

COAST WATER SERVICES BOARD



BIDDING DOCUMENTS

Project Name: Coast Region Equalization Fund;

Issued on: 19th March, 2019

For

**Contract Name: Construction of Kiunga_Mbwajumwali
Water Project in Lamu County**

Reference No. CWSB/ LM-EQF/W/02A/2019

Employer:

COAST WATER SERVICES BOARD

P.O. BOX 90417-80100

MOMBASA, KENYA

March 2019

TABLE OF CONTENTS

| | | <u>PAGE</u> |
|-------------|--|--------------------|
| | INTRODUCTION | 1 |
| SECTION I | INVITATION TO TENDERERS | 4 |
| SECTION II | INSTRUCTIONS TO TENDERERS | 4 |
| SECTION III | CONDITIONS OF CONTRACT | 11 |
| | APPENDIX TO CONDITIONS OF CONTRACT | 21 - 22 |
| SECTION IV | SPECIFICATIONS, DRAWINGS AND BILLS OF QUANTITIES/SCHEDULE OF RATES..... | 23 |
| SECTION V | STANDARD FORMS | 25 |
| | EVALUATION CRITERIA | 25 |

Section I

COAST WATER SERVICES BOARD



TENDER NOTICE (Re-Advertised)

Name of Project: Coast Region Equalization Fund

Contract Title: Construction of Kiunga_Mbwajumwali Water Project in Lamu County

Tender No: CWSB/ LM-EQF/W/02A/2019

1. Coast Water Services Board a State Corporation in the Ministry of Water and Sanitation (MW&S), has received funding from The National Treasury (TNT) towards the cost of financing water projects in the Coast Region under the Equalization Fund and it intends to apply part of the proceeds of this fund to payments of the contract for Construction of Kiunga_Mbwajumwali Water Project in Lamu County.
2. Interested eligible candidates may obtain further information and inspect tender documents during normal working hours from 0800 hours to 1630 hours local time from Monday to Friday, except during lunch hour (1230 hours to 1400 hours), and during weekends and public holidays.
3. A complete set of tender documents may be obtained by interested candidates upon payment of a non-refundable fee of Ksh.1000 in cash or Bankers Cheque payable to the Chief Executive Officer or can download the document free of charge from our website www.cwsb.go.ke or The National treasury Procurement Portal.
4. Prices quoted should be inclusive of all taxes, must be in Kenya shillings and shall remain valid for 90 days from the closing date of tender.
5. Completed tender documents are to be enclosed in plain sealed envelopes marked with Tender name and reference number and deposited in the Tender

Box next to **Procurement Office, Coast Water Services Board Mikindani Street (Off- Nkrumah road)** so as to be received on or before **2nd April, 2019 at 1100hrs EAT** .

6. Tenders will be opened immediately thereafter in the presence of the candidates or their representatives who choose to attend at the public opening at Coast Water Services Board Boardroom, Mikindani Street (Off-Nkrumah road).

**Chief Executive Officer
Coast Water Services Board
Mikindani Street (Off- Nkrumah road)
P.O. Box 90417 – 80100
MOMBASA, KENYA
Fax: +254-041-2316471
www.cwsb.go.ke**

SECTION II

INSTRUCTIONS TO TENDERERS.

1. General

- 1.1 The Employer as defined in the Appendix to Conditions of Contract invites tenders for Works Contract as described in the tender documents. The successful Tenderer will be expected to complete the Works by the Intended Completion Date specified in the said Appendix.
- 1.2 Tenderers shall include the following information and documents with their tenders, unless otherwise stated:
- (a) **copies of certificates of registration, and principal place of business;**
 - (b) **Ensure your firm is e- citizen linked**
 - (c) **Submit Anti-Corruption Declaration Commitment/ Pledge**
 - (d) **Valid Tax Compliance Certificate**
 - (e) **Copies of PIN Certificate**
 - (f) **Copies of VAT Certificate**
 - (g) **Valid Copies of CR 12**
 - (h) **Copies valid AGPO Certificate**
 - (i) **Dully completed , Signed & Stamped Tender Securing declaration**
 - (j) **Dully filled, signed and stamped price schedules & Bill of quantities.**
 - (k) **Bid Validity shall be 90 days**
 - (l) **Power of attorney shall be required**
 - (m) **Dully completed , Signed & Stamped Form of Tender**
 - (n) **Dully completed , Signed & Stamped Business questionnaire**
 - (o) **Copies of certificate of registration NCA 8 and above on water works**
 - (p) **Document must be paginated**
 - (q) **total monetary value of construction work performed for each of the last Three (3) years;**
 - (r) **experience in works of a similar nature and size for each of the last Three (3) years, and clients who may be contacted for further information on these contracts;**
 - (s) **major items of construction equipment owned or leased**
 - (t) **qualifications and experience of key site management and technical personnel proposed for the Contract;**
 - (u) **reports on the financial standing of the Tenderer, such as profit and loss statements and auditor's reports for the last two years;**
 - (v) **Authority to seek references from the Tenderer's bankers.**

- 1.3 The Tenderer shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible or liable for those costs.
- 1.4 The Tenderer, at the Tenderer's own responsibility and risk, is encouraged to visit and examine the Site of the Works and its surroundings, and obtain all information that may be necessary for preparing the tender and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Tenderer's own expense.
- 1.5 The procurement entity's employees, committee members, board members and their relative (spouse and children) are not eligible to participate in the tender.
- 1.6 The price to be charged for the tender document shall not exceed Kshs.5,000/=
- 1.7 The procuring entity shall allow the tenderer to review the tender document free of charge before purchase.

2. Tender Documents

- 2.1 The complete set of tender documents comprises the documents listed here below and any addenda issued in accordance with clause 2.4 here below:-
 - (a) These instructions to Tenderers
 - (b) Form of Tender
 - (c) Conditions of Contract and Appendix to Conditions of Contract
 - (d) Specifications
 - (e) Drawings
 - (f) Bills of Quantities/Schedule of Rates (whichever is applicable)
 - (g) Other materials required to be filled and submitted in accordance with these Instructions and Conditions
- 2.2 The Tenderer shall examine all instructions, forms and specifications in the tender documents. Failure to furnish all information required by the tender documents may result in rejection of his tender.
- 2.3 A prospective Tenderer making inquiries of the tendering documents may notify the Employer in writing or by cable, telex or facsimile at the address indicated in the letter of invitation to tender. The Employer will respond to any request for clarification received earlier than seven [7] days prior to the deadline for submission of tenders. Copies of the Employer's response will be forwarded to all persons issued with tendering documents, including a description of the inquiry, but without identifying its source.

- 2.4 Before the deadline for submission of tenders, the Employer may modify the tendering documents by issuing addenda. Any addendum thus issued shall be part of the tendering documents and shall be communicated in writing or by cable, telex or facsimile to all Tenderers. Prospective Tenderers shall acknowledge receipt of each addendum in writing to the Employer.
- 2.5 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend, as necessary, the deadline for submission of tenders in accordance with clause 4.2 here below.

3. Preparation of Tenders

- 3.1 All documents relating to the tender and any correspondence shall be in **English Language**.
- 3.2 The tender submitted by the Tenderer shall comprise the following:-
- (a) The Tender;**
 - (b) Tender Security;**
 - (c) Priced Bill of Quantities/Schedule of Rates for lump-sum Contracts**
 - (d) Any other materials required to be completed and submitted by Tenderers.**
- 3.3 The Tenderer shall fill in rates and prices for all items of the Works described in the Bill of Quantities/Schedule of Rates. Items for which no rate or price is entered by the Tenderer will not be paid for when executed and shall be deemed **covered** by the other rates and prices in the Bill of Quantities/Schedule of Rates. All duties, taxes and other levies payable by the Contractor under the Contract, as of 30 days prior to the deadline for submission of tenders, shall be included in the tender price submitted by the Tenderer.
- 3.4 The rates and prices quoted by the Tenderer shall not be subject to any adjustment during the performance of the Contract.
- 3.5 The unit rates and prices shall be in Kenya Shillings.
- 3.6 Tenders shall remain valid for a period of sixty (60) days from the date of submission. However in exceptional circumstances, the Employer may request that the Tenderers extend the period of validity for a specified additional period. The request and the Tenderers' responses shall be made in writing.
- 3.7 The Tenderer shall prepare one original of the documents comprising the tender documents as described in these Instructions to Tenderers.

- 3.8 The original shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Tenderer. All pages of the tender where alterations or additions have been made shall be initialed by the person or persons signing the tender.
- 3.9 Clarification of tenders shall be requested by the tenderer to be received by the procuring entity not later than 7 days prior to the deadline for submission of tenders.
- 3.10 The procuring entity shall reply to any clarifications sought by the tenderer within 3 days of receiving the request to enable the tenderer to make timely submission of its tender.

4. Submission of Tenders

- 4.1 The tender duly filled and sealed in an envelope shall;-
- (a) be addressed to the Employer at the address provided in the invitation to tender;
 - [b] bear the name and identification number of the Contract as defined in the invitation to tender; and
 - [c] provide a warning not to open before the specified time and date for tender opening.
- 4.2 Tenders shall be delivered to the Employer at the address specified above not later than the time and date specified in the invitation to tender.
- 4.3 The tenderer shall not submit any alternative offers unless they are specifically required in the tender documents.
- Only one tender may be submitted by each tenderer. Any tenderer who fails to comply with this requirement will be disqualified.
- 4.4 Any tender received after the deadline for opening tenders will be returned to the tenderer un-opened.
- 4.5 The Employer may extend the deadline for submission of tenders by issuing an amendment in accordance with sub-clause 2.5 in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

5. Tender Opening and Evaluation

-
- 5.1 The tenders will be opened in the presence of the Tenderers' representatives who choose to attend at the time and in the place specified in the invitation to tender.
- 5.2 The Tenderers' names, the total amount of each tender and such other details as may be considered appropriate, will be announced at the opening by the Employer. Minutes of the tender opening, including the information disclosed to those present will also be prepared by the Employer.
- 5.3 Information relating to the examination, clarification, evaluation and comparison of tenders and recommendations for the award of the Contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's officials, processing of tenders or award decisions may result in the rejection of his tender.
- 5.4 Tenders determined to be substantially responsive will be checked for any arithmetic errors. Errors will be corrected as follows:
- (a) where there is a discrepancy between the amount in figures and the amount in words, the amount in words will prevail; and
 - (b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will prevail, unless in the opinion of the Employer's representative, there is an obvious typographical error, in which case the adjustment will be made to the entry containing that error.
 - (c) In the event of a discrepancy between the tender amount as stated in the Form of Tender and the corrected tender figure in the main summary of the Bill of Quantities/Quotation, the amount as stated in the Form of Tender shall prevail.
 - (d) The Error Correction Factor shall be computed by expressing the difference between the tender amount and the corrected tender sum as a percentage of the Corrected Builder's Work (i.e. corrected tender sum less P.C. and Provisional Sums).
 - (e) The Error Correction Factor shall be applied to all Builder's Work (as a rebate or addition as the case may be) for the purposes of valuations for Interim Certificates and valuation of variations.
 - (f) The amount stated in the tender will be adjusted in accordance with the above procedure for the correction of errors and with concurrence of the Tenderer, shall be considered as binding upon the Tenderer. If the Tenderer does not accept the corrected amount, the tender may be rejected and the Tender Security forfeited.
-

-
- 5.5 The tender evaluation committee shall evaluate the tender within 30 days of the validity period from the date of opening the tender.
- 5.6 Contract price variations shall not be allowed for contracts not exceeding one year (12 months)
- 5.7 Where contract price variation is allowed, the valuation shall not exceed 15% of the original contract price.
- 5.8 Price variation requests shall be processed by the procuring entity within 30 days of receiving the request.
- 5.9 Preference where allowed in the evaluation of tenders shall not exceed 15%
- 5.10 To assist in the examination, evaluation, and comparison of tenders, the Employer at his discretion, may request [in writing] any Tenderer for clarification of the tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, telex or facsimile but no change in the tender price or substance of the tender shall be sought, offered or permitted.
- 5.11 The Tenderer shall not influence the Employer on any matter relating to his tender from the time of the tender opening to the time the Contract is awarded. Any effort by the Tenderer to influence the Employer or his employees in his decision on tender evaluation, tender comparison or Contract award may result in the rejection of the tender.

6. Award of Contract

- 6.1 The award of the Contract will be made to the Tenderer who has offered **the lowest evaluated tender price**.
- 6.2 Notwithstanding the provisions of clause 6.1 above, the Employer reserves the right to accept or reject any tender and to cancel the tendering process and reject all tenders at any time prior to the award of Contract without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the action.
- 6.3 The Tenderer whose tender has been accepted will be notified of the award prior to expiration of the tender validity period in writing or by cable, telex or facsimile. This notification (hereinafter and in all Contract documents called the "Letter of Acceptance") will state the sum [hereinafter and in all Contract documents called the "Contract Price" which the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract. The contract shall be formed on the parties signing the contract. At the same time the other

tenderers shall be informed that their tenders have not been successful.

- 6.4 The Contract Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be signed by the Employer and sent to the successful Tenderer, within 30 days following the notification of award. Within 21 days of receipt, the successful Tenderer will sign the Agreement and return it to the Employer.
- 6.5 Within 21 days after receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Performance Security amount stipulated in the Appendix to Conditions of Contract.
- 6.6 The parties to the contract shall have it signed within 30 days from the date of notification of contract award unless there is an administrative review request.
- 6.7 The procuring entity may at any time terminate procurement proceedings before contract award and shall not be liable to any person for the termination.
- 6.8 The procuring entity shall give prompt notice of the termination to the tenderers and on request give its reasons for termination within 14 days of receiving the request from any tenderer.

7. Corrupt and fraudulent practices

- 7.1 The procuring entity requires that the tenderer observes the highest standard of ethics during the procurement process and execution of the contract. A tenderer shall sign a declaration that he has not and will not be involved in corrupt and fraudulent practices.
- 7.2 The procuring entity will reject a tender if it determines that the tenderer recommended for award has engaged in corrupt and fraudulent practices in competing for the contract in question.
- 7.3 Further a tenderer who is found to have indulged in corrupt and fraudulent practices risks being debarred from participating in public procurement in Kenya.

SECTION III

CONDITIONS OF CONTRACT

| | Table of Clauses | Page |
|-----|---|-------------|
| 1. | DEFINITIONS..... | 11 |
| 2. | CONTRACT DOCUMENTS..... | 12 |
| 3. | EMPLOYER'S REPRESENTATIVE'S DECISIONS..... | 13 |
| 4. | WORKS, LANGUAGE AND LAW OF CONTRACT..... | 13 |
| 5. | SAFETY, TEMPORARY WORKS AND DISCOVERIES..... | 13 |
| 6. | WORK PROGRAM AND SUB-CONTRACTING..... | 13 |
| 7. | THE SITE..... | 13 - 14 |
| 8. | INSTRUCTIONS..... | 14 |
| 9. | EXTENSION OF COMPLETION DATE..... | 14 - 15 |
| 10. | MANAGEMENT MEETINGS..... | 15 |
| 11. | DEFECTS..... | 15 - 16 |
| 12. | BILLS OF QUANTITIES/SCHEDULE OF RATES..... | 16 |
| 13. | VARIATIONS..... | 16 |
| 14. | PAYMENT CERTIFICATES AND FINAL ACCOUNT | 16 - 17 |
| 15. | INSURANCES | 18 |
| 16. | LIQUIDATED DAMAGES..... | 18 |
| 17. | COMPLETION AND TAKING OVER..... | 18 |
| 18. | TERMINATION..... | 18 - 19 |
| 19. | PAYMENT UPON TERMINATION..... | 19 |
| 20. | CORRUPT GIFTS AND PAYMENTS OF COMMISSION..... | 19 - 20 |
| 21. | SETTLEMENT OF DISPUTES..... | 20 |
| 22. | APPENDIX TO CONDITIONS OF CONTRACT | 21 - 22 |

SECTION III - CONDITIONS OF CONTRACT

1. Definitions

1.1 In this Contract, except where context otherwise requires, the following terms shall be interpreted as indicated;

“Bills of Quantities” means the priced and completed Bill of Quantities forming part of the tender [where applicable].

“Schedule of Rates” means the priced Schedule of Rates forming part of the tender [where applicable].

“The Completion Date” means the date of completion of the Works as certified by the Employer’s Representative.

“The Contract” means the agreement entered into by the Employer and the Contractor as recorded in the Agreement Form and signed by the parties.

“The Contractor” refers to the person or corporate body who’s tender to carry out the Works has been accepted by the Employer.

“The Contractor’s Tender” is the completed tendering document submitted by the Contractor to the Employer.

“The Contract Price” is the price stated in the Letter of Acceptance.

“Days” are calendar days; **“Months”** are calendar months.

“A Defect” is any part of the Works not completed in accordance with the Contract.

“The Defects Liability Certificate” is the certificate issued by Employer’s Representative upon correction of defects by the Contractor.

“The Defects Liability Period” is the period named in the Appendix to Conditions of Contract and calculated from the Completion Date.

“Drawings” include calculations and other information provided or approved by the Employer’s Representative for the execution of the Contract.

“Employer” Includes Central or Local Government administration, Universities, Public Institutions and Corporations and is the party who employs the Contractor to carry out the Works.

“Equipment” is the Contractor’s machinery and vehicles brought temporarily to the Site for the execution of the Works.

“Site” means the place or places where the permanent Works are to be carried out including workshops where the same is being prepared.

“Materials” are all supplies, including consumables, used by the Contractor for incorporation in the Works.

“Employer’s Representative” is the person appointed by the Employer and notified to the Contractor for the purpose of supervision of the Works.

“Specification” means the Specification of the Works included in the Contract.

“Start Date” is the date when the Contractor shall commence execution of the Works.

“A Subcontractor” is a person or corporate body who has a Contract with the Contractor to carry out a part of the Work in the Contract, which includes Work on the Site.

“Temporary works” are works designed, constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.

“A Variation” is an instruction given by the Employer’s Representative which varies the Works.

“The Works” are what the Contract requires the Contractor to construct, install, and turnover to the Employer.

2. Contract Documents

2.1 The following documents shall constitute the Contract documents and shall be interpreted in the following order of priority;

- (1) Agreement,
- (2) Letter of Acceptance,
- (3) Contractor’s Tender,
- (4) Conditions of Contract,
- (5) Specifications,
- (6) Drawings,
- (7) Bills of Quantities or Schedule of Rates [whichever is applicable]

3. Employer’s Representative’s Decisions

3.1 Except where otherwise specifically stated, the Employer’s Representative will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

4. Works, Language and Law of Contract

- 4.1 The Contractor shall construct and install the Works in accordance with the Contract documents. The Works may commence on the Start Date and shall be carried out in accordance with the Program submitted by the Contractor, as updated with the approval of the Employer's Representative, and complete them by the Intended Completion Date.
- 4.2 The ruling language of the Contract shall be English language and the law governing the Contract shall be the law of the Republic of Kenya.

5. Safety, Temporary works and Discoveries

- 5.1 The Contractor shall be responsible for design of temporary works and shall obtain approval of third parties to the design of the temporary works where required.
- 5.2 The Contractor shall be responsible for the safety of all activities on the Site.
- 5.3 Any thing of historical or other interest or significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Employer's Representative of such discoveries and carry out the Employer's Representative's instructions for dealing with them.

6 Work Program and Sub-contracting

- 6.1 Within seven days after Site possession date, the Contractor shall submit to the Employer's Representative for approval a program showing the general methods, arrangements, order and timing for all the activities in the Works.
- 6.2 The Contractor may sub-contract the Works (but only to a maximum of 25 percent of the Contract Price) with the approval of the Employer's Representative. However, he shall not assign the Contract without the approval of the Employer in writing. Sub-contracting shall not alter the Contractor's obligations.

7 The site

- 7.1 The Employer shall give possession of all parts of the Site to the Contractor.
- 7.2 The Contractor shall allow the Employer's Representative and any other person authorised by the Employer's Representative, access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

8 Instructions

- 8.1 The Contractor shall carry out all instructions of the Employer's Representative which are in accordance with the Contract.

9 Extension of Completion Date

- 9.1 The Employer's Representative shall extend the Completion Date if an occurrence arises which makes it impossible for completion to be achieved by the Intended Completion Date. The Employer's Representative shall decide whether and by how much to extend the Completion Date.

- 9.2 For the purposes of this clause, the following occurrences shall be valid for consideration;

Delay by:-

- (a) force majeure, or
- (b) reason of any exceptionally adverse weather conditions, or
- (c) reason of civil commotion, strike or lockout affecting any of the trades employed upon the Works or any of the trades engaged in the preparation, manufacture or transportation of any of the goods or materials required for the Works, or
- (d) reason of the Employer's Representative's instructions issued under these Conditions, or
- (e) reason of the contractor not having received in due time necessary instructions, drawings, details or levels from the Employer's Representative for which he specifically applied in writing on a date which having regard to the date for Completion stated in the appendix to these Conditions or to any extension of time then fixed under this clause was neither unreasonably distant from nor unreasonably close to the date on which it was necessary for him to receive the same, or
- (f) delay on the part of artists, tradesmen or others engaged by the Employer in executing work not forming part of this Contract, or
- (g) reason of delay by statutory or other services providers or similar bodies engaged directly by the Employer, or
- (h) reason of opening up for inspection of any Work covered up or of the testing or any of the Work, materials or goods in accordance with these conditions unless the inspection or test showed that the Work, materials or goods were not in accordance with this Contract, or

- (i) reason of delay in appointing a replacement Employer's Representative, or
- (j) reason of delay caused by the late supply of goods or materials or in executing Work for which the Employer or his agents are contractually obliged to supply or to execute as the case may be, or
- (k) delay in receiving possession of or access to the Site.

10 Management Meetings

- 10.1 A Contract management meeting shall be held regularly and attended by the Employer's Representative and the Contractor. Its business shall be to review the plans for the remaining Work. The Employer's Representative shall record the business of management meetings and provide copies of the record to those attending the meeting and the Employer. The responsibility of the parties for actions to be taken shall be decided by the Employer's Representative either at the management meeting or after the management meeting and stated in writing to all who attend the meeting.
- 10.2 Communication between parties shall be effective only when in writing.

11 Defects

- 11.1 The Employer's Representative shall inspect the Contractor's work and notify the Contractor of any defects that are found. Such inspection shall not affect the Contractor's responsibilities. The Employer's Representative may instruct the Contractor to search for a defect and to uncover and test any Work that the Employer's Representative considers may have a defect. Should the defect be found, the cost of uncovering and making good shall be borne by the Contractor. However if there is no defect found, the cost of uncovering and making good shall be treated as a variation and added to the Contract Price.
- 11.2 The Employer's Representative shall give notice to the Contractor of any defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the Appendix to Conditions of Contract.
- 11.3 Every time notice of a defect is given, the Contractor shall correct the notified defect within the length of time specified by the Employer's Representative's notice. If the Contractor has not corrected a defect within the time specified in the Employer's Representative's notice, the Employer's Representative will assess the cost of having the defect corrected by other parties and such cost shall be treated as a variation and be deducted from the Contract Price.

12 Bills of Quantities/Schedule of Rates

- 12.1 The Bills of Quantities/Schedule of Rates shall contain items for the construction, installation, testing and commissioning of the Work to be done by the Contractor. The Contractor will be paid for the quantity of the Work done at the rates in the Bills of Quantities/Schedule of Rates for each item. Items against which no rate is entered by the Tenderer will not be paid for when executed and shall be deemed covered by the rates for other items in the Bills of Quantities/Schedule of Rates.
- 12.2 Where Bills of Quantities do not form part of the Contract, the Contract Price shall be a lump sum (which shall be deemed to have been based on the rates in the Schedule of Rates forming part of the tender) and shall be subject to re-measurement after each stage.

13 Variations

- 13.1 The Contractor shall provide the Employer's Representative with a quotation for carrying out the variations when requested to do so. The Employer's Representative shall assess the quotation and shall obtain the necessary authority from the Employer before the variation is ordered.
- 13.2 If the Work in the variation corresponds with an item description in the Bill of Quantities/Schedule of Rates, the rate in the Bill of Quantities/Schedule of Rates shall be used to calculate the value of the variation. If the nature of the Work in the variation does not correspond with items in the Bill of Quantities/Schedule of Rates, the quotation by the Contractor shall be in the form of new rates for the relevant items of Work.
- 13.3 If the Contractor's quotation is unreasonable, the Employer's Representative may order the variation and make a change to the Contract Price, which shall be based on the Employer's Representative's own forecast of the effects of the variation on the Contractor's costs.

14 Payment Certificates and Final Account

- 14.1 The Contractor shall be paid after each of the following stages of Work listed here below (subject to re-measurement by the Employer's Representative of the Work done in each stage before payment is made). In case of lump-sum Contracts, the valuation for each stage shall be based on the quantities so obtained in the re-measurement and the rates in the Schedule of Rates.

(i) Advance payment _____ **10% of Contract Price as part of Mobilization against a Bank Guarantee issued by a reputable Bank.**

- (ii) First stage _____ **Once the Contractor executes works worth 30% of the Contract Price as Certified by Employer Representative and approved by the Employer**
- (iii) Second stage **Once the Contractor executes works worth 50% of the Contract Price as Certified by Employer Representative and approved by the Employer**
- (iv) Third stage **Once the Contractor executes works worth 80% of the Contract Price as Certified by Employer Representative and approved by the Employer**
- (v) After defects liability period – Release of the **10% of Contract Price Retention as Certified by Employer Representative and approved by the Employer**

14.2 Upon deciding that Works included in a particular stage are complete, the Contractor shall submit to the Employer's Representative his application for payment. The Employer's Representative shall check, adjust if necessary and certify the amount to be paid to the Contractor within 21 days of receipt of the Contractor's application. The Employer shall pay the Contractor the amounts so certified within 30 days of the date of issue of each Interim Certificate.

14.3 The Contractor shall supply the Employer's Representative with a detailed final account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer's Representative shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 30 days of receiving the Contractor's account if it is correct and complete. If it is not, the Employer's Representative shall issue within 21 days a schedule that states the scope of the corrections or additions that are necessary. If the final account is still unsatisfactory after it has been resubmitted, the Employer's Representative shall decide on the amount payable to the Contractor and issue a Final Payment Certificate. The Employer shall pay the Contractor the amount so certified within 60 days of the issue of the Final Payment Certificate.

14.4 If the period laid down for payment to the Contractor upon each of the Employer's Representative's Certificate by the Employer has been exceeded, the Contractor shall be entitled to claim simple interest calculated pro-rata on the basis of the number of days delayed at the

Central Bank of Kenya's average base lending rate prevailing on the first day the payment becomes overdue. The Contractor will be required to notify the Employer within 15 days of receipt of delayed payments of his intentions to claim interest.

15. Insurance

- 15.1 The Contractor shall be responsible for and shall take out appropriate cover against, among other risks, personal injury; loss of or damage to the Works, materials and plant; and loss of or damage to property.

16. Liquidated Damages

- 16.1 The Contractor shall pay liquidated damages to the Employer at the rate 0.001 per cent of the Contract price per day for each day that the actual Completion Date is later than the Intended Completion Date except in the case of any of the occurrences listed under clause 9.2. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.

17. Completion and Taking Over

- 17.1 Upon deciding that the Work is complete the Contractor shall request the Employer's Representative to issue a Certificate of Completion of the Works, upon deciding that the Work is completed.

The Employer shall take over the Site and the Works within seven days of the Employer's Representative issuing a Certificate of Completion.

18. Termination

- 18.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract. These fundamental breaches of Contract shall include, but shall not be limited to, the following;

- (a) the Contractor stops Work for 30 days continuously without reasonable cause or authority from the Employer's Representative;
- (b) the Contractor is declared bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
- (c) a payment certified by the Employer's Representative is not paid by the Employer to the Contractor within 30 days after the expiry of the payment periods stated in sub clauses 14.2 and 14.3 hereinabove.
- (d) the Employer's Representative gives notice that failure to correct a particular defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time.

- 18.2 If the Contract is terminated, the Contractor shall stop Work immediately, and leave the Site as soon as reasonably possible. The Employer's Representative shall immediately thereafter arrange for a

meeting for the purpose of taking record of the Works executed and materials, goods, equipment and temporary buildings on Site.

19. Payment Upon Termination

- 19.1 The Employer may employ and pay other persons to carry out and complete the Works and to rectify any defects and may enter upon the Works and use all materials on Site, plant, equipment and temporary works.
- 19.2 The Contractor shall, during the execution or after the completion of the Works under this clause, remove from the Site as and when required within such reasonable time as the Employer's Representative may in writing specify, any temporary buildings, plant, machinery, appliances, goods or materials belonging to him, and in default thereof, the Employer may (without being responsible for any loss or damage) remove and sell any such property of the Contractor, holding the proceeds less all costs incurred to the credit of the Contractor.
- 19.3 Until after completion of the Works under this clause, the Employer shall not be bound by any other provision of this Contract to make any payment to the Contractor, but upon such completion as aforesaid and the verification within a reasonable time of the accounts therefor the Employer's Representative shall certify the amount of expenses properly incurred by the Employer and, if such amount added to the money paid to the Contractor before such determination exceeds the total amount which would have been payable on due completion in accordance with this Contract, the difference shall be a debt payable to the Employer by the Contractor; and if the said amount added to the said money be less than the said total amount, the difference shall be a debt payable by the Employer to the Contractor.

20. Corrupt Gifts and Payments of Commission

- 20.1 The Contractor shall not;
- (a) Offer or give or agree to give to any person in the service of the Employer any gifts or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract with the Employer or for showing or forbearing to show favour or disfavour to any person in relation to this or any other contract with the Employer.
 - (b) Any breach of this Condition by the Contractor or by anyone employed by him or acting on his behalf (whether with or without the knowledge of the Contractor) shall be an offence under the Laws of Kenya.

21. Settlement of Disputes

- 21.1 Any dispute arising out of the Contract which cannot be amicably settled between the parties shall be referred by either party to the arbitration and final decision of a person to be agreed between the parties. Failing agreement to concur in the appointment of an Arbitrator, the Arbitrator shall be appointed by the chairman of the Chartered Institute of Arbitrators, Kenya branch, on the request of the applying party.

APPENDIX TO CONDITIONS OF CONTRACT

| Sub Clause | Condition | Data |
|------------|---|---|
| 1.1 | The Employer | Coast Water Services Board P.O. Box 90417-80100, Mombasa Mikindani off- Nkrumah Road |
| 1.1 | Name of Employer's Representative | Chief Executive Officer Coast Water Services Board P.O. Box 90417-80100, Telephone: 041-2315230 Email: info@cwsb.go.ke |
| | Scope of Works | <ol style="list-style-type: none"> 1. Construction of 100m³ Djabia in Kiunga 2. Construction of Mkokoni 3800m length pipeline HDPE (63mm and 90mm) , pump house and ancillary works 3. Construction of reverse osmosis plant 1m³/hr 4. Construction of 2no water kiosks in Mbwajumwali and Mkokoni 5. Installation of 6no. 10m³ plastic tanks and bases 6. Installation of waste water 200m long HDPE 50mm dia pipeline for reverse osmosis 7. Construction of 5no. Shallow wells |
| 1.1 | Start Date | 14 days after contract signature. |
| 1.1 | Intended Completion Date | 10 Calendar Months from the start date |
| 1.2(f) | Major Items of Construction equipment Owned | <p>The essential equipment to be made available for the Contract by the successful Tenderer (proposals for timely acquisition or own, lease, hire, etc) shall be:</p> <ol style="list-style-type: none"> 1) Normal tools for excavation and pipe laying.(eg hand tools, welding machines, wheelbarrows, spades etc 2) Concrete Mixer – 1no. 3) 7 Ton Lorry- 1 no. 4) Pick up-----2 no. 5) Drilling rig—2Nr |

| | | |
|--------|--|--|
| 1.2(g) | Qualifications and experience of Key site management and technical personnel | <ol style="list-style-type: none"> 1) Site Manager with a Bsc Civil or Water Engineer with at least 10years' experience on works of a similar nature. 2) Electro mechanical with at least diploma holder with 5years experience in the relevant field. 3) Surveyor with at least 3 years' experience in Civil Works Mason grade 1 with at least 3years' experience in Masonry works. 4) Inspector of water works with 3 years' experience in water works. 5) A Pipefitter grade 1 with 3 yrs experience in pipefitting. |
| 2.1 | Documents that form part of the Contract | <ol style="list-style-type: none"> 1) Agreement, 2) Letter of Acceptance, 3) Contractor's Tender, 4) Conditions of Contract, 5) Specifications, 6) Drawings, 7) Bills of Quantities or Schedule of Rates |
| 7.1 | Site Possession Date | Shall be at Contract signature date. |
| 7 | Site Location as Defined by Drawings | Lamu West Sub County at Mbwajumwali and –Kiunga Township. Accessed by Road from Mombasa/Malindi or Air travel from Mombasa/Malindi to Lamu a distance of about 150 km. or 330km from Mombasa, and using Speed boats to the Islands of Pate and Kiunga |
| 11 | Defect Liability Period | 300 days |
| | Amount of Tender Security | Kshs 800,000 issued by a reputable BANK or PPRA approved Insurance Company |
| | Tender Submission Address | Chief Executive officer, Coast Water Services Board, Mikindani Street off-Nkrumah,Mombasa |
| | Tender opening Date | 2nd April 2019 at 1100hs EAT |
| | Performance Security | Kshs 10 % of the contract price issued by a Reputable 'BANK' |
| 15.1 | Insurance | <ol style="list-style-type: none"> 1) The minimum insurance covers shall be: <ol style="list-style-type: none"> (a) Loss of or damage to the Works,Plant, and Materials: Contract price (b) Loss of or damage to Equipment: |

| | | |
|------|------------------|--|
| | | <p>Contract Price</p> <p>(c) Loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract: Kshs 100,000; and</p> <p>(d) Personal injury or death Kshs 100,000 for one incident, number of incidences unlimited.</p> |
| 16.1 | Liquated Damages | 0.001 per cent of the Contract price per day |

**SECTION IV – SPECIFICATIONS, DRAWINGS AND BILLS OF
QUANTITIES/SCHEDULE OF RATES**

I. SPECIFICATIONS**SPECIFICATIONS & PERFORMANCE REQUIREMENTS****TABLE OF CONTENTS**

| | |
|---|----------|
| 1. GENERAL..... | 1 |
| 101. OFFICE AND ACCOMODATION FOR RESIDENT ENGINEER AND HIS STAFF | 1 |
| 101.(a) PROVISION FOR PROJECT ENGINEER'S OFFICE IN MOMBASA | 2 |
| 101.(b) SURVEY EQUIPMENT | 4 |
| 102. OFFICE FOR CONTRACTOR..... | 5 |
| 103. CONTROL OF TRAFFIC | 5 |
| 104. TEMPORARY DIVERSION OF TRAFFIC | 5 |
| 105. TEMPORARY TRAFFIC SIGNS | 5 |
| 106. PROTECTION OF WORKS..... | 6 |
| 107. SURVEY BEACONS..... | 6 |
| 108. DAMAGE TO LAND | 6 |
| 109. RIVERS AND DRAINS..... | 6 |
| 110. REINSTATEMENT OF ROADS AND FOOTWAYS FOR WATER MAINS, STORM WATER AND SEWER CROSSINGS | 6 |
| 111. TEMPORARY WORKS..... | 7 |
| 112. LIGHTING AND GUARDING OF OBSTRUCTIONS | 7 |
| 113. SERVICES | 8 |
| 114. PRIVATELY OWNED OR PUBLIC SERVICES | 8 |
| 115. WATER SUPPLY | 8 |
| 116. ADDITIONAL LAND | 8 |
| 117. USE OF HEAVY PLANT..... | 9 |
| 118. PROVISION OF INSTRUMENTS AND LABOUR..... | 9 |
| 119. ACCESS TO SITES | 9 |
| 120. POLLUTION | 9 |
| 121. TREE PROTECTION | 9 |
| 122. GEOLOGICAL DATA..... | 10 |
| 123. WATCHING, FENCING AND LIGHTING | 10 |
| 124. TIPS | 10 |
| 125. TROPICALISATION | 10 |
| 126. MONTHLY SITE MEETINGS..... | 10 |
| 127. INSPECTION BY ENGINEER DURING DEFECTS LIABILITY PERIOD | 10 |
| 128. SUBMISSION OF SAMPLES..... | 11 |
| 129. RESPONSIBILITY FOR ORDERING MATERIALS AND MANUFACTURED ARTICLES AND SAMPLES FOR TESTING | 11 |
| 130. TESTS OF MATERIALS AND MANUFACTURED ARTICLES BEFORE USE | 11 |
| 131. REJECTED MATERIALS..... | 11 |
| 132. QUALITY OF MATERIALS AND WORKMANSHIP | 12 |
| 133. TEST RUNNING OF THE SCHEME | 12 |
| 134. EQUIPMENT FOR THE RESIDENT ENGINEER | 12 |
| 135. OPERATION AND MAINTENANCE MANUAL | 12 |
| 136. CONSTRUCTION PROGRAMME | 13 |
| 137. AS-BUILT AND RECORD DRAWINGS..... | 14 |
| 2. CLEARING SITE | 1 |
| 201. CLEARING SITE..... | 1 |
| 202. VEGETATION | 1 |
| 203. BUSHES AND SMALL TREES | 1 |
| 204. HEDGES | 1 |
| 205. FELLING TREES | 1 |
| 206. GRUBBING-UP ROOTS | 2 |

| | | |
|-----------|--|----------|
| 207. | WEED CONTROL | 2 |
| 3. | EXCAVATION | 1 |
| 301. | DEFINITION AND CLASSIFICATION OF EXCAVATED MATERIALS | 1 |
| 302. | STORAGE AND HANDLING OF EXPLOSIVES AND BLASTING | 1 |
| 303. | EXCAVATION FOR FILL | 3 |
| 304. | COMPACTION OF FILL | 3 |
| 305. | EMBANKMENTS OVER SEWERS | 5 |
| 306. | STONE REVETMENTS (STONE PITCHING) | 5 |
| 307. | TIPPED REFUSE ON SITE | 6 |
| 308. | REMOVAL OF INDUSTRIAL WASTE, ETC. | 6 |
| 309. | LAND SLIPS | 6 |
| 310. | CLASSIFICATION OF MATERIAL FROM SLIPS | 6 |
| 311. | BORROW PITS | 6 |
| 312. | STREAMS, WATERCOURSES AND DITCHES | 6 |
| 313. | FILLING OLD WATERCOURSES | 7 |
| 314. | OPEN DITCHES | 7 |
| 315. | CLEARING EXISTING DITCHES | 7 |
| 316. | EXCAVATION FOR FOUNDATIONS BELOW OPEN WATER | 7 |
| 317. | TRENCHES OF GREATER WIDTH AND DEPTH THAN NECESSARY | 7 |
| 318. | SUPPORTS FOR TRENCHES | 7 |
| 319. | PROVISION OF SPOIL HEAPS | 8 |
| 320. | USE OF VIBRATORY COMPACTION PLANT | 8 |
| 321. | WATER IN EXCAVATIONS | 8 |
| 4. | CONCRETE | 1 |
| 401. | THE DESIGN OF CONCRETE MIXES | 1 |
| 402. | MIXING CONCRETE | 9 |
| 403. | HAND-MIXED CONCRETE | 11 |
| 404. | TRANSPORT OF CONCRETE | 11 |
| 405. | PLACING OF CONCRETE | 12 |
| 406. | COMPACTION OF CONCRETE | 16 |
| 407. | CURING OF CONCRETE | 16 |
| 408. | PROTECTION OF FRESH CONCRETE | 18 |
| 409. | CONCRETING IN HOT WEATHER | 18 |
| 410. | FINISHES ON UNFORMED SURFACES | 19 |
| 411. | MORTAR | 21 |
| 412. | CONCRETE FOR SECONDARY PURPOSES | 21 |
| 413. | RECORDS OF CONCRETE PLACING | 22 |
| 414. | CONSTRUCTION JOINTS | 22 |
| 415. | EXPANSION AND CONTRACTION JOINTS | 23 |
| 416. | WATERSTOPS | 23 |
| 417. | GROUTING OF POCKETS AND HOLES AND UNDERPINNING OF BASEPLATES | 25 |
| 418. | REMEDIAL WORK TO DEFECTIVE SURFACES | 25 |
| 419. | BENDING REINFORCEMENT | 26 |
| 420. | FIXING REINFORCEMENT | 26 |
| 5. | FORMWORK | 1 |
| 501. | FORMWORK FOR CONCRETE | 1 |
| 502. | CONSTRUCTION OF FORMWORK AND FALSEWORK | 1 |
| 503. | PREPARATION OF FORMWORK | 3 |
| 504. | REMOVAL OF FORMWORK | 3 |
| 505. | SURFACE FINISHES ON FORMED SURFACES | 5 |
| 506. | TOLERANCES | 7 |
| 6. | MASONRY | 1 |
| 601. | GENERAL | 1 |
| 602. | WORKMANSHIP | 1 |
| 603. | CAST STONWORK | 1 |
| 7. | MATERIALS | 1 |

| | | |
|-----------|--|----------|
| 701. | GENERAL..... | 1 |
| 702. | GALVANISED PIPES AND SPECIALS..... | 2 |
| 703. | DUCTILE IRON AND CAST IRON PIPES AND SPECIALS..... | 2 |
| 704. | ASBESTOS CEMENT PIPES AND SPECIALS..... | 3 |
| 705. | STEEL PIPES AND SPECIALS..... | 4 |
| 706. | UNPLASTICISED uPVC PIPES..... | 5 |
| 707. | G.R.P. PIPES AND SPECIALS..... | 6 |
| 708. | GATE VALVES..... | 6 |
| 709. | FIRE HYDRANTS..... | 7 |
| 710. | AIR VALVES..... | 7 |
| 711. | WATER METERS..... | 8 |
| 712. | STOP VALVES..... | 9 |
| 713. | CHECK VALVES (DIRECTIONAL VALVES)..... | 9 |
| 714. | PENSTOCKS..... | 9 |
| 715. | FLANGED JOINTS..... | 9 |
| 716. | FLEXIBLE JOINTS..... | 10 |
| 717. | PRESSED STEEL TANKS AND TOWERS..... | 10 |
| 718. | PAINTS..... | 11 |
| 719. | MARKER AND INDICATOR POSTS..... | 11 |
| 720. | POLYETHYLENE (PALOTHENE, PEH) PIPES..... | 11 |
| 721. | PRECAST CONCRETE UNITS..... | 12 |
| 722. | FILTER MEDIA..... | 15 |
| 723. | SUBMISSION OF SAMPLES..... | 15 |
| 724. | MATERIALS FOR CONCRETE..... | 15 |
| 725. | BUILDING STONE..... | 23 |
| 726. | STONE DUST..... | 24 |
| 727. | MURRAM..... | 24 |
| 728. | WATER FOR CEMENT TREATED MATERIALS..... | 24 |
| 729. | CEMENT MORTAR..... | 24 |
| 730. | HYDRATED LIME..... | 24 |
| 731. | CALCIUM CHLORIDE..... | 24 |
| 732. | LIME MORTAR..... | 24 |
| 733. | CEMENT-LIME MORTAR..... | 25 |
| 734. | CEMENT GROUT..... | 25 |
| 735. | CAST STONE..... | 25 |
| 736. | REINFORCEMENT FOR CONCRETE..... | 25 |
| 737. | STRUCTURAL STEEL FOR WELDED WORK..... | 26 |
| 738. | WATERPROOF UNDERLAY..... | 27 |
| 739. | PREFORMED JOINT FILLER..... | 27 |
| 740. | JOINT PRIMER..... | 27 |
| 741. | JOINT SEALING COMPOUND..... | 27 |
| 742. | CONCRETE PIPES AND SPECIALS..... | 28 |
| 743. | CONCRETE POROUS PIPES..... | 28 |
| 744. | CONCRETE DRAIN INVERT BLOCKS..... | 28 |
| 745. | CONCRETE SLABS FOR OPEN DRAINS..... | 28 |
| 746. | AGRICULTURAL TILES AND PIPES..... | 28 |
| 747. | MANHOLE COVERS AND FRAMES..... | 28 |
| 748. | GULLY GRATINGS AND FRAMES..... | 29 |
| 749. | PRECAST CONCRETE MANHOLES AND INSPECTION CHAMBERS..... | 29 |
| 750. | PRECAST CONCRETE GULLIES..... | 29 |
| 751. | MANHOLE STEP IRONS..... | 29 |
| 752. | TIMBER..... | 29 |
| 753. | WATER BARS..... | 29 |
| 754. | CONCRETE BLOCKS..... | 29 |
| 8. | WORKMANSHIP..... | 1 |
| 801. | HANDLING OF PIPES AND FITTINGS..... | 1 |
| 802. | LOADING AND UNLOADING..... | 1 |
| 803. | STORAGE..... | 1 |
| 804. | TRANSPORT..... | 1 |
| 805. | EXAMINATION OF PIPES AND FITTINGS..... | 1 |

| | | |
|------------|--|----------|
| 806. | INTERFERENCE WITH FENCES, DRAINS AND OTHER SERVICES | 1 |
| 807. | METHOD OF EXCAVATION | 1 |
| 808. | MAIN LAYING | 3 |
| 809. | BACKFILLING OF TRENCH | 4 |
| 810. | ANCHOR BLOCKS AND SUPPORTS | 5 |
| 811. | CHAMBERS AND SURFACE BOXES | 5 |
| 812. | TESTING | 5 |
| 813. | CLEANING AND STERILISING THE MAIN..... | 6 |
| 814. | CLEARANCE OF SITE | 7 |
| 815. | TESTING OF WATER RETAINING STRUCTURES | 7 |
| 816. | STERILISATION OF WATER RETAINING STRUCTURES..... | 8 |
| 9. | DRAINS, SEWERS AND MANHOLES..... | 1 |
| 901. | EXCAVATION FOR DRAINS, SEWERS AND MANHOLES..... | 1 |
| 902. | SUPPORTS FOR PITS, TRENCHES AND OTHER EXCAVATIONS | 1 |
| 903. | ROCK CUTTING IN TRENCHES FOR PIPES AND OTHER EXCAVATIONS..... | 1 |
| 904. | WATER IN TRENCHES FOR PIPELINES AND OTHER EXCAVATIONS | 2 |
| 905. | LAYING AND JOINTING RIGID JOINTED CONCRETE PIPES | 2 |
| 906. | PIPES LAID WITH OPEN JOINTS..... | 3 |
| 907. | CAST IRON PIPES | 3 |
| 908. | DRAINS TO BE LEFT CLEAN ON COMPLETION..... | 3 |
| 909. | REFILLING TRENCHES..... | 3 |
| 910. | CONNECTIONS OF EXISTING SEWERS AND DRAINS | 4 |
| 911. | MANHOLES AND INSPECTION CHAMBERS..... | 4 |
| 912. | PRECAST CONCRETE MANHOLES..... | 5 |
| 913. | GULLY CONNECTIONS | 5 |
| 914. | SURFACE BOXES, COVERS ETC..... | 5 |
| 915. | GULLIES | 5 |
| 916. | COMPLETION OF DRAINAGE WORKS | 5 |
| 917. | TEMPORARY STOPPERS..... | 5 |
| 918. | PROVISION FOR FUTURE CONNECTION TO MANHOLES..... | 6 |
| 919. | SURROUNDING OR HAUNCHING OF PIPES WITH CONCRETE..... | 6 |
| 920. | INVERT BLOCK AND STONE-PITCHED DRAINS..... | 6 |
| 921. | TESTING OF JOINTED PIPES AND MANHOLES | 6 |
| 922. | PIPES WITH RUBBER RING JOINTS | 7 |
| 923. | LAYING, JOINTING AND BACKFILLING FOR FLEXIBLE JOINTED PIPES..... | 7 |
| 924. | WEEPHOLES..... | 8 |
| 925. | DEBRIS SCREENS..... | 9 |
| 10. | MISCELLANEOUS..... | 1 |
| 1001. | GENERAL..... | 1 |
| 1002. | BONDING TIES..... | 1 |
| 1003. | PRECAST LINTELS | 1 |
| 1004. | BLOCKWORK | 1 |
| 1005. | DAMP-PROOF COURSE (D.P.C.)..... | 3 |
| 1006. | HARDWOOD..... | 3 |
| 1007. | PLYWOOD | 3 |
| 1008. | DOORS..... | 3 |
| 1009. | FRAMES AND LININGS | 3 |
| 1010. | ARCHITRAVES AND STOPS..... | 3 |
| 1011. | IRONMONGERY..... | 3 |
| 1012. | JOINERY | 3 |
| 1013. | FIXING JOINERY | 4 |
| 1014. | FIXING IRONMONGERY | 4 |
| 1015. | BOLTS AND NUTS..... | 4 |
| 1016. | STRUCTURAL STEELWORK | 5 |
| 1017. | GALVANISED WORK..... | 5 |
| 1018. | ELECTRICAL INSTALLATION | 5 |
| 1019. | WATER AUTHORITIES REGULATIONS | 5 |
| 1020. | RAINWATER INSTALLATIONS | 6 |
| 1021. | TESTING PLUMBER'S WORK | 6 |

| | | |
|------------|--|----------|
| 1022. | SETTING OUT..... | 6 |
| 1023. | COPPER TUBES AND FITTINGS | 6 |
| 1024. | PLASTIC PIPES, FITTINGS AND ACCESSORIES | 6 |
| 1025. | SLEEVES | 6 |
| 1026. | PIPEWORK GENERALLY | 6 |
| 1027. | BRASSWORK..... | 6 |
| 1028. | CISTERNS | 7 |
| 1029. | SANITARY FITTINGS | 7 |
| 1030. | GENERAL..... | 7 |
| 1031. | METAL LATHING | 7 |
| 1032. | CEMENT | 7 |
| 1033. | SANDS | 8 |
| 1034. | LIME PUTTY | 8 |
| 1035. | PLASTICISERS | 8 |
| 1036. | WATER PROOFERS | 8 |
| 1037. | ANGLE AND CASING BEADS AND RENDER STOPS | 8 |
| 1038. | GLAZED CERAMIC WALL TILES | 8 |
| 1039. | ADHESIVE | 8 |
| 1040. | FIXING WALL TILES..... | 8 |
| 1041. | CERAMIC FLOOR TILES..... | 8 |
| 1042. | LAYING FLOOR TILES..... | 8 |
| 1043. | FIXING METAL LATHING | 9 |
| 1044. | FINISH | 9 |
| 1045. | INTERNAL RENDERING | 9 |
| 1046. | EXTERNAL RENDERING (TYROLEAN) | 9 |
| 1047. | EXPANSION JOINTS | 9 |
| 1048. | PREPARATION..... | 10 |
| 1049. | PAINT AND PAINTING | 10 |
| 1050. | PREPARATION..... | 11 |
| 1051. | PROTECTIVE DECORATIVE FINISH | 11 |
| 1052. | RENDERED PANELS..... | 11 |
| 1053. | IRONMONGERY FURNITURE | 11 |
| 1054. | PREPARATION OF ROAD FORMATION | 12 |
| 1055. | MURRAM SUB-BASE | 12 |
| 1056. | WATER-BOUND MACADAM BASE..... | 12 |
| 1057. | ROLLED ASPHALT HOT PROCESS WEARING COURSE..... | 13 |
| 1058. | BITUMEN MACADAM WEARING COURSE | 13 |
| 1059. | COMPACTION AND SURFACE FINISH | 14 |
| 1060. | PREPARATION OF THE BASE FOR SURFACING OR SURFACE DRESSING..... | 14 |
| 1061. | PRIME COAT AND TACK COAT | 14 |
| 1062. | ROLLING OF SURFACE MATERIALS..... | 15 |
| 1063. | TRAFFIC ON NEWLY CONSTRUCTED ROADS..... | 16 |
| 1064. | LAYING KERBS, CHANNELS AND EDGING BLOCKS | 16 |
| 1065. | CONCRETE BLOCK PAVINGS..... | 16 |
| 1066. | LAYING OF BLOCKS | 16 |
| 1067. | LAYING COURSE | 17 |
| 1068. | CUTTING BLOCKS | 17 |
| 1069. | VIBRATION..... | 17 |
| 1070. | PREPARATION OF FOOTPATH FORMATION | 18 |
| 1071. | PRECAST CONCRETE PAVING | 18 |
| 1072. | CHASING | 18 |
| 1073. | DAMP-PROOF COURSES (D.P.C.) | 18 |
| 1074. | BITUMINOUS FELT ROOFING | 18 |
| 1075. | HACKING, ETC. | 19 |
| 1076. | SURFACES | 19 |
| 1077. | PRICES FOR PAVING | 19 |
| 1078. | POLISHED TERRAZZO | 19 |
| 1079. | ATTENDANCE UPON ENGINEER'S STAFF | 19 |
| 11. | ELECTRICAL INSTALLATION | 1 |
| 1101. | CONTRACTOR'S LICENCE | 1 |

| | | |
|-------|--|----|
| 1102. | REGULATIONS AND STANDARDS | 1 |
| 1103. | EXTENT OF ELECTRICAL WORK WITHIN CONTRACT | 1 |
| 1104. | MATERIALS | 2 |
| 1105. | WORKMANSHIP | 3 |
| 1106. | INSTRUCTIONS ON SITE | 3 |
| 1107. | WORKING DRAWINGS | 3 |
| 1108. | RECORD DRAWINGS | 3 |
| 1109. | TESTING | 4 |
| 1110. | L.V. SWITCHBOARD | 4 |
| 1111. | CONDUIT SYSTEM | 5 |
| 1112. | GENERAL WIRING | 6 |
| 1113. | LIGHTING SWITCHES | 10 |
| 1114. | SOCKETS AND SWITCH SOCKETS | 10 |
| 1115. | FUSED CONNECTION UNIT | 11 |
| 1116. | TELEPHONE OUTLETS | 11 |
| 1117. | TIME SWITCHES | 11 |
| 1118. | M.C.B. DISTRIBUTION BOARDS AND CONSUMER UNITS | 11 |
| 1119. | WATER-TIGHT SWITCHES | 11 |
| 1120. | RADIO / T.V. AERIAL OUTLETS | 11 |
| 1121. | BELL PUSHES | 12 |
| 1122. | COOKER CONTROL UNIT | 12 |
| 1123. | WATER HEATER SWITCH & CONNECTION TO WATER HEATER | 12 |
| 1124. | COMPLETION AND INSPECTION CERTIFICATES | 12 |
| 1125. | SCOPE OF WORK | 12 |

1. GENERAL

All materials, equipment and testing apparatus etc. to be furnished and Works to be executed by the Contractor in this Contract shall conform to the requirements of the latest Kenya Standards, International Standards Organization (ISO) Standards, DIN, British Standards or other approved applicable Standard in Kenya, unless otherwise specifically stated.

Equipment to be purchased shall be from well recognized manufacturers whose products are standardised and controlled by any recognised Standards Organisation.

All dimensions and measurement units shall be in S.I. units.

The Contractor may propose to the Engineer an alternative Standard other than specified, in which case he shall submit six (6) copies of the English translation of the proposed Standard and all other information for the materials, equipment and testing, together with written proof from a recognised Standards Organisation that the proposed Standard is equivalent in all significant respects to the Standard specified.

The equipment to be employed by the Contractor shall have sufficient performance capacity and durability as to secure the completion of the Works within the construction period stipulated under the Contract. All materials and equipment shall be subject to inspections or tests by the Engineer at any time and in any state of completion both off-site and on-site as he deems necessary. **The Contractor shall furnish promptly, without additional charge, all facilities, labour and materials reasonably needed for performing such inspections and tests as may be required by the Engineer.**

The Contractor shall make diligent efforts to procure the specified materials, but when the materials specified are unavailable, for reasons beyond the control of the Contractor, substitutes may be used with prior written approval of the Engineer.

101. OFFICE AND ACCOMODATION FOR RESIDENT ENGINEER AND HIS STAFF

All equipment and furnishings detailed under this Clause shall be provided by the Contractor under item for Resident Engineer's offices under Bill No. 1. All the equipment and furnishings will revert to the Contractor at the end of the Contract.

The Contractor shall arrange for the provision of telephones (and if necessary extensions) with suitable privacy for conversation for the exclusive use of the Resident Engineer and his staff by means of a separate connection to the Telephone Exchange. The Contractor shall include in the

sum for provision of the office equipment and furnishings for the charges for installation, maintenance and removal of the telephones. All charges for hiring and telephone calls shall be under the relevant item in Bill No. 1. Provision shall also be made by the Contractor for all necessary gas, electricity, kerosene, water, light, attendance and stationery required in connection with execution of the Contract.

The Resident Engineer's offices shall be regularly and properly cleaned to the satisfaction of the Engineer. A messenger, and tea boy / office cleaner shall be provided by the Contractor exclusively for the Resident Engineer's offices. Also Security Guards shall be provided for day and night security at these offices. The offices, furniture and equipment shall be insured against fire, theft and natural calamity.

101.(a) PROVISION FOR PROJECT ENGINEER'S OFFICE IN MOMBASA

| <u>Furniture</u> | <u>Mombasa</u> |
|--|-----------------------|
| Writing Desk with 3 lockable drawers with side table for printers | 4 Nr |
| Writing Desk without Locks | 1 Nr |
| Fabric, Swivel adjustable height chairs with arm rests | 11 Nr |
| Wooden Conference Table, 4.8m x 1.2m – Interlinked / Configured system of tables | 1 Nr |
| Metal Plan Chest suitable for A1 size drawings, Size 886 x 510 x 1315mm | 1 Nr |
| Lockable Steel Cupboard (Size 1m x 1.8m x 0.5m deep) | 1 Nr |
| Office paper punch | 2 Nr |
| Pin board 2.4m x 1.2m | 6 Nr |
| Whiteboard, 1.2m x 1.2m | 2 Nr |
| Office Tray (3 tier) | 3 Nr |
| Office Stapling Machines | 2 Nr |
| Heavy Duty Stapler | 1 Nr |
| Steel File Cabinet with locks / 4 drawers ('Mecol' or equivalent approved) | 1 Nr |
| 'Casio' or similar small portable scientific electronic calculator | 1 Nr |
| 'Casio' or similar small portable electronic calculator | 2 Nr |
| First Aid kit (for 10 persons) in Metal Box | 1 Nr |
| Potable Fire Extinguisher (5 litres) | 2 Nr |
| Small office scissors | 2 Nr |
| Waste paper baskets | 3 Nr |
| Electric kettle (capacity to make 12 cups of tea) | 1 Nr |
| Coffee/Tea making facility including crockery for all supervisory staff 6 Nr. and 12 additional guests | 1 Nr |
| Coffee/Tea making facility including crockery for all supervisory staff 4nr. and 4 additional guests | - |
| Pedastal electric fan, size 400mm | 1 Nr |

| <u>Furniture</u> | <u>Mombasa</u> |
|---|-----------------------|
| 'Sanyo' or equivalent approved Refrigerator (0.2 cu.m. capacity) | 1 Nr |
| Wooden book shelves with lockable glass frontage 2.0m x 1.5m | 1 Nr |
| Desktop – "DELL" or approved equivalent OptiPlex GX520, Intel Pentium Dual Core 3.0 GHz, 80GB HDD, 512MB RAM, DVD R/CD-RW Optical Drive, with 15" Flat Panel Monitor. Win XP Professional and Microsoft Office 2003 or latest Version | 3 Nr |
| Laptop – "DELL" or approved equivalent Latitude D620 Intel Centrino Duo, 1.8 GHz, 80GB HDD, 512MB RAM, DVD ± RW Optical Drive, 15.4" Wide Screen, WiFi / 56K Modem, Bluetooth, with Win XP Professional and Microsoft Office 2003 or latest Version | 3 Nr |
| HP LaserJet Printer A4 | 2 Nr |
| HP Colour Inkjet Printer A3 | 2 Nr |
| 'L.G' or equivalent approved Air Conditioners (wall mounted) | 6 Nr |
| HP Colour LaserJet Printer, 1200 x 1200 dpi, 20ppm, with Largest Supported Paper Size – A3 (Project Office) 1 Nr | 1 Nr |
| Fax Machine – Panasonic Plain Paper Digital Fax with answering system, Model KXF1160 or approved equivalent | 1 Nr |
| Photocopier - Nashua or approved equivalent, A3, 30 pages per minute | 1 Nr |
| Petty Cash Box with security lock | 1 Nr |
| Wall Clock | 1 Nr |
| Ibico' or approved equivalent binding machine suitable to bind upto 40mm spirals | 1 Nr |
| Flashlights (battery powered) | 2 Nr |
| Digital Camera as specified | 3 Nr |

The Contractor shall provide a Secretary who can speak English and is conversant in the use of above mentioned software for the duration of the Contract.

Stationery required **per month** as follows:

| <u>Stationery</u> | <u>Mombasa</u> |
|------------------------------------|-----------------------|
| Photocopy paper A4 | 6 Reams |
| A3 paper | 3 Ream |
| Biro pens blue/black | ½ Doz. |
| Clutch Pencils | ½ Doz. |
| Box files | 2 Nr |
| Spring Files | 2 Nr |
| Document Wallets | 2 Nr |
| Spirals (various sizes of Reports) | 2 Doz. |
| Embossed (hardback cover) | 2 Doz. |
| Perspex covers | 2 Doz. |
| Cellotape (medium) | 1 Nr |

| Stationery | Mombasa |
|--|----------------|
| Masking tape (medium) | 1 Nr |
| Staples | 2 Pac. |
| Paper clips (various sizes) | 2 Pac. |
| Pencil leads (0.5/0.7) | 2 Sets |
| C-DR (Pack of 12) | 1 Pac. |
| CD-RW (Pack of 12) | 1 Pac. |
| Highlighters (set of all colours) | 2 Sets |
| A6 hardcover notebooks | 2 Nr |
| Soft Pencil Erasers (Staedtler or equivalent) | 3 Nr |
| Envelopes (all sizes) | 3 Doz. |
| A4 Carbon papers | 1 Doz. |
| Batteries for flashlights | 3 Sets |
| Colour and Black ink cartridges for the A3 printer | 1 Set |
| Black ink cartridge/ toner for the A3 printer | 3 Nr |

Supply of clean towels every day, soap, lavatory paper, disinfectant and cleaning materials is to be provided and maintained throughout the Contract Period.

The cost of all the above services shall be included by the Contractor under item for maintenance and attendance for Resident Engineer's offices. Apart from the consumables, the rest of equipment will revert to the Employer at the end of the Contract.

101.(b) SURVEY EQUIPMENT

Listed below are the principal items of survey equipment to be made available for use during the whole duration of Project Implementation. All equipment shall be as new and with all necessary carrying containers, manuals, insurances, etc. The Equipment to revert to Contractor at completion of all Works.

| Equipment | Mombasa |
|---|----------------|
| Precise automatic levels including tripods (Wild or similar) | 1 Nr |
| Total Station including tripods, complete with reflectors, poles and brackets (Wild or similar) | 1 Nr |
| Metric extending levelling staffs with vertical bubble | 1 Nr |
| 30m (enamelled or otherwise protected) steel bands | 1 Nr |
| 3 metre ranging rods | 6 Nr |
| Survey umbrellas with stand | 1 Nr |
| 5 metre steel tapes | 2 Nr |
| Builders spirit levels 1000mm long | 1 Nr |
| Hammers 3 kg each | 1 Nr |

Supply of pegs, crayons, spray paint, nails and all other items required for setting out and measuring the work.

The Contractor shall provide the services of two Chainmen as and when requested for the sole use of the Engineer and Engineer's Representative for the whole period of the Contract.

The cost for provision of the above for use of the Resident Engineer is deemed to be covered in the Bidder's Rates.

102. OFFICE FOR CONTRACTOR

The Contractor shall have an office on the site to be approved by the Engineer and which shall be open and attended to at all hours during which work is in progress.

Notwithstanding anything contained in Clause 6.1 of the General Conditions of Contract, any notice to be given to or served upon the Contractor shall be deemed and taken to be efficiently given or served by the delivery thereof at such office on the site.

103. CONTROL OF TRAFFIC

In the event of single way traffic becoming necessary on any particular section of the Works, or on the approaches to the Works, the Contractor shall, in maintaining through traffic routes, provide a width of at least 3 metres for single way traffic. He shall also provide approved electrically operated signals for traffic control on each of the affected sections and any additional traffic signs as may be directed in accordance with Clause 106. Signal lights are to be operated by competent operators provided by the Contractor, if and when required by the Engineer. Manually operated "Stop-Go" signs will only be permitted if approved by the Engineer, and shall be of the size, colour and type authorised. The Contractor shall be responsible for liaison with Police.

104. TEMPORARY DIVERSION OF TRAFFIC

Temporary diversion ways, including those listed in any schedule to the Bill of Quantities shall be constructed whenever the site is intersected by existing public and private roads, footpaths, cycle tracks, farm accesses, temporary and accommodation roads.

Any diversion way shall be of such a standard of construction that it is suitable in all respects for the class or classes of traffic requiring to use it. It shall be constructed in advance of the taking up of the existing way and regularly maintained for so long as required in a satisfactory condition all to the approval of the Engineer.

105. TEMPORARY TRAFFIC SIGNS

The Contractor shall erect and maintain on the Works and at prescribed points on the approaches to the Works, all traffic signs necessary for the warning, direction and control of traffic and the size of all such signs and

the lettering and wording thereon shall be reflectorised or adequately illuminated at night by approved means.

106. PROTECTION OF WORKS

The Contractor shall carefully protect from injury by weather all work and materials which may be affected thereby.

107. SURVEY BEACONS

During the progress of the Works, the Contractor shall not remove, damage, alter or destroy in any way whatsoever, any plot or survey beacons. He shall notify the Engineer of the need to interfere with any beacon. The Engineer shall authorise any removal and reinstatement that he considers necessary. Should any beacon be found to be above or below the level of the finished work, the Contractor shall immediately report the same to the Engineer.

Should any beacon be damaged or destroyed, the Contractor shall forthwith report the damage to the Engineer and to the Director of Surveys and shall be held liable for the cost of reinstatement thereof.

108. DAMAGE TO LAND

Except where specified for the proper execution of the Works, the Contractor shall not interfere with any fence, hedge, tree, land or crops within, upon or forming the boundary of the site or elsewhere. In the event of such interference, the Contractor shall make good to the satisfaction of the owner and the Engineer and shall pay to the owner such damages as the Engineer may determine.

109. RIVERS AND DRAINS

The Contractor shall at all times maintain the free flow of rivers and drains and prevent excavated material from the Works from being deposited in them.

110. REINSTATEMENT OF ROADS AND FOOTWAYS FOR WATER MAINS, STORM WATER AND SEWER CROSSINGS

Water Mains laid under roads shall be of ferrous material.

Sewer Lines laid under roads shall be flexible jointed uPVC or concrete pipes

The Contractor shall allow in his rates for liaison with the relevant Roads Authority and obtain a Road Opening Permit. Statutory fee for road crossings will be paid under relevant Item in the Bills of Quantity.

The road crossings shall be constructed in the following specifications and any other requirement stipulated by the Road Authority:

- Excavated width of the trench shall not be less than 1m to ensure compaction to required standard
- Protective concrete raft slab shall be constructed for sewer pipes as per details given in the drawings.

- Backfilling shall be carried out with suitable selected excavated material upto the top 300mm, in layer thickness not exceeding 150mm at optimum moisture content
- The top 300mm layer shall be backfilled in two layers of 150mm each comprising of well graded stabilized gravel with 3% cement content at optimum moisture content
- Tarmac roads shall be reinstated to the original condition using approved asphalt from a recommended supplier.

The Contractor shall be responsible for all liaisons with the Police for traffic control during execution of the works.

111. TEMPORARY WORKS

The Contractor shall provide, maintain and remove on completion of the Works all temporary Works including roadways, sleeper tracks and stagings etc., over roads, footpaths, suitable in every respect to carry all plant required for the work or for providing access or for any other purpose.

Details of Temporary Works shall be submitted in advance to the Engineer for his approval and the approval shall not relieve the Contractor of complete responsibility for their safety and satisfactory operation.

112. LIGHTING AND GUARDING OF OBSTRUCTIONS

The details of the method of signing and guarding an obstruction to traffic caused in the course of the execution of the Works shall be submitted to the Engineer for approval before that portion of the Works is commenced.

No greater area of the road than the Engineer considers necessary shall be closed at any one time.

Temporary traffic signs shall comply with Clause 106.

Generally the following precautions will be required:-

Signing

An advance warning sign at least 1.22m x 0.92m in size and 70 metres in advance of the obstruction will be required, and where an appreciable change of direction is necessary at the obstruction, a sign (of the arrow or chevron type) at the obstruction itself. At particular danger points more comprehensive signing may be required.

Guarding

The obstruction shall be marked by posts carrying red flags or reflective red markers and by red lamps. The latter shall be spaced at 6 metres intervals in the direction of traffic flow and at 0.9 metres intervals across this direction. At least 3 lamps shall be placed across this direction of traffic flow. The flags and lamps on the traffic side of the obstruction shall be at least 5 metres from it.

Footpaths

Where a footpath is affected by an obstruction in any way it shall be separated from both obstruction and traffic by effective banners and red lamps spaced at 0.9 metres intervals.

113. SERVICES

Before commencing Works which include excavation or ground levelling by manual or mechanical excavation the Contractor shall at his own expenses ascertain in writing from Telkom Kenya, Kenya Power & Lighting Co. Ltd. and all other Public Bodies, Companies and persons who may be affected, the position and depth of their respective ducts, cables, mains, pipes, or other appurtenances. He shall thereupon search for and locate such services.

The Contractor shall at his own expense arrange to have effectually propped, protected, underpinned, altered, diverted, restored and made as may be necessary, all water courses, pipes, cables or ducts, poles or wires or their appurtenances disturbed or damaged during the progress of the Works, or in consequence thereof.

Except that such services as require to be removed or altered by virtue of the layout of the permanent work and not the manner in which the work is carried out, shall be so removed or altered at the direction and at the expense of the Employer.

The Contractor shall be liable for the cost of repairs to any services damaged as a result of carrying out the Works and execution of these Works.

114. PRIVATELY OWNED OR PUBLIC SERVICES

If any privately owned or public services passing through the site will be affected by the Works, the Contractor shall provide at his own expense a satisfactory alternative service in full working order to the satisfaction of the owner of the services and the Engineer, before the cutting of the existing service. Any damage to private or public services shall be made good by the Contractor at his cost.

In case the remedial work is not executed promptly by the Contractor, the Engineer may make alternative arrangements for the execution of the work and debit the costs to the Contractor.

115. WATER SUPPLY

The Contractor shall provide for all purposes of the work, an adequate supply of water from a suitable source or sources approved by the Engineer. He must pay the water charges, if any, and make arrangements for supply, transport and distribution.

116. ADDITIONAL LAND

The Contractor shall select and arrange at his own expenses for any temporary occupation of land outside the site which he requires for the

efficient execution of the Works. The Contractor must comply fully with all By-laws and Regulations currently in force in the area.

117. USE OF HEAVY PLANT

In the event of the Contractor desiring to use heavy machinery or plant, he shall first satisfy the Engineer that they will be of such size and used in such a manner as not to cause any disturbance or damage in particular to water, electricity, Post Office or other mains, cables and connections or to sewers, culverts etc. or interfere with the line or position of any overhead wires and cables of any sort, telegraph poles, power poles etc.

The Contractor will be held liable for any such damage or disturbance and shall pay the full costs of any reinstatement, relaying, repairing or refixing as may be required, as agreed between the Engineer and the owner affected.

118. PROVISION OF INSTRUMENTS AND LABOUR

The Contractor shall provide at his own expenses all instruments, materials, tools and other things which the Engineer considers necessary for his proper supervision of the Works and shall maintain the same in good order. He shall also provide materials, an experienced Surveyor and labour for attendance on the Engineer and his representatives in carrying out operations connected with the supervision of the Works. All charges arising out of such services shall be deemed to be included in his rates in the Bill of Quantities.

119. ACCESS TO SITES

The Contractor shall construct and maintain all temporary accesses required for the execution of the Works. Access roads shall be constructed and maintained up to the site office and Resident / Assistant Resident Engineer's houses. The cost of all these Works shall be deemed to be covered by rates and prices quoted by the Contractor.

120. POLLUTION

The Contractor shall ensure that during the course of his operations no pollution of the atmosphere, rivers, reservoir catchment areas or groundwater is allowed to take place.

121. TREE PROTECTION

Trees within the permanent and temporary easement are the property of owners. Specific trees will be identified by the Engineer, prior to construction, and the Contractor shall neither remove nor cut their roots unless otherwise directed by the Engineer. If the roots of such trees appear within the trench areas, the Contractor shall handle the roots with maximum care so that no portion of the roots will be damaged. During the excavation of the trench, the exposed roots may be removed to a position that will not damage the roots and will not interfere with the pipelaying. During the construction, the roots shall be thoroughly protected by appropriate cover and wetted as directed. After the pipes are laid, the moved roots shall be placed back to the original locations and backfilled carefully by selected soft soil which can support vegetation.

122. GEOLOGICAL DATA

Any geological data that is made available to the Contractor and is relevant to the Works, will be for his guidance only, and no guarantee is given that other ground conditions will not be encountered. No claims based on the geological data provided shall be entertained by the Engineer. The Contractor shall be deemed to have made any additional investigations required before submission of his Tender.

123. WATCHING, FENCING AND LIGHTING

The Contractor shall arrange to employ watchmen to guard the Works both during the day and night from the commencement of the Works until the substantial completion of the Works.

Any excavation or other obstruction likely to cause injury or damage to any person or domestic animals must be fenced off as directed by the Engineer.

124. TIPS

The Contractor shall be responsible for provision of all tips, at his own expense, for disposal of all spoil or other rubbish collected during the construction of the Works. Any surplus excavated material not required shall also be carted away to these tips. The site of the tips must be approved by the Engineer.

125. TROPICALISATION

In choosing materials and their finishes, due regard shall be given to the tropical conditions of the site to which they will be subjected. The Contractor shall submit details of his practices which have proven satisfactory and which he recommends for application on the parts of the Works which may be affected by the tropical conditions.

126. MONTHLY SITE MEETINGS

Throughout the project period, site meetings will be held at the Resident Engineer's office once every calendar month to discuss the progress of the work, schedule for the ensuing month, methods of construction, procurement, transportation, labours, etc. These meetings can be called at any other time intervals at the request of the Contractor or as directed by the Engineer.

127. INSPECTION BY ENGINEER DURING DEFECTS LIABILITY PERIOD

The Engineer will give the Contractor due notice of his intention to carry out inspection during the Defects Liability Period and the Contractor shall upon receipt of such notice arrange for a responsible representative to be present at the times and dates named by the Engineer. This representative shall render all necessary assistance and take notice of all matters and things to which his attention is directed by the Engineer.

128. SUBMISSION OF SAMPLES

Before incorporating in the finished work any materials or articles which he supplies under the terms of the Contract, the Contractor shall submit to the Engineer's Representative for his approval a sample of each respective material or article, and such samples shall be delivered to and kept at his office for reference. All the respective kinds of materials and articles used in and upon the Works, shall be at least equal in quality to the approved samples. Each and every sample shall be a fair average of the bulk material or of the article which it represents. The Engineer's Representative may decide the method by which each sample to be taken from the bulk material shall be obtained.

129. RESPONSIBILITY FOR ORDERING MATERIALS AND MANUFACTURED ARTICLES AND SAMPLES FOR TESTING

The responsibility for so ordering and delivering materials and manufactured articles and samples that they may be tested sufficiently far in advance of the work as not to delay it, shall rest upon the Contractor, and he shall not be entitled to any time credit for delay occasioned by his neglect to order sufficiently well in advance or to effect payment of any costs he may incur as a result thereof.

With regard to any item in the Bill of Quantities which is the subject of a P.C. Sum, the Contractor shall notify the Engineer of his requirements as early as possible leaving ample time for the Engineer to make any necessary arrangements so that no delay occurs in the progress of the work.

130. TESTS OF MATERIALS AND MANUFACTURED ARTICLES BEFORE USE

Any or all of the materials and manufactured articles supplied by the Contractor for use on any of the Works throughout this Contract shall be subject in advance to tests as may be specified in the relevant Standard Specification as may from time to time be deemed necessary by the Engineer. Samples of all such materials and manufactured articles, together with all the necessary labour, materials, plant and apparatus for sampling and for carrying out of tests on the site on all such materials and manufactured articles shall be supplied by the Contractor at his own expenses. The cost of special tests ordered by the Engineer to be carried out by an independent person at a place other than the site or place of manufacture or fabrication shall be borne by the Contractor.

131. REJECTED MATERIALS

Should any material or manufactured articles be brought on to the site of the Works which are in the judgement of the Engineer unsound or of inferior quality or in any way unsuited for the work in which it is proposed to employ them, such materials or manufactured articles shall not be used upon the Works but shall be branded if, in the opinion of the Engineer, this is necessary and shall forthwith be removed from the site of the Works, all at the Contractor's expense and in each case as the Engineer shall direct.

132. QUALITY OF MATERIALS AND WORKMANSHIP

The materials and workmanship shall be of the best of their respective kinds and shall be to the approval of the Engineer. In the reading of this Specification the words “to the approval of the Engineer” shall be deemed to be included in the description of all materials incorporated in the Works, whether manufactured or natural and in the description of all operations for the due execution of the Works.

133. TEST RUNNING OF THE SCHEME

Upon substantial completion of the scheme and official inspection which agrees to this, the Contractor shall operate the entire scheme for the test period indicated in the Bill of Quantities.

The Contractor shall supply all necessary personnel, electricity, fuels, oils and chemicals for the test running and together with the Resident Engineer shall compile a list of detailed operating instructions that shall be incorporated into the Operation and Maintenance Manual. The Contractor shall further bring to the attention of the Resident Engineer and of the Employer’s operational staff any problem or defects he encounters during this period of test running so that solutions may be found and any necessary alterations made.

134. EQUIPMENT FOR THE RESIDENT ENGINEER

The Contractor shall provide 3 Nr Digital Cameras, Sony or approved equivalent, suitable for Construction Sites with splash and shock proof casing for exclusive use of the Engineer’s Representative and his Staff for the purpose of taking record photographs of the progress of the Works. The Cameras should have picture capture resolution of 7.1 megapixels or more, both optical and digital zoom capabilities, storage capacity of 128 MB, downloading facility by means of USB port, neck strap and hard cover pouch. The Contractor shall further provide 1 Nr suitable photo printer with necessary photo paper and colour ink cartridges for prints production for Monthly, Quarterly Progress Reports as directed by the Engineer’s Representative. The cost for this service is deemed to be covered by the Contractor in his rates in the Bills of Quantities.

135. OPERATION AND MAINTENANCE MANUAL

The Contractor shall prepare and submit to the Engineer for approval, a draft Operation and Maintenance Manual, three month prior to completion of works.

This Manual has to be revised and brought to a final draft prior to the test running of the Project. The Contractor is required to provide in triplicate, and in English, details of all the different manufactured plant and components incorporated in the Works including but not limited to all pertinent manufacturers’ brochures.

Substantial completion of the Project will not be considered until such detailed information as is required has been submitted to and accepted by the Engineer.

136. CONSTRUCTION PROGRAMME

The Contractor shall submit to the Engineer for approval, a revision of the Construction Programme attached in four (4) copies and after approval to the Employer in two (2) copies in the following manner:

- (1) Within thirty (30) days after receiving the Letter of Acceptance, the Contractor shall submit to the Engineer for approval, a detailed Programme based on the key date stated hereinafter or other dates which are given in the Letter of Acceptance in the form of a Critical Path Method (hereinafter referred to as CPM Network) showing the order of procedure in which he proposes to carry out the Works including design, manufacture, delivery to the site, transport, storage, survey, construction, commissioning and maintenance. This Programme shall indicate clearly all activities and its duration along with the earliest and the latest event, times and the first and last dates of the submission of the Drawings and each date of shop inspection by the Engineer for the section or portion of the Works.

The Programme so prepared shall be rearranged in the form of a Time Bar-chart Schedule of which size shall be 841mm x 594mm (A-1 size). This Time Bar-chart Schedule shall be submitted to the Engineer together with the CPM Network.

- (2) The CPM Network shall be in accordance with commonly accepted practices and shall show graphically the chain of activities / sub-activities and their sequential relationship with each other from the start of construction to the completion of the Contract. The Time Bar-chart Schedule shown in weeks shall list all main activities and its applicable sub-activities.
- (3) In preparing the CPM Network and the Time Bar-chart Schedule the Contractor shall make due allowances for possible delays. Under no circumstances shall the CPM Network or the Time Bar-chart Schedule show a completion in excess of the "Time for Completion" stated in the Form of Tender.
- (4) The Programme once approved by the Engineer shall thereafter be referred to as the Contractual Programme. The Engineer's approval of such Programme shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

The Contractual Programme approved shall supersede all other Programmes and shall be deemed to be the Programme on which the Contractor has based his Contract Sum and in accordance with which he will undertake the execution of the Works. This Programme shall become part of the Contract.

The Contractor shall ensure that all the Works especially Electrical and Mechanical Works which may be carried out by the Electrical/Mechanical Sub-Contractor, are well coordinated with the overall Works under the Contract for the efficient execution of the Works, and shall clearly indicate them on the construction programme.

The Contractor shall also describe the conditions of working shifts, if necessary, to execute the Works and whether work needs to be carried out at night and/or on Sundays and holidays. The Contractor should also indicate which particular Works are subject to these timings in his construction programme.

Whenever the Contractor proposes to change the Contractual Programme, approval of the revision shall be obtained in writing from the Engineer.

If the Contractor has fallen behind the approved Contractual Programme or can foresee delay(s) therein, he shall, immediately after such default or event occurred or foreseen or at the request of the Engineer submit a revision of the Contractual Programme showing the reasons of such a delay and the proposed measures to recover such delay or to complete the Works on time, for the approval of the Engineer.

137. AS-BUILT AND RECORD DRAWINGS

The Contractor shall prepare, and keep up-to-date, a complete set of “As-Built” records of the execution of the works, showing the exact “as-built” locations, sizes and details of the work as executed, with cross references to relevant specifications and data sheets. These records shall be kept on the Site and shall be used exclusively for the purposes of this specification. Two copies shall be submitted to the Engineers Representative prior to the commencement of the Tests on Completion of Works.

In addition, the Contractor shall prepare and submit to the Engineers Representative “as-built-drawings” of the works, showing all works as executed. The drawings shall be prepared as the works proceed, and shall be submitted to the Engineers Representative for his inspection. The Contractor shall obtain the consent of the Engineers Representative as to their size, the referring system, and other pertinent details.

Prior to the issue of any Taking-Over Certificate, the contractor shall submit to the Engineers Representative one full-size original copy, six printed copies of the relevant “as-built-drawings” and the corresponding computer files (AutoCAD, Excel, MS Word, etc.) on CD-ROM and any further Construction Documents specified in the Specifications. The works shall not be considered to be completed for the purposes of Taking-Over until such documents have been submitted to the Engineers Representative.

The compliance of this Clause by the Contractor is deemed to be covered in his rates as quoted in the Bid.

2. CLEARING SITE

201. **CLEARING SITE**

The Contractor shall demolish, break up and remove buildings, walls, gates, fences, advertisements and other structures and obstructions, grub up and remove trees, hedges, bushes and shrubs and clear the site of the works at such time and to the extent required by the Engineer but not otherwise, subject to the provisions of Clause 27 of the Conditions of Contract: the materials so obtained shall so far as suitable be reserved and stacked for further use; all rubbish and materials for use shall be destroyed or removed from the site, as directed by the Engineer.

Where top soil has to be excavated this shall be removed and stacked on site. After completion of construction, it shall be spread over the disturbed ground, any surplus being disposed of as directed by the Engineer.

Underground structures and chambers where required to be demolished, shall be demolished to depths shown on drawings or as directed. They shall be properly cleaned out and backfilled and compacted with suitable material to the direction and approval of the Engineer.

202. **VEGETATION**

No allowance will be made for the cutting and removal of crops, grass, weeds and similar vegetation. The cost of all such work will be held to be included in the rates entered in the Bill of Quantities.

203. **BUSHES AND SMALL TREES**

All bushes and small trees, the main stem of which is less than 500mm girth at 1 metre above ground level shall be uprooted (unless otherwise directed by the Engineer) and burnt or otherwise disposed off as directed by the Engineer.

204. **HEDGES**

Where directed by the Engineer, hedges shall be uprooted and disposed off by burning.

205. **FELLING TREES**

Where shown on the drawings or directed by the Engineer, trees shall be uprooted or cut down as near to ground level as is possible. The rates entered in the Bill of Quantities shall include for cutting down, removing branches and foliage, cutting useful timber into suitable lengths, loading, transporting not more than 1 km. and stacking or disposing off all as directed by the Engineer.

For the purpose of measurement trees cut down shall be classified according to their girth at 1 metre above ground level, the cost of grubbing up roots shall be deemed to be covered by the rate for felling trees.

206. GRUBBING-UP ROOTS

Stumps and tree roots shall, unless otherwise directed, be grubbed up, blasted, burnt or removed and disposed of in approved dumps to be provided by the Contractor. Where directed by the Engineer, the holes resulting from grubbing up shall be filled with approved materials, which shall be deposited and compacted in layers not exceeding 225mm loose depth, to the same dry density as that of the adjoining soil. For the purpose of measurement, tree roots shall be classified according to the mean diameter of the stump measured across the cut.

207. WEED CONTROL

The Contractor shall take all necessary precautions against the growth on the site of weeds and remove them as necessary throughout the period of works and maintenance.

The finished base of all footways and elsewhere as directed shall be sprayed with an approved persistent total herbicide at the rate recommended by the manufacturer. The application shall be by an even spray in a high volume of water at about 0.7 to 0.11 litres per square metre. After this application the footways shall receive at least two further waterings before the surface is sealed.

3. EXCAVATION

301. **DEFINITION AND CLASSIFICATION OF EXCAVATED MATERIALS**

Excavation in the Bills of Quantities shall be classified in two categories:-

1) Common Excavation

Any material which in the opinion of the Engineer can be excavated by use of pick axes and hand levers shall be classified as common excavation. Water logged material shall be included in this class. Murram in any form shall be classified as common excavation.

2) Rock

The decision of the Engineer in classifying rock shall be final and binding.

Rock in the Bill of Quantities will be itemised in three classes:-

Class 'A'

Soft rock of the type known locally as 'tuff' which in the opinion of the Engineer cannot be considered as hard rock but which considerably increases the amount of labour needed for its removal shall be known as Class 'A' rock.

Class 'B'

Very weathered phonolite lava containing many fissures and faults shall be known as hard rock. This type of rock contains stones and boulders of unweathered or incompletely formed blacktrap or lava. A boulder or outcrop of hard rock 1.5 cubic metres or less and grey or green building stone in a formation which is massive and geologically homogeneous, will be deemed to be Class 'B' rock.

Class 'C'

Phonolite in a formation which is massive and geologically homogeneous shall be known as Class 'C' rock.

302. **STORAGE AND HANDLING OF EXPLOSIVES AND BLASTING**

The removal of hard materials by use of explosives will normally be permitted subject to compliance by the Contractor in all respects with the Explosives Laws of Kenya.

In the Bill of Quantities hard material is classified as rock where blasting will be permitted subject to this clause.

The Contractor shall provide proper buildings or magazines in suitable positions for the storage of explosives in manner and quantities to be approved; he shall also be responsible for the prevention of any unauthorised issue or improper use of any explosives brought on the works and shall employ only licensed and responsible men to handle explosives for the purpose of the works.

The shots shall be properly loaded and tamped and where necessary, the Contractor shall use heavy mesh blasting nets. Blasting shall be restricted to such periods and such parts of the works as the Engineer may prescribe. If, in the opinion of the Engineer, blasting would be dangerous to persons or property or to any finished work or is being carried out in a reckless manner, he may prohibit it, and order the rock to be excavated by other means and payment will be made at the rate for rock for excavation where blasting is permitted. The use of explosives by the Contractor in large blasts, as in seams, drifts, pits, or large holes, is prohibited unless authorised in writing by the Engineer. In the event of wasting of rock through any such blasting, the Contractor shall if required by the Engineer, furnish an equivalent amount of approved materials for fill, 1 cubic metre of rock in-situ being taken to equal 1.5 cubic metre of material in embankment.

303. EXCAVATION FOR FILL

Where excavation reveals a combination of suitable and unsuitable materials, the Contractor shall, wherever the Engineer considers it practicable, carry out the excavation in such a manner that the suitable materials are placed separately for use in the works without contamination by the unsuitable materials.

If any suitable material excavated from within the site is, with the agreement of the Engineer, taken by the Contractor for his use, sufficient suitable filling material to occupy after specified compaction, a volume corresponding to that which the excavated material occupied, shall, unless otherwise directed by the Engineer be provided by the Contractor from his own sources.

No excavated material shall be dumped or run to spoil except on the direction or with the permission of the Engineer who may require material which is unsuitable to be retained on site. Material used for haul roads shall not be re-used without the permission of the Engineer.

304. COMPACTION OF FILL

All materials used in fill shall be compacted to specification by plant approved by the Engineer for that purpose. Maximum compacted thickness of such layers shall not be more than 200mm.

Work on the compaction of plastic materials for fill shall proceed as soon as practicable after excavation and shall be carried out only when the moisture content is not greater than 2 per cent above the plastic limit for that material. Where the moisture content of plastic material as excavated is

higher than this value the material shall be run to spoil and an equal volume of material suitable for filling shall be replaced, unless the Contractor prefers, at his own expense, to wait until the material has dried sufficiently for acceptance again as suitable material.

Nevertheless, if with any material the Engineer doubts whether compaction will be obtained within the above moisture limits he may require compaction to proceed only when the limits of moisture content for the compaction of non-plastic materials are within the range of the optimum moisture content and 3 per cent below the optimum moisture content as determined by the laboratory compaction test method described in British Standard 1377 : Methods of Test for Soil Classification and Compaction.

If any such non-plastic material on excavation is too wet for satisfactory compaction and the Engineer orders the moisture content to be lowered or raised, such work shall be treated as included in the rates. All adjustments of moisture content shall be carried out in such a way that the specified moisture content remains uniform throughout compaction.

Work shall be continued until a state of compaction is reached throughout the fill, which shall have relative compaction determined according to B.S. 1377 not less than 85% of maximum dry density at optimum moisture contents. For excavation under Roads, House Drives and Car Parks the backfilling shall be compacted in 150mm layer to 100% maximum dry density.

If with non-plastic materials the compacted material has become drier in the interval between the completion of compaction and the measurement of the state of compaction, then the moisture content to be used for the calculation of the air content shall be the mean moisture content for the compaction of such materials as specified above.

305. EMBANKMENTS OVER SEWERS

In carrying embankments over sewer pipes, care shall be taken by the Contractor to have the embankments brought up equally on both sides and over the top of any such structures. Earth embankments shall be formed and compacted in layers of 200mm as the Engineer may direct. The filling immediately adjacent to structures shall be deposited and compacted in accordance with the drawings and approved by the Engineer. The cost of these works shall be included in the prices entered in the Bill of Quantities for the excavations from which embankments are formed.

306. STONE REVETMENTS (STONE PITCHING)

Where shown on the drawings, the slopes of embankments, rivers, streams, watercourses and other surfaces shall be protected against water or other action by hand-set stone facing set on end. The larger stones shall be roughly dressed on the bed and face, and roughly square to the full depth of the joints. No rounded boulder shall be used, or stones less than 225mm in depth of 0.05 cubic metre in volume. The stones shall be laid to break bond, and shall be well bedded on to a 75mm layer of gravel or fine rubble rammed to a uniform surface and the whole work finished to the satisfaction of the Engineer. Where required, a trench shall be excavated at the bottom of the slope to such a depth as will ensure a safe foundation for the revetment.

307. TIPPED REFUSE ON SITE

Tipped refuse other than artificial deposits of industrial waste or shale found on the site shall be removed and disposed off in a spoil heap to be provided by the Contractor.

308. REMOVAL OF INDUSTRIAL WASTE, ETC.

Artificial deposits of industrial waste or shale found on the site shall be removed and disposed off as directed by the Engineer. Should any particular deposits consist of or contain material which in the opinion of the Engineer is suitable for incorporation in fills, all such material shall be used accordingly and deposited in layers and compacted as specified. The prices entered in the Bill of Quantities for the excavation of the material shall include loading, transportation, disposal and compaction of same as and where directed.

309. LAND SLIPS

Remedial works and/or the removal of materials in slips, slides or subsidences and overbreaks of rock extending beyond the lines and slopes, or below the levels shown on the drawings or required by the Engineer, will not be paid for.

310. CLASSIFICATION OF MATERIAL FROM SLIPS

The classification of material from slips or slides will be in accordance with its condition at the time of removal, regardless of prior condition. Measurement of overbreak in rock excavation shall be that of the space originally occupied by the material before the slide occurred and regardless of its subsequent classification.

311. BORROW PITS

Where for any reason, it becomes necessary to form borrow pits, these shall be located and the work executed in all respects to the instructions of the Engineer. They shall be regular in width and shape and admit of ready and accurate measurement, and shall be properly graded and drained and finished with neatly trimmed slopes.

312. STREAMS, WATERCOURSES AND DITCHES

Excavations carried out in the permanent diversion, enlargement, deepening, or straightening of streams, watercourses, or ditches shall be performed as directed by the Engineer. The rates for such excavations shall include for excavated materials and all pumping, timbering works, and materials necessary for dealing with the flow of water.

313. FILLING OLD WATERCOURSES

Where watercourses have to be diverted from the sites of embankments or other works, the original channels shall be cleared of all vegetable growths and soft deposits and carefully filled in with approved materials deposited and compacted as directed by the Engineer.

314. OPEN DITCHES

Open ditches for drainage purposes shall be cut where and of such cross section as the Engineer shall direct and where so required by him they shall be constructed before the cuttings are opened or the embankments begin. The sides shall be dressed fair throughout and the bottom accurately graded so as to carry off the water to the outlet to be provided. The material excavated from the ditches shall be disposed of as directed by the Engineer.

315. CLEARING EXISTING DITCHES

Where directed by the Engineer, existing ditches shall be cleared by removing vegetable growths and deposits. The sides shall be shaped fair throughout and the bottoms properly graded. Material removed from existing ditches shall be disposed of in tips provided by the Contractor. The rates included in the Bill of Quantities for clearing ditches shall include for maintaining and keeping clean until and up to maintenance period.

316. EXCAVATION FOR FOUNDATIONS BELOW OPEN WATER

The rates for excavation for foundations below the water level shall include for the cost of all temporary close timbering and shoring, sheet piling, coffer dams, caissons, pumps and other special appliances required and for the draining of any water in the excavation.

317. TRENCHES OF GREATER WIDTH AND DEPTH THAN NECESSARY

The Contractor shall not be entitled to payment in respect of excavation to any greater extent, whether horizontally or vertically, than is necessary to receive any structure for which the excavation is intended, except where a separate item is provided for additional excavation for working space, timbering, or other temporary work. Excavation to a greater depth or width than directed shall be made good with suitable materials to the satisfaction of the Engineer and at the Contractor's cost.

318. SUPPORTS FOR TRENCHES

The sides of trenches shall where necessary be adequately supported to the satisfaction of the Engineer by timber or other approved means.

319. PROVISION OF SPOIL HEAPS

The Contractor shall provide spoil heaps at his own expense for the disposal of surplus material and all rubbish collected when clearing the site and during the construction of the works. The sites for these shall be approved by the Engineer.

320. USE OF VIBRATORY COMPACTION PLANT

Where vibratory rollers or other vibratory compaction plant is used, the mechanism for vibration shall be kept working continuously during compaction operations, except during periods when the Engineer permits or directs discontinuance of vibration.

Unless otherwise permitted by the Engineer, the frequency for vibration shall be maintained within the range of amplitude and frequency recommended by the manufacturers of the plant for the material to be compacted. The frequency shall be recorded by a tachometer indicating speed of rotation of any shaft producing vibrations.

321. WATER IN EXCAVATIONS

All excavations shall be kept free from water, from whatever source, at all times during construction of works until in the opinion of the Engineer, any concrete or other works therein are sufficiently set. The Contractor's rates are deemed to cover compliance with this requirement.

The Contractor shall construct any sumps or temporary drains that the Engineer may deem necessary and shall be responsible for the removal and disposal of all water entering the excavations from whatever source and shall deal with and dispose of such water in a manner approved by the Engineer so as to ensure that excavations are kept dry.

The Contractor shall provide all plant, labour and materials required for such work and all costs incurred shall be deemed to be included in his rates for excavation.

4. CONCRETE

SCOPE OF SECTION

This section covers the materials, design of mixes, mixing, transport, placing, compaction and curing of concrete and mortar required in the Works. It also covers formwork and reinforcement for concrete.

DEFINITIONS

Structural concrete is any class of concrete which is used in reinforced, prestressed or unreinforced concrete construction, which is subject to stress.

Non-structural concrete is composed of materials complying with the Specification but for which no strength requirements are specified and which is used only for filling voids, blinding foundations and similar purposes where it is not subjected to significant stress.

A formed surface is a face which has been cast against formwork.

An unformed surface is a horizontal or nearly horizontal surface produced by screeding or trowelling to the level and finish required.

A pour refers to the operation of placing concrete into any mould, bay or formwork, etc. and also to the volume which has to be filled. Pours in vertical succession are referred to as lifts.

401. *THE DESIGN OF CONCRETE MIXES*

- a) Classes of concrete

The classes of structural concrete to be used in the works shall be those shown on the Drawings and designated in Table 4.1, in which the class designation includes two figures. The first figure is the nominal strength at 28 days expressed in N/mm^2 and the second figure is the maximum nominal size of aggregate in the mix expressed in millimetres.

- b) Design of proposed mixes

The Contractor shall design all the concrete mixes called for on the Drawings, making use of the ingredients which have been approved by the Engineer for use in the Works and in compliance with the following requirements:-

Table 4.1 - CONCRETE CLASSES AND STRENGTHS

| Class of Concrete | Nominal Strength N/mm ² | Maximum Nominal Size of Aggregate mm | Maximum Water / Cement Ratio | | Trial Mixes Target Mean Strength (Clause 401 c) N/mm ² | Early Works Test Cubes (Clause 401 d) | |
|-------------------|---------------------------------------|---|------------------------------|------|---|---------------------------------------|--|
| | | | A | B | | Any one Cube N/mm ² | Average of any Group of 4 Cubes N/mm ² |
| 10/75 | 10 | 75 | 0.60 | 0.55 | 13.5 | 8.5 | 13.3 |
| 15/75 | 15 | 75 | 0.60 | 0.50 | 21.5 | 12.8 | 20.0 |
| 15/40 | 15 | 40 | 0.60 | 0.50 | 21.5 | 12.8 | 20.0 |
| 15/20 | 15 | 20 | 0.57 | 0.50 | 21.5 | 12.8 | 20.0 |
| 20/40 | 20 | 40 | 0.55 | 0.48 | 31.5 | 17.0 | 27.5 |
| 20/20 | 20 | 20 | 0.53 | 0.48 | 31.5 | 17.0 | 27.5 |
| 20/10 | 20 | 10 | 0.50 | 0.48 | 31.5 | 17.0 | 27.5 |
| 25/40 | 25 | 40 | 0.52 | 0.46 | 36.5 | 21.3 | 32.5 |
| 25/20 | 25 | 20 | 0.50 | 0.46 | 36.5 | 21.3 | 32.5 |
| 25/10 | 25 | 10 | 0.48 | 0.46 | 36.5 | 21.3 | 32.5 |
| 30/40 | 30 | 40 | 0.50 | 0.45 | 41.5 | 25.5 | 37.5 |
| 30/20 | 30 | 20 | 0.48 | 0.45 | 41.5 | 25.5 | 37.5 |
| 30/10 | 30 | 10 | 0.47 | 0.45 | 41.5 | 25.5 | 37.5 |
| 40/20 | 40 | 20 | 0.46 | 0.43 | 51.5 | 34.0 | 47.5 |
| 40/10 | 40 | 10 | 0.45 | 0.43 | 51.5 | 34.0 | 47.5 |

NOTES: 1. Under water/cement ratio, column A applies to moderate and intermediate exposure, and column B applies to severe exposure. See NOTE after Table 4.2.

2. In case of concrete having a maximum aggregate size of 40mm or less, 150mm cubes should be used.

In case of concrete having a 75mm or larger aggregate, 200mm cubes should be used.

- i) The aggregate portion shall be well graded from the nominal maximum size of stone down to the 150 micron size.
- ii) The cement content shall be such as to achieve the strengths called for in Table 4.1 but in any case not less than the minimum necessary for impermeability and durability shown in Table 4.2.
- iii) The workability shall be consistent with ease of placing and proper compaction having regard to the presence of reinforcement and other obstructions.
- iv) The water/cement ratio shall be the minimum consistent with adequate workability but in any case not greater than that shown in Table 4.1 taking due account of any water contained in the aggregates. The Contractor shall take into account that this requirement may in certain cases require the inclusion of a workability agent in the mix.
- v) The drying shrinkage determined in accordance with BS 1881 shall not be greater than 0.05 percent.

Table 4.2 - MINIMUM CEMENT CONTENT

| Minimum Cement Content - kg/m ³ of Compacted Concrete | | | |
|---|----------------------|------------------------------|--------------------|
| Class of Concrete | Moderate Exposure | Intermedia te Exposure | Severe Exposure |
| 10/75,15/75 | 200 | 220 | 270 |
| 15/40, 20/40, 25/40, 30/40 | 240 | 270 | 290 |
| 15/20, 20/20, 25/20, 30/20 | 260 | 300 | 330 |
| 40/20 | 300 | 320 | 330 |
| 20/10, 25/10, 30/10 | 300 | 340 | 390 |
| 40/10 | 310 | 340 | 390 |

Note: the minimum cement contents shown in the above table are required in order to achieve impermeability and durability. In order to meet the strength requirements in the Specification higher contents may be required.

The categories applicable to the Works are based broadly on the factors listed hereunder:

Moderate exposure Surface sheltered from severe rain;
buried concrete, concrete continuously under water

| | |
|-----------------------|---|
| Intermediate exposure | Surface exposed to driving rain; alternate wetting and drying; traffic; corrosive fumes; heavy condensation |
| Severe exposure | Surface exposed to sea water, moorland water having a pH of 4.5 or less, groundwater containing sulphates. |

c) Trial mixes

At least six weeks before commencing placement of concrete in the Permanent Works trial mixes shall be prepared for each class of concrete specified.

For each mix of concrete for which the Contractor has proposed a design, he shall prepare three separate batches of concrete using the materials which have been approved for use in the works and the mixing plant which he proposes to use for the Works. The volume of each batch shall be the capacity of the concrete mixer proposed for full production.

Samples shall be taken from each batch and the following action taken, all in accordance with BS 1881:-

- i) The slump of the concrete shall be determined.
- ii) Six test cubes shall be cast from each batch. In the case of concrete having a maximum aggregate size of 40mm or less, 150mm cubes shall be used. In the case of concrete containing 75mm or larger aggregate, 200mm cubes shall be used and in addition any pieces of aggregate retained on a 53mm BS sieve shall be removed from the mixed concrete before casting the cubes.
- iii) Three cubes from each batch shall be tested for compressive strength at seven days and the remaining three at 28 days.
- iv) The density of all the cubes shall be determined before the strength tests are carried out.

Subject to the agreement of the Engineer, the compacting factor apparatus may be used in place of a slump cone. In this case the correlation between slump and compacting factor shall be established during preparation of the trial mixes.

The average strength of the nine cubes tested at 28 days shall be not less than the target mean strength shown in Table 4.1.

The Contractor shall also carry out tests to determine the drying shrinkage of the concrete unless otherwise directed by the Engineer.

Based on the results of the tests on the trial mixes, the Contractor shall submit full details of his proposals for mix design to the Engineer, including the type and source of each ingredient, the proposed proportions of each mix and the results of the tests on the trial mixes.

If the Engineer does not agree to a proposed concrete mix for any reason, the Contractor shall amend his proposals and carry out further trial mixes. No mix shall be used in the works without the written consent of the Engineer.

d) Quality control of concrete production

i) Sampling

For each class of concrete in production at each plant for use in the works, samples of concrete shall be taken at the point of mixing and/or of deposition as instructed by the Engineer, all in accordance with the sampling procedures described in BS 1881 and with the additional requirements as set out below.

Six number 150mm or 200mm cubes as appropriate shall be made from each sample and shall be cured and tested all in accordance with BS 1881, two at seven days and the other four at 28 days.

Each sample shall be taken from one batch selected at random and at intervals such that each sample represents not more than 20m³ of concrete unless the Engineer agrees to sampling at less frequent intervals.

Until compliance with the Specification has been established the frequency of sampling shall be three times that stated above or such lower frequency as may be instructed by the Engineer.

ii) Testing

- 1) The slump or compacting factor of the concrete shall be determined for each batch from which samples are taken and in addition for other batches at the frequency instructed by the Engineer.

The slump of the concrete in any batch shall not differ from the value established by the trial mixes by more than 25mm or one third of the value, whichever is the greater.

The variation in value of the compacting factor, if used in place of a slump value, shall be within the following limits:

For value of 0.9 or more +0.03

For value of between 0.8 and 0.9 +0.04

For values of 0.8 or less +0.05

- 2) The water/cement ratio as estimated from the results of (a) above, determined by samples from any batch shall not vary by more than five per cent from the value established during the trial mixes.

- 3) The air content of air entrained concrete in any batch shall be within 1.5 units of the required value and the average value of four consecutive measurements shall be within 1.0 unit of the required value, expressed as a percentage of the volume of freshly mixed concrete.
- 4) Until such time as sufficient test results are available to apply the method of control described in (e) below, the compressive strength of the concrete at 28 days shall be such that no single result is less than the value shown in Table 4.1 under the heading early works test cubes' and also that the average value of any four consecutive results is not less than the value shown in Table 4.1 under the same heading.

The 7-day cube result may be used as an early strength indicator, at the discretion of the Engineer.

- 5) When test cube results are available for at least 20 consecutive batches of any class of concrete mixed in any one plant, the average of any four consecutive results at 28 days shall exceed the nominal strength by not less than half the current margin (Table 4.3) and each individual result shall not be less than 85 per cent of the nominal strength.

The current margin shall be defined as 1.64 times the standard deviation of cube tests on at least 20 separate consecutive batches produced from one plant over a period exceeding five days but not exceeding six months or on at least 50 separate consecutive batches produced from one plant over a period not exceeding 12 months. If both figures are available, the smaller shall be taken.

The current margin shall in any case not be less than the figure given below:-

Table 4.3 - MINIMUM CURRENT MARGIN FOR TEST CUBES

| | Minimum Current Margin for | | |
|------------------|----------------------------|--------------------------------|---------------------|
| | 10N/mm ² | 15N/mm ² & above | 20N/mm ² |
| After 20 batches | 3.3 | 5 | 7.5 |
| After 50 batches | 1.7 | 2.5 | 3.8 |

Failure to comply with requirements:

If any one test cube result in a group of four consecutive results is less than 85% of the nominal strength but the average of the group of which it is part satisfies the strength requirement, then only the batch from which the failed cube was taken shall be deemed not to comply with the Specification.

If more than one cube result in a group of four consecutive results is less than 85% of the nominal strength or if the average strength of the group fails to satisfy the strength requirement then all the batches between those represented by the first and last cubes in the group shall be deemed not to comply with the Specification, and the Contractor shall immediately adjust the mix design subject to the agreement of the Engineer to restore compliance with the Specification. After adjustment of the mix design the Contractor will again be required to comply with sub-clauses 401(b) and 401(c) of this Section of the Specification.

The Contractor shall take necessary action to remedy concrete which does not comply with this Specification. Such action may include but is not necessarily confined to the following:-

- i) Increasing the frequency of sampling until control is again established.
- ii) Cutting test cores from the concrete and testing in accordance with SRN 117.
- iii) Carrying out strengthening or other remedial work to the concrete where possible or appropriate.
- iv) Carrying out non-destructive testing such as load tests on beams.
- v) Removing the concrete.

402. MIXING CONCRETE

Before any plant for batching, mixing, transporting, placing, compacting and finishing concrete is ordered or delivered to site, the Contractor shall submit to the Engineer full details including drawings of all the plant which he proposes to use and the arrangements he proposes to make.

Concrete for the Works specifically for Olobanita Pumping Station, Collector Tank, Chlorination Building shall be and mixed using an automatic batching plant in one or more central location. If the Contractor proposes to use ready mixed concrete he shall submit to the Engineer for his approval full details and test results of the concrete mixes. The Engineer may approve the use of ready mixed concrete provided that:

- a) the proposed mixes, the material to be used and the method of storage and mixing comply with the requirements of the Specification;
and
- b) adequate control is exercised during mixing.

Approval for the use of ready mixed concrete may be withdrawn if the Engineer is not satisfied with the control of the materials being used and control during mixing.

The mixing of concrete shall be carried out at central plant located at a site remote from place of discharge of mixed concrete. The mixed concrete shall be transported from the central plant using transit lorry mixers and/or agitator trucks.

Batching and mixing plants shall be modern efficient equipment complying with the requirements of SRN 118 and capable of producing a uniform distribution of the ingredients throughout the mass. Truck mixes shall comply with the requirements of SRN 121 and shall only be used with the prior agreement of the Engineer. If the plant proposed by the Contractor does not fall within the scope of SRN 118, it shall have been tested in

accordance with SRN 119 and shall have a mixing performance within the limits specified in SRN 118.

All mixing operations shall be under the control of an experienced supervisor.

The aggregate storage bins shall be provided with drainage facilities arranged so that drainage water is not discharged to the weigh hoppers. Each bin shall be drawn down at least once per week and any accumulations of mud or silt removed.

Cement and aggregate shall be batched by weight. Water may be measured by weight or volume.

The weighing and water dispensing mechanisms shall be maintained in good order. Their accuracy shall be maintained within the tolerances described in SRN 118 and checked against accurate weighs and volumes when required by the Engineer.

The weighs of cement and of each size of aggregate as indicated by the mechanisms employed shall be within a tolerance of plus or minus two percent of the respective weights per batch agreed by the Engineer.

The Contractor shall provide standard test weights at least equivalent to the maximum working load used on the most heavily loaded scale and other auxiliary equipment required for checking the satisfactory operation of each scale or other measuring device. Tests shall be made by the Contractor at least once a week or at intervals to be determined by the Engineer and shall be carried out in his presence. For the purpose of carrying out these tests, there shall be easy access for personnel to the weigh hoppers. The Contractor shall furnish the Engineer with copies of the complete results of all check tests and shall make any adjustments, repairs or replacements necessary to ensure satisfactory performance.

The nominal drum or pan capacity of the mixer shall not be exceeded. The turning speed and the mixing time shall be as recommended by the manufacturer, but in addition, when water is the last ingredient to be added, mixing shall continue for at least one minute after all the water has been added to the drum or pan.

The blades of pan mixers shall be maintained within the tolerances specified by the manufacturer of the mixer and the blades shall be replaced when it is no longer possible to maintain the tolerances by adjustment.

Mixers shall be fitted with an automatic recorder registering the number of batches discharged.

The water to be added to the mix shall be reduced by the amount of free water contained in the coarse and fine aggregates. This amount shall be determined by the Contractor by a method agreed by the Engineer

immediately before mixing begins each day and thereafter at least once per hour during concreting and for each delivery of aggregates during concreting. When the correct quantity of water, determined as set out in the Specification, has been added to the mix, no further water shall be added, either during mixing or subsequently.

After mixing for the required time, each batch shall be discharged completely from the mixer before any materials for the succeeding batch are introduced.

Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed and thereafter the first batch of concrete through the mixers shall contain only half the normal quantity of coarse aggregate. This batch shall be mixed for one minute longer than the time applicable to a normal batch.

Mixers shall be cleaned out before changing to another type of cement.

403. HAND-MIXED CONCRETE

Concrete for structural purposes shall not be mixed by hand. Where non-structural concrete is required, hand mixing may be carried out subject to the agreement of the Engineer.

The mixing shall be done on a hard impermeable surface. The materials shall be turned over not less than three times dry, water shall then be sprayed on and the materials again turned over not less than three times in a wet condition and worked together until a mixture of uniform consistency is obtained.

For hand mixed concrete the specified quantities of cement shall be increased by 10% and not more than 0.5 cubic metre shall be mixed at one time. During windy weather efficient precautions shall be taken to prevent cement from being blown away during the process of gauging and mixing.

404. TRANSPORT OF CONCRETE

The concrete shall be discharged from the mixer and transported to the Works by means which shall prevent adulteration, segregation or loss of ingredients, and which shall ensure that the concrete is of the required workability and consistency at the point and time of placing. The loss of slump between discharge from the mixer and placing shall not exceed 25mm. The mixed concrete shall be transported using agitator trucks or transit truck mixers. The agitating speed of the drum shall be between 2 and 4 rpm. The interval between feeding of water into the mixer drum and final discharging of the concrete shall not exceed one hour.

The time elapsed between mixing and placing a batch of concrete shall be as short as practicable and in any case not longer than will permit completion of placing and compaction before the onset of initial set. If the placing of any batch of concrete is delayed beyond this period, the concrete shall not be placed in the Works.

405. **PLACING OF CONCRETE**

a) Consent for placing

Concrete shall not be placed in any part of the Works until the Engineer's consent has been given in writing, and the Contractor shall give the Engineer at least 1 full working day's notice of his intention to place concrete.

If concrete placing is not commenced within 24 hours of the Engineer's consent the Contractor shall again request consent as specified above.

b) Preparation of surface to receive concrete

Excavated surfaces on which concrete is to be deposited shall be prepared as set out in Section 3 of this Specification.

Existing concrete surfaces shall be prepared as set out in Clause 414. Before deposition of further concrete they shall be clean, hard and sound and shall be wet but without any free-standing water.

Any flow of water into an excavation shall be diverted through proper side drains to a sump, or be removed by other suitable methods which will prevent washing away the freshly deposited concrete or any of its constituents. Any underdrains constructed for this purpose shall be completely grouted up when they are no longer required by a method agreed by the Engineer.

Unless otherwise instructed by the Engineer surfaces against which concrete is to be placed shall receive a prior coating of mortar mixed in the proportions similar to those of the fines portion in the concrete to be placed. The mortar shall be kept ahead of the concrete. The mortar shall be well worked into all parts of the excavated surface and shall not be less than 5mm thick.

If any fissures have been cleaned out as described in Section 3 of this Specification they shall be filled with mortar or with concrete as instructed by the Engineer.

The amount of mortar placed at any one time shall be limited so that it does not dry out or set before being covered with concrete.

c) Chutes

In general, transportation of concrete by the use of chutes will not be permitted unless approved by the Engineer. The chute shall have a section with round corners and shall have a proper fixed slope so as to allow the concrete to flow satisfactorily and without segregation. The lower end of chute shall be provided with a drop chute not less than 0.6m in height to avoid segregation of falling concrete. The height of

drop shall not exceed 1.5m. Chutes shall be protected from direct sunlight, wind and rain.

d) Concrete pump or placer

The type and capacity of pump shall be determined to meet the specified requirements, taking into account the placing speed, construction schedule, quality of concrete, location to which concrete is poured, etc. Diameter of the delivery pipes shall be not smaller than 3 times of the maximum size of aggregates to be used in the concrete.

Delivery pipes shall be so installed as to permit easy removal. Before starting the pump or placer operation, about one cubic metre of mortar with the same proportion of water, admixture, cement and fine aggregate as designated for the regular concrete mix shall be passed through the pipe. The pipe shall be set as straight and horizontally as possible to prevent clogging of the concrete mix in the pipe. The supports of the pipe line shall be stiff enough to fix the pipes firmly without adverse effect on forms and reinforcing steel already set in position. Care shall be taken to prevent leakage of the concrete mix from the pipe line or any other part.

Air boosters shall not be used except in conditions where the outlet of the pipe is completely embedded at least 2 metres in fresh concrete.

e) Placing procedures

The concrete shall be deposited as nearly as possible in its final position. It shall be placed so as to avoid segregation of the concrete and displacement of the reinforcement, other embedded items, or formwork. It shall be brought up in layers approximately parallel to the construction joint planes and not exceeding 500mm in compacted thickness unless otherwise permitted or directed by the Engineer, but the layers shall not be thinner than four times the maximum nominal size of aggregate.

Layers shall be placed so that they do not form feather edges nor shall they be placed on a previous layer which has taken its initial set. In order to comply with this requirement, a layer may be started before completion of the preceding layer.

All the concrete in a single bay or pour shall be placed in a continuous operation. It shall be carefully worked round all obstructions, irregularities in the foundations and the like so that all parts are completely full of compacted concrete with no segregation or honeycombing. It shall also be carefully worked round and between waterstops, reinforcement, embedded steelwork and similar items which protrude above the surface of the completed pour.

All work shall be completed on each batch of concrete before its initial set commences and thereafter the concrete shall not be disturbed before it has set hard. No concrete that has partially hardened during transit shall be used in the Works and the transport of concrete from the mixer to the point of placing shall be such that this requirement can be complied with.

Concrete shall not be placed during rain which is sufficiently heavy or prolonged as to wash mortar from coarse aggregate on the exposed faces of fresh concrete. Means shall be provided to remove any water accumulating on the surface of the placed concrete. Concrete shall not be deposited into such accumulation of water.

In drying weather, covers shall be provided for all fresh concrete surfaces which are not being worked on. Water shall not be added to concrete for any reason.

When concrete is discharged above its place of final deposition, segregation shall be prevented by the use of chutes, downpipes, trunking, baffles or other appropriate devices, as approved by the Engineer.

Forms for walls, columns and other thin sections of significant height shall be provided with openings or other devices that will permit the concrete to be placed in a manner that will prevent segregation and accumulations of hardened concrete on the formwork or reinforcement above the level of the placed concrete.

When it is necessary to place concrete under water the Contractor shall submit to the Engineer his proposals for the method and equipment to be employed. The concrete shall be deposited either by bottom-discharging watertight containers or through funnel-shaped tremies which are kept continuously full with concrete up to level above the water and which shall have the discharging bottom fitted with a trapdoor and immersed in the concrete in order to reduce to a minimum the contact of the concrete with the water. Special care shall be taken to avoid segregation.

If the level of concrete in a tremie pipe is allowed to fall to such an extent that water enters the pipe, the latter shall be removed from the pour and filled with concrete before being again lowered into the placing position. During and after concreting under water, pumping or dewatering in the immediate vicinity shall be suspended if there is any danger that such work will disturb the freshly placed concrete.

f) Interruptions to placing

If concrete placing is interrupted for any reason and the duration of the interruption cannot be forecast or is likely to be prolonged, the Contractor shall immediately take the necessary action to form a construction joint so as to eliminate as far as possible feather edges

and sloping top surfaces and shall thoroughly compact the concrete already placed in accordance with Clause 406. All work on the concrete shall be completed while it is still plastic and it shall not thereafter be disturbed until it is hard enough to resist damage. Plant and materials to comply with this requirement shall be readily available at all times during concrete placing.

Before concreting is resumed after such an interruption the Contractor shall cut out and remove all damaged or uncompacted concrete, feather edges or any other undesirable features and shall leave a clean sound surface against which the fresh concrete may be placed.

If it becomes possible to resume concrete placing without contravening the Specification and the Engineer consents to a resumption, the new concrete shall be thoroughly worked in and compacted against the existing concrete so as to eliminate any cold joints.

g) Dimensions of pours

Unless otherwise agreed by the Engineer, pours shall not be more than two metres high and shall as far as possible have a uniform thickness over the plan area of the pour. Concrete shall be placed to the full planned height of all pours except in the circumstances described in sub-clause 405(d).

The Contractor shall plan the dimensions and sequence of pours in such a way that cracking of the concrete does not take place due to thermal or shrinkage stresses.

h) Placing sequence

The Contractor shall arrange that as far as possible the intervals between placing successive lifts of concrete in one section of the Works are of equal duration. This duration shall normally be not less than three or more than seven days under temperate weather conditions unless otherwise agreed by the Engineer.

Where required by the Engineer to limit the opening of construction joints due to shrinkage, concrete shall not be placed against adjacent concrete which is less than 21 days old.

When the drawings call for contraction gaps in concrete, these shall be of the widths and in the locations shown on the drawings and they shall not be filled until the full time interval shown on the drawings has elapsed.

406. COMPACTION OF CONCRETE

The concrete shall be fully compacted throughout the full extent of the placed layer. It shall be thoroughly worked against the formwork and around any reinforcement and other embedded items, without displacing them. Particular care shall be taken at arises and other confined spaces. Successive layers of the same pour shall be thoroughly worked together.

Concrete shall be compacted with the assistance of mechanical immersion vibrators, unless the Engineer agrees to another method.

Immersion vibrators shall operate at a frequency of between 7,000 and 10,000 cycles per minute. The Contractor shall ensure that vibrators are operated at pressures and voltages not less than those recommended by the manufacturer in order that the compactive effort is not reduced.

A sufficient number of vibrators shall be operated to enable the entire quantity of concrete being placed to be vibrated for the necessary period and, in addition, standby vibrators shall be available for instant use at each place where concrete is being placed.

Where the concrete contains aggregate with a nominal size of 75mm or more, vibrators with a diameter of 100mm or more shall be used.

Vibration shall be continued at each point until the concrete ceases to contract, a thin layer of mortar has appeared on the surface and air bubbles have ceased to appear. Vibrators shall not be used to move concrete laterally and shall be withdrawn slowly to prevent the formation of voids.

Vibration shall not be applied by way of reinforcement nor shall vibrators be allowed to touch reinforcement or other embedded items. The vibrators shall be inserted vertically into the concrete to penetrate the layer underneath at regular spacing. The spacing shall not exceed the distance from the vibrator over which vibration is visibly effective.

407. CURING OF CONCRETE

a) General

Concrete shall be protected during the first stage of hardening from loss of moisture and from the development of temperature differentials within the concrete sufficient to cause cracking. The methods used for curing shall not cause damage of any kind to the concrete.

Curing shall be continued for as long as may be necessary to achieve the above objectives but in any case for at least seven days or until the concrete is covered by later construction whichever is the shorter period.

The above objectives are dealt with in sub-clause 407(b) and (c) but nothing shall prevent both objectives being achieved by a single method where circumstances permit.

The curing process shall commence as soon as the concrete is hard enough to resist damage from the process, and in the case of large areas or continuous pours, shall commence on the completed section of the pour before the rest of the pour is finished.

Details of the Contractor's proposals for curing concrete shall be submitted to the Engineer before the placing of concrete commences in the Works.

Formed surfaces may be cured by retaining the formwork in place for the required curing period.

If the use of the foregoing methods is inappropriate, surfaces which will not have further concrete bonded to them and which are not to receive an application of a finish may be cured by the application of a curing compound having an efficiency index of at least 90 percent. Curing compounds shall contain a fugitive dye to enable the extent of the spread to be seen easily.

Curing compound is used on surfaces exposed to the atmosphere shall contain sufficient finely divided flake aluminium in suspension to produce a complete coverage of the surface with a metallic finish when applied at the rate recommended by the manufacturer.

Curing compounds shall become stable and impervious to the evaporation of water from the concrete surface within 60 minutes of application. The material shall not react chemically with the concrete surfaces for at least the first four days of the curing period.

If instructed by the Engineer, the Contractor shall, in addition to the curing provisions set out above provide a suitable form of shading to prevent the direct rays of the sun reaching the concrete surfaces for at least the first four days of the curing period.

b) Loss of moisture

Exposed concrete surfaces shall be closely covered with impermeable sheeting, properly secured to prevent its removal by wind and the development of air spaces beneath it. Joints in the sheeting shall be lapped by at least 300mm.

If for some reason it is not possible to use impermeable sheeting, the Contractor shall keep the exposed surfaces continuously wet by means of a water spray or by covering with a water absorbent material which is kept wet, unless this method conflicts with sub-clause 407(c).

Water used for curing shall be of the same quality as that used for concrete mixing as stated in sub-clause 702(g).

c) Limitation of temperature differential

The Contractor shall limit the development of temperature differentials in concrete after placing by any means appropriate to the circumstances including the following:

- i) limiting concrete temperatures at placing as set out in sub-clause 409(b);
- ii) use of low heat cement, subject to the agreement of the Engineer;
- iii) insulation of exposed concrete surface by insulating blankets. Such blankets shall have an insulation value at least equivalent to 50mm of dry mineral wool;
- iv) leaving formwork in place during the curing period. Steel forms shall be suitably insulated on the outside;
- v) preventing rapid dissipation of heat from surfaces by shielding from wind;
- vi) avoiding the use of water sprays when such use would cause rapid cooling of the surface.

408. PROTECTION OF FRESH CONCRETE

Freshly placed concrete shall be protected from rainfall and from water running over the surface until it is sufficiently hard to resist damage from these causes.

No traffic shall be allowed on any concrete surface until such time as it is hard enough to resist damage by such traffic.

Concrete placed in the Works shall not be subjected to any loading until it has attained at least its nominal strength as defined in Clause 401.

If the Contractor desires to impose loads on newly-placed concrete, he shall make at least three test cubes and cure them in the same conditions as the concrete they represent. These cubes shall be tested singly at suitable intervals in order to estimate the time at which the nominal strength is reached.

409. CONCRETING IN HOT WEATHER

a) General

The Contractor shall prevent damage to concrete arising from exposure to extreme temperatures, and shall maintain in good working order all plant and equipment required for this purpose.

In the event that conditions become such that even with the use of the equipment the requirements cannot be met, concrete placing shall immediately cease until such time as the requirements can again be met.

b) Concrete placing in hot weather

During hot weather the Contractor shall take all measures necessary to ensure that the temperature of concrete at the time of placing in the Works does not exceed 30 degrees centigrade and that the concrete does not lose any moisture during transporting and placing.

Such measures may include but are not necessarily limited to the following:-

- i) Shielding aggregates from direct sunshine.
- ii) Use of a mist water spray on aggregates
- iii) Sun shields on mixing plants and transporting equipment.
- iv) Cooling the mixing water. If ice is used for this purpose it should preferably be in flake form. Lump ice shall not be allowed to enter the tank supplying the mixer drum.
- v) Covering skips closely with polythene sheet so that the latter is in contact with the concrete.

Areas in which concrete is to be placed shall be shielded from direct sunshine and rock or concrete surfaces shall be thoroughly wetted to reduce absorption of water from the concrete placed on or against them.

After concrete in any part of an area has been placed, the selected curing process shall be commenced as soon as possible. If any interval occurs between completion of placing and start of curing, the concrete shall be closely covered during the interval with polythene sheet to prevent loss of moisture.

410. FINISHES ON UNFORMED SURFACES

Horizontal or nearly horizontal surfaces which are not cast against formwork shall be finished to the class shown on the drawings and defined hereunder.

UF 1 Finish

All surfaces on which no higher class of finish is called for on the drawings or instructed by the Engineer shall be given a UF 1 finish.

The concrete shall be levelled and screeded to produce a uniform plain or ridged surface, surplus concrete being struck off by a straight edge immediately after compaction.

UF 2 Finish

This is a floated finish for roof or floor slabs and other surfaces where a hard trowelled surface is not required.

The surface shall first be treated as a Class UF 1 finish and after the concrete has hardened sufficiently, it shall be floated by hand or machine sufficiently only to produce a uniform surface free from screed marks.

UF 3 Finish

This is a hard trowelled surface for use where weather resistance or appearance is important, or which is subject to high velocity water flow.

The surface shall be floated as for a UF 2 finish but to the tolerance stated below. When the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, it shall be steel trowelled under firm pressure to produce a dense, smooth uniform surface free from trowel marks.

Table 4.4 - SURFACE TOLERANCES

| Class of Finish | Tolerance in mm. See notes | | |
|-----------------|----------------------------|----|----------------|
| | A | B | C |
| UF 1 | N/A | 10 | + 20 or - 10 |
| UF 2 | Nil | 10 | + 20 or - 10 |
| UF 3 | Nil | 5 | + 12.5 or -7.5 |

Notes:

1. Col. A is the maximum allowable value of any sudden change of level in the surface.
2. Col. B is the maximum allowable value of any gradual irregularity of the surface, as indicated by the gap between the surface and a three metre long straight edge or correctly shaped template placed on the surface.
3. Col. C is the maximum allowable value of the difference in level or position between a three metre long straight edge or correctly shaped template placed on the surface and the specified level or position of that surface.

Where dimensional tolerances are given on the drawings or in this Special Specification they shall take precedence over those given in Table 4.4.

411. MORTAR

This clause covers mortar for use ahead of concrete placing, and other uses not covered elsewhere in the Specification.

Mortar shall be composed of fine aggregate complying with sub-clause 724(c) and ordinary Portland cement complying with SRN 103. The mix proportions shall be as stated on the drawings or elsewhere in this Specification or if not stated shall be one part of cement to two parts of fine aggregate by weight.

Small quantities of mortar may be hand mixed but for amounts over 0.5 cubic metre a mechanical mixer shall be used.

The water content of the mortar shall be as low as possible consistent with the use for which it is required but in any case the water/cement ratio shall not be more than 0.5.

Mortar which is specified as 'dry pack' shall be mixed with sufficient water for the mix to become cohesive but not plastic when squeezed in the hand. Dry pack mortar shall be rammed into the cavity it is required to fill, using a hand rammer with sufficient force to ensure full compaction.

412. CONCRETE FOR SECONDARY PURPOSES

- a) Non-structural concrete (NS concrete) shall be used only for non-structural purposes where shown on the drawings.

NS concrete shall be composed of ordinary Portland cement complying with SRN 103 and aggregates complying with SRN 108-111 including all-in aggregate within the grading limits of SRN 109 and SRN 111. The weight of cement mixed with 0.3 cubic metres of combined or all-in aggregate shall not be less than 50 kg. The mix shall be proportioned by weight or by volume. The maximum aggregate size shall be 40mm nominal.

The concrete shall be mixed by machine or by hand to a uniform colour and consistency before placing. The quantity of water used shall not exceed that required to produce a concrete with sufficient workability to be placed and compacted where required.

The concrete shall be compacted by hand or by mechanical vibration.

- b) No Fines concrete (NF concrete) is intended for use where a porous concrete is required and shall only be used where shown on the drawings or instructed by the Engineer.

The mix shall consist of ordinary Portland cement complying with SRN 115. The aggregate size shall be 40mm to 10mm only. The weight of

cement mixed with 0.3 cubic metre of aggregate shall not be less than 50 kg. The quantity of water shall not exceed that required to produce a smooth cement paste which will coat evenly the whole of the aggregate.

413. RECORDS OF CONCRETE PLACING

Records, in a form agreed by the Engineer, shall be kept by the Contractor of the details of every pour of concrete placed in the Works. These records shall include class of concrete, location of pour, date of pour, ambient temperature and weather conditions during mixing and placing and concrete temperature at time of placing, moisture contents of aggregates, details of mixes, batch numbers, cement batch number, results of all tests undertaken, location of test cube sample points and details of any cores taken.

The Contractor shall supply to the Engineer four copies of these records each week covering work carried out the preceding week. In addition he shall supply to the Engineer monthly histograms of all 28 day cube strengths together with accumulative and monthly standard deviations and any other information which the Engineer may require concerning the concrete placed in the works.

414. CONSTRUCTION JOINTS

Whenever concrete is to be bonded to other concrete which has hardened, the surface of contact between the sections shall be deemed a construction joint.

Where construction joints are shown on the drawings, the Contractor shall form such joints in those positions. The location of joints which the Contractor requires to make for the purpose of construction shall be subject to the agreement of the Engineer. Construction joints shall be in vertical or horizontal planes except in sloping slabs where they shall be normal to the exposed surface or elsewhere where the drawings require a different arrangement.

Construction joints shall be so arranged as to reduce to a minimum the effects of shrinkage in the concrete after placing, and shall be placed in the most advantageous positions with regard to stresses in the structures and the desirability of staggering joints.

Feather edges of concrete at joint shall be avoided and any feather edges which may have formed where reinforcing bars project through a joint shall be cut back until sound concrete has been reached.

The intersection of horizontal or near horizontal joints and exposed faces of concrete shall appear as straight lines produced by use of a guide strip fixed to the formwork at the top of the concrete lift, or by other means acceptable to the Engineer.

Construction joints formed as free surfaces shall not exceed a slope of 20 per cent from the horizontal.

The surface of the fresh concrete in horizontal or near horizontal joints shall be thoroughly cleaned and roughened by means of high pressure water and air jets when the concrete is hard enough to withstand the treatment without the leaching of cement. The surface of vertical or near vertical joints shall be similarly treated if circumstances permit the removal of formwork at a suitable time.

Where concrete has become too hard for the above treatment to be successful, the surface whether formed or free is to be thoroughly scabbled by mechanical means or wet sand blasted and then washed with clean water. The indentations produced by scabbling shall be not less than 10mm deep and shall not extend closer than 40mm to a finished face.

If instructed by the Engineer the surface of the concrete shall be thoroughly brushed with a thin layer of mortar composed of one part of cement to two parts of sand by weight and complying with Clause 411 all as set out in sub-clause 405(b) immediately prior to the deposition of fresh concrete. The mortar shall be kept just ahead of the fresh concrete being placed and the fresh layer of concrete shall be thoroughly and systematically vibrated to full depth to ensure complete bond with the adjacent layer.

No mortar or concrete may be placed in position on or against a construction joint until the joint has been inspected and passed by the Engineer.

415. EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints are discontinuities in concrete designed to allow thermal or other movements in the concrete.

Expansion joints are formed with a gap between the concrete faces to permit subsequent expansion of the concrete. Contraction joints are formed to permit initial contraction of the concrete and may include provision for subsequent filling.

Expansion and contraction joints shall be formed in the positions and in accordance with the details shown on the drawings or elsewhere in the Specifications.

416. WATERSTOPS

All references to waterstops include groutstops.

Waterstops shall be of the material and form shown on the drawings. No waterstop material shall be brought on the site until the Contractor has submitted full details of the materials he proposes to use, including samples, and these have been tested and approved by the Engineer. All samples shall be of adequate length for testing.

Waterstops shall be made of materials which are resistant to chlorides, sulphates, or other deleterious substances which may be present in the environment of the Works.

Rubber waterstops may be of natural rubber and shall have an elongation at breaking stress of at least 500 percent at 25 degrees centigrade and shall allow a joint movement of at least 50mm.

Polyvinyl chloride (PVC) waterstops shall be extruded from an unfilled plasticised PVC polymer or copolymer which does not contain any reclaimed or scrap PVC. PVC waterstops shall have an elongation at breaking stress of at least 225 percent at 25 degrees centigrade and shall allow a joint movement of at least 10mm.

Low modulus waterstops shall be of rubber or PVC as described above but shall have an elongation of at least 200 percent at 25 degrees centigrade under a tensile stress of 6 N/mm² and shall allow a joint movement of at least 50mm.

Waterstops shall be supplied in lengths as long as possible consistent with ease of handling and construction requirements.

In rubber or plastic materials, joints other than butt joints shall be supplied ready made by the manufacturer. Butt joints shall be made on site in accordance with the manufacturer's instructions and with equipment supplied for the purpose by the manufacturer.

Waterstop material shall be stored carefully on site to avoid damage and contamination with oil, grease, or other pollutants. Rubber and plastic waterstops shall be stored in cool well ventilated places away from direct sunlight.

Rubber and plastic waterstops which are embedded in one side of a joint more than one month before the scheduled date of placing concrete on the other side, shall be protected from the sun.

Waterstops shall be firmly fixed in the formwork so that they cannot be displaced during concrete placing and shall be completely free of all dirt, grease, oil, etc., before placing concrete. Where eyelets are provided these shall be fully wired to the reinforcement and be the only means whereby the waterstop is fixed. In no circumstances shall a waterstop be punctured with nails etc. as a means of fixing.

Concrete shall be placed carefully round waterstops so as to avoid distortion or displacement and shall be fully compacted. Where waterstops lie in a horizontal or nearly horizontal plane the Contractor shall ensure that no voids are left on the underside of the waterstop.

Formwork around waterstops shall be carefully removed to avoid damage. If waterstops suffer any damage which cannot be properly repaired in-situ the Engineer may require a section of concrete to be removed and the waterstop replaced.

417. GROUTING OF POCKETS AND HOLES AND UNDERPINNING OF BASEPLATES

Pockets and holding-down bolt holes shall be thoroughly cleaned out using compressed air and water jet. Holes drilled by a diamond bit shall be roughened. The pockets and holes shall be filled with grout consisting of cement and clean fresh water mixed in proportion of two parts by weight of cement to one part by weight of water. The pouring of liquid grout shall cease as soon as each hole is filled and any excess grout on the surface of the concrete foundation shall be completely removed and the surface dried off before the next operation proceeds.

The space between the top surface of foundation concrete and the underside of the baseplates shall be filled with a special mortar made up in the following proportions:-

- Portland Cement 50 kg.
- Fine aggregate 50 kg.
- An additive acceptable to the Engineer to counteract shrinkage in proportions recommended by the manufacturer.

The special mortar shall be mixed with the lowest water-cement ratio which will result in a consistency of mix of sufficient workability to enable maximum compaction to be achieved.

The special mortar shall then be well rammed in horizontally below the baseplate and from one edge only until it is extruded from the other three sides. The mortar which has extruded shall then be rammed back to ensure complete support without voids.

418. REMEDIAL WORK TO DEFECTIVE SURFACES

If on stripping any formwork the concrete surface is found to be defective in any way, the Contractor shall make no attempt to remedy such defects prior to the Engineer's inspection and the receipt of any instructions which the Engineer may give.

Defective surfaces shall not be made good by plastering.

Areas of honey combing (of a mild nature) which the Engineer agrees may be repaired shall be cut back to sound concrete or to 75mm whichever is the greater distance. In the case of reinforced concrete the area shall be cut back to at least 25mm clear distance behind the reinforcement or to 75mm, whichever is the greater distance. The cavity shall have sides at right angles to the face of the concrete. After cleaning out with water and compressed air, a thin layer of cement grout shall be brushed on to the concrete surface in the cavity and it shall then be filled immediately with concrete of the same class as the main body but with aggregate larger than 20mm nominal size removed. A form shall be used against the cavity, provided with a lip to enable concrete to be placed. The form shall be filled to a point above the top edge of the cavity.

After seven days the lip of concrete shall be broken off and the surface ground smooth.

Surface irregularities which are outside the limits of tolerance set out in Clause 410 shall be ground down in the manner and to the extent instructed by the Engineer.

Severe honeycombing and defects other than those mentioned above shall be dealt with as instructed by the Engineer.

419. BENDING REINFORCEMENT

Unless otherwise shown on the drawings, bending and cutting shall comply with SRN 129.

The Contractor shall satisfy himself as to the accuracy of any bar bending schedules supplied and shall be responsible for cutting, bending, and fixing the reinforcement in accordance with the drawings. Any discrepancies should be brought to the attention of the Engineer prior to ordering the reinforcement.

Bars shall be bent cold by the application of slow steady pressure. At temperatures below 5 degrees centigrade the rate of bending shall be reduced if necessary to prevent fracture of the steel.

After bending, bars shall be securely tied together in bundles or groups and legibly labelled as set out in SRN 129.

Reinforcement shall be thoroughly cleaned and all dirt, scale, loose rust, oil and other contaminants removed before it is placed in the Works.

420. FIXING REINFORCEMENT

Reinforcement shall be securely fixed in position within a dimensional tolerance of 20mm in any direction parallel to a concrete face and within a tolerance of 5mm at right angles to a face, provided that the cover is not thereby decreased below the minimum shown on the drawings, or if not shown shall be not less than 25mm or the diameter of the bar, whichever is the greater. Cover on distribution steel shall not be less than 15mm or the diameter of the bar whichever is the greater.

Unless otherwise agreed by the Engineer, all intersecting bars shall either be tied together with 1.6mm diameter soft annealed iron wire and the ends of the wire turned into the body of the concrete, or shall be secured with a wire clip of a type agreed by the Engineer.

Spacer blocks shall be used for ensuring that the correct cover is maintained on the reinforcement. Blocks shall be as small as practicable and of a shape agreed by the Engineer. They shall be made of mortar mixed in the proportions of one part of cement to two parts of sand. Wires cast into the block for tying in to the reinforcement shall be 1.6mm diameter soft annealed iron.

Alternatively another type of spacer block may be used subject to the Engineer's agreement.

Reinforcement shall be rigidly fixed so that no movement can occur during concrete placing. Any fixings made to the formwork shall not be within the space to be occupied by the concrete currently being placed.

No splices (laps) shall be made in the reinforcement except where shown on the drawings or agreed by the Engineer. Splice lengths shall be as shown on the drawings.

Reinforcement shall not be welded except where required by the Contract or agreed by the Engineer. If welding is employed, the procedures shall be as set out in SRN 937 for gas welding or SRN 919 for metal arc welding. Full strength butt welds shall only be used for steel complying with SRN 126, and if used on high yield deformed bars complying with SRN 126 the permissible stresses in the vicinity of the weld shall be reduced to those applicable to plain bars complying with that Specification.

Mechanical splices shall not be used unless the Engineer agrees otherwise.

The Contractor shall ensure that reinforcement left exposed in the Works shall not suffer distortion, displacement or other damage. When it is necessary to bend protruding reinforcement aside temporarily, the radius of the bend shall not be less than four times the bar diameter for mild steel bars or six times the bar diameter for high yield bars. Such bends shall be carefully straightened before concrete placing continues, without leaving residual links or damaging the concrete around them. In no circumstances will heating and bending of high yield bars be permitted.

Bars complying with SRN 127 or other high tensile bars shall not be bent after placing in the Works.

Before concrete is placed in any section of the Works which includes reinforcement, the reinforcement shall be completely clean and free from all contamination including concrete which may have been deposited on it from previous operations.

The Engineer's approval for concrete placing is to be sought in writing for each pour, leaving adequate time to inspect and rectify any defects noted in the formwork, falsework, reinforcement, scaffolding, concreting arrangements, etc.

5. FORMWORK

501. FORMWORK FOR CONCRETE

Definitions

Formwork means the surface against which concrete is placed to form a face, together with all the immediate supports to retain it in position while concrete is placed.

Falsework means the structural elements supporting both the formwork and the concrete until the concrete becomes self supporting.

A formed face is one which has been cast against formwork.

An exposed face is one which will remain visible when construction has been completed.

502. CONSTRUCTION OF FORMWORK AND FALSEWORK

Before construction begins, the Contractor shall submit to the Engineer, drawings showing details of the proposed formwork and falsework.

Formwork and falsework shall be so constructed that they will support the loads imposed on them by the fresh concrete together with additional stresses imposed by vibrating equipment and by construction traffic, so that after the concrete has hardened the formed faces shall be in the positions shown on the drawings within the tolerances set out in Clause 506.

Ground supports shall be properly founded on footings designed to prevent settlement.

Joints in formwork for exposed faces shall, unless otherwise specified, be evenly spaced and horizontal or vertical and shall be continuous or form a regular pattern.

All joints in formwork including formwork for construction joints shall be tight against the escape of cement, water and fines. Where reinforcement projects through formwork, the form shall fit closely round the bars.

Formwork shall be so designed that it may be easily removed from the work without damage to the faces of the concrete. It shall also incorporate provisions for making minor adjustments in position if required, to ensure the correct location of concrete faces. Due allowance shall be made in the position of all formwork for movement and settlement under the weight of fresh concrete.

Where overhangs in formwork occur, means shall be provided to permit the escape of air and to ensure that the space is filled completely with fully compacted concrete.

Formwork shall be provided for concrete surfaces at slopes of 30 degrees to the horizontal or steeper. Surfaces at slopes less than 20 degrees may be formed by screeding. Surfaces at slopes between 20 degrees and 30 degrees shall generally be formed unless the Contractor can demonstrate to the satisfaction of the Engineer that such slopes can be screeded with the use of special screed boards to hold the concrete in place during vibration.

Horizontal or inclined formwork to the upper surface of concrete shall be adequately secured against uplift due to the pressure of fresh concrete. Formwork to voids within the body of the concrete shall also be tied down or otherwise secured against floating.

The internal and external angles on concrete surfaces shall be formed with fillets and chamfers of the sizes shown on the drawings unless otherwise instructed by the Engineer.

Supports for formwork for non-water retaining structures may be bolted to previously placed concrete provided the type of bolt used is acceptable to the Engineer. If metal ties through the concrete are used in conjunction with bolts, the metal left in shall not be closer than 50mm to the face of the concrete.

Supports for formwork for water retaining structures may be bolted to previously placed concrete provided the type of bolts and positions of fixing are acceptable to the Engineer. After concreting the Contractor shall remove all support bolts and seal all holes with well rammed cement/sand mortar containing approved waterproofing cement additive. Metal ties which would be left in the concrete shall not be permitted.

Formwork shall not be re-used after it has suffered damage which in the opinion of the Engineer is sufficient to impair the finished surfaces of the concrete.

Where circumstances prevent easy access within the form for cleaning and inspection, temporary openings for this purpose shall be provided through the formwork.

Shear keys shall be provided in all construction joints of the size and shape indicated on the drawings.

Where precast concrete elements are specified for use as permanent formwork, or proposed by the Contractor and agreed by the Engineer, they shall comply with the requirements of the Specification. Such elements shall be set true to line and level within the tolerances prescribed for the appropriate class of finish in Clause 506 and fixed so that they cannot move when concrete is placed against them.

503. **PREPARATION OF FORMWORK**

Before any reinforcement is placed into position within formwork, the latter shall be thoroughly cleaned and then dressed with a release agent. The agent shall be either a suitable oil incorporating a wetting agent, an emulsion of water suspended in oil or a low viscosity oil containing chemical agents. The Contractor shall not use an emulsion of oil suspended in water nor any release agent which causes staining or discoloration of the concrete, air holes on the concrete surface, or retards the set of the concrete.

In order to avoid colour difference on adjacent concrete surfaces, only one type of release agent shall be used in any one section of the works.

In cases where it is necessary to fix reinforcement before placing formwork, all surface preparation of formwork shall be carried out before it is placed into position. The Contractor shall not allow reinforcement or prestressing tendons to be contaminated with formwork release agent.

Before placing concrete all dirt, construction debris and other foreign matter shall be removed completely from within the placing area.

Before concrete placing commences, all wedges and other adjusting devices shall be secured against movement during concrete placing and the Contractor shall maintain a watch on the formwork during placing to ensure that no movement occurs.

504. **REMOVAL OF FORMWORK**

Formwork shall be carefully removed without shock or disturbance to the concrete. No formwork shall be removed until the concrete has gained sufficient strength to withstand safely any stresses to which it may thereby be subjected.

The minimum periods which shall elapse between completion of placing concrete and removal of forms are given in Table 5.1 and apply to ambient temperatures higher than 10 degrees centigrade. At lower temperatures or if cement other than ordinary Portland are involved, the Engineer may instruct that longer periods be used.

Alternatively, formwork may be removed when the concrete has attained the strength set out in Table 5.1, provided that the attained strength is determined by making test cubes and curing them under the same conditions as the concrete to which they refer.

Compliance with these requirements shall not relieve the Contractor of his obligation to delay removal of formwork until the removal can be completed without damage to the concrete.

Table 5.1 - MINIMUM PERIODS FOR FORMWORK REMOVAL

| Position of Formwork | Min. period for temp over 10 | Strength to be attained |
|----------------------|------------------------------|-------------------------|
|----------------------|------------------------------|-------------------------|

| | degrees Centigrade | |
|--|-----------------------|---------------------|
| Vertical or near vertical faces of mass concrete | 24 hours | 0.2 C |
| Vertical or near vertical faces of reinforced walls, beams and columns | 48 hours | 0.3 C |
| Underside of arches, beams and slabs (formwork only) | 4 days | 0.5 C |
| Supports to underside of arches, beams and slabs | 14 days | C |
| Arched linings in tunnels and underground works | 24 hours | 4 N/mm ² |

Note: C is the nominal strength for the class of concrete used.

If the Contractor wishes to strip formwork from the underside of arches, beams and slabs before the expiry of the period for supports set out above, it shall be designed so that it can be removed without disturbing the supports. The Contractor shall not remove supports temporarily for the purpose of stripping formwork and subsequently replace them.

As soon as the formwork has been removed, bolt holes in concrete faces other than construction joints which are not required for subsequent operations shall be completely filled with mortar sufficiently dry to prevent any slumping at the face. The mortar shall be mixed in the same proportions as the fine aggregate and cement in the surrounding concrete and with the same materials and shall be finished flush with the face of the concrete.

505. SURFACE FINISHES ON FORMED SURFACES

Classes of finish

The surface finish to be achieved on formed concrete surfaces shall be as shown on the drawings and defined hereunder:-

a) Class F1 finish

This finish is for surfaces against which backfill or further concrete will be placed. Formwork may be sawn boards, sheet metal or any other suitable material which will prevent the loss of fine material from the concrete being placed.

b) Class F2 finish

This finish is for surfaces which are permanently exposed to view but where the highest standard of finish is not required. Forms to provide a Class F2 finish shall be faced with wrought thickened tongued and grooved boards with square edges arranged in a uniform pattern and close jointed or with suitable sheet material. The thickness of boards or sheets shall be such that there shall be no visible deflection under the pressure exerted by the concrete placed against them. Joints between boards or panels shall be horizontal and vertical unless otherwise directed. This finish shall be such as to require no general filling of surface pitting, but fins, surface discoloration and other minor defects shall be remedied by methods agreed by the Engineer.

c) Class F3 finish

This finish is for surfaces which will be in contact with water flowing at high velocity, and for surfaces prominently exposed to view where good appearance is of special importance. To achieve this finish, which shall be free of board marks, the formwork shall be faced with plywood complying with B.S. 1088 or equivalent material in large sheets. The sheets shall be arranged in an approved pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features or changes in direction of the surface.

All joints between panels shall be vertical and horizontal unless otherwise directed. Suitable joints shall be provided between sheets to maintain accurate alignment in the plane of the sheets. Unfaced

wrought boarding or standard steel panels will not be permitted for Class F3 finish. The Contractor shall ensure that the surface is protected from rust marks, spillages and stains of all kinds.

d) Curved surfaces

For curved surfaces where F2 or F3 finishes are called for, the formwork face shall be built up of splines cut to make a tight surface which shall then be dressed to produce the required finish.

Alternatively, single curvature surfaces may be faced with plastic or plywood linings attached to the backing with adhesive or with escutcheon pins driven flush. Linings shall not bulge, wrinkle or otherwise deform when subjected to temperature and moisture changes.

506. TOLERANCES

All parts of formed concrete surfaces shall be in the positions shown on the drawings within the tolerances set out in Table 5.2.

In cases where the drawings call for tolerances other than those given in Table 5.2 the tolerances shown on the drawings shall take precedence.

Where precast units have been set to a specified tolerance, further adjustments shall be made as necessary to produce a satisfactory straight or curved line. When the Engineer has approved the alignment, the Contractor shall fix the units so that there is no possibility of further movement.

Table 5.2 - TOLERANCES

| Class of finish | Tolerances in mm (See Note) | | |
|-----------------|-----------------------------|----|--------------|
| | A | B | C |
| F1 | 10 | 10 | + 25 to - 10 |
| F2 | 5 | 10 | + or - 15 |
| F3 | 2 | 5 | + or - 10 |

Note: The tolerances A, B and C given in the table are defined as follows:

1. Column A is an abrupt irregularity in the surface due to misaligned formwork or defects in the face of the formwork.
2. Column B is a gradual deviation from a plane surface as indicated by a straight edge 3m long. In the case of curved surfaces the straight edge shall be replaced by a correctly shaped template.
3. Column C is the amount by which the whole or part of a concrete face is displaced from the correct position shown on the drawings.

6. MASONRY

601. **GENERAL**

All masonry work shall be constructed from building stone as specified in Clause 725.

For culvert headwalls and other small works, the stone shall, unless otherwise specified, be rough dressed. For walls, facing and other exposed works the stone shall unless otherwise specified, be medium chisel-dressed.

602. **WORKMANSHIP**

The Contractor shall provide and use proper setting out rods for all work.

Stones shall be well soaked before use and the tops of walls shall be kept wet as the work proceeds. The stones shall be properly bonded so that no vertical joint in a course is within 115mm of a joint in the previous course. Alternate courses of walling at angles and intersections shall be carried through the full thickness of the adjoining walls. All perpend, reveals and other angles of the walling shall be built strictly true and square.

The stones shall be bedded, jointed and pointed in mortar 1 to 3 in accordance with Clause 729 with beds and joints 9mm thick flushed up and grouted solid as the work proceeds.

All masonry work shall be cured in accordance with the relevant requirements of Clause 407.

603. **CAST STONWORK**

Cast stone shall be as specified in Clause 735. Facing stones shall be brought up in courses to a height not exceeding 1 metre at a time, the concrete backing being then brought up and well incorporated into and round the backs of the stones and the projecting metal ties to ensure a complete bond. The stones shall be bedded and jointed as shown on the drawings.

All materials, moulds, mixing, casting and surface treatment, setting, jointing and pointing, and all centering, scaffolding and labour required to complete the cast stonework specified or as shown on the drawings, shall be included in the rates for such work.

7. MATERIALS

701. GENERAL

The approval in writing or otherwise by the Engineer of any materials shall not in any way whatsoever relieve the Contractor from any liability or obligation under the Contract and no claim by the Contractor on account of the failure, insufficiency or unsuitability of any such materials will be entertained.

- a) All items shall be suitable for water works purposes and for use with cold water installation and operation being in a tropical climate.
- b) All items hereinafter specified shall be to such other Standard or Specification which in the opinion of the Engineer provides for a quality of material and workmanship not inferior to the Standard Reference Number (SRN) quoted. The Standard or Specification must be submitted to the Engineer for approval before commencement of work.
- c) All ferrous pipes and fittings shall be coated with a protective paint suitable for use in and transport through a tropical climate.
- d) The Contractor shall supply to the Employer a certificate stating that each item supplied has been subjected to the tests hereinafter laid down and conforms in all respects to the said Specification.
- e) The Contractor shall provide adequate protection to all piping, flanged items and valves so as to guard effectively against damage in transit and storage and ingress of foreign matter inside the valves.
- f) All pipework and fittings shall be subjected to a works hydrostatic test pressure which shall be not less than twice the maximum operating pressure.
- g) The Contractor should exercise diligence to provide the best material.
- h) Where applicable the manufacturer's Specification should accompany all offers. The name of the manufacturer must in every case be stated.
- j) Where necessary the Contractor shall provide rubber gaskets to comply with SRN 208 and all other bolts, nuts, washers, etc. to undertake jointing at fittings etc.
- k) Any articles required under this Contract which are found to be faulty due to a crack, flaw or any other reason or is not in accordance with the Specification stipulated will not be accepted nor will the Employer be liable for any charges in respect of such an article. Where any

such rejected article can, in the opinion of the Engineer, be rendered usable, the Contractor may deal with it accordingly and include it in the Contract at a price to be mutually agreed. Straight pipes which have been cut will be accepted at the discretion of the Engineer, provided the length is not less than 4 metres or two thirds of the standard length whichever is the lesser and will be priced pro-rata.

- 1) Wherever possible, samples of pipes and fittings shall be submitted for approval of the Engineer prior to the Contractor obtaining the total requirements.

702. GALVANISED PIPES AND SPECIALS

All piping shall conform to SRN 823 and SRN 903 for "Medium" Piping. The pipes shall be screwed and socketted, coupled or flanged.

All specials shall be of such dimensions as will mate with the piping supplied. Screwdown stopvalves shall conform to SRN 826. Barrel nipples shall conform to SRN 823 and all other specials shall conform to SRN 824.

All pipes supplied shall be certified by the manufacturer to have been tested in accordance with the relevant Standard Specification.

703. DUCTILE IRON AND CAST IRON PIPES AND SPECIALS

All cast iron piping and fittings shall conform to the requirements of SRN 200.

Ductile iron pipes and fittings shall comply with SRN 202. Where required the pipes shall be protected as specified by the manufacturer of the pipes and shall be used as recommended by the manufacturer of the pipe.

Where the requirements include for the supply of flexible couplings the Contractor shall submit for approval by the Engineer full details of the type of joint offered and a full description of the method of jointing prior to arranging for the delivery of goods on site.

All flexible couplings shall be protected from corrosion by wrapping with Denso paste and tape or by some similar approved material.

The quality of metal used for the manufacture of the pipes shall be of good quality grey cast iron and subject to the various quality control tests as specified in the relevant Standards.

All piping and fittings shall be coated internally with cement mortar lining to SRN 211. Cement mortar lining shall not contain any constituents soluble in water nor any ingredient which could impart any taste or odour whatsoever to the water after sterilization and washing out of the mains. External protection to be as specified in SRN 258.

The flanges of straight pipes shall be at right angles to axis of the pipe and the faces of the flanges shall be parallel and machine finished.

The faces of the flanges of fittings shall be at right angles to the directional axis. The bolt holes shall be concentric with the bore and located symmetrically off the centre line.

In flanged pipework the holes in one flange shall be located in line with those in the other.

All flanges shall be drilled to SRN 207, unless otherwise detailed.

The weights of the pipe and fittings shall comply with the Specification in the relevant Standard.

704. ASBESTOS CEMENT PIPES AND SPECIALS

All piping and bends shall be plain ended suitable for use with flexible couplings and shall comply with the requirements of SRN 401. Fittings shall be of asbestos cement or cast iron complying with requirements of SRN 201, or mild steel complying with SRN 210.

Where possible, fittings shall have plain ends of an external diameter equal to that of the asbestos cement pipes and shall be suitable for use with asbestos cement, cast iron or mild steel mechanical joints. Where compatible external diameters of fittings and pipes cannot be supplied, suitable stepped couplings of approved manufacturer shall be used.

Flexible couplings shall be supplied complete with bolts, nuts, washers and joint rings as may be required. All metal parts of the joints shall be adequately protected with rust-proof paint.

The couplings shall, if required by the Engineer, be protected from corrosion by wrapping with Denso paste and tape or by some similar approved material.

The Contractor shall submit full details of the type of joint and a full description of the method of jointing.

The lengths of piping supplied shall be in accordance with SRN 401.

All pipes and bends supplied shall be certified by the manufacturer to have been tested in accordance with the relevant clauses of Standard Specification.

Unless specified, the pipes, joints and bends shall be coated internally with cement mortar lining complying with SRN 212. This lining should not impart any taste or odour to the water. External protection for pipes, joints and bends to be as specified in SRN 212.

Precautions shall be taken to avoid damage to the pipes and fittings during handling and storing and during laying, all to the satisfaction of the Engineer.

Where ferrules are tapped into the piping, saddles should be used, otherwise service connections can be incorporated by use of suitable long collar joints.

705. STEEL PIPES AND SPECIALS

All piping shall be plain ended unless otherwise specified and suitable for use with flexible mechanical couplings. The grade of steel used shall comply with the requirements of SRN 213.

The pipes shall be welded or seamless and shall conform to SRN 210.

All the pipes shall be internally protected with cement mortar lining in accordance with SRN 212. External protection to be as specified in SRN 241.

All joints shall be of the flexible mechanical type and shall be supplied complete with all bolts, nuts, washers and joint rings as may be required. All metal parts of joints shall be adequately protected with rust-proof paint. The joints shall be protected from corrosion by wrapping with Denso paste and tape or by some similar approved material.

All fittings and specials shall be of such dimensions as will mate up with the piping supplied.

Flanged adaptors shall be pieces suitable for connecting a flanged gate valve etc. to the type of piping supplied and shall be supplied complete with all bolts, nuts, washers and joint rings.

The spigot ends of all Tees shall be suitable for connection to the pipework supplied using the aforementioned flexible mechanical joints. Branches shall be flanged with flanges drilled to NP 16 or NP 25, as specified in the drawings in accordance with SRN 207, unless otherwise detailed.

All flanges on specials shall conform to NP 16 or NP 25, as specified in the drawings in accordance with SRN 207, unless otherwise detailed.

All flanged joints shall be protected from corrosion by wrapping with Denso paste and tape or some similar approved material.

706. UNPLASTICISED uPVC PIPES

Unplasticised PVC piping shall be in accordance with SRN 300.

The maximum sustained working pressures to which the pipes and fittings will be subjected is based on water at a temperature of 20 degrees centigrade.

The Contractor shall submit full details of the pipes he intends to supply.

The pipes upto and including 40mm diameter can be of a solvent weld type. The pipe shall be supplied with interchangeable sockets preformed at the factory and of such internal diameter that it takes the plain end of the pipe with the same nominal diameter.

The joint shall sustain the end thrust to which the pipe shall be subjected. The Contractor shall supply sufficient quantity of the cleaner and adhesive which shall be required to make the joints with the pipes.

The pipes of 50mm diameter and over shall consist of a grooved socket at one end of the pipe. The socket shall be designed to give a clearance fit on the outside diameter of the parent pipe. The sealing medium which shall seat in the groove shall be a rubber ring.

If the formation of the socket and groove results in the thinning of the original wall thickness of the pipe, it shall be compensated for by shrinking on to the outside of the socket area a reinforcing sleeve of the same material as the pipe. The socket and groove shall incorporate no sharp angles where the stress points are created.

The joint shall take 10% deformation of the spigot at the point where it enters the socket without leakage from the pipe when subjected to the test pressure specified for the pipe. Thermal expansion of the pipe shall be

accommodated in the joint. The joint shall be capable of linear deflection upto 3 degrees.

The sealing ring shall be of first grade natural rubber and the physical properties of the mix shall meet the requirements of SRN 222.

The Contractor shall supply sufficient quantity of any lubricant or other material which shall be needed to make the joint which shall be assembled by hand.

The Contractor shall submit full details of the type of joint offered and a full description of the method of jointing.

The fittings shall have the same type of joint as for the pipes to be used. The Contractor shall submit full details of the materials dimensions and test pressures of the fittings offered.

Precautions shall be taken to avoid damage to the pipes and fittings.

In handling and storing the pipes and fittings, every care shall be taken to avoid distortion, flattening, scoring or other damage. The pipes and fittings shall not be allowed to drop or strike objects. Pipe lifting and lowering shall be carried out by approved equipment only.

Special care shall be taken in transit, handling and storage to avoid any damage to the ends.

Pipes and fittings shall be marked at not greater than one metre intervals showing their class and diameter.

707. G.R.P. PIPES AND SPECIALS

Glass Reinforced Plasting piping shall be in accordance with SRN 317.

708. GATE VALVES

Gate valves shall comply with the requirements of SRN 501.

The gate valves shall be suitable for use in pipelines and for the operating pressure to a head of 160 metres or 250 metres of water (NP 16) or NP 25.

The gate valves shall be double flanged. The dimensions and drilling of flanges shall be in accordance with SRN 207. Flanges shall be machined flat. Flanges shall be NP 16 / NP 25 complying with SRN 207.

Spindles of the gate valves shall be provided with cast iron caps conforming to the requirements as specified under "Valve Caps" in SRN 501 or handwheels if so specified.

The spindles of the gate valves shall be of the non-rising type and screwed so as to close the valves when rotated in a clockwise direction. The direction of closing shall be clearly cast on the valve cap or handwheel.

The gate valves shall be subject to “Closed End Tests” in accordance with the procedure set out in SRN 501.

The gate valves shall be suitable for opening and closing against an unbalanced head by manual operation.

709. FIRE HYDRANTS

Fire hydrants shall be in accordance with SRN 509. They shall be for installation underground and shall be in accordance with SRN 509.

The spindle shall be provided with a cast iron cap conforming to dimensions under “Spindle Cap” in SRN 501.

The spindle of the fire hydrant shall be of the non-rising type and screwed so as to close the hydrant when rotated in a clockwise direction viewed from above. The direction of closing shall be clearly cast on the valve cap.

The flanged outlet of the outlet bend shall have a Bayonet Joint Outlet for a 63mm standpipe. The outlet of the hydrant shall be of the hooked type with hooks 112mm apart.

The outlet shall have a gun metal standpipe seating and be covered by a loose cast iron cap which shall be attached to the hydrant by means of a chain.

Both flanges shall be 63mm drilled to requirements of SRN 207.

The outlet bends shall be subject to a hydrostatic test in accordance with procedure set out in SRN 509 and shall be water-tight against a test pressure of 1.85 Pa. head of water.

710. AIR VALVES

The Contractor shall provide air valves to suit the site on which the main is located and the maximum water pressure specified. The body and cover of air valves shall comply with SRN 906 and SRN 916.

The body, cover, splash cowl and joint support ring of the air valve shall be of mechanite cast iron with flanges drilled to SRN 207.

The internal screwed isolating valve shall have the valve and seating of gun metal, operating screws of bronze, nuts of gun metal, and glands and cap of mechanite.

The large orifice valve shall have a vulcanite covered ball closing on a moulded dexine seat ring. The bush may be in gun metal.

The double orifice type of air valve shall comprise a small and large orifice unit with common connection to the main and screwdown isolating valve to permit inspection of the valve. The spindle of the isolating valve shall be screwed so as to close the valve when rotated in a clockwise direction and be provided with a Spindle Cap to dimensions as specified in SRN 501.

Design of the air valves shall be such that the balls do not blow shut under any working or test conditions when large volumes of air are being released.

711. WATER METERS

All water meters upto 50mm size shall be of the rotary piston positive action type with all moving parts composed of non-corrosive material.

75mm diameter and over meters shall be of the inferential helix full flow type.

The body of the 12mm to 25mm size of meter shall be of brass, the larger sizes in cast iron. The external surface of the brass bodies shall be coated with baked enamel and the cast iron bodies shall be painted to suit.

The working chamber of the rotary type meter shall be made of bronze or similar non-corrosive material and the piston shall be in ebonite or similar material.

The working parts of the Helix type meter shall facilitate removal for repair or replacement without removing the meter body from the pipeline. The working parts shall be inter-changeable and the working chamber so designed as to be full of water under all conditions of flow.

The dial of the meter shall be of the direct reading type registered in cubic metres with suitable lid locking device.

The capacities of the piston type meter shall not be less than the following amounts per month:-

| | |
|------------|-------------------|
| 12mm meter | 250 cubic metres |
| 18mm meter | 350 cubic metres |
| 25mm meter | 600 cubic metres |
| 38mm meter | 1100 cubic metres |
| 50mm meter | 1700 cubic metres |

The Helix type meter shall be capable of continuous working with a head loss not exceeding 300mm at the following rates of flow:-

| | |
|-------------|---------------|
| 75mm meter | 22.5 cu.m./hr |
| 100mm meter | 45 cu.m./hr |
| 150mm meter | 90 cu.m./hr |

All meters shall be accurate to within $\pm 2\%$ over the range of the meter upwards from the minimum flows given for each size:-

| | |
|-------|-----------------|
| 12mm | 23 litres/hour |
| 18mm | 28 litres/hour |
| 25mm | 32 litres/hour |
| 38mm | 110 litres/hour |
| 50mm | 190 litres/hour |
| 75mm | 2.5 cu.m./hr |
| 100mm | 2.8 cu.m./hr |
| 150mm | 4.5 cu.m./hr |

Meters above 150mm diameter should conform to manufacturer's specifications approved by the Engineer.

The 12mm and 18mm sizes shall be guaranteed to register commencing at 5 litres/hour.

The meters shall be tested to a head of not less than 16 bar or as specified.

712. STOP VALVES

All stop valves shall be in accordance with SRN 826. Samples of valves shall be submitted for test and approval to the Engineer.

713. CHECK VALVES (DIRECTIONAL VALVES)

Check valves shall comply with the requirements of SRN 505 with cast iron body and cover, gun metal doors with bronze facing rings and flanged connections in accordance with SRN 207, NP 16.

714. PENSTOCKS

Cast iron penstocks shall be all in accordance with SRN 906 and SRN 916. Seating faces shall be gun metal or bronze.

Spindles shall be threaded as necessary and non-rising unless otherwise specified. Spindles shall be of aluminium bronze, manganese bronze and extension spindles may be of mild steel.

Handwheels shall be of cast iron and words "OPEN" and "SHUT" marked on upper side with appropriate direction arrows.

715. FLANGED JOINTS

All flanges on fittings and pipework where flanged connections are required must comply with the requirements of SRN 207 and drilled to NP 16, unless otherwise specified.

Inspection gaskets for flanged joints shall be rubber reinforced with cotton, 3mm thick and shall be in accordance with SRN 208. Bolts, washers and nuts for flanged joints shall be of mild steel complying with SRN 914.

716. FLEXIBLE JOINTS

All flexible couplings (Viking Johnson or other approved type) shall be supplied complete with rubber gaskets, bolts, nuts and washers. All couplings shall be coated with red oxide primer and bituminous composition suitable for use with potable water.

717. PRESSED STEEL TANKS AND TOWERS

The pressed steel tanks (or similar approved), towers and associated materials and fittings shall comply with SRN 909 and SRN 863.

Detailed drawings of the steel tank should be submitted to the Engineer for approval prior to acceptance.

The pressed steel tank to SRN 909 (B.S. 1564 Type A(2) or similar approved) shall be supplied complete with:-

- a) All stays, cleats, bolts, nuts, washers, jointing compound and associated materials and fittings.
- b) Connections for inlet, outlet, washout and overflow.
- c) Galvanised access ladder 450mm wide.
- d) Steel roof cover to fit the tank complete with access manhole and mosquito-proof cowl ventilators.
- e) Water level indicator.

Jointing material to the tank to be a non-toxic plastic compound which does not impart taste, colour nor odour to the water.

Connections to the tank shall be welded to the outside of the tank plate and drilled and tapped to suit flanges to SRN 207, NP 16 unless otherwise stated.

The cover to the tank shall be of mild steel cambered for external use and adequately supported by rolled steel or pressed steel bearers or trusses.

The tank tower shall be supplied complete with:-

- a) Anchor bolts.
- b) Bolts, nuts, washers and associated materials and fittings.
- c) Access ladder 450mm wide extending from ground level to the top of the tank. Safety rings shall be at 1.2m centres.

The supports to the tank shall consist of steel joints designed to carry imposed load under each transverse joint and the two ends of the tank.

The columns of the tank shall consist of rolled steel joist sections or similar. Four or more such columns shall be provided with adequate bracing.

Internal surfaces of the tank shall be painted with approved non-toxic primer and non-toxic bituminous paint.

External surfaces of the tank and tower shall be painted with approved primer and approved bituminous aluminium paint.

718. PAINTS

All priming, undercoating and finishing paints shall be in accordance with SRN 877 or SRN 878 as appropriate.

The painting of all building works shall comprise a special paint recommended for external work while all other paints, plastic emulsion coating etc. are to be of an approved manufacturer. All paints, distempers etc. shall be delivered on site intact in the original drums or tins, and shall be mixed and applied in accordance with the manufacturer's printed directions. The only addition which will be allowed to be made will be liquid thinners, driers etc. supplied by the makers for the purpose.

All surfaces must be thoroughly cleaned down prior to painting and decorating work and no external painting shall be carried out in rainy weather. All paint must be thoroughly well worked on and excess of paint in any coat must be avoided.

All colours will be selected by the Engineer from the standard range of colours.

719. MARKER AND INDICATOR POSTS

Marker posts shall be erected at changes in direction of water mains as directed by the Engineer. Indicator posts shall be erected at valves and other fittings as directed.

Marker and indicator posts shall be embedded in concrete as shown on drawings and shall be vibrated precast reinforced concrete as per dimensions shown on drawings. They should be painted in colours as indicated on the drawings.

720. POLYETHYLENE (PALOTHENE, PEH) PIPES

Polyethylene High Density pipes shall comply with SRN 307 for testing, storage, handling, laying and backfilling. Contractor shall conform to requirement indicated for PVC pipes. Joints shall be required to sustain test pressures similar to which the pipe shall be subjected.

Contractor shall comply with all instructions issued by the manufacturers and shall submit full details of the type, class, dimensions and test pressures of the brass fittings to the Engineer for approval.

721. **PRECAST CONCRETE UNITS**

Precast concrete covers to be precast units for use in the works, whether instructed under the Contract or proposed by the Contractor.

a) Formwork for Precast Units

Moulds shall be so constructed that they do not suffer distortion or dimensional changes during use and are tight against loss of cement grout or fines from the concrete.

Moulds shall be set up on firm foundations so that no settlement occurs under the weight of the fresh concrete.

Moulds shall be constructed so that units may be removed from them without sustaining any damage.

Release agents used for demoulding shall not stain the concrete or affect its properties in any way.

b) Reinforcement for Precast Units

Reinforcement in precast units shall comply with the requirement of Clauses 736 and 419-420. When preformed cages are used the cages shall be made up on jigs to ensure dimensional accuracy and shall be carefully supported within the mould in such a way that they cannot move when concrete is placed. Reinforcement complying with SRN 126 may be tack welded where bars cross to provide rigidity in the cage but reinforcement complying with SRN 127 shall not be welded.

Cover to main reinforcement shall be as shown on the drawings, or if not shown shall be not less than 25mm or the diameter of the bar, whichever is the greater. Cover on distribution steel shall not be less than 15mm or the diameter of the bar whichever is the greater.

Bars shall be spaced so that the minimum clear distance between them is the maximum nominal aggregate size plus five millimetres but in any case not less than the diameter of the bars.

Bars may be placed in pairs provided that there are no laps in the paired lengths.

c) Casting of Units

Concrete for precast units shall comply with Clauses 724 and 401-410 using the class of concrete specified on the drawings.

If lightweight aggregates are specified, they shall comply with SRN 147.

The area in which units are cast shall be adequately protected from the weather so that the process is not affected by rain, sun or drying winds.

d) Curing Precast Units

Requirements for curing shall be generally as set out in Clause 407.

The Contractor shall ensure that units do not suffer any loss of moisture or sudden changes of temperature for at least four days after casting. If a water spray is used for curing, the water shall be at a temperature within 5 degrees centigrade of the temperature of the unit being cured.

If Contractor proposes curing at elevated temperatures, the method shall be subject to the agreement of the Engineer and shall include means whereby units are heated and subsequently cooled evenly without sudden changes of temperature.

e) Dimensional Tolerances of Precast Units

Units shall be accurately formed to the dimensions shown on the drawings unless closer tolerances are called for by the Engineer.

f) Surface Finish of Precast Units

The formed faces of precast units shall be finished to Class F3 as set out in Clause 505(C) unless another class of finish is specified on the drawings.

Free faces shall be finished to Class UF2 unless another class of finish is specified on the drawings.

In cases where a special finish is required a trial panel shall be constructed by the Contractor which after approval by the Engineer shall be kept available for inspection at the place of casting and production units shall thereafter match the approved pattern.

Those parts of the unit which are to be joined to other units or to in-situ concrete shall be brushed with a stiff brush before the concrete has fully hardened. Alternatively, if the concrete has been allowed to harden, the surfaces shall be roughened by sand blasting or by the use of a needle gun.

g) Handling and Storage of Precast Units

Precast units shall be handled in a manner which will not cause damage of any kind and shall be stored on a hard impermeable base.

Prestressed units and large precast normally reinforced units shall be handled and stored so that no stresses shall be induced in excess of those which they will incur in their final positions in the Works unless they have been designed to resist such stresses.

Units shall be provided with adequate lifting holes or loops, placed in the locations shown on the drawings or agreed by the Engineer and they shall be lifted only by such holes or loops. Where it is not possible to provide holes or loops, suitable sling positions shall be indicated in paint on the units.

Units shall be marked indelibly with the reference number and date of casting and shall be stacked on suitable packers which will not damage the concrete or stain the surfaces. Not more than two packers shall be placed under each unit and these shall be located either at the positions of the permanent support points or in positions such that the induced stresses in the unit will be a minimum.

h) Testing Precast Units

Precast units shall be capable of safely sustaining the loads which they have been designed to carry. The Contractor shall subject units selected by the Engineer to load tests simulating the working conditions. Details of such tests shall be agreed between the Engineer and the Contractor.

In the case of units subject to bending loads the test piece shall be supported at full span and a loading equivalent to 1.25 times the sum of the live and dead loads which were assumed in the design shall be maintained for one hour without the appearance of any signs of distress. The recovery one hour after the removal of load shall be not less than 75 per cent of the full load deflection.

If the unit fails to meet the above requirements, further tests shall be carried out on two more units. If either of these fail the whole batch of units will be rejected.

If the Engineer so requires, a test to destruction shall also be carried out which on units subject to bending shall be as follows:-

The units shall be supported at full span and a load applied in increments instructed by the Engineer up to 95 per cent of the designed ultimate load. This load shall be held for 15 minutes without failure of the unit. The deflection at the end of this period shall be not more than 1/40th of the span. The load shall then be further increased until failure occurs.

If the unit fails to sustain the required load for the prescribed period or if the deflection exceeds the specified amount, the Engineer may

order two further tests, and if either of these fail, the batch of units which they represent may be rejected.

722. FILTER MEDIA

The grading of filter media shall be in accordance to the table of gradings shown on drawings.

Filter media must be free from fines which would clog the air spaces, and free from dirt, silt and all foreign matter.

The media shall be delivered in clean vehicles and if stored it shall be placed on a clean and firm surface and if it is liable to be contaminated, protected with sheets. Different sizes of media shall be kept strictly separate.

The uniformity coefficient as indicated in the drawings should be adhered to and Contractor to submit samples and carry out sieve analysis, organic content, friability tests, etc. to the satisfaction of the Engineer. These tests are to be carried out before the media is placed in filters. All costs arising to be borne by the Contractor.

723. SUBMISSION OF SAMPLES

As soon as possible after the contract has been awarded, the Contractor shall submit to the Engineer a list of the suppliers from whom he proposes to purchase the materials necessary for the execution of the Works. Each supplier must be willing to admit the Engineer or his representatives, to his premises during ordinary working hours for the purpose of obtaining samples of the materials in question. Alternatively, if desired by the Engineer, the Contractor shall deliver the samples of the materials to the Engineer's office without charge.

The information regarding the names of the suppliers may be submitted at different times, as may be convenient, but no source of supply shall be changed without the Engineer's prior approval once a supplier, source or material has been approved.

Samples of materials approved will be retained at the Engineer's office until the completion of the contract. Samples may be tested to destruction.

All materials delivered to site must be at least equal in all respects to approved samples, otherwise they shall be rejected. No special payment will be made for compliance with clauses specifying tests etc. to ensure quality control etc. unless specifically itemised in Bills of Quantities.

724. MATERIALS FOR CONCRETE

a) General

The Contractor shall submit to the Engineer full details of all materials which he proposes to use for making concrete. No concrete shall be placed in the Works until the Engineer has approved the materials of which it is composed. Approved materials shall not

thereafter be altered or substituted by other materials without the consent of the Engineer.

b) Cement

Cement shall comply with the following Kenya Standards:-

- SRN 103 for Ordinary Portland cement.
- SRN 103 for Rapid Hardening Portland cement plus all special conditions to its use stipulated by the manufacturer.
- SRN 104 for Sulphate Resisting or High Alumina cement.

Cement shall be free flowing and free of lumps. It shall be supplied in the manufacturer's sealed unbroken bags or in bulk. Bagged cement shall be transported in vehicles with effective means of ensuring that it is protected from the weather.

Bulk cement shall be transported in vehicles or in containers specially built and equipped for the purpose.

Cement in bags shall be stored in a suitable weatherproof structure of which the interior shall be dry and well ventilated at all times. The floor shall be raised above the surrounding ground level and shall be so constructed that no moisture rises through it.

Each delivery of cement in bags shall be stacked together in one place. The bags shall be closely stacked so as to reduce air circulation but shall not be stacked against an outside wall. If pallets are used, they shall be constructed so that bags are not damaged during handling and stacking. No stack of cement bags shall exceed 3 metres in height. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stacks.

Cement from broken bags shall not be used in the Works.

Cement in bags shall be used in the order in which it is delivered.

Bulk cement shall be stored in weatherproof silos which shall bear a clear indication of the type of cement contained in them. Different types of cement shall not be mixed in the same silo.

The Contractor shall provide sufficient storage capacity on site to ensure that his anticipated programme or work is not interrupted due to lack of cement.

Cement which has become hardened or lumpy or fails to comply with the Specification in any way shall be removed from the site.

All cement for any one structure shall be from the same source.

All cement used in the Works shall be tested by the manufacturer or the Contractor in a laboratory acceptable to the Engineer. The tests to be performed shall be those set out in SRN 103 and the Contractor shall supply two copies of each certificate to the Engineer.

Each set of tests carried out by the manufacturer or Contractor shall relate to not more than one day's output of each cement plant, and shall be made on samples taken from cement which is subsequently delivered to the site. Alternatively, subject to the agreement of the Engineer, the frequency of testing shall be one set of tests for every 200 tones of cement delivered to site from each cement plant.

Cement which is stored on site for longer than one month shall be re-tested in the laboratory of the Materials Branch of the Ministry of Roads, Public Works & Housing or at the Kenya Bureau of Standards or at any other approved laboratory at the rate of one set of tests as shown in SRN 103 for every 200 tonnes, and at monthly intervals thereafter.

Cement which does not comply with the Specification shall not be used in the Works and it shall be disposed off by the Contractor.

The Contractor shall keep full records of all data relevant to the manufacture, delivery, testing and use of all cement used in the Works and shall provide the Engineer with two copies thereof.

c) Fine Aggregate

Fine aggregate shall be clean, hard and durable and shall be natural sand, crushed gravel sand or crushed rock sand complying with SRN 108. All the material shall pass through a 5mm standard sieve and the grading shall be in accordance with Zones 1, 2 or 3 of SRN 109. In order to achieve an acceptable grading, it may be necessary to blend materials from more than one source. Fine aggregate for mortar only shall comply with SRN 135.

The fine aggregate shall not contain iron pyrites or iron oxides. It shall not contain mica, shale, coal or other laminar, soft or porous materials or organic matter unless the Contractor can show by comparative tests, on finished concrete as set out in SRN 117, that the presence of such materials does not adversely affect the properties of the concrete.

Other properties shall be as set out below:

Content passing a 75 micron standard sieve shall not exceed 3 per cent for natural or crushed gravel sand or 15 per cent for crushed rock sand.

Chlorides soluble in a 10 per cent solution by weight of nitric acid shall not exceed 0.05 per cent by weight expressed as chloride ion when tested as set out in SRN 107, subject also to the further restriction given in the note on total chloride content in sub-clause 724 (d).

Sulphates soluble in a 10 per cent solution by weight of hydrochloric acid shall not exceed 0.4 per cent by weight expressed as SO_3 , when tested as set out in SRN 601, subject also to the further restriction given in the note on total sulphate content in sub-clause 724 (d).

Soundness: After five cycles of the test in AASHTO T104 or an approved equivalent, the aggregate shall not show a weight loss of more than 10 per cent.

Organic impurities:

If the test for presence of organic impurities in aggregates described below shows that more than a trace of organic impurities is present, the fine aggregate shall not be used in the Works unless the Contractor can show by tests on finished concrete as set out in SRN 117 that the presence of organic impurities does not adversely affect the properties of the concrete.

Test for presence of organic impurities in aggregates:

This test is designed to indicate the presence of organic impurities in aggregates used for making concrete.

A 350 cc graduated bottle shall be filled to the 120 cc mark with a sample of the aggregate to be tested and a 3% solution of sodium hydroxide in water added until the volume of aggregate and liquid after shaking gives a total volume of 200 cc. The bottle shall be stoppered, shaken thoroughly and allowed to stand for 24 hours. If, after 24 hours, the colour of the solution is not darker than a pale brown, the aggregate under test may be deemed satisfactory.

d) Coarse aggregate

Coarse aggregate shall be clean, hard and durable crushed rock, crushed gravel or natural gravel complying with the requirements of SRN 110. The material shall not contain any iron pyrites, iron oxides, flaky or laminated material, hollow shells, coal or other soft or porous material, or organic matter unless the Contractor can show by comparative tests on finished concrete as set out in SRN 117 that the presence of such materials does not adversely affect the properties of

the concrete. The pieces shall be angular, rounded or irregular as defined in SRN 107.

Coarse aggregate shall be supplied in the nominal sizes called for in the Contract and shall be graded in accordance with SRN 111 for each nominal size.

Other properties shall be as set out below:-

The proportion of clay, silt and other impurities passing a 75 micron standard sieve shall not be more than one per cent by weight.

The content of hollow and flat shells shall be such as will not adversely affect the concrete quality when tested as set out in SRN 117. The total content of aggregate shall not be more than the following:

- 40mm nominal size and above 2% of dry weight
- 20mm nominal size 5% of dry weight
- 10mm nominal size 15% of dry weight

Chlorides soluble in a 10 per cent solution by weight of nitric acid shall not exceed 0.03 per cent by weight, expressed as chloride ion when tested as set out in SRN 107 but subject also to the further restriction under the note on total chloride content hereunder. Sulphates soluble in a 10 per cent solution by weight of hydrochloric acid shall not exceed 0.4 per cent by weight expressed as SO₃ when tested as set out in SRN 601 subject also to the further restriction given in the note on total sulphate content hereunder.

Soundness: After 5 cycles of the test in AASHO T104, the aggregate shall not show a weight loss of more than 12 per cent.

When tested in accordance with test C289 of the American Society for Testing of Materials (ASTM), the aggregate shall be non-reactive.

Flakiness Index when tested in accordance with SRN 113 shall be as set out hereunder:

- For 40mm stone and above, not more than 40
- For 20mm stone and below, not more than 35

If the Flakiness Index of the coarse aggregate varies by more than five units from the average value of the aggregate used in the approved trial mix, then a new set of trial mixes shall be carried out if the workability of the mixes has been adversely affected by such variation.

Impact value: Not more than 45 per cent when tested in accordance with SRN 107.

Ten per cent fines value: Not less than 50kN when tested in accordance with SRN 107.

Shrinkage: When mixed with other ingredients in the approved proportions for concrete and tested as set out in SRN 117, the shrinkage factor shall not exceed 0.05 per cent.

Organic impurities: If the test for presence of organic impurities in aggregates shows that more than a trace of organic impurities is present, the aggregate shall not be used in the Works unless the Contractor can show by tests on finished concrete as set out in SRN 117 that the presence of organic impurities does not adversely affect the properties of the concrete.

Water absorption: The aggregate shall not have a water absorption of more than 2.5 per cent when tested as set out in SRN 112.

Aggregate Crushing Value (ACV): Not more than 35 per cent.

Los Angeles Abrasion (LAA): Not more than 50 per cent.

NOTE: Total chloride and sulphate content:-

The total chloride content, expressed as chloride ion, arising from all ingredients in a mix including cement, water and admixtures shall not exceed the following limits, expressed as a percentage of the weight of cement in the mix:-

For prestressed concrete, steam cured concrete or concrete containing sulphate resisting or super sulphated cement: 0.05 per cent.

For any other reinforced concrete: 0.3 per cent in 95 per cent of all test results provided no result is more than 0.5 per cent.

The total sulphate content expressed as SO_3 of all the ingredients in a mix including cement, water and admixtures shall not exceed 0.4 per cent by weight of the aggregate or 4.0 per cent of the weight of cement in the mix, whichever is the lesser.

e) Testing Aggregates

i) Acceptance testing

The Contractor shall deliver to the Engineer samples containing not less than 50 kg of any aggregate which he proposes to use in the Works and shall supply such further samples as the Engineer may require. Each sample shall be clearly labelled to show its origin and shall be accompanied by all the information called for in SRN 107.

Tests to determine compliance of the aggregates with the requirements of sub-clause 724(c) and (d) shall be carried out by the Contractor in a laboratory acceptable to the Engineer. If the tested materials fail to comply with the Specification, further tests shall be made in the presence of the Contractor and the Engineer and acceptance of the material shall be based on such tests.

A material shall be accepted if not less than three consecutive sets of test results show compliance with the Specification.

ii) Compliance testing

The Contractor shall carry out routine testing of aggregates for compliance with the Specification during the period that concrete is being produced for the Works. The tests set out below shall be performed on aggregates from each separate source on the basis of one set of tests for each day on which aggregates are delivered to site provided that no set of tests shall represent more than 250 tonnes of fine aggregate nor more than 500 tonnes of coarse aggregate, and provided also that the aggregates are of uniform quality. If the aggregate from any source is variable, the frequency of testing shall be increased as instructed by the Engineer.

- Grading SRN 107
- Silt and clay contents SRN 107
- Moisture content SRN 107
- Check on organic impurities

In addition to the above routine tests, the Contractor shall carry out the following tests at the frequencies stated:

Moisture content: As frequently as may be required in order to control the water content of the concrete as required by the Specification.

Chloride content: As frequently as may be required to ensure that the proportion of chlorides in the aggregates does not exceed the limit stated in the Specification.

The Contractor shall take account of the fact that when the chloride content is variable it may be necessary to test every load in order to prevent excessive amounts of chloride contaminating the concrete. For this purpose the Contractor shall use the rapid field test (the Quantab test). In the event of disagreement regarding the results of the field test, the chloride content of the aggregate shall be determined in the laboratory as described in SRN 107 (the Volhard test).

f) Delivery and storage of aggregates

Aggregates shall be delivered to site in clean and suitable vehicles. Different types or sizes of aggregate shall not be delivered in one vehicle.

Each type or size of aggregate shall be stored in a separate bin or compartment having a base such that contamination of the aggregate is prevented. Dividing walls between bins shall be substantial and continuous so that no mixing of types or sizes occurs.

The storage of aggregates shall be arranged so that as far as possible rapid drying out in hot weather is prevented in order to avoid sudden fluctuations in water content. Storage of fine aggregates shall be arranged so that they can drain sufficiently before use in order to prevent fluctuations in water content of the concrete.

g) Water for concrete and mortar

Sea water or brackish water containing more than 1,000 ppm chloride ion or 2,000 ppm sulphate ion shall not be used for mixing or curing concrete.

Water shall be clean and free from harmful matter and shall comply with the requirements of SRN 114.

The Contractor shall carry out tests in accordance with SRN 114 to establish compliance with the Specification.

h) Admixtures

i) General

The use of the admixtures in concrete may be required under the Contract to promote special properties in the finished concrete or may be proposed by the Contractor to assist him to comply with the Specification.

In all cases the Contractor shall submit to the Engineer full details of the admixture he proposes to use and the manner in which he proposes to add it to the mix. The information provided shall include but not be limited to:-

- a) The typical dosage, the method of dosing and the detrimental effects of an excess or deficiency in the dosage.
- b) The chemical names of the main active ingredients in the admixture.

- c) Whether or not the admixture contains chlorides, and if so the chloride ion content expressed as a percentage by weight of admixture.
- d) Whether the admixture leads to the entrainment of air when used at the manufacturer's recommended dosage, and if so, the extent to which it does so.
- e) Details of previous uses of the admixture in Kenya.

The chloride ion content of any admixture shall not exceed 2 per cent by weight of the admixture nor 0.03 per cent by weight of the cement in the mix.

Admixtures shall not be mixed together without the consent of the Engineer.

Calcium chloride or admixtures containing calcium chloride shall not be used in prestressed concrete.

- ii) Workability agents

Workability agents shall comply with SRN 149 and shall not have any adverse effect on the properties of the concrete.

725. BUILDING STONE

All building stone shall be capable of withstanding when wet a crushing stress of 1.4 kg./sq.mm. The source of stone shall be approved by the Engineer and stone supplied therefrom shall be free from Magadi, overburden, mudstone, cracks, sandholes, veins, laminations or other imperfections.

The stone shall be chisel dressed into true rectangular blocks, with each surface even and at right angles to all adjoining surfaces, to the size specified. For exposed stonework the maximum permissible variation of any of the specified dimensions shall be 6mm provided that cut stone, supplied as 'rock face' stone may be hammer dressed on one face only, or on one face and one end, if in other respects it conforms with this specification. Stones shorter than 375mm will not be accepted.

Unless the Engineer allows otherwise the Contractor shall at his own expense provide and dress four 100mm cubes of stone for testing.

The stone shall be sound when tested in accordance with SRN 870 except that:-

- i) The treatment shall be repeated for 10 cycles only; and
- ii) The second criterion of failure shall be amended to allow for a loss of weight of not more than 20% of its original weight.

726. STONE DUST

Stone dust for blinding shall be blacktrap screened to the following grading:-

| | |
|-----------------------|------------|
| Passing 10mm sieve | 100% |
| Passing No. 4 sieve | 85% - 100% |
| Passing No. 100 sieve | 5% - 25% |

727. MURRAM

Murram shall be from an approved source quarried so as to exclude vegetable matter, loam, top soil or clay. The California Bearing Ratio of the murram, as determined for a sample compacted to maximum density (as defined under SRN 601) and allowed to soak in water for four days, shall not be less than 30%. This C.B.R. is a guide to quality only and the compaction in the work will be judged by density.

728. WATER FOR CEMENT TREATED MATERIALS

If water for the works is not available from the Employer's supply the Engineer's approval must be obtained regarding the source of supply and manner of its use. Water to be used with cement or lime shall be free from salt, oil, alkali, organic matter, and other deleterious substances. If the water is required to be tested, this shall be done in accordance with SRN 114 : Tests for Water for Making Concrete, all to the cost of the Contractor.

729. CEMENT MORTAR

Cement mortar shall consist of proportions by volume as specified of Portland Cement and natural sand or crushed natural stone or a combination of both as specified in SRN 135 and SRN 136 : Building Sands from Natural Sources. The constituent materials shall be accurately gauged and mixed in an approved manner.

Cement mortar shall be made in small quantities only as and when required, and any mortar which has begun to set or which has been mixed for a period of more than one hour shall be rejected.

730. HYDRATED LIME

Hydrated lime shall comply with SRN 801 : Building Limes, and shall be of the semi-hydrated type.

731. CALCIUM CHLORIDE

Calcium chloride shall be of good industrial grade, and shall be obtained from an approved source.

732. LIME MORTAR

Lime mortar shall consist of proportions by volume as specified of hydrated lime and naturals and/or crushed natural stone or a combination of both as specified for cement mortar in Clause 729. The constituent materials shall be accurately gauged and mixed in an approved manner.

733. CEMENT-LIME MORTAR

Cement-lime mortar shall consist of Portland Cement, hydrated lime and natural sand or crushed natural stone or a combination of both, as specified for cement mortar in Clause 729. The constituent materials shall be accurately gauged and mixed by volume in an approved manner in the proportions specified.

Cement-lime mortar shall be made only in small quantities as and when required. Any mortar which has begun to set or which has been mixed for a period of more than two hours shall be rejected.

734. CEMENT GROUT

Cement grout shall consist of Portland Cement and water mixed in the proportion of one part by volume of cement and one and a half parts by volume of water. The grout shall be used within one hour of mixing.

735. CAST STONE

Cast stone shall be manufactured by an approved manufacturer to the shapes and dimensions shown on the drawings, and shall conform to the requirements of SRN 871 : Cast Stone. It shall have a dense and even surface of the texture and colour detailed on the drawings or required by the Engineer. Where indicated exposed faces of the stone shall be formed of a specially graded mix. Metal bond ties of approved manufacture shall be cast in with the stone as shown on the drawings. Samples of the completed stone shall be submitted for the Engineer's prior approval.

All stones shall be protected from damage during transport and erection by means of cement slurry coatings or by other approved methods.

736. REINFORCEMENT FOR CONCRETE

Reinforcement which shall comply with the following Standards, covers plain and deformed bar reinforcement and steel fabric to be cast into concrete in any part of the Works but does not include prestressing tendons or any other embedded steel.

- SRN 126 for hot rolled plain bar and high yield deformed bar
- SRN 127 for cold worked steel bar
- SRN 128 for steel mesh fabric

All reinforcement shall be from an approved manufacturer and, if required by the Engineer, the Contractor shall submit a test certificate from the manufacturer.

All reinforcement for use in the Works shall be tested for compliance with the appropriate British Standard in a laboratory acceptable to the Engineer and two copies of each test certificate shall be supplied to the Engineer. The frequency of testing shall be as set out in the relevant Standard.

In addition to the testing requirements described above, the Contractor shall carry out additional tests as instructed by the Engineer.

Any reinforcement which does not comply with the Specification shall be removed from site.

All reinforcement shall be delivered to site either in straight lengths or cut and bent. No reinforcement shall be accepted in long lengths which have been transported bent over double.

Any reinforcement which is likely to remain in storage for a long period shall be protected from the weather so as to avoid corrosion and pitting. All reinforcement which has become corroded or pitted to an extent which, in the opinion of the Engineer, will affect its properties shall either be removed from site or may be tested for compliance with the appropriate Standard at the Contractor's expense.

Dowel Bars

Dowel bars and tie bars shall consist of mild steel, or deformed bars of high yield steel all complying with SRN 126 and they shall be free from oil, paint other than bond-breaking compound, dirt, loose rust and scale.

Dowel bars and tie bars shall be of sizes as shown on the drawings and directed by the Engineer, and shall be straight, free from burred edges, or other irregularities and shall have their sliding ends sawn or, if approved, sheared.

Bond breaking compound for dowel bars shall consist of 66 per cent of 200 pen bitumen blended hot with 14 per cent light creosote oil and, when cold, brought to the consistency of paint by the addition of 20 per cent solvent naphtha or other approved compound meeting the following requirements.

- i) It shall not retard or in any other way affect the setting of concrete.
- ii) The average bond stress on bars coated with the compound with half their length cast into concrete specimens and subject to pull out tests at 7 days shall not exceed 0.14 newtons per square millimetre and the total movement of the dowel bar relative to the concrete shall not be less than 0.25 millimetres at that stress. The concrete specimens shall be 150 millimetres by 150 millimetres in section and 0.45 metre long and made with the same mix proportions as used in the Works.

737. STRUCTURAL STEEL FOR WELDED WORK

Structural steel for riveted and welded work shall comply with the requirements of SRN 125 : Structural Steel, SRN 126 : The Use of Structural Steel in Building and for Welded Work, SRN 125 : High Yield Stress and High Tensile Structural Steel, High Tensile (Fusion Welding Quality) Structural Steel for Bridges, etc. and General Building Construction.

738. WATERPROOF UNDERLAY

Waterproof underlay shall consist of either waterproof paper complying with SRN 856 : Waterproof Building Paper, containing approved fibrous reinforcement, or 500 gauge polythene sheeting as stated in the Bill of Quantities.

739. PREFORMED JOINT FILLER

Prefomed joint filler shall be of the thickness shown on the drawings or as stated in the Bill of Quantities.

The material comprising joint filler shall be as stated on the drawings or approved by the Engineer.

740. JOINT PRIMER

Joint priming compound shall be entirely in accordance with the manufacturer's recommendations for the joint sealant to be used.

741. JOINT SEALING COMPOUND

Poured joint sealing material shall consist of an approved rubber-bitumen compound, complying with the requirements of SRN 879, or a two component, cold applied compound complying with SRN 879 as stated in the Bill of Quantities. Test Certificates, prepared by an approved testing laboratory, shall be supplied by the Contractor to show that the material does in fact comply in respect of cone penetration, flow and bond with the under-mentioned requirements:

| <u>Test Cone Penetration</u> | <u>Hot-poured Materials</u> | <u>Cold-poured Materials</u> |
|---|--|--|
| 0.15 kg. for 5 secs. at 25° centigrade using standard grease cone | Penetration not to exceed 9mm | Penetration to be not less than 5mm not more than 27.5mm |
| <u>Flow</u> | | |
| On a plane inclined at 75° to the horizontal, 5 hours at 60° centigrade | Flow not to exceed 5mm | Flow not to exceed 20mm |
| <u>Bond</u> | | |
| 25mm wide joint extended 12mm at rate of 4mm per hour at 18° centigrade. No more than one specimen in three to develop a crack separation or other opening more than 4mm deep | Five cycles of extension and recompression | Three cycles of extension and recompression |

Approved hot-poured materials shall also comply with a requirement whereby when heated for a period of 6 hours at a temperature of 80 degrees centigrade above recommended pouring temperature or 30 degrees centigrade below the safe heating temperature whichever is the greater shall still comply with the flow requirements of this clause.

In addition to materials complying with SRN 879, the Engineer may approve the use of alternative materials provided that they meet the requirements of this clause relating to cold-poured joint sealing compounds.

742. CONCRETE PIPES AND SPECIALS

Concrete pipes and specials shall comply with the requirements of SRN 840. They shall carry the relevant Standards Institution registration certification trade mark, or test certificates shall be furnished by the manufacturers.

743. CONCRETE POROUS PIPES

Concrete porous pipes shall comply with the requirements of SRN 410 : Concrete Porous Pipes for Under-drainage.

744. CONCRETE DRAIN INVERT BLOCKS

Precast concrete invert blocks shall be manufactured to the detail drawings supplied from concrete Class 20/10 as specified in Table 4.2 using maximum 12mm size aggregates. If required, cube test certificates shall be supplied by the manufacturer.

745. CONCRETE SLABS FOR OPEN DRAINS

Precast concrete slabs for lining open drains shall be manufactured to the detail drawings supplied from concrete Class 20/10 as specified in Table 4.2 using maximum 12mm size aggregates. If required, cube test certificates shall be supplied by the manufacturer.

746. AGRICULTURAL TILES AND PIPES

Agricultural tiles and pipes shall be best well-burnt earthenware, true and circular in bore and with an external flat bottom and plain ends suitable for laying with open or butt joints.

747. MANHOLE COVERS AND FRAMES

Manhole covers and frames shall be basically in accordance with the requirements of SRN 846 : Cast Manhole Covers, Road Gully Gratings and Frames for Drainage Purposes except that the manhole covers shall be constructed of mild steel, concrete filled, in accordance with the standard detail drawings.

Foul water sewer manholes shall have triangular Grade "A" heavy duty covers and frames. Circular manhole covers and frames shall be used on surface water sewer manholes.

748. GULLY GRATINGS AND FRAMES

Gully gratings and frames shall be basically in accordance with the requirements of SRN 846, nominal size 500mm x 350mm except that the gully gratings shall be constructed of mild steel concrete filled in accordance with the standard detail drawings.

Where indicated as being kerb inlet type, the gullies shall conform to the shape and dimensions given on the detail drawings supplied, but in respect of materials and workmanship conform to SRN 846.

749. PRECAST CONCRETE MANHOLES AND INSPECTION CHAMBERS

Precast concrete manholes and inspection chambers shall comply with the requirements of SRN 854 : Concrete Cylindrical Pipes and Fittings including Manholes, Inspection Chambers and Street Gullies, and they shall carry the relevant Standard Institution registered certification trade mark, or test certificates shall be furnished by the manufacturer.

750. PRECAST CONCRETE GULLIES

Precast concrete gullies shall be unreinforced and shall comply with the requirements of SRN 854 : Concrete Cylindrical Pipes and Fittings including Manholes, Inspection Chambers and Street Gullies.

751. MANHOLE STEP IRONS

Step irons of general purpose type shall comply in all respects with SRN 845 : Malleable Step Irons.

752. TIMBER

Timber shall be sound, well seasoned and entirely free from worm, beetle, warps, shakes, splits, and all forms of rot and deadwood. Where required, all timber shall be treated with creosote, as specified in SRN 872 : Coal Tar Creosote for the Preservation of Timber or an alternative approved timber preservative.

753. WATER BARS

Water bars shall be “Dumbell” type and be of natural or synthetic rubber or extruded PVC. They shall be flexible, tough, elastic and durable and of dimensions detailed. They should be unaffected on contact with dilute acids or alkalis. Joints and junctions shall, when possible, be prefabricated by the manufacturer, but if made at site the manufacturer’s instructions including recommended adhesives shall be followed and used. Samples shall be submitted for approval of the Engineer before use of any material.

754. CONCRETE BLOCKS

Solid and hollow concrete blocks for walling shall comply with SRN 904 in every respect.

All solid and hollow concrete blocks used in the walling must be capable of withstanding a crushing pressure of not less than 0.35 kg per square millimetre after 28 days. The blocks shall be cast in Metric sizes.

8. WORKMANSHIP

801. **HANDLING OF PIPES AND FITTINGS**

The Contractor shall exercise care in the handling of all pipes, specials, valves etc., to prevent damage to the structure surfaces and to the ends of the pipes.

802. **LOADING AND UNLOADING**

Normally loading and unloading of small diameter pipes and fittings can be undertaken by hand; where mechanical means are used care should be exercised to ensure that the handling methods do not damage the pipes and fittings.

803. **STORAGE**

The Contractor shall comply with the manufacturer's specification regarding the storage of pipes, fittings and valves. Where storage dumps are to be provided along the route of the pipeline, these will be subject to the Engineer's approval. The cost of so providing shall be borne by the Contractor and deemed to be covered by his rates in the Bill of Quantities.

804. **TRANSPORT**

The Contractor shall provide such transport arrangements as will effectively cater for the lengths of pipes provided and the material of the piping. Adequate support shall be provided so as to ensure that the piping and fittings are not subject to excessive movement.

805. **EXAMINATION OF PIPES AND FITTINGS**

The Contractor shall examine all pipes, valves, fittings and other materials to ascertain that they are in perfectly sound condition before commencing to lay the pipes, valves etc.

806. **INTERFERENCE WITH FENCES, DRAINS AND OTHER SERVICES**

The Contractor shall ensure the proper reinstatement of fences, drains, telephone lines, KP&L cables etc. where affected by his work. All services shall be adequately protected and propped to the satisfaction of the Engineer. The Contractor shall be liable for any damage caused to the services due to his failure to provide adequate protection.

807. **METHOD OF EXCAVATION**

The Contractor is deemed to have covered in his excavation rates all the work that is necessary in order to comply with the provisions of the Specifications in general and this Clause in particular.

- a) The Contractor shall excavate the pipe trenches in the line and to the depths indicated on drawings or as indicated by the Engineer.

Except where otherwise indicated on the drawings or directed by the Engineer, it is intended that the trench shall be excavated to such a depth as will allow of a minimum cover of 600mm over the top of the barrel of the pipe when laid. All trenches shall be excavated in open cuttings and for trenching to uPVC piping, shall not be opened too far in advance of pipe laying.

- b) For the purpose of measurement, the width of trench shall be taken as the nominated width for the particular size of sewer, irrespective of the width of trench the Contractor may choose to excavate.

Nominated trench width for:

| | |
|------------|------|
| 75mm main | 0.5m |
| 100mm main | 0.6m |
| 150mm main | 0.6m |
| 200mm main | 0.6m |
| 225mm main | 0.6m |
| 250mm main | 0.6m |
| 300mm main | 0.7m |
| 400mm main | 0.8m |
| 500mm main | 0.9m |
| 600mm main | 1.0m |
| 700mm main | 1.1m |
| 800mm main | 1.2m |

For two or more pipes in the same trench the nominated width shall be the distance between the centres of the outer pipes plus the internal radii of the outer pipes plus 400mm.

- c) Where the trench passes through grassland, arable land or gardens, whether enclosed or otherwise, the turf, if any, shall be carefully pared off and stacked, and the productive soil shall be carefully removed for a width of 600mm greater than the nominated trench width, or equal to the overall width of track of excavating machine, whichever is greater, and laid aside to be subsequently used in reinstating the surface of the ground after the trench has been refilled.
- d) The bottom of the trench shall be properly trimmed off, and all low places or irregularities shall be levelled up with fine material. Where rock or large stones are encountered, they shall be cut down to a depth of at least 100mm below the level at which the bottoms of the barrel of the pipes or flanges are to be laid, and covered to a like depth with fine material, so as to form a fine and even bed for the pipes. The bottom of trenches to accommodate uPVC piping shall be hardened by tamping in gravel or broken stone in all soft spots. The bedding shall consist of soil which can be properly compacted to provide support for the pipe and to comply with Clause 809 b).

- e) Joint holes shall be excavated to suit minimum dimensions as will allow the joints to be well and properly jointed.
- f) The pipe trench shall be kept clear of water at all times as per Clause 321 of this Specification.
- g) The Contractor shall, wherever necessary, by means of timbering or otherwise, support the sides of the trench so as to make them thoroughly secure, and afford adequate support to adjoining roads, land, buildings and property, during the whole time the trench remains open and shall remove such timbering when the trench has been backfilled. The cost of such timbering or other work shall be deemed to be included in the rates for excavation. In case the Contractor is instructed by the Engineer to leave any portion of such timber in position after backfilling the trench, he will be paid for it accordingly.
- h) The clear width inside the timbering shall be at least 150mm in excess of the external diameter of the pipe being laid, in order to allow it to be freely lowered into position, in the trench without damage to the external protection.
- i) Should the excavation be taken out to a greater depth than is specified the bottom shall be made good to the correct level with Class 15/20 concrete or other material approved by the Engineer. No payment shall be made for any over excavation carried out by the Contractor nor for the cost of filling up to required levels.
- j) If a mechanical excavator is used by the Contractor, he shall indemnify the Employer against all claims for damage which in the opinion of the Engineer, may be caused by the use of this plant.
- k) The Contractor shall fix Sight Rails for use with boning rods at intervals of not more than 30 metres and temporary Bench Marks related to the Survey of Kenya Datum shall be provided at such intervals as directed by the Engineer.

808. MAIN LAYING

- a) Mains shall be laid in straight lines and/or smooth curves as indicated on the drawings. The vertical profile of the pipe shall be to even gradients. Any pipes not so laid shall be removed if so directed by the Engineer, and re-laid in proper manner at the Contractor's expense.

In laying the pipes and specials care shall be taken not to damage the protective linings and the pipes shall be handled with tackle if so directed by the Engineer.

The pipes and specials shall be checked for flaws before they are lowered into the trench. After the pipes or specials have been

checked they shall be cleaned and set to proper gradient and line so that there is a continuous rise from each washout to air valve.

When laying uPVC pipes, final connection at any fixed joints shall be deferred until the majority of the pipeline has been covered with backfill.

- b) Large diameter curves to mains shall wherever possible be formed by allowing for deflection at flexible joints, not exceeding 3 degrees, or as specified by the manufacturers.
- c) In jointing of the pipes and specials the Contractor shall comply with the standards adopted for the various types of joints as specified.
- d) In laying pipes and specials with flanged joints, flanges shall be brought together and bolted with the faces absolutely parallel. A rubber jointing gasket ring 3mm thick shall be used in each flange joint and one washer with and not provided for each bolt.

The bolts shall be tightened up gradually and equally in the customary manner in order to distribute the stress evenly over the flange. If it is found necessary to deviate slightly from the normal run of the flanged piping, the deflection shall be obtained by means of a bevelled gun metal ring washer between the flanges.

- e) The Contractor shall fix the gate valves, air valves and washout pipes all in accordance with the drawings.
- f) The Contractor shall, subject to approval of the Engineer, cut pipes to such lengths as directed. Pipes should be cut off clean and square with the axis. Cuts should be made with an approved cutting device dependant on the type of pipe specified. Ends of pipes should be tapered by means approved by the Engineer if mechanical joints are to be used.
- g) Equipment for tapping off the mains under pressure may be employed in the making of service or branch connections. The Contractor is required to choose a suitable method for fixing of the ferrule to the type of pipe specified, to the Engineer's approval.

809. BACKFILLING OF TRENCH

- a) When a section of the main has been jointed, the ends shall be temporarily closed with caps, plugs or flanges to prevent ingress of foreign matter into the pipe to the satisfaction of the Engineer. The trench shall be properly backfilled and rammed for its whole length so that the soil cover to the main shall not be less than 600mm except at joint holes which shall be kept clear of all backfilling, if necessary, by the use of timbering, so that each joint is left fully exposed for the Engineer's inspection. Special care shall be

exercised when using surround to A.C. and uPVC pipes which shall be free from any stones and well compacted in layers to not less than 100mm above the crown of the pipe.

- b) The Contractor's attention is drawn to the special requirements for bedding and sidefill to uPVC pipes. Clay should not be used. Soils which are of a granular nature and provide adequate support after compaction shall be used. If unavailable from excavated material the Contractor should provide suitable material for which an item in the Bill has been included.

With flexible pipes it is important that the sidefill should be firmly compacted between the pipe and the soil sides of the trench. The bedding material shall be placed in 75mm layers up to the crown of the pipe with adequate compaction and then to a minimum height of 100mm or two thirds of the pipe diameter. The progress of filling and tamping should proceed equally on either side of the pipe so as to maintain an equal pressure on both sides.

- c) Where a main is laid across a road or is in such a position as to interfere seriously with the normal use of the road, the Contractor may, with the consent of the Engineer and at his own risk, fill such holes as may be necessary. Due consideration is to be given to compaction of section of the trench across the road to prevent undue settlement. In the event of damage at this section the Contractor is required to re-excavate and repair the pipeline all at his own expense.

810. ANCHOR BLOCKS AND SUPPORTS

Concrete Class 15/20 shall be placed in anchor blocks at all changes of direction of the pipeline exceeding 6 degrees and wherever else required to withstand thrust resulting from internal water pressure e.g. at blank ends. Concrete in plinths shall be placed where specified.

811. CHAMBERS AND SURFACE BOXES

Gate valves, air valves and fire hydrants etc. shall be provided with suitable chambers or surface boxes in accordance with detailed drawings. In roads and footpaths the boxes shall have metal covers laid flush with the surface. Indicator posts to suit shall also be provided.

812. TESTING

- a) The Contractor shall test as long a section of main as possible subject to the maximum length of open trench approved by the Engineer. The test shall be carried out within 12 working days of the completion of such section of the main.
- b) The pipeline shall be adequately anchored during the test at stop ends or valves to prevent movement under the test pressures.

- c) The test section shall be filled with water and great care should be taken to drive out all air through air valves, ferrules etc. The test pressure is to be at least 1.5 times the nominal working pressure for the class of pipe being tested and is to be applied for at least 2 hours.
- d) The leakage from the mains and connections from each section tested shall be according to SRN 316, i.e. not exceeding 0.02 litres per millimetre of nominal bore per kilometre of pipeline per 24 hour per bar of applied pressure head.

The determine the rate of leakage, the Contractor shall furnish a suitable hydraulic test pump, pressure gauge, connections and water meter or other appliance, for measuring the amount of water pumped. The pressure shall be raised to the amount required and specified by the Engineer, and shall be so maintained for a period of not less than two hours or whatever longer period as required by the Engineer to examine every joint to satisfy himself that they are sound.

If the leakage is at a greater rate than that specified, the Contractor shall re-excavate the trench where necessary and shall re-make the joints and replace defective work until the leakage shall be reduced to the allowable amount.

- e) The Employer shall charge the Contractor the cost of any couplings required to join up tested lengths of main if, in the Engineer's opinion, greater lengths could reasonably have been tested or if failure under test, requires the pipe to be cut, or other methods of laying should have been adopted.

Water used in testing the main shall be supplied by the Contractor. The Contractor shall carry out all work which may be necessary for making temporary connections to the existing mains to obtain water for testing at his own expense.

In carrying out the test for water tightness the Employer only shall authorise the operation of all valves, but the Contractor shall provide all the necessary labour to assist in the opening and closing of the valves to the Engineer's instructions, and he shall allow in his prices for all his expenses in connection with testing on completion.

The Engineer shall be the sole judge of water tightness.

813. CLEANING AND STERILISING THE MAIN

- a) When a pipeline is complete and where applicable, has successfully passed the test, it shall be thoroughly washed out, using if possible, an open end. Thereafter it shall be sterilised by being filled with a suitable solution containing not less than 20 p.p.m. of free available chlorine or

such other sterilising agent as the Engineer shall approve. After standing for 24 hours the main shall again be washed out and refilled with mains water prior to the taking of bacteriological samples. The Contractor shall provide all necessary stop-ends, fittings and chemicals for this work.

- b) Emptying and washing out of the pipes shall be done in such a manner as not to damage the trench or cause undue flooding of the vicinity, and the Contractor shall supply and use piping, specials and/or hose as may be necessary to facilitate the flow of water to the nearest drain or watercourse. Water used for washing out and sterilising may be supplied by the Employer when a suitable supply is available but all expenses should be payable by the Contractor.

Before any section of the main is put into use, a bacteriological sample or samples will be taken by the Engineer's Representative and only on receipt of a satisfactory certificate from a Medical Research Laboratory or similar organisation will the main or section of main be permitted to be put into supply and be considered as having been substantially completed.

Any expenditure involved in providing facilities or materials for the taking of samples shall be included in the Contractor's tendered rates and the Engineer will specify and shall be the sole judge as to the number of samples required and the points at which they are to be taken.

The cost of the bacteriological examination will be borne by the Employer but if the sample or samples are not satisfactory, the cost of any subsequent analysis will be borne by the Contractor.

814. CLEARANCE OF SITE

The Contractor shall remove all surplus pipes, specials and other fittings from the site as directed by the Engineer. The site of works shall be levelled and all surplus excavation, debris, cut trees or bushes shall be carted to approved tip sites.

815. TESTING OF WATER RETAINING STRUCTURES

As soon as possible after completion of water retaining structures viz. storage reservoirs etc. they shall be tested for water retention by filling to the normal maximum level with water at a uniform rate of not greater than 2m in 24 hours.

When first filled, the water level should be maintained by adding of further water for a stabilizing period while absorption and autogenous healing take place. This period may be 7 days after which the level of the water surface should be recorded at 24 hour intervals for a test period of 7 days. The structure shall be considered satisfactory if, during this period the total permissible drop in level, after making due allowance for rainfall and evaporation, should not exceed 1/500th of the average water depth of the full tank, 10mm or another specified amount all in accordance with SRN 102. Water used in testing the structures shall be supplied by the Contractor. Sterilisation of the structures is to be done as specified by the Engineer and sampling of water carried out similar to Clause 813.

This test shall be carried out before any backfilling has taken place.

In the event of any water retaining structures failing to pass the test, the Contractor shall make good and re-test at his own expense.

816. STERILISATION OF WATER RETAINING STRUCTURES

A strong chlorine solution (about 200 milligrams per litre) shall be sprayed on all interior surfaces of the hydraulic structure. Following this, the structure shall be partially filled with water to a depth of approximately 30 centimetres. During the filling operation, a chlorinewater mixture shall be injected by means of a solutionfeed chlorinating device. The dosage applied to the water shall be sufficient to give a chlorine residual of at least 50 milligrams per litre upon completion of the partial filling operation. Precaution shall be taken to prevent the strong chlorine solution from flowing back into the lines supplying the water. After the partial filling has been completed, sufficient water shall be drained from the lower ends of the appurtenant piping to insure filling the lines with the heavy chlorinated water.

Chlorinated water shall be retained in the hydraulic structure and in the associated piping long enough to destroy all non-spore-forming bacteria and, in any event, for at least 24 hours. After the chlorine-treated water has been retained for the required time, the chlorine residual shall be at least 25 milligrams per litre. All valves shall be operated while the lines are filled with the heavily chlorinated water.

9. DRAINS, SEWERS AND MANHOLES

901. EXCAVATION FOR DRAINS, SEWERS AND MANHOLES

The ground shall be excavated to the lines and depths shown on the drawings or to such other lines and depths as the Engineer may direct. Excavations taken out to a greater depth than is necessary shall be filled to the required level with approved material as specified for the pipe bed at the Contractor's own cost. Trenches shall be of sufficient width to enable the pipes to be properly laid and jointed. In case of pipes of greater diameter than 300mm, the width of trench shall be external diameter of pipe, plus 400mm. When any excavation has been taken out and trimmed to the levels and dimensions shown on the drawings or as directed by the Engineer, the Engineer shall be informed accordingly so that he may inspect the completed trench and no excavation shall be filled in or covered with concrete until it has been so inspected and the Contractor has been authorised to proceed with the work. All surplus materials from such excavations not required for refilling shall be carted away to tips, or otherwise disposed of, as directed. All excavations shall be kept dry, and all bailing and pumping, timbering, shoring and supporting of sides that may be required, and any refilling, ramming and disposal of surplus materials necessary in carrying out the excavations and backfilling of trenches shall be taken to provide a solid and even bed for barrels of the pipes and, where a concrete bed is not specified, the floor of the trench shall be properly shaped to receive the sockets and the backfill must be thoroughly rammed along the sides of the pipe.

The rate of excavation in the Bill of Quantities shall include for keeping trenches dry and for all bailing, pumping, timbering, shoring and supporting of sides that may be required.

902. SUPPORTS FOR PITS, TRENCHES AND OTHER EXCAVATIONS

The sides of pits, trenches and other excavations shall, where necessary, be adequately supported to the satisfaction of the Engineer, and all such excavations shall be of sizes sufficient to enable the pipes and bedding to be laid accurately, and proper refilling and compacting to be carried out.

The Contractor shall take all precautions necessary for the safety of adjoining structures and building by shoring, opening in short lengths or otherwise, during the time the trenches are open.

903. ROCK CUTTING IN TRENCHES FOR PIPES AND OTHER EXCAVATIONS

Where solid rock is met within trenches and other excavations, it shall be cut out to a depth of 100mm below the intended level of the bottom of the pipes, and replaced with 100mm of approved material as specified. In

measuring such rock excavation the Contractor will be allowed a width of 400mm more than the external diameter of the pipes to a level of 100mm below the bottom of the pipes. The price inserted in the Bill of Quantities shall be held to cover all expenses in connection with excavating the rock, backfilling after laying of pipes and disposing of surplus material as directed by the Engineer.

904. WATER IN TRENCHES FOR PIPELINES AND OTHER EXCAVATIONS

Trenches and other excavations shall be kept free from water at all times during construction of works until, in the opinion of the Engineer, any concrete or other works therein are sufficiently set, and the Contractor shall construct any sumps or temporary drains that the Engineer may deem necessary.

The Contractor shall be responsible for the removal and disposal of all water entering the excavations from whatever source and shall deal with and dispose of such water in a manner approved by the Engineer so as to ensure that excavations are kept dry while ensuring that the disposal of this water does not cause a nuisance to adjacent plot holders or works.

The Contractor shall provide all plant, labour and materials required for such work and all costs incurred shall be deemed to be included in his rates for excavation.

905. LAYING AND JOINTING RIGID JOINTED CONCRETE PIPES

Concrete pipes as specified in Clause 742, shall be laid true to line and level, each pipe being separately boned between sight rails.

For spigot and socket joints, the spigot of each pipe shall be placed home in the socket of the one previously laid, and the pipe then adjusted and fixed in its correct position with the spigot of the pipe accurately centred in the socket. A ring of tarred rope yarn shall next be inserted in the socket of each pipe previously laid and driven home with a wooden caulking tool and wooden mallet, such yarn when in position shall be 25mm in depth. The socket shall then be completely filled with cement mortar 1 to 2 as specified in Clause 729 and a fillet of the same worked all round the side. The fillet shall be levelled off and extend for a length of not less than 50mm from the face of the socket.

For 'Ogee' jointed pipes, the joints shall be thoroughly cleaned before laying, and cement mortar, as specified in Clause 729 shall be applied evenly to the ends for jointing so as to completely fill the joint. The pipes shall then be neatly pointed with a band of cement mortar approximately 125mm wide and 20mm thick. The inside of each joint shall also be pointed up as the work proceeds.

Special care shall be taken to see that any excess of cement mortar etc. is neatly cleaned off while each joint is being made and any earth, cement or

other material cleaned out of the pipes by drawing a tight-fitting wad through them as the work proceeds, or by other approved means. A properly fitting plug shall be well secured at the end of the last laid pipe and shall be removed only when pipe laying is proceeding. The trenches, pipes and joint holes shall be kept free from water until the joints are thoroughly set.

Where shown on the drawings or directed by the Engineer, concrete pipes shall be bedded and haunched or surrounded with concrete as specified in Clause 1019.

The price inserted in the Bill of Quantities shall include for providing, laying and jointing of pipes.

906. PIPES LAID WITH OPEN JOINTS

O.G. porous concrete pipes as specified in Clause 743 shall be laid unjointed with a space of 12mm between the spigot and the inner end of the socket.

All pipes shall be packed and surrounded as directed by the Engineer with approved broken stone, sand or gravel aggregate, to the gradings as shown on the drawings or stated in the Bill of Quantities. The prices inserted in the Bill of Quantities shall include the trench excavation, providing and laying pipes, supplying and placing graded packing material, refilling trench and disposing of surplus all as specified.

907. CAST IRON PIPES

Cast iron pipes and special castings, shall be as specified in Clause 703 and shall be supplied, laid and jointed with lead wool properly caulked to form perfectly uniform and watertight joints, and when laid and jointed they shall be true to line and level.

Where cast iron pipe drains are laid on unstable ground or ground which is likely to settle appreciably over a period of years they shall be pointed by means of an approved self adjusting or screwed gland joint as directed by the Engineer.

908. DRAINS TO BE LEFT CLEAN ON COMPLETION

On completion, all drains, manholes, etc. shall be flushed from end to end with water from an approved source and left clean and free from obstructions.

909. REFILLING TRENCHES

Trenches shall be refilled with suitable excavated material of 100mm surround but not before the work has been measured and approved by the Engineer. For pipes which are not surrounded with concrete, the first layer of filling material shall be free from stones and shall not be thrown directly on to the pipes, but shall be placed and packed with care all

round them. All filling shall be deposited and compacted in layers, not exceeding 225mm loose depth, to a dry density not less than that of the adjoining soil. The last 450mm of filling must be returned in the order in which it has been removed. Timber and framing shall be withdrawn ahead of the layer to be compacted, care being taken to keep the sides of the trenches solid and to fill all the spaces left by the withdrawn timber.

910. CONNECTIONS OF EXISTING SEWERS AND DRAINS

Where shown on the drawings, existing sewers and drains shall be properly extended, connected and jointed to new sewers, culverts, drains or channels. All such connections shall be made during the construction of the main sewer, drain or other work and a record of their positions kept for future use or reference. Where pipe connections are made to a sewer, stone pitched or lined channel, the pipes shall be well and tightly built into the concrete, or masonry work and be so placed as to discharge in the direction of the main sewer, drain or channel and with the end of the pipe carefully cut to the necessary angle. Where the connections are between pipe sewers or drains, special connecting pipes as shown on the drawings shall be supplied and be truly laid and properly jointed.

911. MANHOLES AND INSPECTION CHAMBERS

Manholes and inspection chambers shall be constructed in accordance with the drawings and in the position shown on the drawings or directed by the Engineer. Foundation slabs shall consist of concrete of the appropriate classes as specified on drawings. The side walls shall consist of similar concrete or building stone as specified in Clause 725 in accordance with the drawings.

The side walls shall be fair faced or rendered internally as specified on drawings. They shall be brought up vertically to receive a precast slab formed of concrete of the appropriate classes specified and reinforced all as shown on the drawings. Cast iron manhole covers and frames as specified in Clause 747 shall be provided and frames shall be bedded in cement mortar 1 to 3 and so set that the tops of the covers shall be flush at all points with surrounding surface of the footway, verge or carriageway, as the case may be. Any slight adjustment of the slab level which may be necessary to accomplish this shall be effected by topping the side walls with concrete integral with the slab.

If required, half channel pipes, bends and junctions as specified in Clause 742 and Clause 719 shall be laid and bedded in cement mortar 1 to 3 to the required lines and levels, and both sides of the channel pipes shall be benched up with concrete of the appropriate class and finished smooth to the slopes and levels as shown on the drawings or directed by the Engineer. The ends of all pipes shall be neatly built in and finished flush with cement mortar 1 to 3. Where the depth of the invert exceeds 1 metre below the finished surface of the carriageway or the adjacent ground, iron

steps as specified in Clause 751 shall be built in with alternate steps in line vertically and with such additional hand irons as the Engineer may direct.

All manholes when completed shall be watertight and to the satisfaction of the Engineer. The prices inserted in the Bill of Quantities shall include for excavation, provision of all materials, construction, refilling and disposal of surplus.

912. PRECAST CONCRETE MANHOLES

Precast concrete manholes as specified in Clause 749 shall be supplied and laid generally in accordance with the drawings.

913. GULLY CONNECTIONS

Connections from gullies to sewers and surface water drains or ditches shall consist of concrete pipes and fittings as specified in Clause 742 jointed with cement mortar 1 to 3 as specified in Clause 729. All pipes, bends and junctions shall be laid to the lines and levels shown on the drawings or as directed by the Engineer.

914. SURFACE BOXES, COVERS ETC.

Surface boxes, manholes and other covers lying within the site of the works, shall be raised, lowered, altered or removed as directed by the Engineer.

915. GULLIES

Gullies complete with gratings and with rodding eyes where necessary all as specified in Clause 750 shall be supplied and laid in accordance with the drawings. Where directed by the Engineer, precast concrete gullies shall be laid on and surrounded with 100mm of concrete of the appropriate grade specified in Table 4.2. The concrete surround is to be brought up to the underside of the frame or flush with the top surface as the case may be. Masonry gullies shall be constructed from 225mm building stone and rendered internally. The rates included in the Bill of Quantities shall include for excavation, provision of all materials, construction, making junctions with connections to main drains, accurate setting of frames to line and level, refilling and disposal of surplus materials. Gullies shall be trapped where leading into foul sewers or into combined foul and surface water sewers.

916. COMPLETION OF DRAINAGE WORKS

All sub-soil and surface water drains shall be completed in advance of the construction.

917. TEMPORARY STOPPERS

Junction pipes which are laid but not immediately connected to gullies shall be fitted with temporary stoppers or seals, and the position of all such junctions shall be clearly defined by means of stakes or training wires properly marked and labelled.

918. PROVISION FOR FUTURE CONNECTION TO MANHOLES

Inlet pipes of the required diameters shall be built into the walls of manholes and elsewhere for future use and shall be of the diameters shown on the drawings. The external ends of all such connections shall be sealed off with temporary stoppers, approved by the Engineer. The pipes shall be laid and jointed as specified in Clause 1005 and during the placing of the concrete they shall be adequately supported.

919. SURROUNDING OR HAUNCHING OF PIPES WITH CONCRETE

Surrounding or haunching of pipes shall be carried out using concrete of the appropriate grade specified in Table 4.2. In carrying out this work the Contractor shall take care to pack the concrete under and around the pipes to ensure even bedding and solidity in the concrete and the concrete shall not be thrown directly on to the pipes. The upper surface of the concrete shall be struck off with a wooden screed or template and neatly finished off. The rates shall include for any formwork that the Contractor requires to use under this item.

920. INVERT BLOCK AND STONE-PITCHED DRAINS

Precast concrete invert blocks and side slabs shall be formed of concrete of the appropriate grade specified in Table 4.2 to the dimensions shown on the drawings. Each course of side slabs required in the Bill of Quantities shall be interpreted as one complete row of side slabs to one side of the channel concerned. Stone used for channels shall be 225mm x 100mm building stone. Drains should not normally be laid to a radius of curvature less than 10 times the actual width of the drain.

Invert block and stone-pitched drains shall be constructed in the positions and to the levels and dimensions shown on the drawings and laid to true line and even fall. Where under-filling is required it shall be in 100mm maximum thickness layers of compacted murrum. The earth sides to such channels shall be neatly finished to a slope of 1 to 1 or such other slope as the Engineer may direct.

Invert blocks and side slabs shall be laid on a 100mm minimum thickness of compacted murrum and be neatly jointed with cement mortar 1 to 3 as the work proceeds. The excavation, murrum bedding, providing, laying and jointing invert blocks or stone, backfilling and disposal of surplus shall all be as specified and all in-situ connections shall be in concrete of the appropriate grade specified in Table 4.2.

921. TESTING OF JOINTED PIPES AND MANHOLES

Sealed jointed drains, up to and including 600mm diameter shall be tested in sections (e.g. between manholes) by filling with water under a head of not less than 1 metre. Drains found to be water-tight after a period of 30 minutes will be passed as satisfactory but the water must be retained in the pipes until a depth of at least 450mm of filling has been deposited and compacted on top thereof. Drains failing to stand the test

shall be taken out and the pipes re-laid and re-jointed until completely water-tight.

Drains exceeding 600mm in diameter shall be tested by means of a smoke test before they are covered up. Both ends of the lengths of drain to be tested shall be sealed to the satisfaction of the Engineer, and smoke shall then be pumped into the section from an approved machine. Should any joint in the section show an escape of smoke, the section shall be taken out and the pipes re-laid and re-jointed until there is no further escape of smoke.

Should the Engineer so direct, manholes shall be tested by completely filling with water, and there shall be no appreciable loss over a period of 2 hours.

On completion of the works, or at suitable intervals during construction, infiltration tests will be carried out. The permissible amount of infiltration shall be 1 litre per hour per linear metre of nominal internal diameter.

The Contractor shall provide all labour and apparatus for the above tests.

All testing will be done in accordance with the procedure of the British Standard Code.

922. PIPES WITH RUBBER RING JOINTS

Rubber rings complying with SRN 308 will be provided by the Contractor. They will be laid in the socket and the pipes then jointed as specified. The jointing of pipes shall be carried out in accordance with manufacturer's instructions and in conformity with any modifications proposed by the Engineer.

923. LAYING, JOINTING AND BACKFILLING FOR FLEXIBLE JOINTED PIPES

The Contractor shall ensure that any hard spots and loose stones are removed from the formation prior to laying of bedding materials. The Contractor shall lay a bed of thickness 100mm consisting of granular material i.e. sand, gravel, or approved soil of friable nature.

After laying of pipes the Contractor shall lay bedding material on the sides of the pipe compacted by tamping into soffit of sewer.

After completion of this operation the Contractor shall lay the bedding material on top of the pipe in 150mm layers to a thickness of 300mm. The material is to be compacted by tamping. However, precautions are to be taken to avoid excessive tamping on top of the pipe. The remaining trench excavation is to be backfilled to comply with Clause 1009 of specification.

The pipes shall be laid with flexible ring seal joints provided that solvent cement joints could be used for fittings where necessary subject to the

approval of the Engineer. Pipes and fittings shall be checked for deformities prior to laying. Deformed pipes and fittings shall not be accepted.

Flexible Rubber Ring Joints

The Contractor shall ensure that the spigot end is free from grit, dust or dirt and sealing rings should be seated evenly in the socket groove. Pipe lengths and fittings are supplied with a chamfer on the spigot. Where pipes are to be cut or are supplied without a chamfer on the spigot end the Contractor shall ensure that the pipe is cut square and then form a chamfer on the spigot end with a medium file to an angle of 15 degrees. Remove saw flashing by scraping with a pen-knife.

Expansion Gap

It is necessary to leave a gap between the edge of the spigot end and the base of the socket to allow for expansion. Moulded fittings are supplied with an embossed line indicating the correct depth of insertion. In other cases where the marking is not done, the Contractor shall ensure that an expansion gap of at least 3mm per metre length of pipe or at least 15mm per pipe length is provided. This can be done by marking spigot ends or by pushing spigot fully home, making a small mark on pipe and then withdrawing the pipe by 15mm.

After completing jointing the pipe shall be laid on the prepared bed making sure that a suitable depression is created in the bed for the socket.

Solvent Cement Joints

For solvent cement joints make sure that mating surfaces are clean and free of grease and dirt. Roughen mating surface with sandpaper, clean both surfaces with cleansing fluid using a clean cloth. Apply solvent cement on both mating surfaces. Without delay bring mating surfaces together and hold in position firmly for a few seconds. A layer of cement should be visible at the edges. Joints should not be disturbed for at least 10 minutes after assembly.

924. WEEPHOLES

Where shown on the Drawings or directed by the Engineer, the Contractor shall cast weepholes into concrete walls. The Contractor shall provide and place plastic pipes of the diameter shown on the Drawings to form weepholes which will be firmly held in position during the placing of the concrete. A 500mm x 500mm square of approved filter fabric shall be placed, central on the weephole between the concrete wall and backfill material.

925. DEBRIS SCREENS

Where shown on the Drawings, the Contractor shall fabricate and install debris screens across the full width of the drain channel cross-section. The screens shall be fabricated using galvanised mild steel complying with BS 729. They shall be mounted on R.C. supports and incorporate a safe access platform to facilitate manual clearing of debris as shown on the Drawings.

10. MISCELLANEOUS

1001. **GENERAL**

The Contractor is referred to the drawings as to the general character of the works and he shall allow in his rates for any extra costs he may consider incurred by reason of the work being in detached positions, in small quantities, difficulty of access or for any other cause. He should also make due allowance for specialist installations taking place during the currency of this contract.

This section of the Specification refers to miscellaneous items. Clauses elsewhere in the Specification shall also be followed where relevant.

1002. **BONDING TIES**

Bonding ties shall be 75mm wide x 250mm long galvanised bitumen-coated expanded metal strip, cast 100mm into concrete surfaces in contact with block work. The bonding tie used shall be approved by the Engineer's Representative.

1003. **PRECAST LINTELS**

All precast items shall be marked with the date of casting and shall not be built into the works until they have matured for 28 days. Ends of bar reinforcement shall be hooked or bent as required. The cover for reinforcement shall be 25mm from internal faces and 38mm from external exposed faces. The 'top' of lintels shall be numbered for identification.

Lintels shall have timber or pre-formed inserts cast in for fixing metal windows where required and shall have fair face finish on all surfaces exposed to view and hacked surfaces where plastered.

1004. **BLOCKWORK**

Building blocks shall be dense concrete blocks complying with the requirements of B.S. 2028, 1364, with faces for plastering and having a compressive strength of 14 N/sq.mm. (Table 2, Type A14).

Blocks shall be obtained from an approved manufacturer and shall be equal to sample blocks previously approved by the Engineer's Representative.

Blocks shall be carefully handled and stored on site and protected from the weather at all times.

Surfaces on which blockwork is to be built shall be kept clean. Blocks shall be well wetted before being laid and the tops of walls where blockwork has been left shall be well wetted before re-commencing. Blockwork shall be built plumb, true to line and level, with all perpend vertical and in line. Blocks shall be built in half bond and alternate

courses shall be block bonded at all junctions, no cut block shall be less than half a block. Joints in concrete blockwork shall be well filled with gauged mortar and shall not exceed 10mm in width.

1005. DAMP-PROOF COURSE (D.P.C.)

Hessian based metal cored bitumen for damp-proof courses shall be lead cored, complying with B.S. 743 paragraph 4, type D, weighing not less than 4.4 kg. per square metre. Damp-proof course shall be bedded horizontally in mortar as for blockwork with 115mm laps in length and full laps at angles.

1006. HARDWOOD

Hardwood for joinery shall be sound, well conditioned and seasoned Mvuli complying with the requirements of B.S. 1186 Part 1, Class 1. A sample of each representative section for use in the work shall be previously submitted by the Contractor for approval by the Engineer's Representative. Moisture content shall be 12% (+ or - 2%).

1007. PLYWOOD

Plywood generally shall comply with B.S. 1455. That from sources not included in B.S. 1455 shall be of corresponding grades of veneers and types of bonding. Plywood for flush doors shall be Grade I Mvuli veneered.

1008. DOORS

Internal doors shall be hardwood framed solid cored flush doors constructed in accordance with B.S. 459 Part 3, faced both sides with 3mm thick Mvuli veneered plywood and lipped all round with matching hardwood lipping. Moisture content at delivery shall be 12% (+ or - 2%).

1009. FRAMES AND LININGS

Door frames and linings shall be Class 1 Mvuli mortice and tenon jointed at angles. Sub-frames for internal doors shall be Class 1 Mvuli tongued at angles.

1010. ARCHITRAVES AND STOPS

Architraves and stops shall be Class 1 Mvuli matching to the frames and linings.

1011. IRONMONGERY

All ironmongery shall be obtained from a source approved by the Engineer's Representative. Samples shall be submitted before ordering and the articles ordered shall match up with the approved samples. Screws of a like metal shall be used for all fittings.

1012. JOINERY

All exposed joiner's work shall have wrought faces. The prices of all joiner's work shall include for slightly rounded arises.

Where the term 'framing' or 'framed' is made use of, it shall be understood to mean all halvings, dovetails, tenons and hardwood pins and the best known means of putting the work together.

All framed work shall be put together loosely and stacked under cover where a free current of air can circulate and is not to be wedged and glued until it is required for fixing.

All joinery, when brought on the works, shall be stacked under cover. The Engineer or his representative, shall have full right of access to the joinery works and power to condemn any work not approved and any approval expressed or implied is not to relieve the Contractor from his responsibility and liability to make good any shrinkage or other defects that may appear after the work is fixed.

All joinery to be painted shall be knotted and primed.

The Contractor shall provide all materials, labour, framing, fixing, etc., nails, screws and everything necessary for the proper execution and completion of the work.

1013. FIXING JOINERY

Doors shall be hung on one or one and a half pairs of butt hinges to give a maximum even tolerance of 2mm all round.

Sub-frames shall be fixed to blockwork with three fixing clamps per side and one dowel let 50mm into the floor and 50mm into the foot of each leg. Linings shall be fixed after completion of other finishings by means of screwing and pelling to sub-frames with matching hardwood pellites. Architraves and stops shall be pinned on, heads punched and filled with tinted filler.

1014. FIXING IRONMONGERY

The rates for supplying and fixing ironmongery shall include for all sinking, cutting, boring, mortising etc., making good, replacing damaged screws, oiling, adjusting and leaving in good working order and for mastering all keys.

1015. BOLTS AND NUTS

Bolts and nuts shall comply with the relevant requirements of the British Standards as set out below:-

| | |
|--|----------------------|
| Black Hexagon Bolts, Screws and Nuts | B.S. 4190, Grade 4.6 |
| Metal Washers for General Purpose | B.S. 4320 |
| Black Cup and Countersunk Head Bolts and Screws, with Nuts | B.S. 4993 |

The items shall preferably have coarse metric threads but items with B.S.W. threads may be used. Bolt lengths shall be sufficient to ensure that nuts are full threaded when tightened in their final position.

1016. STRUCTURAL STEELWORK

The whole of the structural steelwork and testing shall comply with the relevant clauses of B.S. 449. The Contractor shall include for the preparation of all shop details from the drawings supplied by the Engineer. All such details shall be approved in writing by the Engineer before the work is put in hand. Every drawing shall show the number and sizes of all rivets and bolts, complete details of welds, type of electrodes, welding procedure, whether the welds are to be made in the shop or elsewhere and any other relevant information. The Contractor shall be responsible for the accuracy of his shop details and for shop fittings and site connections.

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

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

The fabrication and erection of the steelwork shall be carried out in accordance with Part 5 of B.S. 449.

1017. GALVANISED WORK

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

1018. ELECTRICAL INSTALLATION

The electrical installations will be carried out by Licensed Electrician and complying with the following:-

- a) Regulations for Electrical Equipment of Buildings issued by the Institution of Electrical Engineers.
- b) Electric Power Act.
- c) The K.P.&L. Co.'s Bye-Laws.
- d) Relevant current British Standards and Codes of Practice.
- e) All the relevant clauses in this Specification, particularly the clauses in Sections 13 and 14.

PLUMBING INSTALLATION

1019. WATER AUTHORITIES REGULATIONS

The internal plumbing work shall be carried out to the satisfaction of and in accordance with the regulations of the local Water Authority.

1020. RAINWATER INSTALLATIONS

Rainwater installation shall be in grey PVC pipework with 'O' ring joints.

1021. TESTING PLUMBER'S WORK

The plumbing work and sanitary fittings shall be tested at such times as the Engineer's Representative shall direct and to his entire satisfaction. Gutters and rainwater pipes shall be tested with water to satisfy the Engineer's Representative that gutters are to correct falls, pipes are unobstructed and joints are sound.

1022. SETTING OUT

The positions of all pipe runs, including joints and connections, shall be agreed with the Engineer's Representative before work is commenced.

1023. COPPER TUBES AND FITTINGS

Light gauge copper tubes shall comply with B.S. 2871 Part 1, Table X.

Fittings: Fittings and couplings for jointing pipes shall comply with B.S. 864, Part 2 for capillary and compression type A fittings.

Fixing: Tubes shall be fixed clear of walls or soffits with two piece copper spacing clips complying with B.S. 1494 Table 8d, but in metric sizes to suit tubes spaced at not more than 1.2m horizontally and 1.5m vertically for 15mm diameter pipes 2.0m horizontally and 2.5m vertically for 22mm and 28mm diameter pipes.

1024. PLASTIC PIPES, FITTINGS AND ACCESSORIES

uPVC soil and ventilating pipes and fittings shall comply with B.S. 4514. Waste pipes and fittings shall be modified unplasticised polyvinyl chloride (MuPVC). Waste traps shall comply with B.S. 3943. Balloon gratings shall be plastic coated steel wire.

1025. SLEEVES

Where sleeves are required for pipes passing through concrete or blockwork they shall be of galvanised steel heavy gauge tube of sufficient diameter to give a space of 3mm all round the pipe.

1026. PIPEWORK GENERALLY

Pipes shall be in the maximum lengths possible to avoid unnecessary jointing and fixed to sufficient falls to prevent air locks and to enable the system to be drained down.

1027. BRASSWORK

Ball Valves: Piston type ball valves shall comply with B.S. 1212, Part 1 for high or low pressure as described. Floats to break feed cisterns shall be copper type complying with B.S. 1968, Class C.

Bib-taps shall comply with B.S. 1010 and shall be of brass with fixed jumpers, chromium plated and colour coded for hot and cold.

Pillar valves shall comply with B.S. 1010 and shall be of brass with fixed jumpers, chromium plated and colour coded for hot and cold.

Stop valves shall comply with B.S. 1010 and shall be of brass with crutch handles.

1028. CISTERNS

Storage cisterns and break feed cisterns shall be galvanised steel cisterns complying with B.S. 417, Grade A.

1029. SANITARY FITTINGS

Sanitary fittings shall be manufactured from glazed vitreous china complying with the requirements of B.S. 3402. They shall be supplied by an approved firm and shall pass the requirements of the local Water Authority.

PLASTERWORK AND OTHER FLOOR, WALL AND CEILING FINISHINGS

1030. GENERAL

All branded materials shall be delivered in the manufacturer's packages bearing the manufacturer's name and the name of the material concerned. Cement, lime, plaster etc., shall be stored separately off the ground in dry conditions. All surfaces shall be properly prepared for plastering, rendering and screeding and brushed or cleaned free from dust and all traces of efflorescence and contamination removed. Concrete surfaces shall be thoroughly cleaned free from all traces of mould oil or other formwork coatings and hacked to provide a key.

Surface to receive plastering, rendering, screeding etc. shall be wetted sufficiently in advance to ensure the correct conditions for adhesion. Undercoats shall be thoroughly scratched to allow for keying and allowed to dry sufficiently before application of further coats. Dubbing out shall be in the same mix as the subsequent coat and shall not exceed 20mm in thickness in one application.

1031. METAL LATHING

Metal lathing shall be light galvanised expanded metal weighing not less than 1.2 kg. per square metre and complying in all other respects with B.S. 1369.

1032. CEMENT

Cement shall be Ordinary Portland Cement and shall comply with KS 02-21. White and/or an equivalent approved coloured cements shall comply with KS 02-21 and shall be obtained from an approved manufacturer.

1033. SANDS

Sand for cement and lime shall comply with B.S. 1199, Table 1 for undercoats and Table 2 for finishing coats. Sand for floor screeds shall comply with B.S. 1199, Table 1.

1034. LIME PUTTY

Lime putty shall be prepared from hydrated lime complying with B.S. 890, Table 2. Hydrated lime shall be added to water, stirred to a creamy consistency and left to mature for at least sixteen hours before use. Alternatively, ready slaked lime may be obtained from an approved manufacturer. The lime putty shall be protected from drying out.

1035. PLASTICISERS

Plasticisers shall be of the resin type and shall be used only with the approval of the Engineer's Representative in accordance with the manufacturer's instructions.

1036. WATER PROOFERS

Water proofers shall be approved integral water proofers and shall be used in accordance with the manufacturer's instructions.

1037. ANGLE AND CASING BEADS AND RENDER STOPS

Galvanised steel angle and casing beads and render stops shall be as manufactured by "Expamet" or other equal and approved.

TILE WORK**1038. GLAZED CERAMIC WALL TILES**

Glazed and eggshell ceramic wall tiles shall comply with B.S. 1218 and shall be of the colours described. Samples of tiles shall be submitted to the Engineer's Representative for approval.

1039. ADHESIVE

Adhesive for fixing wall tiles shall be approved adhesive.

1040. FIXING WALL TILES

Tiles shall be wiped clean and fixed dry with the approved adhesive all in accordance with manufacturer's recommendations with straight joints 1.6mm wide, pointed in white cement.

1041. CERAMIC FLOOR TILES

Ceramic floor tiles shall be fully vitrified clay tiles complying with B.S. 1286 and having a water absorption not exceeding 0.3%.

1042. LAYING FLOOR TILES

For laying of floor tiles the surface of the compacted bedding shall be spread with a 3mm thick cement and sand (1:1) slurry. Floor tiles shall

be wiped clean and laid dry, in a square pattern with 3mm wide joints and tapped into the grout. Pointing shall be in an approved proprietary tile grout, tinted to match floor tiles.

1043. *FIXING METAL LATHING*

At junctions of blockwork and concrete where rendering continues over both surfaces a 100mm wide strip of expanded metal lath shall be fixed, centred on the joint.

1044. *FINISH*

Cement-lime-sand undercoats shall be allowed to dry out thoroughly before a further coat is applied and scratched to provide an adequate key for the next coat. The finishing coat shall be finished with a steel float. A neat cut shall be made with the edge of the trowel through all coats of the wall plaster at junctions with concrete columns and soffits.

1045. *INTERNAL RENDERING*

The internal rendering on concrete block panels shall be two coat work, total 20mm finished thickness. The undercoat to be 1:1:5 cement, lime putty, sand by volume, 9mm to 12mm thick and scratched for key. The finishing coat to be 1:1:6 cement, lime putty, sand by volume, 6mm to 9mm thick, trowelled smooth. At junctions of panels to concrete columns and beam soffit, finish the rendering with a clean trowel cutting through both coats of rendering.

1046. *EXTERNAL RENDERING (TYROLEAN)*

The external rendering on concrete blockwork and outer face of in-situ concrete frame shall be two coat work, total 15mm finished thickness. Clean and prepare block and concrete surfaces, shot pin metal lath strip 100mm wide at concrete/blockwork junctions and apply undercoat 10mm finished thickness of 1:1:6 cement, lime putty, sand by volume, floated smooth. The finishing coat shall be approximately 6mm thick off white Culamix Tyrolean open honeycombed texture machine applied to the required thickness by skilled operatives strictly in accordance with the manufacturer's recommendations, manufactured and supplied by Blue Circle Industries Ltd., agents in Kenya, Kencem, P.O. Box 14267, Nairobi, Kenya or other approved alternative. The undercoat surface shall be sound and clean and free from any loose material. All window and door frames shall be protected by suitable masking.

1047. *EXPANSION JOINTS*

Expansion joints in clay ceramic tile flooring shall be 6mm wide x 50mm deep, unless otherwise described, formed with 6mm wide x 38mm deep butyl rubber or other equal and approved compressible strip pointed with 6mm wide x 12mm deep polysulphide compound to match colour of tiling. All surfaces of concrete or screed in contact with the butyl rubber shall be primed.

Expansion joints shall be formed at perimeters and at not less than 4.5 metre centres both ways in the tiled areas.

1048. PREPARATION

Concrete floors to receive screeds shall be raked where necessary to remove concrete, plaster or mortar droppings and well brushed to remove all loose particles and dirt. Concrete floors shall be well wetted before the screeds are laid.

PAINTING AND DECORATING

1049. PAINT AND PAINTING

All paint, including primers, undercoats and finishings, polish, emulsion etc., to be used shall be obtained ready for use from the manufacturer approved by the Engineer.

The Contractor shall order direct from the manufacturer and only fresh paint will be allowed to be used.

All paints shall be of the qualities, i.e. exterior, interior etc., types and colours scheduled. All coats of paint system shall be obtained from the same manufacturer, shall be ordered for use together and as far as practicable, shall be ordered on one order in sufficient quantity for the whole of the work, particularly in the case of the finishing colour. Where more than one of the three systems (gloss, semi-gloss or flat) is in use, these paints shall be used in strict accordance with their accompanying printed instructions.

The Contractor shall use only paints delivered to the site in original sealed containers, not exceeding five litre capacity, stamped and bearing the manufacturer's name or mark, the specification number, method of application (e.g. brushing) colour, quantity, batch number and date of manufacture, and expiry.

Contractor's stocks shall not be accepted unless expressly approved by the Engineer's Representative.

The paint, which will be subject to sampling and testing, shall be used exactly as received, after adequate stirring, without the addition of thinners, driers, or adulterating materials of any kind.

All tints and shades (including colours of undercoats) shall be selected and approved by the Engineer's Representative and the Contractor shall allow in his prices for executing the painting work in colour schemes, to be prepared from a wide range of colours.

All paints described as oil paint shall be alkyd paint.

No painting on exterior work shall be carried out in wet weather or upon surfaces which are not thoroughly dry. Painting shall not proceed in

dusty conditions. Each coat of paint shall be thoroughly dry and shall be rubbed down with glass paper before a subsequent coat is applied. Adequate care must be taken to protect surfaces of paintwork, still wet.

Lead based priming paints for steelwork shall conform to B.S. 2521 and 2523.

1050. PREPARATION

Copper pipes shall be washed with soap and water, roughened with abrasive paper and washed with white spirit.

Metalwork - remove all scale from unprimed iron and steelwork, degrease using proprietary solution compatible with paint finish, remove all dirt and rust by brushing with a steel wire brush. Clean all steel delivered primed, of dirt and dust and touch up any damage to primed surfaces in transit or erection.

Hardwood - rub down and brush off all dirt and dust, stop any holes or other imperfections with stopping tinted to match pigment finish.

1051. PROTECTIVE DECORATIVE FINISH

The protective decorative finish on hardwood joinery shall be PX65 (Pinotex) and Holdex as manufactured and supplied by Sadolins Paints (E.A.), or other equal and approved finish.

External frames and doors shall be treated with two coats PX65 (Pinotex) Pigmented before fixing and one coat PX65 (Pinotex) Top Coat after fixing.

Internal frames and doors shall be treated with two coats PX65 (Pinotex) Pigmented before fixing and one coat after fixing and finished with two coats of Holdex, Silk Matt Interior Lacquer.

Application shall be strictly in accordance with the manufacturer's recommendations.

Not more than three months should separate the initial (before fixing) and final (after fixing) coats.

1052. RENDERED PANELS

The internal rendered blockwork panels shall be painted with two coats Sandtex Matt resin- based surface coating or other equal and approved coating.

Rendered wall surface shall be cleaned down and Sandtex coats laid on by brush or roller in accordance with the manufacturer's recommendations. Spraying wall surfaces will not be allowed.

1053. IRONMONGERY FURNITURE

The rates for painting shall include for taking down and refixing ironmongery furniture, kicking plates etc., as necessary.

ROADS AND FOOTPATHS

1054. PREPARATION OF ROAD FORMATION

After excavation or filling has been completed the road formation shall be shaped to the required contour and compacted with an 8 - 10 tonne roller.

If any soft places develop in the formation during compaction they shall be excavated to such depths as the Engineer may direct, refilled with hardcore or other approved granular material, levelled and re-compacted before the sub-base is laid.

1055. MURRAM SUB-BASE

The murrum sub-base will be constructed only in poor soil conditions where directed by the Engineer. The murrum shall be from an approved source quarried so as to exclude vegetable matter, loam, topsoil or clay. The California Bearing Ratio (C.B.R.) of the murrum, as determined for a sample compacted to maximum density as defined under B.S. 1377 and allowed to soak in water for four days, shall not be less than 30. This C.B.R. is a guide to quality only and the compaction in the work will be judged by density.

The murrum sub-base shall be of the thickness as shown on drawings or stated in the Bill of Quantities.

The sub-base shall be evenly spread and compacted using an 8-10 tonne roller for road construction and a 2-4 tonne roller for footpath construction. The Contractor will be required to maintain the selected material at its optimum moisture content to achieve maximum compaction. The roads and footpaths shall be finished to the grades and levels shown on the drawings.

1056. WATER-BOUND MACADAM BASE

The base shall consist of crushed building stone mechanically laid in one or more separate layers, so as to give a total compacted thickness as shown on the drawings, or stated in the Bill of Quantities. The first layer shall be placed to produce a thickness of 75mm to 150mm after compaction as specified. Where a greater thickness than 150mm of base is specified the material shall be laid in separate layers each not less than 75mm or more than 150mm in thickness after compaction.

The stone shall have the following gradings:-

| <u>B.S. Sieve Size</u> | <u>% by Weight Passing</u> |
|------------------------|----------------------------|
| 5 in. (125mm) ring | 100 |
| 3 in. (75mm) | 25 - 80 |
| 1.5 in. (38mm) | 0 - 20 |
| 3/4 in. (20mm) | 0 - 5 |

Alternatively, a stone base may be placed by hand. In this case the first stones in each layer, which shall be of a cubical nature, shall be placed to the approximate height of the layer. When an area has been covered in this way a second placing of stones of smaller size shall be positioned by eye in the spaces between these first placed, and wedged home by hammering. A third placing of stones shall follow the second and so on until in the opinion of the Engineer the voids are sufficiently filled to permit compaction.

Thorough watering shall be carried out at all stages of compaction. Initial compaction shall be with a light roller. The surface shall then be blinded with quarry dust so as to fill the interstices completely and again rolled, this time using a heavy roller. The base shall then be well watered and brushed and permitted to dry. Further rolling with a heavy roller, blinding with quarry dust, watering and brushing shall be carried on until the whole presents a homogeneous surface and no movement is visible under the action of the heavy roller. On completion of the base, and before any surfacing is laid, the finishing surface shall be maintained free from potholes, ruts and undulations, irregularities, depressions, loose material or other defects, and shall remain true to cross-section, line and level.

1057. ROLLED ASPHALT HOT PROCESS WEARING COURSE

Rolled asphalt wearing course shall be made and laid in accordance with British Standard 594 : Rolled Asphalt (Hot Process) and the thickness after compaction shall be as shown on the drawings or stated in the Bill of Quantities. Except where impracticable, the rolled asphalt shall be laid using an approved paver.

Where a base course has been used as part of the surfacing, the wearing course shall be laid thereon as soon as practicable, care being taken that the latter is thoroughly clean. In any case the wearing course should be laid within 3 days of the laying of the base course, unless the Engineer allows otherwise, and no construction or other traffic shall be allowed on the base course.

1058. BITUMEN MACADAM WEARING COURSE

Bitumen macadam wearing course shall be made and laid in accordance with British Standard 1621 : Bitumen Macadam with Crushed Rock or Slag Aggregate, using the appropriate Table and Section(s) thereof, other than those for Dense Bitumen Macadam, and nominal size of aggregate

all as shown on the drawings or stated in the Bill of Quantities. Except where impracticable the bitumen macadam shall be laid using an approved paver. The maximum mixing temperature for straight run bitumen of penetration 85-100 is 155 degrees centigrade. For other penetration bitumens the mixing temperature shall be as determined by the Engineer.

1059. COMPACTION AND SURFACE FINISH

As soon as rolling can be effected without causing undue displacement of the material, and while the material is above the minimum temperature stated in Table 6.3, it shall be uniformly compacted by an 8-10 tonne roller having a width of roll not less than 18 inches.

1060. PREPARATION OF THE BASE FOR SURFACING OR SURFACE DRESSING

Before any binder or coating material is applied to a base the latter shall have been freed from all extraneous material by brushing with mechanical sweepers or stiff brooms.

Macadam or murrum bases shall normally receive a priming coat in accordance with the following clause.

Concrete, bitumen bound or rolled asphalt bases shall normally receive a tack coat in accordance with the following clause.

1061. PRIME COAT AND TACK COAT

When a base is to be sealed before surfacing by means of a prime coat, the surface shall first be prepared in accordance with the preceding clause.

Unless otherwise stated in the Bill of Quantities or ordered by the Engineer, the prime coat material shall be bitumen grade M.C.O. at a rate of application of 1.2-1.5 lit./sq.m. It shall be applied with a mechanical bitumen distributor complying with the requirements of British Standard 1707 : Binder Distributors for Road Surface Dressing.

The prime coat shall be cured for 48 hours. This period may be relaxed at the discretion of the Engineer who shall be informed and shall give his consent before any surfacing works are commenced.

The Contractor shall not permit traffic to run on a prime coat. Where this is unavoidable the Engineer shall order an application of medium sand at a rate of 6 kg./sq.m. which item shall be measured and paid for separately.

Where adhesion on an existing surface is to be improved before surfacing by means of a tack coat, the surface shall first be prepared in accordance with the preceding clause.

Unless otherwise stated in the Bill of Quantities or ordered by the Engineer, the tack coat material shall be approved bitumen emulsion in accordance with British Standard 434 : Bitumen Road Emulsion containing not less than 55% of bitumen. It shall be mechanically applied at a rate of 0.38 - 0.43 lit./sq.m.

The tack coat shall be allowed to cure to a tacky condition and the Engineer's consent obtained before any surfacing works are commenced. Any ponding which has occurred must be brushed out to bring the coverage within the limits specified.

The Contractor shall not permit traffic under any circumstances to run on a tack coat.

1062. ROLLING OF SURFACE MATERIALS

The type and weight of roller to be employed on each course of surfacing shall be approved before hand by the Engineer. Notwithstanding this, the Engineer may call for a certified weighbridge ticket in respect of any roller at any time.

Roller wheels shall always be clean and even. An adequate water tank shall be provided together with a fully operating roller sprinkler system. The roller shall be operated by a person fully trained and experienced in rolling technique.

Rolling shall be generally carried out in a longitudinal direction, working from the edge of the carriageway to the crown or, in the case of a superelevated carriageway, from the low to the high side. The second pass should be precisely on the path of the first, before the roller shifts transversely. Heavy drive wheels should approach the freshly laid material. Reversing should be carried out slowly and smoothly and the reversing points staggered across the carriageway to avoid any wave effect. Rolling should be continued until all rollmarks are eliminated and there is no perceptible movement under the roller wheels.

Idle standing on freshly laid material is not permitted.

If the total surfacing to be compacted exceeds 3,300 sq.m. per day, the Contractor shall provide a second roller.

In confined areas where normal rolling is not possible, mechanical tamping will be permitted. The tampers must be employed systematically to give a smooth "as-rolled" finish.

No traffic will be permitted on a surfacing course until it has been compacted and in the opinion of the Engineer has acquired a sufficient set.

1063. TRAFFIC ON NEWLY CONSTRUCTED ROADS

The Contractor will not be permitted to use a new carriageway at any stage of construction without the written permission of the Engineer's Representative.

Notwithstanding any conditions which the Engineer's Representative may stipulate at the time of giving his permission, the Contractor will be solely responsible for maintaining the new carriageway, keeping the surface clean and for making good at his own expense any damage or wear so caused.

1064. LAYING KERBS, CHANNELS AND EDGING BLOCKS

Kerbs, channels and edging blocks shall be bedded true to line and level in cement mortar on a concrete foundation Grade 15. They shall be haunched with concrete Grade 15. The foundation and haunch shall be laid before the approved sub-base is laid to the dimensions shown on the drawings.

1065. CONCRETE BLOCK PAVINGS

The precast concrete blocks have to be manufactured to the following requirements:-

- i) Depth of block to be 60mm and 80mm.
- ii) The concrete used shall have a maximum aggregate size of 20mm, high workability, and shall be designed to have a 20 day characteristic cube strength of 45 N/sq.mm.
- iii) To ensure that the surface does not polish but retains a micro texture to give good low speed skidding resistance, sands containing more than 25% acid soluble material must not be used.
- iv) To ensure interlock between blocks, they must be manufactured to accurate dimensions, which allows them to be laid with only small spaces between the joints. When laid, the spaces between blocks should not exceed 2 to 3mm.

1066. LAYING OF BLOCKS

The blocks should be laid in such a way so as to develop interlock. The surface course comprises closely fitting paving blocks, the spaces between them being filled with dust and sand particles.

The finished surface level shall be within 5mm of the design level. The maximum deformation within the completed surface measured by a 3m straight edge placed parallel to the centre line of the road in parts of the carriageway where vertical curves necessitate a greater deviation.

The level of any two adjacent blocks should not deviate by more than 2mm.

1067. LAYING COURSE

The laying course shall consist of 40mm sand as specified containing not more than 3% of silt and clay by weight, and, with no more than 10% retained on a 5mm sieve. It is spread to give a thickness when compacted of 40mm. The profile of the uncompacted sand should be similar to that of the final surface. The required thickness of uncompacted sand forming the laying course will depend upon its moisture content grading, and degree of pre-compaction. The laying course sand needs to be spread to a greater depth than the target compacted depth of 40mm. The amount of surcharge will be of the order of 10 to 15mm but the exact value is best determined by trial. To avoid any need to adjust the surcharge during construction, it is helpful to keep the sand grading and moisture content sensibly constant.

Once spread the sand should be screed smooth to level. For roads less than 4.5m wide, the kerbs may be used as screeding guides, but on wide pavements, it is necessary to set temporary screed rails for striking off the laying course. During spreading and screeding, operatives must not stand in the sand, otherwise uneven pre-compaction will occur causing irregularities in the final road surface. To minimise the risk of disturbance, it is advisable to avoid screeding sand long distances in front of the block laying face.

1068. CUTTING BLOCKS

Awkward shapes at edges or obstructions, like gulleys manholes are filled by cutting blocks with a block splitter or by using a bolster chisel and hammer.

1069. VIBRATION

When the laying of concrete blocks has been completed, then blocks should be vibrated with a plate vibrator. The vibrator should have a centrifugal force of 0.35 to 0.50 sq.m. A frequency of 75 to 100 Hz is recommended.

The required number of passes of the plate depends upon a variety of factors and is best determined by site trial. It should be sufficient to provide an even riding surface and prevent vehicles from causing further compaction. Normally two or three passes will suffice. Vibration should not be carried out within about 1m of unrestricted blocks; on the other hand, as little surface course as possible should be left unvibrated overnight.

Finally, sand should be brushed over the surface and two or three further passes of the vibrator made, to complete interlock and fill the joints.

As soon as vibration has been completed, the road can be used.

1070. PREPARATION OF FOOTPATH FORMATION

After the excavation of filling has been completed as specified the footpath formation shall be regulated to an even and uniform surface, and compacted with a roller weighing not less than 2.5 tonnes.

If any soft places develop in the formation during compaction they shall be excavated and backfilled with approved granular material, levelled and re-compacted.

1071. PRECAST CONCRETE PAVING

Precast concrete paving slabs shall be to B.S. 368 : 1971 and shall be laid with 1:3 lime mortar using five pats not less than 150mm diameter for each slab. They shall be laid at a level not exceeding 4mm above the top of the kerb or concrete edging. The joints shall be thoroughly cleaned out and grouted with cement mortar well brushed in and flushed off. No cracked or broken slabs shall be used.

1072. CHASING

Chasing in load-bearing walling for pipes, etc., is to be kept to a minimum size of cut and the positions and runs of chases are to be approved by the Engineer before any cutting is commenced.

1073. DAMP-PROOF COURSES (D.P.C.)

Damp-proof courses shall be 1000 gauge polythene free from tears and holes and be laid with 150mm minimum laps on and including a levelling screed of cement mortar.

1074. BITUMINOUS FELT ROOFING

Bituminous felt roofing shall be carried out complete by an approved Specialist Sub-Contractor.

Felt roofing shall be executed in accordance with British Standard Code of Practice C.P. 114/101 and strictly in accordance with the manufacturer's instructions, laps shall be 100mm minimum and falls 100mm minimum in 3 metres for flat roofs, and the minimum specification shall be as follows (Felt to B.S. 747):-

- a) One layer of asphalt saturated felt (weighing 6.8 kg. per 10 square metres) laid loose to screed or random and lap nailed to the boarding.
- b) One layer of asphalt saturated felt but weighing 9 kg. per 10 square metres and bedded to underlayer with hot bituminous compound.
- c) One layer of white mineral surfaced roofing felt (weighing not less than 23 kg. per 10 square metres) bedded to underlayer with hot bituminous compound.

1075. HACKING, ETC.

The prices for all pavings and plastering, etc., shall include for hacking concrete surfaces and for raking out joints of walls 12mm deep and for cross scoring undercoats to form a proper key.

Plastering on walls generally shall be taken to include flush faces of lintels, beams, etc., in the walls.

1076. SURFACES

All surfaces to be paved or plastered must be brushed clean and well wetted before each coat is applied. All cement pavings and plaster shall be kept continually damp in the interval between application of coats and for seven days after the application of the final coat.

1077. PRICES FOR PAVING

Prices for paving are to include for adequate covering and protection during the progress of the Works to ensure that the floors are handed over in perfect condition on completion.

1078. POLISHED TERRAZZO

Polished terrazzo shall be laid by an approved Sub-Contractor and shall consist of a screed or backing coat and a finishing coat of "Snowcrete" and marble chippings (1:2) mixed with "Cemantone No. 1" colouring compound in accordance with the manufacturer's instructions in the proportions of 10 lbs. compound to 100 lbs. cement. Overall thicknesses are to be as specified.

The finishing coat shall be a minimum of 12mm thick for pavings trowelled to a smooth and even finish and well rubbed and polished with carborundum.

1079. ATTENDANCE UPON ENGINEER'S STAFF

The Contractor is to provide the necessary support staff, as and when requested by the Engineer, to assist in some of the duties on site. These staff may include but not be limited to chainmen and other short term staff required for quality control monitoring. An allowance for these is made in the Bill of Quantities.

11. ELECTRICAL INSTALLATION

1101. **CONTRACTOR'S LICENCE**

The complete electrical installation shall be carried out by a Registered Electrical Contractor with the valid Class 'A' Electrician's License issued by the Ministry of Energy of the Republic of Kenya.

1102. **REGULATIONS AND STANDARDS**

The complete electrical installation shall be carried out as per the Specifications and complying with the following documents: -

- a) Regulations for the Electrical Equipment of Buildings (14th Edition) issued by the Institution of Electrical Engineers of Great Britain.
- b) Electric Power Act and the Rules made thereunder.
- c) The Kenya Power & Lighting Co. Ltd.'s Bye-Laws.
- d) Relevant current British, Deutsche Industries Norm (DIN), International Standards Organisation and Kenya Standard Specifications and Codes of Practice.
- e) Government Electrical Specification GES 1 and 2, which can be seen at the office of Chief Electrical Engineer of Ministry of Public Works.

Regulations of 14th Edition of I.E.E. Regulations are in force at present in Kenya and to be observed in conjunction with other related local Bye-Laws and Acts.

1103. **EXTENT OF ELECTRICAL WORK WITHIN CONTRACT**

The electrical works in the proposed development are required to be complete in all respects as specified herein and shall include all items of equipment, materials, accessories, switchgear, lighting fittings, cables, labour, etc., necessary whether such items are specifically referred in the Contract or not. The Contractor shall be deemed to have included in his Tender, price for all items necessary such that the installations are complete in all respects and left in a satisfactory working order.

The Contractor will be responsible for liaison with the Kenya Power & Lighting Company Limited and the Kenya Posts & Telecommunications Corporation to suit the incoming power and telephone requirements.

The Contractor shall include for all Civil Works, Structures, Foundations, Builder's Works and associated requirements for the mounting, housing and support of all items of plant and equipment supplied and installed under this Contract. The concrete foundation will be to approved manufacturer's details and instructions.

All work and materials are to be of the best quality approved by the Engineer and strictly in accordance with the Specification.

In the event of any portion of the work or materials failing to pass the tests specified herein, or set forth in the Maker's list for that particular item, the Engineer may at his discretion, reject that portion of the work or material entirely.

1104. MATERIALS

All materials used in the Contract shall comply with the appropriate Standard Specification where such applies. Where materials of a particular manufacturer are called for in the Specification and Drawings, they must be offered. However, the Contractor may alternatively suggest and quote other brands of equal quality approved by the Engineer.

Conduit fittings shall be the same metal as the conduit to which they are connected except that Zinc-alloy OR Aluminium-alloy fittings may be used with steel conduits.

Conduit fittings and accessories shall conform to the appropriate Standard. Conduits shall be mechanically and electrically continuous.

All bends and sets shall be made cold without altering the section of the conduit. The inner radius of the bend shall not be less than two and a half times the outside diameter of the conduit. Not more than two right angle bends will be permitted without the inter-position of the draw-in box. Where straight runs are installed draw-in boxes shall be provided at distance not exceeding 12m. Tees, elbows or sleeves of either inspection or solid type will not be permitted.

Conduits which terminate in fusegear, distribution boards, adaptable boxes, non-spout switches, trunking, etc., shall be connected thereto by means of screwed sockets and smooth bore brass male bushes.

Where conduits are installed flush in floor slabs or in chases in walls, they shall be held firmly in position by means of substantial pipe hooks driven into wooden plugs. Where conduits are installed on surface they shall be fixed with spacerbar saddles at a distance not exceeding one metre. Conduits shall be installed entirely separate and at least 150mm clear of the hot water and steam pipes and at least 75mm clear of cold water and other services.

The Electrical Contractor shall be responsible to ascertain from site details of reinforced concrete and structural steel work and to check from the Main Contractor's drawings the positions of walls, structural concrete and steel work finishes, etc. No reinforced concrete or steelwork shall be drilled without obtaining permission from the Structural Engineer.

All circular conduit boxes shall be of a malleable iron conforming to SRN 052 with 50mm fixing centres fitted with H.G. lids where required. They shall be long spouts internally threaded. Deep boxes or extension rings on

standard circular boxes shall be used where necessary in order to bring the front face of each box flush with the ceiling or wall.

Conduit boxes installed externally shall be galvanised and where subjected to direct weather conditions they shall be compound filled.

Where the words or other approved or equal are used, they shall mean any make of equal quality but the written approval of the Engineer for the use of such alternative shall be obtained prior to their use in the installation. In the absence of any such request, the Engineer is entitled to suppose that materials used are specified.

1105. WORKMANSHIP

The whole of the work shall be carried out in the straight forward manner by competent workmen under skilled supervision. The Engineer shall have the authority to have portion of the work taken down, removed or undone, which is executed in an unworkmanlike manner or with improper materials. Where required, the Electrical Contractor shall submit to the Engineer samples of materials he proposes to install for test and approval before installation.

In the event of the portions of the work or materials failing to pass the specified tests, or the approval of the Engineer, the Electrical Contractor shall be required at his own expense to put right such defects.

1106. INSTRUCTIONS ON SITE

The Contractor shall be required to maintain on site, at all times, during the progress of the Contract an English-speaking Supervisor, to the satisfaction of the Engineer who shall have a full knowledge of the installation and to whom the instructions can be given on site.

1107. WORKING DRAWINGS

The Contractor shall prepare working drawings as necessary and shall submit to the Engineer for approval.

Working drawings in triplicate shall include, but not be restricted to the following: -

1. Shop floor drawing or Switchboard and Control Panels.
2. Such other drawings as called for in the Specification or as the Engineer may require.

Approval by the Engineer of the working drawings shall not relieve the Contractor of his obligations under this Contract nor relieve him from correcting any error found subsequently in the approved working drawings.

1108. RECORD DRAWINGS

The Contractor shall keep on site at all times a complete set of the drawings relative to this Contract, and as the Contract works are proceeded with,

indicate in red colour on such drawings, any variations to the Contract works as executed from those shown on the Contract Drawings. The 'As Built' drawings shall be submitted to the Engineer on completion of works or when demanded in writing. A minimum of three sets of 'As Built' drawings shall be provided.

1109. TESTING

On completion of the electrical installation work the installation shall be subject to the following test as laid down in the I.E.E. Regulations and Electric Power Act in the presence of the Engineer or his representative.

- a) Insulation Test
- b) Polarity Test
- c) Earth Loop Impedance Test
- d) Earth Electrode Resistance Test

Any other tests, which may be required by the Engineer. The results of all the tests shall be recorded on a Test Certificate to be signed by the Contractor and submitted to the Client for record. The original of the Test Certificate shall be submitted to the Kenya Power & Lighting Co. Ltd. together with a Completion Certificate.

The Contract works shall not be considered complete until all testing has been completed to the satisfaction of the Engineer and the Record Drawings have been approved as installed and all specified spares have been provided.

1110. L.V. SWITCHBOARD

This shall be self supporting, floor mounted, totally enclosed, dust-proof, air-insulated cubicle type switchboard complying with SRN 027 designed for use of 415/440 volts, 3 phase, 50 cycles, 4-wire A.C. System and having a short circuit rating of 30KA at low power factor. The switchboard shall be fully front access or near access as instructed by the Engineer.

The switchboard shall be completely wired internally using manufacturer's links for connections between busbar and switch fuses.

The switchboard shall be complete with labels and ready for installation. The fuse switch shall be with H.R.C. fuses with fully interlocked front door and conforming to SRN 007 on moulded case circuit breakers conforming to SRN 040.

The busbars shall be of high conductivity copper and shall be manufactured and tested in accordance with SRN 053. They shall be mounted fully enclosed within the main enclosure of the switchboard in separate chamber in accordance with SRN 027. The busbars shall be fully separated from the incoming and outgoing cable areas. Except for instrument, potential or current connections, which shall be clamped in position and of minimum

length, no circuit wiring shall be within the busbar chamber. Such wiring shall be protected with fuses where necessary as called for by the Engineer.

Interconnections between busbars and switchgear shall be of minimum length, properly insulated and rigidly supported.

All contact areas of the busbar and the connections fastened to the busbars shall be heavily plated. Joints and connections shall be rigidly made with clamps, bolts and nuts with spring washers.

1111. CONDUIT SYSTEM

a) Metallic Conduits and Accessories

Metallic conduits shall be of heavy gauge solid drawn or welded steel to SRN 052. No conduit shall be less than 20mm diameter. Conduits installed within the buildings shall be black enamel finish. Where installed externally or on surface in basement areas, conduits shall be galvanised.

b) Non-Metallic Conduits and Accessories

These shall be rigid PVC super high impact heavy gauge Class 'A' conduit to SRN 054. No conduit shall be smaller than 20mm diameter. Joints shall be made by using an approved cement.

Tube and fittings shall be perfectly clean and free from greases. The cement shall be applied to both surfaces and the tube shall be rotated within the accessory to ensure complete coverage.

In cases of screwed joints, tubes shall be screwed with standard stocks and dies and shall be used with threaded accessories. PVC conduits shall be used only in situation where ambient temperature is between 70 degrees centigrade (153 degrees Fahrenheit) - 60 degrees centigrade (140 degrees Fahrenheit).

Expansion couplers shall be used in straight runs exceeding 6 metre with flexible type joint. These couplers shall be extended in length, the one end of which shall be bored standard depth and the other end shall be provided with a sliding entrance over a longer distance allowing the tube to slide up and down as it expands or contracts.

For a watertight joint, adhesive shall be used for the sliding end. All PVC conduit boxes shall be circular pattern of Rigid PVC with push fit or screwed spout conformed to SRN 054, and circular looping boxes to SRN 054.

1112. **GENERAL WIRING**

The wiring throughout shall be in looping cables from point to point and no tee or other joints shall be permitted. Conductors of the same circuit shall be contained in the same conduit or trunking. At distribution boards, the neutral conductors shall be connected to the neutral bar in the same sequence as the line conductors connected to fuses or circuit breakers so that they can be readily identified.

a) PVC Cables in Conduits

PVC cables in conduits unless otherwise specified shall conform to SRN 055, 600/1000 volts grade, single core PVC insulated. No cable smaller than 1.5mm² shall be used in the installation.

b) Flexible Cords

Flexible cords shall be of 300 volts grade, V.R.I. OR PVC insulated conforming to SRN 056. No flexible cord shall be smaller than 0.72mm² (24/0.20mm).

c) PVC

These cables shall be 600/1000 volt grade, conforming to SRN 024 having standard copper conductors with PVC insulation, cores laid up circular, PVC sheath beading, single wire armour and PVC sheath. The cables shall be terminated on distribution boards, switchboards, trunking or adaptable box with compression type brass gland with locknuts and shroud.

d) PVC Armoured Cables (with Aluminium Conductors)

These cables shall be 600/1000 volt grade, conforming to SRN 063 having cores of solid Aluminium conductors, insulated with PVC, armoured with aluminium strip or steel wire with PVC sheath overall.

e) M.I.C.C. Cables

These cables shall be 440 or 660 volt grade consisting of high conductivity copper conductors embedded in pure and dense, magnesium oxide insulation, contained in a robust yet ductile, seamless, solid drawn copper sheath conforming to SRN 057. Where installed in corrosive situations, they shall be sheathed with PVC sleeving. Terminations of cables shall be provided with sleeves having a temperature rating similar to that of the seals. Terminations shall be made by means of cold screw on pot type seals and in conjunction with ring type universal glands. The greatest care shall be exercised at all times when terminating M.I.C.C. cables and insulation after. All cables shall give infinity test when tested on 1000 volt megger.

Where single core M.I.C.C. cables are used, all necessary precautions shall be taken to prevent Hysteresis. Ferrous plates or structure through which the cables pass shall be slotted and brass glands and sockets shall be used.

f) Wiring System

System A - Cables enclosed in concealed steel screwed conduit or trunking

The wiring shall be carried out in PVC insulated cables installed in steel screwed conduit or trunking concealed in floor slabs, walls of buildings, installed in roof space or concealed in structural beams and columns.

System B - Cables enclosed in steel screwed conduits or trunking fixed to the surface of walls and ceiling

The wiring shall be carried out in PVC insulated cables installed in steel screwed conduit or trunking installed on the surface of the walls and ceiling or in false ceiling spaces.

Conduits shall be screwed in position by means of space bar saddles using brass round head screws fixed with rawlplugs. Where two or more conduits are installed in parallel, multiple saddles which are screwed between each way shall be used. Conduits shall be installed horizontally on the walls and vertically to switches or outlets.

System C - Cables enclosed in concealed non-metallic conduits

The wiring shall be carried out in PVC insulated cables installed in rigid, PVC super high impact heavy gauge conduit concealed in floor slabs, walls of buildings in ceiling space or concealed in structural beams and columns. Each continuity conductor shall be installed throughout the length of the conduit.

System D - Cables enclosed in non-metallic conduits fixed to the surface of walls and ceilings

The wiring shall be carried out in PVC insulated cables installed in rigid PVC super high impact heavy gauge conduit installed on surface of the walls and ceiling or in false ceiling spaces. Where straight run of conduit in excess of 6m are installed on the surface and approved expansion coupling must be installed at every 6m distance. Switch boxes and lighting point boxes shall be fitted with purpose made earthing connectors. Lighting point outlet boxes shall be fitted with steel insert clips to prevent distortion under load.

System E - M.I.C.C. cables installed on surface of the walls and ceilings in the roof space or concealed in walls and floors

M.I.C.C. cables shall be secured with copper saddles fixed at 375mm centres on vertical runs and 525mm centres on horizontal runs. Termination shall be made by means of cold screw on pot type seals and conjunctions with ring type universal glands. Insulation test shall be taken as described in Clause 1209 above.

System F - cables clipped to the roof members and run in steel conduit or rigid PVC conduit drops concealed in walls

The wiring shall be in PVC insulated and sheathed cables securely fixed to the roof member by means of buckle clips and then to switches and outlets through conduit drop (steel conduit or rigid conduit). Earth continuity conductor shall be run throughout, if PVC single insulated and sheathed cables are used or PVC twin with earth shall be used.

System G - PVC insulated and sheathed cables clipped to the surface of the wall and roof members or to the ceiling

The wiring shall be in PVC insulated and sheathed cables fixed to the roof member, surface of the walls and ceiling only when there is no reasonable access from above. They shall be fixed by means of buckle clips. Where cables pass through holes they shall be bushed.

System H - PVC insulated single wire armoured, PVC sheathed cables laid in ducts or saddled to walls

All the PVC insulated single wire armoured PVC cables laid direct in the ground shall be laid at minimum depth of 600mm, on 75mm bed of sand. Cables shall be suspended on purpose made frames and hangers, drawn through ducts or laid in trenches. Cables suspended on multiple hangers shall be so arranged that one can be removed without disturbing the other. Frames and hangers shall be galvanised or of non-ferrous material and shall not be fixed in contact with which they are liable to set up electrolytic action. All spacing of cable hangers and supports shall not exceed those laid down for the relevant size and type of cables in the I.E.E. regulations. PVC SWA cables laid direct in ground shall be provided with concrete cable tiles marked "Danger", "Hatari", throughout. Cables shall be terminated using brass compression glands and cable lugs of appropriate size.

1113. LIGHTING SWITCHES

Flush Switches

These shall be flush type contained in steel or alloy boxes of the ratings and gangs as specified on the drawings, complete with overlapping ivory or BMA or Matt Chrome coverplates and switch dodies. They shall be as manufactured by "M.K. Electric Limited", gridswitch range or other equal and approved to SRN 058.

Ceiling Switches

These shall be of the semi-recessed ivory pattern for fixing to, standard conduit boxes as "M.K. Electric Limited" list to 3121 or other equal and approved. Surface ceiling switches shall be ivory pattern as "M.K. Electric Limited" list 3121 or other equal and approved to SRN 058.

Surface Wall Switches

These shall be contained in a steel box with steel cover plate with rating and gangs as specified on the drawings and as manufactured by "M.K. Electric Limited" either dolly-operated or Rocker-operated or any other equal and approved to SRN 058.

1114. SOCKETS AND SWITCH SOCKETS

These shall be 13 amp, flush pattern in steel box complete with overlapping ivory or BMA or Matt Chrome coverplates.

They shall be 13 amp. 3 pin, shuttered, switched or unswitched as specified on the drawings and as manufactured by "M.K. Electric Limited" or any other equal and approved and as per SRN 059. All sockets or switch sockets shall be with fused plugtop containing a fuse whose rating shall be suitable for the load connected to it. The plugtop shall be as manufactured by "M.K. Electric Limited" or other equal and approved and as per SRN 059.

The surface type sockets or switch sockets or switch sockets shall be in a steel box with metalclad steel coverplates or ivory insulated with ivory

mounting block and backplate as manufactured by "M.K. Electric Limited" or other equal and approved and to the SRN 059.

1115. FUSED CONNECTION UNIT

These shall be flush, D.P. switched or unswitched in a steel box with ivory or BMA or Matt Chrome overlapping coverplate with or without pilot light as manufactured by "M.K. Electric Limited" or other equal and approved and as per SRN 059.

Surface fused spurboxes shall be in a steel box, D.P. switched or unswitched with metalclad steel coverplates as manufactured by "M.K. Electric Limited" or other equal and approved and as per SRN 060.

1116. TELEPHONE OUTLETS

These shall consist of 75 x 75 x 50mm deep steel box with single or double outlet telephone cord-outlet plate, ivory or MBA or Matt Chrome as manufactured by "M.K. Electric Limited" or other equal and approved. A 25mm diameter conduit shall be provided between the telephone outlet plate and the outside / to of the building. Where the conduit is taken to the top of the building, the conduit end shall be bent to prevent ingress of rain water. Conduits shall be left with draw-wires.

1117. TIME SWITCHES

These shall be 30 Amps. A.C. 200/250 volts 50 C/S with 9 hours spring reserve, "Venner" type TJDISP or other equal and approved.

1118. M.C.B. DISTRIBUTION BOARDS AND CONSUMER UNITS

These shall be surface or flush pattern complete with hinged cover incorporating single pole or three pole circuit breakers as indicated on the drawings. The M.C.B. distribution boards and consumer units shall be as manufactured by CRABTREE OR equivalent. The MCB units shall have a short circuit rating as specified on the drawings or as appropriate to its location in the distribution network. The boards shall be complete with 100 Amps. D.P. or T.P. switches as specified.

1119. WATER-TIGHT SWITCHES

These shall be of the rating specified 5 ampere OR 15 ampere single pole as manufactured by 'THORN' Cat. No. PD 145. The Protection class shall be IP65, or other approved equivalent.

1120. RADIO / T.V. AERIAL OUTLETS

These shall be flush type, ivory, with steel box as manufactured by "M.K. Electric Limited" List No. 3523 WHI/890 OR equivalent. A 25mm diameter conduit shall be provided between the outlet and the top of the building with the top conduit end suitably bent to prevent ingress of rain water. Conduit shall be left with draw-wire.

1121. BELL PUSHES

These shall be flush type, ivory, with steel box as manufactured by “M.K. Electric Limited” List No. 4850 WHI/890 OR equivalent. The wiring for bell circuits shall be carried out through 2406V step down transformer.

1122. COOKER CONTROL UNIT

These shall be white flush type with pilot lamp, installed in an aluminium stove enamelled box with earth terminals as manufactured by “M.K. Electric Limited” List No. 5011/5120. The Electrical Contractor shall supply and install flush connector box for Cooker underneath the cooker control unit 300mm above floor level, complete with wiring in 6mm² PVC cables in 25mm conduit and with terminal block and moulded with cover plate as manufactured by “M.K. Electric Limited” List No. 5045 OR equivalent. The wiring between the connector box and the cooker terminals shall be carried out in 6mm² PVC twin with earth cable.

1123. WATER HEATER SWITCH & CONNECTION TO WATER HEATER

The Contractor shall wire the water heater switch from 15 Amp., S.P. & N., M.C.B. in the distribution board of consumer unit. The wiring from water heater switch to the water heater shall be in 70 / 0076 x 3 core asbestos flexible cable. The water heater switch shall be 20 Amp, D.P. ivory flush type, with pilot lamp and flex-outlet installed in a box as manufactured by “M.K. Electric Limited” List No. 5523 WHI/890 OR other equal and approved by the Engineer.

1124. COMPLETION AND INSPECTION CERTIFICATES

On completion of the Electrical Works, the Contractor shall submit to the Engineer Completion and Inspection Certificates as required by Section E of I.E.E. regulations.

ELECTRICAL INSTALLATION - SPECIFICATION OF WORK**1125. SCOPE OF WORK**

Scope of work shall include the following: -

a) Resident Engineer’s Office

Complete installation of lighting, power, telephone points, lighting fittings, distribution board, meter board, etc. in the Resident Engineer’s Office.

b) Security Lighting

Complete installation of security lighting with columns, cables, lanterns, distribution board, etc.

STANDARD REFERENCE NUMBERS

1. Introduction

The Engineer has agreed to use a method of modifying the text of engineering specifications by referring to a Standard Specification Reference Number (SRN) instead of a National Standard and then providing a tabulated comparison between British and German Standards, cross-referenced further where appropriate to an International Standard (ISO), an International Electrotechnical Standard (IEC), to an American Waterworks Standard (AWWA) or other appropriate National Standards.

2. General Clause on Standard Specification

A general introductory clause to be inserted into general specification documents has been prepared. It is quoted below to assist in the preparation of Future Specification Volumes.

Standards

The Contractor shall observe these Specifications and shall carry out all work in a skilled and workmanlike manner in keeping with modern methods of mechanical and construction engineering.

In addition, the Contractor shall conform with all conditions currently in force with regard to the execution of construction work and shall follow all instructions issued by the competent Authorities, the Employer and the Engineer.

Where Standard Specifications are referred to in the Text of the Specifications this is done by reference to a Standard Specification Reference Number (SRN). A table of comparison is annexed to this Specification where the SRN is cross-referenced to Standard Specifications issued by the International Standards Organisation (ISO) and to National Standard Specification that will be accepted in their English version by the Engineer as providing for the quality of workmanship etc. required.

The Tenderer shall at his discretion base his Tender on one or other of the National Standard Specifications indicated in that table save that where a relevant Standard Specification issued by the ISO exists at the date of Tender, such an International Standard should as a minimum be complied with. As the National Standards referred to in the table of comparison may expand on or strengthen further the requirements of ISO, Tenderers choosing not to comply with one of the National Standards indicated may either indicate an alternative National Standard with which they shall comply or provide with their Tender a full and detailed description of the Standards they propose to attain.

Where a Tenderer offers a particular item to a National Standard not specified in the table of comparison he shall comply with the requirements of the Instructions to Tenderers in this respect and shall enclose a copy in English of the alternative National Standard offered with his Tender. Alternative National Standards or Tender's own detailed description of the Standards they propose shall be subject to the approval of the Engineer.

3. List of National Specification Cross Referenced

The list has been sub-divided into sections as follows: -

| <u>SRN No.</u> | <u>Specification</u> |
|----------------|--|
| 001-099 | Electrical and Mechanical |
| 100-199 | Concrete |
| 200-299 | Metallic Pipes and Fittings |
| 300-399 | Plastic Pipes and Fittings |
| 400-499 | Other Pipes and Fittings |
| 500-599 | Valve, Meters, Hydrants and Other Specials |
| 600-649 | Testing Methods and Equipment |
| 650-699 | Site Work Codes of Practice |
| 700-749 | Drawing Practice, Standard Symbols, etc. |
| 750-799 | Glossary |
| 800-899 | Building Materials (exclu. In-situ Concrete) |
| 900-999 | Miscellaneous |

3.1 CONCRETE

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|------|-----------|------|------------------|-----------------------------|---|
| 100 | METHOD FOR SPECIFYING CONCRETE | 1045 | TBL. 1 | 5328 | TBL. 3 | KS 02-594 | |
| 101 | STANDARD OF MATERIAL & WORK - GENERAL | See | VOB | 8110 | | VOB 2 | |
| 102 | STANDARDS OF MATERIAL, WATER RETAINING STRUCTURES | | SUB. NO. | 8007 | | | |
| 103 | ORDINARY PORTLAND CEMENT | 1164 | 1 | 12 | | KS 02-1262 & KS 02-1263 | |
| 104 | SULPHATE RESISTANT CEMENT | 1164 | 1;CL. 4 | 4027 | | | |
| 105 | MORTAR CUBES - COMPRESSIVE STRENGTH | 1164 | 1;CL. 4-4 | 12 | METHOD 2 CL.7.3 | ISO 3893 | |
| 106 | CEMENT - TEST FOR SOUNDNESS | | 6, EN.112 | 12 | CL.9 | | |
| 107 | SAMPLING AND TESTING OF AGGREGATES | 4226 | 1-4 | 812 | 1, 2, 3 | BS EN 1097-3 BS EN 932-1 | BS 812 Part 1 Replaced by BS 882 Part 2 Replaced by BS EN 1097-3 Part 102 Replaced by BS EN 932-1 but remains current |
| 107 | SAMPLING AND TESTING OF AGGREGATES (CONT.) | 1045 | | 812 | 101-119 | | |
| 108 | FINE AGGREGATE FOR CONCRETE - GENERAL | 4226 | 1-4 | 882 | CL.4.1 | | |
| 108 | FINE AGGREGATE FOR CONCRETE - GENERAL (CONT.) | 1045 | | | | | |
| 109 | FINE AGGREGATE FOR CONCRETE - GRADING | 4226 | 1-4 | 882 | TBL.2 | | |
| 110 | COARSE AGGREGATES FOR CONCRETE - GENERAL | 4226 | | 882 | CL.4.1 | | |
| 110 | COARSE AGGREGATES FOR CONCRETE - GENERAL (CONT.) | 1045 | | | | | |
| 111 | COARSE AGGREGATES FOR CONCRETE - GRADING | 4226 | | 882 | TBL.2 | | |
| 111 | COARSE AGGREGATES FOR CONCRETE - GRADING (CONT.) | 1045 | | | | | |
| 112 | COARSE AGGREGATES FOR CONCRETE - SHRINKAGE & ABSORPTION | 4226 | | 812 | 2 | ISO 6783 BS EN 1367 | BS 812 Part 120 Replaced by BS EN 1367 but remains current |
| 112 | COARSE AGGREGATES FOR CONCRETE - SHRINKAGE & ABSORPTION (CONT.) | 1045 | | | | | |
| 113 | COARSE AGGREGATES FOR CONCRETE - FLAKINESS | 4226 | | 812 | 105.1 | | |
| 113 | COARSE AGGREGATES FOR CONCRETE - FLAKINESS (CONT.) | 1045 | | | | | |
| 114 | WATER FOR MAKING CONCRETE | 4226 | | 3148 | | | |
| 114 | WATER FOR MAKING CONCRETE (CONT. 1) | 4030 | | | | | |
| 114 | WATER FOR MAKING CONCRETE (CONT. 2) | | | | | | |
| 115 | CONCRETE MIX DESIGN - GENERAL | | | 5328 | | | |
| 115 | CONCRETE MIX DESIGN - GENERAL (CONT.) | 1084 | 1 | | | | |
| 116 | TRIAL MIXES - CUBES | 1048 | | 1881 | 108 | | |
| 117 | SAMPLING & TESTING OF CONCRETE | 1048 | | 1881 | 5, 114, 121, 122 | ISO 1920, 4012, 4108, 4013 | |
| 118 | CONCRETE BATCH MIXER | | | 1305 | | | BS 1305 Obsolescent |
| 119 | CONCRETE BATCH TYPE MIXERS | 459 | | 3963 | | | BS 3963 Obsolescent |
| 120 | STRUCTURAL USE OF R/C IN BUILDING | 1045 | | 8110 | 1 | | |
| 121 | CONCRETE TRUCK-MOUNTED MIXERS | 1084 | 3 | 4251 | Withdrawn | | BS 4251 Withdrawn |
| 122 | BITUMEN RUBBER JOINT SEALING COMPOUND | | | 2499 | TYPE A1 | | |
| 123 | POLYSULPHIDE JOINT SEALING COMPOUND | | | 4254 | | | BS 4254 Obsolescent |
| 124 | WATERPROOF BUILDING | | | 1521 | (CLASS B) | | |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-------|------|----------------|--------------------|--------------------|--|
| | PAPERS | | | | | | |
| 125 | IMPACT TESTING OF MILD STEEL | 488 | 3 | 7613 7668 | Grade NDI, CL.B | | BS 4360 Withdrawn. Replaced by BS 7613, BS 7668, BS EN 10029 Parts 1 to 3 of BS EN 10113, BS EN 10155, BS EN 10210-1 |
| 126 | STEEL R/F HOT-ROLLED STEEL BARS | 488 | 1-3 | 4449 | | | |
| 127 | STEEL R/F COLD TWISTED | 488 | 1-3 | 4449 | | | |
| 128 | STEEL R/F STEEL FABRIC | 488 | 4-5 | 4483 | | | |
| 129 | BAR REINFORCEMENT AND BENDING | | | 4466 | | | |
| 130 | SAND FOR INTERNAL PLASTERING | 4226 | | 1199 | | | |
| 131 | PLYWOOD SHUTTERING | 68791 | | 6566 | 1-8 | | BS 6566 Withdrawn. Replaced by various BS EN standards on the same subject |
| 131 | PLYWOOD SHUTTERING (CONT.) | 68792 | | | | | |
| 132 | CONCRETE COMPACTION | 4235 | 1,2 | | | | |
| 133 | CONCRETE - SITE QUALITY CONTROL | 1084 | 1 | | | | |
| 134 | DESIGN OF CONCRETE MIXES | 52171 | | See HMSO | | HMSO RD NOTE 4 | |
| 135 | SAND FOR MORTAR | 4226 | | 1200 | | | |
| 136 | SAND FOR RENDERING | 4226 | | 1199 | | | |
| 137 | HOT APPLIED JOINT SEALER | | | 2499 | | | |
| 138 | WATER STOPS AND WATER BARS | 7865 | 1, 2 | 8007 | | | |
| 139 | TESTING CONCRETE STATIC MODULES (COMPARISON ELASTICITY) | | | 1881 | 121 | | |
| 140 | TESTING CONCRETE - WATER ABSORPTION | | | 1881 | 122 | | |
| 141 | TESTING CON-SAMPLING, TESTING FRESH CONCRETE, ETC. | 1048 | | 1881 | 101-110 & 113 | KS 02-595 : 1-8 | |
| 142 | PRECAST CONCRETE COMPONENTS (COPING UNITS) | | | 5642/2 | 2 | | |
| 143 | STRUCTURAL USE OF CONCRETE DESIGN & CONSTRUCTION | | | 8110 | 1 | | |
| 144 | STRUCTURAL USE OF CONCRETE - SPECIAL CIRC. | | | | | | |
| 145 | IN-SITU CONCRETE DIAPHRAGM WALLS | 4126 | | | | | |
| 146 | TEST SIEVES FOR AGGREGATES | | | 410 | | | |
| 147 | LIGHT WEIGHT AGGREGATES FOR CONCRETE | 4226 | 2, 3 | 3797 | 2 | | BS 3797 Partly Replaced by BS EN 1744-1: 1998 |
| 148 | SUPERSULPHATED CEMENT | | | 4248 (4550) | | | BS 4248 Partly Replaced by Parts and Section of BS 4550 |
| 149 | CONCRETE ADMIXTURES | | | 5075 | | | |
| 150 | GRADUATE MEASURING CYLINDER | | | 604 | | ISO 4788 | |
| 151 | COLD REDUCED STEEL WIRE FOR THE REINFORCEMENT OF CONCRETE | | | 4482 | | | |
| 152 | FUSION BONDED EPOXY COATED CARBON STEEL BARS FOR THE REINFORCEMENT OF CONCRETE | | | 7295 | 1 & 2 | | Part 1: Coated bars Part 2: Coatings |

3.2 METALLIC PIPES AND FITTINGS

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|------|------|------|-------|---|--|
| 200 | GREYCAST IRON PRESSURE PIPES AND FITTINGS | | | 1211 | | ISO 13; ISO 49 | BS 1211 Obsolescent Partially replaced by BS 4772 |
| 200 | GREY IRON PIPES AND FITTINGS (CONT) | | | 4622 | | ISO 13 | BS 4622 Obsolescent |
| 201 | CAST IRON FLANGED PIPES & FITTINGS | | | 2035 | | | BS 2035 Obsolescent Partially replaced by BS 4772 |
| 202 | DUCTILE IRON PIPES & FITTINGS (WATER) | | | | | ISO 2531, EN 545 | |
| 202 | DUCTILE IRON PIPES & FITTINGS (SEWERAGE) | | | | | EN 598 | |
| 202 | DUCTILE IRON PIPES & FITTINGS (GAS) | | | | | EN 969 | |
| 203 | STEEL TUBES WITH PLAIN OR THREADED ENDS | | | 1387 | | ISO 65 | |
| 203 | STEEL TUBES WITH THREADED ENDS (CONT) | 2440 | | | | | |
| 203 | STEEL TUBES WITH THREADED ENDS)CONT) | 2441 | | | | | |
| 203 | STEEL TUBES WITH THREADED ENDS (CONT) | 2442 | | | | | |
| 203 | STEEL TUBES WITH THREADED ENDS-THREADS | 76 | 2 | 21 | | ISO 7/1:1982; ISO 7/2:1982 | |
| 204 | WROUGHT STEEL PIPE FITTINGS TO SSRN 203 | | | 1740 | 1 | ISO 4145 | |
| 204 | TH. STEEL PIPE FITTINGS TO SSRN 203 | 2980 | | | | | |
| 204 | TH. STEEL PIPE FITTINGS TO SSRN 203-LONG THREAD | 2981 | | | | | |
| 204 | TH. STEEL PIPE FITTINGS TO SSRN 203-NIPPLES | 2982 | | | | | |
| 204 | TH. STEEL PIPE FITTINGS TO SSRN 203-BENDS | 2983 | | | | | |
| 204 | TH. STEEL PIPE FITTINGS TO SSRN 203-TEES ETC. | 2987 | 1, 2 | | | | |
| 204 | W. STEEL PIPE FITT. TO SSRN 203-BUSHINGS | 2990 | | | | | |
| 204 | W. STEEL PIPE FITT. TO SSRN 203-PLUGS & CAPS | 2991 | | | | | |
| 204 | TH. STEEL PIPE FITTINGS TO SSRN 203-SOCKETS | 2986 | | | | ISO 7-2:1982 | |
| 204 | W. STEEL PIPE FITT. TO SSRN 203-RED'NG SOCKETS | 2988 | | | | | |
| 205 | COPPER TUBES FOR WATER | | | | | EN 1057, ISO 8493 (TESTS) | |
| 205 | COPPER TUBES FOR WATER (CONT) | 1754 | 3 | | | | |
| 205 | COPPER TUBES FOR WATER (CONT) | 1755 | 3 | | | | |
| 206 | COPPER TUBES - GENERAL PURPOSE | | | 2871 | 2 | ISO 196:1978 | |
| 206 | COPPER TUBES - GENERAL PURPOSE (CONT) | 1754 | 1,2 | | | | |
| 206 | COPPER TUBES - GENERAL PURPOSE (CONT) | 1755 | 1,2 | | | | |
| 207 | FLANGES FOR FERROUS PIPES - STEEL BY PN | 2500 | | 4504 | 3-3.1 | ISO 7005-1:1992 | BS 4504 Part 3: Sections 3.2 (1989) Withdrawn. Replaced by BS EN 1092-2 (1997) |
| 207 | FLANGES FOR FERROUS PIPES - STEEL BY CLASS | 2501 | 1 | 1560 | 3-3.1 | ISO 7005:1988; ANSI B 16.5 | |
| 207 | FLANGES FOR FERROUS PIPES - C.I. BY CLASS | 2519 | 1 | 1560 | 3-3.2 | ISO 7005-2 | |
| 207 | FLANGES FOR FERROUS PIPES - C.I. BY PN | | | | 2 | EN 1092, ISO 2531:1991; ISO 7005-2:1988 | |
| 207 | FLANGES FOR FERROUS PIPES-SLIP ON FOR WELDING | 2576 | | | | | |

| 207 | FLANGES FOR FERROUS PIPES- WELDING NECK | 2627- 38 | | | | | |
|-----|---|-------------|---------|----------|------|---|---------|
| 207 | FLANGES FOR FERROUS PIPES- SCREWED | 2566 | | | | | |
| 207 | FLANGES FOR FERROUS PIPES- LAPPED-PLAIN COLLAR | 2655- 56 | | | | | |
| 207 | FLANGES FOR FERROUS PIPES- LOOSE-WELDING NECK | 2673 | | | | | |
| 207 | FLANGES FOR FERROUS PIPES- CONTACT SURFACE | 2526 | | | | | |
| 207 | FLANGES FOR FERROUS PIPES- BLANK | 2527 | | | | | |
| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
| 208 | GASKET DIMENSIONS TO SSRN 207 (a) & (d) | | | | 1 | EN 1514 | |
| 208 | GASKET DIMENSIONS TO SSRN 207 (a) & (d) (CONT) | | | | 2 | EN 1514 | |
| 208 | GASKET DIMENSIONS TO SSRN 207 (a) & (d) (CONT) | | | | 3 | EN 1514 | |
| 208 | GASKET DIMENSIONS TO SSRN 207 (a) & (d) (CONT) | | | | 4 | EN 1514 | |
| 208 | GASKETS-FOR GROOVED FLANGES | 2693 | | | | | |
| 208 | GASKETS-GROOVED O-RINGS | 2697 | | | | | |
| 209 | C.I. PIPE FITTINGS, MALLEABLE, SCREWED | | | | | ISO 49:1994 | |
| 210 | STEEL PIPES & FITTINGS - GENERAL | | | 534 | | | |
| 210 | STEEL PIPES - WATER- GENERAL | 2460 | | 534 | | EN 10224, AWWA C200-97, NFA 49-150 | |
| 210 | STEEL PIPES & FITTINGS - DESIGN | 2413 | 1, 2 | 8010 2.1 | | AWWA M11 | |
| 210 | STEEL PIPES & FITTINGS - WELDING JOINTS | 2559 | 1, 2, 3 | 8010 2.1 | | AWWA M11 | |
| 211 | CEMENT MORTAR LINING - D.I. PIPES | | | EN 545 | | EN 545, AWWA C.104A, C602-95 | |
| 211 | CEMENT MORTAR LINING - D.I. PIPES | 2614 | | | | | |
| 211 | CEMENT MORTAR LINING - D.I. PIPES (CONT) | | | | | DVGW W343 ISO 4179:1985, ISO 6600:1980, | |
| 212 | CEMENT MORTAR LINING - STEEL PIPES | 2614 | | 534 | | AWWA C 205, NFA 49- 701DVGW- W343/W346 | |
| 212 | CEMENT MORTAR LINING - STEEL PIPES (CONT) | 2614 | | | | AWWA C 602-95 ISO / DIS 8324 | |
| 213 | S. PIPES & TUBES-MATERIAL, PROP., TESTS | 1629 | | 3600 | | AWWA C200-97 | |
| 213 | CARBON STEEL PIPES AND TUBES | | | 3601 | | ISO 2604/2 /3 /6 | |
| 213 | STEEL PIPES AND TUBES- SPECIAL REQUIREMENTS | 1626 | | | | | |
| 213 | STEEL PIPES AND TUBES- SEAMLESS | 2448 | | | | | |
| 213 | STEEL PIPES AND TUBES- WELDED | 2458 | | | | | |
| 214 | BITUMEN PROTECTION TO IRON AND STEEL - HOT | | | 4147 | | (BS 4147 type I, grade 'd') | |
| 214 | BITUMEN PROTECTION TO IRON AND STEEL- COLD | | | 3416 | | (BS 3416 type II) | |
| 214 | BITUMEN PROTECTION TO STEEL PIPES ETC. | 30673 | Type E4 | | | | |
| 214 | BITUMEN PROTECTION TO DUCTILE IRON PIPES | 30674 | 4 | | | | |
| 215 | EXT. PROTECTION - IRON & STEEL-EPOXY C. | | | none | | AWWA C210-97 | |
| 216 | STEEL FITTINGS - REINFORCING | | | none | | AWWA C208-59 AWWA M11 | |

| | | | | | | | |
|------------|--|----------------|-------------|--------------|-------------|-------------------------------------|--|
| 216 | STEEL FITTINGS - DIMENSIONS | | | 534 | | AWWA C208-59 AWWA M11 | |
| 217 | D.I. PIPES & FITT.-SCREWED GLAND JOINTS | | | | | See SSRN 219 | |
| 218 | D.I. PIPES & FITT.-BOLTED GLAND JOINTS | | | | | See SSRN 219 | |
| 219 | D.I. PIPES & FITT.-S & S JOINTS | | | 8010 | 2-2.1 | | |
| 219 | D.I. PIPES & FITT.-S & S JOINTS (CONT) | | | | | EN 545 | |
| 219 | D.I. PIPES & FITT.-S & S JOINTS (CONT) | 28603 | | | | | |
| 219 | PIPELINES ON LAND; DESIGN, CONSTRUCTION AND INSTALLATION: STEEL FOR OIL AND GAS | | | 8010 | 2.8 | | |
| 220 | D.I. PIPES-ZINC COATING & PROT. SHEATHS | 30674 | 3 | none | | | |
| 221 | IRON AND STEEL PIPES- ENAMEL-HOT APPLIED | | | 7873 | | AWWA C203-97 | |
| 221 | STEEL FLANGED PIPES & FITTINGS-ENAMELLED | 2873 | | | | | |
| 222 | ELASTOMERIC JOINTS RINGS- REQUIREMENTS | | | 2494 | | | Partly replaced by BS 7874 and BS EN 681-1 |
| 222 | ELASTOMERIC JOINTS RINGS- VULCANISED RUBBER | | | | 1 | EN 681 | |
| 222 | ELASTOMERIC JOINTS RINGS- DRAINS & SEWERS | 4060 | | | | | |
| 223 | PIPE THREADS-TUBES & FITT. (WATERTIGHT) | See ISO DIN | | 21 | | ISO 7/1:1982; ISO 7/2:1982 | |
| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
| 224 | CAST IRON S & S PIPES AND FITTINGS | | | 78 | 2 | | BS 78 Withdrawn, Replaced by BS 4622 Part 2 Obsolescent, Partially replaced by BS 4772 |
| 225 | STEEL PIPES-HOT DIP GALVANISING | | | | | EN 10240 | |
| 226 | CARBON STEEL FITTINGS - BUTT-WELDING-GENERAL | 2609 | | 1965 | 1 | | BS 1965 Part 2 Withdrawn |
| 226 | STEEL FITTINGS - BUTT- WELDING-TEES | 2615 | 1, 2 | | | | |
| 226 | STEEL FITTINGS - BUTT- WELDING-REDUCERS | 2616 | 1, 2 | | | | |
| 226 | STEEL FITTINGS - BUTT- WELDING-CAPS | 2617 | | | | | |
| 227 | POLYTHENE SLEEVING FOR STEEL PIPES & FITTINGS | none | | none | | ISO 8180:1985 | |
| 227 | POLYTHENE SLEEVING FOR D. I. PIPES | 30674 | 5 | | | | |
| 228 | ST. PIPES-DIMENSION & MASSES-PRESS. PURPOSE | 2413 | 1, 2 | 3600 | | | |
| 228 | S. PIPES-DIMENSION & MASSES-PRESS. (CONT) | 2460 | | | | | |
| 229 | STAINLESS STEEL TUBES AND WIRES | | | 1554 | | | |
| 229 | STAINLESS STEEL TUBES AND WIRES (CONT) | | | 4825 | 1 | ISO 2037:1980 | |
| 229 | STAINLESS STEEL TUBES AND WIRES (CONT) | | | 6362 | | ISO 7598 | |
| 229 | STAINLESS STEEL TUBES AND WIRES (CONT) | 17457 | | | | | |
| 229 | STAINLESS STEEL TUBES AND WIRES (CONT) | 17440 | | | | | |
| 230 | STEEL PIPES FOR WATER FLEXIBLE SOCKET & SPIGOT JOINTS | 2460 | | CP2010- 2 | | EN 10224, ISO 559 | |
| 230 | STEEL PIPES FOR WATER FLEXIBLE SOCKET & SPIGOT JOINTS | 2460 | | CP2010- 2 | | EN 10224, AWWA C200-97 | |
| 231 | FERROUS P. DEFINITION OF NOMINAL PRESSURE | | | none | | ISO 7268:1983 | |
| 232 | STEEL PIPELINES - TAPE COATING SYSTEMS | 30672 | 1 | none | | AWWA C214-95 | |
| 233 | BURSTING DISCS & DEVICES | | | 2915 | | ISO 6718:1991 | |

| | | | | | | | |
|------------|--|------------|-------------|------------|-------------|-----------------------------------|----------------|
| 234 | STEEL PIPES FOR PETROLUUM AND GAS INDUSTRY | 17172 | | | | EN 10208-2, API 5L | |
| 235 | FITTINGS TO STAINLESS STEEL TUBES | | | 4825 | 2 | ISO 2851:1973 | |
| 235 | FITTINGS TO STAINLESS STEEL TUBES (CONT) | | | 4825 | 3 | ISO 2852:1974 | |
| 235 | FITTINGS TO STAINLESS STEEL TUBES (CONT) | | | 4825 | 4 | ISO 2853:1976 | |
| 235 | FITTINGS TO STAINLESS STEEL TUBES (CONT) | | | 4825 | 5 | | |
| 236 | FITTINGS TO BRASS TUBES | | | 2051 | 1 | | |
| 237 | RUBBER GASKET MATERIAL JOINTS FOR PIPELINES | | | 2494 | | ISO 4633; ISO 6447; ISO 6448 | |
| 238 | STORAGE OF VULCANISED RUBBER | | | none | | ISO 2230:1973 | |
| 239 | BITUMINOUS VARNISH TO DUCTILE IRON PIPES | | | none | | ISO 8179-2:1995 | |
| 240 | FOUNDING - SPHEROIDAL GRAPHITE CAST IRON | | | | | EN 1563 | |
| 240 | FOUNDING - AUSTEMPERED DUCTILE IRON CASTINGS | | | | | EN 1564 | |
| 241 | FUSION BONDED EPOXY COATINGS FOR STEEL PIPES | 30671 | | none | | EN 10309, AWWA C213, NFA 49-706 | |
| 241 | FUSION BONDED EPOXY LININGS FOR STEEL PIPES | | | | | AWWA C213 | |
| 242 | FLEXIBLE BOLTED SLEEVE COUPLINGS | | | 534 | | AWWA C219 | |
| 243 | FLEXIBLE GROOVED AND SHOULDERED COUPLINGS | | | | | AWWA C606 | |
| 244 | SPHERICAL JOINTS FOR WELDING, STEEL PIPES | | | 534 | | UNI 6363 | |
| 245 | BIT. SEAL COAT'GS ON D.I. PIPE CEM. MOR. LINING | | | 7892 | | | |
| 246 | POLYMERIC FILM PROT. SLEEV'G FOR IRON PIPES | 30674 | 5 | 6076 | | EN 534 | |
| 247 | HOT ENAMEL COATING TO IRON & STEEL PIPES | | | 7873 | | | |
| 248 | EXTERNAL ZINC COATINGS ON DI PIPES | 2444 | | none | | ISO 8179-1:1995 | |
| 249 | BOLTS & NUTS FOR PIPELINES | 2507 | | none | | | |
| 250 | STEEL PIPELINES - THERMOSET PLASTIC COATINGS | 30671 | | BGC/C W6 | | AWWA C213, NFA 49-706 | |
| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
| 251 | STEEL PIPES - POLYPROPYLENE COATING | 30678 | | none | | EN 10286, NFA 49-711 | |
| 252 | STEEL TUBES - ELECTROMAGNETIC TESTING - LEAKS | | | | 1 | EN 10246 | |
| 253 | TWO & THREE LAYER POLYTHENE COATINGS FOR STEEL PIPES | 30670 | | 534 | | AWWA C215, NFA 49-704, NFA 49-710 | |
| 254 | LIQUID EPOXY COATINGS FOR STEEL PIPES | | | | | AWWA C210 | |
| 255 | LIQUID EPOXY LININGS FOR STEEL PIPES | | | | | AWWA C210, NFA 49-709 | |
| 256 | LIQUID POLYURETHANE COATINGS FOR STEEL PIPES | 30671 | | | | AWWA C222 | |
| 257 | LIQUID POLYURETHANE LININGS FOR STEEL PIPES | | | | | AWWA C222, NFA 49-709 | |
| 258 | EXTRUDED POLYTHENE COATINGS FOR D.I. PIPES | 30674 | 1 | EN 545 | | EN 545 | |
| 259 | CEMENT MORTAR COATINGS FOR D.I. PIPES | 30674 | 2 | | | | |
| 260 | LIQUID EPOXY COATINGS FOR D.I. PIPES | | | EN 545 | | EN 545 | |
| 261 | FUSION BONDED EPOXY COATINGS & LININGS FOR D.I. FITTINGS | | | | | AWWA C116 | |
| 262 | LIQUID POLYURETHANE COATINGS FOR D.I. PIPES | | | EN 545 | | EN 545 | |
| 263 | LIQUID POLYURETHANE LININGS FOR D.I. PIPES | | | EN 545 | | EN 545 | |

| | | | | | | | |
|-----|--|--|--|--|--|------------------------|--|
| 264 | TWO LAYER EPOXY-NYLON COATINGS & LININGS FOR STEEL PIPES | | | | | EN 10310, AWWA C224 | |
|-----|--|--|--|--|--|------------------------|--|

3.3 PLASTIC PIPES AND FITTINGS

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-------|-------|--------------------------|------|--|---|
| 300 | uPVC PIPES FOR COLD WATER | 19532 | | 3505 | | ISO 2505, 3114, 3606 | |
| 300 | uPVC PIPES FOR COLD WATER (CONT. 1) | 8062 | | | | ISO 3472, 3472, 3473, 3474 | |
| 300 | uPVC PIPES FOR COLD WATER (CONT. 2) | | | | | ISO 161/1 | |
| 300 | uPVC PIPES FOR COLD WATER (CONT. 3) | | | | | KS 06-149:2 | |
| 301 | JOINTS AND FITTINGS FOR uPVC PRESSURE PIPES | 8063 | 1, 12 | 4346 | 1-3 | ISO 2035, 2044 | |
| 301 | JOINTS AND FITTINGS FOR uPVC PRESSURE PIPES (CONT. 1) | 16450 | | | | ISO 2045, 2048, 2536 | |
| 301 | JOINTS AND FITTINGS FOR uPVC PRESSURE PIPES (CONT. 2) | 16451 | | | | | |
| 302 | uPVC PIPELINES - LAYING AND JOINTING | 16928 | | See CP | | CP 312 | |
| 303 | uPVC PIPELINES - PRESSURE TESTING | 4279 | 1, 7 | | | | |
| 304 | uPVC PIPELINES - ADHESIVES FOR JOINTING | 16970 | | | | | |
| 305 | uPVC PIPES - GENERAL | 8061 | | 3505 | | | |
| 305 | uPVC PIPES - GENERAL (CONT. 1) | 8062 | | 3506 | | | |
| 305 | uPVC PIPES - GENERAL (CONT. 2) | 19532 | | | | | |
| 306 | uPVC PIPES - PRESSURE TESTS TO DESTRUCTION | | | 4728 | | ISO 1167 | Obsolescent (but still remains current) Replaced by BS EN 921 and partially replaced by BS EN 2782 Part II method 1127P - 1997 but remains current |
| 307 | HDPE PIPES, JOINTS, FITTINGS | 16963 | 1-3 | 3284 (6572) (6730) | | | Obsolescent - Partially replaced by BS 6572, BS 6730 |
| 308 | RUBBER RINGS FOR MECHANICAL JOINTS | | | 2494 | | | |
| 309 | uPVC UNDERGROUND DRAIN PIPES & FITTINGS | | | 4660 | | | Partially replaced by BS EN 1401-1 |
| 310 | uPVC PIPES IMPACT TEST 20 DEGREES CENTIGRADE | | | 3505 | | ISO 3127 | |
| 311 | uPVC PIPES SHORT TERM HYDROSTATIC TEST | | | 3505 | | | |
| 312 | uPVC PIPES LONG TERM HYDROSTATIC TEST | | | 3505 | | | |
| 313 | uPVC PIPES INTERNAL PRESSURE ENDURANCE TEST | 8061 | | | | | |
| 314 | uPVC WATER ABSORPTION TEST | 8061 | | | | ISO 2508 | |
| 315 | uPVC PIPES - VARIOUS OTHER TESTS | | | | | ISO 2505, 3114, 3472, 3473, 3474 | |
| 316 | PIPES - RATE OF LEAKAGE | | | 8010:2 | | | |
| 317 | G.R.P. PIPES | | | 6464 | | | |
| 318 | PLASTICS PIPES AND FITTINGS FOR USE AS SUB SOIL FIELD DRAINS | | | 4962 | | | |
| 318 | POLYPROPYLENE WASTE PIPE AND FITTINGS (EXTERNAL DIAMETER 34.6MM, 41.0MM AND 54.1MM) | | | 5254 | | | |
| 319 | THERMOPLASTICS WASTE PIPE AND FITTINGS | | | 5255 | | | |
| 320 | GLASS REINFORCED PLASTICS (GRP) PIPES, JOINTS AND FITTINGS FOR USE FOR WATER SUPPLY OR SEWERAGE | | | 5480 | | | |
| 321 | UNPLASTICIZED PVC PIPE AND FITTINGS FOR GRAVITY SEWERS | | | 5481 | | | |
| 322 | PLASTICS PIPEWORK (THERMOPLASTICS MATERIALS) | | | 5955 | 6 | | Part 6: Installation of unplasticized PVC pipework for gravity drains and sewers |
| 323 | BLUE POLYETHYLENE PIPES UP | | | 6572 | | | |

| | | | | | | | |
|-----|---|--|--|------|--|--|--|
| | TO NOMINAL SIZE 63 FOR BELOW GROUND USE FOR POTABLE WATER | | | | | | |
| 324 | BLACK POLYETHYLENE PIPES UP TO NOMINAL SIZE 63 FOR ABOVE GROUND USE FOR COLD POTABLE WATER | | | 6730 | | | |

3.4 OTHER PIPES AND FITTINGS

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|-------------|-------------|------|------|------------------------|--|
| 401 | ASBESTOS CEMENT (A/C) PRESSURE PIPES | 19800 | 1-3 | 486 | | ISO 160 BS EN 512 | BS 486 Withdrawn Replaced by BS EN 512 |
| 401 | ASBESTOS CEMENT (A/C) PRESSURE PIPES (CONT.) | | | 4624 | | | |
| 402 | A/C SEWER PIPES, JOINTS, FITTINGS | | | 3656 | | ISO 881 BS EN 588-1 | BS 3656 Withdrawn Replaced by BS EN 588-1 |
| 402 | A/C SEWER PIPES, JOINTS, FITTINGS (CONT. 1) | | | | | | |
| 402 | A/C SEWER PIPES, JOINTS, FITTINGS (CONT. 2) | 19850 | 1, 2 | | | | |
| 403 | A/C PIPES FOR THRUST BORING | | | | | ISO 4488 | |
| 404 | A/C PIPES - GUIDE FOR LAYING | | | 5927 | | ISO 4482 | |
| 405 | A/C PIPES - FIELD PRESSURE TESTING | 4279 | 1, 6, 9, 10 | 5886 | | ISO 4483 | |
| 406 | PIPE SUPPORTS | See DVGW | | 3974 | 1 | DVGW 310 PT. 2 | |
| 407 | UNREINFORCED CONCRETE PIPES (OGEE) | 4032 | | 5911 | 3 | | |
| 408 | PRESTRESSED CONCRETE PRESSURE PIPES | 4035 | | 4625 | | | |
| 409 | PRECAST CONCRETE PIPES - DRAINS & SEWERS | 4032 | | 5911 | 1, 3 | | |
| 409 | PRECAST CONCRETE PIPES - DRAINS & SEWERS (CONT.) | 4035 | | | | | |
| 410 | CONCRETE POROUS PIPES - UNDER DRAINS | | | 5911 | 114 | | |
| 411 | NON-PRESSURE DUCTILE IRON PIPES ETC. | | | | | ISO 7186 | |
| 412 | RUBBER AND PLASTIC HOSES AND ASSEMBLIES | | | | | ISO 7751 | |
| 413 | CONCRETE CYLINDRICAL PIPES & FITTINGS METRIC | | | 5911 | 1-3 | AWWA C602- 83 | BS 5911 Part I: 1981 Withdrawn Replaced by BS 5911 Part 100: 1988 BS 5911 Part 200: 1989 BS 5911 Part 200: 1994 |
| 414 | CLAY PIPES (SEWERAGE) | | | 65 | | | |
| 415 | TESTING OF JOINTED PIPES AND MANHOLES | | | 2005 | | | BS 2005 - Obsolescent |
| 416 | CONCRETE PRESSURE PIPES INCLUDING JOINTS AND FITTINGS | | | | | BS EN 639 | |

3.5 VALVES, METERS, HYDRANTS

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|----------|------|------|---------|-----------------|--|
| 501 | DOUBLE FLANGED C.I. GATE VALVES (WATER) | | | 5163 | | AWWA C203-78 | |
| 501 | DOUBLE FLANGED C.I. GATE VALVES (WATER) (CONT. 1) | 3230 | 1-3 | | | | |
| 501 | DOUBLE FLANGED C.I. GATE VALVES (WATER) (CONT. 2) | | | | | | |
| 501 | DOUBLE FLANGED C.I. GATE VALVES (WATER) (CONT. 3) | 3352 | 1, 4 | | | | |
| 502 | C.I. GATE VALVES - GENERAL | | | 5150 | | | |
| 502 | C.I. GATE VALVES - GENERAL (CONT.) | 3352 | 1, 4 | | | | |
| 503 | C.I. (PARALLEL SLIDE) GATE VALVES - GENERAL | | | 5151 | | | |
| 504 | C.I. GLOBE VALVES - GENERAL | 3356 | 1-5 | 5152 | | | |
| 505 | C.I. CHECK VALVES - GENERAL | 3202 | | 5153 | | AWWA C508-82 | |
| 505 | C.I. CHECK VALVES - GENERAL (CONT.) | See DVGW | | 6282 | 1, 4 | DVGW-W376 | |
| 506 | C.I. AND STEEL BUTTERFLY VALVES - GENERAL | 3354 | 1-4 | 5155 | | BS EN 593: 1998 | BS 5155 Withdrawn Replaced by BS EN 593,: 1998 |
| 507 | BOURDON TYPE PRESSURE GAUGES | | | 1780 | | BS EN 837: 1998 | BS 1780 Withdrawn Replaced by BS EN 837-1: 1998 |
| 508 | FLOAT OPERATED VALVES N.D. 500MM | | | 1212 | 1, 2, 3 | | |
| 509 | FIRE HYDRANTS | 3221 | 1, 2 | 750 | | | |
| 510 | WATER METERS | 19648 | 1-3 | 5728 | 1, 2 | ISO 4064-1 | BS 5728 Part 1 Withdrawn Replaced by BS 5728: Part 7 |
| 510 | WATER METERS (CONT.) | | | | | KS 06-248 1, 2 | |
| 511 | COPPER ALLOY GATE, CHECK, ETC. VALVES | 3352 | 11 | | | | |
| 511 | COPPER ALLOY GATE, CHECK, ETC. VALVES (CONT.) | | | 5154 | | | |
| 512 | FIRE HOSE COUPLINGS & EQUIPMENT | 14244 | | 336 | | | |
| 513 | SURFACE BOXES | | | 5834 | 2, 3 | | |
| 513 | SURFACE BOXES (CONT. 1) | | | | | | |
| 513 | SURFACE BOXES (CONT. 2) | | | | | | |
| 513 | SURFACE BOXES (CONT. 3) | | | | | | |
| 513 | SURFACE BOXES (CONT. 4) | | | | | | |
| 514 | METALLIC BALL VALVES | 3357 | 1-7 | | | | DIN 3357 Part 6, 7 Withdrawn |
| 515 | uPVC VALVES | 3441 | 2 | | | | |
| 517 | FIRE HYDRANT SYSTEMS FOR BUILDINGS | | | 5041 | 1-5 | | |
| 518 | BUTTERFLY VALVES | | | 5155 | | | |
| 519 | DIAPHRAGM VALVES | | | 5156 | | | |
| 520 | CAST IRON PLUG VALVES | | | 5158 | | | |
| 521 | UNDERGROUND STOPVALVES FOR WATER SERVICES | | | 5433 | | | |

3.6 TESTING METHODS AND EQUIPMENT

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|----------|------------|-------------|---------|---|--|
| 600 | NON-DESTRUCTIVE TESTING OF WELDS (TUBES) | 8564 | 1 | 3889 (6072) | 1, 2A | AP15LS | BS 3889 Partially Replaced by 6072 |
| 600 | NON-DESTRUCTIVE TESTING OF WELDS (TUBES) (CONT.) | 50120 | 1, 2 | 6072 | | | |
| 601 | SOILS FOR CIVIL ENGINEERING PURPOSE - TEST METHODS | 18196 | | 1377 | | | |
| 602 | TESTING OF PIPELINE FOR WATER (INTERNAL PRESSURE) | 4279 | 1-7, 9, 10 | | | | |
| 603 | TESTING OF CEMENT | See EDIN | | 4550 | 1, 2, 3 | BS EN 196-7 EDIN EN75, 112, 114, 15 | BS 4550 Part 1 & Part 2 Withdrawn Replaced by BS EN 196-7: 1992 |
| 604 | MATERIAL TESTING - DOCUMENTATION | | | | | ISO 404, EURONORM 21 | |
| 605 | MEASUREMENT OF WATER FLOW (WATER METERS) | | | | | ISO 4064/3 | |
| 606 | DRINKING WATER QUALITY - TESTING | | | | | KS 05-459:5 | |
| 607 | RECOMMENDATIONS AND CLASSIFICATION FOR TOPSOIL | | | 3882 | | | |
| 608 | METHODS OF TESTING MORTARS, SCREEDS AND PLASTERS | | | 4551 | | | |
| 609 | STRUCTURAL FIXINGS IN CONCRETE AND MASONRY | | | 5080 | 1 & 2 | | Part 1: Method of test for tensile loading Part 2: Method for determination of resistance to loading in shear |
| 610 | SIZE OF HARDWOODS AND METHODS OF MEASUREMENT | | | 5450 | | | |
| 611 | RECOMMENDATIONS FOR TESTING OF AGGREGATES | | | 5835 | 1 | | Part 1: Compactibility test for graded aggregates |

3.7 SITE WORK CODES OF PRACTICE

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|-------|--------|----------------|----------|--|---|
| 650 | SITE INVESTIGATIONS | 18196 | | 5930 | | | |
| 650 | SITE INVESTIGATIONS (CONT.) | 18307 | | | | | |
| 651 | WATER SUPPLY | 2000 | See BS | BS 6007 | | CP 310 | CP 310 Withdrawn Replaced by BS 6007 |
| 651 | WATER SUPPLY (CONT. 1) | 2425 | 3, 5 | BS 8301 | | CP 301 | CP 301 Withdrawn Replaced by BS 8301 |
| 651 | WATER SUPPLY (CONT. 2) | 4046 | | | | | |
| 651 | WATER SUPPLY (CONT. 3) | 19630 | | | | | |
| 652 | BUILDING DRAINAGE | 1986 | 2-4 | BS 8301 | | CP 301 | CP 301 Withdrawn Replaced by BS 8301 |
| 653 | WATER PIPELINE CONSTRUCTION | 19630 | | | | | |
| 654 | TRENCHING FOR PIPELINES | 4124 | | | | | |
| 655 | SEWAGE PIPELINE CONSTRUCTION | | | | | | |
| 656 | WALLING (BRICK & BLOCK MASONRY) | 18330 | See BS | 5390 5628 | | CP 121 | CP 121 Withdrawn Replaced by BS 5390 and BS 5628 Part 3 |
| 657 | USE OF STRUCTURAL STEEL IN BUILDING | 18203 | 1, 2 | 449 BS 5950 | 2 | | BS 449 Parts 1 and 2 Withdrawn Part 2: Addendum No. 1 (1975) Replaced by BS 5950 Part 5 (1987) |
| 658 | SEWERAGE | | | 8005 | | BS EN 1610 | |
| 659 | SMALL SEWAGE TREATMENT WORKS AND CESSPOOLS | | | 6297 | | | |
| 660 | TEST PUMPING OF WATER WELLS | | | 6316 | | | |
| 661 | METHODS OF MEASUREMENT OF LIQUID FLOW IN OPEN CHANNEL | | | 3680 | 1-10 | BS ISO 748 BS ISO 1100- 2 ISO TR 8363 | BS 3680 Part 3A Withdrawn Replaced by BS ISO 748: 1997 BS 3680 Part 3C Withdrawn Replaced by BS ISO 1100-2 BS 3680 Part 3G Withdrawn Replaced by ISO TR 8363 BS 3680 Parts 3J, 8F, 8G Withdrawn |
| 662 | MEASUREMENT OF FLOW IN CLOSED CONDUITS (BY CURRENT METERS OR PITOT STATIC TUBES) | | | | | ISO 7194 | |
| 663 | CONSTRUCTION AND DEMOLITION OF CONCRETE AND MASONRY | | | | | ANSI A10, 9- 1983 | |
| 664 | DRAINAGE OF ROOFS AND PAVED AREAS | | | 6367 | | | |
| 665 | FOUNDATIONS | | | 8004 | | CP 2004 | CP 2004 Withdrawn Replaced by BS 8004 |
| 666 | STRUCTURAL USE OF TIMBER | | | 5268 | | CP 112, 2 | CP 112, 2 Withdrawn Replaced by BS 5268 Part 2 BS 5268 Part 3 |
| 667 | RETAINING WALLS | 4085 | | | | | |
| 668 | WATERPROOFING OF BUILDINGS & STRUCTURES | 18195 | 1-4 | | | | |
| 669 | WATER QUALITY - SAMPLING | | | | | ISO 5667/2/3 | |
| 670 | WELDING PROCEDURES - APPROVAL TESTING | | | 4870 | 1 | BS EN 288-3 BS EN 288-4 | BS 4870 Part 1 Withdrawn Replaced by BS EN 288-3 BS 4870 Part 2 Withdrawn Replaced by BS EN 288-4 |
| 671 | WELDING - APPROVAL TESTING | | | 4871 | 1 | BS EN 287-1 BS EN 287-2 | BS 4871 Part 1 Withdrawn Replaced by BS EN 287-1 BS 4871 Part 2 Withdrawn Replaced by BS EN 287-2 |
| 672 | LOGGING OF ROCK CORES | | | | | LOGGING OF ROCK CORES FOR ENGINEERIN G PURPOSES, GEOL. SOC. OF LONDON | |
| 673 | TEST FOR STABILISED SOILS | | | 1924 | | | |
| 674 | DRAIN AND SEWER SYSTEMS | | | | 1, 2 & 3 | BS EN 752 | Part 1: Generalities and |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-----|------|------|----------|------------|---|
| | OUTSIDE BUILDINGS | | | | | | definitions Part 2: Performance requirements Part 3: Planning |
| 675 | CONSTRUCTION AND TESTING OF DRAINS AND SEWERS | | | | | BS EN 1610 | |
| 676 | IDENTIFICATION OF PIPELINES AND SERVICES | | | 1710 | | | |
| 677 | WELDING OF STEEL PIPELINES ON LAND AND OFFSHORE | | | 4515 | | | |
| 678 | PERFORMANCE REQUIREMENTS FOR JOINTS AND COMPRESSION FITTINGS FOR USE WITH POLYETHYLENE PIPES | | | 5114 | | | |
| 679 | STRUCTURAL USE OF TIMBER | | | 5268 | 2, 3 & 5 | | Part 2: Permissible stress design, materials and workmanship Part 3: Trussed rafter roof Part 5: Preservative treatment of structural timber |
| 680 | STAIRS, LADDERS AND WALKWAYS | | | 5395 | 1, 2 & 3 | | Part 1: Design of straight stairs Part 2: Design of helical and spiral stairs Part 3: Design of industrial type stairs, permanent ladder and walkways |
| 681 | INTERNAL PLASTERING | | | 5492 | | | |
| 682 | GUIDE TO ACCURACY IN BUILDING | | | 5606 | | | |
| 683 | SAFE USE OF EXPLOSIVES IN THE CONSTRUCTION INDUSTRY | | | 5607 | | | |
| 683 | USE OF MASONRY | | | 5628 | 3 | | Part 3: Materials and components, design and workmanship |
| 684 | EARTHWORKS | | | 6031 | | | |
| 685 | PAINTING OF BUILDINGS | | | 6150 | | | |
| 686 | LOADING FOR BUILDINGS | | | 6399 | 1 | | Part 1: Dead and imposed loads |
| 687 | GUIDE TO INSTALLATION AND USE OF VALVES | | | 6683 | | | |
| 688 | DESIGN, INSTALLATION, TESTING AND MAINTENANCE OF SERVICES SUPPLYING WATER FOR DOMESTIC USE WITHIN BUILDINGS AND THEIR CURTILAGES | | | 6700 | | | |
| 689 | GUIDE FOR STRUCTURAL DESIGN OF PAVEMENTS CONSTRUCTED WITH CLAY OR CONCRETE BLOCK PAVER | | | 7533 | | | |
| 690 | SEWERAGE | | | 8005 | 1 | | Part 1: Guide to new sewerage construction |
| 691 | PROTECTION OF STRUCTURES AGAINST WATER FROM THE GROUND | | | 8102 | | | |
| 692 | DESIGN AND INSTALLATION OF DAMP-PROOF COURSES IN THE MASONRY CONSTRUCTION | | | 8215 | | | |
| 693 | CODE OF PRACTICE FOR BUILT-UP FELT ROOFING | | | 8217 | | | |

3.8 DRAWING PRACTICE, STANDARD SYMBOLS ETC.

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-------|------|------|----------|---------------------|---|
| 700 | IDENTIFICATION OF PIPELINE ACCORDING TO FLUID CONVEYED | 2403 | | | | | |
| 701 | GRAPHICAL SYMBOLS FOR GENERAL ENGINEERING - PIPING SYSTEMS | 2406 | | 1553 | 1 | | |
| 701 | GRAPHICAL SYMBOLS FOR GENERAL ENGINEERING - PIPING SYSTEMS (CONT.) | 2429 | 1 | | | | |
| 702 | PROJECT NETWORK TECHNIQUES | | | 4335 | | | |
| 703 | DRAWING OFFICE PRACTICE - ARCHITECTS AND BUILDERS | | | 1192 | 1-4 | | BS 1192 Part 2 Obsolescent |
| 704 | CONSTRUCTION DRAWING PRACTICE | | | 1192 | 1-4 | | BS 1192 Part 2 Obsolescent |
| 705 | ENGINEERING DRAWING PRACTICE | | | 308 | 1 | ISO 128, 2162, 2203 | |
| 706 | DRAWING PRACTICE FOR ENGINEERING DRAWINGS | | | 5070 | 1-3 | BS EN 61082 | BS 5070 Part 1 Partially Replaced by BS EN 61082-1 BS 5070 Part 2 Withdrawn Replaced by BS EN 61082-2 |
| 707 | BUILDING AND CIVIL ENGINEERING TERMS | | | 6100 | 1-6 | | |
| 708 | WATER SUPPLY - MAPS AND PLANS | 2425 | 3, 5 | | | | |
| 709 | CARTOGRAPHIC REPRESENTATION OF CLIMATE | 50019 | 1 | | | | |
| 750 | CONCRETE (INC. R/F) - GLOSSARY | | | 6100 | 6.2, 6.3 | | |
| 751 | VALVES - GLOSSARY | | | | | | |
| 752 | IRON AND STEEL - GLOSSARY FOR PIPES | | | 6562 | 1-2 | | |

3.9 BUILDING MATERIALS

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-------|-------------|---|---------|--|--|
| 801 | LIME FOR MORTAR | 1060 | 1, 2, 3 | 890 | CL.B | | DIN 1060 Part 2 & 3 Withdrawn |
| 802 | QUARRY TILES FOR SILLS | | | 6431 | | BS EN ISO 10545-2, 3, 4, & 6 | BS 6431 Parts 10, 11, 12 & 14 Replaced by BS EN ISO 10545-2, BS EN ISO 10545-3 BS EN ISO 10545-4 BS EN ISO 10545-6 Respectively but remain current |
| 803 | DAMP-PROOF COURSE (BITUMINOUS FELT) | | | 743 (6398: BS 6398, BS 6515 and BS 8215) | | | BS 743 Partially Replaced by |
| 804 | CONCRETE BLOCKS | | | 6398 | | KENYA M.O.W. ST. SPEC. | |
| 804 | CONCRETE BLOCKS (CONT.) | | | 6073 | 1, 2 | | BS 6073 Partially Replaced by BS EN 772-2 |
| 805 | HOLLOW CLAY PARTITION BLOCKS | 278 | | 3921 | | | BS 3921 Partially Replaced by BS EN 772-3 & 7 |
| 806 | BRICK WALLING | 105 | 1-5 | 3921 | | | BS Partially Replaced by BS EN 772-3 & 7 |
| 806 | BRICK WALLING (CONT.) | 106 | 1, 2 | | | | |
| 807 | ASBESTOS ROOF SLATES AND SHEETING | | | 690 | 3, 4 | | BS 690 Part 3 & 4 Withdrawn Replaced by BS EN 494 and 492 respectively |
| 808 | FIXING BOLTS & SCREENS FOR ROOFING | | | | | | |
| 809 | INSULATION BOARD AND HARD BOARD | | | 1142 | 1, 2, 3 | ISO 766/7/9, 818/19, 2695, 3340, 3546, 3729 | BS 1142 Partially Replaced by BS EN 120, 310, 316-323, 324: 1 & 2, 325, 382-1 and BS EN 622: 1-5 |
| 809 | INSULATION BOARD AND HARD BOARD (CONT.) | | | | | | |
| 810 | BLOCKBOARD | 68705 | 1, 3 | 3444 | | ISO 1096, 97, 98, 2074, 2426-30 | DIN 68705 Part 1 Withdrawn |
| 811 | PLYWOOD (TROPICAL HARDWOOD) | 4078 | | 6566 | 1-8 | ISO 1096, 1097 | BS 6566 Replaced by various BS EN Standards on the same subject |
| 811 | PLYWOOD (TROPICAL HARDWOOD) (CONT.) | 68705 | 1, 5 | | | ISO 1098 | DIN 68705 Part 1 Withdrawn |
| 812 | SEALING OF EXT. WALL JOINTS | 18540 | SH. 1, 2, 3 | | | | |
| 813 | CHIPBOARD | 68761 | 4 | 5669 | | | BS 5669 Part 1 Partially Replaced by BS EN 120, 309, 310, 311, 312, Parts 1-6 and 317 BS 5669 Part 4 Partially Replaced by BS EN 634-2 & BS EN 1328 BS 5669 Part 5 Withdrawn Replaced by BS 7916 |
| 813 | CHIPBOARD (CONT. 1) | 68763 | | | | | |
| 813 | CHIPBOARD (CONT. 2) | 68764 | | | | | |
| 814 | LAMINATED PLASTIC SHEETING | 16922 | | 3794 | | BS EN 438 | BS 3794 Withdrawn Replaced by BS EN 438 Parts 1 & 2 |
| 814 | LAMINATED PLASTIC SHEETING (CONT. 1) | | | | | | |
| 814 | LAMINATED PLASTIC SHEETING (CONT. 2) | | | | | | |
| 815 | WOOD WOOL SLABS | 1101 | | 1105 | | | BS 1105 Obsolescent |
| 815 | WOOD WOOL SLABS (CONT. 1) | 1102 | | | | | |
| 816 | QUALITY OF TIMBER - WORKMANSHIP | 68141 | | 1186 | 2 | | |
| 817 | MATERIAL FOR FLUSH DOORS | 68706 | | 459 | | | BS 459 Part 3 Withdrawn |
| 817 | MATERIAL FOR FLUSH DOORS (CONT. 1) | 18101 | | | | | |
| 817 | MATERIAL FOR FLUSH DOORS (CONT. 2) | | | | | | |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-------|------|----------------------|---------|---|---|
| 818 | WATERPROOF ADHESIVE | 53255 | | 1203 | TYPE MR | | |
| 819 | STRUCTURAL STEEL & METALWORK | | | 4360 7316 7668 | | ISO 630, 6891 BS EN 10029: 1-3 BS EN 10113 BS EN 10155 BS EN 10210-1 | BS 4360 Withdrawn - Replaced by BS 7316, BS 7668, BS EN 10029 Parts 1 to 3 BS EN 10113, BS EN 10155 and BS EN 10210-1 |
| 819 | STRUCTURAL STEEL & METALWORK (CONT. 1) | | | | | | |
| 820 | SPLIT RING TIMBER CONNECTORS | | | 1579 | | | |
| 821 | METAL WINDOWS | | | 6510 | | | |
| 822 | GLASS FOR GLAZING | 1249 | 1 | 952 | 1 | | |
| 822 | GLASS FOR GLAZING (CONT.) | 18301 | | | | | |
| 823 | GALVANISED M.S. TUBING (MILD STEEL) | 2440 | | 1387 | | ISO 65, 7/1, 7/2 | |
| 823 | GALVANISED M.S. TUBING (MILD STEEL) (CONT. 1) | 2441 | | 21 | | | |
| 823 | GALVANISED M.S. TUBING (MILD STEEL) (CONT. 2) | 2442 | | | | | |
| 823 | GALVANISED M.S. TUBING (MILD STEEL) (CONT. 3) | 2999 | 1 | | | | |
| 824 | FITTINGS TO M.S. TUBING MILD STEEL | 2460 | | 1256, 143 | | | |
| 824 | FITTINGS TO M.S. TUBING MILD STEEL (CONT. 1) | | | 143 | | BS EN 10242 | |
| 824 | FITTINGS TO M.S. TUBING MILD STEEL (CONT. 2) | | | 1740 | 1 | | |
| 825 | POLYTHENE TUBING FOR COLD WATER SERVICES | 19533 | | 2782 | | ISO 161-1 BS ISO 4065 BS ISO 11922-1 | |
| 825 | POLYTHENE TUBING FOR COLD WATER SERVICES (CONT. 1) | 8072 | | 6572 6730 | | | |
| 825 | POLYTHENE TUBING FOR COLD WATER SERVICES (CONT. 2) | 8073 | | | | | |
| 825 | POLYTHENE TUBING FOR COLD WATER SERVICES (CONT. 3) | 8075 | | | | | |
| 825 | POLYTHENE TUBING FOR COLD WATER SERVICES (CONT. 4) | 8074 | | | | | |
| 826 | BRASSWORK & FITTINGS FOR TAPS & STOP VALVES | | | 1010 | 2 | | |
| 827 | BALL VALVES FOR CISTERNS | | | 1212 | 3 | | |
| 828 | PLASTIC FLOATS FOR BALL VALVES | | | 2456 | | | |
| 829 | CAST IRON SOIL, WASTE & VENT PIPES | | | 416 | | | |
| 829 | CAST IRON SOIL, WASTE & VENT PIPES (CONT. 1) | | | | | | |
| 829 | CAST IRON SOIL, WASTE & VENT PIPES (CONT. 2) | | | | | | |
| 829 | CAST IRON SOIL, WASTE & VENT PIPES (CONT. 3) | 19522 | 1, 2 | | | | |
| 830 | GALVANISED MILD STEEL COLD WATER TANKS | | | 417 | 2 CL.A | | |
| 831 | ENAMELLED CAST IRON BATH | | | 1189 | | | |
| 831 | ENAMELLED CAST IRON BATH (CONT. 1) | | | | | | |
| 831 | ENAMELLED CAST IRON BATH (CONT. 2) | 4774 | | | | | |
| 832 | PILLAR TAPS | 7572 | | 1010 | 2 | | |
| 833 | GLAZED VITREOUS CHINA W.C. PAN | 1387 | | 5503 | | | |
| 833 | GLAZED VITREOUS CHINA W.C. PAN (CONT.) | 1381 | | | | | |
| 834 | HINGED PLASTIC SEAT TO W.C. PAN | | | 1254 | | | |
| 835 | GLAZED VITREOUS CHINA LAVATORY BASIN | 4462 | | 1188 | | | |
| 835 | GLAZED VITREOUS CHINA LAVATORY BASIN (CONT.) | | | 5506 | 2 | | |
| 836 | STAINLESS STEEL SINK | 4465 | | 1244 | 2 | | |
| 837 | BRASS "S" AND "P" TRAPS | | | 1184 | | | BS 1184 Obsolescent |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|---------|---------|---------|------------|-------------------------------------|---|
| 839 | A/C DRAIN PIPES AND FITTINGS | 19831 | | 3656 | | BS EN 588-1 | BS 3656 Withdrawn Replaced by BS EN 588-1 |
| 839 | A/C DRAIN PIPES AND FITTINGS (CONT. 1) | 19841 | | | | | |
| 839 | A/C DRAIN PIPES AND FITTINGS (CONT. 2) | 19850 | 1, 2 | | | | |
| 840 | CONCRETE DRAIN PIPES | See 409 | | 2870 | | | |
| 841 | PITCH FIBRE DRAIN PIPES | | | 2760 | | | BS 2760 Withdrawn |
| 842 | CAST IRON DRAIN PIPES | 19500 | | 437 | | ISO 6594 | |
| 842 | CAST IRON DRAIN PIPES (CONT. 1) | 19501 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 2) | 19502 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 3) | 19503 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 4) | 19504 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 5) | 19505 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 6) | 19506 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 7) | 19507 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 8) | 19508 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 9) | 19509 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 10) | 195010 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 11) | 195011 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 12) | 195014 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 13) | 195019 | | | | | |
| 842 | CAST IRON DRAIN PIPES (CONT. 14) | 19521 | | | | | |
| 843 | JOINTING COMPOUND FOR C.I. DRAIN PIPES | | | BS 6956 | 1, 5, 6, 7 | | |
| 844 | C.I. S & S FITTINGS FOR DRAINS | 19519 | | 437 | | | |
| 845 | STEP-IRONS TO MANHOLES & SEPTIC TANKS | 1211 | 1 | 1247 | | | |
| 845 | STEP-IRONS TO MANHOLES & SEPTIC TANKS (CONT. 1) | 1212 | 1 | | | | |
| 845 | STEP-IRONS TO MANHOLES & SEPTIC TANKS (CONT. 2) | 1213 | | | | | |
| 845 | STEP-IRONS TO MANHOLES & SEPTIC TANKS (CONT. 3) | 4281 | | | | | |
| 846 | C.I. MANHOLE COVERS AND FRAMES | 1229 | | 497 | 1 | BS EN 124 | BS 497 Withdrawn Replaced by BS EN 124 |
| 846 | C.I. MANHOLE COVERS AND FRAMES (CONT. 1) | 4271 | 1, 3 | | | | |
| 846 | C.I. MANHOLE COVERS AND FRAMES (CONT. 2) | 19593 | 1, 2, 3 | | | | |
| 846 | C.I. MANHOLE COVERS AND FRAMES (CONT. 3) | 19594 | 1, 2 | | | | |
| 846 | C.I. MANHOLE COVERS AND FRAMES (CONT. 4) | 19596 | | | | | |
| 846 | C.I. MANHOLE COVERS AND FRAMES (CONT. 5) | 19597 | | | | | |
| 847 | STEEL LADDERS FOR PERMANENT ACCESS | 3620 | | 4211 | | | |
| 848 | HANDRAILING | 24533 | | 6180 | | | |
| 849 | GALVANISED CHAIN LINK FENCING | 11991 | | 1722 | 1 | | |
| 850 | OPEN MESH STEEL FLOORING | | | 4592 | 1 | | |
| 851 | MASTIC ASPHALT FOR ROOFING | | | 6925 | | | |
| 852 | ALUMINIUM FOR LOUVRE WINDOWS | | | 1470 | | BS EN 485 BS EN 515 BS EN 573 | BS 1470 Withdrawn Replaced by BS EN 485 Parts 1-4, BS EN 515, BS EN 573 Parts 1-4 |
| 853 | FIXING ACCESSORIES FOR BUILDING PURPOSES | | | 1494 | 1 | | BS 1494 Part 2 Withdrawn |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-------|------|-------------------|------|------------|--|
| 854 | PRECAST CONCRETE MANHOLES | 4034 | | 5911 | 2, 3 | | BS 5911 Part 1 Withdrawn Replaced by BS 5911 Part 100 (1988) Bs 5911 Part 200 (1989) and BS 5911 Part 200 (1994) |
| 855 | PRECAST CONCRETE KERBS & CHANNELS | 483 | | 7263 | 1 | | |
| 856 | WATERPROOF BUILDING PAPERS | 4122 | | 1521 | | | |
| 856 | WATERPROOF BUILDING PAPERS (CONT. 1) | 52126 | | | | | |
| 856 | WATERPROOF BUILDING PAPERS (CONT. 2) | 52127 | | | | | |
| 856 | WATERPROOF BUILDING PAPERS (CONT. 3) | 52128 | | | | | |
| 856 | WATERPROOF BUILDING PAPERS (CONT. 4) | 52129 | | | | | |
| 856 | WATERPROOF BUILDING PAPERS (CONT. 5) | 52130 | | | | | |
| 857 | METAL TIES FOR CAVITY WALL | | | 1243 | | | |
| 858 | A/C BUILDING PRODUCTS (TESTS FOR SHEETS) | 274 | 1-4 | 4624 | | | |
| 859 | PRECAST CONCRETE FLAGSTONES | 485 | | 7263 | 1 | | |
| 860 | ASBESTOS CEMENT RAIN WATER GOODS | 19831 | 1-9 | 569 | | | |
| 860 | ASBESTOS CEMENT RAIN WATER GOODS (CONT. 1) | 19841 | 1-6 | | | | |
| 860 | ASBESTOS CEMENT RAIN WATER GOODS (CONT. 2) | 19850 | 1 | | | | |
| 861 | LINTELS - PREFABRICATED | | | 5977 | 2 | | |
| 862 | uPVC SOIL AND VENT PIPES, FITTINGS, ETC. | 1187 | | 4514 | | | |
| 863 | STRUCTURAL STEEL IN BUILDINGS | | | 449 (5950) | 2 | | BS 449 Part 2 Withdrawn Replaced by BS 5950 Part 5 |
| 864 | PROTECTIVE BARRIERS IN AND ABOUT BUILDINGS | | | 6180 | | | |
| 866 | BITUMENS FOR BUILDING & CIVIL ENGINEERING | | | 3690 | 1, 3 | | |
| 867 | SOLAR WATER HEATERS | | | | | AS 2813-85 | |
| 868 | FLOORING - INITIAL TREATMENT MAINTENANCE | | | 6263 | 2 | | |
| 869 | RIGID FLAT SHEET BUILDING MATERIALS | | | | | | |
| 870 | BUILDING STONE | | | 1438 | | | |
| 871 | CAST STONE | | | 1217 | | | |
| 872 | WOOD PRESERVATIVES - CREOSOTE | | | 144 | | | |
| 873 | WASTE TRAPS - PLASTIC | | | 3943 | | | |
| 874 | COPPER FLOATS FOR FLOAT OPERATED VALVES | | | 1968 | | | |
| 875 | VITREOUS CHINA SANITARY FITTINGS | | | 3402 | | | |
| 876 | PAINTS - LEAD BASED | | | 2523 (5082, 5358) | | | BS 2523 Obsolescent, Partially Replaced by BS 5082 and BS 5358 |
| 877 | READY MIXED OIL-BASED PRIMING PAINTS | | | 2521/4 (See 2523) | | | |
| 878 | READY MIXED OIL-BASED UNDERCOATING AND FINISHING PAINTS | | | | | | |
| 879 | COLD POURED SEALING MATERIALS FOR CONCRETE PAVEMENTS | | | 5212 | | | |
| 880 | GULLY TOPS AND MANHOLE TOPS FOR VEHICULAR PEDESTRIAN AREAS. DESIGN REQUIREMENTS, TYPE TESTING, MARKING QUALITY CONTROL | | | | | BS EN 124 | |
| 881 | STRUCTURAL TIMBER. STRENGTH CLASSES | | | 338 | | | |
| 882 | CLAY ROOFING TILES AND | | | 402 | 1 | | Part 1: Specification for |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|---------|--|-----|------|------|----------------|-----------|---|
| | FITTINGS | | | | | | plain tiles and fittings |
| 883 | BITUMEN ROAD EMULSIONS (ANIONIC AND CATIONIC) | | | 434 | 1 | | Part 1: Bitumen road emulsions |
| 884 | DRESSED NATURAL STONE KERBS, CHANNELS, QUADRANTS AND SETTS | | | 435 | | | |
| 885 | CONCRETE ROOFING TILES AND FITTINGS. PRODUCT SPECIFICATION | | | | | BS EN 490 | |
| 886 | AIR BRICKS AND GRATINGS FOR WALL VENTILATION | | | 493 | | | |
| 887 | EAVES GUTTERS AND FITTINGS MADE OF PVC-C | | | | | BS EN 607 | |
| 888 | EAVES GUTTERS AND RAINWATER DOWN-PIPES OF METAL SHEET | | | | | BS EN 612 | |
| 889 | PLYWOOD | | | | | BS EN 635 | |
| 890 | TIMBER IN JOINERY | | | | | BS EN 942 | |
| 891 | PRESSED STEEL GUTTERS, RAINWATER PIPES, FITTINGS AND ACCESSORIES | | | 1091 | | | |
| 892 | WC FLUSHING CISTERNS (INCLUDING DUAL FLUSH CISTERNS AND FLUSH PIPES) | | | 1125 | | | |
| 893 | NAILS | | | 1202 | 1, 2 & 3 | | Part 1: Steel nails Part 2: Copper nails Part 3: Aluminium nails |
| 893 | FIXING ACCESSORIES FOR BUILDING PURPOSES | | | 1494 | 1 | | Part 1 Fixings for sheet, roof and wall coverings |
| 894 | AUTOMATIC FLUSHING CISTERNS FOR URINALS | | | 1876 | | | |
| 895 | WASTES (EXCLUDING SKELETON SINK WASTES) AND BATH OVERFLOWS | | | 3380 | | | |
| 896 | LIGHTWEIGHT AGGREGATES FOR MASONRY UNITS AND STRUCTURAL CONCRETE | | | 3797 | | | |
| 897 | TERRAZO TILES | | | 4131 | | | |
| 898 | WELDABLE STRUCTURAL STEELS | | | 4360 | | | |
| 899. 1 | UNPLASTICIZED POLYVINYL CHLORIDE (PVC-U) RAINWATER GOODS AND ACCESSORIES | | | 4576 | | | |
| 899. 2 | INDUSTRIAL TYPE METAL FLOORING, WALKWAYS AND STAIRS TREADS | | | 4592 | 1, 2, 3 & 4 | | Part 1: Open bar gratings Part 2: Expanded metal grating panels Part 3: Cold formed planks Part 4: Glass reinforced plastics open bar gratings |
| 899. 3 | READY-MIX BUILDING MORTARS | | | 4721 | | | |
| 899. 4 | INTERNAL AND EXTERNAL WOOD DOORSETS, DOOR LEAVES AND FRAMES | | | 4787 | 1 | | Part 1: Dimensional requirements |
| 899. 5 | HOT-ROLLED STRUCTURAL STEEL SECTIONS | | | 4848 | 2 & 4 | | Part 2: Hot-finished hollow sections Part 4: Equal and unequal angles |
| 899. 6 | URINALS | | | 4880 | 1 | | Part 1: Stainless steel slab urinals |
| 899. 7 | MORTAR ADMIXTURES | | | 4887 | 1 & 2 | | Part 1: Air-entraining (plasticizing) admixtures Part 2: Set retarding admixtures |
| 899. 8 | SOFTWOOD GRADES FOR STRUCTURAL USE | | | 4978 | | | |
| 899. 9 | COATED MACADAM FOR ROADS AND OTHER PAVED AREAS | | | 4987 | 1 & 2 | | Part 1: Constituent materials and mixtures Part 2: Transport, laying and compaction |
| 899. 10 | WATER-BORNE PRIMING PAINTS FOR WOODWORK | | | 5082 | | | |
| 899. 11 | MASONRY CEMENT | | | 5224 | | | |
| 899. 12 | EXTERNAL RENDERINGS | | | 5262 | | | |
| 899. 13 | SOLVENT-BORNE PRIMING PAINTS FOR WOODWORK | | | 5358 | | | |
| 899. | WALL AND FLOOR TILING | | | 5385 | 1, 2, 3, 4 & 5 | | Part 1: Design and |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|--------|---|-----|------|------|-------|-------|---|
| 14 | | | | | | | installation of internal ceramic wall tiling and mosaics in normal conditions Part 2: Design and installation of external ceramic wall tiling and mosaics (including terra cotta and faience tiles) Part 3: Design and installation of ceramic floor tiles and mosaics Part 4: Tiling and mosaics in specific conditions Part 5: Design and installation of terrazzo tile and slab, natural stone and composition block floorings |
| 899.15 | STONE MASONRY | | | 5390 | | | |
| 899.16 | SPECIFICATION FOR LOW-RESISTANCE SINGLE TAPS AND COMBINATION TAP ASSEMBLIES (NOMINAL SIZE ½ AND ¾) SUITABLE FOR OPERATION AT PN 10 MAX. AND A MINIMUM FLOW PRESSURE OF 0.01 MPa (0.1 BAR) | | | 5412 | | | |
| 899.17 | VITREOUS CHINA WASHDOWN WC PANS WITH HORIZONTAL OUTLET | | | 5503 | 1 & 2 | | Part 1: Connecting dimensions Part 2: Materials, quality, performance and dimensions other than connecting dimensions |
| 899.18 | VITREOUS CHINA BOWL URINALS (RIMLESS TYPE) | | | 5520 | | | |
| 899.19 | PRESERVATION OF TIMBER | | | 5589 | | | |
| 899.20 | PLASTIC CONNECTORS FOR USE WITH HORIZONTAL OUTLET VITREOUS CHINA WC PANS | | | 5627 | | | |
| 899.21 | STILES, BRIDLE GATES AND KISSING GATES | | | 5709 | | | |
| 899.22 | GLAZING FOR BUILDINGS | | | 6262 | | | |
| 899.23 | MANUFACTURE OF GLUED STRUCTURAL COMPONENTS FOR TIMBER AND WOOD BASED PANEL PRODUCTS | | | 6446 | | | |
| 899.24 | POLYETHYLENE DAMP-PROOF COURSES FOR MASONRY | | | 6515 | | | |
| 899.25 | INSTALLATION OF CHMICAL DAMP-PROOF COURSES | | | 6576 | | | |
| 899.26 | PORTLAND PULVERIZED-FUEL ASH CEMENTS | | | 6588 | | | |
| 899.27 | PRECAST CONCRETE PAVING BLOCKS | | | 6717 | 1 | | Part 1: Paving blocks |
| 899.28 | EXTERIOR WOOD COATING SYSTEMS | | | 6952 | 1 | | Part 1: Guide to classification and selection |
| 899.29 | PRECAST CONCRETE FLAGS, KERBS, CHANNELS, EDGINGS AND QUADRANTS | | | 7263 | 1 & 2 | | Part 1: Specification Part 2: Code of practice for laying |
| 899.30 | IN-SITU FLOORINGS | | | 8204 | 2 | | Part 2: Concrete wearing surfaces |

3.10 ELECTRICAL / MECHANICAL

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|-----------|-----------------|----------------------|-------------|-----------------------------------|--|
| 001 | FRACTIONAL HORSE-POWER MOTORS (DIMENSIONS) | 42021 | | 2048 | 1 | | |
| 002 | CURRENT TRANSFORMERS | | | 7626 | | IEC 60185 | |
| 003 | VOLTAGE TRANSFORMERS | | | 7625 | | IEC 60186/186A | |
| 004 | CIRCUIT BREAKERS 1 kV A.C. | | | 5311 | | IEC 60056/267 | |
| 005 | CIRCUIT BREAKERS A.C. VOLT. OPERATED | | | 842 | | BS EN 61008-1 | |
| 006 | CIRCUIT A.C. CURRENT OPERATED | | | 4293 | | BS IEC 1008-2-2 | BS 4293 Partially Replaced by BS EN 61008-1 and BS IEC 1008-2-2 |
| 007 | FUSE SWITCHES (AIR BREAK) | | | 5419 | | IEC 408 | BS 5419 Withdrawn Replaced by BS EN 60947-3 |
| 008 | MOTOR STARTERS AND CONTROLLERS | 46062 | | 587 | | | BS 587 Withdrawn Replaced by BS EN 60947-4-1 and BS 5856-1 |
| 009 | MOTOR STARTERS ABOVE 1000 V.A.C. | | | 5856 | 1 | IEC 60632-1 | |
| 010 | ELECTRIC MOTOR DIMENSIONS | 42673 | BL. 1-4 | 4999 | 10 | IEC 60072, 72A | |
| 011 | INDUCTION MOTORS FOR GENERAL PURPOSE | 42673 | BL. 1-4 | 5000 | 10 | IEC 60072 | |
| 012 | ENCLOSURE PROTECTION SWITCH / CONTROL GEAR | 40050 | BL. 2, 6, 9, 10 | 5420 | | IEC 60144 (IP32) | BS 5420 Withdrawn Replaced by BS EN 60947-1 |
| 013 | MOTOR STARTERS NOT EXC. 1000 V.A.C. | 46062 | | 4941 | 1, 3, 4 | IEC 292, 1, 2, 3, 4 | BS 4941 Withdrawn Replaced by BS EN 60947-4-1 |
| 014 | ELECTRICITY METERS | | | 37 | 1, 5, 8 | | BS 37 Withdrawn Replaced by Parts 1-4 of BS 5685 |
| 015 | WATT-HOUR METERS | | | 5685 | | IEC 521 | BS 5685 Part 1 (1979) and Parts 2, 3 & 4 (1986) all Obsolescent |
| 016 | ACCEPTANCE TESTS FOR PUMPS (CLASS C) | 4325 | | 5316 | 1 | ISO 2548 | |
| 017 | ACCEPTANCE TESTS FOR PUMPS (CLASS B) | 4325 | | 5316 | 2 | IEC 198 | |
| 018 | CODE OF PRACTICE, ELECTRICAL WIRING | | | | | ISO 3555 | |
| 019 | ELECTRICAL PROTECTIVE RELAYS | | | 142 | | IEC 198 | |
| 020 | FACTORY BUILT SWITCHGEAR ASSEMBLIES | 57670 | TL. 6 | 5486 | 1, 2, 3, 13 | IEE W. REGS (15 TH ED) | BS 142 Part 1 Section 1.5 Sub-Section 1.5.1 - 1.5.3 all renumbered as BS 60255-21-1, 2, 3 respectively |
| 021 | RECIPROCATING INT/COMB. ENGINES | | | 5514 | 1, 2 | BS 439-2 | BS 5486 Part 1 Withdrawn Replaced by BS EN 60439-1 |
| 022 | MACHINES FOR MISCELLANEOUS APPLICATIONS | | | 5000 | 99 | ISO 3046, PT. 1, 2 | BS 5541 Part 2 (1988) 'Test Methods' Withdrawn - Replaced by BS 5514 Part 1 (1996) |
| 023 | INSULATING MATERIALS FOR ELECTRICAL MACHINES | | | 2757 | | | |
| 024 | PCV INSULATED CABLES NOT EXCEEDING 1900 V.A.C. | 57207 | 4, 5 | 6346 | | IEC 85 | |
| 025 | ROTATING ELECTRICAL MACHINES - GENERAL | | | 4999 | 1, 2, 3 | IEC 34-1, 34-8, 72, 72A | Renumbered as EN 60034-4 |
| 026 | CONCRETE CABLE COVERS | | | 2484 | | | BS 2484 Obsolescent |
| 027 | ELECTRIC POWER SWITCHGEAR (LOW VOL. N.E. 1kV) | 57660 | | 5486 5727 7354 | | | |
| 028 | SAFETY ISOLATING TRANSFORMERS | | | 3535 | | | |
| 029 | ROTATING ELECTRICAL MACHINES - RATING PLATES | 42961 | | 4999 | 4 | IEC 60034-1 | |
| 030 | ROTATING ELECTRICAL MACHINES - ENCLOSURES | 40050 | | 4999 | 20 | IEC 60035-5 | |
| 031 | ROTATING ELECTRICAL MACHINES - CONDITIONS | | | 4999 | 31 | IEC 60034-1 | |
| 032 | ROTATING ELECTRICAL MACHINES - TEMPERATURE LIMITS | See E DIN | | 4999 | 32 | IEC 60034-1 E DIN | |
| 033 | ROTATING ELECTRICAL | See | | 4999 | 50 | ISO 2373 | |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|----------------------|------|----------------|---------|-----------------------------|--|
| | MACHINES - VIBRATION | DIN ISO | | | | | |
| 034 | ROTATING ELECTRICAL MACHINES - TESTS | | | 4999 | 60 | IEC 60034-1 | |
| 035 | GENERATORS DRIVEN BY I/C ENGINES | See VDMA 22418 | | 5000 | 3 | VDMA 6280 | |
| 036 | MACHINES WITH FLAMEPROOF ENCLOSURES | | | 5000 | 17 | | |
| 037 | MAINTENANCE OF ELECTRICAL SWITCHGEAR (V.N.E. 14 kV) | | | 6626 | | | |
| 038 | PROTECTION PROVIDED BY ENCLOSURES (CLASS N OF DEG.) | | | 5490 | | IEC 600529, BS EN 60529 | BS 5490 Withdrawn Replaced by BS EN 60529 |
| 039 | ELECTRICAL EQUIPMENT OF INDUSTRIAL MACHINES | | | 2771 | | EN 60204, Part 1 | BS 2771 Part 1 Replaced by EN 60204-1 (1993) but remains current for use as a reference standard for BS EN 60204-3-1: 1992 |
| 040 | SWITCHGEAR AND CONTROL GEAR UPTO 1000V | | | 4752 | | IEC 600157- 1, 600157-1A | BS 4752 Withdrawn Replaced by BS EN 60947-2 |
| 041 | PVC INSULATED CABLES FOR SWITCHES AND CONTROL GEAR | | | 6231 | | | |
| 042 | BASIC ENVIRONMENTAL TESTING PROCEDURES | | | 2011 | 1.1 | IEC 60068-1 | BS 2011 Parts Withdrawn and Replaced by Parts of BS EN 60068 |
| 043 | DEFINITIONS AND GENERAL REQUIREMENTS | | | | | IEC 60051-1 | |
| 044 | PANEL MOUNTED INSTRUMENTS - DIMENSIONS | | | | | IEC 600473 | |
| 045 | CELLULOSIC PAPERS FOR ELECTRICAL PURPOSES | | | 5626 | 1, 2, 3 | IEC 600554 | |
| 046 | COMMISSIONING, OPERATION AND MAINTENANCE OF STORAGE PUMPS | | | | | IEC 600805 | |
| 047 | RUBBER INSULATED CABLES | | | | | IEC 600245 | |
| 048 | VOLTAGE FLUCTUATION LIMITS - GUIDE | | | | | IEC 600827 | |
| 049 | ELECTRIC CABLES - ARMOURING - WIRE FOR | | | | | KS 04-290 | |
| 050 | ROTATING ELECTRICAL MACHINES FOR HAZARDOUS AREAS ("N") | | | 5000 | 16 | | |
| 051 | POWER TRANSFORMERS - GENERAL | | | | | BS EN 60076-1 | |
| 052 | ELECTRIC CONDUIT - STEEL | | | 4568 | 2 | | |
| 053 | BUS BARS | | | 159 | | | |
| 054 | NON-METALLIC CONDUITS | | | 4607 (6099) | 2 | | Partially Replaced by BS 6099 Part 1 and BS 6099 Section 2.2 |
| 055 | PVC CABLES IN CONDUITS | | | 6004 | | | |
| 056 | INSULATED FLEXIBLE CORD | | | 6500 | | | |
| 057 | M.I.C.C. CABLES | | | 4782 | 1 | | |
| 058 | FLUSH SWITCHES | | | 3676 | | | |
| 059 | ELECTRIC SOCKETS | | | 1363 | | | Part 3: 1989 Replaced by BS 1363 Part 3 (1995) but remains current |
| 060 | FUSED SPUR BOXES | | | 1362 | | | |
| 061 | CONTACTORS | | | 775 | | | Part 1 (1969) Withdrawn Replaced by BS 5424: Part 1 1977 |
| 062 | SECURITY LIGHTING INSTALLATION | | | | | CP 1004 | Renumbered as BS 5498 |
| 063 | ALUMINIUM SOLID CONDUCTORS | | | 3988 | | | |

3.11 MISCELLANEOUS

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|------------|----------|------|----------|---------------------------------|---|
| 900 | ZINC SPRAY PROTECTION | 55928 | 1-9 | 2569 | 1 | ISO 2063 BS EN 22063 | BS 2569 Withdrawn Replaced by BS EN 22063 |
| 900 | ZINC SPRAY PROTECTION (CONT.) | | | 5493 | | BS EN ISO 12944 | BS 5493 Proposed for Obsolescence Partially Replaced by Parts 1-8 of BS EN ISO 12944 |
| 901 | METALLIC ZINC RICH PRIMER | | | 4652 | | | |
| 902 | COLOUR OF FINISH (BUILDING MATERIALS) | See VOB | | 4800 | | VOB pt. C | |
| 903 | HOT DIP GALVANIZING ON IRON & STEEL | | | 729 | | ISO 1459 | |
| 903 | HOT DIP GALVANIZING ON IRON & STEEL (CONT.) | | | 5493 | | ISO 1461 BS EN ISO 12944 | BS 5493 Proposed for Obsolescence Partially Replaced by Parts 1-8 of BS EN ISO 12944 |
| 904 | BLACK BITUMEN SOLUTION (COLD APP.) FOR WATER TANKS | | See DVGW | 3416 | TYPE II | DVGW-GWS | |
| 905 | WELDABLE STRUCTURAL STEELS | 1025 | 1-5 | 4360 | | ISO 630 | BS 4360 Withdrawn - Replaced by BS 7613, BS 7668, BS EN 10113, BS EN 10155 & BS EN 10210 |
| 906 | CLASSIFICATION OF GREY CAST IRON | | | 1452 | | ISO 185 | BS 1452 Withdrawn Replaced by BS EN 1561 |
| 907 | BEARING DESIGN LIFE | | | | | | |
| 908 | BITUMEN - HOT APPLIED - COATINGS FOR IRON AND STEEL | 30673 | | 4147 | | | |
| 908 | BITUMEN - HOT APPLIED - COATINGS FOR IRON AND STEEL (CONT.) | | | 5493 | | | |
| 909 | PRESSED STEEL RECTANGULAR TANKS | | | 1564 | | | |
| 910 | GREY IRON CASTINGS FOR MANHOLE COVERS | | | 1452 | GRADE 10 | | |
| 911 | MALLEABLE CAST IRON | | | 6681 | | ISO 5922 | BS 6681 Withdrawn - Replaced by BS EN 1562 |
| 911 | MALLEABLE CAST IRON (CONT.) | | | | | ASTM A 47- 77 | |
| 912 | ROLLED STEEL | | | 4360 | | ISO 630 | BS 4360 Withdrawn - Replaced by BS 7613, BS 7668, BS EN 10113, BS EN 10155 & BS EN 10210 |
| 912 | ROLLED STEEL (CONT.) | | | | | | |
| 913 | STRUCTURAL STEEL SECTIONS | 1025 | 1-5 | 4 | 1 | | BS 4 Part 2 (1969) Withdrawn Replaced by BS 4848 Part 2 BS 4160 Obsolescent |
| 914 | ISO METRIC BLACK HEXAGONAL BOLTS, SCREWS AND NUTS | 267 | 1, 2 | 4190 | | ISO 272, 4759-1, 3 | |
| 914 | ISO METRIC BLACK HEXAGONAL BOLTS, SCREWS AND NUTS (CONT 1) | | | | | ISO 885, 888 | |
| 914 | ISO METRIC BLACK HEXAGONAL BOLTS, SCREWS AND NUTS (CONT 2) | | | | | ISO 898/2, 898/1 | |
| 915 | SIZES FOR FERROUS & NON- FERROUS BARS | | | 6722 | | | |
| 916 | MECHANITE IRON, GRADE E | | | | | ASTM A48, No. 308 | |
| 917 | CORROSION PROTECTION OF STEEL STRUCTURES - GENERAL | 55928 | 1-9 | 5493 | | BS EN ISO 12944 | BS 5493 Proposed for Obsolescence Partially Replaced by Parts 1-8 of BS EN ISO 12944 |
| 918 | INGOT ZINC | | | 3436 | | ISO 752 BS EN 1179 (1996) | BS 3436 Withdrawn Replaced by BS EN 1179 (1996) |
| 919 | WELDING OF STEELS (METAL ARC) | 8528 | 1-2 | 5135 | 1 | | BS 5135 Partially Replaced by BS EN 1011-1 (1998) |
| 919 | WELDING OF STEELS (METAL ARC) (CONT 1) | 8553 | | 499 | 1 | | BS 499 Part Obsolescent / Withdrawn |
| 919 | WELDING OF STEELS (METAL | 8558 | 1 | | | | |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|---|-------|------|------|------------------|---|---|
| 919 | ARC) (CONT 2) WELDING OF STEELS (METAL ARC) (CONT 3) | 50120 | 1 | | | | |
| 920 | STEEL PLATE, SHEET AND STRIP | | | 1449 | 1 (Withdrawn) | ISO 3573 | BS 1499 Parts Withdrawn Replaced by BS EN 10111, 10209, BS EN 10149-2 & 3, 10051, 10131, 10139, 10149-2 & 3, 10048, 10140, 10029, 10258 & 10259 |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 1) | | | | | ISO 3574 | |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 2) | | | | | | |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 3) | | | | | | |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 4) | | | | | | |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 5) | | | | | | |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 6) | 1614 | | | | | |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 7) | 1632 | 2 | | | | |
| 920 | STEEL PLATE, SHEET AND STRIP (CONT 8) | 1624 | | | | | |
| 921 | ELECTROPLATED COATINGS ON THREADS - STANDARD | | | 3382 | 1-6 | | |
| 922 | ELECTROPLATED COATINGS ON THREADS - THICKENED | | | 3382 | 7 | ISO-DIS 4042 | |
| 923 | ISO METRIC SCREW THREADS | | | 3643 | 1-2 | ISO 68, 261, 724, 965/1, 965/3, 262 | |
| 923 | ISO METRIC SCREW THREADS (CONT) | | | | | ISO 1106-3, 7438 | |
| 924 | ISO METRIC PRECISION HEXAGON BOLTS, SCREWS AND NUTS | | | 3692 | | ISO 887 | BS 3692 Obsolescent |
| 925 | METAL WASHERS FOR GENERAL ENGINEERING | | | 4320 | | ASS 2602: 83 2603: 83 - ISO/12 887 | |
| 926 | STEEL STRUCTURES - PAINTS FOR POLYURETHANE | | | | | | |
| 927 | SHEAR TEST FOR METALS | 50141 | | | | | |
| 928 | WELDED STEEL TANKS FOR OIL STORAGE | | | | | APS 650 | |
| 929 | LIFTING APPLIANCES - OVERHEAD TRAVELLING CRANES | | | | | ISO 7752/5 | |
| 930 | HIGH STRENGTH FRICTION GRIP BOLTS | | | 4325 | | | |
| 931 | ELECTRODES FOR MANUAL ARC WELDING | | | 639 | | BS EN 499 | BS 639 Withdrawn Replaced by BS EN 499 |
| 932 | BLACK CUP COUNTERSUNK BOLTS, SCREWS WITH NUTS | | | 4933 | | | BS 4933 Obsolescent |
| 933 | METAL LATHING | | | 1369 | | | |
| 934 | ROLLED ASPHALT HOT PROCESS FOR ROADS | | | 594 | | | |
| 935 | BINDER DIST. FOR ROAD SURFACE DRESSING | | | 1707 | | | |
| 936 | BITUMINOUS ROOFING FELT | | | 747 | | CP 114: 3 | CP 114:3 Withdrawn |
| 937 | GAS WELDING | | | 2640 | | | |
| 938 | METALLIC COATINGS. HOT DIP GALVANISED COATINGS ON FERROUS MATERIALS | | | | | BS EN 1460 | |
| 939 | METHOD FOR SPECIFYING ELECTROPLATED COATINGS OF ZINC AND CADMIUM ON IRON AND STEEL | | | 1706 | | | |
| 940 | DIMENSIONS OF GASKETS FOR PIPE FLANGES TO BS 4504 | | | 4865 | 1 | | Part 1: Non-metallic flat gaskets (including gaskets for flanges to BS 4722) |

| SRN | SUBJECT | DIN | PART | BSS | PART | OTHER | REMARKS |
|-----|--|-----|------|-------|------|-------|---|
| 941 | BONDING AGENTS FOR USE WITH GYPSUM PLASTERS AND CEMENT | | | 5270 | 1 | | Part 1: Polyvinyl acetate (PVAC) emulsion bonding agents for indoor use with gypsum building plasters |
| 942 | FALSEWORK | | | 5975 | | | |
| 943 | TUBULAR POLYETHYLENE FILM FOR USE AS A PROTECTIVE SLEEVING FOR BURIED IRON PIPES AND FITTINGS | | | 6076 | | | |
| 944 | FLEXIBLE JOINTS FOR GREY OR DUCTILE CAST IRON DRAINPIPES AND FITTINGS (BS 437) AND FOR DISCHARGE AND VENTILATING PIPES AND FITTINGS (BS 416) | | | 6087 | | | |
| 945 | HOT ROLLED PRODUCTS OF NON-ALLOY STRUCTURAL STEELS | | | 10025 | | | |
| 946 | STAINLESS STEELS | | | 10088 | 2 | | Part 2: Technical delivery conditions for sheet/plate and strip for general purposes |

4.1 **DIN**

| DIN | SRN | DIN | SRN | DIN | SRN | DIN | SRN | DIN | SRN |
|------|-----|------|-----|------|-----|-------|-----|-------|-----|
| 105 | 806 | 2000 | 651 | 2988 | 204 | 4279 | 405 | 19630 | 651 |
| 106 | 806 | 2403 | 700 | 2990 | 204 | 4279 | 602 | 19648 | 510 |
| 267 | 914 | 2406 | 701 | 2991 | 204 | 4281 | 845 | 19800 | 401 |
| 278 | 805 | 2410 | 213 | 2993 | 204 | 4325 | 017 | 19850 | 402 |
| 459 | 119 | 2413 | 210 | 2999 | 203 | 4325 | 016 | 19850 | 839 |
| 483 | 855 | 2413 | 228 | 2999 | 823 | 7572 | 832 | 19850 | 860 |
| 488 | 128 | 2425 | 708 | 3202 | 502 | 7865 | 138 | 22418 | 036 |
| 488 | 127 | 2425 | 651 | 3202 | 505 | 8061 | 305 | 28500 | 201 |
| 488 | 126 | 2429 | 701 | 3202 | 501 | 8061 | 314 | 28500 | 200 |
| 488 | 125 | 2440 | 203 | 3221 | 509 | 8061 | 313 | 28601 | 217 |
| 1025 | 905 | 2440 | 823 | 3230 | 501 | 8062 | 300 | 28602 | 218 |
| 1025 | 913 | 2441 | 203 | 3352 | 501 | 8062 | 305 | 28603 | 219 |
| 1045 | 108 | 2441 | 823 | 3352 | 502 | 8063 | 301 | 30670 | 227 |
| 1045 | 107 | 2442 | 203 | 3352 | 511 | 8072 | 825 | 30671 | 215 |
| 1045 | 110 | 2442 | 823 | 3354 | 506 | 8073 | 825 | 30672 | 221 |
| 1045 | 120 | 2444 | 225 | 3356 | 504 | 8074 | 825 | 30673 | 214 |
| 1045 | 111 | 2448 | 213 | 3357 | 514 | 8075 | 825 | 30673 | 908 |
| 1045 | 113 | 2458 | 213 | 3441 | 515 | 8528 | 919 | 30674 | 220 |
| 1045 | 112 | 2460 | 210 | 3620 | 847 | 8553 | 919 | 40050 | 012 |
| 1048 | 116 | 2460 | 213 | 4030 | 114 | 855 | 919 | 40050 | 030 |
| 1048 | 117 | 2460 | 824 | 4032 | 407 | 8564 | 600 | 42021 | 001 |
| 1060 | 801 | 2500 | 207 | 4032 | 409 | 8565 | 220 | 42673 | 010 |
| 1084 | 115 | 2501 | 207 | 4033 | 655 | 1045 | 100 | 42673 | 011 |
| 1084 | 121 | 2505 | 216 | 4034 | 854 | 16450 | 301 | 42961 | 029 |
| 1084 | 133 | 2519 | 207 | 4035 | 409 | 16451 | 301 | 46062 | 008 |
| 1101 | 815 | 2526 | 207 | 4035 | 408 | 16922 | 814 | 46062 | 013 |
| 1102 | 815 | 2559 | 210 | 4046 | 651 | 16928 | 302 | 50019 | 709 |
| 1164 | 103 | 2566 | 207 | 4060 | 222 | 16963 | 307 | 50120 | 600 |
| 1164 | 106 | 2605 | 226 | 4078 | 811 | 16970 | 304 | 50120 | 919 |
| 1164 | 105 | 2615 | 226 | 4085 | 667 | 18101 | 817 | 50141 | 927 |
| 1164 | 104 | 2615 | 216 | 4124 | 654 | 18195 | 668 | 50976 | 903 |
| 1187 | 862 | 2616 | 226 | 4126 | 145 | 18196 | 601 | 52128 | 856 |
| 1199 | 849 | 2616 | 216 | 4226 | 109 | 18196 | 650 | 52129 | 856 |
| 1211 | 845 | 2617 | 216 | 4226 | 110 | 18203 | 657 | 52130 | 856 |
| 1212 | 845 | 2617 | 226 | 4226 | 108 | 18301 | 822 | 53255 | 818 |
| 1229 | 846 | 2632 | 207 | 4226 | 107 | 18307 | 650 | 55928 | 900 |
| 1230 | 414 | 2633 | 207 | 4226 | 130 | 18330 | 656 | 55928 | 917 |
| 1249 | 822 | 2673 | 207 | 4226 | 111 | 18540 | 812 | 57207 | 024 |
| 1381 | 833 | 2693 | 208 | 4226 | 136 | 19522 | 829 | 57660 | 027 |
| 1387 | 833 | 2695 | 208 | 4226 | 114 | 19532 | 300 | 57670 | 020 |
| 1614 | 920 | 2696 | 208 | 4226 | 113 | 19532 | 305 | 68705 | 811 |
| 1623 | 920 | 2697 | 208 | 4226 | 112 | 19533 | 825 | 68706 | 817 |
| 1624 | 920 | 2873 | 221 | 4226 | 135 | 19593 | 846 | 68761 | 813 |
| 1626 | 213 | 2950 | 209 | 4235 | 132 | 19594 | 846 | 68763 | 813 |
| 1629 | 213 | 2980 | 204 | 4271 | 846 | 19596 | 846 | 68764 | 813 |
| 1754 | 205 | 2986 | 203 | 4279 | 202 | 19597 | 846 | 68791 | 131 |
| 1986 | 652 | 2987 | 204 | 4279 | 303 | 19630 | 653 | 68792 | 131 |

4.2 **BSS**

| BSS | SRN | BSS | SRN | BSS | SRN | BSS | SRN | BSS | SRN |
|-----------|-----|----------------|-----|----------------|-----|------|-----|------|-----|
| 4 | 913 | 1188 | 835 | 2494 | 308 | 4466 | 129 | 5486 | 020 |
| 12 | 103 | 1189 | 831 | 2499 | 137 | 4483 | 128 | 5493 | 900 |
| 12 | 106 | 1192 | 703 | 2439 | 122 | 4504 | 207 | 5493 | 908 |
| 12 | 105 | 1192 | 704 | 2569 | 900 | 4514 | 862 | 5493 | 917 |
| 21 | 203 | 5911 | 410 | 2640 | 937 | 6811 | 012 | 5506 | 835 |
| 21 | 223 | 1199 | 130 | 2757 | 023 | 4550 | 603 | 5514 | 021 |
| 21 | 823 | 1199 | 136 | 2871 | 206 | 4568 | 052 | 5626 | 045 |
| 5685 | 014 | 1200 | 135 | 2871 | 205 | 4592 | 850 | 5642 | 142 |
| 65 | 414 | 1203 | 818 | 3148 | 114 | 4607 | 054 | 5669 | 813 |
| 78 (4772) | 224 | 1211 (4772) | 200 | 3284 (6811) | 307 | 4622 | 200 | 5685 | 015 |
| 143 | 824 | 1212 | 508 | 3382 | 921 | 4624 | 401 | 5728 | 510 |
| 144 | 872 | 1212 | 827 | 3382 | 922 | 4624 | 858 | 5834 | 513 |
| 159 | 053 | 1217 | 871 | 3402 | 875 | 4625 | 408 | 5856 | 009 |
| 308 | 705 | 1243 | 857 | 3416 | 904 | 4652 | 901 | 5886 | 405 |
| 336 | 512 | 1244 | 836 | 3444 | 810 | 4660 | 309 | 5911 | 407 |
| 368 | 859 | 1247 | 845 | 3505 | 311 | 4670 | 938 | 5911 | 409 |
| 410 | 146 | 1254 | 834 | 3505 | 310 | 4800 | 902 | 5911 | 413 |
| 416 | 829 | 1256 | 824 | 3505 | 300 | 4870 | 670 | 5911 | 854 |
| 417 | 830 | 1363 | 059 | 3505 | 305 | 4871 | 671 | 5927 | 404 |
| 437 | 844 | 1369 | 933 | 3505 | 312 | 4999 | 030 | 5930 | 650 |
| 437 | 842 | 1377 | 601 | 3506 | 305 | 4999 | 033 | 5977 | 861 |
| 459 | 817 | 1387 | 203 | 3535 | 028 | 4999 | 034 | 6004 | 055 |
| 499 | 919 | 1362 | 060 | 3600 | 213 | 4999 | 031 | 6072 | 600 |
| 534 | 210 | 1387 | 823 | 3600 | 228 | 4999 | 010 | 6073 | 804 |
| 534 | 212 | 1438 | 870 | 3601 | 213 | 4999 | 029 | 6100 | 707 |
| 569 | 860 | 1449 | 920 | 3643 | 923 | 4999 | 025 | 6100 | 750 |
| 594 | 934 | 1521 | 124 | 3656 | 839 | 5000 | 011 | 6180 | 864 |
| 604 | 150 | 1521 | 856 | 3676 | 058 | 5000 | 022 | 6231 | 041 |
| 690 | 807 | 1553 | 701 | 3680 | 661 | 5000 | 036 | 6263 | 868 |
| 729 | 903 | 1554 | 229 | 3690 | 866 | 5000 | 035 | 6282 | 505 |
| 743 | 803 | 1564 | 909 | 3692 | 924 | 5000 | 050 | 6297 | 659 |
| 747 | 936 | 1579 | 820 | 3889 | 600 | 5041 | 517 | 6316 | 660 |
| 750 | 509 | 1707 | 935 | 3921 | 805 | 5070 | 706 | 6346 | 024 |
| 775 | 061 | 1722 | 849 | 3921 | 806 | 5075 | 149 | 6367 | 664 |
| 812 | 107 | 1740 | 204 | 3941 | 003 | 5135 | 919 | 6398 | 804 |
| 812 | 112 | 1740 | 824 | 3943 | 873 | 5150 | 502 | 6431 | 802 |
| 812 | 113 | 1881 | 139 | 3988 | 063 | 5151 | 503 | 6464 | 317 |
| 842 | 005 | 1881 | 140 | 3974 | 406 | 5152 | 504 | 6500 | 056 |
| 882 | 108 | 1881 | 141 | 4027 | 104 | 5153 | 505 | 6510 | 821 |
| 882 | 109 | 1881 | 116 | 4147 | 214 | 5154 | 511 | 6626 | 037 |
| 882 | 110 | 1881 | 117 | 4147 | 908 | 5163 | 501 | 6722 | 915 |
| 882 | 111 | 1924 | 673 | 4211 | 847 | 5212 | 879 | 6746 | 024 |
| 890 | 801 | 1968 | 874 | 4248 | 148 | 5311 | 004 | 6925 | 851 |
| 952 | 822 | 2011 | 042 | 4293 | 006 | 5316 | 016 | 8007 | 102 |
| 1010 | 826 | 2048 | 001 | 4320 | 925 | 5316 | 017 | 8010 | 316 |
| 1010 | 832 | 2494 | 318 | 4335 | 702 | 5328 | 100 | 8110 | 101 |
| 1105 | 815 | 2521 | 877 | 4346 | 301 | 5328 | 115 | 8110 | 143 |
| 1142 | 809 | 2456 | 828 | 4395 | 930 | 8007 | 138 | | |
| 1186 | 816 | 2494 | 222 | 4449 | 126 | 5419 | 007 | | |

4.3 OTHER STANDARDS

| OTHER STANDARDS | SRN | OTHER STANDARDS | SRN |
|--|-----|----------------------------------|-----|
| AAS 2602:83, 2603:03 | 926 | ISO 2035, 2044 | 301 |
| AGMA 5T 510 | 907 | ISO 2045, 2048, 2536 | 301 |
| ANSI A10 9-1983 | 663 | ISO 2063 | 900 |
| API5LS | 234 | ISO 2505, 3114, 3472, 3473, 3474 | 315 |
| APS 650 | 928 | ISO 2531 | 202 |
| AS 2813-85 | 867 | ISO 2531 | 207 |
| ASTM A 47-77 | 911 | ISO 2548 ICE 198 | 016 |
| ASTM A 48, No. 308 | 916 | ISO 272, 4759-1, 3 | 914 |
| AWWA C. 508-82 | 505 | ISO 3046, PARTS 1, 2 | 021 |
| AWWA C. 104A, C602-76 | 211 | ISO 3114, 3606 | 300 |
| AWWA C.200-75 | 210 | ISO 3127 | 310 |
| AWWA C.200-75 | 230 | ISO 4042 | 922 |
| AWWA C.203-78 | 221 | ISO 4179, 6600, DVGW W342 | 211 |
| AWWA C.205 DVGW-W-342-71 | 212 | ISO 4200 | 228 |
| AWWA C.214-83 | 232 | ISO 4633 | 222 |
| AWWA C.602-83 | 212 | ISO 49 | 209 |
| AWWA C.602-89 | 413 | ISO 7/2 | 203 |
| CP 1004 | 062 | ISO 7005/2, 3 | 207 |
| CP 112, 2 | 666 | ISO 7-1/2 | 223 |
| CP 2004 | 665 | ISO 7186 | 411 |
| CP 2005 | 658 | ISO 7194 | 662 |
| CP 301 | 652 | ISO 7268 | 231 |
| CP 310 | 651 | ISO 752 | 918 |
| CP 312 | 302 | ISO 7751 | 412 |
| CP 499 | 848 | ISO 7752/5 | 929 |
| IEC 60072 | 011 | ISO 8493 | 205 |
| IEC 60072, 72A | 010 | ISO 881 | 402 |
| IEC 600805 | 046 | ISO 885, 888 | 914 |
| IEC 600827 | 048 | ISO 887 | 925 |
| IEC 60085 | 023 | ISO 898/2, 898/1 | 914 |
| IEE W. REGS (15 TH EDITION) | 018 | ISO 965/3, 262 | 923 |
| ISO 1106-3, 7438 | 924 | ISO DIS 4042 | 921 |
| ISO 1167 | 306 | KENYA M.O.W. STANDARD SPEC. | 804 |
| ISO 128, 2162, 2203, 5455, 5457 | 705 | KS 04-290 | 049 |
| ISO 13 | 200 | KS 05-459:5 | 606 |
| ISO 160 | 401 | KS 06-149:2 | 300 |
| ISO 161/1 | 300 | KS 06-248 1, 2 | 510 |
| ISO 161-1 | 825 | VDB 2 | 101 |
| ISO 185 | 906 | VDB PART C | 902 |
| ISO 1920, 4012, 4108, 4013 | 117 | VDMA 6280 | 035 |
| ISO 196 (TESTS) | 206 | | |

II DRAWINGS

III BILL OF QUANTITIES/SCHEDULE OF RATES

SECTION V
STANDARD FORMS

List of Standard Forms

- (i) Form of Invitation for Tenders**
- (ii) Form of Tender**
- (iii) Letter of Acceptance**
- (iv) Form of Agreement**
- (v) Form of Tender Security**
- (vi) Performance Bank Guarantee**
- (vii) Performance Bond**
- (viii) Bank Guarantee for Advance Payment**
- (ix) Qualification Information**
- (x) Tender Questionnaire**
- (xi) Confidential Business Questionnaire**
- (xii) Details of Sub-Contractors**
- (xiii) Request for Review Form**

FORM OF INVITATION FOR TENDERS

_____ [date]

To: _____ [name of Contractor]
_____ [address]

Dear Sirs:

Reference: _____ [Contract Name]

You have been prequalified to tender for the above project.

We hereby invite you and other prequalified tenderers to submit a tender for the execution and completion of the above Contract.

A complete set of tender documents may be purchased by you from _____

_____ [mailing address, cable/telex/facsimile numbers].

Upon payment of a non-refundable fee of Kshs _____

All tenders must be accompanied by _____ number of copies of the same and a tender security in the form and amount specified in the tendering documents, and must be delivered to

_____ [address and location]

at or before _____ (time and date). Tenders will be opened immediately thereafter, in the presence of tenderers' representatives who choose to attend.

Please confirm receipt of this letter immediately in writing by cable/facsimile or telex.

Yours faithfully,

_____ Authorised Signature

_____ Name and Title

FORM OF TENDER

TO: _____ [Name of Employer] _____ [Date]
_____ [Name of Contract]

Dear Sir,

1. In accordance with the Conditions of Contract, Specifications, Drawings and Bills of Quantities/Schedule of Rates for the execution of the above named Works, we, the undersigned offer to construct, install and complete such Works and remedy any defects therein for the sum of Kshs. _____ [Amount in figures] Kenya Shillings _____ [Amount in words]
2. We undertake, if our tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Employer's Representative's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Appendix to Conditions of Contract.
3. We agree to abide by this tender until _____ [Insert date], and it shall remain binding upon us and may be accepted at any time before that date.
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.
5. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this _____ day of _____ 20_____

Signature _____ in the capacity of _____

duly authorized to sign tenders for and on behalf of
_____ [Name of Tenderer] of
_____ [Address of Tenderer]

Witness; Name _____

Address _____

Signature _____

Date _____

(Amend accordingly if provided by Insurance Company)

LETTER OF ACCEPTANCE
[letterhead paper of the Employer]

_____ [date]

To: _____
[name of the Contractor]

[address of the Contractor]

Dear Sir,

This is to notify you that your Tender dated _____
for the execution of _____
[name of the Contract and identification number, as given in the Tender documents]
for the Contract Price of Kshs. _____ *[amount in*
figures] Kenya Shillings _____ *(amount in words)*] in
accordance with the Instructions to Tenderers is hereby accepted.

You are hereby instructed to proceed with the execution of the said Works in
accordance with the Contract documents.

Authorized Signature

Name and Title of Signatory

Attachment : Agreement

FORM OF AGREEMENT

THIS AGREEMENT, made the _____ day of _____ 20 _____
between _____ of [or whose registered
office is situated at] _____
(hereinafter called “the Employer”) of the one part AND
_____ of [or whose registered
office is situated at] _____
(hereinafter called “the Contractor”) of the other part.

WHEREAS THE Employer is desirous that the Contractor executes

_____ *(name and identification number of Contract)* (hereinafter called “the Works”) located at _____ *[Place/location of the Works]* and the Employer has accepted the tender submitted by the Contractor for the execution and completion of such Works and the remedying of any defects therein for the Contract Price of Kshs _____ *[Amount in figures]*, Kenya Shillings _____ *[Amount in words]*.

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and shall be read and construed as part of this Agreement i.e.
 - (i) Letter of Acceptance
 - (ii) Form of Tender
 - (iii) Conditions of Contract
 - (iv) Appendix to Conditions of Contract
 - (v) Specifications
 - (vi) Drawings
 - (vii) Priced Bills of Quantities/Priced Schedule of Rates [whichever is applicable]
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The common Seal of _____

Was hereunto affixed in the presence of _____

Signed Sealed, and Delivered by the said _____

Binding Signature of Employer _____

Binding Signature of Contractor _____

In the presence of (i) Name _____

Address _____

Signature _____

[ii] Name _____

Address _____

Signature _____

FORM OF TENDER SECURITY

WHEREAS(hereinafter called “the Tenderer”) has submitted his tender dated for the construction of
..... (name of Contract)

KNOW ALL PEOPLE by these presents that WE having our registered office at(hereinafter called “the Bank”), are bound unto(hereinafter called “the Employer”) in the sum of Kshs..... for which payment well and truly to be made to the said Employer, the Bank binds itself, its successors and assigns by these presents sealed with the Common Seal of the said Bank this Day of20.....

THE CONDITIONS of this obligation are:

1. If after tender opening the tenderer withdraws his tender during the period of tender validity specified in the instructions to tenderers
Or
2. If the tenderer, having been notified of the acceptance of his tender by the Employer during the period of tender validity:
 - (a) fails or refuses to execute the form of Agreement in accordance with the Instructions to Tenderers, if required; or
 - (b) fails or refuses to furnish the Performance Security, in accordance with the Instructions to Tenderers;

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him, owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including thirty (30) days after the period of tender validity, and any demand in respect thereof should reach the Bank not later than the said date.

[date]

[signature of the Bank]

[witness]

[seal]

PERFORMANCE BANK GUARANTEE

To: _____(Name of Employer) _____(Date)
_____ (Address of Employer)

Dear Sir,

WHEREAS _____(hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ (hereinafter called "the Works");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognised bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Kshs. _____ (*amount of Guarantee in figures*) Kenya Shillings _____ (*amount of Guarantee in words*), and we undertake to pay you, upon your first written demand and without civil or argument, any sum or sums within the limits of Kenya Shillings _____ (*amount of Guarantee in words*) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change, addition or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this Guarantee, and we hereby waive notice of any change, addition, or modification.

This guarantee shall be valid until the date of issue of the Certificate of Completion.

SIGNATURE AND SEAL OF THE GUARANTOR _____

Name of Bank _____

Address _____

Date _____

(Amend accordingly if provided by Insurance Company)

PERFORMANCE BOND

By this Bond, We _____ of (or whose registered office is situated at) _____ as Principal (hereinafter called "the Contractor") and _____ of [or whose registered office is situated at] _____ as Surety (hereinafter called "the Surety"), are held and firmly bound unto _____ of [or whose registered office is situated at] _____ as Obligee (hereinafter called "the Employer") in the amount of Kshs. _____ [amount of Bond in figures] Kenya Shillings

_____ [amount of Bond in words], for the payment of which sum well and truly, the Contractor and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Contractor has entered into a Contract with the Employer dated the _____ day of _____ 20 _____ for the execution of

_____ [name of Contract] in accordance with the Contract documents, Specifications and amendments thereto, which to the extent herein provided for, are by reference made part hereof and are hereinafter referred to as the Contract.

NOW THEREFORE, the Condition of this Obligation is such that, if the Contractor shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise it shall remain in full force and effect. Whenever the Contractor shall be, and declared by the Employer to be, in default under the Contract, the Employer having performed the Employer's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

- (1) complete the Contract in accordance with its terms and conditions; or
- (2) obtain a tender or tenders from qualified tenderers for submission to the Employer for completing the Contract in accordance with its terms and conditions, and upon determination by the Employer and the Surety of the lowest responsive tenderer, arrange for a Contract between such tenderer and Employer and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof.

The term "Balance of the Contract Price", as used in this paragraph, shall mean the total amount payable by the Employer to the Contractor under the

Contract, less the amount properly paid by the Employer to the Contractor;
or

- (3) pay the Employer the amount required by the Employer to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

Any suit under this Bond must be instituted before the expiration of one year from the date of issuance of the Certificate of Completion.

No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Employer named herein or the heirs, executors, administrators, successors and assigns of the Employer.

In testimony whereof, the Contractor has hereunto set his hand and affixed his seal, and the Surety has caused these presents to be sealed with his corporate seal duly attested by the signature of his legal representative, this _____ day of _____ 20_____

SIGNED ON _____ SIGNED ON _____

On behalf of _____ On behalf of _____
[name of Contractor] *[name of Surety]*

By _____ By _____

In the capacity of _____ In the capacity of _____

In the presence of;Name _____ In the presence of;Name _____

Address _____

Address _____

Signature _____

Signature _____

Date _____

Date _____

BANK GUARANTEE FOR ADVANCE PAYMENT

To: _____ *[name of Employer]* _____ *(Date)*
_____ *[address of Employer]*

Gentlemen,

Ref: _____ *[name of Contract]*

In accordance with the provisions of the Conditions of Contract of the above-mentioned Contract, We, _____ *[name and Address of Contractor]* (hereinafter called "the Contractor") shall deposit with _____ *[name of Employer]* a bank guarantee to guarantee his proper and faithful performance under the said Contract in an amount of Kshs. _____ *[amount of Guarantee in figures]* Kenya Shillings _____ *[amount of Guarantee in words]*.

We, _____ *[bank or financial institution]*, as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to _____ *[name of Employer]* on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding Kshs _____ *[amount of Guarantee in figures]* Kenya Shillings _____ *[amount of Guarantee in words]*, such amount to be reduced periodically by the amounts recovered by you from the proceeds of the Contract.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between _____ *[name of Employer]* and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

No drawing may be made by you under this guarantee until we have received notice in writing from you that an advance payment of the amount listed above has been paid to the Contractor pursuant to the Contract.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until _____ *(name of Employer)* receives full payment of the same amount from the Contract.

Yours faithfully,

Signature and Seal _____

Name of the Bank or financial institution _____

Address _____

Date _____

Witness: Name: _____

Address: _____

Signature: _____

Date: _____

QUALIFICATION INFORMATION

1. Individual Tenderers or Individual Members of Joint Ventures

1.1 Constitution or legal status of tenderer **(Shall attach copy of Incorporation Certificate);**

Place of registration: _____

Principal place of business _____

Power of attorney of signatory of tender **shall be required**

1.2 Total annual volume of construction work performed in the last **Three (3) years shall be 90Million Shillings**

| Year | Volume | |
|------|----------|-------|
| | Currency | Value |
| Yr 1 | | |
| Yr 2 | | |
| Yr 3 | | |

1.3 Work performed as Main Contractor on works of a similar nature within the last Three (3) years with a *minimum value* of each **Ksh.40Million**. Also list details of work under way or committed, including expected completion date.

| Year | Project name | Name of Client | Description of Similar work performed | Value of Contract (Ksh) |
|------|--------------|----------------|---------------------------------------|-------------------------|
| Yr 1 | | | | |
| Yr 2 | | | | |
| Yr 3 | | | | |

1.4 Major items of Contractor's Equipment proposed for carrying out the Works. List all information requested below.

| Item of Equipment | Description, Make and age (years) | Condition(new, good, poor) and number available | Owned, leased (from whom?), or to be purchased (from whom?) |
|-------------------|-----------------------------------|---|---|
| | | | |

| | | | |
|------------|-------|-------|--|
| _____ | _____ | _____ | |
| _____ | _____ | _____ | |
| _____ (etc | _____ | _____ | |
| .) | _____ | _____ | |

1.5 Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data.

| Position | Name | Years of experience (general) | Years of experience in proposed position |
|-----------------|-------|-------------------------------|--|
| Project Manager | | | |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| (etc.) | | | |

1.6 Financial reports for the last three (3) years: balance sheets, profit and loss statements, auditor's reports, etc. List below and attach copies.

1.7 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List below and attach copies of supportive documents.

1.8 Name, address and telephone, telex and facsimile numbers of banks that may provide reference if contacted by the Employer.

1.9 Statement of compliance with the requirements of Clause 1.2 of the Instructions to Tenderers.

1.10 Proposed program (work method and schedule) for the whole of the Works shall be submitted

2 Joint Ventures

- 2.0 The information listed in 1.1 – 2.0 above shall be provided for each partner of the joint venture.
- 2.1 The information required in 1.11 above shall be provided for the joint venture.
- 2.2 Attach the power of attorney of the signatory(ies) of the tender authorizing signature of the tender on behalf of the joint venture
- 2.3 Attach the Agreement among all partners of the joint venture (and which is legally binding on all partners), which shows that:
- a) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms;
 - b) one of the partners will be nominated as being in charge, authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture; and
 - c) the execution of the entire Contract, including payment, shall be done exclusively with the partner in charge.

TENDER QUESTIONNAIRE

Please fill in block letters.

1. Full names of tenderer;
.....
2. Full address of tenderer to which tender correspondence is to be sent (unless an agent has been appointed below);
.....
3. Telephone number (s) of tenderer;
.....
4. Telex of tenderer;
.....
5. Name of tenderer's representative to be contacted on matters of the tender during the tender period;
.....
6. Details of tenderer's nominated agent (if any) to receive tender notices. This is essential if the tenderer does not have his registered address in Kenya (name, address, telephone, telex);
.....
.....

Signature of Tenderer

Make copy and deliver to: _____ (*Name of Employer*)

CONFIDENTIAL BUSINESS QUESTIONNAIRE

You are requested to give the particulars indicated in Part 1 and either Part 2 (a), 2 (b) or 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

Location of business premises; Country/Town.....

Plot No..... Street/Road

Postal Address..... Tel No.....

Nature of Business.....

Current Trade Licence No..... Expiring date.....

Maximum value of business which you can handle at any time: K.
pound.....

Name of your bankers.....

Branch.....

Part 2 (a) – Sole Proprietor

Your name in full..... Age.....

Nationality..... Country of Origin.....

Citizenship details

Part 2 (b) – Partnership

Give details of partners as follows:

| | <i>Name in full</i> | <i>Nationality</i> | <i>Citizenship Details</i> | <i>Shares</i> |
|---|---------------------|--------------------|----------------------------|---------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |

DETAILS OF SUB-CONTRACTORS

If the Tenderer wishes to sublet any portions of the Works under any heading, he must give below details of the sub-contractors he intends to employ for each portion.

Failure to comply with this requirement may invalidate the tender.

- (1) Portion of Works to be sublet:
- [i] Full name of Sub-contractor
and address of head office:
-
- [ii] Sub-contractor's experience
of similar works carried out
in the last 3 years with
Contract value:
-
-
- (2) Portion of Works to sublet:
- (i) Full name of sub-contractor
and address of head office:
-
-
- (ii) Sub-contractor's experience
of similar works carried out
in the last 3 years with
contract value:
-
-

[Signature of Tenderer)

Date

LETTER OF NOTIFICATION OF AWARD

Address of Procuring Entity

To: _____

RE: Tender No. _____

Tender Name _____

This is to notify that the contract/s stated below under the above mentioned tender have been awarded to you.

1. Please acknowledge receipt of this letter of notification signifying your acceptance.
2. The contract/contracts shall be signed by the parties within 30 days of the date of this letter but not earlier than 14 days from the date of the letter.
3. You may contact the officer(s) whose particulars appear below on the subject matter of this letter of notification of award.

(FULL PARTICULARS) _____

SIGNED FOR ACCOUNTING OFFICER

REPUBLIC OF KENYA
PUBLIC PROCUREMENT ADMINISTRATIVE REVIEW BOARD

APPLICATION NO.....OF.....20.....

BETWEEN

.....APPLICANT

AND

.....RESPONDENT (*Procuring Entity*)

Request for review of the decision of the..... (*Name of the Procuring Entity*) of
.....dated the...day of20.....in the matter of Tender No.....of
.....20...

REQUEST FOR REVIEW

I/We.....,the above named Applicant(s), of address: Physical
address.....Fax No.....Tel. No.....Email, hereby request the Public
Procurement Administrative Review Board to review the whole/part of the above
mentioned decision on the following grounds , namely:-

- 1.
 - 2.
- etc.

By this memorandum, the Applicant requests the Board for an order/orders that: -

- 1.
 - 2.
- etc

SIGNED(Applicant)

Dated on.....day of/...20...

FOR OFFICIAL USE ONLY

Lodged with the Secretary Public Procurement Administrative Review Board on
day of20.....

SIGNED
Board Secretary

ANNEX 1 – EVALUATION CRITERIA

PRELIMINARY EXAMINATION OF COMPLETENESS OF BID DOCUMENTS

A. MANDATORY REQUIREMENTS

- (a) copies of certificates of registration of the Company
- (b) Ensure your firm is e- citizen linked
- (c) Valid Tax Compliance Certificate
- (d) Copies of PIN Certificate
- (e) Copies of VAT Certificate
- (f) Dully filled, signed and stamped Bill of quantities.
- (g) Bid Validity shall be 90 days
- (h) Dully completed , Signed & Stamped Form of Tender
- (i) Dully completed , Signed & Stamped Business questionnaire
- (j) Copies of certificate of registration NCA 8 and above on water works
- (k) Document must be paginated
- (l) Total annual volume of construction work performed in the last Three (3) years.
- (m) experience in works of a similar nature and size for each of the last Three (3) years, and clients who may be contacted for further information on these contracts;
- (n) major items of construction equipment owned or leased
- (o) qualifications and experience of key site management and technical personnel proposed for the Contract;
- (p) reports on the financial standing of the Tenderer, such as profit and loss statements and auditor's reports for the last two years;
- (q) Authority to seek references from the Tenderer's bankers.
- (r) Submit Anti-Corruption Declaration Commitment/ Pledge

B. QUALIFICATION CRITERIA

- a) Access to Liquid assets
- b) Minimum average annual construction turnover
- c) General construction experience
- d) Minimum contracts of similar experience
- e) Adequacy of technical proposal
- f) Key Personnel
- g) Equipment