African Union

Procurement of Works
by Open Tender

African Union Commission

Drilling of Water Well at the African Union Commission Headquarters

Procurement Number: 07/BETS/12

Date of Issue: 23rd April 2012

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Fax: +251-11-5517844, **website: www. africa-union.org**

Section I. Invitation for Bids

DRILLING OF WATER WELL AT THE AFRICAN UNION COMMISSION HEADQUARTERS

Procurement Number: 07/BETS/12

The African Union Commission has allocated funds for the procurement of works for Drilling of Water Well at the African Union Commission Headquarters and now invites sealed bids from eligible bidders for the supply of Works consists of construction of a borehole and a transmission line summarised below:

a) Construction of 150m depth briefly described below:

- 150m down the hole hammer percussion drilling;
- Insertion of 8" diameter casing;
- Placement of wire bound stainless steel screens and gravel filters;
- Supply and Installation of electromechanical appliances

b) Construction of 240m length 3" GI transmission line and 150m 2" GI expansion works consisting of:

- Earthworks Supply and laying of pipes;
- Construction of value chambers;
- Construction of anchor and support blocks;
- Stone pavement crossing and reinstatement;
- Cleaning, disinfestation and commissioning, etc

Detailed drawings and BOQ format are hereby attached to the Bid document.

Please note that this is a TWO ENVELOPE bidding process. The FINANCIAL and TECHNICAL offers must be delivered in TWO SEPARATE inner envelopes.

Interested bidders may obtain further information and inspect the bidding document at the address below or on our website; **http://www.au.int/en/bids.**

Bids MUST be submitted in the format indicated under section IV accompanied by:

- **The Bid (in the format indicated in Section IV); and qualification criteria under section VI;**
- **Registration documents**
- **Power of Attorney**
- **a valid tax certificate;**
- **Priced Bill of Quantities**
- **Detailed technical proposal**
  - **Financial statements**
  - **References (Experience of firm detailing both on going and pas projects)**
  - **Equipment**
  - **Construction schedule and work methods**
  - **Personnel information**

The deadline for bid submission will be 31st May 2012 at 3.00pm. TECHNICAL BIDS will be opened on the same day i.e 31st May 2012 at 3.30pm, in the presence of bidders or bidders' representatives who choose to attend, at the address below. Late bids will be rejected and returned unopened to bidders.

Interested bidders are hereby notified that there will be a Compulsory formal **Site Visit which will take place on 7th May 2012 at 10.30am.** Each representative is to be present at the AUC premises (3rd floor reception building C) at the scheduled time where he/she will be escorted by the Procurement Section's staff to the Site area. This will be the **only** site visit that will take place; therefore it is mandatory that each Contractor is represented.

Address
African Union Commission
P. O. Box 3243
Department of Administration & Human Recourse management
Building C, 3rd floor
Roosevelt Street (Old Airport Area)
Addis Ababa, Ethiopia
(251) 115517711 (Ext 4321)

NB: Bidders are advised to review the list of detailed specifications and detailed evaluation criteria to guide them in preparation of the tender document.

BIDDERS' CHECK LIST
Bid submission check list for Bidders

No	Description	tick
1	Duly filled and signed bid submission form	
2	Financial statements of the company (enclosed in same envelope as technical proposal)	
3	Read and understood the **Terms of Reference and scope of work** (section 6) and **Bid data** under Section 3	
4	Bid validity (90 days)	
5	Attached relevant document registration and tax documents	
6	Any other documents deemed fit	
7	Submitted **ONE original** and **THREE copies** of Technical and financial Offer in separate envelopes	

Section II. Instructions to Bidders
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Instructions to Bidders

A. General

1. Scope of Bid

1.1 The Employer as defined in the Bidding and Contract Data, invites bids for the construction of Works, as described in the Bidding and Contract Data. The name and procurement number of the Contract is provided in the Bidding and Contract Data.

1.2 The successful Bidder will be expected to complete the Works by the Intended Completion Date specified in the Contract Data.

2. Source of Funds

2.1 The African Union Commission (AUC) (hereinafter called "the Employer") has an approved budget for the cost of the Works specified in the Bidding Data, and intends to apply a portion of the funding to eligible payments under a contract for which this Invitation for Bids is issued. Details of any funding provided to cover eligible payments under the Contract in addition to that provided directly by the African Union are given in the Bidding Data.

3. Eligible Bidders

3.1 This Invitation for Bids is open to all bidders from eligible countries as defined in the Bidding Data. Any materials, equipment, and services to be used in the performance of the Contract shall have their origin in eligible source countries.

3.2 All bidders shall provide in Section IV, Forms of Bid and Qualification Information, a statement that the Bidder (including all members of a joint venture and subcontractors) is not associated, nor has been associated in the past, directly or indirectly, with the consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Employer to provide consulting services for the preparation or supervision of the Works, and any of its affiliates, shall not be eligible to bid.

3.3 Bidders must not be under a declaration of suspension for corrupt, fraudulent, collusive, coercive or obstructive practices issued by the African Union in accordance with ITB Clause 37.1.

4. Qualification of Bidders

4.1 All bidders shall provide in Section IV, Forms of Bid and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary.

4.2 If a formal prequalification of potential bidders has been undertaken, only bids from prequalified bidders will be considered for award of Contract. These qualified bidders should submit with their bids any information updating their original prequalification applications or, alternatively, confirm in their

bids that the originally submitted prequalification information remains essentially correct as of the date of bid submission. The update or confirmation should be provided in Section IV.

4.3 If the Employer has not undertaken prequalification of potential bidders, all bidders shall include the following information and documents with their bids in Section IV, unless otherwise stated in the Bidding Data:

(a) copies of original documents defining the constitution or legal status, place of registration, and principal place of business; written power of attorney of the signatory of the Bid to commit the Bidder;

(b) total monetary value of construction work performed for each of the last five years;

(c) experience in works of a similar nature and size for each of the last five years, and details of work under way or contractually committed; and clients who may be contacted for further information on those contracts;

(d) major items of construction equipment proposed to carry out the Contract;

(e) qualifications and experience of key site management and technical personnel proposed for the Contract;

(f) reports on the financial standing of the Bidder, such as profit and loss statements and auditor's reports for the past five years;

(g) evidence of adequacy of working capital for this Contract (access to line(s) of credit and availability of other financial resources);

(h) authority to seek references from the Bidder's bankers;

(i) information regarding any litigation, current or during the last five years, in which the Bidder is involved, the parties concerned, and disputed amount; and

(j) proposals for subcontracting components of the Works amounting to more than 10 percent of the Contract Price.

4.4 Bids submitted by a joint venture of two or more firms as partners shall comply with the following requirements, unless otherwise stated in the Bidding Data:

(a) the Bid shall include all the information listed in ITB Clause 4.3 above for each joint venture partner;

(b) the Bid shall be signed so as to be legally binding on all partners;

(c) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms;

(d) one of the partners will be nominated as being in charge, authorised to incur liabilities, and receive instructions for and on behalf of any and all partners of the joint venture; and

(e) the execution of the entire Contract, including payment, shall be done exclusively with the partner in charge.

4.5 To qualify for award of the Contract, bidders shall meet the following minimum qualifying criteria:

(a) annual volume of construction work of at least the amount specified in the Bidding Data;

(b) experience as prime contractor in the construction of at least two works of a nature and complexity equivalent to the Works over the last 10 years (to comply with this requirement, works cited should be at least 70 percent complete);

(c) proposals for the timely acquisition (own, lease, hire, etc.) of the essential equipment listed in the Bidding Data;

(d) key personnel required for the performance of the contract with the qualifications and experience detailed in the Bidding Data; and

(e) liquid assets and/or credit facilities, net of other contractual commitments and exclusive of any advance payments which may be made under the Contract, of no less than the amount specified in the Bidding Data.

A consistent history of litigation or arbitration awards against the Applicant or any partner of a Joint Venture may result in disqualification.

4.6 The figures for each of the partners of a joint venture shall be added together to determine the Bidder's compliance with the minimum qualifying criteria of ITB Clause 4.5(a) and (e); however, for a joint venture to qualify, each of its partners must meet at least 25 percent of minimum criteria 4.5(a), (b), and (e) for an individual Bidder, and the partner in charge at least 40 percent of those minimum criteria. Failure to comply with this

requirement will result in rejection of the joint venture's Bid. Subcontractors' experience and resources will not be taken into account in determining the Bidder's compliance with the qualifying criteria, unless otherwise stated in the Bidding Data.

4.7 African Union bidders and joint ventures of African Union and foreign bidders applying for eligibility for any margin of preference in bid evaluation as stated in the Bidding Data, shall supply all information to satisfy the criteria for eligibility as described in ITB Clause 30.

5. One Bid per Bidder

5.1 Each Bidder shall submit only one Bid, either individually or as a partner in a joint venture. A Bidder who submits or participates in more than one Bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

6. Cost of Bidding

6.1 The Bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

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7. Site Visit

7.1 The Bidder, at the Bidder's own responsibility and risk, is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

B. Bidding Documents

8. Content of Bidding Documents

8.1 The set of bidding documents comprises the documents listed in the table below, and addenda issued in accordance with Clause 10:

Section	I	Invitation to Bid
	II	Instructions to Bidders
	III	Bidding Data
	IV	Forms of Bid and Qualification Information
	V	Conditions of Contract
	VI	Contract Data
	VII	Specifications
	VIII	Drawings
	IX	Bill of Quantities[1]
	X	Forms of Securities

8.2 The documents to be completed by the bidder as part of the bid are contained in Sections IV, IX, and X, and the number of copies of the bid required to be submitted by the bidder is

[1] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule".

defined in the Bidding Data.

9. Clarification of Bidding Documents

9.1 A prospective Bidder requiring any clarification of the bidding documents may notify the Employer in writing or by telex, e-mail and facsimile at the Employer's address indicated in the Bidding Data. The Employer will respond to any request for clarification received earlier than 21 days prior to the deadline for submission of bids. Written copies of the Employer's response will be sent to all prospective bidders that have received the bidding documents including a description of the inquiry, but without identifying its source.

10. Amendment of Bidding Documents

10.1 At any time prior to the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.

10.2 Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing to all prospective bidders that have received the bidding documents. Prospective bidders shall acknowledge receipt of each addendum in writing to the Employer.

10.3 To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may extend, as necessary, the deadline for submission of bids, in accordance with ITB Clause 20.2 below.

C. Preparation of Bids

11. Language of Bid

11.1 All documents relating to the Bid shall be in the English language unless otherwise specified in the Bidding Data.

12. Documents Comprising the Bid

12.1 The Bid submitted by the Bidder shall comprise the following:

(a) The Bid (in the format indicated in Section IV);
(b) Bid Security;
(c) Priced Bill of Quantities;[2]
(d) Qualification Information Form and Documents;
(e) Alternative offers where invited;

and any other materials required to be completed and submitted by bidders, as specified in the Bidding Data.

13. Bid Prices

13.1 The Contract shall be for the whole Works, as described in Sub-Clause 1.1, based on the priced Bill of Quantities[3] submitted by the Bidder.

13.2 The Bidder shall fill in rates and prices for all items of the Works

[2] In lump sum contracts, delete "priced Bill of Quantities" and replace with "priced Activity Schedule".
[3] In lump sum contracts, delete "priced Bill of Quantities" and replace with "priced Activity Schedule".

described in the Bill of Quantities.[4] Items for which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

13.3 In completing the Bid Form, the Bidder shall note in particular the provisions of Clause 45 of the Conditions of Contract in respect of Taxes and Duties. Prices should be quoted net of duties and taxes already payable on major equipment, materials, fittings and fixtures that are subject to the African Union exemption on payment of duties and taxes. All other duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of bids, shall be included in the rates, prices, and total Bid price submitted by the Bidder.[5]

13.4 The rates and prices[6] quoted by the Bidder shall not be subject to adjustment during the performance of the Contract unless provided for in the Bidding and Contract Data and the provisions of Clause 47 of the Conditions of Contract. The Bidder shall submit with the Bid all the information required under the Contract Data and Clause 47 of the Conditions of Contract.

14. Currencies of Bid and Payment

14.1 The unit rates and prices[7] shall be quoted by the Bidder in US Dollars, unless otherwise stated in the Bidding Data. Where indicated in the Bidding Data, payment may be partially made in foreign currencies. Foreign currency requirements shall be indicated as a percentage of the Bid price (excluding provisional sums) and shall be payable at the option of the Bidder in foreign currencies in accordance with the limitations stated in the Bidding Data.

14.2 Where applicable, the rates of exchange to be used by the Bidder in arriving at the US Dollar equivalent and the percentage(s) mentioned in ITB Clause 14.1 above, shall be the selling rates established by the authority specified in the Contract Data prevailing on the date 28 days prior to the deadline for submission of bids. These exchange rates shall apply for all payments so that no exchange risk will be borne by the Bidder. If the Bidder uses other rates of exchange, the provisions of ITB Clause 28.1 shall apply. In any case, payments will be computed using the rates quoted in the Bid.

14.3 Where applicable, Bidders shall indicate details of their expected foreign currency requirements in the Bid.

[4] In lump sum contracts, delete "described in the Bill of Quantities" and replace with "described in the drawings and specifications and listed in the Activity Schedule".
[5] In lump sum contracts, delete "rates, prices, and".
[6] In lump sum contracts, delete "rates and prices" and replace with "lump sum price".
[7] In lump sum contracts, delete "unit rates and prices" and replace with "lump sum price".

14.4 Where applicable, Bidders may be required by the Employer to clarify their foreign currency requirements and to substantiate that the amounts included in the rates and prices[8] and in the Contract Data are reasonable and responsive to ITB Clause 14.1.

15. Bid Validity

15.1 Bids shall remain valid for the period specified in the Bidding Data after the date of bid submission prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as non-responsive.

15.2 In exceptional circumstances, the Employer may request that the bidders extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing. A Bidder may refuse the request without forfeiting the Bid Security. A Bidder agreeing to the request will not be required or permitted to otherwise modify the Bid, but will be required to extend the validity of Bid Security for the period of the extension, and in compliance with Clause 16 in all respects.

15.3 In the case of fixed price contracts, if the award is delayed by a period exceeding sixty (60) days beyond the expiry of the initial bid validity, the contract price may be increased by a factor specified in the request for extension. Bid evaluation will be based on the Bid prices without taking the above correction into consideration.

16. Bid Security

16.1 The Bidder shall furnish, as part of the Bid, a Bid Security in US Dollars or in a freely convertible currency, in the amount or the equivalent amount specified in the Bidding Data.

16.2 The Bid Security shall, at the Bidder's option, be in the form of a certified banker's cheque or a bank guarantee from a reputable bank. Bank guarantees issued by foreign banks shall only be acceptable if endorsed by a correspondent bank in the Country specified for performance of the works. The format of the Bid Security should be in accordance with the form of Bid Security included in Section X. Bid Security shall be valid for a minimum of thirty (30) days beyond the validity of the Bid.

16.3 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Employer. The Bid Security of a joint venture must define as "bidder" all joint venture partners and list them in the following manner: a joint venture consisting of "_____," "_____," and "_____".

16.4 The Bid Security of unsuccessful bidders will be returned within thirty (30) days of the end of the Bid validity period specified in ITB Clause 15.1.

[8] For lump sum contracts, delete "rates and prices" and replace with "Lump Sum".

16.5 The Bid Security of the successful Bidder will be discharged when the Bidder has signed the Agreement and furnished the required Performance Security.

16.6 The Bid Security may be forfeited

(a) if the Bidder withdraws the Bid after Bid opening during the period of Bid validity;

(b) if the Bidder does not accept the correction of the Bid price, pursuant to ITB Clause 27; or

(c) in the case of a successful Bidder, if the Bidder fails within the specified time limit to

(i) sign the contract; or

(ii) furnish the required Performance Security.

17. Alternative Proposals by Bidders

17.1 Bidders shall submit offers that comply with the requirements of the bidding documents, including the basic technical design as indicated in the drawings and specifications. Alternatives will not be considered, unless specifically allowed in the Bidding Data. If so allowed, ITB Clause 17.2 below shall govern.

17.2 If so allowed in the Bidding Data, bidders wishing to offer technical alternatives to the requirements of the bidding documents must also submit a Bid that complies with the requirements of the bidding documents, including the basic technical design as indicated in the drawings and specifications. In addition to submitting the basic Bid, the Bidder shall provide all information necessary for a complete evaluation of the alternative by the Employer, including design calculations, technical specifications, breakdown of prices, proposed construction methods and other relevant details. Only the technical alternatives, if any, of the lowest evaluated cost Bidder conforming to the basic technical requirements shall be considered by the Employer.

18. Format and Signing of Bid

18.1 The Bidder shall prepare an original and the number of copies of the bid indicated in the Bidding Data, clearly marking each "ORIGINAL BID" and "COPY OF BID," as appropriate. In the event of any discrepancy between them, the original shall govern.

18.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorised to sign on behalf of the Bidder, pursuant to ITB Clauses 4.3(a) or 4.4(b), as the case may be. All pages of the Bid where entries or amendments have been made shall be initialled

by the person or persons signing the Bid.

18.3 The Bid shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Bidder, in which case such corrections shall be initialled by the person or persons signing the Bid.

18.4 The Bidder shall furnish information as described in the Form of Bid on commissions or gratuities, if any, paid or to be paid to agents relating to this Bid, and to contract execution if the Bidder is awarded the contract.

D. Submission of Bids

19. Sealing and Marking of Bids

19.1 The Bidder shall seal the original and all copies of the Bid in two inner envelopes, and one outer envelope sealed with red wax, duly marking the inner envelopes as "ORIGINAL" and "COPIES".

19.2 The inner and outer envelopes shall

(a) be addressed to the Employer at the address provided in the Bidding Data;

(b) bear the name and procurement number of the Contract as defined in the Bidding Data; and

(c) provide a warning not to open before the specified time and date for Bid opening as defined in the Bidding Data.

19.3 In addition to the identification required in ITB Clause 19.2, the inner envelopes shall indicate the name and address of the Bidder to enable the Bid to be returned unopened in case it is declared late, pursuant to ITB Clause 21.

19.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

20. Deadline for Submission of Bids

20.1 Bids shall be delivered to the Employer at the address specified above no later than the time and date specified in the Bidding Data.

20.2 The Employer may, at its discretion, extend the deadline for submission of bids by issuing an amendment in accordance with ITB Clause 10, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline as extended.

21. Late Bids

21.1 Any Bid received by the Employer after the deadline for submission of bids prescribed by the Employer pursuant to ITB Clause 20 will be rejected and returned unopened to the Bidder.

22. Modification and Withdrawal of Bids

22.1 Bidders may modify, substitute or withdraw their bids by giving notice in writing to the Employer before the deadline prescribed for submission of bids in ITB Clause 20.

22.2 Any modification or withdrawal notices shall be prepared, sealed, marked, and delivered in accordance with ITB Clauses 18 and 19, with the outer and inner envelopes additionally marked "MODIFICATION", "WITHDRAWAL," or "REPLACEMENT BID" as appropriate. A withdrawal notice may also be sent by fax or E-mail, but followed by a signed confirmation copy, postmarked not later than the deadline for submission of bids.

22.3 No Bid may be modified after the deadline for submission of Bids.

22.4 Withdrawal of a Bid between the deadline for submission of bids and the expiration of the period of Bid validity specified in the Bidding Data or as extended pursuant to ITB Clause 15.2 may result in the forfeiture of the Bid Security pursuant to ITB Clause 16.

22.5 Bidders may only offer discounts to, or otherwise modify the prices of their bids by inclusion in the original Bid submission or by submitting Bid modifications in accordance with this clause.

E. Bid Opening and Evaluation

23. Bid Opening

23.1 The Employer will open the bids in the presence of the bidders or bidders' representatives who choose to attend at the time, on the date and at the place specified in the Bidding Data. The bidders or bidders' representatives who are present shall sign an attendance sheet.

23.2 Envelopes marked "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause 22 shall be returned un-opened to the Bidder.

23.3 The bidders' names, the Bid prices, the total amount of each Bid and of any alternative Bid (if alternatives have been requested or permitted), any discounts, Bid modifications and withdrawals, the presence or absence of Bid Security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening.

23.4 The Employer will prepare minutes of the Bid opening, including

the information disclosed to those present in accordance with ITB Clause 23.

24. Process to Be Confidential

24.1 Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced.

25. Clarification of Bids and Contacting the Employer

25.1 To assist in the examination, evaluation, and comparison of bids, the Employer may ask any Bidder for clarification of its Bid, including breakdowns of unit rates.[9] Requests for clarification and the response shall be in writing, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with ITB Clause 27.

25.2 From the time of bid opening to the time of contract award, if any bidder wishes to contact the Employer on any matter related to the bid, it should do so in writing.

25.3 Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in the rejection of the Bidders' bid.

26. Examination of Bids and Determination of Responsiveness

26.1 Prior to the detailed evaluation of bids, the Employer will determine whether each Bid (a) meets the eligibility criteria defined in ITB Clause 3; (b) has been properly signed; (c) is accompanied by the required Bid Security; and (d) is substantially responsive to the requirements of the bidding documents.

26.2 A substantially responsive bid is one which conforms to all the terms, conditions, and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the bidding documents, the Employer's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

26.3 If a Bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

[9] In lump sum contracts, delete "unit rates" and replace with "the prices in the Activity Schedule".

27. Correction of Errors

27.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

(a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; 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 govern, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern, and the unit rate will be corrected.

27.2 The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount, the Bid will be rejected, and the Bid Security may be forfeited in accordance with ITB Clause 16.6(b).

28. Currency for Bid Evaluation

28.1 Bids will be evaluated as quoted in US Dollars in accordance with ITB Clause 14.1, unless a Bidder has used different exchange rates than those prescribed in ITB Clause 14.2, in which case the Bid will be first converted into the amounts payable in different currencies using the rates quoted in the Bid and then reconverted to US Dollars using the exchange rates prescribed in ITB Clause 14.2.

29. Evaluation and Comparison of Bids

29.1 The Employer will evaluate and compare only the bids determined to be substantially responsive in accordance with ITB Clause 26.

29.2 In evaluating the bids, the Employer will determine for each Bid the evaluated Bid price by adjusting the Bid price as follows:

(a) making any correction for errors pursuant to ITB Clause 27;

(b) excluding provisional sums and the provision, if any, for contingencies in the Bill of Quantities,[10] but including Day works, where priced competitively;

(c) making an appropriate adjustment for any other acceptable variations, deviations, or alternative offers submitted in accordance with ITB Clause 17;

(d) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with ITB

[10] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule".

Clause 22.5; and

(e) duties and taxes already payable on major equipment, materials, fittings and fixtures that are subject to the African Union exemption on payment of duties and taxes.

29.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the bidding documents or otherwise result in unsolicited benefits for the Employer will not be taken into account in Bid evaluation.

29.4 The estimated effect of any price adjustment conditions under ITB Clause 47 of the Conditions of Contract, during the period of implementation of the Contract, will not be taken into account in Bid evaluation.

29.5 If bids are invited for individual lots and award of multiple contracts to individual bidders is permitted pursuant to ITB Clause 29.2(d), the methodology of evaluation and the application of any conditional discounts to determine the award of contracts shall be specified in the Bidding Data.

30. Margin of Preference

30.1 If so indicated in the Bidding Data, contractors from African Union Member States may receive a margin of preference in Bid evaluation, for which this clause shall apply.

30.2 African Union bidders shall provide all evidence necessary to prove that they meet the following criteria to be eligible for a margin of preference in the comparison of their bids with those of bidders who do not qualify for the preference. They should

(a) be registered within a Member State of the African Union;

(b) have majority ownership by nationals of Member States of the African Union;

(c) not subcontract more than ten (10) percent of the Contract Price including provisional sums to foreign contractors; and

(d) satisfy any other criteria specified for the purpose of eligibility for the margin of preference, as specified in the Bidding Data.

30.3 Joint ventures of African Union Member State firms may be eligible for the margin of preference provided that:

(a) individual partners satisfy the criteria of eligibility of ITB Clauses 30.2 (a) and (b);

(b) the joint venture is registered in the Country specified for performance of the works;

(c) the joint venture shall not subcontract more than ten (10) percent of the Contract Price, excluding provisional sums, to foreign firms; and

(d) satisfy any other criteria specified for the purpose of margin of preference eligibility, as specified in the Bidding Data.

30.4 The following procedure will be used to apply the margin of preference:

(a) Responsive bids will be classified into the following groups:

(i) Group A: bids offered by African Union Member State bidders and joint ventures meeting the respective criteria of ITB Clauses 30.2 and 30.3 above; and

(ii) Group B: all other bids.

(b) For the purpose of evaluation and comparison of bids only, an amount equal to the percentage stated in the Bidding Data of the evaluated Bid prices determined in accordance with ITB Clause 29.2(a), (b), and (d), will be added to all bids classified in Group B.

F. Award of Contract

31. Award Criteria

31.1 Subject to ITB Clause 32, the Employer will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the bidding documents and who has offered the lowest evaluated cost Bid price, provided that such Bidder has been determined to be (a) eligible in accordance with the provisions of ITB Clause 3, and (b) qualified in accordance with the provisions of ITB Clause 4.

32. Employer's Right to Accept any Bid and to Reject any or all Bids

32.1 The Employer reserves the right to accept or reject any Bid, and to cancel the bidding process and reject all bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected Bidder or bidders of the grounds for the Employer's action.

33. Notification of Award and

33.1 The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity

Signing of Agreement

period by e-mail, facsimile and confirmed by registered letter or courier service. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that 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 (hereinafter and in the Contract called the "Contract Price").

33.2 The notification of award will constitute the formation of the Contract, subject to the Bidder furnishing the Performance Security in accordance with ITB Clause 34, and signing the Agreement in accordance with ITB Clause 33.3.

33.3 The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be signed by the Employer and sent to the successful Bidder, within 14 days following the notification of award along with the Letter of Acceptance. Within 14 days of receipt, the successful Bidder will sign the Agreement and deliver it to the Employer.

33.4 Upon the furnishing by the successful Bidder of the Performance Security, the Employer will promptly notify the other bidders that their bids have been unsuccessful.

34. Performance Security

34.1 Within 14 days after receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security in the amount stipulated in the Contract Data in the form of a Bank Guarantee, denominated in the type and proportions of currencies in the Letter of Acceptance and in accordance with the Conditions of Contract.

34.2 The Bank Guarantee shall be issued either (a) at the Bidder's option, by a bank located in a Member State of the African Union or a foreign bank through a correspondent bank located in the Country specified for the performance of the works, or (b) with the agreement of the Employer directly by a foreign bank acceptable to the Employer.

34.3 Failure of the successful Bidder to comply with the requirements of ITB Clause 34.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.

35. Advance Payment and Security

35.1 The Employer may provide an Advance Payment on the Contract Price as stipulated in the Conditions of Contract, subject to a maximum amount of 25%.

36. Adjudicator

36.1 The Employer proposes the person named in the Bidding Data to be appointed as Adjudicator under the Contract, at a fee rate specified in the Bidding Data, plus reimbursable expenses. If the Bidder disagrees with this proposal, the Bidder should so state in

the Bid. If, in the Letter of Acceptance, the Employer has not agreed on the appointment of the Adjudicator, the Adjudicator shall be appointed by the Appointing Authority designated in the Contract Data at the request of either party.

37. Corrupt or Fraudulent Practices

37.1 The African Union requires that Officers of the AU, as well as Bidders/ Suppliers/Contractors, observe the highest standard of ethics during the procurement and execution of such contracts.[11] In pursuance of this policy the AU:

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice"[12] is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

(ii) "fraudulent practice"[13] is any act or omission including a misrepresentation that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) "collusive practice"[14] is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

(iv) "coercive practice"[15] is impairing or harming or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(v) "obstructive practice" is deliberately destroying, falsifying, altering or concealing of evidence material to any investigation or making false statements to investigators in order to materially impede any investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any

[11] *In this context, any action taken by a bidder, supplier, contractor, or a sub-contractor to influence the procurement process or contract execution for undue advantage is improper.*
[12] *"another party" refers to an officer of the AU acting in relation to the procurement process or contract execution. In this context, "officer of the AU" includes staff and employees of other organisations taking or reviewing procurement decisions.*
[13] *a "party" refers to any officer of the AU; the terms "benefit" and "obligation" relate to the procurement process or contract execution; and the "act or omission" is intended to influence the procurement process or contract execution.*
[14] *"parties" refers to any participants in the procurement process (including officers of the AU) attempting to establish bid prices at artificial, non competitive levels.*
[15] *a "party" refers to any participant in the procurement process or contract execution.*

party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation;

(b) will reject a recommendation for award of contract if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question;

(c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded an African Union financed contract if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing, an African Union financed contract.

37.2 Furthermore, Bidders shall be aware of the provisions stated in Clause 23.2 and Clause 59.2 of the Conditions of Contract.

Section III. Bidding Data

The following specific data for the works to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in the ITB.

Instructions to Bidders Clause Reference	
ITB Clause 1.1	Name of Employer: African Union Commission
ITB Clause 1.1	The Project Title/Name of Contract: Drilling of Water Well at the African Union Commission Headquarters
ITB Clause 1.1	The Procurement Number is: 07/BETS/12
ITB Clause 2.1	Funding for the Contract is provided by The African Union Commission
ITB Clause 3.1	All countries and territories which are member states of the United Nations are eligible
ITB Clause 4.5a	The minimum required annual volume of construction work for the successful Bidder in the last five years is ETB *10,000,000 or USD580,000*
ITB Clause 4.5c	The essential equipment required for the Works is: • Appropriate Drilling • Machine (1) • Compressor (1) • Mud pump(1) • Submersible Pump(1) • Concrete mixer (1/8m3) (1) • Generator (50kv) (1) *Note: The above requirement is only indicative and the successful bidder shall be responsible for the deployment of the required resources to carry out and complete the works as per the contract.*
ITB Clause 4.5d	The key personnel required for the performance of the contract and their qualifications are: ▪ Project Manger ▪ Chief Driller ▪ Materials Engineer ▪ Construction Superintendence ▪ Chief Surveyor ▪ Driller

Position	Education Level	General Experience (Years)	Specific Experience in similar position (Years)
Project Manager	Hydrogeologist	8	5
Chief driller	Degree or diploma from technical school and other trainings.	8	4
Driller	Diploma from technical school plus other trainings.	6	4
Materials Engineer	Diploma from technical school	8	4
Chief Surveyor	Degree from technical school	8	4
Construction Superintendence	Degree	8	4

Experience will be also be considered in lieu of qualifications

ITB Clause 4.5e The required minimum amount of net liquid assets and/or credit facilities is ETB2,000,000 or USD 115,000.

ITB Clause 8.2 (and 18.1) The number of copies of the Bid to be submitted is ONE original and THREE copies.

ITB Clause 9.1 The Employer's address, and contact information are: [Roosevelt street P.O. Box 3243 Addis Ababa, Ethiopia Tel. +251 115517700, Fax +251 115517844 , email: tender@africa-union.org.

ITB Clause 11.1 The Language of the Bid is English

ITB Clause 12.1 Other documents to be submitted by the bidder are: financial documents

ITB Clause 14.1 Bids shall be denominated in US Dollars or Euros or Ethiopian Birr.

ITB Clause 15.1 The period of Bid validity shall be 90 days after the deadline for submission of bids.

ITB Clause 16.1 The amount of Bid Security shall be for 2% the estimated bid price in the currency of the bid.

ITB Clause 17.1 Alternative proposals to the requirements of the bidding documents will not be permitted.

ITB Clause 19.2(a) The address for the submission of bids is; Chairperson of Tender

Board, African Union Commission, 3rd Floor Building C.

ITB Clause 19.2(b) The Name and Procurement Number of the Contract is: 07/BETS/12

ITB Clause 19.2(c) The time and date for bid opening is 31st May 2012 at 3.30pm.

ITB Clause 20.1 The deadline for submission of bids is 31st May 2012 at 3.00pm.

ITB Clause 29.5 For detailed evaluation methodology, please refer to evaluation criteria hereunder

ITB Clause 30.1 African Union Bidders will not receive a margin of preference in Bid evaluation.

ITB Clause 36.1 The Adjudicator proposed by the Employer is *[to be communicated in if the need arises]*.

The fee rate for this proposed Adjudicator shall be *[to be communicated in if the need arises]*.

The biographical data of the proposed Adjudicator is as follows: *[to be communicated if need arises]*.

In the event of disagreement between the Employer and the Contractor on an Adjudicator, the Adjudicator will be appointed by *[both contracting parties in agreement]*.

Evaluation and Qualification Criteria

This section, read in conjunction with Section 1, Instructions to Bidders and Section 2, Bid Data Sheet, contains all the factors, methods and criteria that the Employer shall use to evaluate a bid and determine whether a bidder has the required qualifications. The method of Evaluation shall be Quality based evaluation

Stage I: Technical Evaluation (Qualification Evaluation)

The qualification information provided by the bidders will be evaluated using the following criteria:

A) Preliminary Technical evaluation

The following will be considered;

General Information regarding the status of the firm: legal status, place of registration, principal place of business, powers of attorney, valid tax certificates applicable and bid form, in the format attached.

B) Detailed Technical Evaluation

	Attribute	***Points allotted***
1.	Project Site Visit & Preliminary Reconnaissance to the Project ▪ Site visit attestation, (*2 pts)* ▪ Appreciation of the project site, (*1 pts)* ▪ Understanding of the project works, (*2 pts)*	*Maximum 5 points*
2.	The general construction experience of the firm and proposed associates in works similar to the project to be executed. Similar works includes drilling and water supply works. ▪ Field of specialization *(3pts)* ▪ Similar construction works previously executed*(15pts)* ▪ Current Work Commitments *(2pts)*	*Maximum 20 Points*
3.	Proposed construction schedule, material schedule for main work items, proposed work method, organization chart for head office & site, proposed site facilities and source of construction materials to carry out the contract. ▪ Work Program *(10 pts)* ▪ Method statement *(10pts)* ▪ Organization chart*(2pts)* ▪ Proposed facilities and sources of construction materials *(4pts)*	*Maximum 26 Points*
4.	Equipment Capabilities: major items of construction equipment proposed to carry out the contract.	*Maximum 08 Points*

	Attribute	***Points allotted***
	Less than 75% of minimum requirements *(0 pts)* 75 % of minimum requirements *(4pts)* 100 % of minimum requirements *(08pts)*	
5.	Personnel capabilities: qualifications, experience and competence of the key site management and technical personnel proposed for the contract Less than the minimum number of years stated *(0 pts)* Equal or more than the minimum number of year stated ▪ Project Manager *(8pts)* ▪ Chief Driller *(5pts)* ▪ Materials Engineer *(5pts)* ▪ Construction Superintendence *(4pts)* ▪ Chief Surveyor *(4pts)* ▪ Driller *(4pts)*	*Maximum 30 Points*
	Financial Capabilities; reports on the financial standing of the bidder, such as profit and loss statements, audited accounts reports for the past three years, evidence of adequacy of cash flow for this contract (access to credit lines and any other financial resources), Authority to seek references from the bidders' Bankers. ▪ Average Construction Turnover in the last five years, *Maximum allotted point 5* -Less than Birr 10 million----(*0 pts)* -Above Birr 10 million ($578,000)--------***(5 pts)***	*Maximum 11 Points*
	▪ Liquidity, ***(2pts)*** Max. score for Liquidity >> 2.0 60% of score for Liquidity = 2.0 Zero (0) for Liquidity << 1.0	
	▪ Liquid cash availability – ***(4pts)*** Total Credit Worthiness of less than ETB. 2,000,000= *(0 pts)* Total Credit Worthiness of more than ETB. 2,000,000 ($115,000)= *(3 pts)*	

IMPORTANT NOTES

1. The bidders with a total score of less than **70 points** shall be rejected.
2. All other applicants will be ranked according to the points achieved.

Stage II: Financial Evaluation

i) Proposals that score less than 70 points in the technical evaluation will be rejected, and the financial proposals of those firms will not be opened.

ii) Proposals which score more than 70 points will be considered to have passed the minimum acceptable capacity for execution of the contract, and the financial proposals for those firms will be opened and compared.
The technical offer will account for 70% whilst the financial will account for 30%.

iii) The priced bids will be checked for accuracy, and adjusted if necessary to ensure a fair comparison.

iv) The mode of evaluation will be Quality and Cost based selection (QCBS). In case of QCBS, the lowest priced Financial Bid (Fm) will be given a financial score (Sf) of 100 points. The financial scores (Sf) of the other Financial Bids will be computed as indicated in the Data Sheet. Bids will be ranked according to their combined technical (*St*) and financial (*Sf*) scores using the weights (T = the weighting for the Technical Bid; P = the weighting for the Financial Bid as indicated in the Data Sheet. T + P = 1); The firm achieving the highest combined technical and financial score using the formula $S = St \times T\% + Sf \times P\%$ will be invited for negotiations.

2. Qualification Criteria

The figures for each of the partners of a joint venture shall be added together to determine the Bidder's compliance with the minimum qualifying criteria; however, for a joint venture to qualify, each of its partners must meet at least 25 percent of minimum criteria for an individual Bidder, and the partner in charge at least 40 percent of those minimum criteria. Failure to comply with this requirement will result in rejection of the joint venture's Bid.

Subcontractors' experience and resources will not be taken into account in determining the Bidder's compliance with the qualifying criteria.

Qualification Criteria			Compliance Requirements/Marks Allotted (%)		Documentation
Schedule No.	Subject	Requirement	Single Entity	Joint Venture **All Parties Combined**	Submission Requirements
1	Information on Eligibility & Qualification Requirements	Copies of original documents defining the constitution or legal status, place of registration and principal place of business; written power of attorney of the signatory of the Bid to commit the bidder;	*(Must meet requirement)*	*To be considered in the preliminary evaluation as pre conditions for 2nd stage of technical evaluation.* (Existing or intended Joint Venture must meet requirement)	
2	Project Site visit & Preliminary Reconnaissance	Project Site visit and reconnaissance to the project site with site visit attestation, brief project appreciation and understanding of the project works.	*Allotted point 5*	*Allotted point 5*	
3	Financial Capability a) Historical Financial Performance	Submission of audited balance sheets or other financial statements acceptable to the Employer, for the last ***five (5) Years*** to demonstrate the current soundness of the Bidders financial position and its prospective long term profitability,	*Allotted point 11*	*Allotted point 11*	
	b) Average Construction Turnover	Minimum average annual construction turnover of ETB Ten Million (10,000,000***)*** calculated as total certified payments received for contracts in progress or completed, within the last ***Five years (5) Years***	Has to meet requirement	Have to meet requirement	
	c) Currently Available Liquid Cash (Working Capital)	Minimum current working capital of ETB Two Million (2,000,000.00) (Line of Credit)	Has to meet requirement	Have to meet requirement	Authority to seek information shall be granted to the bidder.

Qualification Criteria			Compliance Requirements/Marks Allotted (%)		Documentation
Schedule No.	Subject	Requirement	Single Entity	Joint Venture **All Parties Combined**	Submission Requirements
4.	Past Experience & Current Work Commitments a) Past Experience b) Current Work Commitments	Participation as contractor in drilling projects and construction within the last five (5) years, that have been successfully or substantially completed Bidders and each partner should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued. Projects at hand that are currently more than 70% completed against their respective work schedule will receive full mark	*Allotted points 20*	*Allotted points 20*	
5.	List of Major Equipment	Bidder should have a minimum number of under listed equipment proposed to carry out the works, stating whether a) Owned b) Leased/hired, or c) To be purchased; with evidences. • Appropriate Drilling Machine (2) • Compressor (1) • Mud pump(1) • Submersible Pump(1) • Concrete mixer (1/8m3) (1) • Generator (50kv) (2)	*Allotted points 08*	*Allotted points 08*	

Qualification Criteria			Compliance Requirements/Marks Allotted (%)		Documentation
Schedule No.	Subject	Requirement	Single Entity	Joint Venture **All Parties Combined**	Submission Requirements
6.	Proposed Construction Schedule (i)	1) Proposed work program in sufficient detail to demonstrate the adequacy of the bidder's proposals to meet the contract requirements within the completion period.	*Allotted point 10*	*Allotted point 10*	
	(ii) Construction Methodology	Proposed work methods in sufficient detail to demonstrate the adequacy of the bidder's proposals to meet the contract specifications within the completion period.	*Allotted point 10*	*Allotted point 10*	
	(iii) Organization Chart of Management Staff	Bidders to show in detail the organizational chart of both the Head Office and Site staff	*Allotted point 02*	*Allotted point 03*	
	(iv) Proposed Site Facilities	The Bidder shall provide a description of his construction site facility	*Allotted point 2*	*Allotted point 2*	

Qualification Criteria			Compliance Requirements/Marks Allotted (%)		Documentation
Schedule No.	Subject	Requirement	Single Entity	Joint Venture **All Parties Combined**	Submission Requirements
	Sources of Construction materials		*02*	*02*	
7.	Personnel	The qualifications and experience of key technical and supervising staff proposed for the execution of the Contract, both on and off site; with the following minimum requirements	*Allotted point 30*	*Allotted point 30*	With attachments, CV, testimonials, confirmation of past experience

Section IV. Forms of Bid, Qualification Information, Letter of Acceptance and Agreement

Contractor's Bid
BID FORM

Notes on Form of Contractor's Bid

The Bidder shall fill in and submit this Bid form with the Bid. Additional details on the price should be inserted if the Bid is in various currencies. If the Bidder objects to the Adjudicator proposed by the Employer in the bidding documents, he should so state in his Bid, and present an alternative candidate, together with the candidate's fee rates and biographical data, in accordance with Clause 36 of the Instructions to Bidders.

{letterhead paper of the bidder}

{date}

To: *{name and address of Employer}*

We offer to execute the *{name and procurement number of Contract}* in accordance with the Conditions of Contract accompanying this Bid for the Contract Price of *{amount in numbers}, {amount in words} {name of currency}.*

The Contract shall be paid in the following currencies:

Currency	Percentage payable in currency	Rate of exchange: one foreign equals [*rate*] US Dollar	Inputs for which foreign currency is required
(a)			
(b)			
(c)			

The advance payment required is:

Amount	Currency
(a)	
(b)	
(c)	

We accept the appointment of *{name proposed in Bidding Data}* as the Adjudicator.

[or]

We do not accept the appointment of *{name proposed in Bidding Data}]* as the Adjudicator, and propose instead that *{name}* be appointed as Adjudicator, whose fee rates and biographical data are attached.

This Bid and your written acceptance of it shall constitute a binding Contract between us. We understand that you are not bound to accept the lowest or any Bid you receive.

Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are listed below:

Name and address of agent	Amount and Currency	Purpose of Commission or gratuity

(if none, state "none")."

We hereby confirm that this Bid complies with the Bid Validity and Bid Security required by the bidding documents and specified in the Bidding Data.

Authorised Signature: _____

Name and Title of Signatory: _____

Name of Bidder: _____

Address: _____

Qualification Information

Notes on Form of Qualification Information

The information to be filled in by bidders in the following pages will be used for purposes of post-qualification or for verification of prequalification as provided for in Clause 4 of the Instructions to Bidders. This information will not be incorporated in the Contract. Attach additional pages as necessary. Pertinent sections of attached documents should be translated into the language of the Bid. If used for prequalification verification, the Bidder should fill in updated information only.

1. Individual Bidders or Individual Members of Joint Ventures

1.1 Constitution or legal status of Bidder: *{attach copy}*

Place of registration: *{insert}]*

Principal place of business: *{insert}*

Power of attorney of signatory of Bid: *{attach}*

1.2 Total annual volume of construction work performed in five years*: {insert figure in US Dollars or an equivalent in a freely convertible foreign currency}*

1.3 Work performed as prime Contractor on works of a similar nature and volume over the last five years. The values should be indicated in the same currency used for Item 1.2 above. Also list details of work under way or committed, including expected completion date.

Project name and country	Name of client and contact person	Type of work performed and year of completion	Value of contract
(a)			
(b)			
(c)			

1.4 Major items of Contractor's Equipment proposed for carrying out the Works. List all information requested below. Refer also to Clause 4.3(d) of the Instructions to Bidders.

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?)
(a)			
(b)			
(c)			

1.5 Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data. Refer also to Clause 4.3(e) of the Instructions to Bidders and Clause 9.1 of the Conditions of Contract.

Position	Name	Years of experience (general)	Years of experience in proposed position
(a)			
(b)			
(c)			

1.6 Proposed subcontracts and firms involved. Refer to Clause 7 of Conditions of Contract.

Sections of the Works	Value of subcontract	Subcontractor (name and address)	Experience in similar work
(a)			
(b)			
(c)			

1.7 Financial reports for the last five years: balance sheets, profit and loss statements, auditors' reports, etc. List below and attach copies.

1.8 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List below and attach copies of support documents.

1.9 Name, address, and telephone, and facsimile numbers of banks that may provide references if contacted by the Employer.

1.10 Information on current litigation in which the Bidder is involved.

Other party(ies)	Cause of dispute	Amount involved
(a)		
(b)		
(c)		

1.11 Statement of compliance with the requirements of Clause 3.2 of the Instructions to Bidders.

1.12 Proposed Program (work method and schedule). Descriptions, drawings, and charts, as necessary, to comply with the requirements of the bidding documents.

2. Joint Ventures

2.1 The information listed in 1.1 - 1.11 above shall be provided for each partner of the joint venture.

2.2 The information in 1.12 above shall be provided for the joint venture.

2.3 Attach the power of attorney of the signatory(ies) of the Bid authorising signature of the Bid on behalf of the joint venture.

2.4 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, authorised 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.

3. Additional Requirements

3.1 Bidders should provide any additional information required in the Bidding Data or to fulfil the requirements of Clause 4.1 and Clause 30 of the Instructions to Bidders, if applicable.

Also prepare:

a) Construction Methodology
b) Construction schedule
c) Organisation chart of management staff.

Letter of Acceptance

[letterhead paper of the Employer]

Notes on Standard Form of Letter of Acceptance

The Letter of Acceptance will be the basis for formation of the Contract as described in Clauses 33 and 34 of the Instructions to Bidders. This Standard Form of Letter of Acceptance should be filled in and sent to the successful Bidder only after evaluation of bids has been completed and Tender Board approval to the evaluation report and award of contract is granted.

[date]

To: *[name and address of the Contractor]*

This is to notify you that your Bid dated *[date]* for execution of the *[name of the Contract and Procurement Number, as given in the Contract Data]* for the Contract Price of *[amount in numbers and words] [name of currency]*, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted.

(a) We accept that *[name proposed by bidder]* be appointed as the Adjudicator.[16]

or

(b) We do not accept that *[name proposed by bidder]* be appointed as adjudicator, and by sending a copy of this letter of acceptance to *[insert the name of the Appointing Authority]*, we are hereby requesting *[name]*, the Appointing Authority, to appoint the Adjudicator in accordance with Clause 36.1 of the Instructions to Bidders.[17]

You are requested to submit the Performance Security of *[amount in numbers and in words]* US Dollars *[or other agreed currency]* and attend at *[address]* on *[date]* at *[time]* hours for signature of the Contract.

Authorised Signature: _____

Name and Title of Signatory: _____

Name of Employer: _____

Attachment: Agreement

[16] To be used only if the Contractor disagrees in the Bid with the Adjudicator proposed by the Employer in the Instructions to Bidders, and has accordingly offered another candidate. If the Employer does not accept the counterproposal, the sentence should so state, and be followed by an additional sentence: "We therefore shall request the *[name of Appointing Authority as named in the Contract Data]* to appoint the Adjudicator in accordance with Clause 36 of the Instructions to Bidders."

[17] To be used only if the Contractor disagrees in the Bid with the Adjudicator proposed by the Employer in the Instructions to Bidders, and has accordingly offered another candidate. If the Employer does not accept the counterproposal, the sentence should so state, and be followed by an additional sentence: "We therefore shall request the *[name of Appointing Authority as named in the Contract Data]* to appoint the Adjudicator in accordance with Clause 36 of the Instructions to Bidders."

Agreement

This Agreement, made the *[day]* day of *[month]*, *[year]* between *[name and address of Employer]* (hereinafter called "the Employer") and *[name and address of Contractor]* (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute *[name and Procurement Number of Contract]* (hereinafter called "the Works") and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein for the sum of *[Contract Price in numbers and words]*, (hereinafter called "the Contract Price").

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, and they shall be deemed to form and be read and construed as part of this Agreement.

2. The following documents shall be deemed to form and be read and construed as part of this agreement, in the following order of priority, viz:
   (a) Agreement;
   (b) Contract Data;
   (c) Conditions of Contract;
   (d) Specifications;
   (e) Drawings;
   (f) Contractor's Bid, including the Priced Bill of Quantities[18];
   (g) Letter of Acceptance; and
   (h) any other document listed in the Contract Data as forming part of the Contract.

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 wherein 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 _____
in the presence of: _____

Name, Title and Signature of Employer _____

Name and Signature of Contractor _____

[18] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule".

Section V. Conditions of Contract

Table of Clauses

Conditions of Contract

A. General

1. Definitions 1.1 Boldface type is used to identify defined terms.

The **Adjudicator** is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in Clauses 24 and 25 hereunder.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Bid for an Admeasurement (Unit Price) Contract.

Activity Schedule means the priced and completed Activity Schedule forming part of the Bid for a Lump Sum Contract

Compensation Events are those defined in Clause 44.

The **Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with Clause 55.1.

The **Contract** is the Contract between the Employer and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed in Clause 2.3.

The **Contractor** is a person or corporate body whose Bid to carry out the Works has been accepted by the Employer.

The **Contractor's Bid** is the completed bidding document submitted by the Contractor to the Employer.

The **Contract Price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

The **Country specified for the performance of the Works** is the Country specified in the Contract Data.

Days are calendar days; months are calendar months.

Dayworks are varied work inputs subject to payment on a time basis for the Contractor's employees and Equipment, in addition to payments for associated Materials and Plant.

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

The **Defects Liability Certificate** is the certificate issued by Project Manager upon correction of defects by the Contractor.

The **Defects Liability Period** is the period named in the Contract Data and calculated from the Completion Date.

Drawings include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

The **Employer** 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 to construct the Works.

The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Project Manager, following approval of the Employer, by issuing an approved extension of time or an acceleration order.

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

Plant is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.

The **Project Manager** is the person named in the Contract Data (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the day-to-day operation of the Contract.

The **Site** is the area defined as such in the Contract Data.

Site Investigation Reports are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.

The **Start Date** is given in the Contract Data. It is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.

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 that are needed for construction or installation of the Works.

A **Variation** is an instruction given by the Project Manager which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and hand over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager will provide instructions clarifying queries about these Conditions of Contract.

2.2 If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

2.3 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement;
(2) Contract Data;
(3) Conditions of Contract;
(4) Technical Specifications;
(5) Drawings;
(6) Contractor's Bid, including the Priced Bill of Quantities[19];
(7) Letter of Acceptance; and
(8) any other document listed in the Contract Data as forming part of the Contract.

3. Language and Law

3.1 The language of the Contract is English and the law governing the Contract is International Law unless otherwise stated in the Contract Data.

[19] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule".

4. Project Manager's Decisions

4.1 Except where otherwise specifically stated, the Project Manager will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

4.2 The Project Manager shall obtain specific approval from the Employer before carrying out any of his duties under the Contract which in the Project Manager's opinion will cause the total amount finally due under the Contract to exceed the Contract Price or will give entitlement to an extension of time. This requirement shall be waived in an emergency affecting safety of personnel or the Works or adjacent property.

5. Delegation

5.1 The Project Manager may delegate any of his duties and responsibilities to other people, except to the Adjudicator, after notifying the Contractor, and may cancel any delegation after notifying the Contractor.

6.Communications

6.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered.

7. Subcontracting

7.1 The Contractor may subcontract with the approval of the Project Manager, but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations.

8. Other Contractors

8.1 The Contractor shall co-operate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors, as referred to in the Contract Data. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

9. Personnel

9.1 The Contractor shall employ the key personnel named in the Schedule of Key Personnel, as referred to in the Contract Data, to carry out the functions stated in the Schedule or other personnel approved by the Project Manager. The Project Manager will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are substantially equal to or better than those of the personnel listed in the Schedule.

9.2 If the Project Manager asks the Contractor to remove a person who is a member of the Contractor's staff or work force, stating valid reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's

10.1 The Employer carries the risks which this Contract states are

and Contractor's Risks

Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's Risks

11.1 From the Start Date until the Defects Correction Certificate has been issued, the following are Employer's risks:

(a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to:

(i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works; or

(ii) negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor.

(b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the Country specified for performance of the Works.

11.2 From the Completion Date until the Defects Correction Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is an Employer's risk except loss or damage due to

(a) a Defect which existed on the Completion Date,

(b) an event occurring before the Completion Date, which was not itself an Employer's risk, or

(c) the activities of the Contractor on the Site after the Completion Date.

12. Contractor's Risks

12.1 From the Starting Date until the Defects Correction Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risks are Contractor's risks.

13. Insurance

13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts stated in the Contract Data for the following events which are due to the Contractor's risks:

(a) loss of or damage to the Works, Plant, and Materials;

(b) loss of or damage to Equipment;

(c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract;

(d) personal injury or death, and

(e) any other insurance as specified in the Contract Data.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

13.3 If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due to the Employer.

13.4 Alterations to the terms of an insurance shall not be made without the approval of the Project Manager.

13.5 Both parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports

14.1 The Contractor, in preparing the Bid, shall rely on any Site Investigation Reports referred to in the Contract Data, supplemented by any information available to the Bidder.

15. Queries about the Contract Data

15.1 The Project Manager will clarify queries on the Contract Data.

16. Contractor to Construct the Works

16.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings.

17. The Works to Be Completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.

18. Approval by

18.1 The Contractor shall submit Specifications and Drawings

the Project Manager

showing proposed Temporary Works to the Project Manager, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for design of Temporary Works.

18.3 The Project Manager's approval shall not alter the Contractor's responsibility for design of Temporary Works.

18.4 The Contractor shall obtain approval of third parties to the design of Temporary Works, where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

21. Possession of the Site

21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data, the Employer will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Project Manager and any person authorised by the Project Manager 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.

23. Instructions Inspection and Audits

23.1 The Contractor shall carry out all instructions of the Project Manager providing they comply with the applicable laws of the Country specified for performance of the Works.

23.2 The Contractor shall permit the Commission of the African Union to inspect the Contractor's accounts and records relating to the performance of the Contract and to have them audited by auditors appointed by the Commission, if so required by the Commission.

24. Disputes

24.1 If the Contractor believes that a decision taken by the Project Manager was either outside the authority given to the Project Manager by the Contract or that the decision was wrongly taken,

the issue shall be referred to the Commission of the African Union for review. If an agreed resolution is not achieved within 14 days of the complaint by the Contractor, the issue shall be referred to the Adjudicator for decision.

25. Procedure for Disputes

25.1 The Adjudicator shall give a decision in writing within 28 days of receipt of a notification of a dispute, providing he has been timely provided with all the relevant information.

25.2 The Adjudicator shall be paid at the rate specified in the Bidding Data and Contract Data, together with reimbursable expenses of the types specified in the Contract Data, and the cost shall be divided equally between the Employer and the Contractor, whatever decision is reached by the Adjudicator. Either party may refer a decision of the Adjudicator to an Arbitrator within 28 days of the Adjudicator's written decision. If neither party refers the dispute to arbitration within the above 28 days, the Adjudicator's decision will be final and binding.

25.3 The arbitration shall be conducted in accordance with the arbitration procedure published by the institution named and in the place shown in the Contract Data.

26. Replacement of Adjudicator

26.1 Should the Adjudicator resign or die, or should the Employer and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract, a new Adjudicator will be jointly appointed by the Employer and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Adjudicator shall be designated by the Appointing Authority designated in the Contract Data at the request of either party, within 14 days of receipt of such request.

B. Time Control

27. Program

27.1 Within the time stated in the Contract Data, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

27.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

27.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount stated in the Contract Data from the next

payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted.

27.4 The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

28. Extension of the Intended Completion Date

28.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost. Approval of any such extension of time is subject to the provisions of Clause 4.2.

28.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to co-operate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

29. Acceleration

29.1 When the Employer wants the Contractor to finish before the Intended Completion Date, the Project Manager will obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Employer accepts these proposals, the Intended Completion Date will be adjusted accordingly and confirmed by both the Employer and the Contractor.

29.2 If the Contractor's priced proposals for acceleration are accepted by the Employer, they are incorporated in the Contract Price and treated as a Variation.

30. Delays Ordered by the Project Manager

30.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

31. Management Meetings

31.1 Either the Project Manager or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

31.2 The Project Manager shall record the business of management

meetings and provide copies of the record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

32. Early Warning

32.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.

32.2 The Contractor shall co-operate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.

C. Quality Control

33. Identifying Defects

33.1 The Project Manager shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.

34. Tests

34.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.

35. Correction of Defects

35.1 The Project Manager 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 Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

35.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.

36. Uncorrected Defects

36.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. Cost Control

37. Bill of Quantities[20]

37.1 The Bill of Quantities shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

37.2 The Bill of Quantities is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

38. Changes in the Quantities[21]

38.1 If the final quantity of the work done exceeds or falls short of the quantity set out in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 1 percent of the Initial Contract Price, the Project Manager shall adjust the rate or price to allow for the change subject to the provisions of Clause 4.2.

38.2 The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 10 percent, except with the prior written approval of the Employer.

38.3 If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities.

39. Variations

39.1 All Variations shall be included in updated Programs[22] produced by the Contractor.

40. Payments for Variations

40.1 The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.

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[20] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule," and replace Clauses 37.1 and 37.2, as follows:

37.1 The Contractor shall provide updated Activity Schedules within 14 days of being instructed to by the Project Manager. The activities on the Activity Schedule shall be coordinated with the activities on the Program.

37.2 The Contractor shall show delivery of Materials to the Site separately on the Activity Schedule if payment for Materials on Site shall be made separately.

[21] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule," and replace entire Clause 38 with new Clause 38.1, as follows:

38.1 The Activity Schedule shall be amended by the Contractor to accommodate changes of Program or method of working made at the Contractor's own discretion. Prices in the Activity Schedule shall not be altered when the Contractor makes such changes to the Activity Schedule.

[22] In lump sum contracts, add "and Activity Schedules" after "Programs".

40.2 If the work in the Variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated in Clause 38.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.[23]

40.3 If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and recommend to the Employer a change to the Contract Price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.

40.4 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

40.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.

41. Cash Flow Forecasts

41.1 When the Program[24] is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.

42. Payment Certificates

42.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.

42.2 The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.

42.3 The value of work executed shall be determined by the Project Manager.

42.4 The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.[25]

42.5 The value of work executed shall include the valuation of

[23] In lump sum contracts, delete this paragraph.
[24] In lump sum contracts, add "or Activity Schedule" after "Program".
[25] In lump sum contracts, replace this paragraph with the following: "The value of work executed shall comprise the value of completed activities in the Activity Schedule."

Variations and Compensation Events.

42.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

43. Payments

43.1 Payments shall be adjusted for deductions for advance payments and retention. The Employer shall pay the Contractor the amounts certified by the Project Manager within 45 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be entitled to claim interest on the late payment. Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made calculated using the following formula:

$$\frac{\text{Value of the Payment Certificate} \times 15\% \times \text{No. of days delay}}{365}$$

43.2 If an amount certified is increased in a later certificate or as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be entitled to claim interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

43.3 Unless otherwise stated, all payments and deductions will be paid or charged in the proportions of currencies comprising the Contract Price.

43.4 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

44. Compensation Events

44.1 The following shall be Compensation Events:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.

(b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract.

(c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time.

(d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.

(e) The Project Manager unreasonably does not approve a subcontract to be let.

(f) Ground conditions are substantially more adverse than could reasonably have been assumed before issue of the Letter of Acceptance from the information issued to bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.

(g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.

(h) Other contractors, public authorities, utilities, or the Employer do not perform work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

(i) The advance payment is delayed.

(j) The effects on the Contractor of any of the Employer's Risks.

(k) The Project Manager or Employer unreasonably delays issuing a Certificate of Completion.

(l) Other Compensation Events described in the Contract Data or determined by the Project Manager shall apply.

44.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

44.3 As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly following approval by the Employer. If the Contractor's forecast is deemed unreasonable, the Project Manager shall recommend adjustment of the Contract Price based on the Project Manager's own forecast. The Project Manager will assume that the Contractor will react competently and promptly to the event.

44.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the

Contractor's not having given early warning or not having co-operated with the Project Manager.

45. Taxes and Duties

45.1 The African Union is exempted from all direct taxes, and are exempted from customs duties in respect of articles imported or exported for its official use in conformity with the General Convention on Privileges and Immunities. Accordingly, the Contractor authorises the Commission of the African Union (AUC) to deduct from payments any amount representing such taxes or duties charged to the African Union by the Contractor. In the event that any taxing authority refuses to accept the African Union's exemption from such taxes or duties, the Contractor shall immediately consult with the AUC.

45.2 A Contractor shall be entirely responsible for obtaining exemption for the African Union of all such taxes, duties, license fees, etc., incurred, unless otherwise agreed in writing by the AUC.

45.3 The Employer may adjust the Contract Price on the recommendation of the Project Manager if taxes, duties, and other relevant levies are changed within the country specified for performance of the works, between the date 28 days before the submission of bids for the Contract and the date of the final Completion certificate. Taxes, duties and other levies that are reclaimable under the general exemption of the African Union from taxes and duties shall not give rise to any adjustment. Any adjustment to the Contract Price shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price or are a result of Clause 47.

46. Currencies

46.1 Where payments are made in currencies other than US Dollars, the exchange rates used for calculating the amounts to be paid shall be the exchange rates stated in the Contractor's Bid.

47. Price Adjustment

47.1 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for and in the manner detailed in the Contract Data. If so provided, the amounts certified in each payment certificate shall be adjusted in accordance with the price adjustment provisions given in the Contract Data.

48. Retention

48.1 The Employer shall retain from each payment due to the Contractor the retention percentage stated in the Contract Data until Completion of the whole of the Works.

48.2 On completion of the whole of the Works, half of the total amount retained shall be repaid to the Contractor and half when the Defects Liability Period has passed and the Project Manager has certified that all Defects notified by the Project Manager to

the Contractor before the end of this period have been corrected.

48.3 On completion of the whole Works, the Contractor may substitute retention money with an "on demand" Bank guarantee.

49. Liquidated Damages

49.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date. The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.

49.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rates specified in Clause 43.1.

50. Bonus

50.1 Unless otherwise stated in the Contract Data, the Contractor shall not be paid a bonus for early completion of the Works.

51. Advance Payment

51.1 The Employer shall make advance payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to the advance payment. The Guarantee shall remain effective until the advance payment has been repaid, but the amount of the Guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

51.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilisation expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager.

51.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.

52. Securities

52.1 The Performance Security in the form of an unconditional Bank Guarantee given in the bidding documents shall be provided to the Employer no later than the date specified in the Letter of Acceptance. The Bank Guarantee shall be issued either (a) by a bank located in a Member State of the African Union, or a foreign bank through a correspondent bank located in the Country specified for performance of the works, or (b), with the agreement of the Employer directly by a foreign bank acceptable to the Employer. The Guarantee shall be denominated in the types and proportions of the currencies in which the Contract Price is payable. The Performance Security shall be valid until a date 28 days after the date of issue of the Certificate of Completion.

53. Dayworks

53.1 If applicable, the Dayworks rates in the Contractor's Bid shall be used for small additional amounts of work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.

53.2 All work to be paid for as Dayworks shall be recorded by the Contractor on forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the work being done.

53.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

54. Cost of Repairs

54.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

55. Completion

55.1 The Contractor shall request the Project Manager to issue a certificate of Completion of the Works, and the Project Manager will do so upon both the Project Manager and the Employer deciding that the work is completed.

56. Taking Over

56.1 The Employer shall take over the Site and the Works within the period specified in the contract data after the issuance of a Certificate of Completion.

57. Final Account

57.1 The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and

complete. If it is not, the Project Manager shall issue within 56 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 Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.

58. Operating and Maintenance Manuals

58.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

58.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Project Manager's approval, the Project Manager shall withhold the amount stated in the Contract Data from payments due to the Contractor.

59. Termination

59.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

59.2 Fundamental breaches of Contract shall include, but shall not be limited to, the following:

(a) the Contractor stops work for 28 days when no stoppage of work is shown on the current Program and the stoppage has not been authorised by the Project Manager;

(b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 28 days;

(c) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(d) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 90 days of the date of the Project Manager's certificate;

(e) the Project Manager 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 determined by the Project Manager;

(f) the Contractor does not maintain a Security, which is required; and

(g) at any time during the Contract, the Contractor has delayed the completion of the Works, as measured by the Program, by the number of days for which the maximum amount of

liquidated damages can be paid, as defined in the Contract Data.

(h) if the Contractor, in the judgement of the Employer has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for or in executing the Contract.

For the purpose of this paragraph:

"corrupt practice"[26] is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

"fraudulent practice"[27] is any act or omission including a misrepresentation that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

"collusive practice"[28] is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

"coercive practice"[29] is impairing or harming or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

"obstructive practice" is deliberately destroying, falsifying, altering or concealing of evidence material to any investigation or making false statements to investigators in order to materially impede any investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation;

59.3 When either party to the Contract gives notice of a breach of

[26] *"another party" refers to an officer of the AU acting in relation to the procurement process or contract execution. In this context, "officer of the AU" includes staff and employees of other organisations taking or reviewing procurement decisions.*
[27] *a "party" refers to any officer of the AU; the terms "benefit" and "obligation" relate to the procurement process or contract execution; and the "act or omission" is intended to influence the procurement process or contract execution.*
[28] *"parties" refers to any participants in the procurement process (including officers of the AU) attempting to establish bid prices at artificial, non competitive levels.*
[29] *a "party" refers to any participant in the procurement process or contract execution.*

Contract to the Project Manager for a cause other than those listed under Clause 59.2 above, the Project Manager shall decide whether the breach is fundamental or not.

59.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

59.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.

60. Payment upon Termination

60.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer.

60.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

61. Property

61.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor's default.

62. Release from Performance

62.1 If the Contract is frustrated by the outbreak of war or by any other event of force majeure entirely outside the control of either the Employer or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a commitment was made.

Section VI. Contract Data

CC Clause 1.1

Contract: The name and Procurement Number of the Contract are *[insert name and number as indicated in the Invitation for Bids]*.

Contractor: The Contractor is *[insert Name and address of Contractor]*.

Country specified for the performance of the Works: The Country is *[insert name of Country]*

Defects Liability Period: The Defects liability Period is *[days/months]*.

Employer: The Employer is *[insert Name of Employer, address, and name of authorised representative]*.

Intended Completion Date: The Intended Completion Date for the whole of the Works shall be *[insert date]*. *[If different dates are specified for completion of the Works by section ("sectional completion"), these dates should be listed here.]*

Project Manager: The Project Manager is *[insert full name and address]*.

Site: The Site is located at *[location]* and is defined in drawings Nos.: *[insert numbers]*

Start Date: The Start Date shall be *[insert date]*.

Works: The Works consist of *[brief summary description of the Works, including relationship to other contracts under the Project]*.

CC Clause 2.3(9) The following documents also form part of the Contract: *[list documents e.g. Schedule of Operating and Maintenance Manuals - see CC Clause 58; Schedule of Other Contractors - See CC Clause 8; The Schedule of Key Personnel - CC Clause 9; Site Investigation Reports - see CC Clause 14, etc]*

CC Clause 3.1 *[State language of the Contract if not English and the governing law if other than International Law - otherwise delete this paragraph.]*

CC Clause 8.1 The Schedule of Other Contractors attached at Appendix *[appendix number]* shall form part of the Contract.

CC Clause 9.1 The Schedule of Key Personnel attached at Appendix *[appendix number]* shall form part of the Contract.

CC Clause 13.1 The minimum insurance cover shall be:

(a) The minimum insurance cover for the loss of or damage to the Works, Plant and Materials shall be *[insert percentage (usually 110%)]* of the Contract Sum with a maximum deductible of *[insert amount and currency]*.

(b) The minimum insurance cover for loss or damage to Equipment is *[insert amount and currency]* with a maximum deductible of *[amount and currency]*

(c) The minimum insurance cover for loss or damage to property (except the Works, Plant, Materials and Equipment) is *[insert amount and currency]* with no deductible

(d) The minimum insurance cover for personal injury or death is *[insert amount and currency]* with no deductible

(e) In addition the Contractor shall be required to provide all insurance cover as required by the laws and regulations of the Country specified for the performance of the Works.

CC Clause 14.1 The following Site Investigation Reports attached at Appendix *[appendix number]* shall form part of the Contract:
[give list and identifying details]

CC Clause 21.1 The Site Possession Date shall be *[date]*. *[If the Site is made available by section, the different dates should be listed here.]*

CC Clause 25.2 Fees and types of reimbursable expenses to be paid to the Adjudicator: *[list fee and expenses rates]*.

CC Clause 25.3 Arbitration will be conducted under the rules and regulations of *[name of institution]*.

Arbitration shall take place at *[location]*

CC Clause 26.1 Appointing Authority for the Adjudicator is: *[insert name of Authority]*.

CC Clause 27.1 The Contractor shall submit a revised Program for the Works within *[insert number]* days of delivery of the Letter of Acceptance.

CC Clause 27.3 The period between Program updates shall be *[number]* days.

The amount to be withheld for late submission of an updated Program is *[insert amount]*.

CC Clause 35.1 The Defects Liability Period is *[insert number]* days.

CC Clause 44.1(l) The following events shall also be Compensation Events: *[list any additional events not listed in Conditions of Contract Clause 44.1]*

CC Clause 47.1 The Contract *[specify "is" or "is not"]* subject to price adjustment in accordance with Clause 47 of the Conditions of Contract, and the following information regarding method of adjustment *[specify "does" or "does not"]* apply.
Price adjustment shall be based on basic prices for labour, cement, aggregates, structural steel, reinforcing steel, bitumen, fuel etc submitted at time of bid and verified and accepted by the Employer. The Contract Price shall be adjusted to reflect the variations between the base unit price and actual prices for labour and material actually used for the performance of the contract and verified by the Project Manager.

CC Clause 48.1 The proportion of payments retained is *[percent]* percent.

CC Clause 49.1 The liquidated Damages for the whole of the Works shall be *[percentage of the final Contract Price]* per day.

The maximum amount of liquidated damages for the whole of the Works shall be *[percent]* percent of the final Contract Price.

CC Clause 51.1 The Advance Payment will be *[insert currency and amount or state as a percentage of the contract sum]* and will be paid to the Contractor no later than *[insert date]*.

CC Clause 52.1 The Performance Security shall be for a minimum amount equivalent to *[insert percentage]* percent of the Contract Price:

The Performance Security shall be a certified banker's cheque or an Unconditional Bank Guarantee in the form presented in Section X of the Bidding Document.

CC Clause 56.1 The Employer shall take over the Site and the Works within [*insert the number of days*] after the issuance of a Certificate of Completion.

CC Clause 58.1 The date by which "as built" drawings are required is *[insert date]*.

The date by which operating and maintenance manuals are required is *[insert date(s)]*.

[If no as built drawings are required, delete this Clause reference from the Contract Data.]

CC Clause 58.2 The amount to be withheld for failure to deliver "as built" drawings and/or operating and maintenance manuals by the dates required is *[insert amount]*.

[If no as built drawings are required, delete this Clause reference from the Contract Data.]

CC 60.1 The percentage to apply to the value of the work not completed, representing the Employer's additional cost for completing the Works, is *[insert percentage]*.

SECTION VII
SPECIFICATIONS

Section VII (b-1)

TECHNICAL SPECIFICATIONS FOR SUPPLY SECTION

EQUIVALENCY OF STANDARDS AND CODES

Wherever reference in the Contract to specific standards and codes to be met by the goods and, materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. Differences between standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's Approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards set forth in the documents.

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1. SPECIFICATION FOR PIPES AND FITTINGS (FOR WATER SUPPLY & SEWERAGE SYSTEMS)

1.1 PARTICULAR TECHNICAL SPECIFICATION OF DCI AND GS PIPES FITTINGS AND VALVES

1.1.1 DUCTILE IRON (DI) PIPE

Ductile iron pipe, unless otherwise indicated, shall be of Class K9. It shall have a cement mortar lining and a coating of zinc followed by bitumen layer at least 120 µm thick and shall conform to the standards in the following table.

Specifications	Standards			
	International	European	British	French
General Technical specification for ductile iron pipelines	ISO 2531	EN 545	BS 4772	NF EN 545
“Express” joint				NF A 48 860
“Standard” Joint				NF A 48 870
Socket pipes	ISO 2531	EN 545	BS 4772	NF EN 545
Flanged pipes	ISO 2531	EN 545	BS 4772	NF EN 545
Socket fittings	ISO 2531	EN 545	BS 4772	NF EN 545
Flanged fittings	ISO 2531	EN 545	BS 4772	NF EN 545
Flange dimensions	ISO 2531	EN 545	BS 4772	NF EN 545
Joint gaskets. Materials	ISO 4633			NF T 47-305
Pipe zinc coating	ISO 8179-1	EN 545	BS 3416	NF EN 545
Cement mortar pipe lining	ISO 4179	EN 545	BS 4772	NF EN 545

If requested by the Supervisor, the supplier shall submit an affidavit of compliance with the standard specifications and supplementary data as required for evaluation.
Cement-mortar lining shall be standard thickness.
Joints shall generally be of the socket and spigot, push-on type with preformed synthetic rubber gasket.
Joints shall be capable of taking a 3-degree minimum deflection per joint.
The net laying lengths of pipes shall be at least as shown below unless otherwise specified or approved by the Supervisor.

DN	150 - 600	700 - 800
Net laying length, m	6	7

Unless otherwise approved, the sockets and other dimensional details of ductile iron pipes shall be similar to the "Standard" range of Pont-à-Mousson and compatible with them.
For flanged ductile iron pipes, the flanges shall be drilled to ISO PN 10 unless otherwise indicated. If so indicated in the Bill of Quantities the flanges shall be to ISO PN 16.

1.1.2 GS PIPES

1.1.2.1 STANDARDS OF PIPES AND FITTING

The materials, manufacturing and kinds of pipes and fitting to be supplied shall comply with the British Standard BS 1387 Medium Class and with the British standard BS 143 and 1256. If the manufacturing standard is other than BS 1387 Medium Class and BS 143 and 1256, than the bidder shall confirm in writing that the offered standard is equivalent to BS 1387 Medium Class and BS 143 and 1256 and shall attach one copy of the quoted standard in the technical proposal.

1.1.2.2 TYPE OF JOINTS

The pipes shall be screw and socketed, with one socket on each pips. Fittings shall also be screwed type. Threads on pipes and shall comply with the British standard BS 21 or equivalent.

1.1.2.3 LENGTH OF PIPES

All pipes shall be supplied in length of 6 meter unless specified other wise in the BOQ.

1.1.2.4 TOLERANCES

The manufacturing tolerances shall comply with the conditions of the standards mentioned under clause 1.1.1 above.

1.1.2.5 COATING OF PIPES AND FITTINGS

Pipes and fittings to be offered shall be galvanized inside and outside by the hot-dip process according to the British standards BS 1387 and 729, or other equivalent standards. The Galvanizing shall be done before screwing of pipes and fittings.

1.1.2.6 INTERNAL PRESSURE PROOF TEST

Pipes shall be tested for leak tightness at the manufacture’s work. The test shall be a hydraulic test at a pressure of 50 bars. The proof test shall be applied after galvanizing of pipes according to the British standard BS 1387, or other equivalent standards.

Fitting shall be tested for leak tightness at the manufacture’s work. The test shall be a hydraulic test at a pressure not less than 20 bars. The proof test shall be applied according to the British Standard BS 143 & 1256, or other equivalents.

1.1.2.7 SHOP TESTING AND INSPECTION

Inspection of external appearance, shape, dimensions and weights shall be carried out for each pipe and fitting. All pipes and fitting shall be straight and stripped with care to avoid warping. All pipes and fittings shall be sound and free surface defects.

Each pipe and fitting shall be subjected to hydrostatic pressure test complying with latest version of BS 1387. Any pipe or fitting that does not withstand the test pressure shall be rejected.

Mechanical testes for hardness, tensile strength, and elongation shall be performed on test pipes selected at random out of batches grouped in lost according to the manufacturer's quality control schedule approved the client. Each successful tested batch is identified by a mark.

Results of all such tests shall be submitted to the client on a previously approved from of certificate.

1.1.2.8 PHYSICAL PROPERTIES

Dimensions

Nom. Dia		Size Outside dia.		Thickness S mm	Screwed and socketed pipe weight kg/m	Series
MM	**Inch**	**Max.mm**	**Min.mm**			
25	1	34.2	33.4	3.2	2.43	Medium
40	$1_{1/2}$	48.8	48.0	3.2	3.13	"
50	2	60.8	59.8	3.60	5.10	"
65	$2_{1/2}$	76.6	75.4	3.6	6.55	"
75	3	89.5	88.1	4.0	8.54	"
100	4	114.9	113.3	4.5	12.5	"
150	6	166.1	164.1	5.0	20.3	"

1.1.2.9 SOCKETS

Minimum length and outside diameter in accordance with ISO – 50.

1.1.2.10 PIPE LENGTH

6 meter

1.1.2.11 PACKING

Pipes shall be packed of extra protection with pipe end protectors in wooden frames bound together in standard weight bundles. Fitting packed in standard size boxes.
Pipe sockets shall be separately packed in wooden boxes. Pipes shall be packed with out sockets pipe thread projectors.

1.1.2.12 TECHNICAL INFORMATION

- Physical properties of pipes
- Details of thread pitch and threads backing details.

1.1.2.13 FITTINGS

Seamless galvanized steel fittings, threaded to ISO-standard medium class

1.1.3 VALVES

1.1.3.1 GENERAL.

Valves shall be designed to meet the operational conditions as specified in the particular section of the specification. Unless otherwise specified, valves shall be provided to suit the maximum working pressures including all surge pressures.
Unless otherwise specified all valves shall be double flanged to ISO PN 16 or relevant DIN or BS 4504 with flanges drilled for PN l6.
All valves larger than DN 100 shall be workshop tested to DIN 3230 for tightness and soundness of materials.
All valve bodies shall have the following information cast onto them.

- Manufacturer's name
- Hydraulic operating pressure
- Size of valve
- Direction of flow arrow

All valves, spindles and handwheels shall be positioned to give good access for operational personnel. It shall be possible either to remove and replace or to recondition seats, gates or gland packings which shall be accessible without removal of the valve from the pipework or, in the case of power operated valves, without removal of the actuator from the valve.
Valves buried or installed in underground chambers where access to a handwheel would be impractical shall be operated by means of extension spindles and/or keys.
The operating gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified service value and any gearing shall be such as to permit manual operation in a reasonable time with a required rim pull not exceeding 35 kg.
All handwheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the handwheels.
Valves of DN 200 and greater, nominal bore shall be fitted with mechanical position indicators to show the amount which the valve is open or closed in relation to its full travel, i.e. 0.25, 0.50, 0.75, 1.
Valve bodies, discs and wedges shall be of ductile cast iron, with facing rings, seating rings, wedge nut and other trim of corrosion resistant bronze.
The valve stem, thrust washers, screws, nuts and other components exposed to the water shall be of a corrosion resistant grade of bronze or stainless steel.

1.1.3.2 WEDGE GATE VALVES.

All wedge gate valves, unless otherwise specified shall be of the non-rising spindle type and be flanged to PN l6 and be in accordance with the relevant clauses of NF E 29-324 or DIN 3226 or BS 5163 or 5150. Their face to face flange dimensions shall comply with standards ISO 5752 series 15, NF E 29-324 series 15 or DIN 3202 series F5.
DN 80 gate valves shall have female threaded ends and ductile iron or copper alloy bodies. They shall comply with BS 5154 or BS 5150.
Gate valves from DN 100 to DN 300 size shall have rubber clad gates which provide a seal by compressing the elastomer against the body contact area.
Valves larger than DN 300 shall have wedge gates with gun-metal faces and seats.
Valves shall have ductile cast iron bodies, high tensile brass spindles, gun-metal nuts, bronze gland bushes and bonnets fitted with soft packing glands. Valves larger than DN 400 shall have detachable bolted covers for inspection, cleaning and flushing purposes.
Valves larger than DN 300 shall be provided with renewable seats and it shall be possible to remove the wedge without removing the valve body from the pipework.
The gate face rings shall be screwed into the gate or alternatively securely pegged over the full circumference.
Unless otherwise detailed on the Drawings, gate valves in chambers, and other similar locations shall be provided with handwheels. Valves which are to be buried in the ground shall be provided with extension spindles, protection tubes, spindle caps, spindle supports and surface boxes.
Valves of 450 mm and above shall be provided with a geared headstock for manual operation.
Each valve shall be tested in accordance with the requirements of the relevant BS or DIN, open-ended in each direction.

1.1.3.3 BUTTERFLY VALVES

Rubber seated butterfly valves shall be airtight when shut-off. Valves shall be suitable for the application/pressures and for mounting in any position and shall comply with DIN 3202 or BS 5155, for double flanged valves, except where otherwise specified. All bolts, nuts and other fixings which will be in contact with the contents of the pipelines or in the case of buried valves, within the ground, shall be stainless steel. The flanges shall be to ISO PN 16.
Butterfly valves shall be suitable for frequent operation as well as for operation after long periods of idleness in either the open or closed position.
Unless otherwise specified valves shall be hand operated with handwheels driving through 90° gearboxes.
The valve body shall be ductile cast iron, the flanges and hubs for shaft bearing housing being integrally cast with the valve body.
The disc shall be ductile iron having edges machined with rounded corners and polished to a smooth finish. The valve disc shall rotate through an angle of 90 degrees from the valve opened to the fully closed position where the seating shall be at an angle normal to the axis of the pipe. Mechanical stops shall be provided to prevent over-travel of the valve disc in both the open and closed positions. Particular attention shall be given to the pipework both upstream and downstream of all butterfly valves to ensure that the disc cannot foul the adjacent pipe.
The shaft shall be fabricated of stainless steel. The shaft, disc and mechanical stops shall be capable of absorbing the full operating torque with a minimum design safety factor of five. Shaft seals, when used, shall be rubber 0-ring type. Packing shall be either rubber 0-ring or self-adjusting chevron type.
The valve seat shall be replaceable and formed of nitrile rubber 70/75 IRHD securely clamped into a machined groove in the valve body or to the edge of the disc by seat retention members, or equivalent so as to prevent leakage and to hold the seat securely during operation. The seat retention

members shall be of stainless steel and securely clamped with stainless steel fasteners. All fastenings shall be set flush so as to offer the least resistance possible to the flow through the valve. Valve seats which extend over the face of the flanges to secure the seat in place, or which require surface grinding and/or hand fitting of the disc; or designs which require the adjoining pipe flange to retain the seat in place and resist line pressure, are not acceptable.
Each valve shall be tested in accordance with the requirements of DIN 3202 or BS 5155 for body, seat and disc strength tests. Seat and disc strength tests shall be carried out in each direction and the valve shall be drop tight.

1.1.3.4 NON-RETURN (CHECK) VALVES.

Non-return valves shall be suitable for the operating conditions and where applicable shall conform to DIN 3202 or BS 5153. Long pattern valves shall generally be used.
All non-return valves shall be of the butterfly and nozzle type.
Check valves shall possess high speed closing characteristics by use of heavy flaps with external weights where specified, but designed for minimum slam condition when closing.
Flaps shall be fitted with renewable bronze or gun-metal sealing faces, which shall mate accurately with renewable bronze or gun-metal seating rings in the valve body. All seating/seals shall be positively located.
Valves larger than DN 500 shall be provided with lifting eyes, feet and jacking screws.
Hinge pins/shafts and internal fixing devices shall be stainless steel. Hinge pins/shafts shall preferably be square in section to ensure positive location of flaps and provide for secure fixings. For valves with external levers and adjustable balance weight the hinge pin/shafts shall extend through a renewable sealing gland on the side of the body.
Check valves for potable water shall be free acting type single flap or multi flap with external by-pass and hand operated control valve as necessary. Flaps shall be of design and weight to suit the prevailing hydraulic conditions and shall turn in close fitted low friction bearings.
Each valve shall be tested in accordance with DIN 3202 or BS 5153 or if outside the size of this standard to the form as set out in BS 5153 and to the nominal pressure designation/test pressure relationship set out therein. For potable water applications where space is at a premium wafer type double flap non-return valves with spring assisted closing may be specified. These valves shall have cast iron bodies and flaps with resilient seats and fitted with stainless steel hinge pins and springs.

1.1.3.5 PRESSURE AND VACUUM GAUGES

Gauges shall be provided for all pumps and for other equipment as shown on the Drawings and for all other equipment where necessary.
Pressure and compound gauges of approved manufacture, shall be provided and fixed directly to and at the same level as the delivery and suction branches of each pump. The gauges shall be fitted with diaphragm type isolating valves, but syphon pipes will not be required. Gauges shall not be connected to air release pipes.
All gauges shall have concentric dials of I50 mm diameter, pressure gauges being graduated in meters head, and compound gauges in cm of mercury and meters head. Gauge graduations shall be such that the gauge is never used continuously beyond 60 per cent of the maximum graduation. The face of the dial shall have a warning label marked in red attached thereto reading in Amharic and English:

"IMPORTANT - TURN OFF WHEN NOT IN USE"
The gauge mechanism shall be of the Bourdon tube type, having stainless steel movements. It shall

be sealed from the liquid being measured by means of a diaphragm or capsule and be filled with silicone oil.
All gauges shall be fitted with a pressure snubber to dampen pressure pulsations.
Before the gauges are delivered to site, each gauge shall be tested in accordance with the relevant standards and a test certificate for each gauge, confirming that they are of the required accuracy, shall be sent to the Supervisor. Further copies of the test certificates shall be incorporated in the operating and maintenance manuals.

1.1.3.6 AIR VALVES

Air valves shall be double orifice type to suit a maximum working pressure of 1.6 MPa and a hydrostatic test pressure of 2.4 MPa. Valves shall have a cast iron body with two chambers, each housing a ball, one chamber having a cast iron small orifice plate with bronze seat, the other having a cast iron large orifice plate with rubber seat. The valves shall be supplied with rubber gaskets and cast iron splash covers.
Double orifice valves shall incorporate the characteristics of both the small orifice and the large orifice valves. The valves shall exhaust small pockets of air when line is under pressure, fully open the large orifice when the valve chamber is empty and fully close "drop-tight" when chamber is full of water.
Air valves shall have either an integral isolating valve or be mounted on an isolating gate valve.
Small orifice (air release) valves shall be float actuated and be open when the valve chamber is empty and closed "drop-tight" when the chambers is full of water. Internal levers, pins, screws, etc., shall be stainless steel or bronze.
Large orifice (vacuum breaking) valves shall have a ball sealed orifice, fully open when the valve chamber is empty and closed "drop-tight" when the chamber is full of water.
Surface boxes for air valves shall be constructed with precast concrete pipes and covers as shown on the construction standard drawings complete with locking chain, padlock and hardware.

1.1.3.7 AIR RELEASE VALVES

Body and cover: ductile iron confirming with ISO 1083:1987(E) grade 400-15, with flat faced Flange and built-in isolating ball valve.
Float: Coated stainless steel covered with rubber, stainless steel lever pins, retaining rings and screws.
Seat: BUNA-N

1.1.3.8 FLAP VALVES

Flap valves shall have cast iron frames and doors with non-ferrous metal facings. They are to be double hung with hinge pins and links of suitable non-ferrous materials.

1.1.3.9 VALVE KEYS

Valve keys shall be suitable for operating buried valves equipped with standard square operating nuts through the surface valve box. Keys shall be fabricated in a "T" configuration with length of approximately 1.5 m.

1.1.3.10 SPARE PARTS

The Contractor shall submit in his Technical File detailed parts lists and drawings for all valves, and meters, including a list of recommended spare parts and prices for each spare part.
The exact type and quantity of spare parts to be supplied will be determined by the Supervisor on the basis of the information submitted.

1.1.4 WATER METER AND TOOLS

1.1.4.1 GENERAL

The Work under this Contract: Goods – Supply of Pipes and Fittings, includes the supply and delivery of Water Meters and Tools and miscellaneous items in accordance with the specifications. The materials shall be delivered to a location specified above in section 1.

1.1.4.2 WATER METERS

Water meters shall consist of self-contained integrating measuring instruments continuously determining and displaying the volume of water flowing through them, employing a direct mechanical process involving the action of velocity of the water on the rotation of moving part, and conform to the recommendations of ISO 4064 or equivalent.

Water meters for potable water services and public fountains shall be a single rotary vane type, capable of withstanding a working pressure of 1.0 MPa (PN 10) with dry dial, completely waterproof encased gear train, flow indicator, register, magnetic coupling and conform to the following supplementary data. Nominal sizes shall be ½" and ¾" with male threaded end connections complete with tailpiece couplings on each end to connect the meter to threaded fittings which are the same nominal size as the meter.

(a) Threads shall be of a uniform standard throughout, compatible with threaded pipe, valve and fittings specified in these documents.

(b) Materials used in the construction of the meters shall be of the best quality, mechanically and chemically suited for the intended service conditions without any detrimental effect on the quality of the water.

(c) The flow indicator shall consist of a single pointer and circular scale which shall rotate whenever the flow through the meter is greater than the starting flow rate. One revolution of the pointer shall correspond to a fixed unit of flow.

(d) The register shall consist of a row of direct reading, in-line consecutive digits visible in one or more apertures, indicating totalized volume of water in cubic meters as following:

(e) The register shall consist of a row of direct reading, in-line consecutive digits visible in one or more apertures, indicating totalized volume of water in cubic meters.

(f) Tamper proof devices consisting of a wire and lead seal shall be provided for the register and the plug above the adjusting screw to protect against unauthorized opening and tampering with the meter.

(g) Meters shall be designed for a lifetime of ten (10) years under normal operating conditions. The Supply Contractor shall obtain and submit a separate written guarantee from the Manufacturer of the meters against defects due to five (5) years after the date of delivery. Meters which are found to be defective during this period shall be repaired or replaced by the Supply Contractor at no additional cost to the Owner

1.1.4.3 WATER METERS BOXES

Water meter boxes shall consist of precast, concrete pipe sections with concrete lid, locking chain and pad lock with key as shown on the drawings. Prefabricated metal boxes may be

considered as an alternative, subject to prior approval of the Engineer.

1.1.4.4 TOOLS

The Operation and Maintenance Tools are listed below. The supplier shall supply all the listed items as required. All the tools shall be new with a factory warranty. The tools shall be brand names that are commonly used in Ethiopia.

a. Complete set of tools to install/cut/repair/replace/ DCI pipes and fittings DN 60 to 300, including mechanical winches.

b. Lifting tools for DCI DN 60 to 300 pipes and fittings including 2 tripods and 2 mechanical chain elevators to lift 2 ton 3 m, hand operated. Including lifting sockets, pipe clamps, pipe wrenches, etc.

c. Complete set of tools to install/cut/repair/replace/ uPVC pipes and fittings DN 50 to 300.

d. Complete set of tools to install/cut/repair/replace/butt welding for HDPE pipes and fittings DN 50 to 150

e. Mobile work bench with parallel bench vice

f. Potable Electric Drill

g. Arc welding machine, mains power, 3 phase, 400v, 50 Hz, capacity 300A, with accessories

h. Arc welding accessory set

i. General purpose hydraulic jack

j. Punch & chisel set

k. Straight file set

l. Needle file set

m. Screw Driver Set

n. Hammer Set

o. Universal pliers combination set

p. Socket Wrench Set 23-46 mm

q. Hexagon wrench set 2-12 mm

r. Straight drill set 1-13 mm

s. Snap ring pliers

t. Oil gun

u. Torque wrench 6-60 kgfm

v. Pipe wrench 12" + 18" + 24" + 36" + 48"

w. Mechanic hand tool box & set

x. Electrician hand tool box & set

y. Plumber hand tool box & set

z. Wire stripper

aa. Terminal Pliers

1.1.4.5 SPARE PARTS

The Supplier shall submit in his Technical File detailed parts lists and drawings for all tools and meters, including a list of recommended spare parts and prices for each spare part. The Engineer on the basis of the information submitted will determine the exact type and quantity of spare parts

to be supplied.

1.1.4.6 WORKMANSHIP - HANDLING

The Contractor shall use every precaution to prevent damage to the materials supplied. Any damage from any cause during transport and before final acceptance by the Owner shall be repaired as directed by the Engineer, by and at the expense of the Contractor. Materials that can not be repaired shall be removed and replaced at the Contractor's expense.

Materials shall be loaded and unloaded without dropping, by hand or by using cranes or other equipment approved by the Engineer. The Contractor shall not roll or drop the materials from any conveyance used for hauling.

1.2 TECHNICAL SPECIFICATION OF UNPLASTICIZED POLYVINYL (UPVC) AND POLYETHYLENE (HDPE) PIPES AND FITTINGS FOR WATER SUPPLY SYSTEM

(OPTIONAL)

1.2.1 STANDARDS OF PIPES AND FITTINGS

The material quality, mechanical property, geometric property and physical property of unplasticized PVC pipes and fittings to be supplied shall meet the requirements of the ISO 4422 (1996) and standards referred therein. If the manufacturing standard is other than ISO 4422, then the bidder shall confirm in writing that the offered standard is equivalent to ISO 4422 and shall attach one copy of the quoted standard in the technical proposal.
The supplier shall submit technical data sheet and brochure (issued by the Manufacturer that includes the offered items. The supplier/manufacturer shall mark in red ink the specific items (with nominal pressure & nominal diameter) in the brochure that he intends to offer.

1.2.2 TYPES OF JOINTS

The pipes shall be socket and spigot type. The socket end of the pipe shall be either for cold welding or rubber ring push-fit connection. The supplier shall specifically state the type of joint of the offered pipes.
All fittings shall be of the socket type for cold welding only, unless otherwise described in the BOQ.
If the offered pipes are of push-fit type, they shall be provided with appropriate type of gasket and lubricant. The supplier shall specifically state in the priced & up-priced BOQ whether the offered pipes are cold welding or push-fit type.
The supplier can quote alternative offers for push-fit and cold welding type of pipes. But, this shall be shown separately in the BOQ.

1.2.3 LENGTH OF PIPE

The total length of each pipe shall not be less than 5.5 meters. The effective length is the total length minus the socket length. The dimensions of the socket shall be in accordance with the relevant standard of ISO or equivalent. The total length of pipes to be supplied shall be calculated based on the 5.5m effective length of each pipe.
The effective length should strictly be marked on both ends of each pipe. Failure to fulfill this requirement will lead to rejection.

1.2.4 WALL THICKNESS

The wall thickness of the pipes shall be as per ISO 4422 (1996); Table 1 of SDR for PN 16 and 13.6, Table 2 of SDR 26 for PN 10. The supplier shall indicate the nominal wall thickness of each offered pipe diameter in the technical data sheet or clause-by-clause commentary.

1.2.5 WEIGHT

Weight per linear meter of each offered pipe shall be indicated in the technical data sheet or in the clause-by-clause commentary of the technical specification

1.2.6 TOLERANCES

Dimensions and tolerances shall comply with conditions of the standards mentioned under clause 1.1, 1.3 and 1.4 above.

1.2.7 WORKING PRESSURE

The minimum working pressure to be sustained in continuous use at a temperature of 20^0C shall be 10 bars for pipes greater than or equal to DN 110; and 16 bars for pipes less than DN 110 and for all fittings and appurtenances unless otherwise specified in the BOQ.

1.2.8 INTERNAL PRESSURE PROOF TEST

All pipes and fittings to be offered shall be subjected to a works hydrostatic test pressure, which is the pressure the tubes must sustain without bursting during one hour, at a temperature of 60^0C, of 50 bars.

1.2.9 CHEMICAL RESISTANCE

Supplier is obliged to list all chemicals against which the offered pipes and fittings are non-resistant or of limited resistance.

1.2.10 COMPOSITION

The unplasticised polyvinyl chloride (uPVC) pipes and fittings shall be comply the material stated in the latest version of ISO 4422 parts 1, 2 and 3. The comprising materials shall contain at least 15% of pure polyvinyl chloride. No plasticizing material shall be used. The pipes shall be opaque and gray color.

1.2.11 SHOP TESTING AND INSPECTION

Inspection of external appearance, shape, dimensions and weight shall be carried out for each pipe and fitting. Pipes and fittings shall be straight and shall be stripped with care to avoid warping. All pipes and fittings shall be sound and free from surface defects. Mechanical tests for hardness, tensile strength, and elongation shall be performed on test pipes selected at random out of batches grouped in lots according to the manufacturer's quality control schedule approved by the client. Each successful tested batch will be identified by a mark.

Results of all such tests shall be submitted to the client on a previously approved form of certificate.

1.2.12 ADHESIVE

The adhesive for jointing of uPVC pipes and fittings shall present a basis of polyvinyl chloride organic solvents. An adhesive complying with the requirements of French Norms (Norms Francaise) NF pr T50040 shall be designated consisting of such information as:
" PVC strong solvent adhesive (Solvent Cement) for the function of unplasticized polyvinyl chloride piping elements".
Moreover, low viscosity and quick drying types are preferable.

1.2.13 WARNING TAPE

Pipes shall be supplied together with warning tapes. The warning tapes shall be made of PE with metal threads or wires that enable the buried pipes to be detected by metal detectors. The color of the warning tape shall preferably be blue. The warning tape shall be over printed in appropriate and readable color with a marking of "Addis Ababa Water and Sewerage Authority". The dimensions of the warning tape shall be minimum 150 mm wide and having min. thickness 0.15 mm (excluding the wire) in 200 meters roll.
The total length of the warning tape to be supplied is as indicated in the B.O.Q.

1.2.14 MECHANICAL COUPLINGS

Mechanical couplings are those with bolts and nuts connection with central sleeves, which are suitable and appropriate for joining plain ends at uPVC, GS, DCI or Steel Pipes.

1.2.15 MARKINGS

Pipes and fittings shall be marked as indicated in the general specification or as indicated in part 3" Technical Evaluation Criteria and Merit Point Allocation" item 8 of this section.

1.3 PARTICULAR TECHNICAL SPECIFICATION OF HDPE PIPES AND FITTINGS

(Optional)

1.3.1 STANDARDS OF PIPES AND FITTINGS

High Density Polyethylene (HDPE) pipes and fittings suitable for cold water supplies shall meet the requirements of **ISO 4427** and standards referred therein. If the manufacturing standard is other than **ISO 4427**, then the bidder shall confirm in writing that the offered standard is equivalent to ISO 4427 and shall attach one copy of the quoted standard in the technical proposal.
The supplier shall submit technical data sheet and brochure (issued by the Manufacturer that includes the offered items. The supplier/manufacturer shall mark in red ink the specific items (with nominal pressure & nominal diameter) in the brochure that he intends to offer.

1.3.2 TYPES OF JOINTS

The connection between pipes shall be made using either brass or plastic quick connectors/joints.

1.3.3 LENGTH OF PIPE

HDPE pipes are to be supplied in standard coils of 100 meters length for diameters up to 2

inch (63 mm) and 50 meters length for diameters above 2 inch (63 mm). Coiled pipes shall be supplied with re-rounding equipment. The minimum diameter of a drum for coiled pipes shall be 18 x DN so that kicking of the pipes is prevented.
Two re-rounding equipments shall be supplied for diameter up to 75 mm and two re-rounding equipments for DN 90 and 110 mm. Two sets of Chamfering tools (150 - 300) shall be provided.
For pipe diameter greater than or equal to 150mm, the total length of each pipe shall not be less than 6.0 meters

1.3.4 TOLERANCES

The dimensions of the pipes shall be in accordance with **ISO 3126**, and the nominal outside diameters shall conform to **ISO 161-1**. The tolerances on the outside shall be in accordance with **ISO 11922-1**.

1.3.5 DESIGN STRESS

The required Polyethylene pipes must have a design stress **of 6.3 MPa**.

1.3.6 WORKING PRESSURE

The minimum working pressure, which pipes, fittings and appurtenances to be supplied shall sustain is 16 bars (PN 16) for diameters up to 2 inch (63 mm) and 10 bars (PN 10) for diameters above 2 inch (63 mm) respectively at a water temperature of 20^0 C.

1.3.7 CHEMICAL RESISTANCE

The Supplier is obliged to list all chemicals against which the offered pipes and fittings are non-resistant or of limited resistance.

1.3.8 COMPOSITION

The high-density polyethylene (HDPE) pipes shall be made from first quality virgin material containing anti-oxidants, UV Stabilizers and pigments and must be suitable for cold water supplies. The HDPE pipes must be non-toxic, non-contaminating and completely resistant to corrosive and aggressive soils and waters. The pipes shall be opaque or blue (preferably) or black or black with blue stripes in color. For black pipes the Carbon Black content in the compound shall be 2.25 or 0.25 % by mass in accordance with ISO 6964. The materials of the stripes shall be of the same type of resin as used in the base compound for the pipe.

1.3.9 SHOP TESTING AND INSPECTION

Inspection of external appearance, shape, dimensions and weight shall be carried out for each coil of pipe and fitting. All pipes and fittings shall be sound and free from surface defects. Mechanical tests for hardness, tensile strength, percentage elongation, elasticity, yield stress and standard weight density shall be performed on test pipes selected at random out of grouped coils according to the manufacturer's quality control schedule approved by the client. Each successful tested coil will be identified by a mark. Results of all such tests shall be submitted to the client on a previously approved form of certificate.

1.3.10 WARNING TAPE

Pipes shall be supplied together with warning tapes. The warning tape shall be made of PE

with metal threads or wires that enables the buried pipes to be detected by metal detectors. The color of the warning tape shall preferably be blue. The warning tape shall be over printed in appropriate and readable color with a marking of the Project. The dimensions of the warning tape shall be minimum 150mm wide and having minimum thickness 0.15mm (excluding the wire) in 200 meters roll.

The total length of the warning tape to be supplied is as indicated in the B.O.Q.

1.3.11 RIGID LINERS

At time of connecting two ends of HDPE pipes or one end with fitting, rigid liners are inserted into the pipe ends to keep them straight and suitable for accommodating the quick connectors or any appropriate type of fittings. Thus, liners have to be provided in quantities indicated in the B.O.Q. The length of each liner shall be minimum 10 cm.

1.3.12 RE-ROUNDING EQUIPMENT

HDPE pipes shall be supplied with turrets (small tower on top of a largest tower) on metal frames on which coils will be installed for an easy uncoiling. One equipment shall be supplied for DN 20 up to 63mm pipes; and one equipment shall be provided for >DN 63 up to 110mm pipes. The cost of this equipment should be distributed to all pipe costs.

Failure to fulfill this requirement shall lead to a **rejection**

1.3.13 MARKINGS

Pipes shall be marked at maximum intervals of 3 meter, indicating at least the following information**:**

The manufacturer's name and/or Trade mark.
Nominal Outside diameter x Nominal wall thickness
The Nominal Pressure
The designation of the pipe material (PE 110, PE 90, ... PE 20)
The Manufacturing Standard (ISO) number.

1.3.14 QUALITY ASSURANCE CERTIFICATE

The supplier should submit a quality test certificate of the pipe material for potable water, which is in accordance with ISO standards.

1.4 PARTICULAR TECHNICAL SPECIFICATION FOR UNPLASTICIZED PVC (UPVC) SEWER PIPES AND FITTINGS

Unplasticized PVC (uPVC) pipes and fittings shall meet the requirements of the latest version of ISO 161/1, DIN 8061/62, ISO 4422, ISO 4435, BS 4660, BS 5481, ISO 265-1, DIN 19534, ISO 3473 and standards therein related or other equivalent standards. If other equivalent standards are quoted, its equivalency shall be confirmed in writing and attached in the technical proposal together with a copy of the quoted standards.

1.4.1 TYPES OF JOINTS

Joints shall be of the spigot and socket type with rubber sealing rings unless and otherwise specified in the BOQ. Specifications for sealing rings shall be submitted with the Technical File.

1.4.2 JOINT CHARACTERISTICS

The jointing of the pipes and fitting, shall be the socket and spigot type, and shall be automatic with rubber sealing rings. Unless specified elsewhere herein, no other types of joints will be considered.

The joint is considered automatic when the mere assembling into final position of the socket and spigot ends, or of the sleeve and plain ends, after these ends have been cleaned and lubricated and the sealing rings have been inserted in the corresponding grooves, ensures by itself the continuity of the sewer line and its water-tightness without any other action such as cementing or screwing.
The automatic rubber ring joints shall allow for a deviation between successive pipes on moderate curves without the need for special fittings. The supplier shall indicate in the Technical File the maximum deviation angle between the axes of two successive pipes, expressed in degrees, for which the tightness of the joint shall still be warranted.

The sealing rings shall be made of natural or synthetic rubber, offering chemical inertias compatible with those of the pipes and fitting. The rings shall provide an effective seal against internal and external water pressure and against penetration by tree roots.
The natural or synthetic rubber used for the sealing rings shall comply with the following requirements:

a) The residual loss of thickness measured on a test piece of 10 mm thick, kept for three days at a temperature of 200 C under a constant pressure reducing its thickness to 6 mm, and shall not exceed 0.50 mm**.**
b) After artificial aging for ten days in a stove at a constant temperature of 700 C, the rupture strength and elongation of the test piece shall not have changed by more than 25 percent, or its hardness by more than ten international degrees.

1.4.3 FITTINGS

All fittings shall have the same physical characteristics and shall belong to the same strength class as the pipes of the same nominal diameter with which, they are to be installed. All fittings shall be socket and spigot type with rubber sealing unless and otherwise specified in the BOQ. In addition, fittings shall conform to ISO 265 and 2056.

1.4.4 GEOMETRICAL CHARACTERISTICS OF PIPES AND FITTINGS

The sewer pipes shall be internally cylindrical with a circular cross section. They shall be designated by their nominal diameter, strength class and wall thickness. Diameters and thickness shall be expressed in millimeters.

The internal cylinder generating lines shall be straight over the full nominal length of the pipes. The wall thickness of the pipes and fittings shall be uniform along the whole length, with the exception of the jointing areas. Unless otherwise specified by the standards relevant to each particular type of pipe, the minimum thickness of the pipe barrel walls shall not differ from the maximum thickness by more than five percent of the latter or by more than 3

mm if the maximum thickness is less than 60 mm.
The ends of pipes and fittings shall be plane and perpendicular to the generating lines.

Fittings for service connections shall be as follows:

a) Junctions

Junctions shall be 90^0 tee fittings. The bidder in the Bill of Quantities shall indicate the type offered. All Junctions shall have 150 mm diameter branches regardless of the size of the main pipe. The length of run and branch shall be as short as practical. The internal surfaces shall be smooth and the end of the branch shall not project into the main pipe. All junctions shall be made in one piece.

b) Saddles

Saddles shall provide a 90^0 tee junction with the main pipe. The bidder in the technical file shall indicate the type offered. The diameter of the branch should be150 mm. The joint of the socket type saddle with the main pipe shall be easily made in the field and shall provide a tight seal with no projections of the branch pipe inside the internal section of the main pipe. All accessories necessary for the fixing of the saddle to the main pipe shall be supplied with each saddle unit. A complete description of the saddle and instructions for its fixing to the main pipe shall be furnished with the technical file.

c) Bends

Bends shall have a nominal diameter of 150, 200, 250 mm or above according to the requirement and their angle shall be 45˚ or 90˚ as specified. The useful length along the centerline shall be between 300 and 500 mm. Bends shall have a wall thickness not less than that of the 150 mm diameter pipe.

1.4.5 LENGTH OF PIPE

The effective length of pipes shall be a minimum of 5.5 meters. Effective length less than 5.5 m is not acceptable. The total length to be supplied shall be calculated based on the 5.5 m length of each pipe. The effective length is the total length minus the socket length. The effective length should strictly be marked on both ends of each pipe.

1.4.6 TOLERANCE

Dimensions and tolerances shall comply with conditions of the standards mentioned under clause 1.1 above.

1.4.7 CHEMICAL RESISTANCE

The supplier is obliged to list all chemicals against which the offered pipes and fittings are non-resistant or of limited resistance.

1.4.8 COMPOSITION

The unplasticized polyvinyl chloride (uPVC) pipes and fittings shall be made from first quality

resins. The comprising materials shall contain at least 15% of pure polyvinyl chloride. No plasticizing material shall be used.

1.4.9 COLOR OF PIPES AND FITTINGS

The color of uPVC Sewer pipes and fittings shall be opaque and orange brown or golden brown..

1.4.10 SHOP TESTING AND INSPECTION

Inspection of external appearance, shape, dimensions and weight shall be carried out for each pipe and fitting. Pipes and fittings shall be straight and shall be stripped with care to avoid warping. All pipes and fittings shall be sound and free from surface defects.
Mechanical tests for hardness, tensile strength, and elongation shall be performed on test pipes selected at random out of batches grouped in lots according to the manufacturer's quality control schedule. Each successful tested batch shall be identified by a mark.

Results of all such tests shall be submitted to the client on a previously approved form of certificate.

1.4.11 PIPE BEDDING AND SURROUNDING CONDITIONS

All sewer pipes will be laid on a bed of a selected material which has been well compacted. The minimum thickness of bedding material below the barrel shall be 100 mm. The bedding material will evenly support the pipe, except at the joints where grooves will be dug in the bedding material, for the whole width of the trench bottom. Once the pipes are laid and jointed, the pipe bed will be extended up to the level of the pipe horizontal diameter with the same material compacted in layers no thicker that 150 mm each.
Two alternative types of pipe bedding and surrounding are to be used according to loading conditions and pipe material and strength. The bidder may have the liberty to look in to the following two alternative types of pipe bedding and surrounding in order to verify that the pipes and fittings to be supplied fit to the bedding condition without any adverse impact on them.

Type 1

In Type1, pipe bedding will consist of granular material containing less than 12 percent of particles smaller than 0.1 mm in diameter, and no particles larger than 20 mm. Moreover, the materials shall be well graded in accordance with the following formula:

$$\frac{D_{60}}{D_{10}} < 4 \quad and \quad 1 < \frac{(D_{30})^2}{D_{10} X\ D_{60}} < 3$$

Where D is the mesh dimension, which allows 10, 30 or 60 percent of the sample to pass the given sieve size. The pipe bedding material will extend above the pipe horizontal diameter for a height of at least 200 mm above the top of the pipe. Above the bedding material the backfill will be done with well-graded soil selected from excavated trench material which contains no lumps or particles larger than 30 mm in the largest dimension. This material shall be hand placed and compacted in lifts not exceeding 150 mm in thickness to a minimum of 200 mm above the top of the extended bedding material.

The remainder of the trench shall be back filled with excavated trench material from which stones larger than 200 mm in maximum dimension, roots, stumps or other debris that would prevent consolidation have been removed. This material shall be placed and compacted in layers not exceeding 300 mm in thickness.

Type 2
In Type 2, pipe bedding shall be concrete for the whole width of the trench and the concrete shall extend above the horizontal diameter up to 200 mm over the top pipe. The remainder of the trench shall be back filled as for type 1. The concrete shall be type 2 concrete, containing 200 kg of class 210/325 ordinary Portland cement per cubic meter of concrete.

When underground water is encountered and the quantity to be removed does not exceed 1.0 liter per meter length, half of the minimum bedding thickness below the pipe barrel shall consist of a drainage layer of crushed stone or gravel of a size ranging from 20 to 50 mm. The bottom of the trench will have a minimum transverse slope of 3 percent, and the top of the drainage layer will be horizontal.

If the quantity of underground water to be removed exceeds 1.0 liter per minute per meter, the trench shall be deepened by a minimum of 200 mm with its bottom sloped as above. In addition, a longitudinal gully of 300 mm width and depth shall be dug along the low side. The gully shall be filled with stones of a size ranging from 50 to 150 mm. Backfill up to the bottom of the normal bedding shall be crushed stone or gravel in size from 20 mm to 50 mm.

1.4.12 DETERMINATION OF MINIMUM PIPE STRENGTH

Trench and soil characteristics mentioned in clause 1.13 herein above and pipe bedding and surrounding conditions mentioned in clause 1.14 shall be considered in the determination of minimum pipe strength. A live load corresponding to a truck wheel weighing 65 KN shall also be considered. The type of bedding adopted for each range of trench depth shall be indicated in technical proposal.
Fittings shall belong to the same strength class as pipes of the same diameter if the pipes and fittings are produced by a licensed factory under a certification scheme operated by ISO, with periodical inspection of the manufacturer's works complete particulars of the terms of license, in English, shall be furnished with the Technical File. The Standard dimension ratio shall be SDR 41.

1.4.13 WATER STOPS FOR MANHOLE CONNECTIONS

UPVC pipes which have a coating to which concrete will not bond shall be supplied complete with rubber ring water stop to provide watertight connections to concrete manholes.

1.4.14 STORING, HANDLING AND HAULING OF PIPES AND FITTINGS

The Supplier shall provide protection to the approval of the Engineer for the ends of all pipes and fittings prior to the pipes and fittings leaving the place of manufacture in order to guard them effectively against damage during transit.
All details of the proposed method of providing such protection shall be submitted at the time of tendering with the Technical File.
Every precaution shall be taken to avoid damage to pipe and fittings. In handling pipes and fittings, every care shall be taken to avoid distortion, flattening, denting, scoring or other damage. Pipes and fittings shall not be allowed to drop or strike objects and shall be lifted or lowered from one level to

another by means of approved equipment only.

When lifting pipes and fittings, special lifting hooks with curved plates to fit the curvature of the pipes or fittings shall be used. Alternatively, webbing slings not less than 300 mm wide or other approved means shall be used. Cushions shall also be provided between securing chains or lashings when loads are being transported. Pipes and fittings shall be stored in orderly fashion at Addis Ababa storage areas. UPVC pipes shall be stored in pyramidal stacks, but in stacks no more than 1.50 meters high. Each stack shall contain pipes of the same diameter only. Socket and spigot pipes shall be stacked in alternately inverse layers so as to allow the pipes in one layer to rest on the whole barrel length of the pipes in the lower layer. Fittings and sleeves shall be carefully stored apart so as to use the minimum space and provide adequate protection and the rubber gaskets shall be kept in cases.

SECTION VI (b-2)

TECHNICAL SPECIFICATIONS

FOR

CONSTRUCTION SECTION

TABLE OF CONTENTS

1 SITEWORKS AND EARTHWORKS

1.1 SITE PREPARATION

1.1.1 Scope

The works under this Chapter include site clearance and any demolitions that may be required, protection of any existing structure or element that must remain intact, etc. prior to commencing the above works the Contractor shall obtain all necessary licenses and permits required for performance.
General clearing and grubbing work shall consist of scraping soft soil up to 200 mm depth, clearing, grubbing, removing and disposal of all vegetation including trees of girth less than 0.15 Mts. And debris which are within the site, except vegetation and objects designated to remain. The work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

1.1.2 Site Clearance – General

The areas of all sites and access roads (weather temporary or permanent), and other areas as directed by the Engineer shall be cleared of all standing or felled trees, stumps, brush, logs buildings, debris, rubbish and other objectionable matter.
The Contractor shall not commence clearing any area and/or demolition's without having received written instruction from the Engineer.

1.1.3 Clearing of Vegetation

Trees, stumps and brush shall be cut off flush with the ground in all areas to be cleared, except in areas to be grubbed as prescribed in Sub-Clause 21.1.4 The clearing shall be maintained until completion of the works. All trees outside the areas to be cleared and such other trees that are not to be removed shall be carefully protected from damage during the work operations, and no trees shall be remove without the prior consent of the Engineer. All cut trees shall remain the property of the Employer, and the Contractor shall collect these trees and store them until required by the Employer.

1.1.4 Grubbing

In addition to the clearing to be carried out as specified in Sub-Clause 21.1.3, the stamps and roots of trees and brush shall be grubbed in areas at the sites of all earth fill construction, structures, and elsewhere as directed.

1.1.5 Disposal of Trees, Roots, Etc.

Except for trees which shall remain the property of the Employer, as under Sub clause 21.1.2, all materials from required clearing and grubbing shall be removed from the area, burned completely, or disposed of in a manner satisfactory to the Engineer.
All materials to be burnt shall be piled and all burning shall be so through that the materials will be reduced to ashes. Piling for burning shall be done in such manner and in such locations as to cause the least fire hazard and in such locations as to cause the least fire hazard and nuisance to inhabitants of the area. The Contractor shall have available at all times, for use in preventing and suppressing fires, apparatus and fire-fighting equipment satisfactory to the Engineer. When, in the opinion of the Engineer, the fire hazard is great, burning shall be deferred or additional fire-fighting equipment shall be provided.

All Materials not burned to ashes shall be disposed of by removal from site of the works, and upon removal such materials shall become the property of the Contractor who shall dispose of them by burial in locations and in a manner approved by the Engineer.

1.2 PIPELINES IN BUSH AREAS

Where pipelines pass through bush areas the contractor shall clear a 6m wide strip along the route of the pipeline.
All trees, stumps and roots shall be removed to a minimum of 30cm below the finished grade of the pipeline, or killed, within a strip of two meters on either side of the pipeline.

1.3 PIPELINES IN CITY AREAS

Where pipelines pass through city or town areas the contractor shall take all appropriate measures to protect from damages of adjacent properties like fence, buildings, etc. Furthermore, underground lines like water supply, electric, sewer, telephone, etc shall be protected from interruptions and damages. The Contractors shall give the plan of action well ahead of time (not less than 6-weeks) before the commencement of the works in this area.

1.4 REMOVAL AND REPLACEMENT OF SOD

Where excavation is made across lawns on private property over which the Employer has secured passage or right-of-way, the Contractor shall remove and carefully store sufficient sod and topsoil to repair damage-cased to lawns. Sod shall be replaced on graded topsoil and shall be neatly fitted and well tamped with flat wooden tampers. The cost of removal and replacement of sod shall be included in the rates of excavation.

2 EARTHWORKS

2.1CLASSIFICATION

All excavation shall be performed in accordance with local and ILO safety regulations. Excavation will be classified as “rock excavation” or “common excavation” in accordance with the following definitions of the material excavated.

2.1.1 Rock Excavation

“Hard Rock” shall mean intact or slightly weathered solid rock as found in ledges or masses in its original position, which can only be loosened by blasting or by pneumatic tools, or if excavated by hand, by wedges and sledge hammers or specialized rock breaking hammers. Rock which is in a shattered from moderately to highly weathered conditions and/or is capable of being loosened by rippers of earthmoving plant up to 150 h.p. or giving way to pick-axes with some effort is excluded from the definition of hard rock. The loose rock material as such may be classified as “soft rock” if so defined in the preamble to the schedule of rates. Boulders and detached pieces of rock (as defined above having a volume of more than 0.1 cubic meter will also be classed as hard rock.

No material, except the aforesaid, will be defined as rock and classified as such for the purposes of payment, whether loosened by blasting, pneumatic tools or otherwise. To remove any doubt, it shall be understood that hardpan, decomposed or soft rock, cemented gravel, shale, red ash, etc. even though it may be advantageous to use explosive in their removal, will in no case be classified as rock.

Nothing in the Contract shall entitle the Contractor to be paid for excavation in rock unless, at the time the excavation is open and visible, the Contractor shall have given notice in writing to the Engineer that he claims to be paid for excavation in rock. After giving such notice the Contractor shall not fill in the excavation or otherwise prevent the excavation from being inspected until the Contractor and Engineer have jointly examined and measured the work.

The excavated rock, subject to locally applied regulations, shall remain the property of the Employer and stock piling or disposal should be as directed by the Engineer.

All agreements between the Contractor and the Engineer as to whether or not excavation is in rock, and the quantity thereof, shall be duly recorded and signed by the Contractor and the Engineer.

Compliance with the foregoing provision in relation to recording of excavation in rock and the quantities thereof shall be a condition precedent to the right of the Contractor to be paid for excavation in rock and such record shall be final and binding between the parties as to the quantity of excavation in rock.

2.1.2 Common Excavation

The excavation of all other materials, whether hard or soft to which the definition of “hard rock or soft rock” as above does not apply, shall be considered as “common excavation.”

3 CONCRETE

3.1CONCRETE

3.1.1 Scope and Standards

This Chapter describes the quality of materials and workmanship of concrete and reinforced concrete works cast in situ in all parts of structures below or above ground.

The specification shall apply to concrete prepared on site as well as ready mixed concrete and small pre-cast concrete elements. It is based on BS8110: 1997 in general, and on BS8007: 1987 in respect of exposure of concrete to water and moisture.

The standards and Codes of Practice, detailed below are by reference made part of this Specification.

E	BCS 2:1995 Structural use of Concrete
E	S C.D3.201 Normal Concrete Aggregates
E	S C.D5.201 Portland Cement General Requirements
ES C.D8.490	Portland Cement Methods of Sampling & Testing
BS	Portland cement (ordinary and rapid hardening)
BS 410	Test sieves
BS 812	Methods for sampling and testing of mineral aggregates, sands and filters
BS 882	Aggregates from natural sources for concrete
BS 1305	Batch type concrete mixers
BS 1370	Low heat Portland cement
BS 1881	Guide to use of non-destructive methods of test for hardened concrete
BS 3148	Tests for water for making concrete
BS 4449	Carbon steel bars for the reinforcement of concrete
BS 4466	Bending dimensions and scheduling of bars for the reinforcement of concrete
BS 4482	Steel wire for the reinforcement of concrete
BS 4483	Steel fabric for the reinforcement of concrete
BS 4550	Methods for testing cement
BS 5075	Concrete admixtures
BS 5135	Metal-arc welding of carbon and carbon manganese steel
BS 8007	Code of practice for the design of concrete structures for retaining aqueous liquids
BS 5606	Code of practice for Accuracy in Building
BS 4027	Sulphate Resisting Portland Cement
BS 8110	Structural use of concrete – parts 1-3

ASTM standard C309 Liquid membrane forming compound for curing concrete ASTM standard C260 Air entraining admixtures for concrete

In case of discrepancy or contradiction, the requirements of this specification shall rule over any standard.

3.2 CLASSIFICATION OF CONCRETE

3.2.1Normal Concrete

All normal concrete (i.e., other than mass concrete as specified below) to be used in reinforced and plain structure is classified in the contract documents according to required strength grade as per Table 1 and to (exposure) class as per Table 2.

Table 1:Grades of Concrete and Strength Requirements

Grade	Characteristic Strength N/mm^2	Cube Strength at 28 days, in N/mm^2 Work Cube [1] Average	Each Individual	Trial Mix [1] Average
10	10	12.3	8.5	
15	15	20.0	12.8	21.5
20	20	27.5	17.0	31.5
25	25	32.5	21.3	36.5
30	30	37.5	25.5	41.5
40	40	47.5	34.0	51.5
50	50	57.5	42.5	61.5

[1] Note: Concrete may be accepted the basis of 7 days cube strength, provided the average strength is at least 70% of the required 28 days strength.

Table 2: Minimum Cement Content (kg/m^3) required for Classes of Exposure

Class	Reinforced Concrete					Plain Concrete				
	Max. Size of Aggregate, mm				Max. Free Water Cement Ratio	Max. Size of Aggregate, mm				Max. Free Water Cement Ratio
	40	20	14	10		40	20	14	10	
E Severe	320 (290)	360 (330)	390 (350)	410 (370)	0.45	270 (240)	310 (280)	330 (300)	360 (320)	0.50
F Moderate	260 (240)	290 (260)	320 (290)	340 (310)	0.55	220 (200)	250 (230)	280 (250)	300 (270)	0.60
G Mild	220 (200)	250 (230)	270 (250)	290 (260)	0.65	200 (180)	220 (200)	250 (220)	270 (240)	0.70

Notes: The minimum cement content may be reduced, as given in brackets when:

1. Trial mixes have verified that a concrete with a maximum free water cement ratio not greater than that given for the particular concrete can be consistently produced and that it is suitable for the conditions of transporting, placing and compaction.

2. The maximum free water/cement ratio is strictly controlled by a site laboratory.

3. The cement content shall comply with requirements of Table 2. The actual amount of cement needed for each type of concrete in the various parts of the structures shall be determined by the tests as specified hereinafter, taking into consideration actual site conditions.

4. No change in the unit rates submitted for concrete will be allowed, if the actual quantity of cement used to obtain a specified concrete characteristic strength (grade) is greater than the minimum cement content specified in Table 2.

3.2.2 Concrete Designation

Concrete may be named on the Drawings and in the Bills of Quantities as follows:

Normal Concrete will be designated by three symbols: the first number stands for grade as to strength (Table 1), the middle letter stands for class of exposure (Table 2), the last figure stands for the maximum size of aggregate. Thus, for example, 20-f-40 designates a concrete having a characteristic strength of 20 N/mm2, class of exposure F, and maximum size of aggregate 40 mm.

3.3 CEMENT

3.3.1 Quality

All cement shall be Portland cement of approved manufacture. Unless otherwise specified, it shall be ordinary Portland cement complying with BS 12.

Rapid-hardening Portland cement shall not be used in mass concrete. Low-heat Portland cement complying with BS1370 may be used for mass concrete.

A certificate that the consignment complies in all respects with the approved standard shall be forwarded to the Engineer with each consignment.

The Engineer reserves the right to subject the deliveries to independent tests and to reject without question such cement that fails to comply with the specification or fails to produce concrete of the quality or of the rate of hardening specified. All such rejected cement shall forthwith be removed from the site of the works.

3.3.2 Supply

The supply of cement to the site shall be made in whole and original bags, marked with the trade mark of an approved manufacture or in special closed bulk containers manufactured expressly for this purpose. Cement from torn bags or cement which has been split and swept up shall not be used.

The Contractor shall inform the Engineer in writing at least 30 days before first shipments are required, concerning the mill or mills from which the cement is to be acquired and the purchase order number, contract number, or other designation that will identify the cement to be used by the Contractor.

3.3.3 Storage

In order that cement may not become unduly aged after delivery, the Contractor shall use cement in the chronological order in which it was delivered on the job. Each shipment shall be stored so that it may readily be distinguished from other shipments. The cement shall be free of lumps and shall be otherwise undamaged when used in concrete.

Sacked cement shall be stored in a watertight and weatherproof shed a floor raised at least 150mm from the ground. Stacking cement bags to a height exceeding ten layers will not be permitted. Any cement damage by water or otherwise defective and damaged bags of cement will be rejected and shall be removed from the site immediately.

Bulk cement shall be stored in weatherproof bins or silos to be approved by the Engineer. The bin shall be emptied and cleaned at regular intervals as directed by the Engineer.

The use of sacked cement which has been stored for more than three months after delivery will not be permitted, except when it is proved by tests, to the satisfaction of the Engineer that it complies with the requirements of the Specification.

3.3.4 Contractor's Responsibility

A suitable quantity of approved and certified cement shall always be available on site in order to ensure continuity in case of the rejection of a consignment by Engineer.

If the Contractor has used cement for which no certificate of compliance with the standards was submitted as required in Sub-Clause 31.3.1 above or, where the Engineer has ordered independent tests, before obtaining results of such tests, and the cement is later found defective in quality, the Engineer shall have the right to reject that portion of the structure constructed with this cement and the Contractor shall be obliged to dismantle or demolish such structure and reconstruct it at his own expense and with a cement complying with the requirements.

3.3.5 Water

Water for mixing and for curing concrete mortar and grout shall be free from objectionable quantities of silt, organic matter, alkali salts, and other impurities. The source of the water to be used shall be subjected to the Engineer's approval.

Where tests are required they shall be in accordance with BS 3148.

3.4 AGGREGATES

3.4.1 General

Aggregate for concrete (including for granolithic) shall be coarse aggregate and fine aggregate confirming in all respects to BS 882: 1983.

The grading shall be such as to produce a concrete with the specified properties and consistency and one that will work readily in position without segregation and without the use of an excessive water content and can be readily compacted into a dense impervious mass.

Aggregate for concrete shall be furnished by the Contractor from approved sources, provided that they meet the requirements of the above standards. The approval of any sources by the Engineer shall not be construed as constituting the approval of all materials taken from these sources and the Contractor will be held responsible for the specified quality of all such materials used in the works. Specimen samples of aggregates for concrete shall be submitted to the Engineer for approval before any order is placed. Such approval will not relieve the Contractor of the responsibility of satisfying himself before placing an order that the aggregate will conform to BS882. All aggregate as delivered to the batching plant, shall have uniform and stable moisture content.

The Contractor shall test all aggregates as ordered by the Engineer, including tests for sulphates and chlorides, and shall provide such facilities as may be necessary for procuring representative test samples. The Contractor shall prepare, for preliminary tests and approval, a representative sample of fine aggregate and of each size of coarse aggregate proposed for use in the works at least 30 days before the aggregates are required for use. The cost of all tests required under this Clause as well as the supply of representative samples shall be spread over the items for concrete work inserted in the Bill of Quantities.

During construction, the sizes of the coarse aggregates and grading of the fine aggregates shall be determined at least once for every 100 tones supplied, and at least once a week a check shall be made on supplies to ensure that the required grading is being maintained. If any aggregate or sand when so tested does not meet the requirements of the relevant Standard, the

Contractor shall forthwith cease to use that aggregate or sand and shall correct the quality and/or grading of the aggregate or sand without cost to the Employer.

If aggregates are bought to the site in separate loads containing aggregate of one size, they shall be stored in such a way as will prevent aggregates of different sizes being mixed together. Aggregates mixed either in transport or on site will be rejected. Unloading shall be done in such a way as to prevent excess segregation as directed by the Engineer.

All aggregates, sand and stone intended for use in the works shall be stored on a concrete floor or a screened and well drained surface to the approval of the Engineer to prevent contamination by contact with ground.

A stock of aggregates permitting concreting operations for at least 5 days shall be available on the site.

All sand and coarse aggregate, when required by BS 882, shall be washed in clean fresh water at no extra cost to the Employer.

3.5 CURING OF CONCRETE

3.5.1 General

From casting until the end of the specified minimum curing period the concrete shall be kept constantly moist and adequately protected against damage due to fluctuation in surface temperature.

3.5.2 Water Curing

Concrete cured with water shall be kept wet for at least 7 days for class ‘G’ concrete and 10 days for Classes ‘E’ and ‘F’ and mass concrete, immediately following placement of the concrete, or until covered with earth or fresh concrete, by ponding or covering with water-saturated material or by a system or perforated pipes, mechanical sprinklers, or porous hose, or by any other approved method which will keep all surfaces to be cured continuously and not periodically wet. Water used for curing shall meet the requirements of Clause 31.4. The unformed top surfaces of walls, roofs and slabs shall be protected, immediately after finishing operations have been completed, against the detrimental action of sun, wind or rain, as directed by the Engineer.

4 EARTHWORKS FOR PIPELINES

4.1GENERAL

Earthworks under this Chapter includes trench excavation and backfill where pipes are placed below ground and excavation and backfill for structures such as ponds, roads, manholes, valve chambers, concrete blocks, pipe supports, etc., all in accordance with of this Specification.

4.2CLASSIFICATION OF ROCK EXCAVATION

Further to Clause 5.1, boulders or detached pieces of sound rock of more than 0.2 cu.m in volume, in open excavation, or more than 0.1 cu.m in narrow trench excavation, shall also be classified as rock excavation.

4.3 EXCAVATION FOR PIPE TRENCHES

4.3.1 General

Pipe trenches shall be excavated to the lines and levels shown on the Drawings, or as directed by the Engineer. Strong sight rails shall be fixed and maintained at each change of gradient, and at as many intermediate points as may be necessary. On the rails shall be marked the centre line and the level to which the pipe is to be laid, such rails being not more than 35 m apart.
Except as otherwise provided herein, excavation for pipelines shall be in open-cut trenches with vertical sides, unless otherwise directed by the Engineer and shall be carried out only so far in advance of pipe laying in one continuous reach.
At points where pipes are to be welded in the trench, the trench shall be enlarged sufficiently to permit such welding to be performed.

4.3.2 Trench Width

The trench width at the ground surface may vary with and depend upon, its depth and the nature of the ground encountered. For all diameters the clear width of unsheeted trench, measured at the horizontal diameter of the pipe, shall provide a minimum clearance of 250 mm on each side of pipe. Where tamping of side fill on pipe is required under the Specification, a minimum clearance of 300 mm on each side of the pipe shall be provided.
The maximum clear widht of trench at the top of the pipe shall not be more than outside diameter of the barrel of the pipe plus 750 mm.
Greater width of trench will be permitted only on written approval by the Engineer, in accordance with the requirements hereinafter.
Trenches with vertical sides are shown on the Drawings, but where approved by the Engineer in writing the Contractor may excavate trenches having vertical sides below and sloping sides above the top of the pipe; provided that any additional right of way required therefore shall be procured by the Contractor at his sole cost and expense, and all liability and costs on account of damage to property and improvements in connection with said sloping shall be assumed by the Contractor; and provided further that no payment will be made for excavation payment lines established as specified in the Preamble of the Bill of Quantities.
In general, permission to slope the trench sides as herein stipulated will be granted only where the excavation is in areas other than the travelled portions of streets and highways, and in no event shall such permission operate to waive any other requirement set forth herein. The said permission will be granted only upon written application of the Contractor, specifically agreeing to all the terms hereof.
Where pipes are laid on curves of large radius, the trench shall, without extra charge, be widened so as to ensure that no part of the pipe shall be nearer to the side of the trench than the clearance required under the Specification.

4.3.3 Trench Bottom

The trench shall be excavated to the necessary depth to meet the requirements specified in the BoQ. Any part of the trench excavated below grade shall be backfilled to grade with thoroughly compacted material approved by the Enigneer, and shall be treated as excess excavation in accordance selected borrow fill.
When an unstable subgrade condition is encountered and, in the opinion of the Engineer, it cannot support the pipe, an additional depth as directed by the Engineer shall be excavated and refilled to pipe foundation grade with approved suitable material to achieve a satisfactory trench bottom.

4.3.4 Excavation Methods

The use of trench-digging machinery will be permitted except where operating it will cause damage to trees, buildings, or existing structures above or below the ground. At such locations hand methods shall be employed to avoid such damage.

Machinery, trucks, etc. will only be permitted to move on the temporary access road and only in a longitudinal direction the equipment may only leave the said road at places which are especially provided therefor.

Wherever necessary to prevent caving, trench excavations in soil such as sand, gravel, and sandy soil shall be adequately sheeted and braced. Where Sheetings and bracing are used, the net trench width after sheeting shall not be less than that specified in Sub-Clause 72.3.2 above. As backfill is placed and if sheeting is to be withdrawn, it shall be withdrawn in increments of not more than 300 mm and the void left by the withdrawn sheeting shall be filled and compacted. If, despite such precautions,or by reason of their neglect, any portions of the bottoms, sides or ends shall be given way or be excavated without instructions from the Engineer, the Contractor shall excavate and remove all the ground therby disturbed and make it good, with well rammed fill or in such class of concrete as may be ordered by the Engineer, and such extra excavations shall be treated as excess excavation in accordance with Sub-Clause 72.3.7 below.

All excavated material shall be piled in a manner that will not endanger the work or cause an obstruction.

4.4 PREPARATION OF TRENCH BOTTOM

As directed by the Engineer, the pipe shall be laid directly on the trench bottom or on earth mounds as specified below:

4.4.1 Pipe Laid on Trench Bottom

This applies to pipes with any type of coupling or push-in joint. Pipes shall be laid directly on a trench bottom containing coupling or socket holes and shaped to provide continuous contact with the pipe between coupling or socket holes.

The bottom portion of the trench shall be excavated and trimmed so that the pipe will be uniformly bedded on the required grade. Normal bedding according to the typical excavation sections shown on the Drawigns, without concrete surround, shall be used unless otherwise called for elsewhere on the Drawings or directed by the Engineer. For said normal bedding the trench bottom shall be given a final trim and shape so that each pipe section when first laid will be continously in contact with the ground along the length of the pipe section. Any stones or flints likely to damage the pipe or its coating shall be picked out of the pipe bed, and any holes so formed shall be filled in with approved compacted soft material, and trimmed to the correct level. Wherever said normal bedding is required and, due to over-excavating, inaccurte trimming, or other cause, the bottom of the trench fails to afford uniform support as herein required, the Contractor shall, at his own cost, refill to required grade with approved suitable material compacted at optimum water content and retrim the trench bottom to the required section and grade, or, if so instructed by the Engineer, shall make good the bottom of the trench with such class of concrete as directed by the Engineer.

The following procedure shall be adhered to before the pipe is lowered into the trench:

- A coupling or socket hole shall be dug with sufficient length, width, and depth to permit assembly and provide a minimum clearance of 50 mm between coupling or socket and undisturbed trench bootom;

- The trench bottom between coupling or socket holes shall be made flat and cut true and even to grade so as to provide continuous contact of the trench bottom with the pipe as specified hereinabove;

- One or more holes shall be excavated at the approximate location to permit removal of the slign or slings without damage to the pipe coating.

4.4.2 Pipe Laid on Earth Mounds or Cement Bags

This applies to pipes with any type of coupling and to push-in or welded joints.
PVC pipe shall be laid on earth mounds of a size adequate to hold the pipe in alignment and to maintain a 50 mm minimum clearance from coupling or socket to undisturbed trench bottom . Each mounds shall be of approved backfill material tamped in place. Each pipe shall be laid on two mounds with the centre of each mound palced one fifth of the pipe length from each end. The trench shall be excavated a minimum of 50 mm below the grade of the bottom of the outside diamater of the coupling or socket and high spots between couplings or sockets shall be levelled so as to maintain a minimum of 50 mm under the pipe barrel. The earth mounds shall be levelled so as to maintain a minimum of 50 mm under the pipe barrel. The earth mounds shall be tamped firmly in place and raised to a height that will allow for placement of the pipe so as to maintain, before backfilling, a minimum clearance of 50 mm between the trench bottom and the pipe and coupling or socket.
The same method shall also be used for laying steel and D.I pipes jointed in the trench by mechanical couplings except that the pipe shall be laid on cement bags or similar kind of bags filled with sand, instead of on earth mounds, and that the clearance between the coupling or socket or flanged joints and the undisturbed trench bottom shall be adequate for making the joint and sufficient for the proper compaction of the backfill underneath the pipe. Where welded joints are to be made in the trench, a clearance of at least 400mm, for welding around the joint, shall be provided. The sandbags shall be broken at the proper time to avoid the development of concentrated loads in the final installation. The use of rigid or wooden blocks instead of sandbags will not be permitted.
Where the Engineer has directed the pipes to be laid on the trench bottom as under (a) , but the Contractor prefers, after having obtained the Engineer's permission, to lay the pipes on earth mounds as under (b), the extra trench excavation and backfill shall be at the Contractor's expense.

4.4.3 Excess Excavation

Excess excavation is defined as excavation done by the Contractor beyond the lines shown on the Drawings, specified in the Specification or ordered by the Engineer.
The Contractor shall backfill any excess excavation with compacted material approved by the Engineer, or in such class of concrete as may be ordered by the Engineer.
No payment will be made for excess excavation nor for its backfilling as specified.

4.5 LIMITATION IN LENGTH OF OPEN TRENCH

The following limitations for lengths of open trenches shall rule for a pipeline laid in one continuous reach unless otherwise directed by the Engineer, and subject to any more stringent requirements imposed by the competent authorities:

a. Not more than 100 m of trench in built-up areas and/or 300 m elsewhere, shall be opened in advance of pipelaying.

b. Not more than 300 m of pipeline shall be left uncovered after pipelaying in built-up areas and mot more than 600 m elsewhere.

If these lengths of open trench are exceeded or if, in the opinion of the Engineer, there is undue delay in:

a. testing the pipline;

b. removing surplus material ;

c. general tidying-up of areas where pipes have been laid;

d. partial restoration or maintenance of surface;

the Engineer may order that no further trenches shall opened until the outstanding work has been carried out to his satisfaction, and the Contractor shall have no grounds for claims against the employer on this account

4.6 COVER OF PIPES

4.6.1 Minimum Cover

All pipes shall have a minimum cover, measured from the top of the pipe to the ground surface as follows:

- 0.8 m for pipes up to DN 400 mm, laid under open areas;

- 1.0 m where pipes of any diameter are laid under roads or road verges and for all pipes or DN 450mm diameter and above, irrespective of location.

Where the minimum cover specified is not provided, the pipes shall be srrounded with 20-F-20 concrete, 150 mm thick.

4.6.2 Maximum Cover

Where the cover, as measured form the top of the pipe to the ground surface, exceeds the maximum permissible depth, the pipe shall be surrounded in 20-F-20 concrete, 150 mm thick.

4.7 METHOD OF BEDDING OF PIPES

4.7.1 Rock or Other Incompressible Foundation

Where ledge rock, rocky, or gravelly soil, hard pan, or other unyielding foundation material is encountered at a the pipe seat site, the pipe shall be bedded in accordance with the requirements of one of the classes of bedding, but with the following additions: the hard unyielding material shall be excavated below the elevation of the bottom of the concrete cradle (Class A bedding) or the bottom of the pipe or pipe bell (Class B, B_1, C and C_1 beddings) for a depth of at least 30cm or 15mm for each foot of fill over the top of the pipe, whichever is greater, but not more than ¾ of the nominal diameter of the pipe. For Class D bedding, the depth shall be 20cm. The width of the excavation shall be 30cm greater than the outside diameter of the pipe and shall be refilled with selected fine compressible material, such as silty clay or loam and lightly compacted and shaped as required for the specified class of bedding.

4.7.2 Methods of Bedding

The contact between a pipe and the foundation of which it rests is the pipe bedding. It has an important influence of the supporting strength of the pipe. The class of bedding to be

employed shall be determined by the Engineer and specified on the road plans. Six classes of pipe beddings shall be as follows:

Class A:-Concrete Cradle Bedding
In this class of bedding, the lower part of the pipe exterior shall be bedded in a continuous cradle constructed of concrete, having a minimum thickness under the pipe of one-fourth (¼) the nominal inside diameter and extending up the sides of the pipe for a height equal to one fourth (¼) of the outside diameter. The cradle shall have a width at least equal to the outside diameter of the barrel of the pipe plus 20cnm and it shall be constructed monolithically without horizontal construction joints.

Class B Bedding
The pipe shall be carefully bedded on fine granular materials over an earth foundation, accurately shaped by means of a template to fit the lower part of the pipe exterior for at least 15 percent of its overall height. Compactable soil material shall then be rammed and tamped in layers not more than 15cm thick, around the pipe for the remainder of the lower 30 percent of its height. Backfilling to the top of the pipe shall then be completed as specified under "Backfilling."

Class C Bedding
In this class of bedding, the pipe shall be bedded with the "ordinary" care in a soil foundation shaped to fit the lower part of the pipe exterior with reasonable closeness for at least 10 percent of its overall height. The remainder of pipe shall be surrounded by material placed by hand tools to fill completely all spaces under and adjacent to the pipe. Back filling to the top of the pipe shall then be completed as specified under "Back filling".

4.8 DISPOSAL OF EXCAVATED MATERIAL

All suitable materials removed in excavation or as much thereof as may be needed, shall be used for backfill. material removed from trenches shall be placed alongside the trench at a sufficient distance from the trench to prevent it from falling into the trench, or its weight causing the trench sides to cave in. Where necessary, selected material required for backfill and topsoil and/or sod for later replacement shall be stored separately. In urban areas, where no storage space is available for excavated material along the trench, or where the authorities so require, the excavated material shall be removed immediately from the right-of-way, and backfill material shall be brought to the site immediately before backfilling of trench. Rock and waste material not suitable or not required for backfill shall be mounded or spread along the trench and/or along the right-of-way, except that where such mounding or spreading is prohibited by the authorities or by the owners of property or otherwise undesirable in the Engineer's opinion, such materials shall be removed and disposed of in a manner approved by the Engineer.

4.9 BACKFILLING OF PIPE TRENCHES

4.9.1 General

All excavations shall be backfilled to the level of the original ground surfaces, unless otherwise shown on the Drawings or ordered by the Engineer, and in accordance with the requirements of the Specification. The material used for backfill, the amount thereof, and the manner of depositing and compacting shall be subject to the approval of the Engineer, but the Contractor will be held responsible for any displacement of pipe or other structures, and damage to their surfaces or any instability of pipes and structures caused by the improper depositing of backfill materials.

Subject to the procedures outlined below in this Clause, backfilling operations shall follow the laying of the pipes as closely as possible.
Steel pipes shall not be backfilled until the exterior coating at field joints has attained sufficient age, as determined by the Engineer. The Contractor shall take such precaution as may be necessary to prevent injury to the pipes, joints or exterior coating during backfilling operations. The positions of all joints shall be clearly marked upon completion of the backfilling.
Pipe srrounds and structures of concrete shall be backfilled as soon as the concrete has attained sufficient strength, as determined by the Engineer, to sustain the load imposed.

4.9.2 Backfilling before Tests

Backfilling before tests shall be done as follows:

A Selected backfill material approved by the Engineer, free from organic matter, rock, lumps of clay, large stones, boulders, or other unsuitable substances, shall be deposited in the trench uniformly on both sides of the pipeline for the full width of the trench. This backfill material shall be sufficiently damp to permit thorough compaction under and on each side of the pipe to provide support free from voids. It shall be placed in layers not exceeding 10 cm thickness after compaction and brought up to the horizontal diameter of the pipe.
Where the pipes are laid under roads the backfill shall be compacted as required in Sub-Clause 72.8.3 below for such cases.
B If visual inspection during the test in not required in accordance with Sub-Clause 72.8.4 below, the pipe and joints shall be backfilled as specified above and a cushion of approved material shall be placed over pipeline and joints in accordance with the following requirements:
PV Pipes: The cushion shall be hand placed over the pipeline and joints to an average depth of 300 mm for all sizes of pipes.
Ste el and D.I. pipes: The cushion shall be placed to a grade of not less than 150 mm above the top of pipeline for all sizes of pipes.
C If joints are to be exposed during the test, the pipes and joints shall be backfilled up to the horizontal pipe diameter as above and additional approved backfill material shall then be placed between joints in order to hold the line securely during the test. The average depth of such additional backfill shall be 300 mm over the top of DN 200 mm and smaller pipe and not less than 600 mm over larger pipe. Backfilling of PVC pipes shall be hand placed.

4.9.3 Backfilling after Tests

On completion of pressure and leakage tests, exposed coupling and other joints shall be covered with approved selected backfill placed over the top of the pipe and couplings and joints, in accordance with the requirements of Sub-Clause 72.8.2, para (b) above. The balance of backfill shall contain no stones more than 150 mm in their largest dimension and the backfill mixture shall not contain more than 25 percent of stones. The Contractor shall not permit excavation to be used for disposal of refuse.
Trenches in the right-of-way of a road shall be backfilled with selected material placed in layers not exceeding 100 mm in thickness after compaction, wetting and compacted ot a density of not less than 90 percent of the maximum dry density at optimum moisture content as determined in accordance with BS 1377 Test No. 12 (also knows as Standard Proctor Density).
Trenches not in a right-of-way may be backfilled without tamping Any deficiency in the quantity of material for backfilling the trenches shall be supplied by the Contractor at his expense. A mound of earth to 10 % of the trench depth should be left to contain the gradual settelment of backfill.

The Contractor shall at his own expense make good any settlement of the trench backfill occuring after backfilling and until the expiry of the period of Maintenance.
On no account shall any excavated material be dozed back when backfilling trenches in roads and no such backfilling shall be carried out unless in the opinion of the Engineer sufficient mechanical rammers are in operation on that portion of the work.
In no case shall any soft material be used in filling any part of any trench within a road right-of-way.
The Contractor shall taken into account, and include in his rates, for the effects of the rainy season rainfalls on backfilled trenches and the maintenance resulting therefore.

4.9.4 Backfilling Joints before Tests

Normally, joints will be left exposed during testing of pipelines. However, the Engineer may at any time order the Contractor to proceed with and complete the backfilling of the trench before testing, where the pipeline is laid in the right-of-way of a road, in built-up areas and wherever for any other reason the pipe trench cannot be left open until after testing. In such cases the positions of all joints shall be clearly marked by the Contractor outside of the trench so that they can easily be located for the purpose or repair if and when required.

4.9.5 Transported Backfill Material

When length of trench are excavated partly in rock, stony ground of soft spongy material, or in other material unsuitable for backfilling and, in the opinion of the Engineer, there is insufficient suitable material from the excavation to supply the backfill material specified above, the Contractor shall import suitable material from other parts of the work, or from borrow pits.

The cost of providing, transporting and backfilling selected backfill material from approved sites at a distance not exceeding 500 m from the point of backfilling shall be included in the rate for excavation. The additional cost of transporting suitable backfill materials from a distance exceeding 500 m as aforesaid, will be paid to the Contractor as an extra for excavation.

4.9.6 Backfilling around Structures

In filling excavation other than pipe trench excavations, after permanent work have been approved by the Engineer, the best and most suitable portions of the excavated material shall be used. If the material is to be consolidated by hand-ramming it shall be deposited in layers not more than 100 mm thick and each layer shall be thoroughly rammed and watered if required, one man being employed ramming for each man filling. Where mechanical rammers are employed the depth of the layers shall not exceed 150 mm. The backfill material shall be compacted to 95 percent of the Standard proctor Density as defined above.

4.10 RESTORATION AND CLEAN-UP

The Contractor shall restore or replace all removed or damaged curbing, sidewalk paving, gutters, shrubbery, fences, sod, and other disturbed surfaces or structures to a condition equal to that before the work began, to the satisfaction of the Engineer and as specified in the following Clauses, and shall furnish all labor and material incidental thereto. In restoring paved surfaces, new pavement shall be laid. No permanent surfacing shall be placed within 30 days after the backfilling has been completed, except by order of the Engineer.
Surplus pipeline material, tools, and temporary structures shall be removed by the Contractor. All dirt, rubbish, and excess earth from excavations shall be hauled to an approved dump prvided by the Contractor, and the Site shall be left clean to the satisfaction of the Engineer.

4.11 SURFACE RESTORATION OTHER THAN OF PUBLIC ROADS AND FOOTPATHS

The Contractor shall carefully replace all surface material and maintain all surfaces of private roads, path, fields, gardens, open spaces, etc., and make good any subsidence's and defects to the satisfaction of the owner or occupier until the end of the period of Maintenance. Quitting receipts shall be obtained from the property owners or tenants and the Defects Liability Certificate provided under Clause 62 (1) of the Conditions of Contract will not be released until these have been received.

4.12 REINSTATEMENT OF ROADS

4.12.1 General

Where any public road surface is removed or damaged by the Contractor's operations it shall be replaced or repaired to the satisfaction of the appropriate authority responsible for the maintenance of the road. The materials and methods used for such reinstatement shall be similar to those used for the original pavement and shall comply with the following procedures for reinstatement of roads:

a) Upon completion of backfilling operations, the Contractor shall carry out the interim reinstatement of roads as specified in Sub-Clause 72.11.2 below. The period for completion of reinstatement at any point of a road, computed from the completion day of backfilling until completion of interim reintatement, shall not exceed seven days.

b) Upon completion of interim reinstatement, the road shall be opened to traffic for a period of not less than thirty days, or a longer period if ordered by the Engineer, to allow for its consolidation.

c) As soon as in the opinion of the Engineer the road has been satisfactorily consolidated, the Contractor shall carry out the permanent reinstatement of roads.

Nothing contained herein or shown on the Drawings shall relieve the Contractor from his obligation in respect of the maintenance of public roads in accordance with the Clause 12.3 " Access to the Works" of the General Provisions.

4.12.2 Interim Reinstatement

The edges of the trenches and excavations in road shall be cut back neatly for a width of 150 mm on either side of the trench and to a depth of 150 mm.
The interim reinstatement of roads shall consist of the top 600mm of the trench being filled with 350 mm of consolidated sub-base material on top of which shall be 250 mm of consolidated base material, all supplied and placed as approved by the Engineer and the requirements of the Ministry of Works and Transport or other agency having jurisdiction over road construction.

4.13 REINSTATEMENT OF FOOTPATHS

The edges of the trench excavation shall be cut back neatly to width of 100 mm on either sides of the trench and around excavations and to a depth of 150 mm below the existing surface.
The Contractor shall then carry out the reinstatement of the trench surfaces to the satisfaction of the Engineer. The top 150 mm shall be filled with selected gravelly material which shall be well compacted with a power compaction equipment or other methods approved by the Engineer and the level of the reinstated surface made flush with the adjoining surfaces.

4.14 MAINTENANCE OF REINSTATEMENT OF ROADS AND FOOTPATHS

The surface of the permanent reinstatement shall be finished level with the adjacent carriageway or footpath and shall be maintained in a safe condition at all times.

The Contractor shall carry out any necessary maintenance of any trenches immediately in order to obviate danger to roads users. If the Contractor fails to carry out such maintenance of reinstatement the necessary repairs will be carried out immediately by the competent public or other agency and the cost of the same shall be deducted by the Employer from any sum due to the Contractor.

5 PIPELAYING

5.1HAULING AND HANDLING OF PIPES, VALVES, ETC.

When handling, transporting and laying pipes and accessories, care shall be taken to prevent cracks and other damage to the pipes and, in the case of steel pipes, to preserve their circular shape, particularly at the ends. Special care shall be taken to keep the coating and lining of the pipes intact.

Pipes shall be handled in such a manner as to avoid damage to the machined ends. Damaged pipes that cannot be repaired to the Engineer's satisfaction shall be replaced at the Contractor's expense.

The vehicles used for transporting the pipes shall be adequately equipped to prevent movement of pipes and/or damage to pipes or coating. Pipes shall be well secured to the vehicles to ensure stability of the load. All parts of the vehicles, cables and ropes coming into contact with the pipes shall be well padded. The unloading shall be done by means of cranes or other suitable equipment using slings or other approved tackle, in order to ensure slow and careful lowering of each pipe. Pipes shall not be gripped by hooks or other equipment liable to injure or distort pipe ends, or cause damage to the lining.

Pipes must not be dropped on the ground or on other pipes. When lifting or lowering pipes by means of a crane, each pipe shall be kept under control when suspended, to prevent its colliding with equipment or other objects that may injure the pipe or its coating.

Pipes shall not be moved be dragging or rolling them on the ground, but shall be lifted and placed carefully in their new position. When working on site all handling equipment shall keep to the temporary access road at all times and always moves longitudinally along the said road. The equipment may only leave the road at places especially provided therefore.

Each off-loaded pipe shall be blocked to prevent it from rolling and shall not be placed directly on the ground.

In storage, pipes shall be arranged in such manner that the pressure of pipes placed on each other will not cause deformation or damage to the pipe and/or coatings. Coated pipes that are or are likely to be exposed to the direct rays of the sun, either in storage or when being strung along the lines, shall receive a lime wash in order to prevent softening and deterioration of the coating under the influence of the sun's heat. The cost of the lime wash shall be borne by the Contractor.

PVC pipes and fittings shall also be protected from the sun.

Valves and other accessories shall be kept and stored before installation in a manner approved by the Engineer.

5.2STRINGING OF PIPES ALONG THE LINE

When stringing pipes, they shall be so placed on the ground along the trench, as not to interfere with the normal progress of work or the passage of equipment etc.

Stringing shall be done on the side of the trench except where there is insufficient space available or when such stringing will interfere with the normal activities in the vicinity. In such cases the Contractor will be permitted to stockpile pipes at suitable sites.

Where explosives are used for trench excavation, stringing shall not be done until after blasting operations have been completed for a sufficient distance ahead. In such cases the Contractor shall stockpile pipes at a safe distance from the site of the blasting.

Each pipe shall be placed beside the trench as near as possible to its final laying position in order to minimize moving of pipes along the line after stringing.

Subject to other restrictions that may be imposed by local Authorities or owners of property concerned, the Contractor shall so regulate the order and rate of stringing and laying of pipes that no pipes shall be left exposed to the action of weather for a period exceeding four months. PVC pipes shall at all time be protected from the sun to the Engineer's satisfaction. The Contractor shall see to it that the pipes do not obstruct or interfere with normal traffic and with the normal activities of the adjacent occupiers, and in every case the Contractor shall obtain the consent of the local authorities or the owners of property with regard to the locations and manner in which pipes are strung along the lines.

5.3 LOWERING OF PIPES AND ACCESSORIES INTO THE TRENCH

Implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work.

All pipes and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage. Under no circumstances shall pipes or accessories be dropped or dumped in to the trench. Pipes shall be rolled in to place for lowering into the trench over suitable timber planking free from roughness, and carefully controlled by ropes or other approved tackle. If a crane or a trench digger is used for handling the pipes and lowering them into the trench, the pipes shall be slung by approved wide slings passed around the outside at the balancing points. The Contractor shall inspect the coating on the underside of the pipe while it is suspended from the sling and shall repair any injury to the coating before the pipe is lowered into the trench.

Pipes and accessories shall be inspected for defects prior to their being lowered into the trench. Any defective, damaged, or unsound material shall be repaired or replaced in accordance with the requirements of the specification and as directed by the Engineer.

All foreign matter or dirt shall be removed from the interior and ends of pipes and accessories before they are lowered in to position in the trench. Pipes shall be kept clean by means approved by the Engineer during and after laying.

No metal tools or heavy objects shall be permitted to come in contact with finished coating. Workmen shall not walk on coated pipes except where necessary, and, when they do, they shall wear shoes with rubber or composition soles and heels. Any injury to the protective lining and coating from any cause during the installation of the pipeline shall be repaired by the Contractor at his own cost.

5.4 LAYING OF PIPES – GENERAL REQUIREMENTS

The pipes shall be placed in position true to profile and direction of slope indicated on longitudinal sections on ascending grades from washouts to air valves. Such grades shall not be less than 1 in 500 and sight rails shall be set up at all changes of grade where the gradient is less than 1 in 200.

The pipes shall be laid in straight lines in plan where possible, but where curves or changes in direction are shown on the Drawing or indicated by local conditions they shall be deflected accordingly.

Before pipes are jointed they shall be thoroughly cleaned of all earth lumps, stones, or any other objects that may have entered the interior of the pipes.

At the end of each working day and whenever work is interrupted for any period of time, the free ends of laid pipes shall be protected by suitable covers, or temporary plugs, against the entry of dirt or other foreign matter.

When pipe laying is not in progress, the open ends of installed pipes shall be closed by approved means to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, enough backfill shall be placed on the pipe to prevent

floating. Any pipe that has floated shall be removed from the trench and re-laid as directed by the Engineer.
No pipe shall be laid in wet trench conditions that preclude proper bedding, or when, in the opinion of the Engineer, the trench conditions or the weather are unsuitable for proper installation.

5.5 CURVES, BENDS, ETC.

Where curves of a long radius are required, these shall be obtained by deflection at the joints; such deflections, however, shall not exceed either vertically or horizontally the limits recommended by the manufacturers of the joints.

Where a change of direction cannot be made by deflection at the joints of ordinary straight pipes, prefabricated bends supplied together with the pipes shall be used. For the curved alignments requiring greater angular deflection at the mechanical joints than permitted by the joint manufacturer so that a change of direction cannot be made by deflection at the joints of standard length straight pipes, and where the field conditions are such that the required angle and/or radius of curvature cannot be accommodated by factory-made bends furnished together with the pipes, the Contractor shall use one of the following methods as directed by the Engineer:

a) The curve shall be made by jointing sections of steel pipes, cut by the Contractor to required lengths, with mechanical joints and deflecting the pipes at the joints within the permitted limits.

b) The curve shall be made by a bend prefabricated by the Contractor.

No extra payment will be made to the Contractor on account of changes in angular deflection or of bends in addition to those shown on the Drawings, if ordered by the Engineer, save for the cost of additional fabricated bends and thrust blocks necessitated thereby. Concrete thrust blocks shall be provided wherever the pipeline changes direction or diameter to effectively keep the line from moving during passage of water.

5.6 JOINTING OF PIPES

5.6.1 Mechanical Joints

The mechanical joints shall be of the mechanical compression sleeve type using rubber gaskets such as Viking Johnson (VJ) or Dresser coupling or equivalent. These could also include Viking Johnson Reducer Couplings (VJ/RC).

All materials for the making of the joints shall be supplied together with the couplings. These materials include bitumen for internal and external protection, bit mastic paint for touching up, whiting for molding boxes, spanners for tightening up bolts, gauges for setting the gaps between the pipes, and portable furnaces for melting the bitumen. In addition, molding boxes and liners for each size of pipe will be provided.

Before jointing, the ends of the pipes to be connected shall be made square, plane and clean, and in the case of steel pipes the ends shall be thoroughly wire brushed and re-coated with a quick-drying bituminous solution so as to produce a smooth coat of uniform thickness.

The mechanical joints shall be installed in accordance with the manufacturer’s instructions care being exercised not to over tighten bolts and that no hot bitumen will come into contact with PVC pipes. The Contractor shall perform all required coating and lining works. Couplings will not be coated where they are encased in concrete.

5.6.2 Welded Joints

(i) Steel pipes

Welded joints between steel pipes shall be made in accordance with B.S. 2971 or other approved standards, and the following additional requirements:

(a) Welders, welding arrangements and welding procedures shall be subject to approval by the Engineer.

(b) No welding shall be done when adverse weather conditions such as rain, mist, sand storms or strong winds may affect the quality of the welds.

(c) The Engineer will exercise a continuous control of the welding work and will inspect the quality of the welds. In addition to routine supervision and visual inspection of the work the Engineer may, in case the results of these prove not to be satisfactory, have macro-etching section tests performed (B.S. 2971, Appendix page 48, or AWWA C-206 Section 8-9). These tests shall be made by and at the cost of the Contractor, who shall not be entitled to any additional payment or compensation, above the unit prices bid in the bill of quantities, by reason of delay or interferences with his work caused by tests and repairs as required under this sub-clause.

(d) Repairs to lining and coating shall be carried out in accordance with the requirements set out in AWWA C-203 and in accordance with the instructions of the pipe manufacturer.

(e) Materials for repairs of defective lining and coating and for lining and coating of field welded joints will be supplied together with the pipes.

(ii) Ductile Iron Pipes

Where instructed to do so by the Engineer the Contractor shall weld flanges onto DI pipe ends. This will be done in accordance with BS 4772 or ISO 2531 and will be performed under conditions and in a manner satisfactory to the Engineer.

5.7 FLANGED JOINTS

Where shown on the Drawings, the Contractor shall make flanged joints. The necessary gaskets, bolts, nuts and washers shall be supplied together with the flanges in accordance with the specification. Flanges shall be matched accurately, with the bolt holes straddling centerline. Bolts shall be tightened by working at one time on diametrically opposite pairs and proceeding evenly all round. In no case shall excessive tightening be exerted on any nut or bolt, and the spanner length shall not exceed 30 cm from the bolt center to the end of the handle or as directed. Spanners shall not be lengthened in any manner to increase the purchase. For steel pipe joints, care shall be taken to ensure that no bare metal is left exposed internally. Externally, metal pipe flanges, bolts and nut shall be coated with three coats of approved bituminous paints when laid underground. Above ground they shall be painted with the epoxy system specified in Chapter 52 of the Specification.

5.8 JOINTING OF PVC AND DCI. PIPES

5.8.1 Spigot and Socket Joints

The sealing rings used for jointing DCI. Pipes must be those supplied by the manufacturers of the pipes and must be firmly locked in position before the spigot end of the pipe is inserted.

Where the sealing component is not supplied locked in position, the ring housing must be cleaned, any grit removed and the ring inserted correctly in the housing before assembly.

The lubricating compound used for jointing DCI pipes shall be supplied or recommended by the pipe manufacturer and in any case it must be non-toxic and not harmful to the rubber joint rings.

The joint ring in the socket of the pipe already in place and the spigot of the new pipe shall be thoroughly cleaned and lubricated and the new pipe shall be immediately inserted after proper alignment in to the socket so as to avoid any opportunity to pick up dirt or deleterious materials. To ensure a pressure-tight seal the spigot shall be pushed fully into the socket, or as far as the mark made on the spigot by the manufacturer.

5.8.2 Mechanical Joints

Mechanical joints similar to those described in sub-Clause 73.6.1 shall be used on PVC and DI pipes when required for connection to specials and fittings and where a need is foreseen to dismantle joints in the future. This jointing system will also be used for connecting pipes of different outer diameters.

5.8.3 Glued Joints

UPVC pipes shall be joined by gluing in accordance with the pipe manufacturers' instructions and the following general procedure:

A Ensure that the uPVC pipe ends or parts to be joined by gluing are thoroughly cleaned, by means of a suitable solvent, making sure that they are not cracked or chipped.
B Spread the special glue provided by the supplier of the pipes and accessories under Contract No. 4, on both the inside and on the outside of the pipe ends.
C Insert the pipe end into the socket as far as it will go or in the case of the sleeve, up to the special stop rabbit.

5.9 FITTINGS AND SPECIALS

5.9.1 General

Where shown on the Drawings, or as found necessary in the field, or as directed by the Engineer, various fittings and specials shall be lowered in to the trench, inspected, cleaned and jointed as specified and shown on the Drawings. Normally all such fittings and specials shall be of standard manufacture and supplied with the pipes.

5.9.2 Fabricated Fittings and Specials

Notwithstanding Sub-Clause 73.9.1 the Contractor may be required to prepare and install prefabricated bends in accordance with Clause 73.5 or other fittings and specials. Where possible such fittings and specials shall be fabricated by the Contractor of standard steel pipes by cutting and welding as specified and approved by the Engineer and shall conform in all respects to the requirements of BS 534.

5.9.3 Closures and Short Sections

Closure pipes and short sections of pipes shall be installed by the Contractor as found necessary in the field or as directed by the Engineer. Where closure pieces are required, the Contractor shall make all necessary measurements and shall be responsible for their correct

size and fit-up. Closure pieces and short sections shall not be less than 120mm in length. Where required these sections shall have flanged joints.

5.10 CUTTING OF PIPES

The Contractor shall cut and prepare all short pipe lengths shown on the Drawings or instructed by the Engineer. Cutting of pipes shall be done by means of an approved mechanical pipe-cutter. External coating, if any, shall be neatly removed for 15mm on each side of the proposed cut, and internal, lining shall be carefully cut and finished flush with the pipe edge or as directed. Pipe ends intended for connection with mechanical joints shall be cut clean square and truly perpendicular to the pipe axis, and shall be trimmed by removing all burs and sharp edges and, if need be, chamfered. Pipe coatings and linings shall be repaired according to the manufacturer's instructions, using the materials provided by him with the pipes, all as specified herein. PVC pipe ends shall be rechamfered as required.

Machines of an approved type and make for cutting and chamfering of pipes shall be used and maintained in good working order at all times.

All the above works and making good shall be at the Contractor's expense.

5.11 PIPE REPAIRS

PVC pipes shall be repaired by cutting off the damaged length. D.I. and steel pipes that have been dented or distorted shall, if possible, have their ends re-rounded by an approved method. Alternately the pipe ends shall be cut off as approved by the Engineer.

Where necessary the pipe lining shall be made good, particular care being taken to cut out any areas where cracks in the lining or lack of adhesion to the pipe wall appear. Material supplied for completing the lining of steel pipes shall be used to replace any bitumen lost, and the whole shall be re-fettled to a smooth finish so that the expanding mandrel will seat closely to the lining and prevent loss of bitumen on pouring the internal lining at the joint.

The external coating of pipes shall be made good wherever the thickness of the coating is seriously reduced by damage or where the coating does not adhere tightly to the barrel.

Where external coating of pipe has been damaged and the metal has been exposed, all rust and dirt shall be carefully removed by an approved method and a coat of bit mastic paint shall be applied before re-fettling. Small stones which may become embedded in the coating shall be picked out and the coating re-fettled by heating with a blow-lamp and smoothing over with a fettling knife, additional external coating bitumen being added where necessary.

Repairs to pipe coating and linings shall be done with the appropriate materials provided with the pipes and shall be in accordance with the pipe manufacturer's instructions and the Engineer's instructions. All the above repairs, including extra pipe lengths and joints, shall be at the Contractor's expense.

5.12 COMPLETING PROTECTION OF STEEL AND DI PIPES

Upon completion of jointing and testing, the Contractor shall complete the internal and external protection of steel and DI. Pipes. Repairs to coating and lining shall be carried out as per Clause 73.12.

Steel pipes and specials to be laid above ground will be supplied painted externally with a coal tar epoxy system as specified in Chapter 52 of the Specification, and repairs there to shall be effected accordingly.

5.13 TESTING PIPELINES

5.13.1 General (Applicable to all Pipelines)

The Contractor shall submit to the Engineer for approval a detailed program for the testing of pipelines, showing the equipment to be used and the procedure to be followed. No pipeline shall be tested unless the Engineer has approved the said program in writing.

The tests shall be made on sections of the lengths specified below. Each section to be tested shall have been completed except for backfilling at joints, which are to be left open for inspection, unless the Engineer has ordered completion of backfill before testing. Care shall be taken that weights and thrust blocks, intended to prevent vertical and lateral displacement of the pipes or specials, have been properly secured. The tests shall be carried out not earlier than 7 days after the blocks have been cast and in any case not until, in the opinion of the Engineer, they have attained sufficient strength to withstand any stresses to which they may be subjected. Ends of sections to be tested, unless permanently secured, shall be provided with temporary bulkheads strong enough to withstand all axial forces. Prior to testing, the section to be tested shall gradually be filled with water and all valves, including air valves, shall be operated and examined to ensure their proper functioning.

Particular care shall be taken that end valves of each section to be tested are properly closed and valves within such sections are fully opened and free from all matter likely to impede their operation.

Each section shall be tested, at a pressure of 1½ times the maximum allowable working pressure of the pipe.

When the test section is being filled with water and before the application of the specified test pressure, all air shall be expelled from the line by means of air valves or taps at peaks on the line.

The length of sections to be tested at a time shall not exceed 300m in built-up areas or 600m elsewhere, except as otherwise directed by the Engineer.

Precautions shall be taken to avoid contamination of the existing pipe systems as a result of flow reversal. While the new pipes are being filled for testing, all existing lines supplying water shall remain full and under pressure. While pipes are being charged, the section to be tested shall be isolated by suitable manipulation of valves and if necessary by the use of check valves and blind plates.

The Contractor shall provide the necessary test pumps and pressure gauges (to record head of water) and shall make such temporary connections as may be required for filling and testing the line in the manner herein specified.

After successfully completing the tests on sections of the pipelines and backfilling has been completed, except at closure joints, the pipeline shall be tested again at maximum working pressure.

5.13.2 Testing of Steel and DI pipes

Steel and DI pipelines shall be filled and examined and all leaks repaired. The test pressure shall then be raised to a pressure of 1½ times the maximum allowable work pressure, pumping discontinued and the test section observed for 24 hours.

Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from

discontinuation of pumping till its resumption. In pipelines constructed with mechanical or push-in joints the pipe section shall be considered as having passed the test if the leakage is not more than 0.1 liter per millimeter of pipe diameter per kilometer of pipelines per day for each 30m head applied. In the case of welded pipelines, any test section showing leakage or loss of pressure during the said period of 24 hours will not be accepted.

5.13.3 Testing of PVC pipes

PVC pipelines shall be filled and examined and all leaks repaired. The test pressure shall then be raised to a pressure of 1½ times the maximum allowable work pressure, pumping discontinued and the test section observed for at least 1 hour but in any case the pressure test must not be applied for more than 24 hours. The permissible leakage shall be the same as specified in this Clause for steel and DI pipes.

5.13.4 Retests

Any line not meeting the test requirements under the Sub-Clauses above shall be repaired and retested until said requirements are complied with.

5.14 CLEARING OF PIPES

No tools or matter of any kind are to be left in pipes and all apertures shall be closed by suitable wooden plugs fitting the open ends and entering the pipe for at least 150mm. These shall be kept in place except when work is in progress.

5.15 CHLORINATION OF PIPES

5.15.1 General

Before being put into service, all pipes intended to carry potable water shall be chlorinated by introducing a chlorine solution into the pipes so that a chlorine residue of not less than 10 ppm remains in the water after 24 hours standing in the pipe.

5.15.2 Flushing

Prior to chlorination, all pipes shall be flushed with clear water flowing at a velocity of above 1.00m per second, or as agreed with the Engineer.

The Contractor will be required to submit for the Engineer’s approval the manner in which he proposes to flush the pipelines laid, in order to ensure the absence of foreign matter. Chlorination is not to be carried out until the Engineer has agreed on the flushing method.

The Contractor shall at his own cost take all necessary precautions to prevent disposal of the flushing water from causing damage to any property or public utilities and shall keep the Employer indemnified against any claims on this account.

Flushing of pipes may be required to be carried out at night time, depending on availability of water and extent of interference involved in supply of water to consumers; the Contractor must include in his rates for this night work.

5.15.3 Materials for chlorination

Chlorine shall be applied in one of the following forms: A mixture of water and a chlorine bearing compound of known chlorine content, such as calcium hypochlorite (in powder) or

chlorinated lime (also called chloride of lime and commonly known as “bleaching powder”) or liquid sodium hypochlorite (commercially known as “liquid laundry bleach”).

When one of the chlorine bearing compounds is used, its chlorine content as certified by the manufacturer shall be ascertained and a 1% chlorine solution (10,000 ppm) shall be prepared for introduction into the water to be treated. In the case of powder, this shall be made into a paste and then thinned to a 1% solution.

Care must be taken to ensure that no local concentration of chlorine occurs which could damage the pipe linings.

5.15.4 Rate of Application

The rate of chlorine mixture flow shall be such, in proportion to the rate of water entering the pipe that the chlorine dose applied to the water entering the pipe will produce at least 10ppm after 24 hours’ standing. This may be expected with an initial application of 25ppm although in some cases local conditions may require more.

The following table 1 shows the approximate amount of chlorine required for each 100 m of pipe of various sizes to obtain the 25 ppm application.

Table 1: Approximate Amounts of Chlorine per 100 m Pipe to Obtain 25 ppm Cl

Nominal Pipe	100% Chlorine	1% Chlorine Water
Diameter		Solution
mm	gram	Litter
80	12	1.2
100	21	2.1
150	45	4.6
200	82	9.2
250	130	13.2
300	180	18.0
350	260	26.0
400	330	33.0
450	400	40.0
500	530	53.0
550	630	63.0
600	730	73.0

After the pipe or system has been filled with the chlorinated water, it shall be kept closed For at least 24 hours, after which period the chlorine content as measured at the extreme end of the pipeline shall not be less than 10 ppm.

5.15.5 Points of Application

The preferred point of application of the chlorinating agent is at the beginning of the pipeline or any valve section thereof. In repaired pipelines or extensions of existing systems the chlorinating agent shall be injected through a newly laid or repaired pipe. In new system, application of chlorine may be made at the hydrants, washouts, standpipe, etc. or at the pumping station, or reservoir. The chlorinating agent may be applied by chemical feeder including chlorinator, or gravity.

To ensure the proper chlorination of all valves and other appurtenances, these shall be operated while the pipelines are being filled with the chlorinating agent.

5.15.6 Preventing Reverse Flow

During the application of chlorine and flushing of pipes, all existing lines supplying the water for chlorination and flushing shall remain full and under pressure. Valves shall be manipulated so as to prevent the treatment dosage and water supplied for flushing from flowing back in to the supplying lines. Where necessary check valves and blind plates shall be used.

6 VALVE ASSEMBLIES, THRUST AND ANCHOR BLOCKS, CROSSINGS, CONNECTIONS

6.1VALVES, TRUST AND ANCHOR BLOCKS

6.1.1 General

This Section deals with the specials requirements for the installation of valves and accessories of all descriptions, crossing of public utilities, river, bridge and road crossings, cutting into existing mains, thrust blocks, valve chambers, etc. The requirements of this section shall be in addition to, and shall in no way diminish from or vitiate the applicable requirements of other sections of the specification, nor shall they relieve the Contractor of any of his obligations under the Contract.

6.1.2 Installation of Valves

All valves and accessories shall be installed in the exact positions shown on the Drawings or as directed by the Engineer, and shall be set accurately level and plumb. Extension spindles, headstocks, etc. shall be properly positioned. All valves and other accessories shall be thoroughly cleaned before installation. Fitting of valves and accessories to the pipes shall be done accurately and true to alignment but without the use of undue force. No attempt shall be made to align valves or accessories by tightening bolts forcibly, by hammer blows or by any other method likely to cause damage or to give rise to internal stresses in the valve body or flanges. Flanged connections and mechanical joints shall be made as specified. To ascertain its proper operation, each sluice valve shall be operated through its full range before and after installation. Non-return valves, air-valves, etc. shall also be checked for ease of operation before and after installation. Valves and other accessories which will be furnished by the manufacturer painted or coated shall have their exposed surfaces, accessible from the inside of valve chambers, manholes, etc. and coated with two additional coats, one applied before erection and the other after erection. Before the application of the new coat, all defective spots in the existing coating shall be cleaned and repaired to make them equal to the existing coating. After installation the valve shall be left clean and ready for operation in all respects. The water-tightness of valves shall be checked during filling and testing of the pipelines or installation and where necessary packing-glands shall be repacked and/or tightened.

6.1.3 Valves, Chambers, Valve Supports, Etc.

Valves and accessories shall be partially encased in concrete thrust blocks. The larger sizes shall be housed in valve chambers, all as shown on the relevant drawings. Where no chamber

is provided the exterior spindle shall be protected by a pipe-casing topped by a concrete cover slab with a surface box.
Valve chambers shall be constructed of cast-in-situ reinforced concrete or solid concrete block walls, built on concrete foundations with or without a concrete floor slab and with a reinforced concrete cover slab with a surface box. Valves in valve chambers shall be anchored to concrete chamber walls and supported or encased by cast-in-situ concrete blocks.
All concrete and block work shall be in accordance of the specification.
Floors of valve chambers between wall foundations and valve supports shall be covered with a layer of gravel. The gravel shall meet the requirements of 20mm size coarse aggregate and shall be evenly spread and consolidated on the chamber floor.
Where shown on the Drawings, ventilation pipes and/or drain pipes shall be provided in valve chambers.

6.1.4 Thrust and Anchor Blocks

As shown on the Drawings at all bends, reducers, tees, valves, etc., concrete blocks shall be cast, which shall be carefully placed to ensure contact with undisturbed ground and shall be to the dimensions shown on the Drawings or determined by the Engineer.

Blocks founded on a rock ledge shall be anchored to the rock as shown on the Drawings.
The Engineer may alter the dimensions of the blocks in order to ensure a satisfactory distribution of pressure over the interface between earth and concrete.
In order to ensure that the blocks fulfill their purpose they must be in close contact with undisturbed ground and therefore, where timbering has been used in the excavation, it must be withdrawn as the concrete is placed. The ground shall be excavated carefully to the correct level. If for any reason the ground has been excavated below this level the foundation shall be made up to the correct level with concrete.

6.1.5 Concrete Surrounds

Where required, pipes shall be surrounded by concrete to the dimension lines and levels shown on the Drawings or determined by the Engineer. Pipes shall be supported and jointed at the correct level clear of the trench bottom, each one supported on two blocks of precast concrete of suitable height, one at each end of the pipe. Concrete, as per Chapter 31 of the specification, shall then be poured and rammed beneath and around the pipes in one operation and finished off to the level and dimensions shown on the Drawings. In order to ensure that the space underneath the pipe is well filled with concrete, it shall be first poured on the side of the pipe until it rises and appears on the other side. Thereafter, concrete shall be poured on both sides of the pipes to the required height.
The pre-cast blocks shall first be properly set on the trench bottom and boned to the correct position and level. The pipes shall then be laid on the blocks and properly centered, jointed and finally brought to the correct gradient by the application of wooden wedges one on each side of the pipe and between the pipe and the concrete blocks. These wedges shall remain left-in whilst the pipes are jointed and tested, as herein specified and during the pouring of the concrete beneath and around the pipes. Where the concrete while being poured would otherwise cause the pipes to float, pipes shall be effectively anchored to prevent such flotation .

6.1.6 Transverse Anchors (Collars)

As shown on the Drawing, pipes laid on steep slopes shall be provided with reinforced concrete transverse anchors. As specified the section of pipe embedded in the concrete shall be free of coating and loose material. The concrete shall conform to the specification.

6.2 METAL WORKS

6.2.1 General

Metal work such as step irons, pipe supports, pipe anchor clamps, etc. shall be fabricated and erected or installed as per the specification and in strict accordance with the dimensions and details shown on the Drawings or determined by the Engineer. Any shop drawings that may be necessary shall be prepared by and at the expense of the Contractor and submitted to the Engineer for approval.

6.2.2 Erection and Painting

All metalwork shall be erected and installed to the exact lines and positions shown on the Drawings or determined by the Engineer and shall be well anchored to the concrete foundations or structures.

Unless installation by grouting-in anchor bolts or use of expansion anchors in previously prepared recesses is approved, anchor bolts and metal parts to be embedded in concrete shall be placed in position before casting of concrete and shall be held firmly and accurately in place while the concrete is being placed.

Painting shall be done in accordance with Chapter 52 of the specification.

6.3 CONNECTIONS TO EXISTING PIPES

Prior to connecting into an existing pipe, it shall be uncovered for a suitable length and the exact position, type and diameter of the existing pipe shall be determined. The interruption of any water supply shall be coordinated with the owner of pipeline and the stoppage of the supply must be kept as short as possible and the time table agreed with the Engineer must be strictly adhered to.

The section of the pipe in which the joint is located shall be fully isolated between the nearest two adjacent valves and all service connections shut off; the other parts of the pipe shall remain full of water under pressure. The pipe shall be emptied in such a manner that the new pipe connection will be installed under dry conditions. Where a new pipe is to be connected to an existing one, without an outlet having been provided beforehand one pipe length shall be disconnected and removed, a section of it cut away and the remaining pipe ends trimmed to accommodate the joint and its accessories as shown on the Drawings.

It is absolutely essential that the existing pipe shall be kept clean from impurities of any kind, and precautions shall be taken to prevent the entrance of dirt of other deleterious matter into the existing pipe while it is open for making the connection. Where the excavation for uncovering the pipe and making the connection is found wet it shall be disinfected with liberal quantities of hypochlorite. The interior of all pipes and fittings used in making the connection shall be swabbed with a 5 percent hypochlorite solution before they are installed. As soon as the connection is completed the isolated section of the existing pipe shall be thoroughly chlorinated and flushed. If valve locations permit, flushing shall be carried out from both directions.

6.4 INDICATOR POSTS

Indicator posts as detailed on the Drawings shall be fixed as ordered to indicate the position of bends, air valves, sluice valves, washouts and also pipes at all crossings of hedges and fences as instructed by the Engineer, especially outside urban areas.

An item is included in the Bill of quantities to cover the provision and fixing of these, including the necessary excavation, and the rates include for casting in the concrete post head the letter AV or SV or WO or such letter as may be directed by the Engineer. The letters shall be 8 cm high and 6mm deep.

6.5 WATER POINTS (STANDPIPES)

Water Point (WP) Assemblies shall be installed as shown on the Drawings or at locations to be determined on site by the Engineer. The WP shall be of galvanized iron pipe, connected to the distribution or tertiary pipes and terminate in four taps.

The concrete plinth and base shall provide support for the WP and shall be drained via channels to a soak away pit or to an adjacent road drainage ditch, where one exists within 2.0 m.

6.6 CROSSING UNDER PUBLIC UTILITIES GENERAL REQUIREMENTS

Wherever the construction of the pipeline is to be performed under culverts, roads, bridges, storm drains, sewers, electric conduits, and any other public utilities, the Contractor shall make arrangements with the public authorities having jurisdiction over such affected utilities regarding the method of crossing and restoration.

6.7 CROSSING IN OPEN CUT

Where the crossing of roads and public utilities is effected in open cut, this shall be done in strict accordance the requirements of this category. Cutting in to existing roads and sidewalks shall be done neatly and carefully to straight lines and to the minimum practicable width as determined by the Engineer.

7 TESTS, QUALIFICATION OF WORKERS AND METHOD OF MEASUREMENTS

7.1SAMPLES, TESTS AND COSTS

All samples shall be submitted or prepared in sufficient quantity as required by each item of work specified on each section of the specification or as directed by the Engineer. Samples shall be maintained in their original approved conditions for undisturbed case and rejected ones shall be removed from site.

Tests and sampling shall be carried out in accordance with the procedures set out in the Standards and Codes referred in the specification. In the absence of such procedures other approved procedure shall be used. Where no testing requirements are specified but become necessary, the Contractor shall get the testing done according to the instruction given by the Engineer.

Costs associated with preparation of materials for testing, transport, testing costs, obtaining of records, etc., shall be according to the BOQ given in the Contract document (if any) or born by the Contractor (if not included in the BOQ), if such tests are required by the specification or are determined necessary by the Engineer (whether or not mentioned in the specification) for conformity of materials, workmanship and installed works to the requirement of the

specification. If re-testing required such costs shall also be born by the contractor. If tests are made for the convenience of Employer/Engineer such tests shall be carried out or cause to be carried by the Contractor and related expenses reimbursed by the Employer.

Tests priced in the Bill of Quantities are measured and paid accordingly, otherwise thought to be included and dispersed in the item of works.

7.2 QUALIFICATION OF WORKERS

Adequate number of workers who are skilled/trained and experienced in the necessary crafts and who are thoroughly familiar with the specified requirements and methods needed for the proper performance of the work in each section of this technical specification shall be provided by the Contractor. Contractor's engineers or foremen and any other lead persons shall submit their experience and testimonials to the Engineer for approval before the start of work and for any specialized trades.

7.3 METHOD OF MEASUREMENT

7.3.1 General

Except where indicated to the contrary in the Specification measurement shall be in accordance with the method of measurement as stated in this Clause. Measurement shall be net and allowance for bulking, shrinkage and waste shall be deemed to be included in the Contract Rates.

7.3.2 Excavation

Bulk excavation shall be measured as the net volume of material required to be excavated to accommodate the structure, including any blinding, as if lowered vertically into position. The rate for bulk excavation shall include for backfilling, reinstatement and disposal of surplus excavated material.

Trench excavation for pipelines shall be measured as the length of trench required to accommodate the net length of pipeline. The measurement shall include for all excavation from ground level to the bottom of the pipe plus any additional bedding as specified. Additional excavation for joints shall not be paid for separately. All excavation outside the measurement limits shall be held to be excess excavation, unless ordered or approved by the Engineer when it shall be held to be bulk excavation. Excess excavation shall not be paid for.

7.3.3 Fill

Backfill, rip-rap, rock fill and other types of fill shall be measured for valuation purposes by the net volume of required fill in place after compaction, but excluding any fill required to make good excess excavation.

7.3.4 Concrete

Normal concrete shall be measured for valuation purposes by the net volume placed, compacted and cured to the lines and limits needed to comply with the Drawings or the Specification, without deduction for steel reinforcement and other embedded items less than 0.1 m^3 in volume.

Where indicated in the Bill of Quantities, concrete may also be measured by area of a layer of specified thickness. Concrete of various grades shall be measured separately. No measurement shall be made for finishing the upper surface of horizontal or sloping concrete that requires no formwork.

7.3.5 Formwork

Formwork shall be measured by net area of finished concrete face according to the type of finish and, where indicated in the Bill of Quantities, its location in the works (horizontal, vertical, sloping).

7.3.6 Reinforcement for Concrete

The reinforcement for concrete shall be measured for valuation purposes by the tonne or kilogramme, net weight, needed by standard unit weights to achieve the requirements of the Drawings. No measured for valuation purposes shall be made for overlaps and additional reinforcement introduced by the Contractor for his convenience. All tying wire, chairs and supports necessary for the fixing of reinforcement shall be included in the rates for the reinforcement.

7.3.7 Brickwork and Block work

Brickwork and block work shall be measured for valuation purposes by net volume or area as indicated in the Bill of Quantities, inclusive of all joint areas and all jointing material, excluding pointing of external surfaces, which shall be measured separately by net area of wall pointed.

7.3.8 Masonry Work

Masonry work shall be measured for valuation purposes by net volume constructed, including joints, or by net area of masonry work of a specified thickness. The payment for masonry work shall include for supply of all stone, chipping to size and shape, and mortar jointing.

7.3.9 Plastering and Rendering

Plastering and rendering shall be measured for valuation purposes by net area covered at the specified thickness.

7.3.10 Pipe laying

Pipe laying shall be measured for valuation purposes by linear metre of pipeline laid (net length), including trench excavation up to the depths indicated in the Bill of Quantities (if not given separately).

Rock excavation required for pipe laying shall be measured as indicated in the Bill of Quantities.

Crossings of watercourses and the like shall be measured separately from pipelines within the limits shown on the Drawings.

7.3.11 Fittings and Appurtenances for Pipelines

The additional work involved in laying and installing fittings, valves and appurtenances for pipelines, including all work as shown on the Drawings (excavation, chambers, thrust blocks, etc.) shall be including in the pipeline installation, as indicated in the Bill of Quantities, up to depths indicated in the Bill of Quantities, with the exception of the following:

- Marker posts (which shall be measured separately by number installed).
- Fittings for watercourse crossings and the like (which shall be measured separately).

7.3.12 Watercourse Crossings and the Like for Pipelines

Watercourse crossings and the like for pipelines shall be measured for valuation purposes separately from pipelines, by lump sum for crossings of standard length as shown on the Drawings, including all work shown on the Drawings. Lengths in excess of the standard length (as indicated on the Drawings) shall be measured as additional length as indicated in the Bill of Quantities.

Watercourse crossings and the like shall be measured separately by type as shown on the Drawings.

7.3.13 Testing of Pipelines

Testing of pipelines shall be measured by lump sum of pipeline laid and successfully tested according to diameter and material, as indicated in the Bill of Quantities.

7.3.14 Disinfection of Pipelines

Cleansing, testing and disinfection of pipelines shall be measured by lump sum of pipeline laid according to diameter as indicated in the Bill of Quantities.

7.3.15 Concrete for Pipelines

Concrete for thrust blocks to pipelines shall be included in the rates for additional work for fittings up to the limits shown on the Drawings. Additional concrete for thrust blocks to pipelines shall not be paid for unless required by the Specification or shown on the Drawings or ordered by the Engineer, in which case, additional concrete will be paid for as normal concrete including all bulk excavation required thereof.

Concrete surrounds to pipelines will be measured for valuation purposes by metre length ordered or approved by the Engineer according to pipeline nominal diameter, as indicated in the Bill of Quantities.

ELECTRO-MECHANICAL SPECIFICATIONS

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SPECIFICATIONS

The technical specification of electromechanical equipment and components to be installed in the system is described below.

DEEP WELL SUBMERSIBLE PUMP

The well will be equipped with deep well multistage submersible centrifugal pump. The required pump type is a multi stage, mixed flow type, electric motor driven, deep well submersible pump.
The pump and associated equipment are to be derated for an ambient temperature of 35 degree Celsius and an altitude of 2600 masl.

The Pump is to be selected to transfer water from any water level in the borehole to the receiving Reservoir, having due regard to the range of water levels and possible friction losses.

In particular;

- The selected pump must not overload its motor when pumping against the minimum possible head
- The pump curves must be sufficiently steep to avoid excessive draw downs when pipe friction losses are low
- The selected pump shall be free from cavitation at all times

The pump is to be provided with a non-return valve, isolating valve, air valve, pressure gauge and flow meter in the delivery branch. When the pump closed valve head exceeds the collector pipe work pressure a pressure relief valve is also to be provided.

SUCTION & DELIVERY PIPE WORK

All pipe systems shall be arranged, installed, supported and provided with all necessary means of venting, draining and expansion.
Flexibility in the pipe work at joints in the main structures shall be provided for. Flexible joints or collars and cut pipes shall be allowed on all pipe work where necessary to allow for some margin or error in the building work.

VALVES

The valves shall comply in all respects, including class, testing, marking etc. to the relevant standards. The working pressure of the valves shall be suitable to the pump shut-off pressure.
Valves shall unless otherwise specified be double flanged and flanges shall be as specified above.
All valves, hand wheel, spindles and headstocks shall be positioned to give good access for operational personnel.
Extension spindles shall be supplied wherever necessary to achieve the specified operating requirements.
Valves buried or installed in underground chambers where access to a hand wheel would be impractical shall be key operated.

It shall be possible either to remove and replace or to recondition seats and gates. Gland packing shall be accessible without removal of the valve from the pipe work.
The operating gear of all valves and penstocks shall be such that they can be opened and closed by one man against an unbalanced head 15 per cent in excess of the maximum service value and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required operating torque of 150 Nm.
All hand wheels shall be arranged to turn in a clockwise direction to close the valve or penstock and the direction of rotation for opening and closing shall be indicated on the hand wheels.
Unless otherwise stated the hand wheels shall be coated with black plastic and incorporate facilities for padlocking in either the open or closed position.
Headstocks and valves of 50 mm, or greater, nominal bore shall be fitted with mechanical position indicators to show the amount which the valves is open or closed in relation to its full travel, i.e. 0.25, 0.50, 0.75, 1.
Valve bodies discs and wedges shall be of cast iron, with facing rings, seating rings, wedge nuts and other trim of corrosion resistant bronze, all as specified.
The valves stem, thrust washers, screws, nuts and other component exposed to the water shall be of a corrosion resistant grade of bronze or stainless steel.
Valve bodies and other components of plastic or other non-metallic materials shall be compatible with the medium and of robust industrial design.

wedge gate valves

All wedge gate valves, unless otherwise specified shall be of the non-rising spindle type and be in accordance with the relevant clauses of BS 5163.
Valves shall have good quality cast grey iron bodies, high tensile brass spindles, gun-metal nuts, wedge gates with gun-metal faces and seat, bronze gland bushes and bonnets fitted with soft packing glands. Valves greater that 400 mm diameter shall have detachable bolted covers for inspection, cleaning and flushing purposes.
Valves shall be proved with renewable seats and it shall be possible to remove the gates without removing the valve body from the pipe work.
The gate face rings shall be screwed into the gate or alternatively securely pegged over the full circumference.
Gate valves in chambers and other similar locations shall be provided with hand wheels. Valves, which are to be buried in the ground, shall be provided with extension spindles, protection tubes, spindle caps, spindle supports and surface boxes.
Where necessary to meet the operation requirements, gate valves shall be provided with appropriate thrust bearing guides, and /or gearing and /or bypass valves. When reduction gearing is employed, the gear ratio shall not exceed 4:1. Each valve shall be tested in accordance with the requirements of BS 5150 open-ended in each direction.

Butterfly valves

Rubber seated butterfly valves shall be airtight when shut-off. Valves shall be suitable for the application/pressures and for mounting in any position

and shall comply with BS 5155, for double flanged valves, except where otherwise specified. All bolts, nuts and other fixings, which will be in contact with the contents of the pipelines or, in the case of buried valves within the ground, shall be stainless steel.
Butterfly valves shall be suitable for frequent operated as well as for operation after long periods of idleness in either the open or closed position.
Unless otherwise specified valves shall be hand operated with hand wheels driving through 90^0 gearboxes.
The valves body shall be cast grey iron, the flanges and hubs for the shaft bearing housing being integrally cast with the valve body.
The disc shall be ductile iron having edges machined with rounded corners and polished to a smooth finish. The valves disc shall rotate through an angle of 90 degrees from the valve opened to the fully closed position where the seating shall be at an angle normal to the axis of the pipe. Adjustable mechanical stops shall be provided to prevent over-travel of the valve disc in both the open and closed positions.
Particular attention shall be given to the pipe work both upstream and downstream of all butterfly valves to ensure that the disc cannot foul the adjacent pipe.
Valve seats which extend over the face of the flanges to secure the seat in place, or which require surface grinding and/or hand fittings of the disc, or designs which require the adjoining pipe flange to retain the seat in place and resist line pressure, are not acceptable.
Each valve shall be tested in accordance with the requirements of BS 5155 for body, seat and disc strength tests. Seat and disc strength tests shall be carried out in each direction and the valve shall be drop tight.
Metal-faced butterfly valves shall generally be as above except.

- The valves shall have metal to metal seating
- The valves shall be designed for operation in the partly closed, throttled position, for long periods.
- The valves shall not be of tight shut-off type and the leakage rate shall not be greater than the following figures: 300 mm - 0.075 l/s; 1200 mm - 0.225 l/s.

Non-return valves
Non-return valves shall be suitable for the operating condition and where applicable conform to BS 5153. Long pattern valves shall generally be used.
Check valves shall possess high speed closing characteristics by use of heavy flaps with external weights where specified but designed for minimum slam condition when closing.
Covers shall be provided to allow ample access for inspection, cleaning and servicing and shall be supplied complete with tapped boss fitted with an air release cock.
Hinge pins/shafts and internal fixing devices shall be stainless steel. Hinge pins/shaft shall preferable by square in section to ensure positive location of flaps and provide for secure fixings.
For valves with external levers and adjustable balance weight the hinge pins/ shafts shall extend through a renewable sealing gland on the side of the body.

Valve body design shall be such that there is adequate clearance around and at the back of the flap to minimize jamming by rags, solid matter, etc.
Check valves for potable water shall be free acting type single flap or multiflap with external by-pass and hand operated control valve as necessary. Flaps shall be of design and weight to suit the prevailing hydraulic conditions and shafts shall turn in close fitted low friction bearings.
For potable water application where space is at a premium wafer type double flap non-return vales with spring assisted closing may be specified. These valves shall have cast iron bodies and flaps with resilient seats and be fitted with stainless steel hinge pins and springs.

Air valves

Air valves shall be of the double orifice type with a large orifice for ventilation or exhaustion of the pipeline and a smaller orifice for automatic release of air under normal working pressure. The valves shall be suitable for the maximum working pressures in the system and tested for pressure tightness in steps of 200 kPa up to the maximum working pressures and then for mechanical strength at 1.5 times maximum working pressures. All air valves shall be provided with isolating valves and flanged end connections.
The valves shall be capable of exhausting air from pipe work automatically when being filled, the air being released at a sufficiently high rate to prevent the restriction of the inflow rate.
The valves shall also automatically release air accumulating in pipe work during normal conditions. Air valves shall be designed to prevent premature closure prior to all air having been discharged from the line.
Similarly the valves shall be capable of ventilating pipe work automatically when being emptied, the air inflow rate being sufficiently high to prevent the development of a vacuum in the pipelines.
The material of the body and cover shall be cast grey iron.
The orifice shall be positively sealed in the closed position but the float (ball) shall only be raised by the water and not by a mixture of air and water spray.
The seating shall be designed to prevent the float sticking after long periods in the closed position.

Pressure gauges

Pressure gauges shall comply with BS 1780. Pressure gauges, transmitters and switches shall have over range protection. No plastic material shall be used in their construction. Internal parts shall be of stainless steel, bronze or approved corrosion-resistant material. Pressure gauges shall have concentric scales.
Where compensation of more than 2% of the instrument span is needed for the difference in level between the instrument and the tapping point, the reading shall be suitable adjusted and the amount of compensation shall be marked on the dial.

ELECTRICAL EQUIPMENT

Electric motor is to be sized to suit the maximum power that may possibly be absorbed by the pumps, and is to be derated for ambient conditions,

whilst limiting the temperature rise to that applicable for class F insulation. Starting current shall be limited to 3 times the full load current and capacitors will be introduced if the power factor is below 0.84.
The main supply cable shall be extended, from the main EEPCO switch to the pump control panel located within the pump room.
The pump control panel shall be floor mounted and supported to suit the final cabling requirements to the panel. Spare compartments shall be arranged so that they can, at a later date, be fully equipped without de-energizing any other compartment of the panel.
Lightning protection surge diverter shall be provided to protect both the power and control requirement of the panel, and the general installation, against the effects of lightning activity.
Cables, both power and control, from the motor control panel to the pump motor shall exit from the bottom of the panel and shall run to the upsets on suitably sized galvanized cable tray to the floor trenches.
Tough rubber sheathed power and control cables suitable for the application shall be extended from the weatherproof cabinets to the submersible motor in the borehole, the cables being suitably supported. Weatherproof termination cabinet shall be supplied and installed at the head of borehole.

CONTROL SYSTEM

The borehole pump will be automatically controlled from high and low level control electrodes installed in the borehole.
The motor control panel to be installed in the pump house shall be provided with a start stop switch as well as provision for the indication of general fault and operation status.
The pump shall also be provided with the following automatic cutouts, to stop the pump and indicate a fault, at the pump panel.

- Low source level
- High reservoir water level
- High delivery pressure (closed valve);
- Phase failure;
- Over current;
- Under voltage, or
- Over voltage.

The control and alarm panel sections of motor control cubicles shall, in general, form an integral part of the motor control cubicles. The control/alarm panel section shall be supplied with all necessary lights, circuit protection, isolation switches, controls, and test button, to illuminate all lights and sound the alarm, and all other functions necessary to form a complete and composite unit.
In addition, a master, emergency, lock-off stop button shall be mounted on the panel the activation of which shall immediately shut down the pump. Illuminated lamps shall show the operation and fault status of the pump.

The relevant indicators will remain illuminated until the fault is checked and cleared.
Pressure switches shall be provided in the discharge pipe work to automatically stop the pumps and indicate an alarm on abnormally high or low delivery pressures. The operation and monitoring of the high pressure switch shall be displayed at the panel in the pump house, both audible and visual alarms being initiated to suit the operational requirements of the system. Both the audible and visual alarms shall remain energised until action is taken and the system is re-set.

GENERAL TECHNICAL SPECIFICATIONS

CHAPTER 1: GENERAL PROVISIONS

1.1 Scope and Applications

These Specifications shall apply to the construction and testing of boreholes required in the context of investigation documents of the Africa Union water supply.

The Works under this Contract comprise drilling and testing of production borehole at AU compound.

1.2 Article Numbers

Unless otherwise stated, all Article numbers refer to the Articles in these Specifications.

1.3 Requirements of Specifications, Standards, Brand Names

The Contractor shall fulfil all requirements and obligations under all Articles of the Specifications. Neither the following Articles of this Specification, any descriptions therein nor the quantities shall limit the obligations of the Contractor under the Conditions of Contract. Where items are not included in the Bill of Quantities for any such requirements or obligations, the cost of such requirements or obligations shall be deemed to be spread over all the items of the Bill of Quantities.

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

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

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

1.4 Approval of Supplies, Services, Materials and Goods

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

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

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

1.5 Contractor's Orders for Materials

Without prejudice to any other Article in the Specification, the Contractor shall, before ordering any borehole construction and\or testing materials, or other articles for use and installation in the Works, seek the approval of the Engineer of the names of the persons or firms from whom he desires to obtain any such articles.

1.6 Samples

In addition to any special provisions herein for sampling and testing of materials, the Contractor shall submit to the Engineer as he may require, samples of all materials and goods he proposes to use or employ in or for the Works. Such samples, if approved, will be retained by the Engineer, and no materials or goods of which samples have been submitted shall be used on the permanent works unless and until such samples have been approved in writing by the

Engineer. Notwithstanding the Engineer's approval as provided for herein, the Contractor shall be solely responsible for the quality of all materials and goods supplied, unless specified otherwise.

The cost of supplying all such samples and of conveying the same to such place of inspection or testing as the Engineer may designate within the country of origin and\or the Employer's country, and of complying with the requirements of this Article shall be deemed to be included in the Bid rates and prices.

1.7 Test Certificates

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

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

1.8 Contractor's Work Programme

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

Pursuant to the relevant Article in the Conditions of Contract for submission of work program after acceptance of the Bid, the contractor shall draw up a work programme, showing in detail the order in which the various parts of the Works are to be implemented, with dates of commencement and completion and, where necessary, intermediate stages of works and the dates thereof.

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

After approval by the Engineer, the work programme shall be binding on the Contractor. Changes in the programme may be made by the Contractor only

after prior approval to them has been obtained from the Engineer, which shall not be unreasonably withheld.

The programme shall fully take into account and allow, in a methodical manner, for the need to coordinate procedures with other contracts being carried out in the area.

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

1.9 Drawings

1.9.1 General

The whole of the Works shall agree in all particulars with the details shown in the Drawings and the Engineer's instructions.

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

1.9.2 Additional Construction Drawings

The Engineer may at any time during the Contract period issue such additional construction drawings as may deem necessary for proper performance of the Works.

1.9.3 Records and As-Made Drawings

After the work has been completed, and prior to obtaining the Certificate of Completion, the Contractor shall furnish "As Made" drawings prepared during construction, showing the Works as constructed, together with all other information that may either be required or be useful in the future.

1.9.4 Drawings and Documents to be Returned

Before the Engineer shall issue the Final Certificate, the Contractor shall return to the Engineer all Drawings, Specifications, Bills of Quantities and any other document which may have been supplied to the Contractor for the purpose of the work, if so requested.

1.10 Hydrogeological Data of Existing Boreholes

Available hydrogeological data of existing boreholes in the vicinity of the Project sites will be made available to the Contractor. The Employer will bear no responsibility to the accuracy of the data shown, and the Contractor should draw his own conclusions and assumptions. The Employer shall not entertain any claims by the Contractor arising from wrong interpretation, missing information, etc.

1.11 Contractor's Temporary Facilities

1.11.1 General

At the beginning of the Contract, the borehole sites shall be fenced off by the Contractor. By the end of the Period of Maintenance the area and its environs shall be cleared of all construction equipment, material, buildings and the like, and shall be re-graded and reinstated as directed by the Engineer.

1.11.2 Buildings for Temporary Use by the Contractor

The Contractor shall maintain in perfectly useable and watertight condition such temporary and permanent buildings as required for the performance of the works.

1.11.3 Temporary Sanitary Conveniences

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

1.11.4 Cost of temporary Facilities

The cost of all the Contractor's temporary facilities as described hereabove shall be held to be uniformly spread over the rates for all items in the Bill of Quantities.

1.12 Contractor's Equipment

All the Contractor's equipment used in the performance of the works shall be of such type, size and of such method of working as the Engineer approves. If

for any reason whatsoever the Engineer shall be of the opinion that any equipment or appliance employed or proposed to be employed by the Contractor for the purpose of the works shall not be used, or that any such machine or appliance as aforesaid is unsuitable for use in the Works or any part of them, then such equipment shall be immediately withdrawn from use. The Engineer shall inspect and approve the Contractor's equipment prior to commencement of drilling operations. If equipment is not satisfactory, the Contractor shall provide such equipment that meets the Engineer's approval.

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

The cost of providing constructional plant for all purpose shall be uniformly spread over all the items of the Bill of Quantities.

1.13 Water Supply

Water will be required for the drilling works. The Contractor shall make his own arrangements for obtaining supplies of water of approved quality. The contractor must insure that he has adequate pumping equipment available to abstract water and transport it to the drilling sites using tankers with a capacity of 10,000 l.

The contractor shall use clean drinking water for the drilling work. Use of any untreated water from rivers or ponds is strictly prohibited without written permission of the engineer. If the contractor is found using water from the above prohibited sources without the approval of the Engineer, the Engineer shall have the right to reject the borehole drilled using such water. No payment shall be made for the rejected borehole without any limitation to the depth of the drilled borehole.

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

The cost of supplying water for all purposes shall be uniformly spread over all items of the Bills of Quantities.

The Contractor shall be solely responsible for the supply of all water required in the works for whatever purpose and no claim for extra payment or extension

of time based on the lack or insufficient or delayed supply of water will be considered or entertained.

1.14 Electric Power Supply

The Contractor shall make his own arrangements for all electric power supply which will be needed for the execution of the Works.

If necessary, the Contractor shall provide, erect, operate and maintain in good condition a diesel driven electric generator, large enough to supply the contractual requirements. Sufficient standby is essential to ensure the required electric power at all times.

The Contractor shall also install, connect and maintain in good condition all cables, conductors and other electrical plant and equipment required to perform his contractual obligations. All such plant and installations as described above shall comply with the relevant requirements and regulations of the Ethiopian Electrical Light and Power Corporation (EEPCO). All the electrical facilities shall be erected and be maintained to the full satisfaction of the Engineer.

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

1.15 Discharge of Water from Works

The Contractor shall make such provisions for the discharge of any water, whether fouled or discoloured or otherwise, from the Works as shall be satisfactory to the Engineer and to any authority and/or person having rights over the lands or water courses over or down which such water is discharged. The Contractor shall hold the Employer indemnified against any claim that may be made through non-compliance with this Article.

In the event of there being any interference with existing land or road drainage due to the construction of the Works within or without the limits of the works, the Contractor shall take immediate steps to restore the drainage to the satisfaction of the Engineer and owners, occupiers, or the authority concerned.

1.16 Project Signboards

The Contractor shall supply, erect, and maintain adequate signboards at locations to be determined by the Engineer. The project signboards shall be 120 cm high and 240 cm wide, and shall be lettered according to instructions provided by the Engineer.

1.17 Fire Fighting Equipment

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

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

1.18 First Aid Equipment

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

a. A complete first aid kit with medicines, bandages, splints, etc.
b. A motor car to be always available for emergency transportation.
c. Stretchers for carrying injured persons are to be provided and maintained at the site.

1.19 Coordination with Other Contractors

Should one or more other contractors be working for the Employer on or near the Site, then, pursuant to the provisions of Conditions of Contract (edf_d4annexgc_en), the Contractor shall coordinate his activities under the direction of the Engineer with those of the other contractor or contractors working for the Employer on or near the Site. Whenever interference between the operations of more than one contractor occurs, the Engineer will decide upon the order of preferences of work under different contracts so that the whole of the Works shall be completed in the most efficient and economic way to the Employer, and the Contractor shall abide by such decision of the Engineer.

The Contractor shall not be entitled to claim any extra payment, time extension or compensation for interference and delays caused by the adherence to the requirements of this Article. However, if the Engineer requests readjustment of time schedule as a result of coordination of works under different contracts, and such readjustment shall, in the Engineer's opinion, cause a delay in the works beyond the time limit fixed under this Contract, the Contractor will be granted an extension of time accordingly.

1.20 Packing, Marking and Delivery

Prior to the dispatch from the factory or Contractor's works, equipment and materials shall be thoroughly protected against corrosion and incidental

damage, including the effects of vermin, rough handling and bumpy land transportation, strong sunlight, rain, high temperature, humid and salty atmosphere or sea spray.

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

All crates and packages shall be correctly and adequately marked indelible blue colour code as follows:

- Name of the Project.
- Contract number.
- Designation.
- Item Number.

CHAPTER 2: SITE WORKS

2.1 Sites of Works, Care of Property

2.1.1 General

The areas within the Sites of the Works on which the Contractor shall be permitted to do his work, to assemble his equipment and tools, to erect his stores as well as the right of way for access to the said areas mentioned herein and in Chapter 1 will be provided by the Employer. The final limits of the above areas will be determined by the Engineer on site in cooperation and mutual agreement with the Contractor.

The Contractor’s responsibilities under Conditions of Contract (edf_d4annexgc_en) shall apply to the whole of the land occupied or used by the Contractor for the purpose of this Contract. Should any event occur which is likely to give rise to liabilities the Contractor shall immediately notify the Employer thereof and shall thereafter keep him informed on the state of negotiations towards settlement of any claims by third parties and on the way in which the Contractor intends to meet his obligations. The

Employer shall have the right to withhold from any sums due to the Contractor payment of such sums as may appear to the Employer sufficient to cover the Contractor's liabilities until evidence is produced by the Contractor to the Engineer to show that the Contractor's liabilities in this respect have been settled and discharged.

The Contractor shall adopt all required measures to prevent soil erosion arising directly or indirectly from his operations and site clearance shall be done on the minimum area necessary for performing the Works. Where possible, the original surface contours shall be reinstated and protected.

2.1.2 Prevention of Obstructions, Pollution & Avoidance of Nuisance

The Contractor shall ensure at all times that the site and the approaches thereto are not obstructed or made congested and that no nuisance is created due to the construction of the Works which might affect the site or its environment.

The Contractor shall ensure that there is no spillage of oil and/or petroleum substances into rivers or other water courses. Before commencing any work which could involve spillage of oil and/or petroleum substances, the Contractor shall consult with the Engineer and provide such effective anti-pollution measures as may be required to prevent such spillage or pollution.

2.1.3 Public Roads, Bridges, etc.

Where any road, path, right of way, or parcel of land, etc. is interfered with by the Works, and wherever necessary or required for the convenience of the public or individual residents, the Contractor shall provide suitable temporary approaches, bridges, gangways, and roads over unfilled excavations, except in such cases as the Contractor shall secure the written consent of the individuals or authorities concerned, to omit these. All such temporary facilities shall be maintained in service until all requirements of the Specification have been fully complied with. Temporary bridges for street and highway crossings shall meet the requirements and approval of the authorities having jurisdiction in each case as may be required.

Particularly, the Contractor shall provide means of access to enable the adjacent occupiers to carry on their normal occupations, and shall indemnify the Employer against any claims or loss of business, property, or amenities.

The Contractor shall obtain the approval of the authorities or owners in advance as to the nature of the temporary approaches, bridges, gangways and roads, and shall arrange with them for suitable dates for the performance of all related work.

The cost of compensation, constructing, maintaining and removing all temporary bypasses, gangways, bridges, etc. under this Article shall be spread uniformly over all items in the Bill of Quantities.

2.1.4 Work in Vicinity of Power Lines

Wherever the Works may cross an electrical power line right of way, the Contractor shall familiarize himself with the requirements and regulation of the Ethiopian Electric Light and Power Corporation (EEPCO) with regard to work carried out in the vicinity of power lines. The Contractor shall comply with such requirements and regulations and obtain any permits required.

Equipment shall not be operated where it is possible to bring such equipment or any part of the equipment within three (3) metres of any energized electrical conductor unless the utility company has been notified, and either the line has been de-energised, or effectively guarded against contact, or displaced or re-routed from the work area. For high-voltage transmission lines, a greater clearance shall be provided as determined by EEPCO.

Where practical, metallic pipe sections shall not be stored under overhead high voltage power lines. If pipe sections must be stored under power lines, the Contractor shall protect personnel from the effects of induced currents by grounding pipe sections at two (2) locations with a 40 mm2 copper ground conductor and grounding rods.

2.2 Royalties

Any royalties payable by the Contractor in respect of soils or rocks excavated or land, outside that made available free under the Contract, for the construction of permanent Works, shall be reimbursed through the monthly interim certificates.

2.3 Access to the Works

2.3.1 General

All work necessary for access to the site shall be performed by the Contractor at his own expense. The Employer assumes no responsibility for the condition or maintenance of any existing road or structure thereon that may be used by the Contractor for performing the work under this Contract and for travelling to and from the site.

No payment will be made to the Contractor for improving, repairing, or maintaining any existing road or structure thereon that may be used by the Contractor for performance of the work under this Contract.

The Contractor shall prepare at his own cost temporary access roads to the sites for construction purposes as approved by the Engineer. Such roads shall be of sufficient width and stability to permit the movement of all vehicles and equipment and shall be maintained by the Contractor in a good and serviceable condition throughout the period of the Works. The Employer and the Engineer and their employees as well as any other contractor working on the sites for the Employer shall at all times have the free use of the temporary roads prepared by the Contractor.

2.3.2 Access to the Works and Damage to Roads

Neither the terms hereof nor anything shown on the Drawings in connection with temporary or permanent right of way provided by the Employer shall be construed to entitle the Contractor to access rights in violation of any local regulations and/or the requirements of this Contract.

Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street or way during the performance of the Works, and he shall conduct his operations in accordance with the requirements of Article 2.1 hereabove.

2.4 Site Preparation

2.4.1 Scope

The works under this Article include site clearance, levelling and erection of fencing that may be required, protection of any existing structure of element that must remain intact, etc. Prior to commencing the above works the Contractor shall obtain all necessary licenses and permits required for their performance.

2.4.2 Site Clearance – General

The areas of all sites on which work is to be done shall be cleared of all standing or felled trees, stumps, bush, logs, debris, rubbish and other objectionable matter.

The Contractor shall not commence clearing any area and/or demolition without having received written instruction to it from the Engineer.

2.4.3 Clearing of Vegetation

Trees, stumps and bush shall be cut off flush with the ground in all areas to be cleared. The clearing shall be maintained until completion of the Works. All trees outside the area to be cleared and such other trees that are not to be removed shall be carefully protected from damage during the Works operations, and no trees shall be removed without the prior consent of the Engineer.

2.4.4 Leveling

In addition to the clearing to be carried out as specified in Sub-Article 2.4.3, the stumps and roots of trees and bush shall be grubbed in areas at the site.

In addition to the clearing to be carried out as specified in Sub-Articles 2.4.2 and 2.4.3, the Contractor shall level the site to the elevations shown on the Drawings or directed by the Engineer.

2.4.5 Disposal of Trees, Roots, Etc.

All materials from required clearing shall be removed from the area, burned completely or disposed of in a manner satisfactory to the Engineer.

All materials to be burnt shall be piled and all burning shall be so thorough that the materials will be reduced to ashes. Piling for burning shall be done in such a manner and in such locations as to cause the least fire hazard and nuisance to inhabitants of the area. The Contractor shall have available at all time, for use in preventing and suppressing fires, apparatus and fire-fighting equipment satisfactory to the Engineer. When, in the opinion of the Engineer, the fire hazard is great, burning shall be deferred or additional fire-fighting equipment shall be provided.

All materials not burned to ashes shall be disposed of by removal from the site of the Works, and upon removal such materials shall become the property of the Contractor who shall dispose of them by burial in locations and in a manner approved by the Engineer.

2.5 Cleaning Up of Site

During the progress and on completion of the Works, the Contractor shall clear up and remove from the surface of the ground all temporary buildings as per the Engineer’s instructions, plant, material, debris resulting from demolitions, litter, rubbish, and surplus soil which may be left on the ground or in and about the Works or land temporarily occupied by the Contractor. After completion of the Works the Contractor shall clean up the entire site and shall leave it in a neat and clean condition to the satisfaction of the Engineer. To this end he shall level and fill any temporary roads, spoil heaps, cuttings or embankments, not permitted to remain as part of the permanent Works, and shall take particular care to restore any

existing drains that may have been blocked or interfered with by his operations. Any surplus soil from the Works shall be disposed of to the satisfaction of the Engineer.

The Contractor shall adopt all measures to ensure that soil erosion is avoided.

CHAPTER 3: CONSTRUCTION OF BOREHOLES

3.1 General

All materials and workmanship shall be of the best quality throughout and shall comply with the relevant latest edition of American Petroleum Institute (API) or with equivalent ISO or DIN Standards. All materials to be permanently built-in shall be new and shall be accompanied by Manufacturer's Certificates, stating their compliance with this Specification and the standards mentioned therein and the name of the inspection authority.

The methods of stocking, mixing, transporting, fixing, placing and applying all materials shall be to the approval of the Engineer who shall be kept advised of any changes of plan.

3.2 Borehole Construction

The boreholes to be constructed hereunder are to be drilled to size and dimensions as specified in the scope of works for each town and the Drawings and as instructed by the Engineer.

It is anticipated that completed boreholes shall consist of the following principal sections:

- Drilling in nominal diameter of 20" to 16" which will enable the placing of conductor (surface) casing of diameter of 16" to 14", respectively. The minimum annulus size for cementation will be 4".
- Drilling in 12" to 10" nominal diameters which will enable placing casing pipes of nominal diameter of 8" to 6", respectively.

Drilling of the boreholes may be for a telescopic section structure or single section structure, as shown in Drawings and as instructed by the Engineer.

A telescopic section borehole shall comprise, in addition to that for the surface casing, also two concentric drilling sections, namely: upper pump housing section of wider diameter, and lower production drilling section of narrower diameter. The diameter of

drilling and depth of change in drilling diameter shall be determined by the Engineer on site.

A single section borehole shall comprise, in addition to that for the surface casing, also a single concentric section. The diameter and depth of drilling shall be determined by the Engineer on site.

Gravel pack may be required, depending on site findings, and shall be done on written detailed instructions by the Engineer. If required the gravel must be introduced slowly and carefully around full circumference of the annulus and water must be pumped to facilitate the movement of gravel to the bottom of the borehole. To avoid bridging of the gravel, it is forbidden to fill-in the gravel by mechanical equipment. The gravel must be filled-in by hand, using shovels.

The correct placing of gravel will have to be controlled by continuous recording of the volume of gravel consumed and by repeated measurement of the level of packing.

The final design of the borehole (total depth, depth of the housing line and the accurate placing of water inlet section/s) will be decided after running an electrical resistivity and / or SP logging upon instruction of the Engineer.

Construction of boreholes shall be immediately followed by the borehole's development and testing as specified in Chapters 4 and 5, respectively, hereinafter.

3.3 Drilling Equipment

The Drilling rig shall be capable of drilling to the specified depths and diameters in all formations and carrying out all subsequent operations required in this Specification to render the borehole complete. It shall also be capable of first drilling and then reaming with larger diameter bit from ground level to depths as deemed by the Engineer.

The Equipment shall include all auxiliaries necessary for the proper execution of the works.

The Contractor shall permit the Engineer to inspect the rig(s) and the ancillary equipment at the Engineer's discretion at the time of bidding.

3.4 Methods of Drilling

The drilling sites are situated in different towns and considerably vary in rock units to be penetrated. Accordingly the drilling methods may vary from town to town and/or may also vary within the same town. The Contractor shall have equipments capable of drilling both in loose and intact units. Unless specified differently, the Contractor shall drill the boreholes by the methods as directed by the Engineer:

a. Rotary.
b. Down the hole (DTH) drilling.

3.5 Drilling Procedure

After the Contractor has acquainted himself with the specific conditions of the borehole to be drilled, and before the beginning of work, the Contractor shall submit to the Engineer a detailed programme of work. The following is only a general description of the work to be carried out, and specific details will be determined while drilling is in progress and more information is at hand about the geological formations.

The Contractor shall select the initial diameter of drilling in accordance with the equipment at his disposition and as approved by the Engineer.

Whenever the nature of the geological formation is such that it is necessary to ensure the stability of the borehole, and/or that deposits are likely to fall in, and/or be washed into the borehole, then the Contractor shall line the borehole to the satisfaction of the Engineer with suitable temporary casing.
The Contractor shall notify the engineer in advance of each and every decrease in diameter of drilling.

The following shall apply to drilling with conventional drilling rigs:

The equipment shall be of the proper type and shall be in good operational condition so that the work can be done without any interruption. Drill collars of sufficient size and length shall be installed to maintain verticality of the borehole.

Circulation of drilling fluid is to proceed continuously on a 24-hour-a-day basis whenever required. No unnecessary delays and work stoppages due to negligence or faulty operations on the part of the Contractor shall be permitted. The Contractor shall be held responsible and payment shall be withheld for damage done to the well by negligence or faulty operation.

Foaming additives can be used in DTH drilling method.

The selection, supply and use of drilling additives shall be the sole responsibility of the Contractor. Toxic or dangerous substances that may adversely affect the quality of the water shall not be added to the drilling fluid. The Contractor shall be responsible for maintaining the quality of the drilling fluid to assure:
- Protection of water bearing and potential aquiferous formations exposed in the borehole,
- Obtaining good and representative samples of the formation material.

3.6 Electrical Logging

Electric logging shall be conducted in successful boreholes.

The purpose of the electrical logging shall be to verify and supplement the descriptive account of the borehole recorded by the Contractor as drilling proceeds, with the following information:

- Details of the lithological profile;
- Depth of aquifers.

Instrumentation for electric logging shall be of the two electrodes “normal device” type. One electrode shall be for the measurement of self-potential (SP), and the other electrode for the measurement of the apparent resistivity (R). All the equipment and instruments used for electric logging shall be approved by the Engineer prior to their use.

The Contractor shall carry out the required operations by personnel skilled in conducting these measurements and in interpretation of the results. The operation shall be as follows:

a. Electric logging shall be conducted in uncased boreholes upon completion of the drilling of the holes (before reaming).
b. The drilled hole shall be cleaned by circulation of drilling fluid, and its depth measured.
c. The electrode cables shall be lowered into the borehole while at the same time measuring the depth.
d. The logs shall be taken from the bottom of the borehole upwards while the cable is taut over its entire length.

Upon completion of all operations, the Contractor shall submit to the Engineer the electric logs, comprising both of SP curve and R curve, together with their interpretation. Contractors that can produce also Gamna-Gamma or neutron logs, additionally to SP and resistivity logs are preferred. Should the Engineer refuse to accept the results of the logging because of technical faults, then the Contractor shall repeat the measurement until satisfactory results are obtained.

3.7 Casing for Permanent Use

Casing to be used for the permanent surface casing shall be of specified diameter, made of steel. It shall be of heavy-duty classification, and it shall have a wall thickness of not less than 7 mm. In his Bid, the Bidder shall indicate the material, wall thickness, method of jointing together individual casing pipes, etc. he intends to apply, and shall not procure, nor start the Works prior to obtaining approval for these from the Engineer.

Prior to ordering materials the Contractor intends to use for the Works he shall provide technical specifications for the Engineer’s approval. The Contractor shall allow the Engineer to examine the materials.

Casing to be used for the permanent inner casing and as permanent part of the borehole shall have the specified diameter. Steel casing pipes shall be seamless and shall comply in all respects with API-5LB. The type and grade of the tube shall be in accordance with API –5LB; whereas u-PVC casings must comply in all respects with DIN 8061 and 4925.

The casing and screen shall be so centered that the completed string will be plumb and true, installed at position as directed by the Engineer. Centralisers shall be spaced not more than 15 m apart.

The type and quality of casing requirement of each town is provided in detail in Part II: Particular Specification of the contract.

3.8 Temporary Casings

Temporary casings under this Specification are defined as temporary units of outer casings which may be withdrawn when the permanent casing and screen are placed.

The temporary outer casings intended for construction purpose only, shall be of such weight and design as necessary to prevent entrance of fine material, be reasonably watertight, and to permit its installation and withdrawal without distortion or rupture to the specified depth and dimension.

3.9 Water Ingress Sections

3.9.1 Diameter and Length

Water access sections of 6’’ or 8” diameters and approved type shall be provided by the Contractor as directed by the Engineer. The length of active screen shall be determined in relation to the thickness of water-bearing strata and according to the driller’s log and electrical log. The section shall be designed to produce a minimum loss of head or drawdown between the water bearing strata and the well, and shall be of a standard manufactured type.

3.9.2 Type of Water Access Section

The type of water access section to be used may be one of the following, in order of preference: wire wound (Johnson type, or equivalent), slotted type or bridge slots (Nold type, or equivalent) or louver (shutter) type. Screen and slot openings shall preferably be V shaped as approved by the Engineer, widening inward to permit fine particles to pass through without clogging during development of the borehole.

The type and quality of screen requirement of each town is provided in detail in Part II: Particular Specification of the contract.

3.9.3 Access Section Openings

The number and type of slots or openings will depend upon the type of water access section selected and upon the areas required to obtain sufficient entrance capacity. The width of slots will be determined on the basis of a sample of the water bearing formation, or shall be predetermined in accordance with the anticipated lithology of the formation. The sizes of openings which are expected to be used shall be as specified.

The size of the slots in the pipes shall normally be 1mm to 3 mm, and the total open area of these pipes shall be at least 10% of the total pipe area.

The opening or slots shall be so designed as to prevent clogging and shall be free of jagged edges, irregularities, or any deformations that will accelerate or contribute to clogging or corrosion.

3.10 Placing and Securing of Casing

After the casing and water inlet section(s) have been lowered into the well, they shall be held slightly above the bottom of the hole by suspending the casing from the ground surface. The Contractor shall take the necessary precautions to secure the casing to its place. It is essential that the Contractor ascertains that the production line is supported directly and on firm ground where there is a diameter change. The ground foundation should be firm enough to support the whole weight of the string.

3.11 Observation Pipes

For the purpose of observation of water levels in the boreholes, a permanent observation pipe shall be installed in the annular space of the borehole. The observation pipe shall be of GS pipe of ND19 mm (3/4 inches) diameter. The observation pipe shall be screened in the area of the aquifer. The Engineer shall decide the position of the screens of the observation pipe. The screen shall be made of 1mm to 2mm slot opening. The slots shall be manufactured or made of hacksaw. Perforations made of welding torches and grinders shall not be acceptable in any condition. During installation the bottom of the pipe shall be plugged by tapering the end in order to avoid entrance of particles through the bottom and also to allow smooth installation.

The observation pipe can be installed along with the well casing by welding or after completion of casing installation. The appropriate method shall be selected based on the drilling condition on the site. It should be noted that failure of installation of observation pipes by the contractor due to difficult drilling conditions resulting from geological conditions will not entitle the employer not to accept the borehole.

3.12 Engineer's Approval for Construction and Completion of Boreholes

The Contractor shall present for the Engineer's approval his proposed materials and construction methods for the completion of the borehole with regard to the following subjects:

a. Completion of the borehole by natural development.
b. Details of the water inlet section(s), including type, technical specification and cost.

The contractor shall construct the borehole as aforesaid, based on data and analysis of samples taken from the boreholes and other information obtained during drilling operations, and to the Engineer's satisfaction.

In no case should the Contractor undertake the completion of a borehole prior to obtaining the engineer's approval.

3.13 Grouting

3.13.1 General

The annular space between the conductor pipe (surface casing) and the wall of the drilled hole shall be filled with cement grout. The objective of this grout is to produce a complete sheath of cement-mortar around the conductor pipe. Before proceeding with the placing of the grout, the Contractor shall obtain the Engineer's approval for the method he proposes to adopt, and the materials to be used.

3.13.2 Materials for Grouting

Materials for grouting of boreholes shall be such that it can easily be placed and will thereafter assume a permanent and durable form. Grout will usually be composed of water and ordinary Portland Cement in accordance with CP110.

Materials required to accelerate or retard the time of setting may be added in accordance with the Engineer's directions. In exceptional cases, when large openings are to be grouted, the addition of sand to the grout may be permitted, subject to the Engineer's approval. The water shall be suitable for concrete mixing, free from injurious impurities.

If so directed by the Engineer, 3% of bentonite (by volume) fluidifier may be added to the neat cement mixture. When addition of sand is permitted, fine clean natural sand shall be used. The grout mixture shall be of minimum water cement ratio in order to keep the shrinkage to a minimum. The quantity of water shall not exceed 10 litres per bag of cement (50 kg). The grout mixture shall be of such consistency that it can be forced through the grout pipe.

3.13.3 Grouting Annular Space Surrounding Protective Casing

The grout outside the surface casing may be placed by the method given below:

The grout shall be applied through a grout pipe of minimum diameter of 25 mm. Application may be by pumping or by gravity. In depths exceeding 50 m the grout shall be introduced only by pumping. The pipe shall initially extend to the bottom of the annular space and shall remain submerged in grout during the entire time that grout is being placed. The pipe may be left in place, or may be gradually removed. In the event of interruption in the grouting operations, the bottom of the grout pipe shall be raised above the grout level and shall not be submerged until all air and water have been displaced from the grout pipes.

No drilling operation or other work in the borehole shall be permitted within 72 hours (when bentonite has been added) or 48 hours (when a neat cement mixture has been used) after the grouting of casings.

3.14 Withdrawal of Temporary Outer Casing

Temporary casings shall be gradually and carefully extracted to expose the inlet section completely in the water bearing formation.

The Contractor may leave the temporary casing in the borehole above the water inlet section, but no payment shall be made for such temporary casing left in the borehole.

3.15 Testing for Verticality and Alignment

3.15.1 Requirement to Test

All boreholes shall be constructed and all casing and liners set round, vertical and true to line as defined herein. The Contractor shall demonstrate to the Engineer the compliance of his work with this requirement, and shall provide all labour, tools and equipment, and shall make the tests described herein in the manner prescribed by, and to the satisfaction of the Engineer. Tests for verticality and alignment must be made after the construction of the well has been completed and before its acceptance, and during the performance of the work. Verticality tests may be conducted either in the open hole or inside the casing. No separate payments shall be made to the Contractor for making these tests.

3.15.2 Description of Tests

Verticality and alignment shall be tested by lowering into the housing line below ground surface a section of pipe 13 m long or a cylindrical dummy of the same length.

The outer diameter of the pipe used for this test (plumb test) shall be 12 mm smaller than the diameter of that part of the casing or hole being tested. If a dummy is used, it shall consist of a 10 or 13 m long galvanized roller sheet metal.

3.15.3 Requirements for Verticality and Alignment

Should the plumb or dummy fail to move freely throughout the length of the casing or hole to the bottom of the housing line, or should the borehole vary from the vertical in excess of 100 mm per 30 m of depth, the plumbness and alignment of the borehole shall be corrected by the Contractor at his own expense. Should the Contractor fail to correct such faulty alignment or verticality, the Engineer may refuse to accept the borehole.

The Engineer may waive the requirements of this paragraph for verticality tests if, in his judgment:

a. The Contractor has exercised all possible care in constructing the borehole and the defect is due to circumstances beyond his control.
b. The usefulness of the completed borehole will not be materially affected.
c. The cost of necessary remedial measures will be excessive.

In no event will the provisions of this paragraph, with respect to the stipulation for alignment test, be waived.

3.15.4 Record of Verticality and Alignment

The Contractor shall, after completion of the tests, prepare and submit to the Engineer a graph showing the verticality and alignment, or deviations therefrom, for every 3 m depth from ground level to the bottom of the housing line.

3.16 Daily and Monthly Reports

The Contractor shall submit a daily report describing the nature of materials encountered and the work done during each day, including such items as work accomplished at depth drilled, casing set, the water level in the well at the beginning and end of each shift, and such other pertinent data as is requested by the Engineer to be recorded.

3.17 Working Records and Samples

3.17.1 General

The Contractor shall furnish to the Engineer, in a form to be approved, records and samples as stipulated hereinafter

3.17.2 Drilling Cuttings

The Contractor shall keep an accurate record of the materials encountered during the drilling of the borehole and shall make every endeavor to describe accurately the formation layers. The Contractor shall also ensure that his description of the formation samples is sufficiently accurate to permit the identification of both lithology of the formation penetrated by the borehole and the stratigraphical succession.

Representative samples shall be taken at fixed intervals of not more than 1 m apart and at each change in formation. Samples and cores shall be stored temporarily, until completely dry, in wooden or aluminum alloy boxes with compartments on which the depth interval represented by each sample shall be clearly marked. When completely dry, the samples shall be transferred to appropriate cardboard or wooden boxes with compartments, for permanent storage and easy inspection. The compartments shall be clearly marked, designating borehole and the depth interval represented by each sample. A special store of sufficient size and having adequate shelves shall be provided by the Contractor for this purpose. Where required by the Engineer, additional samples, marked and labeled as required by the Engineer, shall be taken by the Contractor and retained in the store for examination by a geologist.

3.17.3 Records of Water Levels

The Contractor shall accurately record the elevation at which the water level stabilizes as each aquiferous unit is encountered, and the depth of the top and bottom of each stratum penetrated.

3.17.4 Records of Casing and Water Inlet Pipes

The Contractor shall keep an exact record of the order in which each length of pipe is installed in the well, identifying each one by number, size and length.

3.17.5 Records of Verticality and Alignment

As specified in Article 3.14.4 hereabove.

3.18 Capping of Boreholes

On completion of the borehole, a concrete slab shall be cast around the upper part of the surface casing to a depth and dimensions as directed by the Engineer to fill the space between the surface casing and the wall of the borehole. The top of the permanent casing shall reach 30 cm above normal ground level. Surface casing around the inner casing shall be raised at least 30 cm above the inner casing and then capped properly by welding all around a 6 mm thick steel plate to secure the well. An appropriate socket and plug shall be installed in the steel cap to enable measurement of static water levels through observation pipes.

3.19 Completion of Boreholes

3.19.1 General

Upon completion of all work and tests to the Engineer's satisfaction, and submittal of all records and reports as set out in this Specification or required by the Engineer during the execution of the borehole, the Engineer will issue a Certificate for Completion for each borehole as and when completed.

3.19.2 Borehole Completion Report

A full Borehole Completion Report shall be prepared by the Contractor and submitted to the Engineer within ten (10) days after completion of the pumping and other tests as specified in Chapter 33 herein. The borehole completion report shall be prepared in the form prescribed by the Engineer and shall include the following:

(i) A borehole log, showing borehole location, ground surface elevation, measuring point (datum) elevation, soil strata, static water level, and dimensions of conductor and casing pipes, water inlet sections, grouting and cap.
(ii) Pumping tests results and reports.
(iii) Results of water quality analyses.
(iv) All other records as specified under Article 3.16.

Items (i), (ii) and (iii), and the strata samples shall be submitted also to the Employer's Geological Unit.

3.20 Clean Up

After the borehole has been completely constructed, its vicinity shall be meticulously cleaned up of all foreign materials including tools, timbers, ropes, debris of any kind, cement, oil, grease, joint dope and scum.

3.21 Protection of Borehole

3.21.1 General

At all times during the progress of the work, the Contractor shall protect the borehole in such a manner as is effective to prevent tampering with the borehole and the ingress of foreign matter into it.

3.21.2 Precautions against Contamination

At any time during the progress of the work, the Contractor shall take such precautions as are necessary to prevent contaminated water, having undesirable biological, physical

or chemical characteristics, from entering the stratum from which the borehole is to draw its supply through the opening made by the Contractor in drilling the borehole. The Contractor shall also take all necessary precautions during the construction period to prevent contaminated water, petrol, or any other contaminant from entering the borehole either through the opening or by seepage through the ground surface.

In the event that the borehole becomes contaminated, or that water having undesirable biological, physical or chemical characteristics enters the borehole due to negligence of the Contractor, the Contractor shall, at his own expense, perform such work or supply such casing, seals, sterilizing agents or other material as may be necessary to eliminate the contamination or shut off the undesirable ingress.

3.21.3 Freedom from Load and Turbidity.

The Contractor shall exercise extreme care in the performance of his work in order to prevent the breakdown or caving-in of strata overlying that from which the water is to be drawn. The Contractor shall develop, pump, or bail the borehole by such methods as may be approved by the Engineer, until the water pumped from the borehole shall be substantially free from load and until the turbidity is less than 5 NTU.

3.22 Stopping of Drilling

The Engineer reserves the right to stop drilling operations at any time and at any borehole under the following circumstances:

a. When the Engineer considers that a sufficient supply of water has been obtained.
b. When the Engineer considers that further drilling is unlikely to be advantageous.
c. If the Engineer considers that the work is not being carried out in a satisfactory manner (see Article 3.23).

3.23 Abortive Boreholes

Any borehole which on completion yields less water than in the opinion of the Engineer is necessary to render it of use, shall be considered as an abortive borehole. In this case, the Contractor will be paid for drilling of the borehole at the appropriate rates in the Bill of Quantities. The abandoned borehole shall be sealed as specified in Article 3.25 herein.

3.24 Failure to Complete a Borehole

Should the Contractor fail to comply with the requirements of these Specifications, or should the Contractor fail to complete the borehole due to loss of tools, or of any other cause, and as a result thereof the borehole has to be abandoned, then the Engineer shall have the right to instruct the Contractor to commence a new borehole as near as practicable to the abandoned one, and no payment shall be made for drilling the

abandoned borehole, or any other work carried out in it, or for the casing or other materials used therein.

The Contractor shall then and not later than thirty (30) days from the date of being so instructed by the Engineer, seal the abandoned borehole at his own expense, in a manner as specified in Article 3.25 herein. Salvaged material which has been originally furnished by the Contractor shall remain his property.

3.25 Sealing of Abandoned or Abortive Boreholes

Abandoned or abortive boreholes shall be sealed by filling with concrete, grout, neat cement, clay or clay and sand. In the event that the water bearing formation consists of coarse gravel and producing wells are nearby, care shall be taken to select sealing materials that will not affect the producing wells. Concrete may be used if the producing wells can be shut down for a sufficient time to allow the concrete to set. Clean, disinfected sand or gravel may also be used as fill material opposite the water-bearing formation. The remainder of the borehole, especially the upper portion, shall be filled with clay, concrete, grout, or neat cement to exclude surface water ingress.

CHAPTER 4: DEVELOPMENT AND REHABILITATION OF BOREHOLES

4.1 General

All boreholes shall be developed as specified below before proceeding with testing as specified in Chapter 4 hereinafter.

4.2 Cleaning and Flushing of Boreholes

Once a borehole has reached its final depth as instructed by the Engineer, the Contractor shall inform the Engineer to this effect. The Engineer shall issue an instruction to the Contractor to proceed drilling or reaming of the borehole, or proceed with cleaning and flushing of the borehole. Proceeding with flushing of a borehole by the Contractor without receiving such instruction by the Engineer shall be at the Contractor’s own risk, and the Contractor shall have no grounds for any claim arising from an instruction by the Engineer to revert to deepening or reaming of the borehole.

Where the drilling machine is duly rigged for flushing, it shall be used for this purpose without relocating it from the drilling position.

The Contractor shall submit for approval by the Engineer the Contractor’s programme, methodology and use of materials for cleaning and flushing of the borehole. This shall be based on the method of drilling, lithology and character of the various borehole strata,

drilling fluids used, etc. The Contractor shall proceed with cleaning and flushing operation until the Engineer has been satisfied that it has been completed. Then, the Engineer shall instruct the Contractor to proceed with the borehole development and testing, as appropriate.

4.3 Development of Boreholes

4.3.1 General

The Contractor shall furnish all necessary pumps, compressors, surge plungers, jets, bailers, and other needed equipment and chemicals, as well as equipment of approved size and type for measuring the water discharge, and shall develop the well by such approved methods as shall be necessary to give the maximum yield of water per meter of drawdown and extract from the water-bearing formation the maximum practical yield.

The developing process shall start immediately after the construction of the well and will be considered as completed when the borehole produces entirely clear water to the satisfaction of the Engineer. The water shall be considered sand free when no samples taken during the pumping test contains more than 5 parts per million by weight of particles of sand size. The Engineer may require additional development work aimed to further improve the specific capacity of the well. Testing should not commence until complete development is achieved.

Development process shall be carried out in the presence of the Engineer or his authorized representative, who will issue detailed instructions as the work proceeds. The Contractor shall advise the Engineer in sufficient time before starting the development of any borehole.

4.3.2 Development by Airlift

Development by air compressor shall start immediately after the borehole construction is completed, and no elapsed time period shall be permitted. The airlift is to proceed systematically, from top to bottom, until the discharge will comprise of load free clear water. The air is turned on and off repeatedly to agitate the fine material within the gravel pack and the surrounding formation. This process shall continue every two meters downward within the borehole until the bottom of the borehole is reached. The borehole is then further airlifted until the water is totally clean.

Changing to further development methods such as the usage of surge plunger, jetty tool and pump development shall be subject to the Engineer’s approval.

If required and approved by the Engineer, development by air shall immediately be followed by development by pumping as specified in Article 4.3.3.

4.3.3 Development by Pumping

Developing by pumping shall comprise the following: (it is optional, and shall only be executed upon the Engineer's instructions)

a. Pumping shall be carried out by pumping equipment as specified in Article 4.3 hereinafter and shall be started with a lowest discharge rate and be continued until the water is clear of sand and the water level becoming steady; it shall then be increased gradually and continued as above, and so on, in steps until the maximum discharge is reached. The pump shall be installed at the appropriate position in the housing line.

b. If during pumping in stages as above, the water level for a certain discharge steadies at a large drawdown without yielding clear water, then pumping shall be interrupted and resumed intermittently (jerking method).

4.3.4 Observations Records, Sampling

Observations and data to be recorded and samples to be taken during the borehole development shall include the following:

i) Discharge: Every hour.
ii) Water levels: Before pumping is started, and thereafter at given time intervals coordinated with the Engineer while pumping proceeds.
iii) If requested by the Engineer, samples for water analysis and for load content:
   - Before and after every change of discharge.
   - One and two hours after such change, and thereafter every hour.
iv) All observations, including the date and hour, shall be recorded clearly in a field notebook.

4.4 Equipment for Development

4.4.1 Compressor and Air Pipes

The Contractor shall provide an air compressor having capacity and pressure rating sufficient to carry out the borehole development or cleaning to the satisfaction of the Engineer.

In each case and prior to the carrying out of the operation, the Contractor shall submit to the Engineer for his approval, the Contractor's programme for the borehole development including compressor rating (capacity and pressure), air pipe diameters, method of lowering, air blowing procedure, etc.

4.4.2 Pumping Equipment

The Contractor shall provide and install all the necessary pumping equipment comprising sufficient number, at least two, of pump units and stages capable to pump in a range of discharges from about 7 m3/h to a maximum of 110 m3/h with a varying total dynamic head in a range of 50 to 150 meters. Satisfactory throttling devices or other approved devices shall be provided so that the discharge may be controlled as required.

The pump shall be a vertical turbine pump, oil or water lubricated, or a submersible pump, as approved by the Engineer, and shall be in good running condition. The pumping unit shall be complete with prime mover of ample power, controls and appurtenances, and shall be capable of being operated for long periods of time without interruption.

The pump base (seat) shall have a suitable opening for inserting a water level measuring device. The Contractor shall make available at least two such pumps at the site during the carrying out of the pumping test programme.

The Contractor shall provide all the necessary discharge piping, which shall be of sufficient size and length to convey the water being pumped to a distance of not less than 150 m from the borehole, and as directed by the Engineer. The contractor shall also furnish, install and maintain equipment of approved size and type for measuring the flow of water, such as a weir tank, orifice or water meter. A regulation valve shall be inserted into the discharge pipe just outside the pump head.

4.4.3 Other Equipment

Prior to carrying out cleaning and\or development of boreholes the Contractor shall submit to the Engineer for his prior approval all types of equipment and tools he intends to apply, such as bailers, plungers, etc. and the method(s) of their use. The Contractor shall not commence with cleaning, and\or development of any borehole before a detailed programme of activities to this end and for this case, has been discussed with and approved by the Engineer.

CHAPTER 5: TESTING OF BOREHOLES FOR YIELD AND DRAWDOWN

5.1 General

After a borehole has been constructed and developed the Contractor shall notify the Engineer to that effect, and shall make the necessary arrangements for conducting the final pumping tests. Pumping tests shall follow immediately after the completion of the borehole’s development as specified in Chapter 4 here above.

The Engineer may order the Contractor to carry out such additional tests as he may deem necessary during and after construction. All tests shall be run with similar equipment and in a manner similar to that described hereinafter.

The Contractor shall provide all labour, materials, equipment and supplies required and shall operate the pumping unit at such rates of discharge and for such periods of time as required for the execution of the tests and as instructed by the Engineer.

5.2 Step Drawdown and Step Recovery Tests

The following requirements shall apply to step drawdown and step recovery tests: (The step recovery test is optional, and shall only be executed upon the Engineer's instructions).

5.2.1 General

Before the test commences, a single or double wire water level recorder, a stop watch, and graph paper pad and pencil shall be on hand. The recorder shall be checked to ensure good contact. It shall be lowered into the casing and a trial water level measurement shall be performed.

Once the equipment has been checked, at least three readings of the water level shall be taken during the half hour immediately preceding the test at ten-minute intervals, to obtain the trend of the water level. If two of such readings are identical, it is possible to proceed with the test. If variations occur, the readings shall continue until a definite pattern is established.

5.2.2 Procedures

The test shall cover at least four steps. During successive steps, the discharge shall be increased, and water levels subsequently measured. Discharges shall preferably, but not necessarily, be increased in steps of 0.2xQmax. The Qmax value would be known approximately from the pumping development stage.

The test shall commence with the lowest envisaged discharge rate, which shall be increased gradually.

Water levels shall be recorded during the carrying out of each step at intervals as follows:

Every	1	minutes from	1	to	10	minutes of pumping
Every	2	minutes from	10	to	30	minutes of pumping
Every	5	minutes from	30	to	60	minutes of pumping
Every	10	minutes from	60	to	360	minutes of pumping
Every	15	minutes from	360	to	600	minutes of pumping

During the carrying out of each step of the test the discharge rate shall be kept constant and recorded periodically.

The duration of each step shall in no case be less than 90 minutes, and if necessary longer, until a stable dynamic water level has been achieved.

At successive steps, the procedure for recording water levels and rates of discharge shall be repeated. The discharge rates of each subsequent step shall be increased by a considerable measure (at least 50% of the preceding step) until the maximum discharge is attained.

The consistency of the arrayed discharge\drawdown readings, i.e. the anticipated regression line, is to be checked in the field.

Should further development of the borehole be decided upon, another step drawdown test shall be carried out at the borehole after such additional development.

5.3 Constant Discharge Tests

The following shall apply to drawdown and recovery tests:

5.3.1 General

Constant discharge tests shall be carried out in boreholes after development and after the step drawdown tests have been completed. Tests shall commence after a stable water level trend has been ascertained by the means as follows:

Every	1	minutes from	1	to	10	minutes of pumping
Every	2	minutes from	10	to	30	minutes of pumping
Every	5	minutes from	30	to	60	minutes of pumping
Every	10	minutes from	60	to	360	minutes of pumping
Every	15	minutes from	360	to	600	minutes of pumping
Every	30	minutes from	10	to	24	Hours of pumping
Every	60	minutes from	24	to	72	Hours and above

5.3.2 Procedures

The discharge to be maintained during the drawdown test shall be determined by the Engineer (most probably Qmax) and shall be constant at all times. The time of its start shall be noted by use of a stop watch. Water levels shall be recorded immediately preceding the test start, and then at the time intervals as specified in Article 5.2.2 here above.

The test shall be continued for 72 hours or more, or may be terminated earlier in case that the dynamic water level has stabilized for more than 10 hours.

At the end of a drawdown test, a recovery test shall be carried out. This test is a mirror image of a drawdown test. The time at which recovery commences is when pumping stops. This time shall be recorded, and water levels reading shall be taken and recorded at the same time intervals as specified here above.

5.4 Interference Tests

During development and step drawdown testing, measures shall be taken in order to verify whether there is any impact of the pumping on the static water level (SWL) in adjacent borehole(s).

In case of interference, interference tests shall be executed parallel to the drawdown\recovery tests in the pumped borehole. Special care shall be taken to accurately measure the distance between the pumped and the observed borehole(s), and to accurately synchronize the pump start-up and observations.

5.5 Group Tests (Provisional)

In the case of one or more production boreholes being drilled within a well field (at distances of less than 1 km from each other) and upon request by Engineer, a group test shall be carried out. In this case, the boreholes in question shall be pumped using the same discharge rates and for the same predetermined time (usually between 3 and 7 days).

Group tests shall be run after constant discharge test has been conducted separately on each borehole. During the testing of these boreholes, drawdown effects shall be followed up in nearby observation boreholes.

Provisional Sums have been included in the Bill of Quantities for the case group testing as described above is required.

5.6 Recording and Reports of Testing

The Contractor shall keep a copy of all field records of all data pertinent to the tests specified hereabove duly signed by the Contractor’s hydrogeologist and the Engineer’s representative.

The results of all tests described in Article 5.2 to 5.5 shall be recorded in a form prescribed by the Engineer, and full test reports shall be submitted to the Engineer, in three copies, within fifteen (15) days after the completion of the tests. The report shall present the field records, the corresponding data analysis and the Contractor’s recommendations concerning the safe yield of the borehole based on its own performance and in connection with other groundwater withdrawals in the vicinity (in

case the borehole pertains to a wellfield), depth of installation for the pump, and similarly relevant issues. The data sheets prepared in triplicate shall include (but not limited) the following information:

1) The location of the well being tested.

2) The physical characteristic of the well including depth, diameter, size and length of casing, screen setting and length of screen.

3) Characteristics of the test pump.

4) Depth of setting of the test pump in meters.

5) Date and time of start and finish of pumping test.

6) Static water level at commencement of test, dynamic water levels and discharge rates at prescribed time intervals.

7) Draw-down recovery after pumping is completed.

8) Date and time of start and of removal of the test pump from the borehole.

5.7 Water Quality Analyses

5.7.1 General

Field and laboratory analyses of water quality shall be carried out by the Contractor with equipment and by methods approved by the Engineer. The Contractor shall secure water samples for analysis by an experienced operator, who is capable to exercise care in carrying out field analyses of water quality. The number of samples to be taken and to be analysed shall be at least two per borehole, or as directed by the Engineer. Each sampling shall be properly recorded, stating the date and time, designation of the borehole, and depth from which the sample was taken.

5.7.2 Field and Laboratory Analyses of Water Quality

The following water analyses shall be carried out:

a) Field Tests: - Temperature
- pH value
- Electrical conductivity

b) Laboratory Tests :
- Appearance (colour)
- Odour
- Turbidity

- Total Solids dried at 105°C
- Total Dissolved Solids dried at 105°C
- Electrical Conductivity
- pH at 20°C
- Carbonate Alkalinity as $CaCO_3$
- Bicarbonate Alkalinity as $CaCO_3$
- Total Hardness as $CaCO_3$
- Silica, total (SiO_2)

Cations

NH_4^+
Na^+
K^+
Ca^{++}
Mg^{++}
Fe, total
Mn^{++}
Cr

Anions

F^-
Cl^-
NO_2
NO_3^-
SO_4^{--}
$PO4^{--}$
HCO_3^-
CO_3^{--}

5.7.3 Water Quality Reports

Reports of the analyses results shall be submitted to the Engineer, in three copies, within fifteen (15) days the analyses shall be carried out.

SPECIFIC TECHNICAL SPECIFICATIONS

DEEP WELL CONSTRUCTION

OVERVIEW

Currently the existing water supply of the AU Headquarter relies on water supply system of Addis Ababa.

The Contractor is advised to get himself acquainted with the pertinent data that might be found at:

- AU Headquarter, Addis Ababa

AU Headquarter and the surrounding areas are located on Ignimbrites of young volcanic of Chilalo Formation, Addis Ababa Porpyritic Basalt of Tarmaber Megezez Formation and Coarse grained Ignimbrites and Acid Volcanics of Nazareth Series.

Boreholes screened in these formations found to yield in the range of 3 l/s to 15 l/s for moderate drawdown in most of the cases.

The proposed well point is located in the compound of AU. The well point area has basaltic outcrops which are favorable for ground water exploration due to their good permeability.

2.1.2 SCOPE OF WORK

The Contractor shall construct one new borehole in the AU headquarter compound as follows:

Scheme ID	**UTM Location**		**Elev. (m.a.s.l)**	**Depth (m)**	**Casing type & diam. (inch)**	**Estimated Average Yield (l/s)**	**SWL (m.a.s.l)**	**DWL (m.a.s.l)**
	Easting (X)	**Northing (Y)**						
AUHQ BH1	471462	994689	2312	150	Steel, 8"	5	Near surface	~2270
Abstraction from the Scheme						**5**		

Following a conservative analysis, it is reasonable to assume that borehole correctly completed in the proposed well point area will normally be capable of yielding around 5 l/s or more for modest drawdown. Therefore, correct borehole construction practice should be considered.

A cement grout seal must be installed in the surface annulus between bore casing and bore wall, to prevent ingress of pollutants.

Bentonite/mud should not be used in the drilling system, unless collapse of the formation or washout of the well wall is encountered during the course of drilling, as this can invade and destroy aquifer permeability. Biodegradable drilling polymers or else air flush-foam drilling systems should be used.

In no case the contractor involves the use of oil, salt or any other loss-of-circulation agent, sawdust, cement or any other form of plugging that could affect the production capacity of the water bearing formation intersected. The contractor must also have available the necessary and appropriate chemical agents to speed up the degradation of the drilling medium.

Borehole will have to be drilled to 160 m as target depth. The well will have to be drilled with 12 inches drilling bit and 8 inches production casing will have to be installed. Well collapse is anticipated in the intervening zones and therefore, 8 inches steel casing and screens are recommended to be installed in the borehole. The screen opening must be of minimum 10 %. The type of water ingress section (screen) to be used shall be wire wound (Johnson type, or equivalent) continuous slot.

However, depths of drilling and position of screen sections shall be specified by the Engineer. The borehole shall be completed including concrete head block and well secured capping.

Construction of the borehole shall be carried out in full conformity with the relevant Sections of the Technical Specification.

The drilling activities shall include, but not limited to:

- Bring and set up of drilling rig.
- Carry out drilling, including collection of drilling cutting samples and storing them on site in an adequate sample box as stipulated in the technical Specification.
- Maintain on site a daily monitoring log, updated daily.
- Carry out alignment and verticality tests as determined by the Engineer and as stipulated in the technical Specification.
- Carry out electrical logging (resistivity) test as stipulated in the Technical Specification.
- Supply, join and lower the casing string, incorporating screen section in number, length and positions as directed by the Engineer. The string shall be fitted with conical end piece at its lower end, and shall be lowered centrally in the borehole, all as specified in the Technical Specification.
- If requested by the engineer supply and place approved gravel pack.
- Deliver to the site a continuous supply of water, fuel, lubricant, drilling tools and additives, spare parts and maintenance tool, etc. to allow for uninterrupted activities.

Immediately after completion of drilling and placing of the casing string in the borehole, to the satisfaction of the Engineer, the Contractor shall carry out the following activities, all as specified in the Technical Specification and directed by the Engineer:

- Flush and develop the well by air lift.
- Carry out step drawdown tests.
- Carry out constant drawdown and recovery tests.
- Take water sample and carry out water analysis as specified and in approved laboratory.
- Produce and submit corresponding test results reports.
- Produce and submit borehole completion report.

Section VIII. Drawings

The actual Drawings, including site plansare attached in a separate folder.

1. Pipe Layout
2. Well head details
3. Existing water supply in AUC

Section IX. Bill of Quantities[30]

4.

REFER TO ATTACHMENTS FOR DETAILED BOQs

PREAMBLE TO BOQ

[30] In lump sum contracts, delete "Bill of Quantities" and replace with "Schedule of Activities".

Bill of Quantities

A. Preamble

1. The Bill of Quantities shall be read in conjunction with the Instructions to bidders, General and Special Conditions of Contract, Project Technical Specifications, and Drawings.

2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer/Employer and valued at rates and prices bid in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer/Employer may fix within the terms of the Contract.

4. The rates and prices in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract, include all Constructional Plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.

5. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

6. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Item of Work.

7. General directions and descriptions of work and materials are not necessarily repeated nor summarised in the Bill of Quantities. References to relevant sections of the contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.

8. Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with Sub-Clause 52.4 and Clause 58 Part III of the Conditions of Contract.

9. The method of measurement of completed work for payment shall be in accordance with the Technical Specifications.

10. The following units with their abbreviations are used:

Unit	Abbreviation	Unit	Abbreviation
Lump Sum	LS	Hectare	ha
Linear meter	m or lm	gram	gr
Square meter	m^2	kilogram	kg
Cubic meter	m^3	kilometre	km

Litre Metric ton	ltr or lt t or ton	hour	h or hr

Bill of Quantities

B. Work Items

1. The Bill of Quantities contains the following part Bills, which have been grouped according to their nature of work:

See BoQ

2. Bidders shall price the Bill of Quantities in Ethiopian Birr or usd.

Section X. Security Forms

Notes on Forms of Securities

Samples of acceptable forms of Bid, Performance, and Advance Payment Securities are annexed. Bidders should not complete the Performance and Advance Payment Security forms at this time. Only the successful Bidder will be required to provide Performance and Advance Payment Securities in accordance with the form acceptable to the Employer.

Annex A Form: Bid Security (Bank Guarantee)

Whereas, *[name of Bidder]* (hereinafter called "the Bidder") has submitted his Bid dated *[date]* for the construction of *[name of Contract and procurement Number]* (hereinafter called "the Bid").

Know all people by these presents that We *[name of Bank]* of *[name of country]* having our registered office at *[address]* (hereinafter called "the Bank") are bound unto name of Employer] (hereinafter called "the Employer") in the sum of *[amount]*[31] 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]* day of *[month], [year]*.

The conditions of this obligation are:

(1) If, after Bid opening, the Bidder withdraws his Bid during the period of Bid validity specified in the Form of Bid; or

(2) If the Bidder having been notified of the acceptance of his Bid by the Employer during the period of Bid validity:

  (a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or

  (b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders; or

  (c) does not accept the correction of the Bid Price pursuant to Clause 27,

we undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer's 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 any of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including *[date]* the date 28 days after the deadline for submission of bids as stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

Date _____ Signature and seal of the Bank _____

Name and Title of authorised signatory

_____

_____

[31] The Bidder should insert the amount of the Guarantee in words and figures denominated in the currency of the Bid. This figure should be the same as shown in Clause 16.1 of the Instructions to Bidders.

Annex B Form : Performance Security - Unconditional Bank Guarantee

To: *[name and address of Employer]*

Whereas *[name and address of Contractor]* (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. *[procurement number]* dated *[date]* to execute *[name and Procurement Number of Contract and brief description of Works]* (hereinafter called "the Contract");

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 *[amount of Guarantee] [amount in words]*,[32] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of *[amount of Guarantee]* 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 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 you 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.

This Guarantee shall be valid until a date 90 days from the date of issue of the Certificate of Completion.

Signature and seal of the Guarantor _____

Name of Bank _____

Address _____

Date _____

[32] An amount is to be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract, and denominated either in the currency(ies) of the Contract or in a freely convertible currency acceptable to the Employer.

Annex C Form: Bank Guarantee for Advance Payment

To: *[name and address of Employer]*

[name and Procurement Number of Contract]

Sir / Madam:

In accordance with the provisions of the Conditions of Contract, Clause 51 ("Advance Payment") of the above-mentioned Contract, *[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 Clause of the Contract in an amount of *[amount of Guarantee] [amount in words]*.[33]

We, the *[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 *[amount of Guarantee] [amount in words]*.[34]

We further agree that no change or addition to or other modification of the terms of the Contract or of 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.

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 repayment of the same amount from the Contractor.

Yours truly,

Signature and seal: _____

Name of Bank: _____

Address: _____

Date: _____

[33] An amount is to be inserted by the Bank or Financial Institution representing the amount of the Advance Payment, and denominated either in the currency(ies) of the Advance Payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.

[34] An amount is to be inserted by the Bank or Financial Institution representing the amount of the Advance Payment, and denominated either in the currency(ies) of the Advance Payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.