 – 00800
NAIROBI.

QUANTITY SURVEYORS:

LAUREZ AND ASSOCIATES
P.O. BOX 2439- 00200
NAIROBI.

CIVIL/STRUCTURAL ENGINEERS:

FRAME CONSULTANTS LTD.
P. O. BOX 58624 - 00200
NAIROBI.

MECHANICAL & ELECTRICAL ENGINEERS:

GEOMAX CONSULTING ENGINEERS LTD.
P.O. BOX 53748 – 00200
NAIROBI.

JUNE, 2020

FORM OF TENDER

FOR

PLUMBING, DRAINAGE & FIRE FIGHTING SERVICES

AT

PROPOSED MILK PROCESSING/PASTEURIZING UNIT AND WATER BOTTLING PLANT

TO: Archdiocese of Nairobi,
P. O. Box 14231 – 00800,
NAIROBI.

Sir,

1. Having examined Specification N0.J1902M with Schedules hereto, we hereby offer to execute and do several works and things described or referred to in the said Specification, Schedules and Conditions, which under the terms thereof are to be supplied, executed and done by the Sub-Contractor to perform and observe the Provisions and agreements on the part of the Sub-Contractor, contained or reasonably to be inferred from the said Specification, Schedules and Conditions of Contract for the same at the date set out in the Schedules.

   Our Lump Sum Price for the said installation as set out in Price Schedules

   is (in figures) KShs.....……..……..

   (in words).....…….

   .....……

2. If our Tender is accepted we will, when required, obtain the guarantee of an Insurance Company or Bank or other sureties (to be approved by the Client) to be jointly and severally bound with us in a sum of Ten Percent (10%) of the above named sum for the due performance of the Contract under the terms of a Bond.

3. We agree to abide by this Tender for the period of ninety (90) days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

4. Unless and until a formal agreement is prepared and executed this Tender, together with your written acceptance thereof, shall constitute a binding Contract between us and the Client.

5. We understand that no alteration to this Tender Document will be allowed and any unauthorised alterations may invalidate the Tender.

6. We understand that you are not bound to accept the lowest or any tender you receive.

7. We understand that retention money at the rate of 10% of the certified value shall be held to a limit of 5% of this Contract amount.

Dated this ……day of ……..……

Signature……..Name …….

in the capacity of …….

Duly authorised to sign tenders for and on behalf of …….

……..…….…….

(IN BLOCK CAPITALS)

Address:
.....…….

.....……..

Witness:

Name: .....….....……..

Signature: ……

Address:
.....…….

.....…….

Occupation .....……

INSTRUCTIONS TO TENDERERS

1. **Currency**

The Bills of Quantities and Form of Tender are to be priced out in **Kenya Shillings.**

2. No alterations shall be made on the Form of Tender or in the Specification and Schedules. The tenderer must submit a tender which complies with the Specification in all respects. The tenderer may, in addition, submit alternative tenders for portions or the whole of the works to designs other than those specified. All alternative tenders must be accompanied by a full and comprehensive specification of the alternative design.

3. **Time of Starting and Completion**

Possession of the site will be given immediately upon the issue of the letter accepting the Tender, unless otherwise stated. The works are to commence forthwith and the time of completion is to be calculated from the date of commencement.

4. **Pricing**

The rates and prices set down by the Tenderer against the item in the Bills of Quantities are to be full inclusive value of the finished works described thereunder and are to include for profit and all obligations and liabilities of every kind which under the Contract are to be borne by the Contractor.

The Tenderer's attention is particularly drawn to the section in which provision is made for the pricing of the Contractor's general obligations. Any items not priced, either in this section or elsewhere in the Bills of Quantities, will be deemed to have been allowed for in the prices inserted against other items in the Bills of Quantities.

5. **Assignment and Sub-Letting**

The Tenderer's attention is drawn to the Clause in the Conditions of Contract which prohibits the assignment or sub-letting of the whole or any portion of the works without the prior consent in writing of the Employer or their representative. This requirement will be strictly applied and flagrant disregard of it by the Contractor will be treated as a ground for termination of his employment. The Tenderer shall submit with his Tender a list of all portions of the work he proposes to sub-let, with particulars (as far as possible) of the Contractors, he proposes to employ, but the acceptance of his Tender shall not be regarded as implying in any way approval of his proposal for sub-letting.

6. **Canvassing**

Any form of canvassing is strictly prohibited. If a Tenderer makes any representation intended to influence the consideration of the Tenders either directly or indirectly to any person officially concerned in the Condition of the Tender, his Tender shall be disqualified.

7. **Form of Tender**

(a) The Tender must be submitted on the Form of Tender provided in Envelope B. The Tender amount is to be inserted in words and figures in the space provided and all blank spaces elsewhere in the Form of Tender must be filled in with the information required.

(b) The Tender must be signed by the principal of the firm or by a person authorized for the purpose and the registered name and address of the Contractor must be printed in block letters or typed or rubber-stamped in the space provided. No Tender that is incompletely filled in will be considered.

8. No alterations shall be made on the Form of Tender or in the Specification and Schedules. The tenderer must submit a tender which complies with the Specification in all respects. The tenderer may, in addition, submit alternative tenders for portions or the whole of the works to designs other than those specified. All alternative tenders must be accompanied by a full comprehensive specification of the alternative design.

9. The tenderer (whether his tender is accepted or not) and all other recipients of the specification and documents (whether they submit a tender or not) shall treat the details of the specification and the documents attached thereto as private and confidential.

10. The Purchaser/Employer does not bind himself to accept the lowest or any tender and will not be responsible for or pay for expenses or losses which may be incurred by any tenderer in the preparation of his tender.

11. It will be presumed that the tenderer will have visited the site and has taken into consideration, any special difficulties and requirements not referred to herein but associated with a new plant being installed to serve new and existing buildings, and to have made allowance for such in his tender.

12. The Tender and all accompanying documents duly completed shall be enclosed in a plain sealed envelope marked:-

"PROPOSED MILK PROCESSING/PASTEURIZING UNIT AND WATER BOTTLING PLANT
PLUMBING, DRAINAGE & FIRE FIGHTING SERVICES"

The tender must be received not later than the time, date and the address stated in the covering letter.

Unless written consent is given to the contrary, tenders received later than the date specified above shall not be considered.

13. All items of additional information, issued to the tenderers prior to the time of closing of bids shall become a part of the Contract Documents and shall be included in the proposals.

14. The Contract will be deemed to have been awarded when formal notice is given to the Tenderer that the Purchaser/Employer has accepted the Tenderer's proposals.

15. Failure on the part of the Tenderer to furnish the information requested or to comply with these instructions may be a cause for rejection of the bid.

16. Unsuccessful Tenderers and recipients of the Documents not wishing to bid shall return the complete tender document, together with any additional information supplied to them within five (5) days of notification.

17. The Tenderer shall provide leaflets and catalogues giving technical and physical details of equipment being offered by him as an integral part of his bid.

18. All Tenderer shall, where applicable, mark the details of structural provisions required for the installation of their equipment on the Tender Drawings provided.

19. Unless otherwise specified in the Particular Specification, Tenderers shall assume that all equipment required will be subject to Import Duty and Value Added Tax.

20. An alternative tender which does not comply with the relevant IEC Codes, British Standards and Codes of Practice must contain a statement to this effect and should give reference to the Standards and Codes of Practice upon which the alternative is based.

21. **Conditions of Labour**

The Tenderer's attention is drawn to the requirements in the Conditions of Contract to comply with all regulations, rules or instructions concerning conditions and terms of employment of any class of employee.

22. The Client may choose to supply some of the imported materials specified in which case these will be omitted from the Tender sum. It is deemed that the Tenderer would have taken this possible omission into account in pricing his tender. The Client would then hand over to the nominated Sub-Contractor for installation at a reasonable price to be agreed based on labour and complexities involved.

23. **Tender Documents**

These documents shall not be dismembered and must be filled-in and submitted intact as bound. **Dismembering documents will lead to disqualification and rejection of the bid.**

Tenderers are free to append own Specifications, brochures, warranties etc.

CONFIDENTIAL BUSINESS QUESTIONNAIRE

You are requested to give the particulars indicated in Part 1 and either Part 2 (a), 2 (b) or 2 (c) whichever applies to your type of business.

You are advised that it is a serious offence to give false information on this Form.

Part 1 – General:

Business Name: ……
Attach copy of certificate of incorporation or Registration Certificate.
Location of business premises: ……
Plot No.: …… Street/Road ……..
Postal Address: …… Tel No.: …….
Nature of business: ……..
* Current Trade License No.: ……
* P. I. N. No.: ……
* VAT Certificate No.: ……..
* Attach copies.

Maximum value of business which you can handle at any one time: K£ …….
Name of your bankers …… Branch ……

Part 2 (a) – Sole Proprietor:

Your name in full: …….. Age: ……
P. I. N. No.: ……
Nationality: …….. Country of Origin: ……
* Citizenship details: ……..

Part 2 (b) – Partnership:

Give details of Partners as follows:

	Name	P. I. N. No.	Nationality/Citizenship Details	Shares
1.	……			
2.	……			
3.	……			
4.	……			

Attach copy of P. I. N. certificate.

Part 2 (c) – Registered Company

Private or public: ……

State the nominal and issued capital of the company -
Nominal K£ ……
Issued K£ ……

Give details of all directors as follows:

	Name	P. I. N. No.	Nationality/Citizenship Details	Shares
1.	……..			
2.	……..			
3.	……..			
4.	……..			

Attach copy (ies) of P. I. N. certificate.
Date: …….. Signature of Tenderer ……

* If Kenya Citizen, indicate under “Citizen Details” whether by Birth, Naturalisation or Registration.

EXPERIENCE OF TENDERER

The Tenderer shall complete the following table in respect of Projects completed and in progress in East and Central Africa. It is important that project works similar to those included in this Specification are included

LOCATION	DESCRIPTION OF WORKS	CLIENT	CONSULTING ENGINEER	PROJECT VALUE	DATE COMPLETED

FORM OF SURETY UNDERTAKING

(PERFORMANCE BOND)

TO: Archdiocese of Nairobi,
P. O. Box 14231 – 00800,
NAIROBI.

We
……

of
……

are willing to act as Surety and to be bound to Archdiocese of Nairobi in the sum equal to Ten per cent (10%) of the Contract Sum, for the due performance by ……. (Tenderer of) ……

a Contract which he/they contemplate(s) entering into with Archdiocese of Nairobi for the execution and completion of …….. according to the terms of the Form of bond (MOPW 118 Revised) a copy of which has been inspected by us, without the addition of any limitations.

We further agree that this Surety Undertaking shall remain valid for ninety (90) days or such extended time as agreed upon in writing by the Tenderer, from the final date of submission of the Tender of which this Document forms a part, we agree to enter into a Bond under the above terms within seven days of being called upon to do so.

…… (Surety)

…… (Address)

……

…… Occupation

…… Address

…… Date

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PART 1

PRELIMINARIES AND CONDITIONS OF SUB-CONTRACT

PART 1

PRELIMINARIES AND GENERAL CONDITIONS

		KShs.
1.01	**Examination of Tender Documents** The Tenderer is required to check the numbers of the pages of this document and should he find any missing or indistinct, he must inform the Services Consulting Engineer at once and have the same rectified. All tenderers shall be deemed to have carefully examined the following:- (a) Work detailed in the Specification and in the Sub-Contract Drawings. (b) The "General Conditions of Sub-Contract for Electrical Works". (c) Other documents to which reference is made. The Tenderer shall also be deemed to have included for any expenditure which may be incurred in conforming with the above items (a), (b) and (c) and observe this expense as being attached to the Sub-Contract placed for the whole or any part of the work. The tenderer shall ensure that all ambiguities, doubts or obscure points of detail are clarified with the Consulting Engineers before submission of his tender, as no claims for alleged deficiencies in the information given shall be considered after this date.	
1.02	**Discrepancies** The Sub-Contractor shall include all work either shown on the Sub-Contract Drawings or detailed in the Specification. No claim nor extra cost shall be considered for work which has been shown on the drawings or in the specification alone. Should the drawing and the specification appear to conflict, the Sub-Contractor shall query the points at the time of tendering and be satisfied that all work intended is included as no claim for extra payment on this account shall be considered after the Sub-Contract is awarded.	
1.03	**Statement of Compliance** At the commencement of the works, the Sub-Contractor shall investigate and report to the Engineer if all materials and equipment to be used in the work and not specified as supply by others are available locally. If these materials and equipment are not available locally, the Sub-Contractor shall at this stage place orders for the materials in question and copy the orders to the Engineer. Failure to do so shall in no way relieve the Sub-Contractor from supplying the specified materials and equipment in time.	

		KShs.
	Materials supplied by others for installation and/or connection by the Sub-Contractor shall be carefully examined in the presence of the supplier before installation and connection. Any defects noted shall be reported to the Engineer. The Sub-Contractor shall be responsible for verifying all dimensions relative to his work by actual measurements taken on the site. The Sub-Contractor shall mark accurately on one set of drawings and indicate all alterations and/or modifications carried out to the designed systems during the construction period. This information must be made available on site for inspection by the Engineer.	
1.04	**Conditions of Sub-Contract Agreement** The Sub-Contractor shall be required to enter into a Sub-Contract Agreement with the Main Contractor. The Conditions of the Sub-Contract between the Employer and the Sub-Contractor as hereinafter defined shall be the latest edition of the Agreement and Schedule of Conditions of Building and Civil Engineering Sub-Contractors as particularly modified and amended hereinafter. For the purpose of this Sub-Contract the Agreement and Schedule of Conditions and any such modifications and amendments shall be read and construed together. In the event of discrepancy the modifications and amendments shall prevail.	
1.05	**Definition of Terms** Throughout these Sub-Contract Documents units of measurements and terms are abbreviated, and wherever used hereinafter and in all other documents they shall be interpreted as follows:- (i) **Employer: -** The term "Employer shall mean Archdiocese of Nairobi, P. O. Box 56333 - 00200, Nairobi. (ii) **Main Contractor:-** The term "Contractor" shall mean the person or persons, firms or company whose tender for this work has been accepted, and who has entered into a contract agreement with the Client for the execution of the Contract Works and shall include his or their heirs, executors, administrators, assigns, successors, and duly appointed representatives. (iii) **Sub-Contractor:-** The term "Sub-Contractor" shall mean the person or persons, firms or company whose tender for this work has been accepted, and who has entered into a contract agreement with the Main Contractor for the execution of the Sub-Contract Works and shall include his or their heirs, executors, administrators, assigns, successors, and duly appointed representatives. (iv) **Architects: -** The term "Architects" shall mean Trioscape Space Planning Ltd., P. O. Box 66652 - 00800, Nairobi.	

			KShs.
	(v)	**Quantity Surveyor: -** The term "Quantity Surveyor" shall mean Laurez & Associates, P. O. Box 2439 - 00200, Nairobi.	
	(vi)	**Civil/Structural Engineers: -** The term "Civil/Structural Engineers" shall mean Frame Consultants Ltd., P. O. Box 58624 - 00200, Nairobi.	
	(vii)	**Electrical & Mechanical Engineers:** - The term "Electrical & Mechanical Engineers" shall mean Geomax Consulting Engineers, P. O. Box 53748 – 00200, Nairobi.	
	viii)	**Working Drawings:** - The term "Working Drawings" shall mean those drawings required to be prepared by the Sub-Contractor as hereinafter described.	
	(ix)	**Record Drawings:** - The term "Record Drawings" shall mean those drawings required to be prepared by the Sub-Contractor showing "as installed" and other records for the Sub-Contract Works.	
	(x)	**Abbreviations:**	
	Cm	Shall mean cubic metres	
	Sm	Shall mean square metres	
	Lm	Shall mean linear metres	
	Mm	Shall mean millimeters	
	No.	Shall mean number	
	Kg	Shall mean kilogramme	
	BS	Shall mean the current standard British Standard Specification published by the British Standard Institution, 2 Part Street, London W1, England.	
1.06	**Site Location**		
	The site of the proposed Sub-Contract works shall be located at Limuru farm (Loreto Girls High school) in Kiambu County.		

		KShs.
	The tenderer is recommended to visit the site and shall be deemed to have satisfied himself with regard to access, possible conditions, the risk of injury or damage to property on or adjacent to the site and the conditions under which the Sub-Contract Works shall have to be carried out. A climatic study of the site shall be undertaken by the Sub-Contractor. Unless otherwise stated, all ratings of plant, equipment and apparatus shall be interpreted as site ratings and not sea level or other ratings.	
1.07	**Duration of the Sub-Contract** Possession of the site will be given immediately upon the issue of letter accepting the tender unless otherwise stated. The works are to commence forthwith and the time of completion is to be calculated from the date of commencement. The tenderer in submitting his tender shall be deemed to have included for commencing any necessary works on site immediately. The Sub-Contractor shall be required to phase his work in accordance with the Main Contractor's programme. The programme is to be agreed with the project Architect /Engineer.	
1.08	**Scope of Sub-Contract Works** The Project involves construction of milk pasteurization unit and water treatment plant (go down) with supportive ancillary support services in Kiambu County. The Sub-Contractor shall supply, deliver, unload, hoist, fix, test, commission and hand over in satisfactory working order the complete installation detailed in the specification and accompanying Drawings, including all items of plant and equipment under other contracts. The Sub-Contractor shall supply all accessories, whether described in this Specification or not essential to the completion of the work to the satisfaction of the Engineer and in accordance with all local and Government Regulations. The Sub-Contractor shall be responsible for receiving of items or equipment supplied by other Sub-Contractors but to be fixed and commissioned under this Sub-Contract. The Client may choose to supply some of the imported materials specified in the Sub-Contract. Nevertheless the Tenderer is required to quote for the supply and installation of all materials specified.	

		KShs.
1.09	**Extent of the Sub-Contractor's Duties** At the commencement of the works, the Sub-Contractor shall investigate and report to the Engineer if all materials and equipment to be used in the work and not specified as supply by others are available locally. If these materials and equipment are not available locally, the Sub-Contractor shall at this stage place orders for the materials in question and copy the orders to the Engineer. Failure to do so shall in no way relieve the Sub-Contractor from supplying the specified materials and equipment in time. Materials supplied by others for installation and/or connection by the Sub-Contractor shall be carefully examined in the presence of the supplier before installation and connection. Any defects noted shall be reported to the Engineer. The Sub-Contractor shall be responsible for verifying all dimensions relative to his work by actual measurements taken on the site. The Sub-Contractor shall mark accurately on one set of drawings and indicate all alterations and/or modifications carried out to the designed systems during the construction period. This information must be made available on site for inspection by the Engineer.	
1.10	**Execution of the Works** The works shall be carried out strictly in accordance with all the relevant statutory instruments and regulations which include the following:- (a) All relevant British Standards Specification and Codes of Practice (hereinafter referred to as B.S. and C.P. respectively), I.E.E. Regulations, Electric Power Act and By-Laws of KP & L Co. Ltd. (b) IEC & ISO Standards. (c) By-laws of the Local Authority. (d) The Building Code. (e) Regulations under the Factories Act. (f) The I.E.E. Regulations for Electrical Installations. (g) Any special requirements of the Local Electricity, Water undertakings and Fire Authority. (h) The Architect's and/or Engineer's Instructions.	

		KShs.
	(i) This Specification and Sub-Contract Drawings. The Sub-Contract Drawings and Specifications shall be read and construed together.	
1.11	**Validity of Tender** The tender shall remain valid for acceptance within 90 days from the final date of submission of the tender, and this has to be confirmed by signing the Tender Bond. The Tenderer shall be exempted from this Bond if the tender was previously withdrawn in writing to the Employer before the official tender opening.	
1.12	**Firm Price Contract** Unless specifically stated in the documents or the invitation to tender, this is a firm-price Contract and the Sub-Contractor must allow in his tender for any increase in the cost of labour and/or material, or currency fluctuations during the duration of the Sub-Contract. No claims will be allowed for day to day currency fluctuations. The Sub-Contractor will be deemed to have allowed in his tender for any increase in the cost of materials which may arise as a result of currency fluctuation during the Sub-Contract period.	
1.13	**Variations** No alteration to the Sub-Contract Works shall be carried out until receipt by the Sub-Contractor of written instructions from the Engineer. Any variation from the Sub-Contract price in respect of any extra work, alterations or omissions requested or sanctioned by the Architect or Engineer shall be agreed and confirmed in writing at the time such variations are decided and shall not affect the validity of the Sub-Contract. Unit Rates shall be used to assess the value of such variations. No allowance shall be made for loss of profit on omitted works. Where the Architect requires additional work to be performed, the Sub-Contractor, if he considers it necessary, will give notice within 7 days to the Main Contractor of the length of time he (the Sub-Contractor) requires over and above that allocated for completion of the Sub-Contract. If the Sub-Contractor fails to give such notice he will be deemed responsible for all claims arising from delay occasioned by reason of such extension of time.	

		KShs.
1.14	**Prime Cost and Provisional Sums** A Specialist Sub-Contractor may be nominated by the Architect to supply and/or install any equipment covered by Prime Cost or Provisional Sums contained within the Sub-Contract Documents. The work covered by Prime Cost and Provisional Sums may or may not be carried out at the discretion of the Architect. The whole or any part of these sums utilised by the Sub-Contractor shall be deducted from the value of the Sub-Contract Price when calculating the final account.	
1.15	**Bond** All tenderers will submit the name of an approved Surety who will be willing to be bound to the Main Contractor in an amount equal to 10% of the Sub-Contract amount.	
1.16	**Government Legislation and Regulations** The Sub-Contractor must acquaint himself with current legislation and any Government Regulations regarding the movement, housing, security and control of labour, labour camps, passes for transport, etc. The Sub-Contractor shall allow for providing holidays and transport for work people, and for complying with Legislation Regulations and Union Agreements. The Sub-Contractor will be required to pay full Import Duty and other Government Taxes on all items of equipment, fittings and plant whether imported or locally manufactured items as required whether imported directly for this Sub-Contract or not. The tenderer shall therefore make full allowance in his tender for all such duty and tax. No advance payment will be made to the Sub-Contractor by the Main Contractor for the purpose of opening a Letter of Credit for the items to be imported or purchased locally. The Sub-Contractor will therefore be expected to make his own arrangements for the opening of letters of credit and payment of taxes.	

		KShs.
1.17	**Import Duty and Value Added Taxes** The Sub-Contractor shall be required to pay full Import Duty and Value Added Tax on all items of equipment, fittings and plant whether imported or locally manufactured items as required whether imported directly for this Sub-Contract or not. The tenderer shall therefore make full allowance in his tender for all such Duty and Tax. No advance payment will be made to the Sub-Contractor by the Client for the purpose of opening a letter of Credit for the items to be imported or purchased locally. The Sub-Contractor will therefore be expected to make his own arrangements for the opening of Letters of Credit and payments of taxes.	
1.18	**Insurance Company Fees** The attention is drawn to the Tenderers to allow for all necessary fees, where known, that may be payable in respect of fees imposed by Insurance Companies or statutory authorities for testing or inspection. No allowance shall be made to the Sub-Contractor with respect to fees should these have been omitted by the Tenderer due to his negligence in this respect.	
1.19	**Provision of Services by the Main-Contractor** The Main-Contractor shall make the following facilities available to other Sub-Contractors: (a) Attendance on the Sub-Contractor and the carrying out of the work affecting the structure of the building which may be necessary, including all chasing, cutting away and making good to brickwork, etc., Except that all plugging for fixing fittings, machinery, fans, ducting, etc, and all drilling and tapping of steel work shall be the responsibility of the Sub-Contractor. Any purpose made fixing brackets shall not constitute Builders' work and shall be provided and installed by the Sub-Contractor unless stated hereinafter otherwise. (b) The provision of temporary water, lighting and power. All these services utilised shall be the responsibility of the Main Contractor. The Sub-Contractor shall, however, allow for additional connections/ extensions required for his purposes. (c) Fixing of anchorages and pipe supports in the shuttering, except that all anchorages shall be supplied by the Sub-Contractor who shall also supply the Main Contractor will fully dimensioned drawings detailing their exact locations.	

			KShs.
	D (i)	Provision of scaffolding, cranes etc. but only in so far as it is required for Sub-Contract works. It shall be the Sub-Contractor's responsibility to liaise with the Sub-Contractor to ensure that there is maximum co-operation with other Sub-Contractors in the use of scaffolding, cranes etc.	
	(ii)	Any specialist scaffolding, cranes etc. by the Sub-Contractor for his own exclusive use shall be paid for the Sub-Contractor.	
	(iii)	The Sub-Contractor will be required to unpack from containers on site and transport to store on site all materials supplied by the Employer.	
1.20	**Storage of Materials on Site**		
	The Sub-Contractor shall submit the names of any approved suppliers for the materials to be incorporated to the Engineer for approval. The information regarding the names of the suppliers may be submitted at different times, as may be convenient, but no sources of supply will be changed without prior approval.		
	Each supplier must be willing to admit the Engineer or his representative to this premises during working hours for the purpose of examining or obtaining samples of the materials in question.		
1.21	**Samples and Materials Generally**		
	The Sub-Contractor shall, when required, provide for approval at no extra cost, samples of all materials to be incorporated in the works. Such samples when approved shall be retained by the Engineer and shall form the standard for all such materials incorporated.		
	No materials of any description shall be used or delivered to site without prior sanction by the Engineer, and any condemned materials as unit for use in the works, must be removed immediately from the site without any recompense to the Sub-Contractor.		
	All materials for the permanent works shall be new and shall, where no other specification is given, be of first class quality and suitable for the purpose intended.		
	Where trade names or manufacturer's catalogue numbers are mentioned the reference is intended as a guide to the type or article or quality of material required. The Sub-Contractor may use any article or material equal in type or quality to those described, subject to prior approval by the Engineer. The Sub-Contractor shall be responsible for proving equivalence in quality.		

		KShs.
1.22	**Administrative Procedure and Contractual Responsibility** Wherever within the Specification it is mentioned or implied that the Sub-Contractor shall deal with the employer or Engineer it shall mean "through the Sub-Contractor" who is responsible to the Employer for the whole of the works including the Sub-Contract Works.	
1.23	**Bills of Quantities** The Bills of Quantities have been prepared in accordance with the Standard Method of Measurement of Building Works for East Africa, First Edition, Metric 1970. All the Quantities are based on the tender drawings and are provisional and they shall not be held to gauge or to limit the amount or description of the work to be executed by the Sub-Contractor but the value thereof shall be deducted from the Sub-Contract sum and the value of the work ordered by the Engineer in accordance with the conditions of the Sub-Contract. All work liable to adjustment under this Sub-Contract shall be left uncovered for a reasonable time to allow measurements needed for such adjustment to be taken by the Quantity Surveyor. Immediately the work is ready for measuring the Sub-Contractor shall give notice to the Quantity Surveyor to carry out the measurements before covering up. If the Sub-Contractor shall make default in these respects he shall, if the Architect so directs, uncover the work to enable the necessary measurements to be taken and afterwards reinstate at his own expense.	
1.24	**Sub-Contractor's Office in Kenya** The Sub-Contractor shall maintain (after first establishing if necessary) in Kenya an office staffed with a competent Engineer Manager and such supporting technical and clerical staff as are necessary to control and co-ordinate the execution and completion of the Sub-Contract Works. The Engineer Manager and his staff shall be empowered by the Sub-Contractor to represent him at meetings and in discussions with the Sub-Contractor, the Engineer and other parties who may be concerned and any liaison with the Sub-Contractor's Head Office on matters relating to the design, execution and completion of the Sub-Contract Works shall be effected through his office in Kenya.	

		KShs.
	It shall be the Sub-Contractor's responsibility to procure work permits, entry permits, licenses, registration, etc in respect of all expatriate staff. The Sub-Contractor shall prepare a substantial proportion of his Working Drawings and Record Drawings at his office in Kenya. No reasons for delays in the preparation or submission for approval or otherwise of such drawings or proposals will be accepted on the grounds that the Sub-Contractor's Head Office is remote from his office in Nairobi or the site of the Sub-Contract works or otherwise.	
1.25	**Builder's Work** All chasing, cutting away and making good will be done by the Main-Contractor but the Sub-Contractor shall mark out in advance and shall be responsible for accuracy of size and positions of all holes and chases required. The Sub-Contractor shall drill and plug holes in floors, walls, ceilings and roof for securing services and equipment requiring screw or bolt fixing. Any purpose made fixing brackets shall not constitute Builder's Work and shall be provided and installed by the Sub-Contractor unless stated hereinafter to the contrary.	
1.26	**Structural Provision for the Works** Preliminary major structural provision has been made for the Sub-Contract works based on outline information ascertained during the preparation of the specification. The preliminary major structural provision made will be deemed as adequate unless the Sub-Contractor stated otherwise when submitting his tender. Any minor structural provision or alteration to major structural provisions required by the Sub-Contractor shall be shown on working drawings to be submitted to the Engineer within 30 days of being appointed. No requests for alterations to preliminary major structural provision will be approved except where they considered unavoidable by the Engineer. In no case will they be approved if building work is so far advanced as to cause additional costs or delays in the work of the Sub-Contractor.	

		KShs.
1.27	**Provision of Services, Plant, Equipment, Fitting and Apparatus** The Sub-Contract Drawings give a general indication of the intended layout. The position of the equipment and appliances, and also the exact routes of the ducts, mains and distribution pipework shall be confirmed before installation is commenced. The exact sitting of appliances, pipework etc, may vary from that indicated. The routes of services and positions of apparatus shall be determined by approved dimensions details on Working Drawings or on site by the Engineer in consultation with the Sub-Contractor or the Sub-Contractors. Services through the ducts shall be arranged to allow maximum access along the ducts and services shall be readily accessible for maintenance. Any work which has to be re-done due to negligence in this respect shall be the Sub-Contractor's responsibility. The Sub-Contractor shall be deemed to have allowed in his Sub-Contract sum for locating terminal points of services (e.g. lighting, switches, socket outlets, lighting points, control switches, thermostats and other initiating devices, taps, stop cocks) in positions plus or minus 1.2m horizontally and vertically from the locations shown on Contract Drawings. Within these limits no variations in the contract sum will be made unless this work has already been executed in accordance with previously approved working drawings and with the approval of the Engineer.	
1.28	**Checking of Work** The Sub-Contractor shall satisfy himself as to the correctness of the connections he makes to all items of equipment supplied under the contract agreement and equipment supplied under other contracts before it is put into operation. Details of operation, working pressures, temperatures, voltages, phases, power rating, etc. shall be confirmed to others and confirmation received before the system is first operated.	
1.29	**Setting to Work and Regulating System** The Sub-Contractor shall carry out such tests of the Sub-Contract Works as are required by British Standard Specifications, or equal and approved codes as specified hereinafter and are customary. No testing or commissioning shall be undertaken except in the presence of and to the satisfaction of the Engineer unless otherwise stated by him (Sub-Contractor's own preliminary and proving tests accepted).	

		KShs.
	Each system shall be properly balanced, graded and regulated to ensure that correct distribution is achieved and where existing installations are affected the Sub-Contractor shall also regulate these systems to ensure that their performance is maintained. The proving of any system of plant or equipment as to compliance with the Specification shall not be approved by the Engineer, except at his discretion, until tests have been carried out under operating conditions pertaining to the most onerous conditions specified except where the time taken to obtain such conditions are unreasonable or exceed 12 months after practical completion of the Sub-Contract Works.	
1.30	**Identification of Plant and Components** The Sub-Contract shall supply and fix identification labels to all plant, starters, switches and items of control equipment with white traffolyte or equal labels engraved in red lettering denoting its name, function and section controlled. The labels shall be mounted on equipment and in the most convenient positions. Care shall be taken to ensure the labels shall be mounted on equipment and in the most convenient positions. Care shall be taken to ensure that labels can be read without difficulty. This requirement shall apply also to major components and items of control equipment which are contained within equipment cubicles or plant. Details of the lettering of the labels and the method of mounting or supporting shall be forwarded to the Engineer for approval prior to manufacture.	
1.31	**Contract Drawings** The Sub-Contract Drawings when read in conjunction with the text of the Specification, have been completed in such details as we considered necessary to enable competitive tenderers to be obtained for the execution and completion of the Sub-Contract Works. The Contract Drawings are not intended to be Working Drawings and shall not be used as such unless exceptionally they are released for that purpose. It will be deemed that the Sub-Contractor has included in the tender sum for the costs of all fuel, power, water and the like, for testing and commissioning as required as part of the Sub-Contract Works. He shall submit for approval to the Engineer a suitable programme for testing and commissioning. The Engineer and the Employer shall be given ample warning in writing, as to the dates on which testing and commissioning will take place.	

		KShs.
	The Sub-Contractor shall commission the contract works and provide attendance during the commissioning of all services, plant and apparatus connected under the Sub-Contract Agreement or other sub-contract agreements related to the project.	
1.32	**Working Drawings** The Sub-Contractor shall prepare such working drawings as may be necessary. The working drawings shall be complete in such detail not only that the Contract Works can be executed on site but also that the Engineer can approve the Sub-Contractor's proposals, detailed designs and intentions in the execution of the Contract Works. If the Sub-Contractor requires any further instructions, details, contract drawings or information drawings to enable him to prepare his working drawings or proposals, the Sub-Contractor shall supply in writing to the Engineer for information at a time which is neither unreasonably distant from nor unreasonably close to the date when it is needed. All working drawings shall be submitted to the Engineer for approval. If not so submitted the contract shall accept at his own cost, risk that any work commenced or which he intends to commence at site may be rejected. The Engineer in giving his approval to the working drawings, will pressure that any necessary action has been, or shall be taken by the Sub-Contractors whose installations and works might be affected. If the Sub-Contractor submits his working drawings to the Engineer without first liaising and obtaining clearance for his installations from the Sub-Contractor and the other Sub-Contractors whose installations and works might be affected, then he shall be liable to pay for any alteration or modification to his own, the Sub-Contractor's installation and works, which are incurred, notwithstanding any technical or other approval which the Sub-Contractor's working drawings may have been received from the Engineer. Working drawings to be prepared by the Sub-Contractor shall include but not restricted to the following:- (a) Any drawings required by the Sub-Contractor, or the Engineer to enable structural provision to be made including Builder's Work Drawings or Schedules and those for the detailing of holes, chases, fixing, foundations cables and pipework ducting whether below or above ground or in or outside or below buildings.	

		KShs.
	(b) General arrangement drawings of all plant, control boards, fittings and apparatus or any part thereof and of installation layout arrangement of such plant and apparatus.	
	(c) Schematic layout drawings of services and of control equipment.	
	(d) Layout drawings of all embedded and non-embedded electrical conduit.	
	(e) Complete circuit drawings of the equipment, together with associated circuit descriptions.	
	(f) Such other drawings as are called for in the text of the specification or schedules or as the Engineer may reasonably require.	
	Approved working drawings shall not be departed from except as may be approved or directed by the Engineer.	
	Approval by the Engineer of working drawings shall neither relieve the Sub-Contractor of any of his obligations under the Contract Agreement nor relieve him from correcting any errors found subsequently in the approved working drawings or other working drawings and in the contract works on site or elsewhere associated therewith.	
	The Sub-Contractor shall ensure that his working drawings are submitted to the Engineer for approval at a time not unreasonably close to the date when such approval is required. Late submission of his working drawings will not relieve the Sub-Contractor of his obligations to complete the Sub-Contractor Works within the agreed contract period and in a manner that would receive the approval of the Engineer.	
1.33	**Disclosure of Contract and Publications**	
	The Sub-Contractor shall treat the details of the Sub-Contract as private and confidential, save in so far as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof the previous consent in writing of the Employer or the Consultants. If any dispute arises as to the necessity of any publication or disclosure for the purposes of the contract the same shall be referred to the decision of the Employer whose award shall be final.	

		KShs.
1.34	**Payment** Payments shall be made through certificates to the Main Contractor unless he specifically forgoes this right, in which case direct payments shall be made to the Sub-Contractor. All payments shall be less retention as specified in the Main Contract Agreement. No payments will become due until materials are delivered on the site.	
1.35	**Final Account** On completion of the works the Sub-Contractor shall agree with the Engineer the value of any variations outstanding as soon as possible thereafter to submit to the Engineer his final statement of account showing the total sum claimed sub-divided as follows:- Statement A Detailing the tender amounts less the Prime Cost and Provisional Sums, included therein. Statement B Detailing all the variation orders issued on the contract. Statement C Summarising statement A and B and giving the nett grand total due to the Sub-Contract.	
1.36	**Fair Wages** The Sub-Contractor shall comply in all respects with Clause 7, 'fair wages' contained in the Ministry of Public Works Contract Agreement (1970 edition).	
1.37	**Supervision** During the progress of the works, the Sub-Contractor shall provide and keep constantly available for consultant on site an experienced English-speaking Supervisor and shall provide reasonable office facilities, attendance, etc, for the supervisor. In addition during the whole of the time the works are under construction, the Sub-Contractor shall maintain on site one experienced foreman or charge-hand and an adequate number of fitters, etc, for the work covered by the specification. The number of this staff shall not be reduced without the prior written approval of the Architect/Engineer. (a) Working drawings amended as necessary but titled "record drawings" and certified as a true record of the "as installed" Sub-Contract Works. Subject to the approval of the Engineer such working drawings as may be inappropriate may be omitted. (b) Fully dimensioned drawings of all plant and apparatus.	

		KShs.
(c)	General arrangement drawings of equipment, other areas containing plant forming part of the Sub-Contract works and the like, indicating the accurate site of location of plant and apparatus suitably cross-referenced to the drawings mentioned in (b) above and hereinafter.	
(d)	Route, types, sites and arrangement of all conduit and ductwork including date of installation of underground ducts.	
(e)	Relay adjustment charts and manuals.	
(f)	Routes, types, sites and arrangement of all electric cables, conduits, ducts and wiring including the date of installation of buried work.	
(g)	System schematic and trunking diagrams showing all salient information relating to control and instrumentation.	
(h)	Schematic diagrams of individual plant, apparatus and switch and control boards. These diagrams to include those peculiar to individual plant or apparatus and also those applicable to system and also those applicable to system operation as a whole.	
(i)	**Operating Instructions** Schematic and wiring diagrams shall not be manufacturer's multi-purpose general issue drawings, they shall be prepared specially for the Sub-Contractor Works and shall contain no spurious or irrelevant information. Marked-up drawings of the installation of the Contract Works shall be kept up to date and completed by the date of practical or section completion. Two copies of the Record Drawings of the Sub-Contract Works and two sets of the relay adjustments and grading charts and schematic diagrams on stiff backing shall be provided not later than one month later. The Sub-Contractor shall supply for fixing in sub-stations switchrooms, plant rooms, pump houses, the office of the Maintenance Engineer and other like places, suitable instructions charts, schematic diagrams of instrumentation and of the electrical reticulation as may be requested by the Engineer providing that the charts, diagrams, etc. relate to installations forming part of the sub-contract works. All such charts and diagrams shall be of suitable plastic material on a stiff backing and must be approved by the Engineer before final printing.	

		KShs.
	Notwithstanding the Sub-Contractor's obligations referred to above, if the Sub-Contractor fails to produce, to the Engineer's approval, either:- (a) The marked up drawings during the execution of the Contract Works. (b) The record drawings, etc. within one month of section or Practical Completion. The Engineer shall have these drawings produced by others. The cost of obtaining the necessary information and preparing such drawings etc. will be recovered from the Sub-Contractor. Any instructions given to the supervisor on site shall be deemed to have been given to the Sub-Contractor. One copy of this specification and one copy of each of the Contract Drawings (latest issue) must be retained on site at all times, and available for reference by the Engineer or Sub-Contractor.	
1.38	**Labour Camps** The Sub-Contractor shall provide the necessary temporary workshop and messroom in positions to be approved by the Architect. The people employed by the Sub-Contractor shall occupy only that part of the site necessary for the performance of the work and the Sub-Contractor shall instruct his employees accordingly. If practicable, w.c. accommodation shall be allocated for the sole use of the Sub-Contractor's workmen and the Sub-Contractor will be required to keep the same clean and distended to make good any damage thereto and leave in good condition.	
1.39	**Storage of Materials** The Sub-Contractor shall be liable for the cost of materials but the Sub-Contractor will be responsible for the provision of any lock-up sheds or stores required.	
1.40	**Discount to Main Contractor** No discount to the Main Contractor will be included in the tender for this installation.	
1.41	**Labour** The Sub-Contractor shall provide skilled and unskilled labour as may be necessary for the successful completion of the contract.	

		KShs.
	Nominated Sub-Contractors are to be made liable for the cost of any storage accommodation provided especially for their use. No materials shall be stored or stacked on suspended slabs with the prior approval of the Architect.	
1.42	**Water and Electricity for the Works** These will be made available by the Main Contractor. The Sub-Contractor shall be liable for the cost of any water or electric current used and for any installation provided especially for their own use by the Main Contractor.	
1.43	**Protection** The Sub-Contractor shall adequately cover up and protect his own work to prevent injury and also to cover up and protect from damage all parts of the building or premises where work is performed by him under the Sub-Contract.	
1.44	**Test Certificates** The Sub-Contractor shall provide the Engineer with three copies of all test reports or certificates that are or may be required by this specification.	
1.45	**Taxation** The Sub-Contractor and his staff shall be liable to pay all income and other taxes required by the Laws of the Republic of Kenya which may be in force during the currency of the Contract.	
1.46	**Corrupt Gifts, Bribes and Payment of Commission** If the Sub-Contractor or any of his staff, agents, servants offers to give or agrees to offer or give to any person any bribe, gift or commission as an inducement or reward for doing or forebearing to do any action in relation to the Sub-Contract or any other Sub-Contract with employer, then the employer may enter upon the site and the works and terminate the employment of the Sub-Contractor; and the employer shall be entitled to recover from the Sub-Contractor the amount or value of any such gift, bribe, gratuity or commission.	
1.47	**Damages for Delay** Liquidated and Ascertained damages as stated in the Main Contract Agreement will be claimed against the Main Contract for any unauthorised delay in completion. The Sub-Contractor shall be held liable for the whole or a portion of these damages should he cause delay in completion.	

		KShs.
1.48	**Testing and Inspection – Manufactured Plant** The Engineer reserves the right to inspect and test or witness of all manufactured plant, equipment and materials. The rights of the Engineer relating to the inspection examination and testing of plant during manufacture shall be applicable to Insurance Companies and Inspection Authorities so nominated by the Engineer. The Sub-Contractor shall give two week's notice to the Engineer of his intention to carry out any inspection or tests and the Engineer or his representative shall be entitled to witness such tests and inspections. Six copies of all test certificates and performance curves shall be submitted as soon as possible after the completion of such tests, to the Engineer for his approval. Plant of equipment which is shipped before the relevant test certificates has been approved by the Engineer shall be shipped at the Sub-Contractor's own risk and should the test certificate not be approved new tests may be ordered by the Engineer at the Sub-Contractor's expense. The foregoing provisions relate to tests as manufacturer's works and as appropriate to those carried out at site.	
1.49	**Testing and Inspection – Installation** Allow for testing each section of the Sub-Contract works installation as described hereinafter to the satisfaction of the Engineer.	
1.50	**Record Drawings (as installed) and Instructions** During the execution of the Sub-Contract Works the Sub-Contractor shall, in a manner approved by the Engineer record on working or other drawings of the installed Sub-Contract Works. Marked up working or other drawings and other documents shall be made available to the Engineer as he may require for inspection and checking. Record Drawings may, subject to the approval of the Engineer, include approved working drawings adjusted as necessary and certified by the Sub-Contractor as a correct record of the installation of the sub-Contract Works	

		KShs.
1.51	**Hand-Over** The Sub-Contract Works shall be considered complete and the maintenance and defects liability period shall commence only when the Sub-Contract Works and supporting services have been tested, commissioned and operated to the satisfaction of the Engineer and officially approved and accepted by the Employer, provided always that the handing over of the Sub-Contract Works shall be coincident with the handing over of the Main Contract Works. The procedure to be followed will be as follows:- (a) On completion of the Sub-Contract Works to the satisfaction of the Engineer and the Employer, the Sub-Contractor shall request the Engineer to arrange for handing over. (b) The Engineer shall arrange a Hand over meeting or a series thereof, at site. (c) The Sub-Contractor shall arrange with the Engineer and the Employer for a complete demonstration of each and every service to be carried out for instruction to be representative of the employer. (d) In the presence of the Employer and the Engineer, handover will take place, subject to agreement of the Hand Over Certificates and associated check lists. The hand-over documents shall include Manufacturer's guarantee of equipment which shall extend beyond the 6 months defects liability period.	
1.52	**Maintenance Manual** Upon practical completion of the Sub-Contract Works, the Sub-Contractor shall furnish to the Engineer with four copies of a Maintenance Manual relating to the installation forming part or of the Sub-Contract Works. The manual shall be loose-leaf type, International A4 size with stiff covers and cloth bound. It may be in several volumes and shall be sub-divided into sections, each section covering one Engineering Service system. It shall have a ready means of reference and a detailed index.	

		KShs.
1.53	**Guarantee** Contractor shall guarantee workmanship, equipment and materials installed under his contract for a period of not less than one (1) year from the date of substantial completion. Should any defects occur during this period, the Contractor shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the owner, including cost of labour and materials. This Clause shall not in any way invalidate any Manufacturer's guarantee on equipment which may extend for periods longer than the Engineer's certificate of completion. The manuals are to be specially prepared for the sub-contract works and manufacturer's standard descriptive literature and plant operating instruction cards will not be accepted for inclusion unless exceptionally approved by the Engineer. The Sub-Contractor shall, affix such cards, if suitable, adjacent to plant and apparatus. One spare set of all such cards shall be furnished to the Engineer.	
1.54	**Clear Away on Completion** The Sub-Contractor shall, upon completion of the works at his own expense remove and clear away all plant, equipment, rubbish and unused materials, and shall leave the whole of the works in a clean and tidy state, to the satisfaction of the Engineer. On completion the whole of the works shall be delivered up clean, complete and perfect in every respect to the satisfaction of the Engineer.	
1.55	**Training** The tenderer shall allow for the training of three of the Client's technicians to a level where they are sufficiently confident and proficient in managing, trouble-shooting and maintenance of the installed systems and programming of the devices as necessary.	
1.56	**Initial Maintenance** The Sub-Contractor shall make routine maintenance inspection once a month during the Liability for the Defects Period and shall carry out all necessary adjustments and repairs, cleaning and oiling of moving parts. A monthly report or the inspection and any work done upon the installation shall be supplied to the Engineer. The Sub-Contractor shall also provide a 24-hour breakdown service to attend to faults on or malfunctioning of the installation between the routine visits of inspection.	

		KShs.
	The Sub-Contractor shall allow in the Contract Sum for the initial maintenance, inspection and breakdown 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 as oils, greases, sandpaper, etc or parts which are faulty for any reason whatsoever expecting always Acts of God such as storm, tempest, flood, earthquake and civil revolt, acts of war and vandalism.	
1.57	**Maintenance and Servicing After Completion of the Initial Maintenance** The Sub-Contractor shall, if required, enter into a maintenance and service agreement with the Employer for the installation for a period of up to five years from the day following the last day of the liability for defects period which offers the same facilities as specified in Clause 1.56. The Sub-Contractor shall submit with his tender for the works, a firm quotation for the maintenance and service of agreement for other similar installation. The Sub-Contractor shall submit with his tender for the works, a firm quotation for the maintenance and service of the installation as specified herein, which shall be based upon present day costs and may be varied only to take into account increases in material and labour unit rate costs between the time of tendering and the signing of the formal maintenance and service agreement and which shall remain valid and open for acceptance by the employer upto and including the last day of the fifth complete calendar month following the end of the liability for Defects Period.	
1.58	**Defects after Completion** The defects liability period will be six months from the date of completion of the Main Contract as certified by the Engineer.	

PRELIMINARIES AND GENERAL CONDITIONS

Item	Description	Unit	Qty	Rate	KShs.	Cts.
	COLLECTION PAGE					
	Brought forward from page 1/1					
	Brought forward from page 1/2					
	Brought forward from page 1/3					
	Brought forward from page 1/4					
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Carried to Main Summary of Prices.

PART 2

GENERAL MECHANICAL SPECIFICATION

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PART 2

GENERAL MECHANICAL SPECIFICATION

1.1 General

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

1.2 Quality of Materials

All plant, equipment and materials supplied as part of the 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 Contractor shall be the products of reputable manufacturers and so far as if they had been manufactured by the Contractor.

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

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

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

1.3 Regulations and Standards

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

(a) The Kenya Government Regulations.

(b) The United Kingdom Institution of Electrical Engineering Regulations for the electrical equipment of buildings.

(c) The United Kingdom Chartered Institution of Building Services' Engineers Guides.

(d) The Kenya Bureau of Standards Specifications.

(e) European Standards/Codes of Practice published by British Standards Institution.

The Local Council By-laws.

The electricity Supply Authority By-laws.

The Kenya Building Regulations.

Other International Standards.

1.4 Electrical Requirements

Plant and equipment supplied under this 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 will be provided and installed by the Electrical Contractor, all other wiring shall be as described in the Particular Specification.

The 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 Ltd's By-laws.

All electrical plant and equipment supplied by the Contractor shall be rated for the supply voltage and frequency obtained in Kenya, that is 415 volts, 50HZ, 3-phase or 240 volts, 50HZ, 1-phase as specified in the particular specification.

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

1.5 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 or replaced.

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

Prior to installation all piping, plant 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 Contractor shall replace this equipment at his own cost.

1.6 Site Supervision

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

1.7 Installation

Installation of all special plant and equipment shall be carried out by the Contractor under adequate supervision form skilled staff provided by the plant and equipment manufacturer or his appointed agent, in accordance with the best standards of modern practice to the relevant regulations and standards described under clause 1.3 of this section.

1.8 Testing

1.8.1 General

All testing shall be carried out to the entire satisfaction of the Engineer.

The following sub-clause are intended to define the Contractor's responsibilities with respect to testing and inspection.

1.8.2 Materials Tests

All materials for plant and equipment to be installed under this Contract shall be tested, unless otherwise directed, in accordance with the relevant B.S. Specification.

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 and application of materials concerned.

The Contractor shall prepare specimens and performance tests and analysis to demonstrate conformance of the various materials with the applicable standards.

If stock material, which has not been specifically manufactured for the plant and equipment specified is used, then the Contractor shall submit satisfactory evidence to the Engineer that such materials conform to the requirements stated herein in which case test of material may be partially or completely waived. Certified mill test reports of plates, piping and other materials shall be deemed acceptable.

1.8.3 Manufactured Plant and Equipment - Works 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 Contractor shall give two week's notice to the Engineer of the manufacturer's intention to carry out work tests and inspection.

The Engineer or his representative shall be entitled to witness such tests and inspections. The costs of such tests and inspections shall be borne by the 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 Contractor's own risk and should the test and inspection certificate not be approved, new tests may be ordered by the Engineer at the Contractor's expense.

1.8.4 Pressure testing

All pipework installation shall be pressure tested in accordance with the requirements of the various sections of this Specification. The installation 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 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 Contractor and the specified tests shall then be applied.

The Contractor shall prepare test certificates for signature by the Engineer and shall keep a progressive and up-to-date record of the sections of the work that have been tested.

1.9 **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: 1984.

1.10 **Welding**

1.10.1 Preparation

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

1.10.2 Method

All welding shall be carried out by the electric arc process using covered electrodes in accordance with B.S. EN ISO 1071:2003

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

1.10.3 Welding Codes and Construction

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

a) Pipe Welding

All pipe welds shall be carried out in accordance with the requirements of B.S. 2633:1987

b) General Welding

All welding of mild steel components other than pipework shall comply with the general requirements of B.S.5135:1984.

1.10.4 Welder's Qualifications

Any welder employed on this Contract shall have passed the trade test 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 Contractor to replace him by a qualified welder.

PART 3

GENERAL PLUMBING & DRAINAGE SPECIFICATION

PART 3

GENERAL PLUMBING AND DRAINAGE SPECIFICATION

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PART 3

GENERAL PLUMBING AND DRAINAGE SPECIFICATION

1.0 General

This section specifies the general requirements for plant, equipment and materials.

1.1 Authoritative Standards and Codes of Practice

The authoritative standard referred to in this Specification are European and other International Standards Codes of practice. Should the contractor wish to substitute any other authoritative standard or code of practice for any referred to in the specification, he must submit details of any such standard or code of practice with two copies of the document for approval by the Engineer. Approval will only be given to use an alternative standard or code of practice if the Engineer considers the proposed standard or code of practice will produce work of a standard equal or better than that of the specified standard or code of practice.

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

1.2 Materials

1.2.1 Pipework and Fittings

(a) Black Steel Pipework

All black steel pipework up to 65mm nominal bore shall be manufactured in accordance with European and other International standards medium Grade, with tapered pipe threads in accordance with B.S. EN 10226 – 1: 2004. All fittings shall be malleable iron and manufactured in accordance with B.S. 143 AND 1256:2000

Pipe joints shall be screwed and socketed and sufficient couplings 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.

All black steel pipework, 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.

(b) Galvanised Steel Pipework

Galvanised steel pipework shall be manufactured to comply in all respects with the standards described for black steel pipework in paragraph (a) above.

Galvanising shall be carried out in accordance with the requirements of B.S. EN 10255:2004 and B.S 143 respectively.

(c) Copper Tubing

All copper tubing shall be manufactured in accordance with B.S.EN 13349:2002 from C.160 'Phosphorus 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 connections tubes between galvanised pipework and sanitary fitments 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 connections in any other way than by the use of copper tubing, then a brass straight connector shall be positioned between the galvanised pipe and the copper tube in order to prevent direct contact.

(d) Galvanised iron Pipework

i) Internal Services

Internal iron pipework and fittings for use above ground in connection with internal buildings services, shall be manufactured with spigot and socket joints of the weight required by the Local Authority and shall comply fully with the requirements of B.S. 416.

All joints on galvanised iron spigot and socket pipes shall be made with an approved cold caulking compound and contraction which may take place.

All galvanised iron pipework, branches, tees, bends and other fittings shall be supplied complete with inspection covers for cleaning purposes. These inspection covers shall be included as part of the fittings and shall comply with the requirement of B.S. 416.

ii) External Services

Galvanised iron pipework which is used in connection with buried external services, shall be manufactured, coated and tested in accordance with the requirements of B.S. 1211:1958

All buried galvanised iron bends, elbows swept tees and other fittings, shall comply with the requirements of B.S EN 10242:1995

Jointing on external galvanised iron pipes shall be carried out in accordance with one of the methods described in B.S. Code of Practice 301, Clause 505c (v) to the approval of the Engineer.

(e) Fibre Cement Pipes and fittings for Sewers

Fibre Cement Pipework and fittings for use in connection with external drainage services shall be manufactured in accordance with the requirements of dn 19850-1 Part 1. Pipes shall be connected by means of purpose made tapered joints manufactured in accordance with DN 19850-1. Part 1.

(f) Concrete Pipes

Where concrete pipe and fittings are used in connection with the conveyance of surface water or sewage under atmospheric pressure, they shall be manufactured in accordance with the requirements of B.S. 5911-1:2002 Class 1 except where otherwise stated.

The joints of concrete pipe and fittings may be one of the following depending upon application and conditions:

1. Flexible spigot and socket type

2. Flexible rebated type (Stormwater drainage only)

3. Ordinary spigot and socket type

4. Ordinary rebated type (Stormwater drainage only).

Joints (1) and (2) shall be sealed with suitable rubber gaskets manufactured in accordance with B.S. 2494 except where they are likely to be contaminated by oil products in which case the gaskets shall be manufactured in accordance with B.S. 3514.

Joints (3) and (4) shall be made with an approved cement mortar mix.

(g) P.V.C. (Head) Pressure Pipes and Fittings

All PVC pipes and fittings shall be manufactured in accordance with B.S. EN 1452:2000.

i) Jointing

The method of jointing to be employed shall be that of Solvent Welding, using the pipe and manufacturers approved cement. Seal ring joints shall be introduced where it is necessary to accommodate thermal expansion.

ii) Anchoring

All bends, valves and hydrant tees etc., in the line of the water main shall be adequately anchored to resist thrust due to internal water pressure. A concrete block shall be cast under and around the pipe and between it and sides of the trench. Well rammed material shall be used to support the pipe and either side of the concrete.

iii) Pipe Bed

Pipe shall be uniformly laid on a 75mm thick bed, (the full width of trench) of fine grained material (sand or red soil) and must not be allowed to rest on the joint or on stones etc.

iv) Supports to Fittings

In underground installations care shall be taken to ensure that heavy components such as valves are fully supported so that no weight is carried by the pipeline.

v) Backfilling

For the protection of the pipe initial backfilling shall be carried out as soon as possible after laying. The initial backfill shall be fine grained material thoroughly compacted around the pipe and consolidated to a depth of 6" above the crown of the pipe at no time shall heavy rocks, stones or other objects be included in the balance of the backfill that might protrude through the initial backfill layer and come into contract with the pipe.

vi) Testing

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

(h) PVC Soil system

The Contractor shall supply and fix PVC soil pipe and fittings as indicated on the drawings and schedules.

Pipes and fittings shall be in accordance with relevant B.S. including B.S. 4514:2001, and fixed to the manufacturer's instructions, and B.S. 12056-2:2000

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

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

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

The Contractor shall be responsible for the joint into the Gully Trap on Drain as indicated on the drawings.

1.2.2 **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 fitments 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 galvanised iron construction, in accordance with the requirement of B.S. EN 12288:2003, BS 5163-1;2004 AND DIN 3546-1. All gate valves required for fitting to buried water mains shall be of galvanised iron construction in accordance with the requirements of B.S. 1218.

All gate valves upto and including 65mm nominal bore shall be of bronze construction in accordance with the requirements of B.S. 5163-1:2004.

The pressure classification of all gate 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. 13709:2002.

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

(d) Check or Non-Return Valves

All check or non-return valves 800mm nominal bore and above shall be of the swing check type of galvanised iron construction in accordance with the requirements of B.S. EN 12288:2003.

The pressure classification of all check or non-return valve shall depend upon the pressure conditions pertaining to Site of the Works.

(e) Ball Valves

All ball valves for use in connection with hot and cold water services shall be of the portsmount type in accordance with the requirements of B.S. EN 1983:2006. Constructed from bronze or other corrosion resistant materials. These valves fall into three pressure classifications as follows:-

(i) Low Pressure - 3.58 b maximum

(ii) Medium Pressure - 7.72 b maximum

(iii) High Pressure - 12.62b maximum

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

(f) Manually Operated Mixing Valves

Mixing valves for shower fittings and other appliances being provided under the Contract Works shall be manufactured in accordance with the requirements of B.S. EN 1286:1999 from bronze or other corrosion resistant materials.

1.2.3 **WASTE FITMENT TRAPS**

(a) Standard and Deep Seal P & S Traps

Where standard or deep traps are specified they shall be manufactured in suitable non-ferrous materials in accordance with the full requirements of B.S. 1184:1976

In certain circumstances, galvanised iron traps may be required for galvanised 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 Antisyphon Traps.

1.2.4 **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 supports shall be kept to a minimum and their design shall as such as to facilitate quick and secure fixing to metal, concrete, masonry or wood.

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

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

The Contractor shall submit all his proposals for pipe supports to the Engineer for approval before any erection work commences.

(b) Steel and Copper Pipes and Tubes

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 pipe clips without the prior approval of the Engineer. An approximate guide to the maximum permissible supports spacings in metres for steel and copper pipe and tube is given in the following table for horizontal runs.

Size **Minimal Bores**	**Copper Tube** **to B.S. 659**	**Steel Tube** **to B.S. 1237**
15mm	1.25	2.0m
20mm	2.0m	2.5m
25mm	2.0m	3.0m
40mm	2.5m	3.0m
50mm	2.5m	3.5m
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) Concrete and Pitch Fibre Pipes

These pipes shall not be used for above ground application.

(d) 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 limits prescribed in the relevant B.S. Specification.

The Contractor shall pay particular care when supporting galvanised iron in order to ensure that settlement and building movement do not break the pipe joints.

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 Contractor when arranging his piping shall ensure that no expansion movements are being transmitted from pumps to piping systems or vice versa.

(e) Jointing Pipes

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

Where manufacturers recommend the use of special jointing tackles, the contractor shall use these for the assembly of all joints to pipes. Sockets shall be laid looking uphill unless otherwise approved.

Before making any joints, all jointing surfaces shall be thoroughly cleaned and dried and maintained in such condition until the joints have been completely made or assembled. Notwithstanding any flexibility provided in the pipe joints, pipes must be securely positioned to prevent avoidable movement during and after the making of the joint.

The space between the ends of the spigot shall be as recommended by the manufacturer or ordered by the Engineer.

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

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

Pipes provided with spigot and socket joints of the self-centering, instantaneous joint type, such as the rubber ring push fit joint, shall be laid and jointed strictly in accordance with the maker’s instructions. Generally the joint ring shall be cleaned and inspected for cuts and defects, and socket and spigot examined to ensure freedom from oil, grease, tar and grit. The makers recommended lubricant will be used.

(f) Galvanised iron Joint Fittings

Galvanised iron detachable joint collars and flanges shall be tested by striking lightly with a spanner immediately before they are placed and if thy fail to ring true shall be set aside and not incorporated in the work until proven sound.

The flanges shall be correctly positioned and the component parts including any insertion ring cleaned and dried.

Insertion rings shall be fitted smoothly to the flange without folds or wrinkles. The face and bolt holes shall be brought fairly together and the joints shall be made by gradually and evenly tightening bolts in diametrically opposed positions. Only standard length spanners shall be used to tighten the bolts. The protective coating if any, of the flange shall be made good when the joint is completed.

Bolt threads shall be wrapped with PTFE tape where directed before use.

No washers shall be used on flanged pipework to be laid below ground. Bolts shall be as specified and shall be of the correct length, leaving a maximum of two threads exposed.

(g) **Solvent Welded Joints**

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

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

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

1.2.5 **Connection of Tubing to Cold Storage Tanks, Hot Water Cylinders and Sanitary Fittings**

Each connection of tubing to cold water storage tanks shall be made by drilling a hole in the tank side and using a long screw, union and two backnuts all well screwed up in red lead. Joints of tubing to flanged and bossed connections of hot water cylinders shall be made with a boiler screw, union and backnut screwed up in red lead.

Connections to sanitary fittings shall be made with 450mm lengths of copper tubing bent to shape as required with copper to iron couplings at each end, and red lead joint to joint union of fittings and tubing.

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

All fittings shall be fixed in accordance with the manufacturer's instructions and shall comply with the general requirements of B.S. Code of Practice 305 and the Particular requirements of the latest applicable B.S. Specification.

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

1.2.6 **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 insulation. The sleeve will then be packed with slag wool or similar.

1.2.7 **Cutting Pipes**

Iron pipes shall be cut by a method and with apparatus which provides a clean square cut of the pipe and of the lining, if any, without damage to pipe or lining.

All cut or trimmed ends, and the parts of any pipe on which the coating may have suffered damage shall be recoated with bitumen before the pipes are laid. The external area at cut spigot ends of ductile iron pipes shall be ground for a distance of at least 125mm.

Pitch-impregnated fibre pipes shall be cut by saw and where necessary the end shall be filled or machined to the required 2 degrees taper.

Concrete pipes shall be cut to a square and even finish without splitting or fracturing the wall of the pipe. Reinforcement shall be cut back flush with the concrete and bare metal protected with bituminous paint or cement grout as directed.

Only steel pipes supplied rounded throughout their length shall be used as cut pipes to form closures. The cutting shall be done by an approved method and apparatus which provides a clean square cut, without separation of the lining from the pipe wall. Minor damage to the lining may, if permitted be repaired on site in accordance with the manufacturer's instructions. Where in the opinion of the Engineer the damage is serious the pipe or special shall be returned to the manufacturer for reconditioning.

1.2.8 **Pipes Built into Structures**

The outside surface of all pipes and special castings to be built into structures shall be thoroughly cleaned immediately before installation. Where ordered protective coatings to metal pipes shall be removed from the sections to be built in, while the external surfaces of fireclay and concrete pipes shall be roughened to form a key for concrete or mortar. Sheathing to steel pipes shall be cut away from the sections to be built-in and after erection the protection shall be completed by applying approved bituminous material around the barrels of pipes at the junctions with structures.

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

Where fixing in the course of construction is not possible, temporary opening in structures, formed to the dimensions shown by the Engineer shall be left where indicated or directed to accommodate the subsequent erection of pipes and special castings. In water retaining structures, they shall taper to a smaller dimension towards the external faces of structures and shall include where indicated a waterstop. In basements, dry chambers at pumping stations etc., temporary openings shall taper to a smaller dimensions towards the internal faces of structures and shall also include, where indicated a waterstop.

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

1.2.9 **Setting Valves**

Care must be taken to prevent damage to all valves, fire hydrants and the like, and their ancillary equipment. Valves etc., and ancillary apparatus shall be stored in clean conditions and in a manner that excludes all water. Where directed, head-stock, motors, gearing or indicators shall be removed, adequately labelled for identification, stored carefully in weather-proof premises and be reconnected after erection of the valves. Electrical equipment shall be protected from damp and the damp-proofing seals shall remain intact until the electrician is ready to connect up the equipment.

The gunmetal faces and seats of all valves must be kept clean. No valve shall be closed without first wiping the faces with a clean cloth. The cavity beneath the valve door shall be thoroughly cleaned by hand. In the event of accident, fouling matter shall be either dissolved or carefully removed by methods that do not involve scraping or gunmetal faces.

All valves shall be set so that operating spindles are truly vertical unless otherwise detailed or directed.

Every stuffing box shall be examined when the main is charged with water and leaking boxes shall be adjusted or replaced with square plaited lubricated hemp packing or approved manufacture. The stuffing box shall not be so tightly packed as to materially affect the friction of the packing on the spindle.

No air valve shall be stored before erection in the open in sunlight, or upside down to expose the balls and air cavities. Air valves shall be checked before the main is charged to ensure that the balls and faces are not scored or split and that there is no direct or other deleterious materials in the cavities of the body. All air nozzles shall be probed to see that they are clean.

Fire hydrants and similar fittings shall be checked before being incorporated in the line and before the main is charged to ensure that all passageways are clean.

The installation of special types of valve and metering equipment must be strictly in accordance with the manufacturer's instructions.

The direction of opening of the valve shall be indicated on the headstock and on the underside of hydrant covers.

1.2.10 **Pressed Steel Plate Storage Tanks**

The water capacity of the tanks and the diameter of all pipes and pipe connections therewith will be as detailed on the Drawings and Bills of Quantities. Unless otherwise detailed the proportions of a tank will be such that the height is not less than three quarters of the length and not less than the width. All dimensions must be approved by the Engineer.

Elevated Pressed Steel Plate storage tanks will comply with B.S. 1564 and will be constructed of 4.76mm (top row only) and 6.35mm thick galvanised pressed steel tank plates, 1.22m or 1.00m square nominal size, embossed and with external flanges bolted together. Where detailed in the Contract the tank will be partitioned centrally, the division wall to be adequately stayed to permit emptying of either half of the tank whilst maintaining full water depth in the other half.

The tank will be complete with a pitched or vaulted cover and gable ends of 3mm thick steel plates, lap jointed and supported on bearers with hinged insect proof cover; 1 No. float operate water level indicator; and will be provided with internal and external ladders as follows. Where the tank is constructed to operate in two halves 2 No. access manholes and internal ladders will be provided.

The external ladder will have 40mm x 6mm mild steel flat stringers with 12mm diameter mild steel rungs and will be cleated to the tank at 1.2m intervals. The stringers will be taken 750mm above the tank cover and bent to return to the cover a distance of 450m from the edge. This ladder will be complete with 40mm x 3mm mild steel flat safety hoops of 600mm diameter, spaced at 1.2m vertical centres, truly bent and welded to the stringers. The safety hoops will be jointed by 3 No. 40mm x 3mm mild steel flat vertical guard strips, evenly spaced and flat fillet welded to the hoops.

The internal ladders will have 65mm x 12mm steel flat stringers with 20mm diameter mild steel rings and will be cleated to the tank at 1.2m intervals.

The tank bottom plates will be provided with a single pipe pad for the washout pipe connections and double pipe pads for all other pipes which pass through the bottom of the tank.

The tank will be provided and erected complete with all bolts, nuts, washers, internal braces and approved non-toxic jointing materials (fibre-glass or bitumen impregnated filler strip or approved equal).

The whole of the tank steelwork and plates will be galvanised as specified before dispatch and after erection, painted with an approved etching primer and two coats of a bitumen based aluminium paint externally and two coats of non-toxic black bitumen paint internally, both as specified.

The tank after final erection on its permanent foundation will be filled with water to overflow level for a period of 24 hours. Any leaks which become apparent will be made good to the satisfaction of the Engineer before acceptance of the work. Both halves of the tank will be tested separately.

1.2.11 **Pipework for Pressed Steel Tank**

All pipework associated with the tank and stand will be mild steel pipe to B.S. 534 with flanged joints. The pipework will comprise one ball mounted standing inlet pipe at designed top water level, one outlet pipe with ball mounted and approved strainer to take water from the level as detailed on the Drawings. Where not detailed the outlet pipe will take water from not less than 75mm above the tank bottom. One ball mounted standing overflow pipe with its lip 50mm above designed top water level, and one washout pipe which will be capable of completely draining the tank will be provided. Where the tank is constructed to operate in two halves the inlet, outlet, overflow and washout pipes will be duplicated in each half of the tank.

1.3.0 **INSTALLATION**

1.3.1 **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 Contractor shall be responsible for ensuring that all builders work associated with his piping installation is carried out in a satisfactory manner to the approval of the Engineer.

1.3.2 **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 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, without the need to cut the pipe.

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

All screwed joints to piping and fittings shall be made with Polytetra Flouroethylene (P.T.F.E.) Resin Skived Tape in accordance with ASTM D3308-06

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 one gallon per 25mm of diameter, per 1.6 kilometre 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 systems shall be installed in accordance with the best standards of modern practice as described in B.S. 5572 now replaced with BS EN 12056-2:2000 to the approval of the Engineer.

The Contractor shall be responsible for ensuring that all ground floor waste fittings are discharged to a gulley trap before passing to the sewer via a manhole.

The Contractor shall provide all necessary roding and inspection facilities within the draining system in position where easy accessibility is available.

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

The vent stacks shall terminate above roof level and where stack passes through roof, a weather skirt shall be provided. The 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 roding and testing shall be provided at the foot of each stack.

(c) **Sanitary Appliances**

All sanitary appliances associated with the Contract Works shall be installed in accordance with the best standard of modern practice as described in BS 6465-3:1996 to the approval of the Engineer.

1.3.3 **Underground Installation**

(i) **General**

All underground water and drainage service installation shall be installed in accordance with the best standard of modern practice as described in BS EN 13566-1:2002.

(ii) **Bedding**

(a) **Granular Bedding Material - Type A**

Granular bedding Type A shall comprise broken stone or gravel, crushed brick or concrete to pass a 25mm sieve and be retained on 5mm sieve thoroughly mixed with free draining coarse sand in the ratio of one part sand to two parts stone or gravel; or aggregate to B.S. 882 Table 3 or other material which in the opinion of the Engineer has similar characteristics.

Particles shall be rounded or angular but not flaky or elongated and of adequate crushing strength to produce when tested in accordance with B.S. 812 a 10 percent fines value, greater than 5 tonnes.

(b) **Selected Fill - Type B**

Type B selected fill shall be uniform readily compatible material from tree roots, vegetable matter and building rubbish. All clay lumps retained on a 75mm sieve and all stones retained on a 25mm sieve shall be excluded.

(c) **Granular Bedding Material - Type C**

Granular bedding Type C shall be as type A bedding material but with all material passing a 10mm sieve. In addition, where used to be flexible not exceeding 0.1. The compaction factor test shall be carried out as follows:-

Equipment

1. An open ended cylinder 225mm long and 150mm internal diameter, (a pitch fibre or PVC pipe is suitable)

2. A metal rammer with a skirting face 40mm diameter weighing 0.9 to 1.1 kg

3. A measuring ruler.

Method

A representative sample more than sufficient to fill the cylinder is obtained, (about 12 kg). It is important that the moisture content of the sample should not differ significantly from that of the material from which the sample was obtained at the time of the use of the trench.

The cylinder is placed on a firm surface and the material sample poured into it loosely and without tamping. The top surface of the material is struck off level with the top of the cylinder and all surplus material removed. The cylinder is then lifted clear of its contents and placed on a clean area of the flat surface. About one quarter of the material is then placed back in the cylinder and tamped thoroughly until no further compaction can be obtained. This procedure is repeated until with the second, third and final quarter tamping each successive surface as level as possible.

The height from the material surface to the top of the cylinder is then measured with the ruler and this distance divided by the height of the cylinder, (225mm), is referred to as the Compaction Factor.

For each batch of material three (3) Compaction Factor Tests will be made and if the average value is greater than 0.1 then the batch of material will be deemed to be unsuitable for use as Type C bedding material. Material sufficient for the bed and surround of 200 linear metres of pipe will be considered to comprise a batch.

(d) **Bedding and Surround for Concrete Pipes**

The material to be used for bedding and surround for concrete pipes shall not contain more than 0.3 per cent sulphate expressed as sulphur trioxide nor shall it be obtained from a site where the ground water contains more than 0.1 per cent sulphate.

(iii) **Field or French Drains**

Pipes for french drains shall be either British Standard Surface pipes glazed or unglazed manufactured to B.S. 65 and 540, with Type 2 sockets or plain ended supplied with sleeve couplings or type 1 perforated socketed and sleeve coupled pipes porous concrete pipes to B.S. 1194.

(iv) **Definitions**

For the purpose of underground piped services the following definitions shall apply:-

(a) Top soil shall mean the top layer of soil that can support vegetation.

(b) Suitable material shall mean all material capable of being compacted, forming a stable fill and approved as such by the Engineer.

(c) Unsuitable material shall mean material other than suitable material and shall include material from swamps, marshes or bogs, peat, logs, stumps, or other perishable material, clay of liquid limit exceeding 80 and/or plasticity index exceeding 55, or materials having greater moisture content than approved for use.

(d) Rock in excavation shall mean such material which cannot be excavated by hand methods and individual solid boulders exceeding 0.2 cu.m.

(e) `Rigid pipes' shall mean pipes of cast or spun iron, concrete cement, clay or similar materials.

(f) `Flexible pipes' shall mean pipes of steel, PVC or other plastic, ductile iron or similar materials.

(g) `Rigid joints' shall mean joints made of bolting together flanges integral with the barrels of the pipes, by welding together the barrels of the pipes, by caulking sockets with non-deformable material, such as cement mortar, run lead or by similar techniques.

(h) `Flexible joints' shall mean joints made with factory-made jointing materials, loose collars, rubber rings etc., and which allow some degree of flexing, however small, between adjacent pipes.

(v) **Types of Pipe**

The Contractor shall construct the pipelines using the designs of pipe, bed, haunch and surround detailed on the Drawings.

Where the Contractor wishes to use a type of pipe not manufactured in the minimum internal diameter indicated in the Contract, he may substitute the next larger diameter manufactured, subject to compliance with the design requirements, clearance and cover. The Contractor shall not use pipes and fittings supplied by more than one manufacturer without approval.

(vi) **Setting Out**

The Contractor shall set out the underground services to the lines shown on the Drawings. Where the service is required laid to falls these shall be set by means of proper sight rails and boning rods.

Sight rails shall be of the following minimum standard. They shall be adjustable sight rails of 150mm x 30mm wrought softwood of length 1m painted black and white as directed secured to strong uprights embedded in the ground at distances not exceeding 60 metres.

Care shall be taken to ensure that these sight rails are not obscured by spoil from the excavation.

(vii) **Excavation**

The Contractor shall carry out the excavation in accordance with the Drawings and shall comply with the slopes, levels, depths and heights shown thereon.

Unless otherwise directed top soil shall be stripped, laid aside and kept separate from other excavated materials for reuse. Road bottoming and surfacing material which is approved as suitable for re-use shall be laid aside and kept separate from other excavated materials.

Where shown in the Contract or directed top soil shall be stripped over the full width of the working area before any other operation is carried out and soil deposited in dumps. On completion of the other operations the soil shall be evenly spread over the stripped surface.

Excavation shall be carried out the dry and both trenches and general areas shall be kept free from water by pumping, provision of temporary drains, sumps and the like.

Excavations shall be taken out to the least dimensions required to accommodate the service and the working space necessary for its installation subject to the following restrictions. All excavations shall be carried so that the soil beneath receives the maximum amount of disturbance.

Unless otherwise directed the overall width of pipe trench excavation from the trench bottom to a level 300mm above crown of the pipe shall be in accordance with the following table:

Table 40.1 - Pipe Trench Widths

Nominal Internal Diameter (mm)	Minimum Overall Trench Width (mm)	Maximum Overall Trench Width (mm)
100	430	630
150	500	700
200	550	750
225	580	780
300	680	880
375	950	1150
400	1000	1200
450	1330	1230
525	1120	1320
600	1240	1440
675	1330	1530
750	1400	1600
825	1490	1690
900	1920	2120
1050	2100	2300
1200	2290	2490
Above 1200	outside diameter of pipe plus 800mm	Outside diameter of pipe plus 1000mm

Battering or stepping of the sides of trenches, if approved, will only be permitted from 300mm above the crown of the pipe to the original ground level.

The maximum trench width given above shall be measured to the earth face of any sheeting or trench supports.

Excavation shall be taken to the depth required for the class of bedding shown on the drawings. Any excavation greater than this depth shall be filled with the same material as required for bedding to the Engineer's satisfaction and at the Contractor's expense.

When concrete is directed to be cast directly against existing soil the excavation shall be neatly executed to the shape required.

Excavation shall be timbered, sheet piled or otherwise supported to ensure the stability of the surrounding ground, the Works and adjacent structures and to ensure the safety of all persons. The sides of excavation will be battered only where approved or directed. All over-excavation due to slips, overbreak and the like shall be remedied at the Contractor's expense, by infilling with suitable material as directed by the Engineer.

Should the Engineer regard the Contractor's support of any excavations as inadequate then the Contractor shall comply with any instruction by the Engineer to alter or increase the support. Any instruction so given by the Engineer will in no way relieve the Contractor of his responsibilities under the Contract.

Material from excavations other than unsuitable material shall be set aside clear of the sides of excavation for reuse. Unsuitable material shall be removed to the Contractor's tip.

When the final level of the foundation, as shown on the Drawing or directed by the Engineer, has been reached the Engineer will inspect and approve the foundation prior to the commencement of concreting or other work thereon. The bottoms of all excavations shall be carefully shaped for slop as shown or directed. Any pockets of soft or loose material shall be removed and any cavities or fixtures filled as directed.

The Contractor shall at his own expense make good with mass concrete or as directed exaction greater than required for the complete work. Material which the Contractor has allowed to become unsuitable shall be removed and replaced with mass concrete or as directed, at the Contractor's expense.

The Contractor shall provide whatever additional pipe protection is directed specified maximum width be exceeded due to his method of working.

Where rock or boulders are present in pipe trenches specified to have Class C or FD bedding the sides of the trenches shall be so trimmed that when the pipe is laid to the correct level and alignment no projection of the rock comes within 100mm of the outside of the pipe barrel at any point.

Where rock is found in the bottom of trenches for pipes specified to have Class C or FD bedding, the trenches shall be excavated to the additional depth necessary to allow for Class B or FC bedding respectively.

The Contractor shall avoid unduly disturbing the finished trench formation and shall make good disturbed areas and excavate any wet or puddled material which might result from his failure to do so.

Where directed trenches close to existing structures shall be opened in short lengths and refilled or partly filled with mass concrete or other approved material.

Trenches for pipes carrying water under pressure, except where otherwise required by the Contract, shall be excavated to a sufficient depth to ensure, after consolidation of the refilling, a normal minimum depth of cover of 1800mm from the ground surface to the top of the pipe. Under roads a normal minimum depth of cover of 900mm shall be provided. Where the pipeline is required to be laid to a depth which does not permit this condition to be fulfilled the ground surface shall be made up locally with banking as directed.

(viii) **Pipe laying General**

On arrival at the Site, pipes shall be carefully inspected for damaged ends, cracks or other defects and any found to be faulty shall be marked and set aside for a decision from the Engineer as to their acceptability.

Pipes with damaged ends may be either completely replaced or have the ends cut off and trimmed as directed by the Engineer.

The Contractor shall ensure that all pipes are properly handled both by his staff and by any cartage Contractor employed by him. During transport, pipes shall not be allowed to rest on narrow cross-members of vehicles or anything else that might give concentrated loads due to the weight of the pipe or bumping of the vehicle but shall be properly supported on soft material. Sufficient labour and equipment shall be on hand before loading and unloading is commenced and under no circumstances shall any pipes be dropped or thrown from a vehicle.

The Engineer will have the right to reject consignments or stocks of piping from which failed pipes have been drawn, or order them to be pressure tested to works pressures outside the pipelines at the Contractor's expense even though no defects are apparent, if there is reason to believe that mishandling has taken place.

Flat braided wire slings shall be used for slinging all pipes except externally coated pipes and plastic pipes for which only special band slings not less than 300mm wide shall be used. Chain or rope slings, hooks, or other devices working on scissor or grab principles shall not be used.

Subject to the requirements of inspection before acceptance, protective bolster, caps or discs on the ends of flanges of pipes, specials or fittings shall not be removed until the pipes, specials, or fittings are about to be lowered into the trench.

Before a pipe is lowered into the trench, it shall be thoroughly examined to ensure that the internal coating or lining and the outer coating or sheathing are undamaged.

Where necessary the interiors of pipes, specials and fittings shall be carefully brushed clean.

Any damaged parts of the coatings or lining shall, before a pipe is used, be made good as directed.

Pipeclaying shall not commence until the bottom of the trench and the pipe bed have been approved. Pipes shall be brought to the correct alignment and inclination concentric with the pipes already laid.

(ix) **Bedding and Protecting Pipes Generally**

Pipe bedding refers to all bedding haunching and surrounding of pipes and shall be carried out to the types arrangements and dimensions shown on the Drawings.

During the placing of pipe bedding temporary side supports and sheeting shall be removed except where directed to be left in and the full width of the trench shall be infilled with bedding, haunching, surrounding or anchoring materials.

A cavity of adequate size shall be excavated in the sides and bottom of the trench or left in the pipe bed at each joint and at each sling position.

The bottom of the trench or surface of the bed shall be finished to a smooth even surface at the correct levels to permit the barrel of the pipe to be solidly and evenly bedded throughout its whole length between joint and sling holes.

For water pipes the preparation of the trench bottom or surface of the bed shall be completed for at least one full pipe length in advance of the pipe laying, except where in exceptional circumstances another arrangement is approved.

For sewer pipes the trench bottom or surface of the bed shall be completed between adjacent manholes for inspection by the Engineer prior to laying the pipes.

No pipe bedding material shall be placed in trenches containing water.

Where granular bedding is to be used, stones, bricks or similar materials shall not be used below or against the pipe to locate them in position in the trench or to level the pipes.

Where directed, puddle clay dams 500mm thick shall be constructed around the pipe and across the trench as haunching proceeds. The dams shall be at intervals not exceeding 30 metres or as directed and their height shall be determined by the Engineer.

Where directed by the requirements for testing pipelines the method of haunching and surrounding pipes shall be modified to leave pipe joints exposed.

Where there is high ground water table all pipes shall be surrounded in an approved free draining bedding material as specified.

(x) **Laying of Pipes**

Every pipeline shall be accurately laid to correct line and level perfectly true from joint to joint.

Whenever work is suspended, the open ends of all pipes and junctions shall be adequately plugged to prevent the ingress of any coil or rubbish etc. Care shall be taken at all joints to prevent ingress of any material.

Immediately after laying, the open end of a pipe shall be sealed with a wooden plug or approved stopper of appropriate size to prevent the entry of material which might contaminate the pipeline, damage the linings, obstruct the waterway or affect the working of valves, meters etc. Plugs shall be unperforated and shall be shaped to fit exactly so that water from the trench excavations cannot gain access to the pipeline.

Water pipes and fittings 150mm and under in diameter shall have a brush equal in diameter to the internal bore of the pipe drawn through them as the work proceeds. The brush shall not be removed from the pipeline from commencement until completion.

The plugs in sewers may, with the Engineer's approval, be provided with small holes for drainage purposes, but water from the trench excavation which is heavily charged with silt shall not be allowed to gain access to the pipe.

Where work is interrupted for a period, the plugs left in position shall be regularly inspected for their fixing to ensure that there has been no tampering by unauthorised persons. Whenever any plug is removed, the immediate length of pipe shall be examined for dirt or obstructions and shall be cleaned as required.

Adequate precautions shall be taken by way of backfilling or other means to anchor each pipe securely to prevent floatation of the pipeline in the event of trench being flooded.

No equipment, clothing or apparel shall be left or stored inside pipeline.

If the normal continuity of construction would otherwise be interrupted pending the delivery of valves or specials, the exact extent of the temporary gaps to be left shall be pre-determined after reference to the Engineer. The Contractor shall submit dimensioned sketches, to the Engineer for approval, showing details of the pipes and jointing arrangements to be adopted to effect ultimate closures. Care shall be taken to preserve the accurate alignment of the pipeline across all such temporary gaps.

(xi) **Laying to Curves**

Where flexibly jointed rigid pipes are to be laid to curve, the outside of spigots in the joints shall not butt hard against the inside of the socket. An angle of pull shall not exceed that laid down by the pipe manufacturer.

Where curves are to be negotiated with straight steel piping with welded joints, no joint shall be flexed more than one degree. Up to two degrees will be permitted with Couplings.

Where curves are to be negotiated with straight prestressed concrete pipes no joint shall be flexed more than half a degree. For sharper curves purpose made level pipes, level pipes, level adaptors and standard bends shall be provided.

(xii) **Manholes**

(1) **General**

All manholes provided under the Contract Works shall be constructed of approved materials and in an approved manner.

All manholes shall be water-tight and if constructed of brickwork, solid blockwork or stonework, they shall be rendered internally with a cement mortar of at least 12mm thickness and finished with a smooth surface.
The sides of all channels in every manhole shall be brought up vertically to a height of not less than the diameter of the drain and shall be benched in good concrete from the top of the channels at an angle of 30^0 to the horizontal and floated to a smooth hard surface with a coat of 1:1 cement mortar.

In all other respects, manholes shall be constructed in accordance with B.S. Code of Practice 301.

(2) **Rectangular and Square Manholes**

Rectangular and square straight through manholes shall be constructed from brickwork, solid blockwork, stonework or concrete to comply with the following minimum internal dimensions (millimetres).

Depth Below Ground of Outgoing Invert	Internal Access Shaft Dimensions L X W	Size of Main Channel Diameter	Internal Chamber Dimensions L X W	Height of Chamber above Benching	Wall Thickness
Up to 740	-	100 to 150	610 x 450	-	150
Up to 740	-	230 to 460	760 x 760	-	150
Up to 1200	-	100 to 150	760 x 760	-	150
160 to 1200	-	230 to 460	910 x 910	-	150
1220 to 1800	-	100 to 150	910 x 910	-	150
1220 to 1800	-	230 to 460	1070 x 910	-	150
1830 to 4550	760 x 760	100 to 150	1370 x 910	1370	230
1830 to 4550	760 x 760	230 to 460	1370 x 1070	1370	230
4570 and Over	760 x 760	100 to 150	1370 x 1140	1680	230
4570 and Over	760 x 760	230 to 460	1370 x 1140	1680	230

When branches are connected into the manhole, the length and width dimensions of the chamber shall be increased as follows:-

Length

Branch Diameter

100mm 300mm/branch on the side with most branches.

150mm 380mm/branch on the side with most branches.

230 and 300mm 460mm/branch on the side with most branches.

460mm 610mm/branch on the side with most branches.

Width

Branch Diameter

100mm to 300mm for each side with branches plus 160mm 460mm or the diameter of the main drain which ever is the greater.

3. **Precast Concrete Circular Manholes**

Where specified straight through precast concrete manholes shall be manufactured and constructed to comply with B.S. 556 and the following dimensional requirements, (Dimensions in millimetres).

Ground Depth of Outgoing Invert Diameter	Internal Access Shaft Diameter	Size Main Channel	Height Chamber Diameter	Chamber Above Benching
Up to 740	-	100 to 460	910	-
760 to 2410	-	100 to 460	1070	-
2440 to 4550	760	100 to 460	1200	1370
4570 and Over	760	100 to 460	1370	2680

When branches are connected into manholes the internal diameter of the chamber shall be increased as necessary, up to a maximum chamber diameter 1830mm.

4. **Step Irons and Covers**

Access shaft to manholes of depths greater than 760mm shall be provided with approved step irons at suitable intervals.

Every manhole or manhole access shaft shall be fitted with a removable air-tight galvanised iron cover to adequate size and strength, fixed in a manner which prevents surface water gaining access into the drainage system.

Cast manhole covers and frames shall be manufactured in accordance with the requirements of B.S. 497 and shall generally fall into the following categories:-

Heavy Duty	:	1For Carriageways
Medium Duty	:	For Footpaths

5. **Back Drop Connections**

Where the level of the branch drain entering the manhole is higher than can be suitably accommodated by the normal type benching, then the branch drain shall be connected to the manhole by means of a back drop connection.

Back drop connections shall be made in accordance with the details shown on the relevant Contract Drawings and the requirements of B.S. Code of Practice 301.

6. **Channels**

Where the branch channel connects to the main channel in the manhole, the invert of the branch channel shall be a minimum of 38mm higher than the main channel.

(xiii) **Testing of Pipelines**

After pipelines are connected up and joints have been sealed, the pipeline shall be tested before pipes are, if required, haunched or surrounded in concrete.

Methods of testing and inspection shall be in accordance with Clause 4 of the Specification.

xiv) **Concrete Bedding, Haunching and Surround**

Concrete bedding, haunching and surround shall be provided as necessary or where called for by the Engineer in accordance with the requirements laid down in B.S. Code of Practice 301, Clause 310.

xv) **Backfilling**

Backfilling of trenches, headings and around manholes shall be carried out in accordance with the methods described in B.S. Code of Practice 301, Clause 508.

xvi) **Reinstatement of Surfaces**

Following the final backfilling of all trenches, headings and manhole surrounds, the surface of the excavated areas shall be fully reinstated to the approval of the Engineer.

Where excavations have been carried out in public highways or other areas not forming part of the site, the Contractor shall be deemed to have allowed in his price for all charges associated with the temporary and final reinstatement requirements of the Local of Highway Authority, whether this is carried out by the Contractor or by the Authority concerned.

No claims for extras in this respect will be accepted.

1.4.0 **Testing and inspection**

1.4.1 **Site tests - pipework systems**

(a) **Underground Water Mains**

After laying, jointing and anchoring, the main shall be slowly and carefully charged with water, so that all air is expelled and allowed to stand full for three days before testing under pressure.

A long main shall be tested in sections as the work of laying proceeds and all joints shall be exposed for inspection during the testing.

The open end of the main may be temporarily closed for testing under moderate pressure by fitting a water pipe expanding plug, of which several types are available. The end of the main and the plug should be secured by struts or otherwise, the resist the end thrust of the water pressure in the main.

If the section of main terminates with a sluice valve, the wedge of the valve shall not be used to retain the water, instead the valve shall be fitted temporarily with a blank flange, or if a socket valve with a plug and the wedge shall be placed in the open position while testing. The Contractor shall provide suitable end supports to withstand the end thrust of the water pressure in the main.

(b) **Above Ground Internal Water Service 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 a half times the design working pressure.

If preferred, the Contractor may test the pipelines in sections. Any such section found to be satisfactory need not be the subject of a further test when the 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 Contractor and the section re-tested.

The 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 Contractor's expense.

(c) **Underground Drainage System**

A site test shall be carried out on all drainage pipes before concrete haunching or surrounds are applied. These tests shall be carried out preferably from manhole to manhole.

Short branch drains connected to a main drain between manholes shall be tested as one system with the main drain. In long branches a testing junction shall be inserted next to the junction with the main drain and the branch tested separately. After the test has been passed, the testing junction shall be effectively sealed.

All tests on underground drains shall be permitted on galvanised iron drains at the discretion and to the approval of the Engineer.

Water tests shall be carried out in accordance with the methods described under B.S. Code of Practice 301, Clause 601 (b) and (c) and the test pressure shall not be less than 1,520mm head at the highest point in the pipe section and not more than 10,360mm head at any point in the section.

The test pressure shall be maintained for a period of one hour during which time the pipe and joints shall be inspected for sweating and leakage. Any leak discovered during the tests shall be made good by the Contractor and the section re-tested.

In addition to pressure tests, drain pipe runs shall also be tested for straightness where applicable. This test shall be carried out in accordance with one of the two methods described in B.S. Code of Practice 301, Clause 601 (e).

Testing of manholes shall be carried out in accordance with the methods described under B.S. Code of Practice 301, Clause 601 (f).

(d) **Above Ground Soil Waste and Ventilation Pipe System**

All soil, waste and ventilating pipe system forming part of the above ground installation, shall be given a smoke test to a pressure of 38mm of water gauge and this pressure shall remain constant for a period of not less than three minutes.

Water tests on above ground soil, waste and ventilating pipe systems shall not be permitted.

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

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

In all other respects, tests shall comply with the requirement for B.S. EN 12056-2:2000

1.4.2 **Site test - performance**

Following satisfactory pressure tests on the pipework systems, 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, controls, fittings, equipment and plant are functioning correctly to the satisfaction of the Engineer.

All hot water pipework shall be insulated with performed fibre glass sectional lagging to a thickness of 25mm.

Cold water pipework shall be installed with preformed 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 cover and prepared for painting as follows:-

i) Apply a coating of a suitable filler until the canvas weave disappears and allow to dry.

(ii) Apply two undercoats of an approved paint and finish in suitable gloss enamel to colours approved by the Engineer.

All laggings for cold and hot water pipes erected in crawlways, ducts and above false ceiling which, after erection are not visible from the corridors or rooms, shall be covered with a reinforced aluminium foil finish and 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 standards of modern practice as 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 or larger 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 Contractor shall be deemed to have included in his price for all test pumps, and other equipment required under this Clause of the 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 as in the case of cast or spun iron pipes, where the test pressures should not exceed 120, 180 and 240 metre/head of Clause B, C, or D pipes.

1.4.3 **Sterilization of Hot and Cold Water Systems**

All underground water mains and above ground water distribution systems, 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 procedures shall be carried out by the Contractor or specialist employed by the Contractor in accordance with the requirements of B.S. Code of Practice 310, Clause 409, to the approval of the Engineer.

PART 4

GENERAL TECHNICAL SPECIFICATION

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PART 4

GENERAL TECHNICAL SPECIFICATION

1.1 Materials and Workmanship

All materials shall be of adequate quality for the duty specified and the workmanship shall be in accordance with the best accepted modern practice. Unless otherwise stated the Contractor shall be obliged to comply with the requirements of the latest edition of the relevant Kenya Bureau of Standards Specification where applicable. Failing this, the latest edition of the relevant Britain Standard Specification shall provide the required standard. If the Contractor desires to use any other standard specification or code of practice, it shall be referred to the Engineer for approval.

1.2 Structural Steelwork

The structural steel used in the Mechanical Contract shall be mild steel to B.S. 15. Black bolts and nuts shall be in accordance with B.S. 916. Black metal washers shall be in accordance with B.S. 916.

High Strength friction grips, bolts, nuts and washers shall be in accordance with B.S. 3139, Part 1, and their application shall conform to B.S. 3139, Part 1, and their application shall conform to B.S. 3294, Part 1 torque wrenches or impact tools where used be recalibrated before each shift.

All fabrication and erection procedures shall be in accordance with B.S. 449 as amended, Part 5. Before commencing the fixing of the steelwork the erector shall check the seating for line, level and bolt setting, and any errors which cannot be accommodated by the steelwork erector shall be reported to the Engineer.

1.3 Steel Fabrication and Baseplates

The manufacture of all fabricated items of plant shall be generally in accordance with B.S. 449 as amended, Part 5.

The fabrication and manufacture of the plant and equipment shall be completed in the Mechanical Contractor's workshops before delivery to site. No fabrication of complete units shall take place on site, sitework shall be confined to only such minor alterations and adjustments as are found to be necessary during erection. If major alterations are found necessary the items of plant covered shall be returned to the Mechanical Contractor's workshop for modification on replacement and shall be tested and checked before re-delivery to site.

Drive baseplates shall be robustly constructed and adequately stiffened to prevent twisting and distortion. The ration of the base length to its height shall not be more than 10:1.

All surfaces shall be free from recesses and cavities to prevent the accumulation of dirt and/or waste material, and shall be designed to facilitate ease of cleaning and maintenance.

Where driving units are directly coupled to the driven component all mounting surfaces shall be accurately machined to ensure alignment. After final assembly and testing, the individual items of plant shall be accurately dowelled in position on the baseplate to prevent misalignment during installation or during operation.

The Mechanical Contractor shall include in the design for any measures required to counter the effects of vibration which might be caused by operation of equipment.

1.4 Stainless Steel

All items fabricated in stainless steel shall be in the grade specified and detailed designs shall be compatible with fabrication techniques. The designs of articles to be pressed or welded shall be discussed with the fabricator before manufacture. All stainless steel items shall have a 'half-moon' finish to the satisfaction of the Engineer. Edges shall be finished by either welding on 12mm stainless steel round bar in the same grade as the article or by turning down to an acceptable radius.

1.5 Welding

1.5.1 WELDING

Welding shall be carried out in accordance with the BC Code of Practice for welding No.044 Parts 1, 2, 3, & 4.

1.5.2 Freedom from Surface Defects

All welded fillets or butt joints shall be ground smooth and shall be free from porosity, cavities and entrapped slag. All welds shall conform to the requirements of B.S. 1856.

Welds which are to be hot dip zinc coated shall be neatly formed and the surfaces shall be acceptable and free from cracks in the welds or heat affected zone, from overlap undercuts, porosity, entrapped slag and spatter in or associated with the welds. The welds shall seal completely the edges of all overlapping or contacting surfaces.

1.5.3 Smoothness of joints where Weld is re-commenced or Terminated

The joints in the weld run where welding has been recommenced or terminated shall be smooth and shall show no pronounced hump or crater in the weld surface.

1.5.4 Shape of Profile

The profile of the weld shall be uniform, of appropriately equal leg length and free form overlap at the toes of the weld. Unless otherwise specified the surface shall be either flat or slightly convex in the case of welds and with a reinforcement of not more than 3 mm in the case of butt welds.

1.5.5 Uniformity of Surface

The weld face shall be uniform in appearance through its length.

1.5.6 Electrodes

Electrodes shall be of an approved type for the material being used and shall be kept in a dry condition. All electrodes shall conform to the latest issue of B.S. 693 'Electrodes for Manual Metal Arch Welding of Mild Steel and Medium High Tensiles Steel'.

1.5.7 Qualification of Welders

Welding on or off the site shall be carried out only by welders qualified to the approval of the Engineer. Each welder to be used on the Mechanical Contract Works will be required to carry to test welds to the approval of the Engineer and in the presence of the Engineer's Representative. Only welders whose test welds have been passed by the Engineer shall be employed on the Mechanical Contract Works and then only for the class of welding for which they have been tested. Initial testing of welders and such periodical tests as may be required by the Engineer shall be carried out at the Mechanical Contractor's expense using materials supplied by the Mechanical Contractor.

1.6 **HOT DIP (Galvanised Zinc Coatings)**

1.6.1 General

All hot dip zinc coatings shall conform to the requirements of the latest issue of specification 'Hot-Dip (Galvanised Zinc coatings' with particular reference to the following.

Tubular constructions shall be provided vent holes in appropriate locations to prevent internal pressure build-up during the hot zinc bath shall be referred to the galvaniser who shall state his requirements for the vent holes desired. Welding flux shall be chipped away, all welds shall be wire brushed, ground or grit or shot blasted if necessary before hot zinc coating.

The surfaces to be hot-dip coated shall be free from paint, oil, grease, and similar impurities. Identification numbers of individual pieces shall be clearly stamped on surfaces of members prior to hot-zinc coating, numbers painted or welded on the surfaces of these members shall be unacceptable.

Exposed surfaces, except welds when necessary, need not be grit or shot blasted, but the engineer shall decide to call for grit or shot-blasting in cases of unsuitable surface finish on material for hot-dip zinc coating. The Engineer shall have the right to inspect all steel components before galvanising, and shall have the right to reject or ask for remedial treatment of any material which is considered unsuitable. This applies particularly to welds, burrs, and surfaces having visible surface defects.

Globular extra heavy deposits for zinc which interfere with the intended use of the material shall not be acceptable. Excessively protuberant lumps and nodules shall be removed by hot wiping or skilful application of mechanical means provided that a sufficient minimum thickness of unbroken zinc coating remains after such treatment. Flows on small parts and working surfaces shall be repaired only by stripping, dressing and re-dipping.

1.6.2 Threads

The galvanising on threads or bolts shall be such as to fit a gauge made by overtapping a nut to the following increased limits of size to 7H tolerances:

Bolt Sizes	M6	M8	M10	M12		M16	M24
Overcut,mm	To be Agreed	To be Agreed	0,33	0,33	0,38	0,38	0,38

For threaded articles less than 10mm diameter mechanical plating will be acceptable instead of hot dip zinc coating (galvanising).

Nuts shall be capable of being spun over the full length of the thread by hand ungalvanised internal threads shall be coated immediately after cutting, before they are allowed to rust, with preventive compound of type agreed between the supplier and the Engineer.

1.6.3 Bolts

Bolts to be galvanised shall be standard black bolts manufactured according to B.S 916 (and having threads produced to medium class tolerances G8). Any bolt which has been subjected to cold forming (heading) operation during manufacture shall be stree-relieved at a temperature between 600^0C for a minimum period of 20 minutes and subsequently cooled in air.

1.6.4 Protection of Coating (Passivation)

Immediately after withdrawal from the bath of molten zinc, galvanised material shall be quenched in water containing approximately 1% of sodium dichromat slightly acidified with sulphuric acid. Other bath compositions may be used provided that they contain recognised passivating agents unless otherwise specified.

Alternatively by agreement between the galvaniser and the Engineer, protection may be applied by other means, such as, for instance, a lacquer containing chromate salts.

1.6.5 White Rust (White Storage Stain)

All galvanised material shall be free from gross deposits of white rust. If material has been affected by white rust, the deposit may be removed, by means of non-metallic brushes and provided that the thickness of zinc coating in the affected area meets the requirements of the specification the material can be accepted.

No galvanised material shall be used for erection unless such material:-

a) has been zinc coated under the Kenya Bureau of Standards certification scheme, and this is indicated by the diamond standardisation mark, which should appear on all labels, delivery notes, and other similar documents relating to such material. Such documents should also indicate the name of the galvaniser concerned.

Structural material should also bear a paint mark applied by the galvaniser to indicate standardisation mark quality. The Engineer may call for certificates from the galvaniser indicating that each consignment of material complies with the specification and was galvanised under the certification mark scheme: or

b) The galvanised material has been inspected, and each consignment is accompanied by an inspector's certificate indicating that the material is acceptable and complies with the requirements. Structural material should also bear a paint mark applied by the inspector to indicate that the material has been inspected and accepted. Bolts, nuts and other material of small size should be in a bag or container containing a label bearing the inspector's stamp.

1.7 **Castings**

Because of the corrosion-inducing conditions, and in order to obtain satisfactory mechanical properties of tensile, shear and yield strengths, resistance to impact and transverse loads and hardness properties, all ferrous castings other than those included in the proprietary 'bought out' items of equipment shall comply with the specification hereunder. If the Contractor wishes to offer alternative materials, he shall submit comprehensive details of such alternatives and obtain the prior written approval of the Engineer before proceeding with manufacture.

Material:	Pearlitic Nodular Structure.
Mechanical Properties:	Ultimate Tensile Strength - 725 mpa Elongation - 2%
	Hardness - 240 to 300 brinell (after normalizing)
Inoculation:	All castings shall be inoculated with 3% copper.
Heat Treatment:	To provide the optimum physical properties consistent with the pearlitic nodular structure of the material, and to provide a hardness within the range 207 to 235 brinell.
Test Certificates:	The contractor shall submit to the Engineer all test certificates of analysis including all relevant details of the micro-structure and mechanical properties. The number of tests to be performed and for which certificates of analysis are required shall depend on the respective casting and shall be a greed in writing with the Engineer.

1.8 **VEE-BELT DRIVES**

All vee-belt drives shall conform to B.S. 1440: 1962 - "Endless V-belt drives" and shall be as specified below:

a) Application

Unless otherwise specified or agreed to by the Engineer, Vee-Belt drives shall only be used in applications of constant and slightly varying load conditions. Belt speeds shall not exceed 900 metres per minute, unless otherwise agreed. For reasons of spares interchangeability and maintenance, standard stock vee-belts shall be used.

b) Pulleys

The belt pulleys shall be manufactured from a close-grained galvanised iron and shall be accurately balanced. The belt grooves shall be properly machined to the correct groove angle and depth.

All sharp corners at the top of the groove shall be removed and the groove sides shall be polished smooth to avoid excessive belt wear. The grooves of mating pulleys shall accurately match each other, particularly regarding width, angle and alignment.

c) Adjustment

Adjustment inward, i.e. towards the driven pulley, shall be provided to ensure sufficient movement of the driving pulley to enable the vee-belts to be fitted by hand, without the use of a lever of any king to force the belts over the pulleys.

The outward adjustment shall provide for correct belt tensioning to ensure that slipping does not occur. All belt tensions shall be re-checked within 24hours and again within a week to start-up to ensure that the initial slack, if any, is taken up.

d) Speed Ratio

Speed ratios greater than 7:1 shall not be acceptable unless otherwise agreed by the Engineer.

1.9.0 **Bearings**

1.9.1 Anti-Friction

Anti-friction bearings shall include all bearings which provide rolling contact between one or more sets of hardened steel balls or rollers located between hardened steel rings or raceways. Anti-friction bearings shall be of approved manufacture.

To facilitate maintenance, spares interchangeability and standardisation, anti-friction bearings of standard designs and manufacture shall be employed. All anti-friction bearings shall be provided with greasing facilities in accordance with the manufacturer's requirements.

1.9.2 Bushed Bearings

Only where specifically stated and in cases of low velocities and light loads in moisture-free conditions will bushed bearings be accepted. All bushed bearing shall be made of an approved friction quality and shall be capable of withstanding severe usage.

All bushed bearings shall be provided with lubrication facilities to ensure adequate lubrication and shall be properly grooved to distribute the lubricant uniformly over the bearing surface. Grooves shall not be cut into the journal, but always into the surrounding bush. The edges of all chamfers and grooves shall be rounded to avoid sharp corners and to facilitate the introduction of the oil or grease.

1.9.3 Self Lubricating or Oil-less Bearings

Self lubricating or oil-less bearings shall only be used on application of light loads and low velocities in moisture-free and low humidity conditions and where bearings are of difficult access and likely to be neglected during servicing. The types of bearing metal composition used shall have frictional and wear resistant properties akin to those of grease lubricated bushed bearings.

1.10 Keys and Key Ways

All keys and Keyways and taper pins shall conform to B.S. 46: Part 1, 1958.

1.11 Limits and Fits

Limits and tolerances for shafts and hoes shall conform to B.S.3614.

1.12 General Machinery Protection

1.12.1 Coupling and Shaft Guards

All high speed couplings, projecting shaft ends and every dangerous moving part of machinery shall be protected by a guard manufactured from not less than 1.6mm mild steel plate. The guards shall be neatly formed and securely fixed in position.

1.12.2 Belt Guards

All belt or rope drives shall be adequately protected by a belt guard.

The guard shall be manufactured from wire mesh or open type expanded metal, securely braced and stiffened with suitable rolled steel sections and bolted in position. Guard supports shall not short-circuit vibration isolators on form. Provision must be made for test openings to permit RPM reading of fan and motor without the removal of the belt guard.

1.12.3 Painting

All guards shall be finished in a light orange colour to B.S. 381C in accordance with Clause 2.8.4 Class 'C'.

1.12.4 EQUIPMENT BASES

Unless stated elsewhere in this specification, inertia base formers for machinery shall be provided to the Main Contractor for casting, by the Contractor for casting, by the Contractor. The bases shall consist of reinforced concrete cast into sheet metal formers at least 150mm deep.

The formers shall comply with the standard set by Mason Industries, for both size and construction. Bases shall be mounted on properly selected spring isolators incorporating noise isolation pads.

Either free-standing stable steel spring or caged spring with snubber may be used. Spring isolators shall be provided with levelling bolts. Noise isolation pads shall be large enough to prevent excessive rocking of equipment during start up and normal operation. Bases and supports shall be arranged to give a clearance of approximately 25mm between the underside of the bases and the floor. Bases shall be large enough to accommodate motors and the equipment they drive.

1.13 Identification and Labelling

All plant and equipment items, including items such as dampers, pumps, etc, shall be labelled in a clearly visible position with the item name and, in the case of duplicate items, a number. Plant labels shall correspond with labels on starters, isolators, etc.

Labels shall be of sandwich thermosetting plastic with black lettering on a white background. Lettering shall be at least 6mm high and labels shall be in keeping with the size of equipment and legibility with regard to position.

1.14 Painting

1.14.1 Painting Materials

All paint, driers and the like, and other materials shall conform with the requirements of the relevant British Standard Specification. All paints shall be of the best quality and of approved brand and manufacture. All materials shall be used in strict accordance with the manufacturer's instructions and otherwise in strict accordance with the best standard practice. Undercoats of paintwork and primers shall be as supplied by the manufacturer of the paint begin used for the finishing coat. If necessary, paint shall be strained free from skins and similar impurities immediately before application. Priming coats shall be applied over the whole surface and well brushed in order to obtain the maximum penetration. All materials shall be delivered to the job in their original unopened containers with the manufacturer's name and description of contents thereon and no adulteration will be allowed.

1.14.2 Colours

Samples of the final colours required shall be submitted for approval before painting the work in hand and the work shall then be finished to the colour or colours as approved. Each coat of paint shall be a distinctive colour working up to the finished colour as approved.

1.14.3 External Painting

External painting shall not be undertaken during rainy, damp, frosty or other inclement weather or where such weather is reasonably to be expected within the next 24 hours.

1.14.4 Internal Painting

Before internal painter's work is commenced all floors shall be swept clean, and dirt and rubbish removed, and the rooms left practically free from dust; dust-free conditions being maintained during the progress of the work. No sweeping or dusting shall be done whilst the painting is in progress.

Unless otherwise stated, no paint shall be applied within 50mm of areas which are to be welded. Welds and adjacent parent metal shall be de-slagged, inspected and approved and area shall be abrasive-blasted or ground, and all contaminants shall be removed prior to painting. Wire brushing of the weld shall only be allowed if the paint specification calls for wire-brushing. The weld area shall then be flushed with fresh water and allowed to dry before receiving the full paint system.

Areas where the paint coating has been damaged during transportation erection or by any means whatever, shall be repaired as follows:

Damaged areas or rust spots shall be removed by means of a wire brush or emery paper and the surrounding paint which is still intact shall be feathered for a distance of 20mm beyond the damaged area. Spot priming shall consist of all the coats previously applied and shall overlap the undamaged area by 20mm. Surfaces which are to rest on concrete or other floors or which will be inaccessible after erection shall receive full specified paint system before erection or assembly. Unless otherwise specified, steel embedded with concrete shall not be painted except to within 50mm below the concrete/air interface.

Mating or contact surfaces shall be protected from corrosion by ensuring that the two surfaces brought into contact with each other shall be prepared and primed in accordance with the specification. The primed surfaces shall be brought together while the paint is still wet. Surfaces which are to be friction-bolted shall be prepared in accordance with the specification (i.e. blast-cleaned or wire-brushed) but shall receive no paint coating. All sharp edges shall receive the specified dry film thickness of paint.

Where the shop coat has been allowed to age for a few months before painting, it shall be lightly sanded or rubbed with steel wool and scrubbed with clean water suing a bristle brush.

Before painting galvanised iron surfaces, they shall be treated with galvanised Iron Cleaner" or equal and approved cleaner, used in strict accordance with the manufacturer's instructions. Where a temporary protective coating has been applied to prevent wet storage stain, the surface shall be thoroughly scrubbed down by means of a bristle brush and the approved cleaner until all the temporary protection has been removed. The treated surfaces shall then be thoroughly washed down with clean water and the surfaces allowed to dry before painting.

All galvanised sheeting shall be painted on the ground before erection. This will also ensure that overlaps are well protected. Where it is impracticable to apply the coating system before erection, prior consent to paint after erection shall be obtained form the Engineer.

Paint dry-film thickness shall be measured using a non-destructive thickness gauge such as the MIKROTEST or equivalent.

1.14.5 Inspection of Surfaces

All surfaces to be painted shall be carefully inspected by the Contractor who shall satisfy himself that the surfaces are in a perfect state to take the paintwork specified. No claim will be entertained arising form defective work due to not strictly insisting on receiving from defective work due to not strictly insisting on receiving from other trades, surfaces in a proper condition, fit to receive the type of paint specified. All surfaces shall be perfectly clean, free from dust, dirt, grease, blotches, and other blemishes before painting, staining or application of any coat.

All surfaces shall be properly prepared before painting or staining. Each coat of paint, except the last, shall be rubbed down with a fine glass paper before the next coat is applied.

Unless otherwise directed, the last coat of paint or finishing shall be done when all other work in the Contract is completed and the premises free from all rubbish and dirt. On completion, all painter's work shall be touched up where necessary and any defects made good. All paint and stain spots shall be removed and all surfaces left in a perfect condition.

1.14.6 Iron and Steel Surfaces

The contractor shall ensure that primed steelwork which is to be delivered to site is stacked on bearers and is clear of the ground. Wherever possible channels, angles, and other equipment and material shall be stacked so that water cannot collect on the steel.

Iron and steel surfaces shall be scrapped or shot blasted to produce a clean surface before painting. Paint shall not be applied over any surface containing traces of grit, grease, oil and the like, loose rust, loose millscale or corrosion products and foreign matter of any kind.

All air used for blast-cleaning or spraying shall be free from all traces of water and oil. When blast-cleaned, a satisfactory blast profile (i.e anchor pattern) shall be achieved. If the abrasive used for blast-cleaning is sand, it shall be free of clay. All metal surfaces to which paint is to be applied shall be moisture dry. Paint surfaces which are to be over-coated shall be hard-dry before over-coating, unless otherwise specified.

1.14.7 Painting of Steel Surfaces with Polyurethane System

This system is based on a polyurethane which is cured with an Aliphatic Di-Isocyanate. No polyurethane products which are cured with Aromatic Di-Isocyanate curing agents will be acceptable. This system shall be used as specified in highly corrosive conditions and where a high quality finish is required.

a) In Fabricator's Premises

i) Surface Preparation. All steel surfaces shall be abrasive blast-cleaned to a near-white finish and shall be free from oil and grease and any corrosive contaminants.

ii) Priming. Within 4 hours of blast-cleaning, one coat of an approved zinc chromate epoxy primer shall be applied to give a minimum dry film thickness of 38 micrometers.

iii) Undercoat. One coat of an approved undercoat compatible with both the primer and the finishing coat to give a minimum dry film thickness of 50 micrometers

b) On Site Painting

After erection the following procedures shall be adopted:-

i) Damaged areas shall be repaired as per clause 15.4 above, and spot priming shall comprise all the shop coats.

ii) Undercoat. Unless the undercoat has already been applied it shall be applied before erection as described in Sub-Clause (a) iii) above.

iii) Finishing. Two finishing coats of approved polyurethane enamel in the specified colour shall be applied to give a minimum dry film thickness of 25 micrometers per coat. The two coats shall be distributable in colour and the second coat shall be applied within 24 hours of the first. The total Minimum dry film thickness for the complete paint system shall be 138 micrometers.

1.15.8 Painting of Steel Surfaces with Alkyd System

This system shall be used as specified on columns, roof trusses, steel window frames and door jambs, pipes, pumps and equipment in areas where corrosion is mild and a decorative appearance is required.

i) Surface.

Where a decorative rather than corrosive resistant finish is required, steel surfaces may be specified to be mechanically or hand wirebrushed to remove loose rust millscale.

Where a more corrosive resistant finish than the above is specified, all steel surfaces shall be abrasive blast-cleaned to a near white finish. The abrasive shall be free form oil and grease and corrosive contaminants such as chlorides and the like.

ii) Etch Priming. (Applicable to abravise-blasted surfaces only).

Within 24 hours of cleaning, apply one coat of an approved single pact within 4 hours of cleaning, apply one coat of an approved single pack zinc chromate etch primer to give a dry film thickness of not less than 20 micrometers.

iii) Priming. (For abrasive - blasted surfaces).

Apply one coat of an approved zinc chromate primer (green) to give a dry film thickness of not less than 38 micrometers.

For wire brushed surfaces to the clean steel apply one coat, by rush or roller, of an approved red lead primer to give a dry film thickness of not less than 38 micrometers.

b) On-Site Painting of Steelwork

i) Damaged Areas

Before and after erection damaged areas shall be repainted as for Clause 14.4 above, and spot priming shall comprise all the shop coats.

ii) Undercoat

Apply one coat of an approved undercoat to give a minimum dry film thickness of 38 micrometers. The undercoat may be tinted to a shade just lighter than the finishing colour using approved stainers.

iii) Finishing

Apply at least one coat of an approved high gloss enamel in the specified colour, to give a minimum dry film thickness of 25 micrometers.

The total dry film thickness for the complete system shall not be less than 100 micrometers for wire-brushed surfaces, and 120 micrometers. The total dry film thickness for the complete system shall not be less than 100 micrometers for wire-brush surfaces and 120 micrometers for abrasive-blasted surfaces.

Note: Where window frames, door jambs and the like have been painted in the fabricator's yard with red oxide primer, this shall be rubbed down and primed in accordance with Clause 14.7 (a) III.

c) Painting of Motors, Gear Boxes and other Equipment

i) Surface Preparation

The surfaces to be painted shall be completely free from oil, grease, rust and foreign matter of any kind.

ii) Priming

One coat of an approved epoxy primer shall be applied to form a uniform coat and to fill all porosities in the castings. After 24 hours the primer shall be wet sanded to produce a uniform smooth surface.

iii) Undercoat

One coat of suitable undercoat tinted to a shade just lighter than the finishing colour with suitable staining agent, which is compatible with the paints, shall be applied.

iv) Finishing

One coat of approved high gloss enamel in the specified colour shall be applied. N.B. Flanged faces shall receive the full specified coating.

d) Painting of Pipes

i) Surface Preparation

The surfaces shall be wire brushed to remove loose rust and loose millscale.

ii) Priming

An approved one coat primer shall be applied.

iii) Undercoat

Undercoat shall be specified in Clause 14.8.

iv) Finishing

The finishing coat shall be as specified in Clause 14.8 (c) (iv). The total dry film thickness for the coating system shall not be less than 90 micrometers. N.B. Flanged faces shall receive the full specified coating.

1.15.9 Painting of Galvanised Surfaces with Alkyd System

This paint system shall be used as specified for painting of side sheeting, ducting and plenum walls, underside of roof sheeting and the outside surfaces of rain water gutters where a decorative effect is required. It shall only be used where the corrosive conditions are mild.

i) Surface Preparation

The surfaces shall be prepared in the manner as described in Clause 14.4 above.

ii) Priming

To the cleaned surfaces apply one coat of an approved Calcium Plumbate primer.

iii) Undercoat

Apply one coat of approved high gloss enamel in the specified colour. The total paint dry film thickness for the system shall not be less than 100 micrometers.

1.14.10 Painting of Equipment and Steelwork with Epoxy System

i) Surface Preparation

a) Equipment

Where the equipment is specified to be painted after installation it shall be delivered to site unpainted. The surfaces to be painted shall be completely free from oil, grease, rust and all other foreign matter. If possible, castings shall be fettled prior to priming.

b) Supports and Steelwork

All surfaces shall be abrasive blast-cleaned. The abrasive shall be free from oil, grease, and corrosive contaminants such as chlorides and the like.

ii) Priming

Apply one coat of approved epoxy primer to form a uniform coat, and to fill all porosities in the casting. After 24 hours the primer shall be wet sanded to produce a uniform, smooth surfaces.

iii) Finishing

Apply two coats of an approved Epoxy Enamel in the specified colour, the second coat to be applied within 24 hours of the fist. N.B. Flanged faces shall receive the full specified coating system.

1.14.11 Painting of Galvanised Surfaces with Epoxy System

This paint system shall be used for painting of galvanised surfaces in highly corrosive conditions.

i) Surface Preparation

These surfaces shall be prepared in the manner as described in Clause 15.4 above.

ii) Priming

To the cleaned surfaces apply one coat of approved Epoxy Zinc Chromate Primer.

iii) Finishing

Apply two coats of an approved epoxy enamel. The second finishing coat shall be applied within 24 hours after the application of the fist finishing coat, and shall be distinguishable in colour from the first. The total minimum dry film thickness for the paint system shall be 88mm.

1.14.12 Painting of Chequer Plate of Egg-Crate Flooring and Supporting

Frames with Epoxy Tar System

This paint system shall be abrasive blasted or acid pickled and passiveated.

i) Surface Preparation

Surfaces shall be abrasive or acid and passivated.

ii) Finishing

Three coats of approved epoxy Tar shall be applied. Consecutive coats shall be in distinguishing colours.

1.14.13 Painting of Galvanised Surfaces with Epoxy Tar System

This paint system shall be used for the painting of internal surfaces of galvanised gutters.

i) Surface Preparation shall be described in Clause 14.4

ii) Finishing

To the cleaned surfaces apply one coat of approved Calcium Plumbate Primer.

iii) Undercoat

Apply one coat of suitable undercoat tinted to a shade just lighter than the finishing colour with a suitable tinting agent which shall be compatible with the paint.

iv) Finishing

The Contractor shall apply two coats of approved Epoxy Tar. The second coat shall be applied within 24 hours of the first coat. The total paint dry film thickness shall be not less than 200 micrometers.

1.14.14 Painting of Steelwork with Chlorinated Rubber System

This system shall be used in areas where the steelwork is exposed to occasional corrosive conditions.

a) In Fabricator's Yard

i) Surface Preparation

Abrasive blast-clean all steel surfaces. The abrasive shall be free form oil, grease and any corrosive contaminants.

ii) Priming

One coat of approved chlorinated rubber undercoat shall be applied to give minimum dry film thickness of 75 micrometers.

iii) Undercoat

One coat of approved chlorinated Rubber Undercoat shall be applied to give a minimum dry film thickness of 75 micrometers.

b) On-Site Painting

After erection, the following procedure shall be adopted:-

i) Damaged areas shall be repaired as described in clause 14,4 above and spot priming shall comprise all the shop coats.

ii) Finishing

One coat of approved chlorinated rubber enamel shall be applied in the specified colour, to give a dry film thickness of not less than 25mm.

1.14.15 Painting of Galvanised Surfaces with Micaceous Iron Oxide Pigmented Alkyd System

Unless the Engineer has given his written consent, the galvanised sheets shall be primed on the ground before erection.

i) Surface Preparation. The surfaces shall be prepared in the manner as described in Clause 1.14.4.

ii) Priming To the clean surfaces apply one coat of an approved calcium plumbate primer.

iii) Undercoat. Apply one coat of an approved Alkyd micaceous Iron Oxide structural paint.

iv) Finishing. Apply one coat of an approved Alkyd micaceous Iron Oxide structural paint in colour as specified.

(v) Damaged Areas These shall be repaired in a manner as described in clause 1.14.4

The total paint dry film thickness shall not be less than 114 micrometers.

1.14.16 Specialised Painter

All painting shall be carried out by a painting specialist employed by the contractor.

1.15. PROTECTION OF UNPAINTED SURFACES

Bright Machined Parts

All bright machined parts shall have a protective treatment applied by the manufacturer before despatch and this treatment shall be kept intact up to the time of handover unless it has been removed for installation. If the surface is exposed after installation a further protective coating shall be applied in accordance with the manufacturer's requirements.

1.16. PIPING AND FITTINGS

1.16.1 Materials

Pipework shall be run as shown on the contract drawings. All piping used in the construction of the works shall be straight, cleanly finished, round in cross-section, free from cracks, surface flows, laminations and other defects and free from scale.

1.16.2 Neatness

All pipe runs shall be arranged to present a neat appearance with where practicable shall be parallel both with one another and with the building structure, paying due regard however to the grading and venting requirements. All vertical pipes shall be plumb.

Pipes shall be bent round piers and all other projections and recesses and all offsets due to varying thicknesses of plaster, walls, floors and ceilings and other structural works were such changes in direction of piping are indicated on the drawings or not. Details of the skirting heights, sill heights and floor finishes shall be determined before any work is commenced. No pipework offsets shall be allowed on piping.

1.16.3 Prevention of Dirt Entering Pipes, valves etc

All pipes, fittings, valves, etc shall be guaranteed to be free from corrosion and internal obstruction. Pipes and fittings showing signs of corrosion shall not be fitted.

The open ends of all pipework and valves shall be protected. Wrought-iron screwed caps or plugs or plastic covers only shall be used to cover open ends. Wood, rag or paper plugs shall be used. Pipework delivered for use on the Contract Works shall be stored clear off the ground on suitable racks or stands and with the ends protected as described above.

1.16.4 Pipe Cutting and Cleaning

All cuts from Standard lengths of pipe shall have all burrs and swarf removed, the ends shall be trimmed square and the pipe shall be thoroughly cleaned both internally and externally before erection.

1.16.5 Accessibility

All valves, drains and supports shall be positioned so as to facilitate maintenance. Grouping of valves, drains unions flanges etc shall be preferred to scatted siting. Joints shall not be formed in the thickness of walls, floors or ceilings. All pipework, valves fittings and equipment forming the piping installation shall be erected so that it can be dismantled and be readily accessible for repair and replacement.

Readily accessible means that the flange, union, etc, can be reached and worked upon either in the open or else by removal of a purpose made duct cover, manhole or similar cover. The fitting is not accessible if as fixed it cannot be manipulated.

Where pipework is to be installed in an inaccessible position it shall be welded or brazed. Unions or flanges shall be provided as equipment to facilitate dismantling. Care shall be taken to ensure that pipe flanges, valves etc are staggered relative to similar projections or adjacent pipes and obstructions such as bemas columns and pipe supports, where necessary.

1.16.6 Grading of Pipework

All pipework shall be installed with continuous gradients to allow for drainage and for venting air. The rise or fall of piping in the direction of flow shall be as laid out in the schedule below (unless noted otherwise on the drawings or instructed by the Engineer.

Service	Rise or Fall	Minimum Gradient mm per meter
Water	Rise (preferred)	2
Steam	fall	4
Condensate	fall	4
Compressed Air	fall	8

1.16.7 Pipes laid in Ground

Pipes laid in the ground shall be assembled with care and shall be well bedded in to ensure that pipework and fittings shall not be damaged by movement of the ground. (Steel pipes shall either be supplied with factory applied bitumen/fibreglass wrapping and joints site-wrapped with bitumen tape, or the entire pipeline shall be primed with Densopaste, protected with Denso tape applied with a 55% overlay and protected with PVC wrapping securely fixed).

Excavation in ground and backfilling of trenches with sealed backfill shall be by others unless specified otherwise.

1.16.8 Pipes Joints

a) Types of Joints

Joints shall be screwed, welded or flanged as specified for each particular service elsewhere in this specification. Joints shall comply with relevant Kenya Bureau of Standards or BS specification. All flanges shall be at 90^0 to the centre line of the pipe and the holes shall straddle the centre line.

b) Screwed Joints

Pipes for screwed joints shall be provided with taper threads to B.S. 21 Part 1. Steel pipes shall be carefully reamed out before the plain end is threaded. Threads shall be right, clean and free of burrs prior to installation. Before making a joint, the male screw thread shall be wrapped with Polytetrafluoroethene (PTFE) tape. Alternative jointing compounds shall not be used without the express approval of the Engineer.

Should a screwed joint prove defective under test or in operation, the joint shall be broken and remade, caulking will be permitted.

c) Flanged Joints - Steel Pipes

All flanges, bolts, nuts and washers shall be manufactured from mild or stainless steel to B.S. 4504 Part 2 "Table of Piped Flanges (for land use)" to the table appropriate to the pressure specified. Bolt holes in flanges shall be drilled, not punched, and spot faced for nuts.

Pipes not galvanised shall be provided with flanges crewed or welded for nominal bores of 80mm and below and with welded flanges for larger sizes. Galvanised pipes shall be provided with galvanised screwed flanges for nominal bores 80mm and below and with welded flanges for larger sizes. For galvanised piping all welding shall be carried out before galvanising.

Welded flanges shall be of the machine-faced, slip-on pattern with neck secured by welding both at the neck and bore of the flange to pipe, with the pipe finishing 3mm inside the bore. Care shall be taken not to distort the machined face. The use of alternative flanging to the ASA standards throughout the installation will be considered upon application.

d) Flanged joints - Polypropylene Pipe

Flanges on polyprolene pipes shall be of the full face type up to and including 100mm NB, and the stub flange type with mild steel backing ring for sizes 125mm NB and above, these shall also be used on sizes below 100 mm NB upon the Engineer's request.

All drilling in flanges and backing rings shall be to B.S. 4504 Part 2 "Table of Pipe Flanges" (for land use) and the holes shall be drilled, not punched, and spot faced.

Thickness of flanges and backing rings shall be as specified for each service and the material for the flanges and stub flanges shall be identical to that of the pipe. The use of the alternative flanging to ASA standards throughout the installation will be considered upon application.

e) Gaskets and Bolts

The joint between flanges shall be made up with a joint ring graphite faced on both sides. Joint strings shall be suitable for the pipeline pressure and temperature duty and shall be identified for duty for which they are suitable. Joint rings shall be cut from sheets on site.

Bolts heads and nuts shall be hexagonal in form and washers shall be fitted beneath bolt heads and nuts. The lengths of bolts shall be such that not less than one thread nor more than 5mm of bolt protrudes through each nut when the joint is pulled up. All bolts and nuts shall be corrosion resistant.

f) Welded Joints - General

Welding technique, edge prepatin and welding rods or electrodes shall be selected to be suitable in all respects for the materials and duty of the pipeline, and comply with the applicable British Standards.

Each approved welder will be assigned a reference number which shall be stamped on each weld carried out by him. During the progress of the site work ultrasonic or radiographic examination or welds may be carried out by an independent authority at the expense of the Employer Welds found to be defective shall be cut out and the pipe made good, all the contractor at his own expense, and the new welds retested at the contractor's expense.

The Contractor shall cut out and prepare for mechanical testing in the presence of the Engineer, welded joints selected by the Engineer. Cutting out and preparing of test pieces and the making good of pipelines shall be at the contractor's expenses. The total number of such tests will not exceed one per cent of welded joints except that welds found to be defective shall not form part of this total.

Should a significant proportion of the tested welds of a particular welder prove to be defective due to faulty workmanship, all welds carried out by the particular welder shall be cut out and the pipeline made good by another welder whose work has proved satisfactory.

When the general hydraulic test of the completed systems is carried out, each weld shall be lightly hammered during the time pressure is maintained. If any leaks occur at welds, the portion of weld near the leak shall be removed by cutting or grinding and welded. Repairs shall not be attempted by caulking or fusion of surrounding metal.

g) Welded Joints - Steel Pipes

Oxy-acetylene welding shall generally be carried out in accordance with the "Recommended practise of oxy-acetylene welds in mild steel pipelines" publishing by the Heating and Ventilation Contractors Association. Metal arc welding shall be in accordance with Technical Memorandum T.3 issued by the British Welding Research Association.

The contractor shall obtain from the manufacturers tests certificates representative of welding rods and electrodes used and in accordance with B.S. 1453 or B.S. 639 respectively.

All welded joints, whether produced by oxy-acetylene flame or metal are processes shall be of prime quality. The butts shall be slightly convex with regular ripples and no undercutting, washing away or surface cavities shall be present. Notches at the root into the pipe bore in excess of 1.5mm will be accepted and the external reinforcement shall run out smoothly to the pipe surface on either side. All slag shall be removed after each run. Undercut edges, slag pockets, unsound metal and blowholes shall be chipped out as the work proceeds.

h) Welding - Polypropylene

The use of radial welding equipment for pipework joints shall be preferred. The butt machine used for the welding of polypropylene pipes shall be of a design approved by the Engineer. The machine is to carry out the butt welding of pipes from 100 mm NB up to and including 300 mm NB, must be capable of welding flanges and fittings onto the pipe, and be able to do angular butt welds for development of special bends.

The machine shall be capable of maintaining a welding force of 3500 N. The welding force to be maintained at each weld shall be 10N for each square centimetre of annular pipe surface, at a temperature of 250 plus of minus 10^0C, and therefore provision shall be made for the heating of both mating surfaces to a temperature of, and maintaining, 250 plus of minus 10^0C. All heating surfaces in contact with the piping material shall be Teflon coated.

i) Pipe Fittings

General

Fittings shall be to the standards specified elsewhere in this specification and shall be compatible in all respects with the materials and class of piping being installed. Where standard fittings are not available for the duty required, reductions on the run and to the branch shall be in all cases be made with reducing sockets. Reducing bushes and long screw connectors with backnuts shall not be used.

Bends shall preferably be of the long radius type except for the compressed air system and where space is restricted. In these cases short radius elbows may be used subject to the approval of the Engineer.

In general standard tees shall be used for all connections to pipes and headers. The welding on of sockets or branch pipes will be permitted only with the authority of the Engineer. Reducers shall be of the eccentric type, except on vertical pipelines where concentric reducers may be used. Transitions shall be swept and not abrupt. All connections to plant items shall be so arrange that the plat can be easily disconnected. All steam, compressed air and water connections shall be made to the top of the line unless noted otherwise on the drawings.

1.16.9 Pipe Supports and Guides

a) General

All supports, brackets, hangers clips and other fixing accessories necessary to support all piping system from the building structure or concrete bearers shall be provided and fixed under this Contract. As far as practicable standard bought dip galvanised components shall be used. Samples of these components shall be submitted for approval prior to the placing of order.

Steam and other pipes for high temperature duties be supported on rollers and guided with rollers at changes of direction or other points where necessary to prevent pipes leaving the supports, or on hangers with spherical washers or suitably articulated to take up movement.

Brackets and supporting frames of rolled steel sections shall be fabricated in accordance with the best accepted practice to form true, rigid, neat structures. Makeshift, untidy or unstable supports will be acceptable. Woodscrews, pop-rivets, self-tapping screws, or other fastenings subject to loosening by vibration shall not be used in the fabrication or attachment of pipe supports or fixings. Spring washers, lock nuts or other locking devices shall be used on nuts. Contact between dissimilar metals shall be avoided. A pipe shall not be supported from another pipe unless approved by the Engineer or specifically called for the drawings. Where a common hanger is used for more than one pipe, provision shall be made to accommodate unequal expansion.

b) Fixing to Structure

Fixing to the building structure shall not be carried out in any manner other than that specifically approved by the Engineer for the particular area of the building and type of finish. Care shall be taken to avoid unnecessary damage to finishing.

Competent labour shall be employed to ensure that supports are correctly sized, spaced and set out prior to fixing. All work shall be made good to the Engineer's approval.

For fixing to brick and concrete, holes of correct size shall be neatly drilled using special purpose twist drills, and fixings made by rowl-bolts or equal or bolts of the grouted type approved by the Engineer. Shot fixings shall not be used nor shall fixings be made into mortar between bricks. Fixing to lightweight or hollow structures shall be by means of suitable screw anchors, toggle bolts or approved alternative.

c) Spacing of Supports

Spacing of supports for steel and copper pipes shall not exceed the centres given in the following table:

MAXIMUM SPACING OF SUPPORTS (M)

Nominal Bore of pipe (mm)	Steel Pipes		Copper Pipes	
Horizontal	Vertical	Horizontal	Vertical	
15	2.0	2.4	1.4	1.9
20	2.4	3.0	1.4	1.9
25	2.7	3.0	1.7	2.2
32	2.7	3.0	1.7	2.7
35	3.0	3.6	2.0	3.0
40	3.4	4.0	2.0	3.0
50	3.7	4.5	2.0	3.4
65	3.7	5.0	2.4	4.0
80	4.1	5.0	3.0	4.0
100	4.4	5.0	3.0	4.0
125	4.4	5.5	3.0	4.0
150	4.8	6.0	-	-
200	5.1	6.3	-	-
250	5.8	6.5	-	-
300 and over	6.1		-	-

Special supports shall be provided for all heavy items of pipeline equipment such as stainers, valves, etc.

d) Positions of Supports

Supports shall be positioned to reduce, as afar as possible, stress on joints, valves and items of equipment. Due to regard shall be given to the maintenance of accessibility and to the requirements of access to their services to be fixed in the area.
Vertical pipes shall be supported at the bottom of the riser, or at an intermediate anchor point, to allow for expansion and to carry the entire weight of the riser. Intermediate supports will act as guides. Branches from risers shall not act as supports for the riser.

e) Guides

Guides shall be provided and fixed to prevent pipes leaving their supports due to expansion compensating devices.

f) Anchor Points

Anchor points shall be provided to resist the axial stress transmitted by the flexure of expansion loops or bellows.

Anchors shall be provided complete for attachment to the structure and where applicable shall be bolted or welded to the structure or positioned accurately for grouting in by others.

On steel pipelines anchors shall consist of heavy mild steel saddles welded all round to the pipe surface and provided with exterior lugs for bolting to the building structure or thrust block. Saddles shall be not less than the thickness of the pipe to which they are welded and of width equal to its nominal bore. On polypropylene pipelines shall const of 3mm thick polypylene pads completely surrounding the pipe and then attached to the supporting steelwork with U Bolts. Alternatively, anchors may consist of slip on flanges welded to the pipe and not bolted or welded in the approved manner to rolled steel members attached to the structure.

In the case of copper pipes, anchors shall generally consist of two flanges-to-copper adaptors interposed into the pipe run at the anchor point. Mild steel sections shall be bolted to either side of the flanged joint and attached to the building structure.

1.16.10 Provision for Expansion in Piping

Piping shall be installed in such a manner as to allow for thermal expansion. Where sufficient flexibility is not provided by changes of direction in the run, expansion loops or expansion compensators shall be provided. In general, fabricated expansion loops shall be used to allow 'nesting' of loops in adjacent pipes but purpose made expansion loops may be used if they are suitable for the pressure and expansion duty.

Expansion compensators shall be used only on Engineer's approval and then must be suitable for the working conditions and installed in full compliance with the manufacturer's recommendations regarding guiding, alignment and all other respects of erection and commissioning.

Care shall be taken that the compensators are not overstressed during pressure testing of pipelines, and if necessary, made-up spool-pieces of pipe shall be substituted during these tests.

All supports shall provide for the expansion movement in pipes. Hangers shall be free to 'swing' and rigid supports shall be of the roller type or pipes shall have 'slides' of rolled steel sections welded to them to permit free movement on supports without damage to the pipe or insulation.

1.16.11 Pipe Sleeves

a) General

Pipes shall not be build rigidly into walls, floors, ceilings, footings or under roads. Sleeves shall be provided under this contract, unless noted otherwise on the drawings, for building-in by others at all such locations.

The Contractor shall provide all sleeves in advance of building requirements and shall be responsible for ensuring that sleeves are properly positioned, aligned and built-in. Rectangular or circular openings will be provided by the builder in structural concrete slabs and it shall be the Contractor's responsibility to supply, position, align and secure sleeves, ready for casting in by the builder. Puddle flanges shall be provided for building-in where pipes pass through bound walls or below ground.

b) Sizes

Sleeves shall not be used as pipe supports and a free annular space of at least 6mm shall be allowed between a pipe and its covering, if any and its sleeve. In load bearing walls or footings the annular space shall be of a minimum of 25mm. Where pipes change direction, sleeves shall be oversized to accommodate expansion movement of the pipe.

Sleeves shall extend through walls to within 5mm of the finished surface on both sides to allow for flush caulking over the sleeve with water proofing compound. Vertical sleeves shall be project 50mm above the finished floor level and end 5mm above the underside of the slab. Polystyrene or similar material spacer discs shall be provided to locate the sleeve during casting of concrete, so that when the discs are removed the caulking clearance is left.

c) Materials

Sleeves in load-bearing walls and under roads shall be of cast-iron. Other sleeves shall be of standard galvanised pipe cut to length. Sleeves shall properly cut, reamed and trimmed square. Sleeves for casting in the concrete shall be securely fixed to form work by the contractor before concrete is poured. The annular space between each pipe and sleeve shall be firmly caulked at each end with polysulphide or equal waterproof compound which does not set hard.

1.16.12 Ventilation and Draining of Pipework

a) General

Sufficient provision shall be made at high points of piping and equipment for ventilation and at low points for draining. Drains shall be provided on all major sections of pipework so that they can be drained without draining the entire system. Vents shall be adequate to ensure that airlocks cannot form in the system.

b) Manual Vents

Manually operated air release points shall be provided on all water piping to permit the initial charging of the system. Each point shall comprise an air bottle fitted on tope of the pipe and with a welded cap and 15mm discharge pipe run to a fullway air-release valve at hand level and then to discharge at an agreed point. Pipes up to 40mm shall have air bottles of the same diameter as the pipe, air bottles for larger pipes shall be 40mm diameter. All air bottles shall be 300mm long.

c) Automatic Vents

Automatic vents shall be provided with lockshield isolating valves and 15mm discharge pipes run to approved positions. Steam mains shall be provided with thermostatically operated air vents at all high points in the system to allow for quick warming up of the system after a shutdown.

d) Drain Points

Steam lines shall be provided with steam trapped condensate drain points at all low points at least every 40 meters on long lines. Drain pockets of diameter equal to that of the steam pipe shall be provided on lines up to 100mm diameter and of diameter 50mm less than the pipe diameter for pipes above 100mm. The condensate line from the trap shall enter the top of the condensate in the header or main.

Water lines and equipment shall be drainable through 15mm lockshield isolating valves and discharge pipes run to approved positions. Compressed air lines shall have trapped automatic condensate drains at all low points in the system.

1.16.13 Valves and Strainers

a) General

Valves and strainers shall be of the types specified elsewhere in this specification, of best quality and suitable in all respects for the duties for which they are intended.

b) Valves

Except where loose key or lever operation is specified, all manual valves shall be provided with handweels. Closing shall be by clockwise rotation of the handwheel. All valves shall conform to the following design and materials specification:

Bronze	B.S. 1400 LG-2C or A.S.T.M.B. 62-63
Galvanised iron	B.S. 1452 GR14C or A.S.T.M.A. 445-63T
Ductile Iron	B.S. 1504-161A or A.S.T.M.A. 216 Grade WCB.

Mixing, thermostatic and other automatic valves shall be of 'fail-safe' design and where practicable self-acting.

1.16.14 Pressure Reducing Valve Sets

Pressure reducing valves shall be as equal and approved. They shall be installed complete with separator, isolating valves, strainer, pressure gauges, by-pass and control valves, etc and a pressure relief valve mounted on the low pressure side, sized in accordance with accepted practice, to fully protect any equipment in the event of failure of the pressure reducing valve. The relief valve shall be set, and all gauges shall be in place before steam is allowed to pass through any P.R.V. set. The discharge pipe from the pressure relief valve shall be run to the nearest drain point approved by the Engineer.

1.16.15 Instruments and Gauges - Pipework

Where shown on the drawings pressure gauges and thermometers shall be provided. Pressure gauges shall be of the dial type with minimum 100mm dials and scaled to 50% in excess of maximum anticipated pressure.

They shall be fitted with isolating valves, gauge cocks and syphon bends and installed on extension pipes extended to a convenient position and properly supported. Gauges shall be tested against a deadweight tester in the presence of the Engineer and shall be accurate to within 2% over the working range. Pressure gauges shall be calibrated in kpa. Blow off holes in gauges shall be aimed in a safe direction, away from the operator. Thermometers shall be of brass mercury-in-glass type at least 150mm long and installed in thermometer pockets so that they may be removed without draining the pipeline. Angle or staring pattern thermometers as appropriate shall be used. Calibration shall be in ^{0}C.

1.16.16 Identification and Labelling

a) Pipework

All pipework, both insulated and uninsulated shall have coloured identification band and direction arrows marked on in clearly visible positions at maximum spacings of 6 meters on all runs. This spacing shall be reduced if necessary to ensure that each pipe and branch-passing through any form of space is coded, each branch has at least one coding band and there shall be a coding band within one meter of each valve, plant connections and flange or union.

The colours to be used for banding and arrows shall be agreed with the Engineer but shall comply as far as is possible with B.S. Bands and arrows shall be neatly stencilled using paint system compatible with the surfaces to which they are to be applied. Bands will consist of a base colour band and identification bands of contrasting colours and each 50mm wide.

All insulated pipework other than stainless steel, copper galvanised and polypropylene, shall be painted over the entire length prior to insulating with an approved anti-corrosive inert bituminous based paint, suitable for use on steam pipework. All other pipework shall be pained and code banded, as indicated elsewhere in this specification. On bare polypropylene, identification and direction of flow arrows shall be made by the sue of coloured adhesive tape (of a type approved by the Engineer) banded around the pipe in accordance with the foregoing positions.

b) Equipment Items

All plant and equipment items shall be labelled in a clearly visible position with the items name and, in the case of duplicate items, a number. Plant labels shall correspond with designations on the drawings. Labels shall be of rear engraved and filled 'trefoiled" of sandwich thermosetting plastic with black lettering on white background. Lettering size shall be at least 6mm.

c) Valves

Section isolating valves and valves in service areas shall be labelled to identify the zones they serve and with an abbreviated code to identify the service. A schedule of labels required will be provided by the Engineer.

Valve labels shall be sandwich thermosetting plastic with black lettering on a white background secured to the valve stem with a light chain. Sample labels shall be submitted for approval.

1.17 Pipework System Materials

1.17.1 General

All materials shall be suitable for the temperature rating of the system in which they are installed. These ratings are given in the detailed specification.

1.17.2 Steam Reticulation and Condensate Return

a) Piping

150 mm and below B.S. 1387, heavy class seamless, plain ends prepared for welding.

above 150 mm B.S. 3601/22 or AP1 5.L Sch 20 with wall thickness 6,35mm min.

b) Fittings

Steel but-weld fittings to B.S. 1640 or equal, wall thickness not less than pipe thickness.

c) Flanges

B.S. 4504

d) Valves

Steam Isolating Valves

Upto to 40mm globe valves with cast bronze or ductile iron bodies, replaceable seat, bronze or stainless steel trim, union bonnet pattern and screwed by B.S. 21.

50mm to 150mm globe valves with cast bronze or ductile iron bodies, replaceable seat, bronze or stainless steel trim, union bonnet pattern and flanged to B.S. 4504.

200mm and above globe valves with cast bronze or ductile iron bodies valves with galvanised iron or ductile iron bodies replaceable seat, bronze or stainless trim, rising spindle pattern and flanged to B.S. 4504.

Steam Regulating Valves

These valves shall be needle valves of materials specification similar to isolating globe valves.

Condensate Valves

Upto to 40mm	Cast bronze of ductile iron bodies, replaceable seat, bronze or stainless steel trim, union bonnet pattern and screwed by B.S. 21.
50mm to 150mm	Galvanised iron or ductile iron bodies, replaceable seat, bronze or stainless steel trim, union bonnet pattern and flanged to B.S. 4504.

Gate Valves

Upto to 40mm	ductile iron bodies, replaceable seat, bronze or stainless steel trim, union bonnet pattern and screwed by B.S. 21.

Non return valves

Upto to 40mm	bronze swing check screwed to B.S. 21.
50mm to 150mm	ductile iron bodies, replaceable seat, bronze or stainless steel trim, union bonnet pattern and flanged to B.S. 4504.

Sight Glasses

Bronze/Gunmetal bodies, single window combined sight-check valves may be used only where installed safe from Mechanical damage.

Steam Traps

For line draining	Inverted bucket steam trap (stainless steel trim).
For equipment	Ball float steam trap to correct pressure range or equal, unless otherwise specified on the drawings. (Stainless steel trim)

Air vents

Thermostatic vent depending on pressure.

Pressure Reducing Valves

Diaphragm pilot operated reducing valve. Stainless steel trim, phosphor bronze diaphragm, correctly sized for floor rate and with high turn-down accuracy and tight shut-off.

Strainers

up to 50mm	Malleable or galvanised iron body, stainless steel screen and screwed connections to B.S. 21
65mm and above	Galvanised iron or S.G. iron body, stainless steel screen and fanged connections

1.17.3 Cold and warm 45^{0}C Water Reticulation

a) Piping

Piping - Steel

up to 150mm	Galvanised steel piping to B.S. 1387, medium class, screwed and socketed.
above 150mm	B.S. 3601/22 or API equivalent, 4.5mm wall thickness with plain ends for welding. To be hot dip galvanised after fabricating.

Piping - Polypylene

up to 25 mm	1 500 kpa rated. Extruded from polypropylene - ethylene grade and shall be heat and U.V. stabilised to B.S. 4991 or ISOR 160.
32mm and above	600 kpa rated for cold water and 900 kpa for warm water. Extruded from propylene acetylene and shall be heat and U.V. stabilised to B.S. 4991 or ISOR 160.

b) Fittings

Fittings -Steel

up to 100mm	Fusion welded and of exactly the same material as the polypropylene piping.
above 125mm	butt welded or fusion welded and of exactly the same material as the polypropylene piping.

Fittings -Polyprolene

up to 150mm	Galvanised malleable iron fitting to SABS 509.
above 125mm	flanged to B.S. 4504. Fabricated or forged steel.

c) Flanges

Flanges - Steel

50mm to 150mm B.S. 4504 screwed and galvanised.

above 125 mm Butt welded or fusion welded and of exactly the same material as the polyprolene piping.

Flanges - Polypropylene

Full face polypropylene or polypropylene stub flanges with mild steel backing rings drilled to B.S. 4504.

d) Gaskets

6mm rubber insertion.

e) Valves

Globe

Upto to 40mm bronze body, bronze or stainless steel trim, replaceable seating, and screwed to B.S. 21.

65 and above galvanised iron body, bronze or stainless steel trim, replaceable seating flanged to B.S. 4504.

Gate

Upto to 40mm bronze body, bronze or stainless steel trim, replaceable seating, and screwed to B.S. 21.

65mm and above galvanised iron body, bronze or stainless steel trim, replaceable seating flanged to B.S. 4504.

Check-valves

Upto to 40mm bronze body, bronze or stainless steel trim, replaceable seating, and screwed to B.S. 21.

65 and above galvanised iron body, bronze or stainless steel trim, replaceable seating flanged to B.S. 4504.

Ball valves

Upto to 50mm chrome plated brass, teflon seat rings screwed to B.S. 21, with fixed operating handle.

Restrictor Valves

Ball stop with crew driver operation.

f) Strainers

Upto to 50mm	Malleable iron bodies, stainless steel screen and screwed connections to B.S. 21.
65 and above	galvanised iron or S.C. iron bodies, stainless steel screen and flanged connections.

1.17.4 Hot water (85^0C)

a) Piping

Piping - Steel

Stainless steel type 304 L to A.S.T.M specification A312. Wall thickness 2mm minimum longitudinally welded. **NOTE** All welds made in the pipe during manufacture shall be suitably cold worked to relive stresses and normalize crystal structure in order to prevent stress corrosion occurring while the pipe is in service at 85^0C. All joints in run and to fittings to be welded, using a suitable inert gas technique.

Piping - Polypropylene

Upto to 25mm	1,500 kpa rated. Extruded from polypropylene - ethylene grade and shall be U.V. stabilised, to B.S. 4991 or ISOR 160.
32mm and above	1,500 kpa rated. Extruded from polypropylene - ethylene grade and shall be U.V. stabilised, to B.S. 4991 or ISOR 160.

Piping - Copper

Shall comply with B.S. 2051

b) Fittings

Fittings - Steel

Stainless steel type 304L welded.

Fittings - Polypropylene

Upto to 100mm	Fusion welded of exactly the same material and pressure rating as the polypropylene piping.
125mm and above	Flanged and of exactly the same pressure rating and material as the polypropylene piping.

Fittings - copper

Upto to 50mm	Capillary to B.S. 864 or screwed to B.S. 21. Above 50mm flanged, brazed or bronze welded.

c) Flanges

Flanges - Steel

Stainless steel type 304L flat face - slip-on, to B.S. 4504.

Flanges - Polypropylene

Full face polypropylene or polypropylene stub flanges with mild steel backing rings drilling to B.S. 4504.

Flanges - copper

Bronze or gunmetal brazed or welded to pipe, B.S. 4504. Brass bolts, nuts and washers to be used.

d) Gaskets

6mm Rubber insertion.

e) Valves
Globe (throttling valve only)

Up to 40mm bronze body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 21.

50mm and above Galvanised iron body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 4505.

Gate

Up to 40mm bronze body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 21.

50mm and above Galvanised iron body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 4505.

Valves

Up to 40mm bronze body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 21.

50mm and above Galvanised iron body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 4505.

Check Valves

Up to 40mm bronze body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 21.

50mm and above Galvanised iron body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 4505.

Ball Valves

Up to 40mm chrome plated brass, teflon seat rings, screwed to B.S. 21 with fixed operating handle.

Restrictor Valves

Ballstop with screwdriver option.

Finish - Machined brass unless specified otherwise.

f) Strainers

Up to 50mm Malleable iron body, stainless steel screen and screwed connections to B.S. 21 65mm and above malleable iron body, stainless steel screen and flanged connections

1.17.5 Hot water (85^0C)

a) Piping

Piping - Steel

upto 150mm Steel piping (Black) to B.S. 1387 medium class plain ends for welding.

Above 150mm thickness Steel piping to B.S. 3601/22 or API Equivalent 4, 5 mm wall plain ends for welding.

Piping - Polypropylene

Upto to 100mm 1,500 kpa rated. Extruded from polypropylene - ethylene grade and shall be U.V. stabilised, to B.S. 4991 or ISOR 160.

b) Fittings

Fittings - Steel

Butt-weld fittings to B.S. 1640.

Fittings - Polypropylene

Upto to 100mm Fusion welded of exactly the same material and pressure rating as the polypropylene piping.

125mm and above Butt welded or fusion welded and of exactly the same pressure rating and material as the polypropylene piping.

c) Flanges

Flanges - Steel

B.S. 4504 wrought steel, flat faced, slip on.

Flanges - Polypropylene

Full face polypropylene or polypropylene stub flanges with mild steel backing rings drilling to B.S. 4504.

d) Valves

Up to 50mm	ball valves with bronze body, hard chromed bronze ball, teflon seats, screwed, to B.S. 21. Alternatively forged steel body, stainless steel ball.
65mm and above	globe valves with galvanised iron body, bronze seating rising spindle, flanged to B.S. 4504.

Check Valves

Non-slam double swing check valves with galvanised iron body, bronze flaps and neoprene seat, fitted between flanges.

Traps

15mm	Automatic trap with internal strainer, or approved equal.
20mm	Angle strainer fitted before trap or approved equal. All traps to have balance pipe.

Filter, Regulator, Lubricator Sets

8 mm	Complete with pressure gauge and manual operated drains on filter unit.
10, 15, & 25mm	Complete with pressure gauge and manual operated drains on filter unit.

Filter and Regulator

As for filter, regulator and lubricator sets but without lubricator.

e) Moisture separators

Up to 40mm	Vertical type screwed inlet and outlet to B.S. 21 complete with drain trap.
32mm and above	Horizontal type flanged connections, complete with drain trap.

1.18.6 Chilled Water Pipework

a) Piping

upto 80 mm	B.S. 1307 medium class, screwed and socketed.
100mm to 150mm	B.S. 1387 medium class. Plain ends prepared for welding.
Above 150 mm	B.S. 3601/22 or API equivalent with wall thickness 5 mm minimum. Plain ends prepared for welding.

b) Fittings

Steel butt-weld fittings to B.S. 1640 or equal, wall thickness not less than pipe thickness or screwed malleable iron fittings as applicable.

c) Flanges B.S. 4504

d) Gaskets Rubber insertion

e) Valves
Cocks - Balancing Valves

Upto to 50mm	bronze body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 21.
65mm and above	Galvanised iron body, outside screw and yoke, bolted bonnet, replaceable seating, rising stem incorporation back seal, bronze or stainless steel trim, and flanged to B.S. 4504.

Gate

Upto to 50mm	bronze body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 21.
65mm and above	Galvanised iron body, outside screw and yoke, bolted bonnet, replaceable seating, rising stem incorporation back seal, bronze or stainless steel trim, and flanged to B.S. 4504.

Check Valves

Upto to 50mm	bronze body, bronze or stainless steel trim, replaceable seating and screwed to B.S. 21.
65mm and above	Galvanised iron body, bronze seating, swing-check, flanged to B.S. 4504

f) Strainers

All strainers to be installed as follows:

Upto 50mm diameter screwed to B.S. 21. 50mm and over flanged to B.S. 4504.

Screwed ends Bronze body, stainless steel screen.

Flanged ends Galvanised iron body, stainless steel screen.

1.18.7 Condenser Water Pipework

a) Piping

upto 80 mm	B.S. 1307 medium class, screwed and socketed.- galvanised.
100mm to 150mm	B.S. 1387 medium class. Flanged ends - galvanised after manufacture.
Above 150 mm	B.S. 3601/22 or API equivalent with wall thickness 5 mm minimum, flagged ends - galvanised after manufacture.

b) Fittings

upto 80 mm	Galvanised malleable iron fittings to B.S. 143 screwed to B.S. 21.
above 80 mm	Flanged to suit.

c) Flanges

upto 80 mm	B.S. 4504 screwed and galvanised.
above 80 mm	B.S. 4504 slip on. Pipe and Flange galvanised after manufacture.

d) Gaskets Rubber insertion

e) Valves

Valves shall be all as specified for chilled water, 17.18.6 e.

f) Strainers

Strainers shall be all as specified for chilled water 17.18.6 e.

PART 5

GENERAL SPECIFICATION FOR PLASTICS SYSTEM

PART 5

GENERAL SPECIFICATION FOR PLASTICS SYSTEMS

1.0 Soil and Waste Systems

1.1 UPVC Soil System

1.1.1 The pipes and fittings shall comply in all respects with the requirements of British Standard BS 4514: 2001 and shall, where appropriate, bear the British Standard Kitemark.

1.1.2 Pipes shall be supplied in plain ended lengths.

1.1.3 The minimum acceptable wall thickness of pipe fittings and shall be:-

Nominal Size ins	Pipe mm	Fittings mm
3 82	3.20	3.2
4 110	3.20	3.2
6 160	3.30	3.5

1.1.4 The method of jointing to be employed shall be that of solvent welding using the manufacturer's approved cement. Seal ring fittings shall be used where necessary to accommodate thermal movement, or the sockets of standard fittings shall be converted to seal ring joints by the addition of a seal ring adaptor.

1.1.5 The grade UPVC used for the pipe shall have a minimum softening point of 82^0C when tested by the vicat method as described in British Standard 2782:1976, Method 102A.

1.1.6 The grade of UPVC used for the fittings shall have a minimum softening point of 79^0C when tested by the Vicat method described in British Standard 2782:2004, Method 102A.

1.1.7 The pipe and fittings shall be colour grey, to British Standard 5252: 10.A.07, black, or for water closet connections, white.

1.1.8 The rubber seals for seal ring joints shall be of a section that gives more than one point of contact with the pipe and shall be to the material requirements of British Standard 2494:1986. Water closet connections shall be to the same British standard.

1.1.9 Waste boss connections when fitted to pipes shall consist of two parts with inner and outer flanges, solvent welded as a complete unit with inbuilt gradients for the waste pipes of 1 $1/4^0$. Where it is not possible to gain access to the bore of the soil pipe, self locking bosses with integral clamping action may be used provided that the mating surfaces are suitable for and used with solvent weld cement.

1.1.10 Alternative waste boss connections may be made using unequal junctions conforming to British Standard 4514:2001 with solvent weld joints conforming to British Standard 4514:2001.

1.1.11 When used internally holderbats shall be made of mild steel protected from corrosion by galvanised or plastic coating. They shall have two-position fixing suitable for either acting as a pipe support but allowing thermal movement or as a clamp fit on a fitting creating a fixed point. For optimum fit to pipe supports PVC packing pieces may be used. PVC holderbats may be used for external use.

1.1.12 Access shall be provided where necessary either by means of an integrally moulded door in an access fitting with an externally fitted rubber seal and secured with two galvanised bolts and nuts or alternatively by a two-piece clamp type door fitted into the pipe run.

1.2.0 **MUPVC WASTE SYSTEM**

1.2.1 The pipe and fittings shall comply in all respects with the requirements of British Standard 5255:1989.

1.2.2 Pipes shall be supplied in plain ended lengths.

1.2.3 The minimum acceptable wall thickness of pipe and fittings shall be:-

Nominal ins	Size mm	Pipe and Fittings Wall Thickness mm
1 1/4	32	1.8
1 1/2	38	1.9
2	50	2.0

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

1.2.5 The grade UPVC used for the pipe shall have a minimum softening point of 94^0 when tested by the Vicat method as described in British Standard 2782:2004, Method 102A.

1.2.6 The grade of UPVC used for the fittings shall have a minimum softening point of 80^0C when tested by the Vicat method as described in British Standard 2782:2004, Method 102A.

1.2.7 The pipe and fittings shall be colour grey, to British Standard 5252: 1976 10.A.07, black or white.

1.2.8 The rubber seal rings shall be of a section that gives more than one point of contact with the pipe and shall be to the material requirement of British Standard 2494:1990.

1.2.9 Traps shall be moulded from white polypropylene and shall have a universal compression outlet. The fittings shall comply in all respects to British Standard BDEN 274 where applicable, and shall bear the British Standard Kitemark. Traps of configurations not covered by the British Standard shall comply with the performance specification of the standard.

1.3.0 **SOIL AND WASTE SYSTEMS - WORKMANSHIP**

1.3.1 The installation, method of jointing and fixing shall comply in all respects to the manufacturer's sitework instructions.

1.3.2 Maximum intervals between pipe supports shall be:-

Nominal ins	Size mm	Horizontal m	Vertical m
1 1/4	32	0.5	1.2
1 1/2	38	0.5	1.2
2	50	0.9	1.2
3	82	0.9	1.8
4	110	0.9	1.8
6	160	1.0	1.8

1.3.3 Pipes shall be fixed in straight runs and all horizontal runs shall be laid to gradients in accordance with British Standard 5572:1994 Code of Practice for Sanitary Pipework, and in any event not less than 18mm/m unless otherwise instructed.

1.3.4 Expansion joints shall be provided at a maximum of 4 metre centres for soil, 2 metre centres for waste and between fixed points over 1 metre centres.

1.3.5 The work shall be inspected and tested during installation at agreed stages.
All work which will be concealed shall be tested before it is finally enclosed.

A final test shall be made upon completion of soundness and performance in accordance with British Standard 5572:1994 Code of Practice for Sanitary Pipework.

1.4 Rainwater Systems:

1.4.0 UPVC Half Round Rainwater System Pipe and Gutter

1.4.1 Gutters shall be true half round section 110mm outside diameter complying in all respects with the requirements of British Standard BS EN 1462:2004

1.4.2 Gutters shall be supplied in plain ended lengths.

1.4.3 The minimum acceptable wall thickness of gutter shall be 2.20mm

1.4.4 Rainwater pipes shall be circular in section, 65mm nominal diameter complying in all respects to British Standard BS EN 1462:2004.

1.4.5 Rainwater pipes shall be supplied in plain ended lengths.

1.4.6 The minimum acceptable wall thickness of rainwater pipe shall be 1.80mm.

1.4.7 Pipe support brackets must be adequate to screen expansion gaps.

1.4.8 The grade of UPVC used for gutter and pipe shall have a minimum softening point of 75^0C when tested by the Vicat method as described in British Standard 2782:2004, Method 102A.

1.4.9 The pipe and gutter shall be colour grey, to British Standard 5252: 10.A.07, black or white.

1.5.0 UPVC Square Rain Water System Pipe and Gutter

1.5.1 Gutters shall be rectilinear section 116mm wide maximum.

1.5.2 Gutters shall be supplied in plain ended lengths.

1.5.3 The minimum acceptable wall thickness of gutters shall be 2.20mm.

1.5.4 Rainwater pipes shall be square in section, 58mm internal dimension.

1.5.5 Rainwater pipes shall be supplied in plain ended lengths.

1.5.6 The minimum acceptable wall thickness of rainwater pipes shall be 1.80mm.

1.5.7 Pipe Support brackets must be adequate to screen expansion gaps.

1.5.8 The grade of UPVC used for gutter and pipe shall have a minimum softening point of 75^0 when tested by the Vicat method as described in British Standard 2782:2004, Method 102A.

1.4.9 The pipe and gutter shall be colour grey, to British Standard 5252: 10.A.07, black or white.

1.6.0 UPVC Rainwater Fittings

1.6.1 All fittings shall comply with the relevant requirements of British Standard BS EN 1462:2004

1.6.2 All gutters, pipe and fittings shall be colour grey to British Standard 5252:1976 10.A.07, black or white.

1.6.3 Gutter connecting fittings shall have integrally moulded seal retaining cavities housing a rubber seal or hallow section.

1.6.4 Gutter connecting fittings shall incorporate provision for fixing to fascia boards, rafters or brickwork such that the fixing screws shall not be in contact with the inner surface of the gutter and shall have provision for expansion of the gutter clearly marked in the fitting.

1.6.5 The grade of UPVC used for fittings shall have a minimum softening point of 75^0C when tested by the Vicat method 102A as described in British Standard 2782:2004, Method 102A.

1.7.0 Workmanship

1.7.1 All rainwater systems shall be installed in accordance with the manufacturer's sitework instructions.

1.7.2 Gutters shall be supported on support brackets at one metre centres. In areas of heavy snow load, brackets shall be provided at 800mm centres.

1.7.3 Gutters shall be installed to accommodate the thermal movement.

1.7.4 Expansion joints shall be provided at maximum 4 metre centres.

1.7.5 Screws for fixing shall be roundheaded No.10 and long enough to make full use of the thickness of a traditional 25mm nominal softwood fascia. They shall have a rust-proofed finish. When fixing to other fascia, fastenings of equivalent holdings power shall be used.

1.8 BURIED DRAIN SYSTEM:

1.8.0 UPVC Buried Drain System

1.8.1 The pipes and fittings shall comply in all respects with the requirements of British Standard 4660:2000 and shall, where appropriate, bear the British Kitemark.

1.8.2 Pipes shall be supplied in plain ended lengths.

1.8.3 The minimum acceptable wall thickness of pipe and fittings shall be:-

Nominal	Size	Pipe	Branch Junction Only		All Other Fittings	
			Socket	Body	Socket	Body
ins	mm	mm	mm	mm	mm	mm
4	110	3.2	3.5	3.8	3.2	3.4
6	160	4.1	4.3	4.7	4.3	4.7

1.8.4 The method of jointing to be employed shall be lip-seal socketed fittings jointing to other materials shall be made in the manner specified by the manufacturer.

1.8.5 The grade of UPVC used for the pipe shall have a minimum softening point of 82^0C when tested by the Vicar method as described in British Standard 2782:2004, Method 102A.

1.8.6 The grade of UPVC used for the fittings shall have a minimum softening point of 79^0C when tested by the vicat method as described in British Standard 2782:2004, Method 102A.

1.8.7 The pipe and fittings shall be colour golden brown approximating to British Standard 381C:1971 No.414. The seal retaining caps shall be black polypropylene.

1.8.8. The rubber of lip seal joints shall be to the material requirement of British Standard 2494:1986.

1.8.9 Holderbats shall be made of mild steel protected from corrosion by galvanising or plastic coating. They shall have a two position fixing suitable for either acting as pipe support but allowing thermal movement or as clamp fit on a fitting creating a fixed point. For optimum fit to pipe supports PVC packing pieces may be used.

1.8.10 The base of soil and bent stack connection to the buried drain shall be made with a bend of minimum centre line radius of 250mm.

1.8.11 Minor changes of direction where permitted shall be made with a variable bend that has a constant effective length.

1.9.0 BURIED DRAIN SYSTEM - WORKMANSHIP

1.9.1 The installation, method of jointing and fixing shall comply in all respects to the manufacturer's sitework instructions.

1.9.2 Excavation of Trenches

Trenches shall be excavated to a sufficient depth to allow a 100mm minimum bed below the underside of the pipe. Trench width shall be not less than the outer diameter of the pipe plus 300mm and not wider than necessary.

1.9.3 Trench Invert

The base of the trench shall be such that even support is given to the pipe for its full length. Soft spots shall be removed and replaced with compacted or granular material. High spots and rock shall be removed to allow a full 100mm bed depth.

1.9.4 Pipe Bed

The bed shall be composed of granular material to the specification called for in clause 1.9.7 and shall cover the full trench width and length and be boned to gradient.

1.9.5 Laying and Jointing

Pipes and fittings shall be laid true to gradient in straight lines and jointed in accordance with manufacturer's instructions. All pegs used for alignment and other purposes must be removed after use and before side filling. All joints shall be watertight.

Pipes barrels shall be in continuous contact with the trench when laid.

1.9.6 Side Filling

The side filling of pipes shall be composed of hard granular material which shall be to the requirements of clause 1.9.7

Side filling must be placed equally on both sides of the pipes and compacted, so as to buttress the pipes against the trench walls. Side filling shall continue up to pipe crown level as a minimum and above this level if required by the Engineer.

1.9.7 Back Filling

The first 300mm of backfill above crown level shall be taken from selected trench spoil all passing 25mm sieve. It shall be placed in two 150mm layers each firmly, tamped. Above the 300mm level mechanical filling and compacting may be used.

Where cover is less than 450mm the pipe shall be covered with 75mm of selected material laid to support a concrete tile or slab indicating the presence of a service.

1.9.8 Granular Material for Bed and Side fill

All material for bed and side fill shall be hard and granular passing 20mm sieve and shall contain not more than 5 per cent fines passing 3mm sieve.

The material may be composed of crushed stone, clinker, quarry scalping, ballast, gravel, shingle or all-in aggregate to British Standard 882:1965.

The material shall have a compaction factor of 0.3 or less.

1.10 COLD WATER SYSTEMS:

1.10.0 UPVC Cold Water System

1.10.1 Pipe shall comply in all respects with the requirements of British Standard 3505:1986.

Fittings shall comply in all respects with the requirements of British Standard 4346 Part 1:1969.

1.10.2 Pipes shall be supplied in plain ended lengths.

1.10.3 The minimum acceptable wall thickness of pipe and fittings shall be:-

Nominal Size ins	Pipe and Fittings mm
3/8	1.5
1/2	1.7
3/4	1.9
1	2.2
1 1/4	2.7
1 1/2	3.1
2	3.9
3	5.7
4	7.3

1.10.4 The method of jointing to be employed shall be that of solvent welding using the manufacturer's approved cement, which shall comply with the requirements of British Standard 4346 Part 3. 1982

1.10.5 The grade UPVC used for pipes shall have a minimum softening point of 75^0C and for the fittings a minimum softening point of 72^0C when tested by the Vicat method as described in British Standard 2782:2004, Method 102A.

1.10.6 The pipe and fittings shall be coloured dark grey.

1.11.0 Workmanship

1.11.1 The installation method of jointing and fixing shall comply in all respects to the manufacturer's sitework instructions.

1.11.2 At 20^0C the maximum intervals between pipe supports shall be:-

Nominal Size ins	Horizontal m	Vertical m
3/8	0.75	Up to twice the permitted horizontal spacing of support centres shall be accepted provided the pipe is well protected within a structure.
1/2	0.84	
3/4	0.94	
1	1.07	
1 1/4	1.14	
1 1/2	1.28	
2	1.44	
3	1.72	
4	1.90	

1.11.3 Pipes passing through walls or floors shall be sleeved to allow unrestricted movement.

1.11.4 The work shall be inspected and tested during installation at agreed stages.

All work which will be concealed shall be tested before it is finally enclosed.

A final test shall be made upon completion for soundness and performance to the satisfaction of the Local Water Authority.

PART 6

PARTICULAR SPECIFICATION FOR THE FIRE FIGHTING SERVICES

PART 6

PARTICULAR SPECIFICATION FOR THE FIRE FIGHTING SERVICES

1.1.1 General

The particular specification details the requirements for the supply, installation and commissioning of the hosereel installation. The hosereel installation shall comply in all respects to the requirements set out in European Standards BS EN694 for hosereels and tested, approved and CE marked according to En671 – 1 or other International Standards. The system shall comprise of a pumped system for hosereels on all floors.

The 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.

No claims for extra payment shall be accepted from the Contractor because of his non-compliance with the above requirements.

If in the opinion of the Contractor there is a difference between the requirements of the specification and the contract drawings, he shall clarify these differences with the Engineer before tendering.

1.1.3 Scope of Works

The Contractor shall supply/deliver, erect, test and commission all the automatic fire fighting hosereel installation which is called for in this Specification and shown on the Contract Drawings listed in the Drawing Schedule.

1.1.4 Pipework

The pipework for the hosereel installation shall be galvanised wrought steel tubing `Medium' Grade Class `B' to B.S. EN 10255:2004 malleable iron fittings to B.S. 21.

1.1.5 Pipe Fittings

The pipe fittings shall be wrought steel pipe fittings welded or seamless fittings conforming to B.S. EN 10241:2000 or malleable iron fittings to B.S. 143 and 1256:2000.

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

1.1.6 Flanges

The flanges shall comply with en 1092 – 1:2002. All flanges shall comply to a nominal pressure rating of 16 bar (PN 16) and shall be of either galvanised iron or steel.

1.1.7 Gaskets

The gaskets for use with flanges to en1092-1:2002 shall comply with en 1514-2:1997 for pressure up to and not exceeding 64 bar.

1.1.8 **Non-Return Valves**

The non-return valves up to and including 80mm diameter shall be to EN 12334:2001 with flanges to B.S. EN 1092-1:2002 (PN 16).

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

1.1.9 **Gate Valves**

The gate valves up to and including 80mm diameter shall be non-rising stem and wedge disc to (B.S. 5154: 1991) with screwed threads to B.S. 21 taper thread or flanged to B.S. EN 1092:-1:2002

1.1.10 **Sleeves**

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

1.1.11 **Floor and Ceiling Plates**

Where pipes passes through walls, floors or ceilings, floor, wall and ceiling plates shall be secured around the pipe. The plates shall be of stainless steel construction and will serve no other purpose than to present a neat finish, to the exposed installation.

1.1.12 **Hosereel**

The hosereels to the installation shall consist of recessed automatic hosereels.

All the above hosereels shall comply with European Standards BS EN694, tested, approved and CE marked to EN671 – 1 or other International Standards.

The hosereels shall be supplied and installed complete with first-aid non-kinking hose 30 metres long, with nylon spray/jet/shut-off nozzle inlet to the reel are to be supplied.

The orifice to the nozzle shall not be less than 4.8mm to maintain a minimum flow of 0.4 L/S to the jet.

The hosereels shall be installed at 1.5mm centre above the finished floor level in locations shown on Contract Drawings.

1.1.13 **Earthing**

Earthing installation shall be electrically earthed by a direct earth connection. The installation of the earthing to be carried out by the Electrical Contractor.

1.1.14 Hosereel Pump Set

The Hosereel pump set shall incorporate a pressure monitoring device having two independently adjustable contacts arranged to close on falling pressure. Contact No.1 is set to close on fall in pressure due to opening of Hosereel valve or similar. Operation of this switch initiates the full automatic sequence set, including remote alarm and indication.

BasePlate

Fabricated steel with support for control panel and pipework, together with four lifting eye bolts for ease of installation.

Valves/Pipework

Each set consists of identical pumps with isolating valves on each pump suction and isolating and non-return valves on each pump discharge. The delivery line from the pump is fitted with a pressure switch, test cock/vent, delivery pressure gauge, and a further isolating valve for routine testing.

Suction and discharge manifolds terminate in flanges drilled to BS4504 PN16.
The pipework is fabricated steel.

Membrane Pressure Vessel

A membrane pressure vessel has been integrated into the system to provide a positive charge, thus preventing pump operation as a result of any minor system leakage.

Control Panel

As described.

Electrics

The set, being pre-wired eliminates the need for wiring on site, except for the connection of an electrical power source (3 phase, 3 wire supply) to the control panel.

Testing

The complete unit to be manufactured, tested and delivered as a packaged unit, finished in hard gloss red paint.

1.1.15 **Finish Painting**

Upon completion of testing and commissioning of the hosereel installation the pipework shall be primed and finish painted with 2 No. coats of paint to the Architect's requirements.

1.1.16 **Testing and Commissioning**

The hosereel installation is to 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 a half times the working pressure of the installation to the approval of the Engineer. Simulated fault condition of the pumping equipment, is to be carried out before acceptance of the system by the Engineer and Architect.

1.1.17 **Instruction Period**

The Contractor shall allow in his contract sum for instructing of the use of the equipment to the Client's maintenance staff. The period of instructions 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 seven days in which time the Client's staff shall be instructed in the operation and maintenance of the equipment.

1.2.0 **PARTICULAR SPECIFICATION FOR PORTABLE FIRE EXTINGUISHERS**

1.2.1 **General**

The particular specification details the requirements for the supply and installation and commissioning of the Portable Fire Extinguishers which shall conform to European Standards BS EN 3 or other International Standards. The 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 Contractor there is a difference between the requirements of the specification and the Contract Drawings, he shall clarify these differences with the Engineer before tendering.

1.2.2 **Water/Co_2 Extinguishers**

The portable 9-litre water filled CO_2 cartridge operated portable fire extinguishers shall comply with the requirements of B.S. EN3 or other International Standards. 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:-

a) Method of operation

b) The works "WATER TYPE" (GAS PRESSURE) in prominent letters

c) Name and address of the manufacturer or responsible vendor

d) The nominal charge of the liquid in letters

e) The liquid level to which the extinguisher is to be charged

f) The year of manufacture

g) A declaration to the effect that the extinguisher has been tested to a pressure of 24.1 bar.

h) Instructions for periodical checking and panel for signing when checked, dates and initials.

1.2.3 **Portable Carbon Dioxide Fire Extinguishers**

The portable carbon dioxide fire extinguishers shall comply with B.S. EN3 or other International Standards.

The body of the extinguishers shall be a seamless steel cylinder manufactured to one of the following Standards, B.S. 401, B.S. 1288 or other International Standards.

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, 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 born shall be so as to direct the discharge and limit the entrainment of air. It shall be construed of electrically non-conductive material.

The following and markings shall be applied to the extinguishers:

a) The words 6 Kg. carbon dioxide fire extinguishers and to include the appropriate nominal gas content.

b) Method of operation.

c) The words "Re-charge immediately after use".

d) Instructions for periodical checking and panel with space for date and initials.

e) The number of the Standard B.S. EN 3 or other International Standards.

f) The manufacturer’s name or identification markings.

1.2.4 **Dry Powder Portable Fire Extinguishers**

The portable dry powder fire extinguishers shall comply with B.S. EN 3 or other International Standards. The body shall be constructed of steel not less than the requirements of B.S. 1449 or aluminium to B.S. 1470: and shall be suitably protected against corrosion.

The dry powder charge shall be non-toxic and retain its free flowing properties under the 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;

a) The words "Dry Powder Fire Extinguisher".

b) Method of operation in prominent letters.

c) The working pressure and the weight of the powder charge in kilogrammes.

d) Manufacturer's name or identification mark.

e) The words "RECHARGE AFTER USE" if rechargeable type.

f) 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 and to have panel for dates and initials.

g) The year of manufacture.

h) The pressure to which the extinguisher was tested.

i) The number of this British Standard to B.S. EN3 or other International Standards.

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

Foam Fire Extinguisher

The portable foam extinguisher shall comply with the requirements of B.S. EN3 or other International Standards. The body shall be constructed from 16 s.w.g. steel to B.S. 1449, polythene lined to give protection against internal corrosion while the neck ring shall be in steel to B.S. 980 and welded internally to the body.

The gas cartridge shall be a standard fitting 75 capacity $C0_2$ gas cartridge, plastic coated and also complying with B.S. 5423. The discharge hose shall be made from polyester reinforced flexible P.V.C. and nozzle in moulded A.B.S. Provision shall be made for securing the nozzle when not in use.

The extinguisher shall be clearly marked with the following information:-

a) The words “FOAM FIRE EXTINGUISHER”.

b) Method of operation in prominent letters.

c) The working pressure and the quantity of charge in litres.

d) Manufacturer’s name or identification.

e) The words “RECHARGE AFTER USE” if rechargeable type.

f) Instructions for periodical checking and panel for dates and initials.

g) The number of this British Standard B.S. EN3 or other International Standards.

1.2.5 **Fire Blanket**

The fire blanket shall be made from 3-ply composite material consisting of two layers of glass fibre fabric sandwiching an inner layer of fire retardant film to measure 2000 x 2000mm and shall be fitted with special tapes folded so as to offer instantaneous single action release blanket from storing jacket.

10.2.6.A **Painting & Finishing**

The contractor shall paint or cause to be painted all the service pipework in the respective colour coding as specified to B.S. 1710 and elsewhere in this specifications.

SECTION 7

GENERAL TECHNICAL SPECIFICATION - COMMISSIONING

SECTION 7

GENERAL TECHNICAL SPECIFICATION - COMMISSIONING

7.1 General

Before any commissioning work takes place, the Contractor shall submit a set of schematic commissioning drawings showing duct runs, and other equipment, air flows, water flows and controls. These drawings to be accompanied by the method proposed for commissioning of the plant, as by the method proposed for commissioning of the plant, as well as the number of people involved, their names and experience. The Engineer's approval on the above item is essential before any commissioning takes place.

7.2 Maintenance Manuals

The Contractor shall provide, before any commissioning works starts, three copies of the maintenance and operating manuals for the plant supplied. These manuals shall be sewn and bound in book form with hard plastic covers to withstand constant use, and shall be properly indexed to facilitate quick references. Prior to the submission of the three copies mentioned above the Contractor shall submit one draft copy of the maintenance and operating manuals for approval. The works shall not be considered to be completed for the purposes of taking over until such manuals have been supplied to the Engineer, and subsequent equipment test results have been included in them.

The manuals shall include:-

a) A list of recommended servicing tools and specialist plant.
b) A list of recommended spares necessary for a period of 2 years operation.
c) Exploded drawings or spares lists from which every item of every place of plant can be positively identified of each item of plant.
d) A list giving the name and address of the manufacturer of each item of plant.
f) A copy of all test certificates obtained with the plant.
g) A list of recommended lubricants.
h) A preventive maintenance programme for all plant.
i) Operating instructions for each item of plant.
j) Performance data, equipment tests and characteristic curves.

7.3.0 Initial Testing and Plant Commissioning

7.3.1 Initial Testing

a) Pressure Testing - Piping

All pipework system shall be pressure tested by filling with water and raising the pressure to 1.5 times working pressure. They shall then be left for a period of at least one hour during which all joints must remain water-tight. Any fault found during the pressure test shall be remedied and the test reapplied until the same is dealt with completely.

The pipework shall be tested in sections to suit the construction programme and all services in concealed locations shall be tested before they are finally concealed. No insulation shall be applied before tests have been carried out.

The Contractor shall provide all test equipment and all additional items such as toes, valves, drain fittings, etc, which are necessary to enable the systems to be treated in sections. Each test shall be witnessed by the Engineer or his nominated agent and also a signed certificate of approval shall be obtained.

b) Drawing and Cleaning

On completion of the pressure test on a section of pipework the water used for testing shall be drained away as quickly as possible to remove as much dirt and dross as possible. After completion for a pipework circuit the circuit shall be flushed through to remove all pipe scale, dress and similar material.

c) Pressure Testing - Ducting

See section on ducting

d) Insulation Tests

All electrical wiring and controls integral with the plant supplied shall be subjected to insulation tests. All instrument and other equipment required for the tests shall be provided by the Contractor.

e) Drives

All drives shall be run and tested for direction rotation and correspondence of alignment.

7.3.2 Plant

The Contractor shall check over and test and satisfy himself that all items of plant are correctly assembled and aligned before start-up. This work is to be carried out by skilled commissioning Engineers who are completely familiar with the plant involved.

The Engineer shall witness plant commissioning as required by him and the contractor must advise the Engineer prior to any commissioning work taking place.

On completion of the plant commissioning the Contractor shall provide written confirmation to the Engineer that he has completed all commissioning work to the Engineer that he has completed all commissioning work and is satisfied that the time items of plant are operating satisfactorily.

7.3.3 **Test of Completion**

On completion of the Contractor's initial testing and commissioning as specified above, the plant shall be put into normal operation and the final adjustment os the plant shall be made. Thereafter the Tests on completion shall be carried out to ensure that the plant will fulfil the function for which it has been designed. These tents shall extent for a period of at least four weeks and shall include the following:

a) Simulated tests for all alarm and safely cut out equipment.
b) Simulated tests on automatic controls.
c) Capacity tests to ensure that the plant supplied will handle the quantities specified.

The Contractor shall utilise the Engineer's manual Equipment performance and capacity.

The Contractor shall at his own cost render all assistance and supply all labour, appliances and any other materials, as may be required to carry out these tests. All instruments shall be accurately calibrated before the tests begin.

On completion of the whole of the tests and when the Contractor is satisfied that the entire plant is operating satisfactorily and will fulfil the function for which it has been designed, he shall submit to the engineer triplicate copies of all tests records and charts together with reports on all the tests called for in this specification. The Engineer shall reserve the right to ask for previous tests in order to prove that the operation of the plant is satisfactory and in accordance with the specification and drawings,

The Contractor shall be responsible for the proper operation and running maintenance of the plant throughout the period of the tests. The Contractor shall provide full time experienced commissioning Engineers and artisan staff during the entire testing period.

At the commencement of and during the whole of the testing period the Contractor shall be required to have stored on site all essential spares and tools considered necessary to enable repair work of defective parts to be carried out immediately in the event of a breakdown.

The operation and Maintenance manual shall be completed and handed over to the Engineer before the start of any commissioning work and in any case, prior to the issuing by the engineer of the taking-over certificates. The period of maintenance shall be deemed to have started upon the date of issuing of the taking-over certificate.

7.4 **Operator Training Period**

The Operator Training Period on the whole of the works or on any part thereof shall commence at the date to be fixed after the issue of the taking over certificate and mutually agreed with the Engineer. This period shall continue for a period sufficient to ensure that the operations are full conversant with the functions they are to perform, but shall not exceed a period of 5 days.

The Contractor shall provide full-time instructions during the entire operator training period, who shall be fully experienced in the class of work and shall be capable of training the operating and maintenance staff in the duties they are to perform.

7.5 **Period of Maintenance (Defect Liability)**

The expression period of maintenance shall mean a period of 6 months from the date of taking over in accordance with Clause 3.3. hereof.

PROPOSED FARM OFFICES, PASTEURIZING UNIT & WATER BOTTLING PLANT FOR ARCHDIOCESE OF NAIROBI

PHASE I - WATER SECTION

PLUMBING,DRAINAGE AND FIRE FIGHTING SERVICES

PRICE SCHEDULES AND BILLS OF QUANTITIES

SECTION VIII

PRICE SCHEDULES/BILLS OF QUANTITIES

1. GENERAL

1.1 GENERAL:

a) The total in the Main Summary of Prices shall include the whole of the Contract Works in accordance with specification as defined before and shall be carried forward to the Form of Tender.

b) Any prices omitted from any item, section or part of the price schedules shall be deemed to have been included in another item, section or part.

c) The prices shall include for all obligations under the Contract including but not limited to supply of materials, equipment, apparatus, fittings, spares and tools, shipping, Insurance, Duty & VAT.

1.2 ABBREVIATIONS

(a) The abbreviation D. W. denotes `Definite Work'.

(b) The abbreviation P. W. denotes `Provisional Work'.

(c) The abbreviation P. S. denotes `Provisional Sum' for provisional work which cannot be fully specified at the date of preparation of the specification.

(d) The abbreviation P.C. denotes Prime Cost Sum as defined in Section A7 (iii) of the Standard Method of Measurement mentioned in Condition No. 16 of the Conditions of Contract.

(e) c.m. Shall mean cubic metres.

(f) s.m. Shall mean square metres.

(g) l.m. Shall mean linear metres.

(h) mm. Shall mean millimeters.

(i) No. Shall mean number.

(j) Kg. Shall mean kilogramme.

(k) B.S. Shall mean the current British Standard Specification published by the British Standard Institution, 2 Part Street, London W1, England.

1.3 PROVISIONAL WORK

The Sub-Contractor shall provide quotations for all items of provisional work called for in the price schedule and include it in the Lump Sum Tender Price. The Engineer at his discretion may instruct the Sub-Contractor if any of the items of Provisional Work are not required and in such instances the Tender Price shall be reduced by the amount tendered by the Sub-Contractor for the particular item of Provisional Work.

2. NOTES TO TENDERERS ON SCHEDULES

2.1 The tenderer shall complete all schedules except where otherwise instructed.

2.2 Schedule shall be read in conjunction with other relevant parts of the Specification as defined herein.

2.3 The total of prices in the price schedules summary of prices shall be deemed to include for the whole of the Sub-Contractor works in accordance with the Specification. Any Prices omitted from any time, section or part of a Price Schedule shall be deemed to have been included in another item.

2.4 Attention is drawn to the requirement that the Sub-Contractor will be required to commence necessary work on site immediately after appointment. The Sub-Contractor shall tender on this basis and include for purchasing locally such materials as may be required to execute urgent work to the Main Sub-Contractor's programme.

2.5 The Sub-Contractor's unit rates as quoted in Price Schedule will be used to assess the value of additions or omissions arising from authorised variations to the Contract Works.

2.6 If any quantity has not been included in the Schedules, the tenderer shall put down the quantity from their own calculations.

2.7 The schedules bear an item depicted as “Any other item to complete the installations in this section”. The tenderer shall insert thereunder any other works, obligations, or items that may be referred to the Conditions of Contract, Specification, Drawings in respect of works which he desires to enter as a separate charge.

2.8 Unit rates shall be exclusive of VAT which shall be shown at the Main Summary and shall not be charged against Provisional and/or Prime Cost Sums

Item	Description	Unit	Qty	Rate	Kshs
1.0	**PRELIMINARIES AND GENERAL CONDITIONS**				
	Record Documentation	Item			
A	Allow for contract conditions				
B.	Allow for testing and commissioning of all the installations including reports & record documents to approval.	Item			
C	Allow for preparation and submission of 2CDs (Autocad 2004 or an approved version) soft copies and 3 (A1) hard copies of As built drawings' and operations manuals to approval.	Item			
D	Ditto for working drawings.	Item			
	TOTAL CARRIED TO MAIN SUMMARY PAGE				

EXTERNAL WATER RETICULATION

SECTION D.W. 2: EXTERNAL WATER RETICULATION

Item	Description	Unit	Qty	Rate	KShs.
2.1	**EXTERNAL WATER RETICULATION** **Pipework in this section to be to BS 1387 and fittings to BS 143 medium gauge galvanised mild steel.** **All buried pipework will be wrapped with denso tape as manufactured by Denso International Pipe Products Ltd. before laying in trenches** **Tenderers should allow for all fittings, jointing, couplings including unions and clamps necessary for the proper functioning of the installation when pricing.** **The following to be in GI or equal and Approved**				
A	50mm dia tubing	LM	120		
	Extra over tubing for:-				
B	50mm dia bend with male/female threads	No.	24		
C	50mm dia tee	No.	2		
	Brasswork				
D	50 mm dia non-rising stem solid wedge gate valve as peglars or equal and approved with connections to PP-R and PVC tubing	No	2		
E	50mm dia non-return valve as peglars or equal and approved	No	1		
	Sundries				
F	Trench to take pipe including for excavation, back fill, cart away surplus material and pipe bed class B in normal murram soil depth not exceeding 1200mm average 900mm.	LM	120		
	Water Meter				
G	50mm dia. Water check meter	No	1		
	TOTAL CARRIED TO COLLECTION PAGE				

SECTION D.W.2: EXTERNAL WATER RETICULATION

Item	Description	Unit	Qty	Rate	KShs.
	EXTERNAL WATER RETICULATION COLLECTION PAGE				
2.1	External Water Reticulation				
	TOTAL				

Total Carried Main Collection Page

INTERNAL WATER SUPPLY

SECTION D.W. 3: INTERNAL COLD WATER SUPPLY

Item	Description	Unit	Qty	Rate	KShs.
3.1	**INTERNAL COLD WATER SUPPLY** **To supply and install PPR tubing and fittings as described and shown on the drawings.** **Tenderers must allow for jointings, clippings, couplings ,reducers etc. necessary for the proper and satisfactory functioning of the installation when pricing.** **The following in PPR**				
	Supply piping				
A	20mm dia tubbing.	LM	22		
B	25mm dia tubbing.	LM	40		
C	32mm dia ditto	LM	5		
D	40mm dia ditto	LM	40		
	Extra over tubing for:-				
F	20 mm dia bend with male/female threads	No.	24		
G	25 mm dia ditto	No.	36		
H	32mm dia ditto	No.	8		
I	40mm dia ditto	No.	12		
K	20 mm dia tee	No.	12		
L	25mm dia ditto	No.	12		
M	32mm dia ditto	No.	2		
N	40mm dia ditto	No.	6		
P	32 x 25 x 25 mm ditto	No.	4		
Q	25 x 25 x 20 mm ditto	No.	12		
	Carried to sub-collection				

SECTION D.W. 3: INTERNAL COLD WATER SUPPLY

Item	Description	Unit	Qty	Rate	KShs.
3.2	**<u>Brass work</u>**				
A	32 mm dia non-rising stem solid wedge gate valve as peglars or equal and approved with connections to PPR tubing .	No	1		
B	25 mm dia ditto	No	4		
	<u>Copper Tubing</u>				
C	15 mm dia copper tubing 300 mm long including unions and bent to connect the sanitary fittings to mild steel tubing	No.	12		
D	15mm dia chrome plated angle valve with wall flanges.	No.	12		

Carried to sub-collection

SECTION D.W. 3: INTERNAL HOT WATER SUPPLY(FLOW & RETURN)

Item	Description	Unit	Qty	Rate	KShs.
3.3	**INTERNAL HOT WATER SUPPLY(FLOW & RETURN)** **To supply and install PPR tubing and fittings as described and shown on the drawings.** **Tenderers must allow for jointings, clippings, couplings ,reducers etc. necessary for the proper and satisfactory functioning of the installation when pricing.** **The following in PPR**				
	Supply piping				
A	20mm dia tubbing.	LM	22		
B	25mm dia ditto	LM	40		
C	32mm dia ditto	LM	5		
	Extra over tubing for:-				
D	20 mm dia bend with male/female threads	No.	24		
E	25mm dia ditto	No.	36		
F	32mm dia ditto	No.	2		
G	20 mm dia tee	No.	8		
H	25mm dia ditto	No.	24		
I	32mm dia ditto	No.	2		
J	25 x 25 x 20 dia ditto	No.	4		
K	32 x 32 x 25 dia ditto	No.	2		

Carried to sub-collection

SECTION D.W. 3: INTERNAL HOT WATER SUPPLY(FLOW & RETURN)

Item	Description	Unit	Qty	Rate	KShs.
3.4	**Brass work**				
A	25 mm dia non-rising stem solid wedge gate valve as peglars or equal and approved with connections to PPR tubing .	No	2		
B	32 mm dia non-rising stem solid wedge gate valve as peglars or equal and approved with connections to PPR tubing .	No	1		
	Copper Tubing				
C	15 mm dia copper tubing 300 mm long including unions and bent to connect the sanitary fittings to mild steel tubing	No.	4		
D	15mm dia chrome plated angle valve with wall flanges.	No.	4		
E	Pre-formed glass wool pipe insulation for 32mm dia. Piping, and insulation, to be covered with Aluminium Sheet cover. Tenderers to allow for all fixings, rivets, screws, brackets, and capping and etc.	LM	6		
	Carried to sub-collection				

SECTION D.W.3: INTERNAL WATER SUPPLY

Item	Description	Unit	Qty	Rate	KShs.
	INTERNAL WATER SUPPLY COLLECTION PAGE				
3.1	Internal Cold Water Supply				
3.2	Internal Cold Water Supply (cont)				
3.3	Internal Hot Water Supply				
3.4	Internal Hot Water Supply (cont.)				
	TOTAL				

Total Carried Main Collection Page

SANITARY FITTINGS
AND
ACCESSORIES

SECTION D.W. 4.0: SANITARY FITTINGS

Item	Description	Unit	Qty	Rate	KShs.
4.1	**SANITARY FITTINGS** **Supply, assemble and install the following sanitary fittings including all the necessary joints to service, overflow, waste pipes and jointing materials, mortises, plugs, screws, bolts, nuts, gaskets etc and making good as described and shown on the drawings:-**				
A	Close-coupled WC suite, as Twyford, comprising but not limited to the following components complete with pan, cistern, hinged toilet seat, Push flushing mechanisms, angle valve, WC connector, S trap, and connectors to water supply and drain shall be provided and installed with each W.C. to approval.	No.	4		
B	Semi Pedestal wash basin, as Twyford, set for fixing in white vitreous china with front overflow and single tap hole size 650 x 600 mm and comprising of No. WB2525 WH basin, chrome plated angle valve, No. 54438PLZ trap with extension pipe and wall flange, silicon sealant angle regulating valves, waste plug and fixings to approval.	No.	5		
C	Hansgrohe shower (fixed height) CP # 2777100,27454 Complete with Hansgrohe: Focas E2 3 Way concealed shower of 3-way Finish set and universal body ref # 3196700,13620180 or equal and approved.	No.	4		
D	Stainless Steel Corner Soap Dish to approval	No.	4		
E	Mediclinic liquid soap dispenser with lock and wall fixings to approval. Soap dispenser to be in chrome finish	No.	4		
F	Twyfords PB 0204SI coat hook	No	8		
G	20L Under-sink water heater as Ariston	No	1		
H	Automatic hand drier as Kimberley Clarke for electrical supply compatible with 220/240V 50Hz single phase supply and to be complete with a mounting plate, centrifugal fan and motor unit of rating 130W – 2 pole induction motor 2700 rpm with thermal overload and radio suppression and 2100w spirally wound element with automatic re-setting thermal cut-out.	No	2		
	Carried to Sub-Collection				

SECTION D.W. 4.0: SANITARY FITTINGS

Item	Description	Unit	Qty	Rate	KShs.
A	Mirror from plain beveled glass plates size 1800 x 800mm wide with dome headed C.P. screws and approved back paddling	No.	2		
B	Ditto but 450 by 650mm	No.	1		
C	Lockable Jumbo Toilet roll holder as “Kimberly clarke” or equal and approved.	No.	4		
D	Stainless Steel Paper towel Dispenser as Kimberly Clarke or approved equivalent	No.	3		
E	Delayed Action Wash Hand Basin tap as Twyford or Grohe for the above basin.	No.	5		
F	Elbow- Basin Mixer Tap, as Ideal Standard, complete with, minimum 8 inch lever	No.	1		
G	Wide Groove Stainless steel kitchen sink as manufactured by Franke, Double-Bowl, Single Drainer, finished in bright machine polish and to incorporate sound deadening pads. Size 1800 x 500mm wide. The sink top shall be pierced for tap hole(s) and for a 40mm waste hole(s), outlet and overflow.Fittings to include for chrome plated chain waste(s) 40mm dia. with overflow slots and 2 No. stainless steel bottle traps 40mm dia. with S trap outlet.	No.	1		
H	Kitchen mixer tap as Hansgrohe for hot and cold water, complete with detachable spray head, Stainless Steel in chrome finish	No.	1		
I	“Clifton” bowl urinal for 1 person as Twyford, complete with vitreous China grating,' Concealed manual push-button urinal flush valve, wall hangers, dividers and all accessories for proper function and to manufacturer’s specifications	No.	3		
J	Laboratory Vucathene Sink size 552x400x231mm complete with all accessories including stainless steel mixer as Handgroher, and vulcathene bottle trap, to approval.	No.	1		
K	Instant water heater for shower as Lorenzetti, 4.5kW rated for use with hard water.	No	4		

Carried to sub-collection

SECTION D.W.4: SANITARY FITTINGS

Item	Description	Unit	Qty	Rate	KShs.
	SANITARY FITTINGS & ACCESSORIES COLLECTION PAGE				
4.1	Sanitary Fittings				
4.2	Sanitary Fittings (cont.)				
	TOTAL				

Total Carried Main Collection Page

DRAINAGE

SECTION D.W. 5.0: SOIL & WASTE DRAINAGE

Item	Description	Unit	Qty	Rate	KShs.
5.1	**SOIL AND WASTE DRAINAGE** **Supply and install the following drainage UPVC and PVC pipe system as described and shown on the drawings** **All pipes and fittings in this installation shall upvc and pvc to BS 5572:1978 and B.S.5750 as manufactured by "Key Terrain" or equal and approved. All jointings and fixings shall be in accordance with the manufacturers instructions and as described.** **Tenderers must allow for jointings, clippings, couplings, holders bats, pluggings, reducers, spacers etc. necessary for the proper functioning of the installation when pricing**				
A	100.4.60 pipe	LM	30		
B	100.4.40 pipe	LM	80		
C	100.2.40 ditto	LM	60		
D	100.15.40 ditto	LM	25		
	Extra over pipe for:-				
E	201.4.91 sweep bend	No.	15		
F	201.2.91 ditto	No.	45		
G	201.15.92 sweep bend	No.	18		
H	1805.4.87 long radius bend	No.	4		
I	237.4 access plug	No.	4		
J	237.2 ditto	No.	8		
K	149.18.22 weathering slate	No.	2		
L	155.L1.R2 manifold	No.	2		
M	150.4 vent cowl	No.	2		
N	100 mm dia floor traps	No.	8		
O	100 dia inspection bend	No.	4		
P	100 dia inspection door	No	4		
Q	204.15.91 Sweep tee	No.	6		
R	279 trapped floor gully with 282.6 floor gully inlet and 1841.8 grating	No.	4		
S	300mm by 300mm stainless steel non-trapped floor drain	No.	4		

Carried to sub-collection

SECTION D.W. 5.0: SOIL & WASTE DRAINAGE

Item	Description	Unit	Qty	Rate	KShs.
5.2	**SOIL AND WASTE DRAINAGE - cont.**				
A	Excavate trench in murram ground from ground depth not exceeding 2000 mm average 1200 mm including bedding pipe in bed class “B” for 100 mm dia pipe	LM	80		
B	Allow for materials for the construction of a standard inspection chamber including excavation and make good depth not exceeding 900mm average 600mm. Chamber walls in 150mm block work with water proof cement render and formed channels bend.	No.	7		
C	Medium duty cast iron inspection chamber cover with frame size: 600 x 450mm including bedding the frame in concrete and bitumen sand air seal.	No.	7		
D	Allow for connecting to biodigester	Sum			
	Carried to sub-collection				

SECTION D.W. 5.0: SOIL & WASTE DRAINAGE

Item	Description	Unit	Qty	Rate	KShs.
5.3	**RAIN WATER DRAINAGE** **Supply and install the following drainage UPVC and PVC pipe system as described and shown on the drawings** **All pipes and fittings in this installation shall upvc and pvc to BS 5572:1978 and B.S.5750 as manufactured by "Key Terrain" or equal and approved. All jointings and fixings shall be in accordance with the manufacturers instructions and as described.** **Tenderers must allow for jointings, clippings, couplings, holders bats, pluggings, reducers, spacers etc. necessary for the proper functioning of the installation when pricing**				
A.	100 mm dia. heavy duty upvc rain water pipes cast in columns ducts.	LM	40		
	Extra over tubing for Rainwater				
B.	100 mm dia. 135^0C upvc tee with access bend.	No.	8		
C.	100 mm dia. Domed rain water fullbora as "Key Terrain".	No.	8		
D.	100 mm dia. Upvc rain water shoe.	No.	8		
E.	100 mm dia. bend	No.	8		
	Carried to sub-collection				

SECTION D.W. 5.0: SOIL & WASTE DRAINAGE

Item	Description	Unit	Qty	Rate	KShs.
5.4	**Biodigester**				
A	Supply, hoist, and install aerobic biodigester system rated for continuous use for 20 people. System to be as Riflo RS3 Standard. Note that the system should not require exhausting, or electrical agitation. System should come with minimum 5-year warranty.	No.	1		
B	Construct soak pit and french drain for above biodigester. French drain to be minimum 8m long by 2m wide by 2m deep. Allow for all excavation, french drain materials (including balast to civil engineer's approval), and allow for back-filling, compacting and making good to approval.	No.	1		
C	Provide standard de-greaser to manufacturer's detail as required.	No.	1		
D	Allow for any other item necessary to complete the installations (list below)	Item			
	Carried to sub-collection				

SECTION D.W. 5.0: SOIL & WASTE DRAINAGE

Item	Description	Unit	Qty	Rate	KShs.
	WASTE WATER DRAINAGE				
	COLLECTION PAGE				
5.1	Soil & waste drainage				
5.2	Soil & waste drainage - cont.				
5.3	Rainwater drainage				
5.4	Biodigester				
	TOTAL				

Total Carried Main Collection Page

FIRE FIGHTING SERVICES

SECTION D.W. 6.0: FIRE FIGHTING SERVICES

Item	Description	Unit	Qty	Rate	KShs.
6.1	**PORTABLE EXTINGUISHERS**				
A	Supply and install 9L Water/CO2 fire extinguishers for class A,B & C fires, as manufactured by Angus Fire Armour, or an approved equivalent.	No.	2		
B	Supply and install 9L dry powder fire extinguishers for class A,B & C fires, as manufactured by Angus Fire Armour, or an approved equivalent.	No.	2		
	Roof Ventilators				
A	Supply, deliver and install 600Ø Stainless Steel Roof Cyclone Ventilator as Steel Structures 600mm dia. Complete with top plate, fibre glass, soaker plate, safety frame, mounting and all other necessary accessories to approval.	No.	7		
	TOTAL				

Total Carried Main Summary of Prices

SECTION D.W. 6.0: FIRE FIGHTING SERVICES

Item	Description	Unit	Qty	Rate	KShs.
	WASTE WATER DRAINAGE COLLECTION PAGE				
6.1	Portable Extinguishers				
	TOTAL				

Total Carried Main Collection Page

MAIN COLLECTON PAGE

Item	Description				Price (KShs.)
D.W.2	External Water Reticulation				
D.W.3	Internal Water Supply				
D.W.4	Sanitary Fittings & Accessories				
D.W.5	Drainage Systems				
D.W.6	Fire Fighting Systems				
	Total Carried to Main Summary Page		**P&D SUB TOTAL**		

Item	Description	Unit	Qty	Rate	KShs.
	PROPOSED FARM OFFICES, PASTEURIZING UNIT & WATER TREATMENT PLANT FOR THE ARCHDIOCESE OF NAIROBI - PHASE I (WATER SECTION)				
	PLUMBING,DRAINAGE AND FIRE FIGHTING SERVICES				
	MAIN SUMMARY				
	SECTION	**FROM PAGE**			
(i).	Preliminaries and General Conditions	A/26			
(ii)	Plumbing, Drainage and Fire Fighting Services	8/28			
	Allow sum for contingencies				125,000.00
	SUBTOTAL				
	ADD 16% VAT				
	GRAND TOTAL				

APPENDIX I
STATEMENT OF COMPLIANCE

Tick ☐ For Yes

Ex ☐ For No

1 We hereby declare that all items offered in our bid
(a) Fully comply with the Engineer's Specification ☐

(b) Do not fully comply [If so please state the Alternatives offered]. ☐

2 We hereby declare that we have visited site prior to tender. ☐

3 We hereby declare that we have read the specification checked the tender drawings carefully, understood conditions under which we shall have to work. ☐

4 We confirm we have provided a **letter of intent** from an approved Surety for a Bond. ☐

5 We confirm that our tender validity is at least 90 days from the tender opening date stated on the Invitation letter. ☐

6 We confirm that our firm has the capacity and capability to ☐

Signed: ……
……

Company

Stamp: ……

Date: ……

APPENDIX II
CONDITIONS OF SUB-CONTRACT

1 Deviation from the Specification:

You are required under this Section to highlight any

Diversion from the Specification shall be supported by

……

……

……

……

Signed: _____

Company
Stamp: _____

Date: _____