MINERALS COMMISSION OF GHANA

TENDER DOCUMENT

FOR

THE COMPLETION OF DISTRICT OFFICE BLOCK FOR MINERALS COMMISSION IN BOLGATANGA – UPPER EAST REGION

OCTOBER 2026

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Invitation for Tenders

Invitation for Tenders (IFT)

Date: **OCTOBER, 2026**

Contract Name: **THE COMPLETION OF DISTRICT OFFICE BLOCK FOR MINERALS COMMISSION IN BOLGATANGA – UPPER EAST REGION**

Contract No.:

1. The **MINERALS COMMISSION** of the Republic of Ghana has been allocated funds as part of its budgetary allocation to cover the cost of **INFRASTRUCTURAL DEVELOPMENT WORK** and intends to apply part of these funds to cover eligible payments under the Contract for **THE COMPLETION OF DISTRICT OFFICE BLOCK FOR MINERALS COMMISSION IN BOLGATANGA – UPPER EAST REGION**. Tendering is open to only pre-qualified Tenderers as defined in the Public Procurement Act 663 as amended and in the Guidelines of the Public Procurement Authority of the Republic of Ghana.

2. The **MINERALS COMMIISSION OF GHANA** invites sealed Tenders from eligible Tenderers for the **COMPLETION OF DISTRICT OFFICE BLOCK FOR MINERALS COMMISSION IN BOLGA – UPPER EAST REGION**

3. Tender documents (and additional copies) can be assessed on the Ghana Electronic Procurement System (GHANEPS) portal.

4. Tenders shall be valid for a period of **120 DAYS** after Tender opening and must be accompanied by security of **GHC 40,000.00** and shall be delivered through the Ghana Electronic Procurement System (GHANEPS) portal. In addition, four (4) printed copies of the tender shall be delivered to the address specified below on or before **5th November 2026 at 11:00am GMT**, at which time they will be opened on the GHANEPS platform.

Address <u>for inspecting and purchasing</u> Tender Documents

THE CHIEF EXECUTIVE OFFICER, MINERALS COMMISSION

MINERAL HOUSE, No. 12 SWITCHBACK ROAD RESIDENTIAL AREA.

ROOM 110 (PROCUREMENT)

GPS Code: GL-060-1131, CANTONMENTS, ACCRA.

P. O. BOX M 248, ACCRA

Telephone Number: **(233-0302) – 772783/779823/773053/771318**

Facsimile Number: **233-0302 - 773324**;

Email Address: **info@mc.ghanamining.org**

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Instructions to Tenderers

A. General

1. Scope of Tender

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

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

2. Source of Funds

2.1 The Procurement Entity (hereinafter called "Employer") named in the Tender Data Sheet shall fund this procurement from part of its budgetary allocation toward the realization of the project named in the TDS.

2.2 Payments will be made only at the request of the Employer and upon approval by a designated official of the Republic of Ghana in accordance with the terms and conditions of the contract between the Purchaser and the Supplier (hereinafter called the Contract), and will be subject in all respects to the Financial Administration Act, 2002 and the Financial Administration Regulations, 2002 of the Republic of Ghana. No party other than the Supplier shall derive any rights from the Contract or have any claim to the funds.

3. Eligible Tenderers

3.1 This Invitation for Tenders is open to all Tenderers from eligible countries as defined in the Procurement Guidelines of the Procurement Board of the Republic of Ghana. 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 Tenderers shall provide in Section 2, Forms of Tender and Qualification Information, a statement that the Tenderer (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 Tender.

3.3 Government-owned enterprises in the country may only participate if they are legally and financially autonomous, and operate under commercial law.

4. Qualification of the Tenderer

4.1 All Tenderers shall provide in Section 2, Forms of Tender and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary.

4.2 In the event that prequalification of potential Tenderers has been undertaken, only Tenders from prequalified Tenderers will be considered for award of Contract. These qualified Tenderers should submit with their Tenders any information updating their original prequalification applications or, alternatively, confirm in their Tenders that the originally-submitted prequalification information remains essentially correct as of the date of Tender submission. The update or confirmation should be provided in Section 2.

4.3 If the Employer has not undertaken prequalification of potential Tenderers, all Tenderers shall include the following information and documents with their Tenders in Section 2, unless otherwise stated in the Tender 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 Tender to commit the Tenderer;

(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 Tenderer, 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 Tenderer's bankers;

(i) Information regarding any litigation, current or during the last five years, in which the Tenderer 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 Tenders submitted by a joint venture of two or more firms as partners shall comply with the following requirements, unless otherwise stated in the Tender Data:

(a) The Tender shall include all the information listed in Sub-Clause 4.3 above for each joint venture partner;

(b) The Tender 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, authorized 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, Tenderers shall meet the following minimum qualifying criteria:

(a) Annual volume of construction work of at least the amount specified in the Tender 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 Tender Data;

(d) A Contract Manager with five years' experience in works of an equivalent nature and volume, including no less than three years as Manager; 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 Tender 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 Tenderer's compliance with the minimum qualifying criteria of Sub-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 Tenderer, 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 Tender. Subcontractors' experience and resources will not be taken into account in determining the Tenderer's compliance with the qualifying criteria, unless otherwise stated in the
Tender Data.

4.7 Domestic Tenderers and joint ventures of domestic and foreign Tenderers applying for eligibility for a 7½-percent margin of preference in Tender evaluation shall supply all information to satisfy the criteria for eligibility as described in Clause 30 of these Instructions to Tenderers.

5. One Tender per Tenderer 5.1 Each Tenderer shall submit only one Tender, either individually or as a partner in a joint venture. A Tenderer who submits or participates in more than one Tender (other than as a subcontractor or in cases of

alternatives that have been permitted or requested) will cause all the proposals with the Tenderer's participation to be disqualified.

6. Cost of Tender 6.1 The Tenderer shall bear all costs associated with the preparation and submission of his Tender, and the Employer will in no case be responsible or liable for those costs.

7. Site Visit 7.1 The Tenderer, at the Tenderer'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 Tender and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Tenderer's own expense.

B. Tender Documents

8. Content of Tender Documents 8.1 The set of Tender documents comprises the documents listed in the table below and addenda issued in accordance with Clause 10:

Section I		Instructions to Tenderers
	II	Forms of Tender and Qualification Information
	III	Conditions of Contract
	IV	Tender Data
	V	Specifications
	VI	Drawings
	VII	Bill of Quantities/Activity Schedule
	VIII	Forms of Securities

8.2 Tenderers should complete and return sections II, IV and VII.

9. Clarification of Tender Documents 9.1 A prospective Tenderer requiring any clarification of the Tender documents may notify the Employer in writing or by cable ("cable" includes telex, facsimile and email) at the Employer's address indicated in the invitation to Tender. The Employer will respond to any request for clarification received earlier than 28 days prior to the deadline for submission of Tenders. Copies of the Employer's response will be forwarded to all purchasers of the Tender documents, including a description of the inquiry, but without identifying its source.

10. Amendment of Tender 10.1 Before the deadline for submission of Tenders, the Employer may modify the Tender documents by issuing addenda.

Documents

10.2 Any addendum thus issued shall be part of the Tender documents and shall be communicated in writing or by cable to all purchasers of the Tender documents. Prospective Tenderers shall acknowledge receipt of each addendum by cable to the Employer.

10.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their Tenders, the Employer shall extend, as necessary, the deadline for submission of Tenders, in accordance with Sub-Clause 20.2 below.

C. Preparation of Tenders

11. Language of Tender

11.1 All documents relating to the Tender shall be in the language specified in the Contract Data.

12. Documents Comprising the Tender

12.1 The Tender submitted by the Tenderer shall comprise the following:

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

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

13. Tender 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 submitted by the Tenderer.

13.2 The Tenderer shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items for which no rate or price is entered by the Tenderer 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 All 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 Tenders, shall be included in the rates, prices, and total Tender price submitted by the Tenderer.

13.4 The rates and prices quoted by the Tenderer shall be subject to adjustment during the performance of the Contract if provided for in the Tender and Contract Data and the provisions of Clause 47 of the Conditions of Contract. The Tenderer shall submit with the Tender all the information required under the Contract Data and Clause 47 of the Conditions of Contract.

14. Currencies of Tender and Payment

14.1 The unit rates and prices shall be quoted by the Tenderer entirely in the currency of the Employer's country as specified in the Contract Data. Foreign currency requirements shall be indicated as a percentage of the Tender price (excluding provisional sums [2]) and shall be payable at the option of the Tenderer in up to three foreign currencies of any eligible country.

14.2 The rates of exchange to be used by the Tenderer in arriving at the local currency equivalent and the percentage(s) mentioned in para.

14.1 above shall be the selling rates for similar transactions established by the authority specified in the Contract Data prevailing on the date 28 days prior to the latest deadline for submission of Tenders. These exchange rates shall apply for all payments so that no exchange risk will be borne by the Tenderer. If the Tenderer uses other rates of exchange, the provisions of Clause 28.1 shall apply. In any case, payments will be computed using the rates quoted in the Tender.

14.3 Tenderers shall indicate details of their expected foreign currency requirements in the Tender.

14.4 Tenderers may be required by the Employer to clarify their foreign currency requirements and to substantiate that the amounts included in the rates and prices [3] and in the Contract Data are reasonable and responsive to Sub-Clause 14.1.

15. Tender Validity

15.1 Tenders shall remain valid for the period [4] specified in the Tender Data.

15.2 In exceptional circumstances, the Employer may request that the

Tenderers extend the period of validity for a specified additional period. The request and the Tenderers' responses shall be made in writing or by cable. A Tenderer may refuse the request without forfeiting the Tender Security. A Tenderer agreeing to the request will not be required or permitted to otherwise modify the Tender, but will be required to extend the validity of Tender Security for the period of the extension, and in compliance with Clause 16 in all respects.

15.3 In the case of contracts in which the Contract Price is fixed (not subject to price adjustment), if the period of Tender validity is extended beyond 60 days, the amounts payable in local and foreign currency to the Tenderer selected for award, shall be increased by applying to both the local and the foreign currency component of the payments, respectively, the factors [5] specified in the Tender Data or in the request for extension, for the period of delay beyond 60 days after the expiry of the initial Tender validity, up to the notification of award. Tender evaluation will be based on the Tender prices without taking the above correction into consideration.

16. Tender Security

16.1 The Tenderer shall furnish, as part of the Tender, a Tender Security in local currency or in a freely convertible currency, in the amount specified in the Tender Data.

16.2 The Tender Security shall, at the Tenderer's option, be in the form of a certified check, bank draft, letter of credit, or a bank guarantee from a reputable bank located in the country of the Employer or abroad. The format of the Tender Security should be in accordance with the form of Tender Security included in Section 8 or another form acceptable to the Employer. Tender Security shall be valid for 28 days beyond the validity of the Tender.

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

16.4 The Tender Security of unsuccessful Tenderers will be returned within 28 days of the end of the Tender validity period specified in Sub-

Clause 15.1.

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

16.6 The Tender Security may be forfeited

(a) If the Tenderer withdraws the Tender after Tender opening during the period of Tender validity;

(b) If the Tenderer does not accept the correction of the Tender price, pursuant to Clause 27; or

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

(i) Sign the Agreement; or
(ii) Furnish the required Performance Security.

17. Alternative Proposals by Tenderers

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

17.2 If so allowed in the Tender Data, Tenderers wishing to offer technical alternatives to the requirements of the Tender documents must also submit a Tender that complies with the requirements of the Tender documents, including the basic technical design as indicated in the drawings and specifications. In addition to submitting the basic Tender, the Tenderer 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 Tenderer conforming to the basic technical requirements shall be considered by the Employer.

18. Format and Signing of

18.1 The Tenderer shall prepare one original of the documents comprising the Tender as described in Clause 12 of these Instructions to

Tender

Tenderers, bound with the volume containing the Form of Tender, and clearly marked "ORIGINAL." In addition, the Tenderer shall submit copies of the Tender, in the number specified in the Tender Data, and clearly marked as "COPIES." In the event of discrepancy between them, the original shall prevail.

18.2 The original the Tender shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Tenderer, pursuant to Sub-Clauses 4.3(a) or 4.4(b), as the case may be. All pages of the Tender where entries or amendments have been made shall be initialled by the person or persons signing the Tender.

18.3 The Tender 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 Tenderer, in which case such corrections shall be initialed by the person or persons signing the Tender.

D. Submission of Tenders

19. Sealing and Marking of Tenders

19.1 The Tenderer shall seal the original and all copies of the Tender in two inner envelopes and one outer envelope, 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 Tender Data;

(b) Bear the name and identification number of the Contract as defined in the Tender and Contract Data; and

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

19.3 In addition to the identification required in Sub-Clause 19.2, the inner envelopes shall indicate the name and address of the Tenderer to enable the Tender to be returned unopened in case it is declared late, pursuant to 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 Tender.

20. Deadline for Submission of Tenders

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

20.2 The Employer may extend the deadline for submission of Tenders by issuing an amendment in accordance with Clause 10, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

21. Late Tenders

21.1 Any Tender received by the Employer after the deadline prescribed in Clause 20 will be returned unopened to the Tenderer.

22. Modification and Withdrawal of Tenders

22.1 Tenderers may modify or withdraw their Tenders by giving notice in writing before the deadline prescribed in Clause 20.

22.2 Each Tenderer's modification or withdrawal notice shall be prepared, sealed, marked, and delivered in accordance with Clauses 18 and 19,

with the outer and inner envelopes additionally marked "MODIFICATION" or "WITHDRAWAL," as appropriate.

22.3 No Tender may be modified after the deadline for submission of Tenders.

22.4 Withdrawal of a Tender between the deadline for submission of Tenders and the expiration of the period of Tender validity specified in the Tender Data or as extended pursuant to Sub-Clause 15.2 may result in the forfeiture of the Tender Security pursuant to Clause 16.

22.5 Tenderers may only offer discounts to, or otherwise modify the prices of their Tenders by submitting Tender modifications in accordance with this clause, or included in the original Tender submission.

E. Tender Opening and Evaluation

23. Tender Opening

23.1 The Employer will open the Tenders, including modifications made pursuant to Clause 22, in the presence of the Tenderers' representatives who choose to attend at the time and in the place specified in the Tender Data.

23.2 Envelopes marked "WITHDRAWAL" shall be opened and read out first. Tenders for which an acceptable notice of withdrawal has been submitted pursuant to Clause 22 shall not be opened.

23.3 The Tenderers' names, the Tender prices, the total amount of each Tender and of any alternative Tender (if alternatives have been requested or permitted), any discounts, Tender modifications and withdrawals, the presence or absence of Tender 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 Tender opening, including the information disclosed to those present in accordance with Sub-Clause 23.3.

24. Process to be Confidential

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

to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

25. Clarification of Tenders

25.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at the Employer's discretion, ask any Tenderer for clarification of the Tenderer's Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, telex, facsimile, or email but no change in the price or substance of the Tender 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 Tenders in accordance with Clause 27.

26. Examination of Tenders and Determination of Responsiveness

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

26.2 A substantially responsive Tender is one, which conforms to all the terms, conditions, and specifications of the Tender 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 Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

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

27. Correction of Errors

27.1 Tenders determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:[7]

(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 Tender will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the Tenderer, shall be considered as binding upon the Tenderer. If the Tenderer does not accept the corrected amount, the Tender will be rejected, and the Tender Security may be forfeited in accordance with Sub-Clause 16.6(b).

28. Currency for Tender Evaluation

28.1 Tenders will be evaluated as quoted in the currency of the Employer's country as defined in the Contract Data in accordance with Sub-Clause 14.1, unless a Tenderer has used different exchange rates than those prescribed in Sub-Clause 14.2, in which case the Tender will be first converted into the amounts payable in different currencies using the rates quoted in the Tender and then reconverted to the Employer's currency using the exchange rates prescribed in Sub-Clause 14.2.

29. Evaluation and Comparison of Tenders

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

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

(a) Making any correction for errors pursuant to Clause 27;
(b) Excluding provisional sums and the provision, if any, for contingencies in the Bill of Quantities,[8] but including Daywork,[9] where priced competitively;

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

(d) Making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub-Clause 22.5.

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 Tender documents or otherwise result in unsolicited benefits for the Employer will not be taken into account in Tender evaluation.

29.4 The estimated effect of any price adjustment conditions under Clause 47 of the Conditions of Contract, during the period of implementation of the Contract, will not be taken into account in Tender evaluation. 29.5 [10]

30. Preference for Domestic Tenderers

30.1 A percent margin of price preference of not less than 10% for qualifying domestic tenderers shall apply in tender evaluation in accordance with the criteria set by the Public Procurement Board for fixing such percentages.

30.2 Domestic Tenderers shall provide all evidence necessary to prove that they meet the following criteria to be eligible for the specified percent margin of preference in the comparison of their Tenders with those of Tenderers who do not qualify for the preference. They should

(a) Be registered within the country of the Employer;
(b) Have majority ownership by nationals of the country of the Employer;
(c) Not subcontract more than 50 percent of the Works measured in terms of value to foreign contractors; and

(d) Satisfy any other criteria specified for the purpose of domestic preference eligibility, as specified in the Tender Data.

30.3 Joint ventures between domestic and foreign firms may be eligible for the margin of preference provided the domestic partner or partners

(a) Individually satisfy the above criteria of eligibility for the preference;

(b) Demonstrate a beneficiary interest of no less than 50 percent in the joint venture, as demonstrated by the profit and loss sharing provisions of the joint venture agreement;

(c) Will, under the arrangements proposed, carry out at least 50 percent of the Works, measured in terms of value, which shall exclude any materials or plant which are to be directly imported by the domestic partner(s) (always provided that the domestic partner or partners are qualified to carry out that amount of work, in accordance with the criteria of Sub-Clause 4.3); and

(d) Satisfy any other criteria specified for the purpose of domestic preference eligibility, as specified in the Tender Data.

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

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

(i) Group A: Tenders offered by domestic Tenderers and joint ventures meeting the respective criteria of Sub-Clauses 30.2 and 30.3 above; and

(ii) Group B: all other Tenders.

(b) For the purpose of further evaluation and comparison of Tenders only, an amount equal to 7½ percent of the evaluated. Tender prices determined in accordance with Clause 29.2(a), (b), and (d), will be added to all Tenders classified in Group B.

F. Award of Contract

31. Award Criteria 31.1 Subject to Clause 32, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially

responsive to the Tender documents and who has offered the lowest evaluated Tender price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 3, and (b) qualified in accordance with the provisions of Clause 4.

32. Employer's Right to Accept any Tender and to Reject any or all Tenders

32.1 Notwithstanding Clause 31, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

33. Notification of Award and Signing of Agreement

33.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex, email or facsimile confirmed by registered letter. 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 Tenderer furnishing the Performance Security in accordance with Clause 34 and signing the Agreement in accordance with Sub-Clause 33.3.

33.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be signed by the Employer and sent to the successful Tenderer, within 28 days following the notification of award along with the Letter of Acceptance. Within 21 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

33.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

34. Performance Security

34.1 Within 28 days after receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Performance Security in the amount stipulated in the Contract Data and in the form (Bank Guarantee and/or Bond) stipulated in the Tender Data, denominated in the type and proportions of currencies in the Letter

of Acceptance and in Accordance with the Conditions of Contract.

34.2 If the Performance Security is provided by the successful Tenderer in the form of a Bank Guarantee, it shall be issued either (a) at the Tenderer's option, by a bank located in the country of the Employer or a foreign bank through a correspondent bank located in the country of the Employer, or (b) with the agreement of the Employer directly by a foreign bank acceptable to the Employer.

34.3 If the Performance Security is to be provided by the successful Tenderer in the form of a Bond, it shall be issued by a surety which the Tenderer has determined to be acceptable to the Employer.

34.4 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 34.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Tender Security.

35. Advance Payment and Security

35.1 The Employer will provide an Advance Payment on the Contract Price as stipulated in the Conditions of Contract, subject to a maximum amount, as stated in the Tender Data.

36. Adjudicator

36.1 The Employer proposes the person named in the Tender Data to be appointed as Adjudicator under the Contract, at an hourly fee specified in the Tender Data, plus reimbursable expenses. If the Tenderer disagrees with this proposal, the Tenderer should so state in the Tender. 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 Government of Ghana (GOG) requires that all Procurement Entities as well as Tenderers, Suppliers, Contractors and Consultants participating in contracts financed from the public funds of the Republic of Ghana, adhere to the highest ethical standards, both during the tendering process and throughout the execution of such contracts. The list of definitions set forth below involves the most common types of corrupt practices, but is not exhaustive. For this reason, the Public Procurement Board will also consider claims of similar nature involving alleged acts of corruption, in accordance with the established procedure.

(a). "Bribery" means the act of unduly offering, giving, receiving or soliciting anything of value to influence the

process of procuring goods or services, selecting consultants, or executing contracts.

(b). "Extortion" or "Coercion" means the act attempting to influence the process of procuring goods or services, selecting consultants, or executing contracts by means of threats of injury to person, property or reputation.

(c). "Fraud" means the misrepresentation of information or facts for the purpose of influencing the process of procuring goods or services, selecting consultants, or executing contracts, to the detriment of the Procurement Entity/Purchaser or other participants.

(d). "Collusion" is an agreement between tenderers designed to result in tenders at artificial prices that are not competitive.

37.2 If, in accordance with the administrative procedures of the Public Procurement Board, it is demonstrated that a government/public official, or anyone acting on his or her behalf, and/or a Tenderer in a procurement process or supplier/contractor during the execution of the contract carried out in connection with a project financed from the public funds of the Republic of Ghana has committed corrupt practices, the Public Procurement Board or the appropriate Tender review Board will:

(a) reject a proposal to award a contract in connection with the respective procurement process; and/or

(b) declare a firm and/or its personnel directly involved in corrupt practices, temporarily or permanently ineligible to be awarded future contracts financed from the public funds of the Republic of Ghana.

37.3 The Tenderer shall disclose any commissions or fees that may have been paid or are to be paid to agents, representatives, or commission agents with respect to the tendering process or execution of the contract. The information disclosed must include at the name and address of the agent, representative, or commission agent, the amount and currency, and the purpose of the commission or fee. The information must be included in the

Tender Submission Sheet.

37.4 Any communications between the Tenderer and the Purchaser related to matters of alleged fraud or corruption must be made in writing

G. Tender Data

Instructions to Tenderers Clause Reference

(2.1) The Employer is **MINERALS COMMISSION OF GHANA**

(2.1) The Project is **THE COMPLETION OF DISTRICT OFFICE BLOCK FOR MINERALS COMMISSION IN BOLGANTAGA – UPPER EAST REGION**

(4.3) The information required from Tenderers in Sub-Clause 4.3 is modified as follows: In addition to items listed in sub-clause 4.3, the bidder is required to provide valid; **CURRENT TAX CLEARANCE CERTIFICATE**
SSNIT CONTRIBUTION CERTIFICATE
VAT CERTIFICATE
LABOUR CERTIFICATE
MINISTRY OF WORKS AND HOUSING CERTIFICATE D1, K1
SITE VISIT/ASSESSMENT REPORT
METHOD STATEMENT AND WORK PLAN
HEALTH & SAFETY PLAN
PPA SUPPLIER REGISTRATION CERTIFICATE

(4.4) The qualification data required from Tenderers in Sub-Clause 4.4 are modified as follows: **NONE**

(4.5) The qualification criteria in Sub-Clause 4.5 are modified as follows:

(4.5a) The minimum required annual volume of construction work for the successful Tenderer in any of the last five years shall be **30% of Tender Figure (Evidence from Audited Financial Reports which shall be verified with GRA, and from Bank Statements).**

(4.5c) The essential equipment to be made available for the Contract by the successful Tenderer shall be:

- Batch Mixer	**1 No.**	**-Bar Bender/Cutter**	**2 No.**
- Concrete Mixer	**1 No.**	**- Mechanical Compactor**	**1 No.**
- Poker Vibrator	**1 No.**	**-Theodolite/Total Station**	**1 No.**
- Tipper Truck	**2 No.**		

Indicate clearly how you intend to acquire the above equipment. Show evidence of ownership for owned equipment and evidence of availability at the time of construction for hired and leased equipment.

(4.5d) The minimum level of Personnel proposed for the Project shall be:

- 1 No. Project Manager - over 10 years post qualification Experience (Min. first degree); BSc. Arch,Eng./B.T

- 1 No. Site Engineers - over 5 years experience (B.Sc.)/HND with 10 years experience

- 1 No. Quantity Surveyor - over 5 years experience (B.Sc.)/HND with 10 years experience (Detailed signed C.V's and Certificates, and current working telephone numbers, evidence of personnel's availability should be attached)

(4.5e) The minimum amount of liquid assets and/or credit facilities net of other contractual commitments of the successful Tenderer shall be **30% of Tender figure.** The credit facility should be an unconditional guarantee from a reputable Commercial Bank

(8.2) The number of copies of the Tender to be completed and returned shall be

(18.1) **(1) original and (2) additional copies (Additional copies should be a complete Documents)**

(13.4) The Contract **is** subject to price adjustment in accordance with Clause 47 of the Conditions of Contract.

(14.1) The specified international trading currency shall be Ghanaian **Cedis (GHC)**

(14.2) The date of the exchange rate is **NIL**

The authority for establishing the rates of exchange shall be **NIL**

(15.1) The period of Tender validity shall be **120** days after the deadline for Tender submission specified in the Tender Data.

(15.3) The adjustment of Tender price in accordance with Clause 15.3 shall be calculated on the basis of an annual increase for foreign costs of - percent and an annual increase for local costs of - percent. **(N/A)**

(16.1) The amount of Tender Security shall be - or an equivalent amount in a freely convertible currency. **GHC40, 000.00 from a reputable bank or a reputable Insurance Company approved by the National Insurance Commission**

(17.0) Alternative proposals to the requirements of the Tender documents **will not** be permitted.

(19.2) The Employer's address for the purpose of Tender submission is:

Attention:	THE CHIEF EXECUTIVE OFFICER, MINERALS COMMISSION OF GHANA
Street Address:	No. 12 SWITCHBACK ROAD RESIDENTIAL AREA
GPS Code:	GL-060-1131
Floor/Room No.:	CONFERENCE ROOM **(RM 200)**
City/Town:	CANTONMENTS, ACCRA
Region:	GREATER-ACCRA
Country:	GHANA

The deadline for submission of Tenders shall be

Date: **5th November 2026**

Time: **11:00am**

(30.0) Domestic contractors **will not** receive a margin of preference in Tender evaluation.

(34.0) The Standard Form of Performance Security acceptable to the Employer shall be **Bank Guarantee (10%) or**
Bond (30%)

.

(35.0) The Advance Payment shall be limited to **- 15%** of the Contract Price.

(36.1) The Adjudicator proposed by the Employer is:

Name: **THE PRESIDENT**
Address: **GHANA INSTITUTION OF SURVEYORS (GHI.S)**

The hourly fee for this proposed Adjudicator shall be: **according to the rates approved by the GhI.S.**

Section II. Forms of Tender, Qualification Information, Letter of Acceptance, and Agreement

Contractor's Tender

Notes on Form of Contractor's Tender

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

TENDER FORM
(To be reproduced on Letter Head of Bidder)

Date: _____
To: _____
Address: _____
_____
_____
_____

We offer to execute the _____
in accordance with the Conditions of Contract
accompanying this Tender for the Contract Price of _____

_____

The Contract shall be paid in the following currencies:

Currency	Percentage payable in Currency	Rate of exchange: one foreign equals GHC _____	Inputs for which foreign currency is required
(a) Cedis	**100**	Nil	Nil
(b)			

The advance payment required is:

	Amount	Currency
(a)	NIL	**NIL**
(b)		

We accept the appointment of _____ as the Adjudicator.

Or

We do not accept the appointment of _____ as the Adjudicator, and propose instead that _____ be appointed as Adjudicator, whose daily fees and biographical data are attached.

This Tender 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 Tender you receive.

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

Name & Address of Agent	Amount & Currency	Purpose of Commission or Gratuity
NIL	**NIL**	**NIL**

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

Authorized Signature: _____

Name and Title of Signatory: _____

Name of Tenderer: _____

Address: _____

ATTACHMENTS TO THE TENDER

Attach. 1 Power of Attorney

Attach. 2 Tender Security

Attach. 3 Price Schedules of Major Items

Attach. 4 Documentary Evidence of Tenderer's Qualifications

Attach. 5 Others:

- Work Programme and Schedule
- Health and Safety Plan
- Declaration letter, stating bidder's acceptance of disqualification should any of the information provided for the purposes of the Tender be found to be false.

Qualification Information

Notes on Form of Qualification Information

The information to be filled in by Tenderers 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 Tenderers. This information will not be incorporated in the Contract. Attach additional pages as necessary. Pertinent sections of attached documents should be translated into English. If used for prequalification verification, the Tenderer should fill in updated information only.

Qualification Information

1. Individual Tenderers or Individual Members of Joint Ventures

1.1 Constitution or legal status of Tenderer: _____ **[attach copy]**

Place of registration: _____

Principal place of business: _____

Power of attorney of signatory of Tender: **[attach]**

1.2 Total annual volume of construction work performed in five years, in the internationally traded currency specified in the Tender Data: _____

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.

Reproduce and fill out Format

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

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

Reproduce and fill out Format

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)			

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

Reproduce and fill out Format

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

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

Reproduce and fill out Format

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

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, telex, and facsimile numbers of banks that may provide references if contacted by the Employer.

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

Reproduce and fill out Format

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

1.11 Statement of compliance with the requirements of Sub-Clause 3.2 of the Instructions to Tenderers.

1.12 Proposed Programme (work method and schedule). Descriptions, drawings, and charts, as necessary, to comply with the requirements of the Tender 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 Tender authorizing signature of the Tender 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, authorized to incur liabilities, and receive instructions for and on behalf of any and all partners of the joint venture; and

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

3. Additional Requirements

3.1 Tenderers should provide any additional information required in the Tender Data or to fulfill the requirements of Sub-Clause 4.1 and Clause 30 of the Instructions to Tenderers, if applicable.

LETTER OF ACCEPTANCE

[letterhead paper of the Employer]

Date _____

To: _____

This is to notify you that your Tender dated _____for execution of the _____ for the Contract Price of the equivalent of _____, _____, as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by us.

We accept that _____ be appointed as the Adjudicator.

Or

We do not accept that _____ be appointed as adjudicator, and by sending a copy of this letter of acceptance to _____, we are hereby requesting _____, the Appointing Authority, to appoint the Adjudicator in accordance with Clause 36.1 of the Instructions to Tenderers.

You are hereby required to submit the Performance Security stipulated in the Tender Documents within 28 days after receipt of this Letter of Acceptance.

Following receipt of the Performance Security you will be invited to:

(i) sign the Contract Agreement as provided in the Tender Documents; and

(ii) to commence performance of the said contract in accordance with the Contract Documents.

Authorized Signature _____

Name and Title of Signatory _____

Name of Employer: _____

Attachment: Agreement

cc: *Public Procurement Board and Relevant Departments.*

Agreement

This Agreement, made the _____ day of……., **2026** between **MINERALS COMMISSION OF GHANA** (hereinafter called "the Employer") and ---------- (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute **THE COMPLETION OF DISTRICT OFFICE BLOCK FOR MINERALS COMMISSION IN BOLGATANGA – UPPER EAST REGION** (hereinafter called "the Works") and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

Now this Agreement witnessed 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. 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.

3. 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.

For the Employer :	For the Contractor
Name:	Name:
Designation:	Designation:
Signature:	Signature:
Witnessed by:	Witnessed by:
Name:	Name:
Designation:	Designation:
Signature	Signature

Section III. Conditions of Contract

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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 Tender.

Compensation Events are those defined in Clause 44 hereunder.

The **Completion Certificate** is the certificate issued by the Project Manager after the Defects Liability Period and upon correction of all defects by the Contractor.

The **Completion Date** is the date of taking-over the Works as certified by the Project Manager, in accordance with Sub-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 below.

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

The **Contractor's Tender** is the completed Tender 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.

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 Taking-Over 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 substantially 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 by issuing an 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 Contract.

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

Site Investigation Reports are those that were included in the

Tender 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.

The **Taking-Over Certificate** is a certificate issued by the Project Manager when the works are substantially completed in accordance with Sub-Clause 55.1

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 turn 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 or neuter, 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) Letter of Acceptance,
(3) Contractor's Tender,
(4) Contract Data,
(5) Conditions of Contract,
(6) Specifications,
(7) Drawings,
(8) Bill of Quantities,[11] and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Language and Law

3.1 The Contract and the law governing the Contract shall be in English

4. Duties and Authority of the Project Manager

4.1 (a) The Project Manager shall carry out the duties specified in the Contract

(b) The Project Manager may exercise the authority specified in or necessarily to be implied from the Contract.

(c) Except as expressly stated in the Contract, the Project Manager shall have no authority to relieve the Contractor of any of his obligations under the Contract

4.2 With reference to Sub-Clause 4.1 (b), the following provision shall also apply:

The Project Manager shall obtain the specific approval of the Employer before taking any of the following actions:

(a) approving subcontracting of any part of the Works;
(b) certifying additional cost;
(c) determining an extension of time;
(d) issuing a variation under, except if such variation would increase the Contract Price by less than the amount stated in the Appendix to Tender; or
(e) fixing rates or prices.

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

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

4.4 Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Project Manager, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Project Manager, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of the Project Manager. The Project Manager shall determine an addition to the Contract Price, in respect of such instruction, in consultation with the Employer and shall notify the Contractor accordingly, with a copy to the Employer

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 cooperate 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 the 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 and Contractor's Risks

10.1 The Employer carries the risks, which this Contract states are 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 where the Works are to be executed.

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 and deductibles 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; and
(d) personal injury or death.

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.

13.4 Alterations to the terms of 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 Tender, shall rely on any Site Investigation Reports referred to in the Contract Data, supplemented by any information available to the Tenderer.

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	17.1	The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Programme submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.
Date **18. Approval by the Project**	18.1	The Contractor shall submit Specifications and Drawings showing the 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 the Temporary Works.
	18.4	The Contractor shall obtain approval of third parties to the design of the 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	Insofar as the Contract may prescribe the Employer shall give:
		(a) the extent of portions of the Site of which the Contractor is to be given possession from time to time

(b) the order in which such portions shall be made available to the Contractor, and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Project Manager's notice to commence the Works, give to the Contractor possession of

(c) so much of the Site, and

(d) such access as, in accordance with the Contract, is to be provided by the Employer as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the programme referred to in Clause 27, if any, and otherwise in accordance with such reasonable proposals as the Contractor ' shall, by notice to the Project Manager with a copy to the Employer, make. The Employer will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with such programme or proposals, as the case may be.

22. Access to the Site

22.1 The Contractor shall allow the Project Manager and any person authorized 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

23.1 Pursuant to the Duties and Authority of the Project Manager as specified in Clause 4, the Contractor shall carry out all instructions of the Project Manager, which comply with the applicable laws where the Site is located.

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 decision shall be referred to the Adjudicator within 14 days of the notification of the Project Manager’s 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.

25.2 The Adjudicator shall be paid by the hour at the rate specified in the Tender 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. Programme

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

27.2 An update of the Programme shall be a Programme 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 Programme at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated Programme 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 Programme has been submitted.

27.4 The Project Manager's approval of the Programme shall not alter the Contractor's obligations. The Contractor may revise the Programme and submit it to the Project Manager again at any time. A revised Programme 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.

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 cooperate 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 an 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 The Project Manager shall arrange monthly management meetings. 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 cooperate 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 Taking-Over, and is defined in the Contract Data.

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 Defects Liability Period, the Project Manager will have the Defects corrected and the Contractor surcharged with the amount involved.

D. Cost Control

37. Bill of Quantities [12]

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 [13]

38.1 If the final quantity of the work done differs from the quantity 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 to allow for the change.

38.2 The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the prior 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 Programmes [14] 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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[12] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule," and replace Sub-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.

[13] In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule," and replace entire Clause 38 with new Sub-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.

[14] 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 Sub-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.[15]

40.3 If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and make 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 Programme [16] 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.

[15] In lump sum contracts, delete this paragraph.
[16] In lump sum contracts, add "or Activity Schedule" after "Program".

42.4 The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.[17]

42.5 The value of work executed shall include the valuation of 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 28 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest on the late payment in the next 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 at the prevailing rate of interest for commercial borrowing for each of the currencies in which payments are made.

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 paid 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 the Site as defined in Clause 21 by the Site Possession Date as stated in the Contract Data.

[17]

(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 issuance of the Letter of Acceptance from the information issued to Tenderers (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 does not 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 unreasonably delays issuing a Certificate of Completion.

(l) Other Compensation Events described in the Contract 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. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust 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 cooperated with the Project Manager.

45. Tax

45.1 The Project Manager shall adjust the Contract Price if taxes, duties, and other levies are changed between the date 28 days before the submission of Tenders for the Contract and the date of the last Completion certificate. The adjustment 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 the Ghanaian Cedis, the exchange rates used for calculating the amounts to be paid shall be the exchange rates stated in the Contractor's Tender.

47. Price Adjustment

47.1 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the Contract Data. If so provided, the amounts certified in each payment certificate, after deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due in each currency. A separate formula of the type indicated below applies to each Contract currency:

$$P_c = A_c + B_c \, Imc/Ioc$$

where:

P_c is the adjustment factor for the portion of the Contract Price payable in a specific currency "c". A_c and B_c are coefficients [18] specified in the Contract Data, representing the nonadjustable and adjustable portions, respectively, of the Contract Price payable in that specific currency "c"; and Imc is the index prevailing at the end of the month being invoiced and Ioc is the index prevailing 28 days before Tender opening for inputs payable; both in the specific currency "c".

47.2 If the value of the index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next payment certificate. The index value shall be deemed to take account of all changes in cost due to fluctuations in costs.

48. Retention

48.1 The Employer shall retain [19] from each payment due to the Contractor the proportion stated in the Contract Data until Completion of the whole of the Works.

48.2 On completion of the whole of the Works, half 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 [20] 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 Sub-Clause 43.1.

50. Advance Payment

50.1 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.

50.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization 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.

50.3 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.

51. Securities

51.1 The Performance Security shall be provided to the Employer not later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and 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 from the date of issue of the Certificate of Completion in the case of a Bank Guarantee, and until one year from the date of issue of the Completion Certificate in the case of a Performance Bond.

52. Dayworks

52.1 If applicable, the Dayworks rates in the Contractor's Tender 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.

52.2 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.

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

53. Cost of Repairs

53.1 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

54. Completion

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

55. Taking Over

55.1 The Employer shall take over the Site and the Works within seven days of the Project Manager's issuing a certificate of Completion.

56. Final Account

56.1 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.

57. Operating and Maintenance Manuals

57.1 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.

57.2 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.

58. Termination

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

58.2 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 Programme and the stoppage has not been authorized 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 84 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) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in the Contract Data.

58.3 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under Sub-Clause 59.2 above, the Project Manager shall decide whether the breach is fundamental or not.

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

58.5 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.

59. Payment upon Termination

59.1 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.

59.2 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.

60. Property

60.1 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.

61. Release from Performance

61.1 If the Contract is frustrated by the outbreak of war or by any other event 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 IV. Contract Data

The following documents are also part of the Contract:

Contract Clause

1.0 The Site is located at **PLOT No.7, ZORBISI, BOLGA – UPPER EAST REGION** and is defined in drawings No: _____

1.1 The Employer is:

Name: **MINERALS COMMISSION OF GHANA**

Address: **P.O. BOX M 248,**
ACCRA –GREATER-ACCRA REGION

Name of Authorized Representative: **THE CHIEF EXECUTIVE OFFICER, MINERALS COMMISSION OF GHANA**

The Project Manager is:

Name: **MESSRS. FASOTA LIMITED**
Address: **P.O. BOX AH 8689**
KUMASI.

Name of Authorized Representative **THE PRINCIPAL DIRECTOR**
FASOTA LIMITED

The name and identification number of the Contract is: ……

The Works consist of **TWO (2) STOREY OFFICE BLOCK WITH ANCILLARY FACILITIES**

The Start Date shall be _____.

The Intended Completion Date for the whole of the Works shall be

_____.

The following documents also form part of the Contract:

INSTRUCTION TO TENDERERS

FORM OF TENDER

ARTICLES OF AGREEMENT

CONDITIONS OF CONTRACT

PRELIMINARIES, BILLS OF QUANTITIES AND DRAWINGS

3.0 The language of the Contract documents is **ENGLISH**

The law that applies to the Contract is the law of the Republic of Ghana.

8.0 Schedule of Other Contractors

9.0 The Schedule of Key Personnel

13.0 The minimum insurance covers shall be: **GHC 250,000.00 TO COVER CONTRACTOR'S ALL-RISK INSURANCE (CAR)**

14.0 Site Investigation Reports

21.0 The Site Possession Date shall be _____

25.0 Institution whose arbitration procedures shall be used:

Fees and types of reimbursable expenses to be paid to the Adjudicator:

25.0 Arbitration will take place in accordance with [21] (**ALTERNATIVE DISPUTE RESOLUTION ACT, 2010 (ACT 798)**

26.0 Appointing Authority [22] for the Adjudicator: **GhI.S**.

27.0 The Contractor shall submit a revised Programme for the Works within

14 days of delivery of the Letter of Acceptance.

27.0 The period between Programme updates is 30 days.

The amount to be withheld for late submission of an updated Programme is **GHC 1,000.00**

35.0 The Defects Liability Period (DLP) is 180 days [23].

41.0 The Contractor shall submit an Updated Cash Flow Estimate for the Works within **14** days of delivery of the Letter of Acceptance.

44.0 The following events shall also be Compensation Events:

47.0 The Contract is subject to price adjustment in accordance with Clause 47 of the Conditions of Contract, and the following information regarding coefficients **shall** apply.

THE CONSTRUCTION COST INDICES DEVELOPED BY CSIR – BUILDING AND ROAD RESEARCH INSTITUTE, GHANA.

48.0 The proportion of payments retained is 10 percent.

49.0 The liquidated damages for the whole of the Works **shall be 0.05 percent of the final contract price per day**

The maximum amount of liquidated damages for the whole of the Works is ***5 %*** *percent* of the final Contract Price.

50.0 The Advance Payment will be **15% of the Contract Sum**.

The Performance Security shall be for the following minimum amounts equivalent as a percentage of the Contract Price:

(a) Bank Guarantee 10**%**. OR
(b) Bond 30%

The standard form(s) of Performance Security acceptable to the Employer shall be _____ of the type presented in Section 8 of the Tender Documents.

[27] If Sectional Completion and Damages per Section have been agreed, the latter should be specified here.

Section V. Specifications

SECTION V

TECHNICAL SPECIFICATIONS
FOR THE WORKS

SPECIFICATIONS

1.0 GENERAL

The Technical specifications are intended to be descriptive only and not restrictive. The bidder may substitute alternative standards, brand names and/or catalogue numbers in its bid, providing it demonstrates to the employer's satisfaction that the substitutions are substantially equivalent or superior to those designated in the technical specifications.

In the following specifications unless the context otherwise requires, the following expressions shall have the meanings hereby assigned to them:

1.1 "Employer" is the **MINERALS COMMISSION OF GHANA**

1.2 "Contractor" means the party whose Tender has been accepted by the Employer.

1.3 "Consultant" means the authorized representative of **FASOTA LIMITED, KUMASI.**

1.4 'Works' means the works to be executed in accordance with the Contract, and includes all labour, materials, supplies, plant and equipment, and other items necessary for the performance, and the maintenance of all work to be executed under the contract.

1.5 Drawings" means all drawings, plans sketches, and maps issued to the Contractor and such other drawings as may from time to time be provided or approved by the Consultant.

1.6 "Site" means the land upon which is to be constructed the facilities shown and delineated on the contract drawings.

2.0 EARTHWORK

2.1 Visit to the Site

The contractor is advised to visit the site and satisfy himself as to the nature of the soil to be excavated and the level of the water table.

The contractor's price for excavation shall include for excavating in any type of ground (except rock as defined hereunder).

2.2 Excavation

2.2.1 Excavation for foundation and trenches shall be carried out to the lines and levels shown on the drawings or as may be required by the Consultant. The excavation shall be taken out to the minimum beyond the lines and levels as shown so as to reduce the amount of backfill required, due allowance to be made for working space and all necessary timbering.

2.2.1 Excavation over 1800mm deep shall be properly supported to prevent collapse. Slips which occur as a result of the contractor's failure to take due precautions will be taken out and made good at the contractor's own expense.

2.2.2 Where loose soil or weak pockets occur below the intended foundation level, they shall be taken out to the satisfaction of the Consultant and made up in mass concrete or other materials as shall be directed by the Consultant.

2.2.3 Where the excavation is exceeded, the levels are to be made up in mass concrete or other material as specified by the Consultant and at the Contractor's expense.

2.2.4 Excavation, backfilling and compaction by mechanical means will be permitted only where it is reasonably practicable and will not endanger or damage other structures or property.

2.2.5 The Contractor shall take all steps to keep the excavations free of water and give due regard to the possibility of floods and provide all pumps, timbering, sheet piling and other equipment necessary for the correct execution thereof.

2.2.6 No concrete or permanent works shall commence upon the excavation bottom until the excavation has been inspected and approved by the Consultant.

2.2.7 Should the Consultant so decide, soil at the building site shall be treated with sodium pentachlorophenate or other approved chemical.

2.3 Rock Excavation

2.3.1 The term "rock" where used in the Bills of Quantities shall be deemed to be geological formation which in the opinion of the Consultant can only be removed by means of pneumatic drills or similar mechanical plant or explosives.

2.3.2 The contractor's rates for excavation in rock shall include the getting out and disposal of extra material arising from such excavation and for backfilling with approved concrete to the lines and levels shown on the drawings.

2.3.3 Where excavation is in rock, the contractor shall cut back to the required inclination, trim, remove or support all projections as instructed by the Consultant.

2.4 Use of Explosives

2.4.1 The Consultant's express permission must be given for the use of explosives for this purpose. If permission is given, the contractor will be held responsible to ensure that charges are not excessive, that charge boreholes are adequately protected before being fired and that proper precautions are taken for the protection of the works, persons employed on the works, members of the public and adjoining property.

2.4.2 Should the presence of rock be such that foundation excavation or concrete foundation be unnecessary to the extent of the requirement stated on the drawings, the Consultant's approval must be given for any such omission.

2.5 Disposal of Materials

2.5.1 Excavated material which is suitable for re-use shall be stacked on site at such places as agreed with the Consultant.

2.5.2 All excavated material not required for re-use shall be removed from site to such places of disposal as shall be previously agreed with or indicated by the Consultant.

2.6 Backfilling

2.6.1 No backfilling is to commence until the foundation and permanent works have been inspected and passed as correct by the Consultant, otherwise the drawings shall be used to compute the quantities of any hidden work.

2.6.2 The material used as backfill shall be free from vegetable and other deleterious matter. It shall be of such quality as to be free of excessive voids when watered and compacted and should not contain rocks or lumps over 75mm in greatest dimension.

2.7 Placing and Compacting

2.7.1 The backfilling material shall be spread in layers not exceeding 150mm before compaction. The contained water shall be distributed uniformly through the soil and the water content shall be that which will permit proper compaction.

2.7.2 Field Density Test shall be carried out at the raked Floor areas where filling is quite significant.

2.8 Hardcore

2.8.1 The hardcore filling under floors shall be approved laterite, hand broken stone or concrete, free from deleterious matter and evenly graded from 75mm down to 20mm ring. Hardcore shall be laid in layers not more than 150mm thick, well watered, rammed and consolidated and blinded with fine material where necessary.

2.8.2 The contractor's attention is drawn to the fact that the volume of fill has been measured net and that allowance should be made for loss in bulk that will occur due to consolidation, etc.

3.0 CONCRETE WORK

3.1 Generally

The materials, mixing, placing and curing of concrete works, reinforcement and formwork shall be in accordance with the recommendation laid down by the latest British Standard Code of Practice for the structural use of reinforced concrete in buildings.

3.2 Cement and Cement Storage

3.2.1 The cement shall be Ordinary Portland Cement (OPC) and Portland Limestone Cement (PLC) from approved manufacturers or their agents, and shall conform in every way with the provisions of British Standard 12 for normal setting Portland cement or other approved equivalent standards.

3.2.2 Cement for masonry works shall be Portland Limestone (PLC) of grade 32.5R(Super Rapid).Cement for Reinforcement Works shall be Ordinary Portland(OPC) of grade 42.5N(Super Strength).

3.2.3 The cement shall be delivered in the unbroken; original packages of the manufacturers plainly branded and must be stored in a well ventilated, watertight shed on a floor raised at least 300mm from the floor. Sufficient quantities must be stored to ensure continuous supplies and each consignment shall be kept separately and plainly marked for identification purposes so that it may be used in proper sequence.

3.2.4 No cement other than normal setting Portland cement may be used, and no admixtures may be added to the cement or the formwork unless specified or approved by the Consultant.

3.3 Fine Aggregate (Often Termed "Sand")

3.3.1 Fine aggregate shall consist of hard siliceous sand, crushed rock(quarry dust) or approved inert material with similar characteristics having clean, hard, uncoated grains, free from lumps, soft or flaky particles, tree roots, shale, mica, crusher dust, silt, alkali, loam, organic matter, or other deleterious substance. The amount of silt, loam clay etc. in the fine aggregate must not exceed 10% to be determined as described in the Public Works Department Standard Site Instruction No.8.
The Structural engineer reserves the right to change the grading of the various aggregates.

3.3.2 Fine aggregate shall be uniformly varying in size and must pass through a mesh of 5mm square measured in the clear and not more than 10% shall pass through a No. 100 British Standard Sieve.

3.4 Coarse Aggregate (Often Termed "Stone")

3.4.1 The coarse aggregate shall consist of gravel, crushed stones, or other approved material with similar characteristics, having lean, hard, uncoated particles, free from soft, friable, porous, elongated or laminated pieces, crusher dust, alkali, loam, mica, organic matter or other deleterious substances.

3.4.2 The particles shall be uniformly varying in size and must pass through a screen with a mesh of 20mm square measured in the clear, and be retained on a screen with a mesh of 5mm square measure din the clear. The grading of the coarse aggregate shall be considered satisfactory if, by sieve analysis, the percentages by weight passing through the sieves measured square in the clear are as follows:

Sieve Opening (Square opening mm)	Percentage Passing by Weight
20	100
12	90 – 100
10	25 – 55
5	0 – 10

3.5 Samples of Aggregates

Samples of both fine and coarse aggregates are to be submitted to the Consultant for testing at least two weeks before commencing deliveries. No deliveries in bulk are to be commenced until such samples are approved by the Consultant as complying with this specification.

3.6 Storage of Aggregates

The aggregate shall be stored on clean, hard surfaces so as to prevent any contamination and admixture with foreign material, and in way such that aggregates of different type and size do not become mixed.

3.7 Steel Reinforcement

The steel reinforcement shall conform to British Standard 4449 for rolled steel bars British standard 4482 for hard drawn steel wire, and British Standard 4461 for cold twisted steel bars or other approved equivalent standards. The steel fabric reinforcement is to be hard drawn steel wire fabric and shall conform to British Standard 4482 or other approved equivalent standards.

3.8 Water

Water shall be clean and free from oil, acid, alkali, earth, salt, vegetable or organic matter, or other deleterious substance in suspension or in solution. Sea water shall not be used in any part of the works.

3.9 Rejected materials

3.9.1 All condemned materials shall be removed from the site within 24 hours.

3.10 Steel Reinforcement, Bending and Fixing

3.10.1 All steel bending is to be in accordance with BS 4466. The bending of reinforcing steel shall be carried out cold. No welding or heating of steel is permitted without the written consent of the Consultant. Al l reinforcement shall, prior to placing, be free from loose mill scale, loose rust, oil, grease, dirt or other foreign matter.

3.10.2 All reinforcement shall be placed in the exact position indicated on the drawings and shall be securely wired with 18 gauge soft iron wire at all intersections, and shall be supported in position in such a manner as to ensure that no movement will take place before the concrete has set.

3.11 Concrete Cover

3.11.1 The covers to bars as specified on the drawings are to be obtained by placing steel or spacer blocks (made of cement and sand mortar mix 1:3) supplied by the contractor, of approved size and shape and tied to the reinforcement. Were cover to bars is not shown on the drawings, the bars shall be so placed that in no case shall any main reinforcement have a cover of less than:

(a)	Column	40mm
(b)	Beam	25mm
(c)	Slab	13mm or the thickness of the bar whichever is the greater.

3.12 Construction of Formwork

3.12.1 **Timber formwork shall be used only twice**.

3.12.2 The formwork shall be of timber, steel or other suitable and approved material, which must be sufficiently strong, impervious and resistant to the action of cement. The formwork shall be true to line and level and adequately supported by struts and shores in such a matter that there will be no deflection under the liquid and solid pressure exerted by the concrete. The faces of formwork shall be constructed so as to avoid all leakage of liquid from the concrete and any joints in the formwork must be flushed up so as to avoid any marking appearing on the finished work. All rubbish and loose materials shall be removed from the inside of the formwork before concreting. The face of the formwork in contact with the concrete shall be wetted with clean water or approved shutter oil immediately prior to concreting. The formwork for beams and slab is to be so designed that sides of beams or slabs can be struck first, leaving shuttering to beam soffit and supporting props in position. In the case of beams exceeding 7500mm ins pan, the soffit shall be given a camber towards the center as specified on the drawings or as directed.

3.12.3 In the case of columns, the formwork shall be so constructed that the height of poor does not exceed 15000mm (this can usually be achieved by cutting a "window" in the formwork on a lightly reinforced side of the column at a height of 1500mm; pouring to this height; closing the window, and then continuing the concreting from the top. When this cannot be done, instructions will be given on the drawings).

3.13 Removal of Formwork

3.13.1 All formwork shall be struck without jarring the concrete or subjecting same to sudden shock.

3.13.2 Before striking any formwork, the contractor shall satisfy himself that the concrete is sufficiently hardened to bear its own load and any other loads that may be placed upon it. No formwork is to be removed if in the opinion of the Consultant the concrete has not set sufficiently. Approval of the Consultant shall not relieve the contractor of his liability to make good any concrete which may be damaged by premature removal or collapse of formwork.

3.13.3 Subject to the foregoing provisions and the concrete test cube results, the minimum periods for the removal of formwork generally are as follows:

SLABS	Soffit (Props left under)	-	4 days
	Props to Slabs	-	10 days
BEAMS	(Up to 6000mm span) sides	-	3 days
	Props and Soffits	-	16 days
BEAMS	(Over 6000mm span) sides	-	3 days
	Props and Soffits	-	16 days
	Plus ½ day for every 300mm In excess of 6000mm.		
COLUMNS	and walls (unloaded) sides	-	3 days
COLUMNS	and walls (loaded) as stated On drawing		

(These periods may be reduced only with the written approval of the Consultant).

In the case of special types of formwork, striking times are to be approved by the Consultant.

3.12.4 If a beam or slab is required to support a construction load in excess of its design load, the beam or slab is to be propped until the supported construction has reached the age when its propping may be removed.

3.12.5 No supports for the shuttering may be left in the finished concrete without the written permission of the Consultant.

3.13 Normal Finish to Structural Concrete Surfaces

3.13.1 After removal of the shuttering, the surface of all concrete shall be brought to a true surface and all defective portions of the face repaired, all cavities filled and any projections removed. In the event of parts of the concrete being honey-combed, such portions shall be cut out to a depth and shape required by the Consultant and made up with fine concrete of equal quality.

3.14 Concrete Making

3.14.1 Proportions of Concrete Mix

3.14.2 The concrete mixes will be specified on the drawing by strength requirements as specified in paragraph 3.20.6.

3.14.3 The batches shall be gauged as follows:

Concrete Mix Described as	Dry Cement	Fine Aggregate	Coarse Aggregate	Grade
1:3:6	50 kg.	$0.11m^3$	$0.21m^3$	15
1:2:4	50 kg.	$0.07m^3$	$0.14m^3$	20

3.14.4 The Consultant shall have the right to vary slightly the volume of fine aggregate from time to time as required to obtain a denser mix. Any adjustment will be made so that the combined volume of fine and coarse aggregate remains unaltered. The contractor shall comply with this condition without extra charge.

3.15 "Bulking" of the Aggregate

3.15.1 The Consultant may require allowance to be made in the gauging of the fine aggregate to counteract the increase in volume (often termed "bulking") due to moisture content.

3.16 Gauge Boxes

3.16.1 When the aggregates are gauged by volume, accurate gauge boxes must be used. The boxes must always be completely filled, and the top struck off level. All such boxes shall be approved by the Consultant.

3.17 Weight-batching

3.17.1 When the aggregates are gauged by weight, the weights of aggregate per batch must be accurately determined and agreed with the Consultant.

3.18 Cement

3.18.1 The quantity of cement in a concrete mix is always to be measured by weight, and the mixer is to be of sufficient size to ensure that a batch of the specified mix may be made using whole bags of cement. The 50 kg. Bag is to be considered as 0.0355 m^3 of volume in calculating volumetric proportions.

3.19 Mixing of Concrete Materials

3.19.1 All concrete is to be mechanically mixed in a batch mixer of approved type. The dry concrete material shall be mixed for at least three turns in the mixer, after which the gauged amount of water shall be gradually added while the mixer is turning. When the water has been added, the concrete is to be mixed for at least two minutes or other such periods as the Consultant shall direct to ensure thorough mixing of the ingredients but on no account shall mixing be carried out until segregation of the ingredients occurs. On the cessation of work, the mixer and all handling plant shall be washed clean. The contractor shall not mix any concrete by hand unless permission has been obtained from the Consultant and in the event of this being given twice the amount of cement required shall be used without extra charge by the contractor.

3.20 Consistency

3.20.1 The consistency of the concrete shall be determined at all times by means of the standard slump test. The slump cone shall be supplied by the contractor.

3.20.2 For normal concrete, the slump shall not exceed 100mm; for mechanically vibrated concrete, the slump shall not exceed 38mm.

3.20.3 The maximum slump of concrete for floor slabs placed on soil sub-grade shall not exceed 75mm.

3.21 Testing

3.21.1 Concrete shall have a minimum compressive as indicated in item 3.20b.

3.21.2 The strength of the concrete shall be determined by the testing of 150mm specimen test cubes taken from the concrete during the progress of the work.

Nine such cubes shall be taken for each day's concreting or for each $15m^3$ of concrete placed, whichever is the lesser. Three cubes are to be tested at 7 days, and at 20 days, and three are to be held in reserve.

3.21.3 The standard method of naming, curing and testing the cubes shall be adopted and agreed with the Consultant.

3.21.4 All cubes made are to be marked and recorded as shall be agreed on with the Consultant.

3.21.5 The contractor shall supply the cube moulds and the testing facilities required. The contractor shall also supply the concrete required for the cubes and his prices shall include all costs for this work.

3.21.6 The test cubes above referred to, made, cured and tested in accordance with the provisions of this specification shall show, to the satisfaction of the Consultant that the concrete from which the samples were taken and the concrete used on the contract generally, complies with the following minimum requirements.

Concrete Mix Described as	**Compressive Strength**	
	7 days After Mixing	***28 days After Mixing***
1:3:6	$10.0N/mm^2$	$15.ON/mm^2$
1:2:4	$14.0N/mm^2$	$20.ON/mm^2$

3.22 Water Cement Ratios

3.22.1 With the approval of the Consultant, concrete mixes may be designed for the required 28 days compressive strength using the water cement (w/c) ratio (in lieu of volumetric proportions based on cement content). Permissible maximum water cement ratios by weight, which include all free surface moisture carried by the aggregates, for the several 28 days compressive strengths of mixes are as follows:

Required Minimum 28-day Compressive Strength in N/mm^2	**Water-Cement Ration (W/C) by Weight**
15	0.710
20	0.578

3.23 Notice of concreting to be given

3.23.1 Before concreting any portion of the work, the contractor shall give written notice to the Consultant and obtain his written approval.

If due notice is not given, the Consultant may require the contractor to remove any concrete so placed at the contractor's expense.

3.24 Distribution of Concrete

3.24.1 The concrete may be distributed in barrows, concrete cars or by means of chutes or head pan or by any other approved methods which will prevent aggregation or loss of the ingredients.

3.24.2 When shutting is used, the slope of such shutting shall be uniform throughout and shall not exceed 45 degrees. The shute is to be kept clean and free at all times from the gradual deposition of concrete.

3.25 Placing and consolidation of concrete

3.25.1 The concrete must be placed into position as rapidly as possible after wetting and in any case before any setting is commenced. The concrete shall be thoroughly compacted when in position so that it will, with the aid of Roding and tamping, flow entirely and solidly around the reinforcement without leaving any voids.

3.25.2 Mechanical vibration and pre-vibration will be permitted, on the application of the contractor, subject to the following conditions:

a) Methods of vibration shall not cause separation or segregation of the aggregate and cement components of the wet concrete;

b) Vibration shall not disturb concrete which has recently begun to set;

c) All details of the proposed vibration plant and manner of application shall be subject to the approval of the Consultant. Permission and/or approval do not receive the contractor from his liability to make good work which may be damaged by excessive or ill-applied vibration or pre-vibration.

3.26 Construction Joints

3.26.1 Immediately prior to concreting up to the joint, its face shall be soaked with water and covered with a thin layer of freshly made cement and sand mortar consisting of equal proportions.

3.27 Exposed Corners

3.27.1 All exposed concrete shall be chamfered 20mm.

3.28 Expansion Joints

3.28.1 The expansion joints are to be made as shown on the drawings or as instructed by the Consultant.

3.29 Curing

3.29.1 All concrete shall be kept thoroughly moist for the first 7 days of setting by means of wet sand or wet sacks.

3.30 Workmanship

3.30.1 The work is to be carried out strictly in accordance with the details and no deviation whatsoever will be allowed except by written permission of the Consultant.

3.31 Embedded items

3.31.1 Structural steel shapes anchor bolts, steel plates, etc., and other similar items to be embedded in concrete shall conform to accept British Standards for such material.

3.31.2 No openings, holes, chases, mortices, boxings, etc. shall be formed in the concrete without the approval of the Consultant. Details of fixings or fixtures to be permanently built into concrete shall be submitted to the Consultant for approval.

3.32 Monolithic Floors – Trowel Finish

3.32.1 Concrete surfaces which form finished floors shall be struck off and consolidated by screeding and tamping to exact elevations and slopes shown on the drawings or as directed. The concrete shall then be further smoothed and consolidated to a uniform, close textured surface by means of a wood float or power floating machine and all high and lower spots exceeding 6mm under a 5000mm straight edge eliminated. Floating and testing of the surface shall be continued until all high and low spots are corrected and a dense uniform surface obtained. Floating in excess of that required to level and consolidate the surfaces and bring a small amount of grout to the surface will be prohibited. In addition to the above, the floor shall be finished by steel toweling after the concrete has hardened sufficiently (30 – 45 minutes depending on weather conditions) to prevent excess fine material from working to the surface. The final finish shall be smooth and free from defects and blemishes. Finish shall be polished or unpolished as directed.

3.33 Tamped Finish

3.33.1 Where a tamped finish is specified, the surface of the concrete shall be leveled and tamped with a timber screed board.

3.34 Float Finish

3.34.1 Where a float finish is specified, the surface of the concrete shall first be tamped. After hardening sufficiently, the concrete shall be smoothed with a wood float so as to produce a uniform surface. Cement shall not be sprinkled on the surface before floating.

3.35 **Ready Mixed Concrete**

3.35.1 Ready mixed concrete shall be manufactured and delivered in accordance with B.S. 1926, "Ready Mixed Concrete".

3.35.2 The concrete shall comply with this specification. Works cube tests and slump tests shall be made once each day for each concrete grade delivered to site.

3.36 **Precast Concrete**

3.36.1 Precast concrete shall comply with the preceding sections of the concrete specifications except where modified by the following paragraphs.

3.37 Construction

3.37.1 The manufacture and installation of precast units shall comply with the recommendations made in British Standard Code of Practice C.P. 116, "The Structural use of Precast Concrete".

3.37.2 Precast concrete units are to be cast in one length where practicable. Where this is not possible, members shall be cast in lengths convenient for handling purposes as agreed with the Consultant and between such lengths as may be required.

3.38 Handling

3.38.1 Before removal from the casting beds, the concrete shall have attained sufficient strength to avoid any damage or distortion or overstressing of the precast units. The contractor shall provide and incorporate all necessary lifting devices which shall be subject to the approval of the Consultant.

3.39 Erection

3.39.1 Prior to erection in the works, the contractor shall submit to the Consultant for approval, details of his proposed arrangement for lifting and erecting the units.

3.40 Jointing

3.40.1 All joint surfaces shall be thoroughly cleaned. Dry packed mortar joints shall be formed by compacting the mortar with a steel tool in layers not exceeding 20mm in thickness. Bedded mortar joints shall be formed by bedding the precast units on a firm layer of mortar. The unit shall be supported in such a way as to prevent extrusion of the mortar.

Thin bedded mortar joints shall be formed with neat cement mortar spread evenly to form a bed sufficiently thick only to make up any low points on the bedding surface.

4.0 BRICKWORK AND BLOCK WORK

4.1 The cement and sand shall be as described under CONCRETE.

4.2 Sandcrete Blocks

4.2.1 Sandcrete blocks shall be solid and ungrooved blocks made on the site in a n approved machine or purchased form an approved manufacturer. They shall be composed of one part of cement to six parts sand.

4.2.2 All blocks shall be finished with smooth surfaces and clean sharp arises. All mixture shall be made into block within 20 minutes of water being added and the mixture not used within this time shall be removed from the site.

4.3 Curing of Sandcrete Block

4.3.1 The blocks shall be matured for twenty-four hours in a shed protected from direct sunlight, rain and drying winds. They must be kept moist during the twenty-four hours if necessary by gently spraying with water.

4.3.2 After twenty-four hours the blocks shall be carefully removed and laid on the ground in one layer. They shall be covered with polythene sheets, and kept thoroughly soaked for ten days.

4.4 Dimensions of Blocks

4.4.1 The external dimensions of blocks within the tolerance specified shall be as follows:

Length	…	450mm	$\pm$ 3mm
Height	…	225mm	$\pm$ 3mm
Thickness (solid blocks)	…	100 – 150mm	$\pm$ 3mm
Thickness (hollow blocks)	…	100 – 225mm	$\pm$ 1.6mm

4.4.2 Blocks shall be true to shape and be left with good sharp, clean arises.

4.5 Mix and Quality

4.5.1 Block shall be produced using 1:6 mix or such other mix as the Consultant may direct to meet the requirements specified below.

4.6 Extract from B.S. 2028

4.6.1 The following extract from B.S. 2028 shall be the guiding factor as to the strength, etc. required:

(a)	Density	The density of the solid or hollow blocks shall not exceed 1600 kg/m^3 determined on dry specimens.
(b)	Strength	The compressive strength of block shall not be less than: Average of 12 blocks - 2.8N/mm^2 Lowest individual block – 2.18N/mm^2 gross area
(c)	Dry Shrinkage	The average value of dry shrinkage of three test specimen shall not exceed 0.06%.
(d)	Moisture Movement	The average moisture movement of specimen shall not exceed 0.05%.

4.7 Mortar

4.7.1 The jointing mortar for sandcrete blocks shall be composed of one part cement and four parts sand. Up to 10% by volume of hydrated lime may be added to provide a workable mix.

4.8 Block laying

4.8.1 Block work shall be generally laid in stretcher bond and properly bedded and jointed. Joints shall be thoroughly flushed up while laying the blocks and joints shall not exceed 12 mm.

4.8.2 Walls are to be carried up in a uniform manner and no part of the walls shall be carried more than 1000mm above another part at anytime. All courses shall be level and all perpends, quoins and the like kept strictly true.

4.9 Pointing

4.9.1 Where block walls are to be left unplastered, all joints shall be struck flush and compressed to a dense surface with a piece of 12mm diameter bent rod.

4.9.2 Where block walls are to be plastered or are to receive ceramic tile, joints shall be raked out to a depth of 12mm.

4.10 Reinforcing

4.10.1 Where indicated on the drawings, block work shall be reinforced with bar reinforcement conforming to British Standard 4449. Cells in the block in which vertical reinforcement is placed shall be filled with Portland cement mortar as specified herein.

Bars in filled cells shall not be moved or otherwise disturbed until the mortar has set. Where horizontal reinforcement is called for, the cells in the blocks in the course above and below the joint in which the reinforcement is placed shall likewise be filled with mortar. Wall intersections and corners shall be tied with reinforcement and the cells filled with mortar as specified for horizontal reinforcement.

4.11 Clay Bricks, Blocks and Facing Tiles

4.11.1 Clay bricks and facing tiles are to be obtained from approved manufacturer and are to be laid in accordance with the manufacturer's recommendations. The external dimensions of bricks within the tolerances specified shall be as follows:

4.11.2

	Lengths (3mm)	**Width (3mm)**	**Thickness (1.6mm)**
Hollow blocks	300mm	225mm	100 – 125mm
Standard Perforated Bricks	225mm	100mm	75mm
Standard Bricks (Solid)	225mm	100mm	75mm
Decorative Bricks slips	225mm	75mm	12mm
Roofing Tiles	265mm	165mm	12mm

5.0 ROOFING

5.1 Corrugated Sheet Roofing

5.1.1 Corrugated sheets for roofing shall be corrugated chromium plated aluminium sheets, of gauges and thicknesses specified on the Drawings or Bills of Quantities. Roofing sheets and accessories are to be obtained from approved manufacturers and are to be fixed in strict accordance with the manufacturer's instructions. In no case shall side laps be less than two corrugations.

5.2 Aluminium Hips, Ridges and Valleys

5.2.1 Hips, ridges and valleys may be plain or preformed units, formed with 0.7mm flat aluminium sheet, fixed in accordance with the manufacturer's instructions for aluminium sheet roofing.

5.3 Concrete Hips and Ridges

5.3.1 Hips and ridges for corrugated asbestos sheet roofing shall be preformed asbestos units, or precast or in-situ concrete units as specified on the Drawings and Bills of Quantities. Precast or insitu concrete ridges and hips shall all have a two layer felt underlay.

5.4 Bituminous Felt Roofing

5.4.1 Roofing felt shall be three layers of self-finished bitumen felt to B.S. 747: 1968 IC, laid with 50mm side and 75mm end laps staggered, the layers bonded together with hot bitumen bonding compound as described in C.P. 144 Part 1: 1968.

5.5 Flintkote

5.5.1 Flintkote roofing materials shall be obtained from the Shell Company of Ghana Limited, Accra, and shall be applied in strict accordance with the manufacturer's instructions to the following specifications.

5.5.2 Brush all surfaces thoroughly and remove all loose dirt, dust, etc. and apply priming coat consisting of equal volumes of flintkote type 3 emulsion and water (1 litre of emulsion per 4 square metres). The primary coat shall be well brushed into the surface and allowed to dry.

5.5.3 Apply a heavy brush coat of Flintkote type 3 emulsion (3 litres of emulsion per 4 square metres) and immediately embed "Tyglasses" or similar open mesh woven glass fibre membrane lapped 75mm at all joints).

5.5.4 Apply a light fibre brush coat of Flintkote type 3 emulsions (2 litres of emulsion per 4 square metres). Allow to dry.

5.5.5 Apply a heavy brush coat of Flintkote Type 5 emulsion (3 litres of emulsion per 4 square metres). Allow to dry.

5.5.6 Finish surfacing with two coats of Flintkote Decoralt "F" consisting of two parts Decoralt "F" to one part of water (1 litre of Decoralt "F" per 9 square metres per coat). The first coat shall be brushed on in one direction and allow to dry. The second coat is to be applied at right angles to the first.

5.6 Clay Roof Tiles (Where Applicable)

5.6.1 Clay roofing tiles, hips, ridges and valley tiles are to be obtained from approved manufacturer and are to be laid in accordance with the manufacturer's instructions.

5.7 Micro Precast Concrete Roofing Tiles

5.7.1 Micro precast concrete roofing tiles and accessories are to be obtained from approved manufacturer and are to be laid in accordance with the manufacturer's instructions.

5.8 Eaves

5.8.1 The fascia board projection below the eaves boarding shall not be less than 20mm and not more than 25mm. In no circumstances shall the fascia and the eaves boarding flush.

6.0 CARPENTRY AND JOINERY

6.1 General

6.1.1 This section covers furnishing, protecting, fabricating, and installation and surfacing of all framing, blocking, sheating and finish lumber. All rough hardware, facings laminated to wood surfaces, and other millwork and all supplies and services appurtenant to such materials are covered hereby.

6.2 Timber

6.2.1 The whole of the timber for the Carpentry and Joinery work shall be approved by the Consultant. Unless otherwise described the contractor shall submit samples clearly labeled and stating the proposed usage of each specimen to the Consultant.

6.2.2 The whole of the timber for Carpentry and Joinery work shall be made thoroughly termite proof to the satisfaction of the Consultant with an approved preservative and used strictly in accordance with the manufacturer's instructions.

6.2.3 After thorough immersion the timber shall be withdrawn and stacked to dry out before being used.

6.3 Sawn Timber

6.3.1 Timber required for carpentry shall be ordered sawn and carefully stacked under cover so as to allow air to freely circulate around it and shall hold up to the full scantling specified.

6.4 Wrot Timber

6.4.1 The whole of timber for joinery work shall be wrot and unless described as "Finished", the sizes stated are those before planning and 3mm will be allowed on each wrot face from all specified thickness.

6.5 Workmanship

6.5.1 Each of the various classes of carpentry and joinery hereby shall be performed by craftsmen skilled in that class.

6.5.2 Every item shall be rigidly anchored or attached, square, plumb and true in other planes and shapes shown on the drawings. All joints shall be tight, even and free of offsets. All surfaces shall be sanded, filled or otherwise prepared to receive paint where indicated.

6.5.3 Where timber for carpentry and Joinery is described as plugged the fixing is to mean plugging to concrete, or block work or any other material requiring plugging by means of "Rawplugs" or timber plugs and the contractor is to include for the same in his prices.

6.6 Materials

6.6.1 Species

6.6.2 Timbers shall be West African hardwood and softwood selected for their durability and allowable working stresses best suited for the intended use. Mixed species for the same structural or finish use in any one building will not be permitted without approval of the Consultant. Where possible, timber shall be one of the type specified in the following table:

Botanical Name	Trade Name	Local Name
Chlorophora Excelsa	Iroko	Odum
Cylicodiscus Gabunensis	Okan	Denya
Erythrophleum Geuinesse	Tali	Potrodum
Piptadenia Africana	Dahoma	Dahoma
Sarcocephalus Dederrichi	Opepe	Kusia

6.7 Other types of lumber

6.7.1 Other types of lumber than those herein specified shall be used if so indicated on the drawings or specified elsewhere and may be used if approved. A complete list of grades of such other types of lumber, along with three copies of the grading rules under which such lumber will be furnished, shall be submitted and approved before such other types of lumber are delivered to the site.

6.8 Protection of Materials

6.8.1 All lumber shall be handled, stacked, stored, cut and installed according to the best recognized practices of the manufacturer of each type and grade of lumber.

6.9 Seasoning of Timber

6.9.1 Timber for building purpose should always be seasoned. Timber delivered green or semi-green should be stacked under cover in an approved manner and allowed to season before use. The length of time required to season from green in West Africa is approximately two months per 25mm of thickness. Timber shall be seasoned in the locality where it will be used for a period of 6 months or until the moisture content is reduced to 20% or less, whichever occurs first.

6.10 Timber for Polishing

6.10.1 Where timber is to be polished, or stained and oiled, or stained and varnished, such timber shall be specially selected for grain, figuring and marking and approved by the Consultant.

6.11 Exterior Use

6.11.1 Timbers for exterior use where durability under exposure to the elements is of prime importance will be of one of the following species: Opepe or Iroko (Odum).

6.11.2 The required species selected for structural requirements will be indicated on the drawings or specified by the Consultant. Other suitable species will be permitted upon approval by the Consultant.

6.12 Interior Use

6.12.1 Timbers for interior use may be of the less durable woods of other species approved by the Consultant. The required specie selected for structural requirements or finish will be indicated on the drawings or specified by the Consultant.

6.13 Structural Requirement

6.13.1 Timbers for structural use shall be of a specie suitable for exterior or interior exposure as required, and shall have minimum working stresses based on factors of safety as shown in the following table:

Bending	Max. Strength	Allowable Working Stress N/mm^2
Compression parallel to grain	**8**	8.0
Compression at right angles to grain	**Hardness** **3**	3.0
Shear parallel to grain	**Shear** **8**	1.5
Tension parallel to grain	**Bending + 50%**	12.0
Modulus of Elasticity	**Individual Modulus** **2**	4600

6.14 Doors

6.14.1 Doors shall be paneled and obtained from Wood Dizens, Kumasi or any other approved source of equal quality.

6.15 Plywood

6.15.1 Plywood shall conform to the provision of British Standard 1455 and shall be either Interior or Exterior type as defined on the drawings, or as directed by the Consultant, and shall be of an approved manufacture preferably from Bondplex Ghana Ltd., Kumasi or other approved source of equal quality.

6.16 Laminated Plastic Sheeting

6.16.1 Laminated plastic sheeting is to be Formica as manufactured by Formica Limited, De la Rue House, 84/86 Regent Street, London W.1, England or other similar equal and approved and shall be fixed with an approved adhesive in strict accordance with the manufacturer's instructions.

6.17 Tongued-and-Grooved Boarding

6.17.1 Tongued-and-grooved boarding shall be 20mm thick hardwood strips in 75 mm. maximum face widths or as otherwise stated on the drawings, samples from manufacturers must be submitted to the Consultant for selection and approval. Selected timber for lining shall be kept clean for polishing.

6.18 Insect Screen Cloth

6.18.1 Insect screen cloth shall be aluminium wire conforming to Federal Specification L.S. 139 unless otherwise specified and shall be 20 mesh per 25mm width.

6.19 Burglar-Proofing

6.19.1 Burglar-proofing for panned windows shall be 20mm square tabular yield rods conforming to British Standard 4449 for steel bars. Rods shall be fixed through block work as indicated in the drawings and shall not disturb opening of the windows.

6.20 Nails and Screws

6.20.1 All nails and screws shall conform with B.S. 1202 and 1210. Oval or round brands of nails shall be used for fixing all face work and heads shall be properly punched in and neatly puttied.

6.21 Glass Paper

6.21.1 All woodwork to be painted is to be thoroughly glass papered and care must be taken to ensure that plane marks do not occur.

6.22 Priming

6.22.1 All joinery specified to be painted is to be knotted and primed (see Painting and Decoration) before leaving the Joiner's shop.

7.0 **IRONMONGERY**

7.1 Scope

7.1.1 This section covers all rough and finish hardware and the requirements thereof apply to any items indicated on the drawings and hardware schedule which, in accordance with accepted trade practices, require the installation of rough or finish hardware for proper operation or appearance. Quality of hardware shall be as specified in the Bills of Quantities stating acceptable manufacturing model or catalogue designation for the functions specified, herein.

7.2 Samples

7.2.1 Samples of all locks, latch sets, door handles, hinges closers and the like shall be submitted to the Consultant for approval before nay finish hardware is installed.

7.3 Finish

7.3.1 Finish of all hardware within the Building shall match unless otherwise specified. Ironmongery is to be fixed with screws of the same metal and finish as the fitting except that all steel or iron ironmongery is to be fixed with brass screws. All screws damaged during fixing, or from any other cause, are to be withdrawn and replaced with undamaged ones.

7.4 Material

7.4.1 In general, hardware shall be manufactured of brass or bronze as specified below. Substitution of aluminium in place of brass or bronze will be acceptable subject to approval by the Consultant.

7.5 Design of Trim

7.5.1 Unless otherwise specified, door trim shall be of a commercial plain design. Large items, such as escutcheons, shall have straight sides, square corners, and medium beveled edges. Small items, such as roses, key plates, etc. shall have smooth rounded edges and corners.

7.6 Master Key Systems

7.6.1 Key lock and padlocks specified herein shall be, master keyed to conform to the system requirements of the Consultant. The contractor shall furnish 3 keys for each lock and 6 master keys for each system.

7.7 Hinges – General

7.7.1 These shall be non-template butt hinges, ball bearing type, unless otherwise specified. Hinges shall be made from wrought brass or bronze with stainless steel pins. 100mm pairs of hinges shall be used at all doors unless otherwise specified.

7.7.2 All locks and other fittings are to be oiled, and adjusted and left in perfect working order.

7.7.3 Prior to the handling over of the works, or any section thereof, the contractor shall fit wooden tabs to each set of keys, clearly showing to which lock they belong and all the sets of keys shall be delivered to the Consultant mounted on a suitable plywood key-board.

8.0 STRUCTURAL STEELWORK AND METALWORK

8.1 Mild Steel

8.1.1 Mild steel shall conform to B.S. 15

8.2 Holes

8.2.1 Holes in metal for fixing are to be drilled clean, burns removed and filed smooth on face. All counter-sinking is to be concentric and to the required depths.

8.3 Bends

8.3.1 All bends shall be evenly forged.

8.4 Welding

8.4.1 Welding is to be carried out by the use of the "Metallic Arc Method" and is to be executed by skilled and fully competent operatives under careful supervision.

8.5 Bolts

8.5.1 Bolts shall be best screw bolts with Whitworth threads and hexagonal heads and fitted with washers under the nuts and with tapered washers under heads and nuts where such bear on a tapered surface. The threaded portion of each bolt shall project through the nut at least two threads.

8.6 Priming

8.6.1 All steelwork shall be primed before fixing with red lead oil primer or other approved paint.

8.7 "Naco" Louvre Carriers

8.7.1 All louvre carriers and surround shall be approved by the Consultant. The carrier shall be of aluminium or consist of zinc plated and passivated mild steel clips and side channels finished with an aluminium lacquer. The louvre panels shall be operated by means of manual lever controls except where otherwise stated and shall be capable of being locked when in the closed position.

8.8 Aluminium Windows and Doors

8.8.1 Supply and installation of aluminium doors and windows shall be carried out by a Nominated Sub-contractor who shall be responsible to the Main Contractor in all respects.

8.8.2 The main contractor will be required to provide adequate storage facilities for the Nominated Sub-contractor.

8.8.3 The Nominated Sub-Contractor shall by site visit agree with the Main Contractor about time for execution of work, time limited etc.

9.0 PLUMBING AND ENGINEERING INSTALLATIONS

9.1 Generally

9.1.1 The whole of the plumbing work is to be carried out strictly in accordance with the requirements of the Local Authority and to the approval of the Consultant and shall conform with the relevant British Standard.

9.2 P.V.C. Pipes and Fittings

9.2.1 P.V.C. pipes and Fittings shall be obtained from approved manufacturer.

9.2.2 "U" P.V.C. rainwater, soil and ventilating pipes, waste and overflows are to comply with B.S. 3505 Class "B".

9.2.3 "u" P.V.C. pressure pipes are to comply with B.S. 3505 Class "C".

9.3 Mild Steel Pipes and Fittings

9.3.1 The mild steel tubing is to be galvanized screwed and socketed and to comply with the B.S. 1387 or other equal and approved and to be "Heavy" Grade for services laid in the ground and "Medium" Grade for other services all jointed in red lead cement and fine spun yard. The fittings are to be malleable iron plain fittings to B.S. 143 and 1256.

9.4 Copper Pipes and Fittings

9.4.1 Copper pipes shall be fixed with brass pipe brackets in accordance with B.S. 659 Table "A".

9.5 Cast Iron Drain Pipes and Fittings

9.5.1 The cast iron pipes shall be spigot and socket type to B.S. 437 made from a suitable pig iron with a mixture of clean scrap with fittings to B.S. 1130. The pipes shall ring clearly when struck with a light hammer and protected by being coated with a composition having a tar base. Joints shall be made in caulked lead and yarn.

9.6 Asbestos Cement Pipe

9.6.1 Asbestos cement pipe shall be obtained from approved manufacturer.

9.7 Fixing of Pipes and Tubings

9.7.1 All pipes and tubings are to be fixed 25mm clear of all faces and 75mm clear of floors or ceilings. Joints are not to be made in the thickness of any wall or floor.

9.7.2 Holderbats, pipe clips, brackets, straps and hangers etc., are to be provided as required and as directed by the Consultant.

9.8 Valves and Fittings

9.8.1 All valves and bib cocks are to be of the best quality and equal to the samples to be submitted and approved by the Consultant.

9.9 Copper Pipes and Fittings

9.9.1 Copper pipes shall be solid drawn seamless copper and shall be of compression type conforming to B.S. 864.

9.10 Sanitary Fittings

9.10.1 Sanitary fittings shall be of approved pattern and be obtained from a supplier to be approved by the Consultant.

9.11 Testing

9.11.1 The whole of the Plumbing system is to be tested in the presence of and to the satisfaction of the Consultant. The method of testing is to be at the discretion of the Consultant and the Contractor is to allow for providing all necessary equipment, labour, etc. Any fittings working unsatisfactorily shall be removed and replaced at the Contractor's expenses to the satisfaction of the Consultant.

10.0 ELECTRICAL INSTALLATION

10.1 Regulations for Installation and Erection

10.1.1 The whole of the Electrical Installations shall be carried out in accordance with the latest Edition of the Regulations for the Electrical Equipment of Buildings, as issued by the Institute of Electrical Engineers, London, the latest Code of Practice for the Electrical Equipment of Buildings issued by the Electricity Corporation of Ghana, and any such Regulations as may be published by the Electricity Corporation of Ghana, and any appropriate Insurance firm regulations.

10.1.2 The Electrical Contractor shall be responsible for giving all the necessary notification to the various authorities involved and for paying all fees.

10.1.3 The contractor shall provide all necessary tools, plant scaffolding and equipment and be responsible for the safety of such during the work.

10.1.4 All workmen engaged on the works shall be skilled workmen and the contractor shall guarantee work performed for a period of six (6) months, starting after issuance of a Certificate of Completion, against any defects.

10.2 Power Supply

10.2.1 The Electrical Power Supply will be made by the Electricity Corporation of Ghana via the existing sub-station.

10.3 Cables

10.3.1 All cables and flexible cords shall comply, in respect to current carrying capacity with the latest edition of the Ghana Electricity Corporation's Regulations for the Electrical Equipment of Building.

10.3.2 All lights shall be controlled by individual wall switches, samples of which should be shown to the Consultant, and shall be mounted 1200mm above floor level.

10.3.3 All cables shall be pvc insulated only 250 volts grade, single core, to B.S. 2004/1953 with minimum sizes as follows:

Lighting Circuits	3/036 ($1.5mm^2$)
Ring Mains for 13 AMP fuse Switch socket outlets	7/029 ($2.5mm^2$)
Water Heaters and Window Air-conditioners	7/036 ($4.0mm^2$)
15A socket Outlets	7/036 ($4.0mm^2$)
Cooker Circuits	7/044 ($6.0mm^2$)
Sub-mains to distribution Boards	19/064 ($25.0mm^2$)

10.3.4 All cables shall be supplied on suitable drums and shall be delivered to site with labels showing origin and specification. Such labels shall be retained by the Electrical Contractor for checking by the Engineers.

10.3.5 3-Phase P.V.C. cables shall have insulation identified by the usual colour coding for phases and neutral.

10.3.6 1-phase PVC cables shall have red-colouring for phase, and black-colouring for neutral.

10.3.7 Single-core cables shall be installed in a manner that shall eliminate circulating currents. Cable ways through ferrous plates shall be slotted and all cable glands and sockets shall be made of brass.

10.3.8 To avoid distortion under short circuit conditions all single core cable should be firmly secured.

10.3.9 All cables shall be made of copper.

10.4 Main Switch Board

10.4.1 The Electrical Contractor shall provide and install the Main Switch Board which shall be a framework comprising a main Busbar chamber, the main-incoming, fuse-switch, and the outgoing fuse-switches and switch fuses.

10.4.2 The rating of the fuse-switches and switches has been indicated in the Bill of Quantities.

10.4.3 Adequate space shall be provided on the main switch board for the Electricity Corporation of Ghana to fix and connect a 3-ph KWH meter and all necessary current transformers.

10.5 Conduits

10.5.1 Wiring shall be carried out in PVC insulated cables installed in rigid PVC conduits and trunking.

10.5.2 The conduits shall comply with B.S. 2004 and shall not be less than 20mm in diameter. Trunking shall be 100 x 100mm. Conduit junction boxes shall be malleable iron and of adequate size to enable cables to be drawn in without damage to insulation. The use of elbows or tees of any type will not be permitted. All conduit ends and accessory boxes liable to become blocked with wet concrete or plaster shall be stopped with suitable plugs to keep the conduits clean during construction work.

10.5.3 Conduits shall be swabbed to clear all traces of moisture before laying. Provision shall be made for drainage of conduit and fittings in situation liable to condensation.

10.5.4 Conduit boxes laid in or under concrete floors shall have traps of approved design fitted with flanged outer frames for keying into concrete and recessed cover suitable for fitting in with the floor materials.

10.5.5 Cover of boxes fixed in walls shall be fitted flush with plaster at all points.

10.5.6 All conduits threads shall be cut clean, be of correct length and conduit ends shall be cut square and have internal burrs removed with a reamer.

10.5.7 Connections between conduits and boxes shall be screwed metal to metal. Exposed places where galvanizing has been damaged, shall be thoroughly cleaned and then painted with two coats of anti-corrosion paint.

10.5.8 Joints and runners in conduit runs shall be kept to a minimum and running sockets shall be secured with hexagonal lock-nuts.

10.5.9 Conduits boxes and running joints with locknuts shall be provided at suitable places to allow subsequent extension without undue dismantling of the system.

10.6 Wiring

10.6.1 The wiring shall be in PVC insulated cables of the 250V grade and shall comply with B.S. 2004.

10.6.2 Final sub-circuit wiring for lights and fans shall be of the "loop-in" system, with the loop connections made at lighting points and not at local switches. Lighting and fan point conductors shall not be less than the $1.5mm^2$ size.

10.6.3 Final sub-circuit wiring for 13Amp switch socket outlets/socket outlets shall be carried out with P.V.C. insulated single conductors not less than $2.5mm^2$ size and shall have up to six in ring circuits of 30Amp, rating with not more than two spur-units.

10.6.4 Final sub-circuit wiring for 15Amp switch socket and outlets shall be carried out with PVC insulated single conductors not less than $2.5mm^2$ size and shall be one point per way of 20Amp rating.

10.6.5 Final sub-circuit wiring for 10A S.P.N. or 30A TPN switch fuse shall be carried out with P.V.C. insulated single conductors not less than $4mm^2$ size and shall be one point per way of 30Amp rating.

10.6.6 Plates of flush type switches and socket outlets must overlap the hole and fit flush with the plaster at all points.

10.7 Distribution Fuse boards

10.7.1 Distribution fuse boards shall be metal-clad, wall-mounted, with hinged door, and with gaskets fitted to the doors to prevent the ingress or moisture, dirt and vermin.

10.7.2 Distribution fuse boards shall all be surface mounted, at a height to be determined on site.

10.8 Fuse Switch and Switch fuses

10.8.1 Fuse switches and switch fuses, whether provided as separate items or part of the main switch board shall be capable of carrying continuously, making and breaking their rated current without deterioration.

10.8.2 Fuse switches and switch fuse shall be of the metal clad totally encased type.

10.8.3 Switch fuses may be of the T.P. and N and S.P. & N types.

10.8.4 Fuse switches and switch fuses of the T.P. & N type shall have the three phase poles linked together.

10.8.5 Fuse switches and switch fuses shall have their cover interlocked with the operating handle so that it cannot opened with the handle if in the "ON" position.

10.8.6 Fuses shall be of the H.R.C. Cartridge or rewirable types, except where a specific type has been specified by the Engineers.

10.9 Labels and Circuit Charts

10.9.1 At the completion of installation all switchgear, distribution boards, etc. shall be clearly marked with engraved labels firmly secured with screws to the cases.

10.9.2 On switchgear the inscription should read designation number and circuit controlled.

10.9.3 On distribution fuse boards inscription should read designation number, voltage, and phase of supply.

10.9.4 On T.P. & N Distribution fuse boards and switchgears, an additional label reading "DANGER 415 VOLTS" written in red, shall be fixed.

10.9.5 A circuit chart typed on stiff cards held in transparent compartments fitted inside the covers of each distribution fuse boards shall be provided by the Electrical Contractor.

10.9.6 The circuit chart shall show the location and number of all points controlled by each circuit, and the capacity type and class of each fuse.

10.10 Earthing

10.10.1 All electrical equipment, such as metal-clad switchgear, bus bar chamber, distribution fuse boards, conduits and cable sheaths shall form a continuous bonded earthing system. Any part not solidly connected to the system shall be bonded with 10mm x 1.5mm hard drawn copper tapes having its ends bolted to the frame of the equipment and the termination of the local conduits. The tapes are required to run either along walls suitably clamped at 1200mm spacing or in duct or buried in the ground or concrete.

10.10.2 The metal work of all lighting fittings shall be solidly bonded to the conduit system. The Earthing system shall consist of 20mm diameter, 3000mm long, copper rod buried in a mixture of $0.20m^3$ of charcoal and 20 kg., of common salt.

10.10.3 The copper rod shall be connected to the Main Switch board by 25mm x 6mm hard drawn copper tape. The tape be taken to ground and turned out with an easy sweep at about 300mm below ground and continued to a distance about 5 metres from the beginning and bonded to the earth terminal.

10.11 Switch Socket Outlets

10.11.1 Switch socket outlets shall be of the 13Amp and 15Amp types as indicated on the drawings.

10.11.2 Switch socket outlets shall be flush with B.S. gauge shuttered sockets and controlled by single-pole A.C. switches.

10.12 Switches

10.12.1 The switches shall be 5 Amp, single-pole, rocker-operated, ivory-insulated and flush and shall be as described in the Bills of Quantities.

10.13 Lighting Fittings

10.13.1 The Electrical Contractor shall supply and install all lighting fittings complete as detailed on the drawings.

10.13.2 No lighting fittings other than the ones specified shall be ordered without the written approval of the Engineers.

10.13.3 Mounting positions of all lighting fittings shall be determined on site. The Electrical Contractor shall be responsible for the accurate location of all lighting fittings and shall obtain approval of the Engineers in consultation with the site Consultant for all such fittings before fixing. All lighting fittings shall be adequately supported from the Structure of the building.

10.13.4 The metal work of all lighting fittings shall be solidly bonded to the earthing system.

10.13.5 All fluorescent fittings shall be of the quick start, high temperature control gear type. They shall have power factor correction condensers to suit tropical conditions. All florescent tubes shall be of the "white" type except where it is otherwise specified.

11.0 PLASTERWORK AND OTHER FLOOR, WALL AND CEILING FINISHINGS

11.1 Cement

11.1.1 Cement shall be as described in "Concrete Work".

11.2 Sand

11.2.1 Sand is to be river or pit sand complying with B.S. 1199 natural occurring sand, and is to be washed free from all organic matter, clay or other deleterious material.

11.3 Preparation of Surfaces

11.3.1 Adequate drying out time shall be allowed for block walls and concrete surfaces. Plastering shall not commence until walls are mature and completely dried out.

11.3.2 Immediately before applying rendering, wall surfaces shall be thoroughly wetted with clean water and joints of block work raked out 15mm deep to provide key. Concrete surfaces are to be hacked.

11.4 Cement and Sand Rendering

11.4.1 Rendering of walls and ceilings shall be executed in cement and sand mixed in the proportions of one part cement to four parts sand (1:4). The rendering shall be 12mm thick, or as otherwise stated, and executed in one coat and finished fair and perfectly smooth and even using a steel trowel.

11.4.2 The rendering of external walls shall be executed in cement and sand mixed in the proportions of one part cement to four parts sand (1:4). Waterproofing compound approved by the Consultant shall be added to the mix in the proportions laid down by the manufacturer. The rendering shall be 20mm thick or as otherwise stated and is to be executed in one coat and finished fair and even using a wooden float.

11.4.3 No mortar shall be used after more than 30 minutes has elapsed from the time of mixing. No knocking-up for re-use will be allowed.

11.4.4 All arises and angles in wall rendering are to be finished straight and true and all external angles and arrises to reveal or openings are to be "pencil" rounded. Rendering shall be kept damp for at least seven days after being applied.

11.5 Cement and Sand Paving

11.5.1 Cement and sand paving unless otherwise described shall be composed of 1 part of cement to 3 parts of sand by volume laid in bays not exceeding 15 square metres and finished smooth with a steel trowel.

11.6 In-situ Terrazzo Paving

11.6.1 In-situ terrazzo paving shall be laid in bays not exceeding four square metre between 3mm thick ebonite dividing strips and shall be of approved colour and composed of 1 ½ parts of marble chippings graded from 13mm to 3 mm ring and 1 part coloured cement, finished fair on exposed faces and rubbed down on completion to a grit finished surface free from hole and blemishes and polished with a three-disc fine grain carborundum grinding machine.

11.6.2 The paving shall be laid on cement and sand screeded bed after this has set. Immediately after laying, the floor shall be covered with damp sacks and kept damp until ready for polishing.

11.7 Precast Terrazzo Tiles

11.7.1 The quality of materials and mix for precast terrazzo shall be as described for in-situ work. The sizes and colour shall be as the Consultant shall approve. Tiles shall be bedded and pointed in cement and sand (1:3) and polished to a fine smooth finish to the satisfaction of the Consultant.

11.8 Glazed Wall Tiling

11.8.1 Wall tiles shall be 150mm x 150mm x 6mm white glazed unless otherwise stated, true to shape, free from blemishes and conforming to B.S. 1281. Tiles shall be soaked in clean water and brushed on the underside with Portland cement slurry 24 hours before fixing.

11.8.2 Tiles shall be bedded with straight joints throughout in cement mortar (1:3) and pointed in neat white cement.

11.9 Ceramic Floor Tiles

11.9.1 Ceramic tiles shall be the non-slip type and of colour to be approved by the Consultant. In all cases, tile sizes shall be 20 cm. X 20 cm. Unless otherwise stated, samples from manufacturer must be submitted to the Consultant for selection and approval.

11.10 Beds and Backings

11.10.1 The screeds and backings shall consist of one part cement to three parts sand by volume otherwise stated and finished to receive the finishes specified.

12.0 **CLEANING**

12.1 During the course of the work, all debris and misplaced plaster as well as material scraps shall be cleaned up. Packaging materials shall be promptly removed from the premises or burned or wasted upon the premises if so directed. Upon completion, plaster shall be removed from all finished surfaces, particular care being taken to protect all finished surfaces from damage. All scaffolding, equipment and extra material shall be removed and the premises left broom clean.

13.0 **GLAZING**

13.1 Quality, Sizes, Etc.

13.1.1 Glass shall be of approved manufacture and shall conform to S.S. 952. I t shall be supplied by the manufacturer in cut sizes and in packages bearing their name and/or trade mark and marked as to the quality of the contents. All packages containing glass shall be kept dry.

13.2 Sheet Glass

13.2.1 Sheet glass shall be "O.Q" quality – free from defects.

13.3 Polished Plate Glass

13.3.1 Polished plate glass shall be 6mm ordinary glazing quality.

13.4 Obscure Glass

13.4.1 Obscure glass shall be 5mm cast of approved quality and pattern.

13.5 Putty

13.5.1 The putty for glazing in metal frame shall be approved tropical metallic mastic. The putty for glazing in wood frames shall conform to B.S. 544.

13.6 Mirrors

13.6.1 Mirrors are to be 6mm thick silver drawn sheet glass mirror quality "A" with electro copper red varnished back with tropical climate resisting silvering.

13.7 Fixing

13.7.1 All glass shall be cut to fit the rebates with at least 2.5mm clearance all round and bedded in putty or mastic, back puttied and sprigged in position as necessary.

14.0 PAINTING AND DECORATING

14.1 **Scope**

The works under this specification consists of the preparation of surfaces and furnishing and applying paint coats as shown in the Bills of Quantities and as specified herein.

All paints and distempers shall be of the best quality obtainable and of approved manufacture guaranteed anti-fungus and suitable for use in tropical countries and equal to samples to be submitted to the Consultant. Such samples when approved shall become the standard for the work and immediately upon being so approved the contractor shall place orders for and obtain his total requirements for the works.

14.2 **Delivery**

All paints and distempers shall be delivered on site intact and in the manufacturer's drums and tins, and shall be mixed and applied strictly in accordance with the manufacturer's instructions.

The only addition which may be allowed to be made locally to oil paints will be liquid thinning and driers, supplied by approved makers for the purpose.

The priming, undercoats and finishing coats for all painted work shall be of differing tints as directed by the Consultant.

Paint shall be thoroughly stirred up in their original containers and strained into kettles. Kettles shall be kept clean of skins and dirt and the paint kept stirred during use. Any skins which may form shall be entirely removed before paint is used.

14.3 Preparation of Surfaces

14.3.1 General

14.3.2 All surfaces requiring paint shall be thoroughly cleaned of all dirt, grease, or oil before knotting or priming. Oil or grease film shall be washed off with an acid that is non-injurious to the surface or stop primers and rinsed off completely with plain or soapy water. Surfaces shall be dry unless dampening is required for a particular finish material.

14.4 Creosoted Lumber

14.4.1 Lumber which has been treated with creosote shall be permitted to weather until the surface is dry. Remaining deposits of creosote shall be wiped or scraped off from the surface before priming.

14.5 Concrete on Masonry

14.5.1 Work of this nature which is scheduled to receive paint shall be neutralized using zinc sulphate in solution of 4 oz. ZnS04 per gallon of water. The solution shall be applied liberally off before painting. Masonry shall be free of all mortars of efflorescent and other foreign material.

14.6 Wood to be painted

14.6.1 All finishing nails shall be set. All dents, chips and similar damage shall be filled with wood dough. All nails, splits, checks and similar holes shall be puttied. All knots, pitch pockets shall be sealed with wood dough, putty or shellac. All surfaces shall be prepared to receive paint.

14.7 Wood to be stained or Natural Finished

14.7.1 All nails shall be set. Holes shall be filled with tainted putty. Open grained woods shall be filled using tinted filler. The filler shall be rubbed off immediately after application and allowed to dry 24 hours before coating. All irregularities shall be sanded.

14.8 Plaster

14.8.1 Plaster surfaces shall be done dry before application of sealer or other paint.

14.9 Metal Surfaces

14.9.1 All unprimed metalwork, except stainless steel or aluminium shall be cleaned down by wire brushing and scraping to remove all possible scale, dirt or grease, and shall immediately be primed with metal primer.

14.9.2 Metal surfaces which have been shop primed before delivery, shall be inspected, unsatisfactory priming cleaned off and damaged part touched up with the appropriate primer.

14.10 Application

14.10.1 Application shall be by hand brushing, rolling or air spray. Shop prime coats shall be restored wherever damaged by abrasion, burning, or other cause, after removing loose or burned paint. All bare areas shall be completely coated after thorough cleaning so that a continuous full-bodied firm of primer covers all surfaces and laps the shop coat, if any. Primer shall be well brushed into connections, corners, depressions and around and over bolts or other ferrous attachments to completely seal off inaccessible areas.

14.10.2 When more than one coat of the same paint is scheduled, the first application, including primers, shall be tinted slightly different from the selected finish colour. Finished surfaces shall be uniform in colour, free from holidays, pin-holes, sags, runs, rippings or other imperfections. Surfaces which will be inaccessible after erection of other elements of the structure shall be painted prior to the installation of the interfering work.

14.10.3 The thickness of each coat of paint shall be strictly in accordance with the manufacturer's directions as to coverage per gallon and no thinning beyond that named in such direction or this specification shall be done.

14.10.4 Surfaces which by material or nature, require painting pursuant to this specification, although not particularly specified, shall be coated the same as similar items or surfaces in each location.

14.10.5 Any end grain cut on the job shall be primed before installing in accessible locations.

14.11 Cleaning

14.11.1 Cleaning of paint dropping, films and smudges from finished surfaces and areas not to be painted shall be carried on concurrently with the work.

At completion, all equipment, excess containers shall be removed and the premises cleaned of all painted waste and debris.

14.12 Priming

14.12.1 When surfaces are to be finished in oil paint the correct primer shall be used according to the type of surface i.e. wood primer for all timbers, chromate metal primer for iron and steel, zinc galvanizing, aluminium and alkaline – resisting primer for cement and sand renderings and asbestos cement sheets.

14.13 Undercoats

14.13.1 Undercoats where specified, shall be obtained from the same manufacturer as the finishing paint and shall be the manufacturer's recommended undercoat for the finish.

14.14 Knotting

14.14.1 Knotting shall be an approved patent knotting consisting of shellac dissolved in methylated spirit only, free from resins and naphtha.

14.15 Preliminary Trials

14.15.1 Preliminary trials of colour proportions shall be made and approved by the Consultant and when approved the whole batch to be used on any surface shall be prepared at once in order to avoid colour variations. The contractor shall provide an ample supply of clean dust sheets to protect the work during progress.

14.15.2 The contractor shall include for carrying out the work in multi-colours including cutting in all edges.

14.16 Protection of Surfaces

14.16.1 Surfaces not to be painted e.g. switches, ironmongery, etc. shall be masked or removed and replaced when painting is dry. Surfaces shall be evenly coated and free from runs, sags, skins, grit and bristles. Floors shall be protected from droppings.

14.17 Materials

14.17.1 Paints shall be in accordance with the specification.

14.18 Quality of Material

14.18.1 Paint shall be furnished in unbroken original containers bearing the manufactures' brand name and colour designations. Paints shall be warranted to so conform by acceptance of a contract to perform their work specified and shall conform to applicable British Standards.

14.19 Colours

14.19.1 The colours, shades and textures of all coatings except aluminium, black and bituminous pant, are subject to selection and approval by the Consultant. After colours have been selected, two 125 x 200mm samples of each colour applied on 3mm thick wrought hardwood in accordance with the painting system specified shall be submitted along with the exact locations where each will be applied. Application of the final coat to any surface shall not be commenced until written approval of the colour has been obtained. The finished work must conform to the approved sample.

14.20 Mixing

14.20.1 Paints shall be ready-mixed unless otherwise specified except that any coating in paste or powder form shall be field-mixed in accordance with the directions of the manufacturer.

14.21 Recommendations

14.21.1 Unless otherwise approved in writing by the manufacturer, the application of each material shall be in strict accordance with directions and recommendations of the manufacturer thereof.

14.22 Clear Varnish

14.22.1 Polyurethane lacquer shall be obtained from approved manufacturer and shall be applied in accordance with their instructions.

15.0 ROADS, DRAINS AND PAVED WALKWAYS

15.1 Definitions

15.1.1 As used herein “provided” shall be understood to mean “provided complete in place”, i.e. “furnished and installed”.

15.2 Lines and Grades

15.2.1 The Consultant will establish roadway center lines and center line grades at 30,000mm intervals only. Contractor shall lay out all work from established center lines and grades, shall furnish and place all additional stakes, templates, and bench marks necessary for marking and maintaining points, lines and elevations, and shall be totally responsible for the accuracy of all lines and grades established by his employees.

15.3 Grading and Excavation

Grading includes all excavation and the construction of fill required to grade the site, roadways and walkways to elevations and slopes indicated on the drawings or established in the field. Cuts and fills shall be finished to grades, slopes and lines indicated with a plus or minus tolerance of 60mm, which shall not result in any low undrained areas or sharp ridges. Final finish for roadways shall be cut to a smooth uniform surface with a grader blade.

15.3.1 Before each stage of grading commence, the contractor shall satisfy himself as to the correctness of all elevations shown on the drawings and shall agree to the same elevations with the Consultant. If the contractor is not satisfied with accuracy of the elevation shown on the drawings, he must given written notice thereof; otherwise no claim shall be entertained in this respect.

15.4 Excavation

15.4.1 All excavation shall be accurately and neatly cut to lines, sections, and grades shown on the drawings or established in the field. All suitable materials excavated shall be used as far as practicable in forming the embankments and at such other places as directed. No excavated material shall be wasted unless so ordered.

15.4.2 Excavation carried below the depths indicated, without specific directions, shall be refilled to the proper grade with thoroughly compacted suitable fill. Where excavation is in rock, the contractor shall cut back to the required inclination, trim and remove or support all projections as instructed by the Consultant.

15.5 Blasting

15.5.1 No explosives are to be used without the written permission of the Consultant. The use transport and storage of the explosive shall be subject to the prior approval of the Consultant and shall comply with all legislation governing the use, transport and storage of explosives. The contractor shall provide, store and transport all explosives and other materials, stores and equipment required for the blasting operation.

15.5.2 The contractor shall, at his own expense, provide safety means and take all other necessary precautions for the protection of any person in the vicinity.

15.5.3 Full arrangements for blasting and blasting hours shall be agreed in writing with the Consultant before the commencement of such operations.

15.6 Test for Quality of Materials, Thickness and Control of Construction

15.6.1 Before any section of road works is commenced and during the construction, tests as required by the Consultant shall be carried out in order to determine the quality of materials, the required degree of compaction in the fills, subgrade, and pavement, and the required total thickness of the pavement.

The Consultant may make use of the following tests:

1. Plasticity index tests
2. Grading tests
3. Moisture content tests
4. In-situ dry density measurement
5. Compaction tests
6. In-situ and laboratory C.B.R.

15.6.2 Tests 1, 2, 3 and 4 shall be carried out in accordance with B.S. 1377 & 1961, the sand replacement method being used for the measurement or dry density in-situ.

15.6.3 The compaction shall be carried out in a mould 150mm internal diameter and 125mm internal height. The mould shall be filled in five equal layers, each layer being (Ghana Compaction Standard) Modified A.A.S.H.O. Compaction Rammer).

15.6.4 The conditions of tests for the laboratory C.B.R. test shall be agreed with the Consultant before the commencement of the works. Failing this, laboratory C.B.R. test shall be carried out on materials compacted to the maximum dry density and at the optimum moisture content given by the compaction tests. The C.B.R. tests shall be compaction repeated on similar specimens after 24 hours repeated on soaking in the case of sub-base and base materials and after 48 hours in the case of sub-grade materials.

15.7 Preparation of Ground Before Placing Embankment, etc.

15.7.1 If, after the soil has been stripped, the ground in any area is not suitable in the opinion of the Consultant for placing the fill, the contractor shall excavate this area to such additional depth as directed by the Consultant and shall dispose of the excavated material as directed by the Consultant.

15.8 Fill material for Top 60mm of Earth Embankments

15.8.1 Materials for the top 600mm of earth fill embankment shall be free from clay lumps and reasonably free from vegetable matter and perishable material.

15.8.2 Lumps of rock or earthy materials shall be broken down to such size that they will not interfere with the compaction of the material. The material shall be approved by the Consultant, and when compacted in the laboratory at the maximum dry density and optimum moisture content shall have a CBR of not less than 10% (determined after 48 hours soaking). The fill material shall be compacted in layers not exceeding 225mm loose depth or 150mm compacted.

15.9 Compaction

15.9.1 Compaction shall be carried out at moisture content as directed by the Consultant, for fills, embankments and sub grades, the imported material shall be dug, spread and compacted with a minimum of delay so that the material is compacted at its natural moisture content without being allowed either to dry or wet up.

15.9.2 For sub-base material, the moisture content for compaction shall be the optimum content as determined by the laboratory compaction test under test 5 at Clause 15.6.1. Where it is necessary to add water to adjust the moisture content of the material before compaction, the water shall be added by a water cart fitted with an approved sprinkler and the water shall be mixed into the full depth of the loose material by means of a blade grade or other mixing equipment approved by the Consultant. During compaction, additional water shall be added to the surface where necessary to prevent excessive drying out.

15.9.3 Compaction shall, be carried out by means approved by the Consultant. Irrespective of compaction carried out by special equipment, the maximum use shall be made of all construction traffic to assist in the compaction of all earthworks. All construction equipment must operate over the whole area to ensure uniform compaction. All filling shall be deposited in layer of not greater than 225mm loose depth. Longitudinal and transverse joints in any two successive layers shall be staggered by a minimum distance of 3000mm.

15.9.4 For base materials the state of compaction to be obtained shall be 100% of the maximum dry density as measured in the compaction test. For all other materials 95% of the maximum dry density measured in the laboratory compaction test shall be obtained.

15.10 Sub-grade

15.10.1 In cuttings, except rock cuttings, the sub-grade shall be compacted for a depth of not less than 150mm below the finished level, or as required by the Consultant. Where the sub-grade is heavy clay, a light roller only should be used to smooth the surface of the clay, such soils cannot be compacted beyond their normal state of compaction and rolling with a heavy roller would only result in the remoulding and consequent weakening of the soil.

15.11 Services

15.11.1 Where possible, all services, etc. shall be laid prior to the construction of the road base, and all trenches backfilled to the approval of the Consultant.

15.12 Sub-base and Base

15.12.1 The sub-base and base material shall be compacted separately to the state of compaction laid down in 12.6.6 above.

In addition, the CBR value of the sub-base (in-situ test) shall not normally be less than 40% and the CBR value of the base measured in-situ shall not be less than 80%. When the materials are tested in the laboratory at the maximum dry density these values shall be normally obtained after 24 hours soaking. Rolling shall be carried out with a 10-12 ton roller but shall not be continued to the point where the stone aggregate becomes unduly rounded or crushed.

15.13 Material for sub-base and base

15.13.1 The sub-base shall be of gravel or other approved material. The base shall be constructed of gravel or of crushed rock, and its quality and grading shall be approved by the Consultant. Where the base material is gravel, it shall normally comply with the conditions of grading and plasticity given below:

B.S. SIEVE	**PERCENTAGE PASSING**		
Nominal Maximum Size	***75mm***	***38mm***	***18mm***
75mm	100	-	-
38mm	80 – 100	100	-
18mm	60 – 80	80-100	100
10mm	56-65	55-80	80-100
5mm	30-50	40-60	50-75
No.7	-	30-50	35-60
No.14	-	-	-
No.25	10-20	15-30	15-35
No.52	-	-	-
N0.200	0-10	0-10	0-10

Note

(i) Not less than 10% should be retained between each successive pair of sieves specified for use, except the large pair.

(ii) The material passing the No.36 sieve shall have the following characteristics (B.S. 1377: 1961):

(a) Liquid limit not exceeding 25%

(b) Plasticity index not exceeding 10%

The grading of crushed rock is not critical but when laid, it shall be such that there is minimum of voids present in the compacted layer.

The maximum size of the stone used shall be 50mm. Crusher – run materials will normally be found to be deficient in fine material when laid, and during compaction, stone fines 5mm to dust shall be fed into the surface until the whole layer is choked and a close well knit surface obtained. During the final part of the compaction, water shall be added as directed by the Consultant.

15.14 Provision of Road Shoulders

15.14.1 Well compacted shoulders of sub-base material with vertical face for the full depth of the base shall be prepared in advance of spreading the base or sub-base so as to permit the roller to overlap at least one half width of the rear wheel when rolling the edge of the work.

15.15 Spreading of Base and Sub-base Material

15.15.1 The base and sub-base material shall be spread longitudinally in a uniform layer to produce the correct finished thickness. It shall, where possible, be spread by a mechanical spreader of approved type and care shall be taken to ensure that no segregation occurs. Loads of aggregate should be dumped outside the areas on which it is spread.

15.16 Bituminous surfacing

15.16.1 Bituminous surfacing shall comprise:

(a) Surface preparation

(b) Application of a hot sprayed bituminous seal coat and spreading and rolling of stone chippings into the seal coat.

15.16.2 Bitumen or cut-back coat above the base shall not be placed on any surface until it has been thoroughly cleaned and finished to the levels and cross falls shown on the drawings.

15.17 Cutback Bitumen Prime Coat

15.17.1 The prime coat shall be low viscosity cut-back bitumen MC-2. If dry, the base shall be slightly damped (not wetted as directed by the Consultant. MC-2 shall then be spread at the rate of 1 to 1:751 litres/m^2 at a temperature of (65-107 deg. C.) left not less than 6 hours before blinding with 6mm chippings or clean sharp coarse sand.

15.17.2 Should the specified rate of spray appear to be incorrect, the contractor shall immediately stop spraying, inform the Consultant and amend the spray rate as may be instructed.

15.17.3 Coarse sand for blinding shall be of 6mm maximum size with not more than 20% passing a No. 25 sieve, applied at the rate of one cubic metre of chippings or sand per 118 square metres of road surface or such other rate as may be found necessary to secure adequate coverage.

15.17.4 The chippings or coarse sand shall be brushed if necessary to secure even coverage. The chippings or coarse sand shall be thoroughly rolled with a light roller (4 to 6 tons) and allowed to stand overnight. Further-rolling shall be carried out the next day and the surface opened to traffic. Care should be taken to see that the chippings are not appreciably crushed. Barriers shall be erected and moved periodically to ensure that the traffic uses the whole width of the road, after which repair work shall be done on the road.

15.18 Wearing Coat with Cutback Bitumen

15.18.1 After all repair work has been allowed sufficient time to harden, the surface shall be swept clean of all loose material and Shelmac S.125 or similar approved cut-back bitumen having a viscosity of 100-150 seconds at 40 degrees Celsius shall be applied to the previously treated section at the rate of 1.1-1.9 litres/m^2 at a temperature of 132-160 deg. C. (Recommended 143 deg. C) and blinded immediately with a 20mm chippings to BS. 63 applied at the rate of 24-28 kg/m^2 of chippings or such other rate as may be found necessary to secure adequate coverage.

15.18.2 The chippings shall be brushed to ensure even coverage and then shall be thoroughly rolled with a light roller (4-6 ton) and allowed to stand overnight. Further rolling is then carried out after which Shelmac S.125 having similar viscosity as indicated above is applied at a rate of 0.8 – 1.2 litres/m^2 at a temperature of 132 – 160 deg. C and blinded with 10mm chippings at a rate of 12-15kg/m^2 and rolled with light roller (4-6 yon). Smooth wheeled rollers should not be used on second and subsequent dressings. Further rolling shall be carried out before the surface is opened to traffic, barriers shall be erected and moved as directed for a period of 3 weeks to ensure maximum traffic speed of 20 mph.

15.19 Precautions During Rains

15.19.1 Adequate measures are to be taken by the Contractor during periods of rains to protect all work, providing drainage of all exposed surfaces of earthworks and to limit erosion. No placing of fill will be permitted until the surface on which the fill is to be laid is dry. Eroded areas shall be made good and where necessary the top layer of previous work shall be harrowed to the required depth and re-compacted. The sub-base is to be laid as soon as possible after the C.B.R. and density of the sub-base has been measured and found adequate. In no case shall the sub-base or base be laid if the previous surface has been affected by rain until it has recovered or been made good to the satisfaction of the Consultant.

15.20 Prime Coat to Follow Immediately on Compaction of Base

15.20.1 The laying of the prime coat is to follow immediately after the base has been compacted and its C.B.R. and density measured and approved.

15.21 Drains

15.21.1 All drains including headwalls shall be constructed to the required shapes, lines and elevations as shown on the drawings. All stones forming rubble drains shall be of approved type and shall be carefully laid in 1:3 cement and sand mortar.

16.0 SEWER AND WATER MAINS

16.1 EXCAVATION GENERAL

16.2 Excavation for Pipe Laying

16.2.1 Trenches shall not be excavated more than one day in advance of pipe laying except by written permission of the Consultant or his representative. Open trenches shall be barricaded and lighted at night as directed and/or required by statute or regulations.

16.2.2 Trenches shall be accurately excavated to alignment and grades shown on the drawings furnished to the contractor, and shall be of sufficient width to enable properly jointing and laying of pipes.

16.2.3 Where pipes are not laid on concrete the bottoms of the trenches as excavated shall be absolutely smooth and shall be free from stones or other projections. Holes cut at the joints shall be of as small a size as possible and the pipes shall have a uniform and solid bearing throughout their entire length. The trench shall firstly be excavated to within 150mm of its formation and proper grade pegs shall then be set in the bottom of the trench by the Contractor for the accurate taking out of the rest of the excavation.

16.2.4 Pipe clearance in rock excavation – Large rock, boulders and large stone shall be removed to provide clearance to each side of and below all pipes and accessories. This clearance for pipes and accessories shall be 100mm. Adequate clearance shall be provided in rock trenches for proper jointing of the pipe.

16.2.5 The minimum clear width of unsheeted or sheeted trenches measured at the horizontal diameter of the piper shall be 450mmm, or 300mm greater than the outside diameter of the barrel of the pipe, whichever is greater. Where the natural bottom of a pope trench is unsuitable for the proper bearing of pipes the Consultant may instruct the Contractor to excavate the trench to an additional depth of 100mm and refill with well tamped soft approved soil.

16.2.6 Where spoil from excavation is required for re-use as refill or for the formation of embankment, the material shall be kept separate and stored in convenient and approved places. Soil surplus to requirement shall be removed from the site and disposed of within 24 hours.

16.2.7 No explosives are to be used without the written permission of the Consultant. The use, transport and storage of the explosives shall be subject to the prior approval of the Consultant and shall comply with all legislation governing the use, transport and storage of explosives. The contractor shall provide, supply, store and transport all explosives and other materials, stores and equipment required for the blasting operations.

16.2.8 The contractor shall, at his own expense, provide safety means and take all other necessary precaution for the protection of any person in the vicinity.

16.2.9 Full arrangement for blasting and blasting hours will be agreed in writing with the Consultant before the commencement of such operation.

16.2.10 Where required to prevent sliding and for protection of workmen, trenches shall be sheeted and braced in a safe, substantial manner. Unless ordered to be left in place all sheeting and bracing shall be removed before backfilling.

16.2.11 Adequate pumping facilities shall be provided and maintained to keep trenches dry.

16.3 Pipe-laying

16.3.1 All pipes shall be carefully brushed out inside and shall be tested for soundness before being laid. The pipes shall be laid separately to true inverts, straight lines and falls, each pipe being separately boned between sight rails and bearing evenly upon the solid ground or concrete for its full length. Any defects in the internal or external coating of the pipes especially, valve, etc. shall be made good. After inspection and any necessary attention, the carefully lowered to their final positions. No pipes shall be dragged along the trench bottom.

16.3.2 No surface water or other extraneous matter shall be permitted to enter the pipes during or after laying. Except where necessary for jointing, the ends of the pipe - line shall be kept closed with tightly fitting wooden or expanding stoppers. IN the event of dirty water or extraneous matter entering the pipe, the contractor shall immediately arrange for the necessary cleaning as may be instructed by the Consultant.

16.4 Pipe Jointing

16.4.1 Flanged joints shall be made with the joint rings and nuts, washers, and bolts. Two washers shall be used per bolt, one under the bolt head and the other under the nut.

The tightening of the bolts shall be evenly done all round by tightening at one time diametrically opposite pairs. In no case shall excessive tightening be exerted on any nut or bolt. After the satisfactory conclusion of the water-tightness test, all flanged joints shall be cleaned and given two coats of an approved bituminous paint.

16.4.2 Valves and other fittings shall be securely fixed, properly aligned and fixed on a vertical position. They shall be tested for ease of operation and water-tightness and valve glands shall be repacked where necessary. Any damages to protective coating shall be made good and they shall be left clean in all aspects.

16.4.3 Concrete thrust and anchor blocks shall be formed at bends tees and valves as directed by the Consultant. The additional excavation shall be made after the bends, etc. have been jointed and the concrete shall then be placed with all possible speed. The back of supports and blocks shall abut on the solid ground all loose material being removed before concreting. After placing concrete no pressure shall be applied in any section of the pope until concrete has set and had at least 3 days curing.

16.5 Communication Pipe

16.5.1 The pipe being the main water service to the building should be large enough to supply adequate water to the service pipe. It should be of not less than 32mm diameter and of pvc type.

16.6 Cold Service Pipe

16.6.1 The cold water service pipes should be 25mm diameter and branches to the draw offs to be 20mm and 12mm diameter respectively as designed to the fittings. The piping should be tested to the mains pressure before joints are sealed in the wall.

16.7 Hot Water Pipe

16.7.1 The water heater outlets, inlets and draw off points should be 20mm and 12mm diameter copper pipe respectively and tested to the water mains pressure before joints are sealed in the wall.

16.8 Waste Water Pipes

16.8.1 All waste pipes should be of copper or polyvinyl chloride and the sizes should be as designed to the fittings. They should enter a BSS type floor gulleys and well ventilated.

16.9 Soil Pipes

16.9.1 All soil pipes should be of 100mm diameter pvc or other approved material. They should enter a BSS type manholes, inspection chambers and be well ventilated.

16.10 Branch Sewer Pipe

16.10.1 Sewer pipes to be of 100mm diameter pvc or other approved material pipe. BSS type manholes should be built at junctions, curves and at intervals, well ventilated and the invert well designed to BS standards,

16.11 Testing

16.11.1 The contractor shall furnish all equipment, water and labour and test all piping as follows:

16.12 Water-Supply Line

16.12.1 The mains shall be slowly filled and all air expelled and subjected to a hydrostatic pressure equal to 150% of the maximum service pressure but in no case to less than 1.0N/mm^2 which shall be held for a period of two hours without loss of pressure. All joints shall be examined for leakage and all leaks repaired. All tests shall be carried out in the presence of the contractor's representative.

16.13 Sanitary Sewers

16.13.1 The test pressure for bituminous fibre pipe shall be 1200mm head of water measured above the highest point of the invert of the length of pipeline under test, i.e. manhole to manhole. The test shall be applied by fitting a suitable stopper at the lowest point and plugging the highest point with a stopper having an outlet and tube connected to a test tank. The system shall be filled with water to the required level and 15 minutes allowed for absorption. The pipe shall then be subjected to a 24 hour infiltration test, during which the infiltration as measured by leakage of the section under test shall not exceed 4.5 litres per hour per M of diameter per 30.0m length of sewer. Excessive leakage shall be corrected by the contractor and the section shall be re-tested.

16.14 Disinfection of Domestic Water Lines

16.14.1 When the treated water mains are completed and satisfactorily tested the contractor shall on the instructions of the Consultant wash out and then sterilize them. The contractor shall introduce at a slow rate of water flow, by a portable chlorinator or other approved means, a solution of sterilizing agent containing 30 parts chlorine per million part of water and shall be held in the line for a period of 24 hours under a head of at least 1525mm above the highest point in the line. During the retention period, all valves shall be operated. Following the retention period, the lines shall be thoroughly flushed using the supply water until the residual chlorine is approximately but not less than 2/10 parts per million. When flushing has been satisfactorily completed, samples of water will be taken by the Consultant's Representative for bacteriological analysis. If any of the samples taken from the mains are inferior in quality to that of the control samples of the supply water, the operation of sterilization shall be repeated and another set of samples taken. The procedure shall be repeated as many times as may be necessary in order to produce satisfactory results.

16.15 Manholes

16.15.1 Manholes shall be of precast concrete if readily available at the job site. Otherwise, manholes shall be constructed of solid ungrooved blocks made in an approved concrete block-making machine and shall conform generally to British Standard 2028 – Type 'A'.

16.15.2 The jointing mortar for precast concrete blocks shall be composed of 1 part cement and 4 parts sand. Up to 10% by volume of hydrated lime may be added to provide a workable mix.

16.15.3 Mortar shall be mixed on a clean platform or in an approved mixer. No mortar which has started to set shall be used or knocked-up for re-use.

16.15.4 Block work shall be generally laid in stretcher bond and properly bedded and jointed. Joints shall be thoroughly flushed up while laying the blocks.

16.15.5 The walls are to be carried up in a uniform manner and no part of the wall shall be carried more than 1000 mm above another part at anytime.

16.15.6 Upon completion of the block work, the interior surface of the wall shall be plastered with a 12mm thick coat of cement and sand mortar of approved mix.

16.15.7 All benching in manholes shall be carried out in sulphate resisting concrete.

16.15.8 Unless otherwise specified, manhole covers and frames shall comply with British Standard 497: 1955 and be of the type specified or shown on the drawings.

16.15.9 Step iron shall be galvanized and shall comply with British Standard 1247.

TECHNICAL SPECIFICATION OF

PLUMBING MATERIALS AND EQUIPMENT

PIPE WORKS AND FITTINGS

A. General Requirements

Supply and install, wherever shown on the drawings and as specified herein, all pipe works and fittings.

All pipes shall carry the Kite Mark of the standard to which they are manufactured, clearly indicated at intervals. Pipes without the above markings shall be rejected.

Pipe works shall be installed in a manner to allow for ease of air escape and system draining. It shall be endeavored to obtain this naturally by gravity; however, where conditions do not permit it, an automatic air vent shall be supplied and installed at all air pockets locations and a drain valve shall be supplied and installed at all low points and risers legs.

In addition to the stipulations of the above paragraph, cold water pipes supplying washrooms as well as all vertical risers shall be provided with automatic air vents and associated drain pipes.

Drainage pipes shall be installed with a slope of not less than 1% unless specifically indicated otherwise on the drawings.

Drainage pipes installed underground shall be minimum 50mm (2") diameter.

Before installing any pipe, it shall be internally cleaned from dirt, debris, etc, by passing through it a cleaning cloth.

Pipes shall be installed in a neat manner with runs parallel and branching or changes in direction at 90 or 45 degrees. Change in direction and size, branching and jointing of pipes shall be made with regular pipe fittings (elbows, tees, reducers etc...). Pipe bending shall not be accepted. All elbows shall be long radius. All drainage fittings shall be long radius sweep type.

Field fabricated fittings, bushings, close nipples and street elbows shall not be allowed.

Sleeves shall be supplied and installed wherever pipes cross slabs, walls, partitions, etc., Sleeves shall be cuts of galvanized steel pipes having an internal diameter of not less than 1 1/2" (4cms) larger than the outside diameter of the bare sleeved pipe or the insulated sleeved pipe.

Floor sleeves shall protrude about 3/4" (2cms) above finished floor level and shall be flush with finished walls. Gaps between sleeves and pipes shall be filled with non-flowing plastic or waterproof mastic filler or paste.

Cleanouts shall be supplied and installed at all changes in direction and every 15 meters of long runs of soil, waste and drain and rain water drain pipes,

Unions or flanges shall be provided at adequate intervals in the piping networks, as approved by the Engineer, to permit easy disassembly for alternations and repair.

Unions or flanges shall be provided at connections to equipment, near valves, controls, strainers and other accessories requiring removal.

All pipes shall be supplied and installed complete with the followings:

a. All connections and fixings to equipment and accessories.

b. Unions, flanges, couplings, elbows, crosses, reducers, caps, etc,

c. Expansion joints wherever specified or indicated on the drawings as well as all passages of pipes at structural expansion joints.

On drain and soil pipes, expansion joints shall be packing type.

d. Shock absorbers or water hammer arrestors at quick closing valves as well as automatic air vents at high points and drain valves at low points.

e. Dielectric unions or flanges wherever copper pipes connect to ferrous pipes, or wherever dissimilar metals liable to galvanic corrosion are connected together.

f. Metallic supports, saddles, anchors, etc,

g. All cutting, patching and making good of walls, slabs, partitions, etc, in connection with fixing, supporting and anchoring of pipes within the building.

h. All works of excavations, trenching, back filling and making good of roads, green spaces, walkways, etc, in connection with installing of pipes outside the building.

Buried metallic pipes shall be wrapped with corrosion protection tape or other approved type of protective cover (i.e. Denso tape or equal).

B. Pipes Material

Unless otherwise noted on drawings, pipe materials to be used shall be as follows:

a. Galvanized steel pipe and fittings for exposed domestic cold water on the roof.

b. Polypropylene Random (PPR) and fittings for domestic cold, hot and potable and heating water, to be provided with aluminum protection wherever noted.

c. Polypropylene drainage pipes for laboratory drainage system.

d. UPVC non-pressure pipe and fittings for soil waste and vent pipes and rainwater pipes

e. Black seamless steel pipes and fittings for fire water system and fuel oil pipes and heating system when noted.

C. Black Steel Pipes

Supply and install all black steel pipes as specified herein

Each black steel pipe shall conform with the following requirements:

a. Black steel pipes shall be seamless steel to ASTM A106 Grade B, schedule 40 or conforming to DIN 2440, BS 1387 medium class or equivalent international standard for steel pipes.

b. Pipe fittings (tees, elbows, crosses, reducers, unions, flanges, etc,) shall be of the same weight and quality as the pipe.

c. Pipes and fittings up to 2" shall be black malleable iron suitable for threaded

connections. Each black steel pipe shall conform with the following requirements: (Cont'd)

d. Pipes and fittings larger than 2" shall be black seamless suitable for welded

connections. e. Fittings up to 2" shall be banded with threaded connections.

f. Pipe wall thickness and weight shall be as follows:

Pipe Size (inches)	Thickness (mm)	Weight of Plain End Pipe Kg/m
1/2	2.65	1.22
3/4	2.65	1.58
1	3.25	2.44
1 1/4	3.25	3.14
1 1/2	3.25	3.61
2	3.65	5.10
2 1/2	3.65	6.51

D. Galvanized Steel Pipes

Supply and install all galvanized steel pipes as specified herein.

Each galvanized steel pipe shall conform with the following requirements:

a. Galvanized steel pipes shall be seamed steel medium weight conforming with DIN 2440, BS 1387 medium class or equivalent international standard for steel pipes.

b. Pipe fittings (tees, elbows, crosses, reducers, unions, flanges, etc,) shall be galvanized steel of the same weight and quality as the pipe.

c. Pipes and fittings shall be suitable for threaded connections.

d. Fittings shall be banded with threaded connections.

e. Pipe thickness and weight shall be same as those for corresponding black steel pipes.

E. UPVC Non-Pressure Pipes

Supply and install all UPVC pipes as specified herein.

Each UPVC pipe shall conform with the following requirements:

a. Plastic pipes shall be extruded unplasticized PVC (UPVC) conforming to the following
British Standards or approved equal, for non-pressure drainage pipes:

- Pipes 32mm to 50mm diameter to BS 5255. for above and under ground pipes

- Pipes 82mm to 160mm diameter installed above ground: to BS 4514.

- Pipes 110mm and 160mm diameter installed underground: to BS 4660.

- Pipes larger than 160mm diameter to BS 3506.

b. Pipe fittings shall be UPVC of the same weight and quality as the pipe.

c. All pipes and fittings shall be marked with the Kite Mark of the standard to which they are manufactured.

d. Unless specifically stated otherwise, pipes and fittings for drainage works shall be suitable for rubber ring pressure joint. Sealing rings to be rubber to BS 2494 Part 2.

F. Pressure UPVC Pipes and Fittings

Supply and install all pressure UPVC pipes and fittings as specified herein.

a. All pressure UPVC pipes shall be of extruded unplasticized Polyvinyl Chloride to BS 3505 class E or approved equal International Standards. Fittings shall be of same material and pressure as pipe.

b. All joints shall be of the solvent weld joint.

G. Polypropylene Random (PPR)

Polypropylene pipe shall be of high grade polypropylene random (PPR), to comply with DIN 16962 appropriate to the service working pressure. The tube shall be provided in straight lengths form.

Joints and fittings shall be welded type, of the Saul material and type of the tube. Fittings shall consist of gunmetal bodies coated with polypropylene suitable to be welded to the tube at one end and to receive a threaded coupling at the other end.

Welding shall in all cases be carried out by skilled craftsmen who are in possession of a current certificate of competency issued by an approved authority. Specimen welds, representative of the thickness and diameter of the joints and the condition of site welding, shall be submitted as required by the Engineers in request of every craftsman employed in such work.

When the general hydraulic tests of the completed systems are carried out, each weld shall be lightly hammered whilst pressure is maintained. If any leaks occur, the portion of the weld near the leak shall be cut out and re-welded. Should a considerable portion of the welded joints made by a particular operative be found to be defective due to faulty workmanship, all such welds shall be cut out and re-welded by another operative whose work has proved satisfactory.

All expansion loops shall be proportioned such that the total stress set up in the material of the pipe wall; taking into account the components due to internal pressure, torsion and bending; is taken up in the geometry of the changes of direction.

All expansion loops shall be generally inserted in the pipe lines in such a manner that cold draw to extend of one-third of the anticipated expansive movement is taken up. Such conditions shall be agreed on the site with the Engineer at time that erection is taking place.
Expansion loops shall be factory fabricated of similar materials to the pipe work

15.2. PIPE HANGERS AND SUPPORTS

A. General Requirements

a. Supply and install pipe hangers and supports to properly carry weight of pipes and accessories without sagging as specified and required.

b. Hangers and supports shall be designed and tested to sustain a load 8 times the actual supported load, and shall be easily adjustable.

c. Hangers and supports shall be steel with smooth flat bearing surfaces and shall allow free movement of pipes due to expansion and contraction without any deformation. Hangers and supports for UPVC Pipes shall be of material, type and spacing strictly in accordance with manufacturer's recommendations.

d. Hangers and supports on insulated pipes shall have galvanized steel sheet protection saddles or shields, 3mm thick, 30cms long to fit outside diameter of insulation and cover 180° of arc.

e. Pipe anchors and guides shall be 3/4" diameter U-bolt.

f. Piping to be independently supported of equipment and located at adequate intervals to avoid air pockets and dirt traps. All branching shall be directly supported.

g. Spring cushions shall be used where pipe is subject to considerable vertical movement or vibration.

h. Insulated hot pipes shall be supported on a clevis hanger or pipe clamp lined with protection shields.

j. The contractor shall submit shop drawings for all types of supports showing construction details.

k. Hangers and supports locations shall be shown on shop drawings.

B. Steel Pipe work

Horizontal steel pipe supports shall be installed at intervals not exceeding the maximum support spacing and by hanger rod of minimum size as follows:

Pipe Diameter	Maximum Support Spacing -M	Minimum Size of Hanger Rod (mm)
1/2"	1.5	10
3/4"	1.8	10
1"	2.0	10
11/4"	2.5	10
11/2"	2.7	10
2"	3.0	10
21/2"	3.3	13
3"	3.6	13
4"	4.2	16
5"	4.8	16
6"	5.2	22

Vertical steel pipe supports shall be installed at a minimum of every storey height.

C. UPVC Pipe work

The following shall be used as a guide line. Manufacturer's recommendations shall be strictly followed:

Pipe Diameter		Maximum Support Spacing		Minimum Size
Horizontal Pipes (cm)	Vertical Pipes (cm)		of Hanger Rod	
1/2"		60	120	10 mm
3/4"		70	140	10 mm
1"		75	150	10 mm
11/4"		80	160	10 mm
11/2"		90	180	10 mm
2"		105	210	10 mm
3"		135	270	13 mm
4"		150	300	16 mm
6"		180	360	16 mm
8" and larger		215	360	16 mm

D. PPR Pipe Work

The following shall be used as a guideline. Manufacturer's recommendations shall be strictly followed:

Maximum support spacing for vertical pipes is 1.3 times that of horizontal pipe support spacing.

VALVES AND SPECIALTIES

A. General Requirements

Supply and install, wherever shown on the drawings and as specified herein, all valves and specialties.

In addition to valves proper, this section is applicable to the strainers, safety valves, automatic air vents, float valves, etc,

The drawings indicate locations of major valves only. This does not limit the Contractor's responsibility to supply and install all valves and specialties specified separately under equipment or systems and in full compliance with the requirements of this section and the following stipulations:

a. Valves shall be designed for a working pressure of not less than 125 psi steam working pressure rating and 200 psi cold water non-shock pressure rating unless otherwise specified.

b. Valves 2" diameter and less shall be bronze, threaded ends.

c. Valves 2 1/2" diameter and larger shall be cast iron, flanged ends.

d. Valves on fire service pipes are to be of the indicating type.

e. Unless specifically stated otherwise, valves shall be of the same size as the pipes on which they are installed.

Whenever the pipe size on which valves are to be installed is larger or smaller than the equipment connection provided, an enlarger or reducer shall be first installed at the equipment connection to the required pipe size, after which the valves can be installed.

f. A conical union shall be supplied and installed with each threaded valve.

B. Gate Valves

Supply and install, wherever shown on the drawings and as specified herein, all gate valves.

Each gate valve shall conform with the following requirements:

a. Bronze gate valves shall have bronze body and trim and shall be non-rising stem, screwed bonnet and solid wedge disc.

b. Cast iron gate valves shall have cast iron body and shall be inside screw, non-rising stem, bolted bonnet, wedge disc and bronze trimmed.

C. Globe Valves

Supply and install, wherever shown on the drawings and as specified herein, all globe

valves. Each globe valve shall conform with the following requirements:

a. Bronze globe valves shall have bronze body and trim and shall be inside screw, rising stem, screwed bonnet and renewable composition disc.

b. Cast iron globe valves shall have cast iron body and shall be outside screw and yoke, rising stem, bolted bonnet, renewable bronze disc and seat ring and bronze trimmed.

D. Check Valves

Supply and install, wherever shown on the drawings and as specified herein, all check valves.

Each check valve shall horizontal or vertical lift, non-slam type and shall conform with the following requirements:

a. Bronze check valves shall have bronze body and bronze trim and shall be screwed bonnet and renewable composition disc.

b. Cast iron check valves shall have cast iron body and shall be bolted bonnet, renewable bronze disc and seat ring and bronze trimmed.

c. Silent check valves 2 1/2" diameter and above shall be non-slam, spring loaded, flanged, with cast iron body, bronze seat and disc, 18-8 stainless steel spring, with body having 250 psi working pressure rating.

F. Float Valves

Supply and install, wherever shown on the drawings and as specified herein, all float valves.

Each float valve shall conform with the following requirements:

a. All bronze construction including levers and arms suitable for 150 psi cold water working pressure.

b. Balancing piston type flow control mechanism.

c. Adjustable bronze rod.

d. Copper float.

e. Similar to Newman-Hattersley No. 329 for screwed inlet and No. 328E for flanged inlet, or approved equal.

G. Safety Valves

Supply and install, wherever shown on the drawings and as specified herein, all safety valves. Each safety valve shall conform with the following requirements:

a. Bronze body and trim, suitable for 150 psi steam working pressure.

b. Adjustable, spring loaded relief mechanism testing arm.

c. Spring pressure adjusted locknut.

d. Relief outlet for piped connection.

Setting of safety valves shall be at 125% of the system operating pressure. After adjustment, the adjusting screw shall be locked by an adequate lead sealed wire.

H. Expansion Joints

Supply and install, wherever necessary and as specified herein, all expansion joints.

Expansion joints shall be installed on piping to relieve expansion stresses and shall be located at all structural expansion joints and on all straight runs of pipes at 30 meters intervals.

U-bends expansion joints may be accepted under certain conditions after written Engineer's approval.

Each expansion joint shall conform with the following requirements:

a. Pack less bellows type, monel metal for pressure pipes services suitable for 150 psi steam working pressure.

b. Packing type for gravity piped.

c. Expansion joints shall have screwed flanged or welding ends as required for the pipe size and system served.

I. Automatic Air Vents (AAV)

Supply and install, wherever shown on the drawings and as specified herein, all automatic air vents. Each automatic air vent shall be completed as specified herein:

a. Cast iron body.

b. Standard float.

c. Single lever orifice vent.

d. Vent test cock.

e. Isolating valve.

J. Hose Bibs (HB)

Supply and install, wherever shown on the drawings and as specified herein, all hose bibs. Each hose bib shall conform with the following requirements:

a. All brass, chrome plated construction.

b. 3/4" threaded end connection with serrated hose bib nipple for 3/4" hose connection.

L. Flexible Connections

Supply and install, wherever shown on the drawings and as specified herein, all flexible connections.

Flexible connections shall be installed on all pipe connections to rotating equipment. Each flexible connection shall conform with the following requirements:

a. Seamless bronze tubing with annular corrugations covered with high tensile bronze braid suitable for 200 psi cold working pressure.

b. Screwed ends for pipes 2" diameter and smaller and flanged ends for pipes 2 1/2" diameter and larger.

15.4. POLYETHYLENE WATER TANKS

Supply and install polyethylene water tanks wherever shown on the drawings and as specified herein.

Each tank shall be of the open cylindrical type fabricated from polyethylene. Shall be provided with screwed cover of the same thickness and must conform to GS1195:2018.

Each tank shall be provided with a 300mm high concrete plinth constructed to meet the size of the tank.
Each tank shall be complete with:

a. Access cover.

b. Balancing piston type float valve with shut-off valve.

c. Low level float switches assemblies as required and as necessary for the control of the relevant systems.

d. High water level alarm float switches connected to central alarm panel at the reception desk.

e. Drain valve, and supply valve.

f. Drain and overflow to nearest drain provision or as shown on the drawings and vent pipes with insect copper mesh screen.

DRAINAGE

A. Floor Drains

Supply and install all floor drains wherever shown on drawings and as specified herein.

Floor drains are to be bottom outlet for FDV, and horizontal outlet for FD, of type suitable for connection to UPVC non-pressure pipes. All floor drins shall be of 304 stainless steel polished. similar to Redi, Nicoll or approved equal.

B. Roof Drains (RD), Terrace Drains (TD),

Supply and install all roof drains, terrace drains and trench drains wherever shown on the drawings and as specified herein.

Drains shall be used on all horizontal surfaces exposed to rain water i.e. roofs, terraces, etc,

1. **Roof Drain - Type RD**

Each roof drain shall be constructed of heavy duty UPVC with bottom outlet and shall conform to the following requirements:

a. Large grate area body with no trap and with gravel guard.

b. Adjustable heavy duty elevated dome type strainer.

c. Perforated extension sleeve for inverted roofing.

d. Integral flashing flange.

2. **Terrace Drain - Type TD**

Each terrace drain shall be constructed of heavy duty UPVC and shall conform to the following requirements:

a. Large sump with no trap, bottom outlet.

b. Heavy duty UPVC grate 300mm x 300mm with frame.

c. Integral flashing flange.

C. Clean-Outs

Supply and install all clean-outs wherever shown on the drawings and as specified herein.

Each clean-out shall be of the same material and dimension as the pipe shall conform with the following requirements:

a. For pipes exposed or in false ceilings, clean-outs shall consist of a threaded cap screwed onto pipe end.

b. Floor **FCO** and wall clean-outs **WCO** shall consist of capped wide elbows ending under a chrome plated bronze tile 20 x 20cms with screwed cover.

D. Roof Vents and Vent Caps

Supply and install all roof vents and vent caps wherever shown on the drawings and as specified herein.

a. Vent cap shall be full size of stack connected to it and provided with cap. UPVC with hooded vent cap.

b. Vent shall be provided with an extension nipple for fixing onto the vented stack.

E. Manholes Type MH

Supply and install manholes wherever shown on the drawings and as specified herein.

a. Manholes shall be constructed of in situ reinforced concrete as detailed on drawings.

b. Top shall have a circular opening with recess to accommodate cast iron cover and frame.
c. floors shall be formed by hand with cement mortar to size and shape of sewer. Changes in sewer size shall be gradual and even.

d. Wall to be plastered internally with two coats of cement and sand ratio 1:3 to a total thickness of 15mm.

e. Provide complete with cast iron cover and frame. Cover is to be of the type suitable for tiling on top of it.

It shall be the Contractor's responsibility to coordinate and determine manholes invert levels, pipes inverts and locations of pipes connected to manholes.

Depth shall conform with pipe invert and site conditions but shall in any case allow a final cover of at least 40cm over pipes and a minimum slope between consecutive manholes of not less than one percent, unless otherwise indicated.

SANITARY FIXTURES

A. General

a. Plumbing fixtures, trim and accessories to be obtained from one approved manufacturer unless otherwise specified. Approved manufactures shall include Tywford, Vitreous china, Geberit, Jaguar, and Grohe.

b. Plumbing fixtures shall be of first quality, of specified color, with smooth glazed surfaces free from warps, cracks, checks, flaws, discoloration or other imperfections.

c. Selected product must have accessories to match fixtures and of same manufacture and color.

d. Exposed piping and metal trim: chrome plated brass or same finish as other trim and accessories in the same area with polished finish guaranteed not to strip or peel off.

e. List of all proposed plumbing fixtures, trim and accessories, indicating manufacturer, type and model number and catalogues shall be submitted for approval by the engineer.

f. Samples for fixtures, trim and accessories shall be submitted for approval.

g. Plumbing fixtures shall be stored under cover and kept dry.

h. Waterproof jointing compound for wastes: type recommended by waste manufacturer.

B. Wash Hand Basin

1. Hand basin

All bathroom vanities shall be of customised cabinet with a granite top and Under Counter Wash hand basin. The basin shall be 595x420x200mm oval shaped or equally approved by the engineer , complete with following trim and accessories or approved equal:

a. 1/2" chrome plated single hole **Infrared Electronic basin mixer.** The basin mixer shall be manufactured by Hansgrobe, Gebrit, Grohe or equally approved.

b. 1¼" Chrome plated P-trap with wall tube and wall flange, adjustable type, with reducer joint 2" to 11/4"

c. Two No. ½" chrome plated angle valves, blue and red index with 300mm long tubes and wall flanges.

2. Lavatory - (For Handicapped)

Plumbing fixtures and fittings shall be of as above. Installation height shall be of the standard height suitable for wheelchair users, or approved equal, complete as above.

a. Towel rail, 60cms long, chrome plated.

C. Water Closets

1. Water Closet

Water Closet shall be of European type, Close Couple, floor mounted, siphonic action with tank, S-trap bottom connection, manufacuted by Tywford, Vitreous china, Geberit, Jaguar, and Grohe,or approved equal, complete with the following trim and accessories or approved equal:

a. White open front solid plastic seat with cover, with chrome plated metal hinge, washers, screws and nuts.

b. Complete with flush tank accessories.

c. 304 Stainless Steel toilet paper holder, with hood and plastic roller, exposed surface mounted type, polished finish.

2. **Water Closet –Disabled**

Water Closet shall be of European type, Close Couple, floor mounted, siphonic action with tank, S-trap bottom connection, manufacuted by Tywford, Vitreous china, Geberit, Jaguar, and Grohe,or approved equal, complete with the following trim and accessories or approved equal:

a. White open front solid plastic seat with cover, with stainless steel metal hinge, washers, screws and nuts,
b. Flush tank mechanism complete with all accessories and fittings.

c. Stainless steel toilet paper holder, with hood and plastic roller, exposed surface mounted type, polished finish

d. L-shaped supporting frame with floor fixing and support.

It suitable for people with disabilities, and in addition, complete with stainless steel grab bar sets as follows:

- Wall grab bar 60 cm,
- Swing away grab bar, wall mounted,

TECHNICAL SPECIFICATION OF MECHANICAL MATERIALS AND EQUIPMENT

(SUPPLY AND INSTALLATION OF VRV AIR CONDITIONING SYSTEM)

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INTRODUCTION

The specified products are the minimum requirements and any other product offered as an alternative shall be the same quality and have the same capabilities or better than that specified.

The decision of the Consulting Engineer will be final.

QUALIFICATION

If the Contractor wishes to submit other items in place of or wish to qualify any of the provisions of any of the documents comprising this tender document, he shall set out details of his amendments below. Contractors are advised that preference could be given to Contractors who will submit unqualified tenders.

STANDARD MECHANICAL SPECIFICATION

GENERAL REQUIREMENTS

This installation shall be suitable in all respects for operation under the atmospheric conditions and electricity supply as outlined in the schedules. The onus is on the Contractor to ascertain any other local conditions or peculiarities which might affect the working of the plant, and no allowance in price or standards of materials or workmanship will be made for any ignorance on the part of the Contractor in this respect.

All materials and workmanship supplied under this contract shall be of the highest quality.

The Consulting Engineer shall have the right to reject and demand satisfactory replacement at the Contractor's cost, or any part of it, which, is his opinion, does not conform to the highest standards of material and workmanship. The installation shall be required to run for long continuous periods, and it is essential that all installations shall be capable of operating continuously and satisfactorily over such periods.

STANDARD SPECIFICATIONS

GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender, of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof.

Where a specification or standard is not specifically referred to, it will be assumed that the relevant BS Standard listed in order of preference will apply

MANUFACTURER'S SPECIFICATIONS, CODES OF PRACTICE AND INSTALLATION INSTRUCTIONS

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers' specifications, instructions and codes of practice.

MUNICIPAL REGULATIONS, LAWS AND BY-LAWS

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

MATERIAL AND WORKMANSHIP

The contract works shall be executed in accordance with the specified standards and level of workmanship, to the satisfaction of the Consult Engineer.

All materials shall be of the quality specified and the Contractor shall, upon request of the Consulting Engineer, furnish him with proof to his satisfaction that the materials are of the specified quality. In this regard, the Contractor shall submit documentary evidence and details of the plant, equipment and diagrams to the Consulting Engineer prior to ordering the equipment.

All materials and equipment used for the installations shall be new and undamaged.

The Contractor shall, if requested by the Consulting Engineer, provide samples of material and equipment for approval. If judged necessary by the Engineer, such samples, may only be returned

after the completion of the installation, in order to ensure that the quality of the installed product is the same as that of the approved sample.

PART OF THE SPECIFICATION

The Standard Mechanical Specification covers the general technical requirements of the mechanical installation. These specifications shall be read in conjunction with the document in its entirety. If the conditions and/or specifications contained herein are at variance with anything contained in the detail specification, the latter shall take preference, otherwise these Standard Mechanical Specifications shall apply as if duly included.

MINIMUM REQUIREMENT

The conditions and/or specifications in this section shall be regarded as the absolute minimum requirement. More stringent similar conditions and/or specifications stated in the Detailed and Standard Technical Specification shall take preference to those in these Standard Mechanical Specifications.

APPROVAL OF EQUIPMENT

The Contractor shall, prior to ordering or manufacturing of equipment and materials, submit details of the intended materials and equipment for approval by the Consulting Engineer. These details shall include engineering data sheets, drawings and any other documentation that the Engineer asks for to enable the Consulting Engineer to assess that equipment offered meets the requirement of the specification.

Once installation has commenced with the appropriate approvals for using any type and make of article or equipment, the same type and make of article or equipment shall be used throughout the project for that specific application unless otherwise specified.

REFERENCE SPECIFICATIONS AND STANDARDS

The latest revision of any Specification referred to in this specification, will be applicable.

Where a specification or standard is not specifically ref erred to, it will be assumed that the relevant BS Standard listed in order of preference will apply.

The SI (“Le Systeme International d’ Unites”) – Metric System of Units will apply.

DRAWINGS

ENGINEER'S DRAWINGS

Unless otherwise specified, the Engineer's drawings are not manufacturing drawings and the dimensions given are only sufficient to enable the Contractor to complete manufacturing drawings. It is the responsibility of the Contractor to verify all dimensions.

The Consulting Engineer shall make available to, at the request of the Contractor, any available record drawings of the present installation.

CONTRACTOR'S DRAWINGS

GENERAL

The Contractor will be furnished, on request, with the Engineer's drawings and a complete set of "as built" drawings identified as available in this document.

The Contractor shall supply two (2) copies of each detail design drawing for approval.

The Contractor shall allow the Consulting Engineer one (1) week for drawing approval. After a marked-up copy with all the Engineer's comments has been returned, the Contractor shall update the original, which shall then be submitted to the Consulting

Mechanical Engineer for signature. This will ensure that all prints used for construction will be certified as approved Two (2) copies of the certified drawing shall be issued to the Engineer for distribution.

The Contractor will be required to produce the following detail design drawings:

- Builder's Work Drawings.
- Mechanical Drawings

These are all Workshop and Equipment Layout Drawings required for the manufacture and erection of the installations.

Instrumentation Drawings, such as:

- Schematic Control Diagrams.
- General Arrangement Drawing of Control Board

VARIABLE REFRIGERANT VOLUME SYSTEMS (VRV)

DESCRIPTION

Supply, deliver, install, commission, test and hand over variable refrigerant volume (VRV) multi-split air conditioning plants of the "Media VRV VI" or other approved type. The plants shall be of the heat pump system type.

VRV COMPRESSOR CONDENSING UNITS (OUTDOOR UNITS)

GENERAL

The compressor condensing units shall be of the Daikin RXYQ heat pump series type as specified. Each unit shall be able to service as the lead unit, but normally the largest unit shall be set as the primary lead unit. Each unit shall contain variable compressor drive normal compressors and condenser sections.

The unit shall be a factory assembled unit housed in a sturdy weatherproof casing constructed from rust-proofed mild steel panels coated with a baked enamel finish.

The compressor shall be equipped with inverter controller capable of changing the rotating speed to follow variations in cooling and heating load.

The noise level of the outdoor unit shall not be more than 58 dB(A) at normal operation measured horizontally 1m away and 1.5m above ground.

The unit shall be modular in design, where applicable.

COMPRESSORS

Compressors shall be of the hermetic scroll type equipped with inverter control capable of changing the speed in accordance to the cooling or heating load requirements.

The inverter shall be of the IGBT (Insulated Gate Bipolar Transistor) type.

The outdoor units shall have at least 20 steps of capacity control to meet load fluctuation and ensure individual control for the indoor units.

The compressors shall be equipped with crankcase heaters. Should the unit be equipped with more than one compressor then only one of the compressors shall be fitted with an inverter motor.

HEAT EXCHANGER

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross fin coil.

The aluminium fins shall be covered by anti-corrosion acrylic resin film.

REFRIGERANT CIRCUIT

The refrigerant circuit shall include an accumulator, E-bridge heat exchanger to control the liquid level in the receiver, liquid and gas shut-off valves, solenoid valves, filter drier and oil separator. The refrigerant shall be R410A.

All necessary safety devices shall be provided to ensure the safety operation of the system.

SAFETY DEVICES

The following safety devices shall be part of the outdoor unit:

High pressure switch, fuse, crankcase heater, fusible plug, over current protection for the inverter, thermal overload protection on the compressors and condensing fans, a timer to prevent short-circuiting of the compressor and anti-freeze-up protection.

OIL RECOVERY SYSTEM

The unit shall be equipped with an oil recovery system to ensure stable operation and maximum oil separation.

Oil equalising piping shall be installed between the condensing units to equalise oil levels every six (6) minutes and so ensure equal refrigerant distribution.

INSTALLATION

The condensing units are to be installed on concrete plinths on the floor slabs in the positions shown on the drawings. If the moving parts of the unit are free of vibration, the units may be placed directly onto the concrete plinths on “Teco” rubber pads. If however, vibration is transmitted, the units will have to be installed on anti-vibration mountings.

Condensing sections shall be placed and spaced to the manufacturers specification ensuring that service space, air discharge and suction are as specified.

HAIL SCREENS

The condenser coils shall be protected with approximately 25 x 12 x 1,6mm galvanized wire mesh hail guards, as supplied by "Steeldale Mesh" or other equal aproved as indicated in the Detailed Technical Specification. The guards shall have sheet metal surrounds and shall be screwed to the casing around the condenser coils with self -taping screws.

HOISTING

All hoisting onto the roof slab forms part of this contract . Sufficient service space shall be provided upon installation of the unit for future maintenance purposes.

CAPACITY

The cooling capacity of each outdoor unit shall meet the sum of the total cooling capacities of the indoor units of a single zone or the nominal capacity stipulated below, whichever is the highest. The outdoor units shall be selected at an utilisation level of not less than 100%. The capacities shall be as indicated in the detailed air – conditioning specification

ELECTRICAL

A 400 Volt 3-phase bare ended cable shall be supplied at each outdoor unit by the Electrical Contractor, unless specified otherwise in the Detail Specification.

A surface mounted weatherproof failure protection distribution switchboard shall be provided by the Air Conditioning Contractor for each module of each outdoor unit.

The Air Conditioning Contractor is to note that although an isolator shall be provided at the outdoor unit, the supply to each module shall not be looped. Separate circuit breakers and contactors shall be provided for each module.

The connection of the cable to the switchboards and the inter-connecting wiring to the outdoor units forms part of this contract.

A 230 Volt, 5 Amp electrical plug point shall also be supplied and installed within 1m of each indoor unit by the Electrical Contractor. Connection between this point to the indoor unit forms part of this contract. All other interconnecting control wiring between the, condensing unit, etc. for the proper functioning and operation of these systems forms part of this contract.

The Air Conditioning Contractor must liaise with other trades in this regard.

INDOOR UNITS

Indoor units shall either be of the wall mounted, ceiling mounted duct type, cassette or underceiling type installed in the positions shown on the drawings and shall be hung from mild steel brackets entering over the roof trusses.

Each unit shall have an electronic expansion device, which controls refrigerant flow rate in response to load variations of the room.

The address of the indoor unit shall be set automatically in case of indi vidual and group control.

CASSETTE UNITS

The cassette unit(s) shall consist of an evaporator coil, mildew-proof polystyrene condensate drip compartments, supply air fan, fan scroll, fan motor, controls and efficient filter all mounted in an attractive compact casing with a hinged decorative bottom panel.

The unit shall be suspended through an opening in the ceiling from and including four (4)

correctly sized hanger rods securely bolted to the unit's hanger brackets. Where specified, the unit shall be fitted with a condensate drain pump capable of raising the condensate 550mm above the level of the drain connection.

The unit(s) shall be fitted with a single, silent running, diffuser type turbo fan. The fan blades shall be of dynamically balanced aluminium or other non-ferrous metal manufacture, mounted on a central shaft and driven by a continuously rated two-speed electric motor, resiliently mounted on a suitable cradle. The fan motor is to be fitted with self-aligning sealed bearings.

The fan motor shall be of the single phase, permanent split capacitor type with built-in resettable overload protection. The motor shall have multi speed windings and shall be factory connected to a terminal box. All wiring is to be marked to correspond with labelled terminals matching the motor wiring diagram.

The supply air louvres shall be of the auto-swing type with remote pre-set and automated vertical airflow direction control.

Air shall be supplied from the bottom of the unit (s) and returned through a bottom mounted hinged grille. The unit shall be adjustable for four-way, three-way and two-way air discharge. Provision shall be made for one or two branch ducts to be connected to the unit as standard accessories. Provision shall also be made for a fresh air duct to be connected to the unit as a standard accessory.

The evaporator coil shall consist of a multi -pass coil of heavy gauge, solid drawn copper tubing mechanically expanded into aluminium cooling fins. The coil shall be provided with an automatic defrost thermostat to prevent excessive frosting.

The evaporator coil shall be completely sealed off to ensure that maximum supply air flows over the coil.

The air filter shall be of the easily accessible and removable mould resistant resin net type, washable with mild detergent. The filter media shall be arranged so that no air bypasses the filter at the edges.

The unit shall be efficient and extremely quiet in operation and the noise level shall not exceed 35 dB's on the "A" scale at a distance of three meters from the unit.

The units shall be self contained and set to deliver air that is filtered and cooled, or filtered and heated as may be required. The units shall be suitable for a si ngle phase,

220V, 50 Hz, AC power supply and shall have nominal capacities as shown in the Detail Specification.

DUCTED UNITS

The ducted unit shall consist of an evaporator coil, corrosion resistant condensate drip tray, supply air fan, fan scroll, fan motor, controls and efficient long life filter all mounted in an attractive compact casing.

The unit shall be fixed to the roof rafters or slab with four (4) correctly sized suspension bolts. An additional purpose made galvanised drip tray with drain piping to the outside of the building shall be installed under the unit.

The unit shall be fitted with twin double inlet, silent running, centrifugal drum fans within properly sized aluminium or steel fan scrolls. The fan blades shall be of dynamically balanced aluminium or other non-ferrous metal manufacture, mounted on a common shaft and driven by a continuously rated two-speed electric motor, resiliently mounted on a suitable cradle. The fan motor is to be fitted with self -aligning sealed bearings.

The fan motor shall be of the single phase, permanent split capacitor type with built-in resettable overload protection. The motor shall have multi speed windings and shall be factory connected to a terminal box. All wiring is to be marked to correspond with labeled terminals matching the motor wiring diagram.

Supply air shall be ducted to grilles provided as an integral part of the unit or to diffusers through a custom made galvanised sheet metal plenum including 25mm thick sonic lineras per the Standard Specification and spigots for flexible duct connections of the number and sizes as indicated on the drawings.

Return air shall be ducted to the unit through grilles provided as an integral part of the unit or through a similar plenum as described above, including return air grille and removable filter medium secured behind a wire mesh screen in a hinged panel accessible from the air-conditioned area.

The evaporator coil shall consist of a multi -pass coil of heavy gauge, solid drawn copper tubing mechanically expanded into aluminium cooling fins. The coil shal l be provided with an automatic defrost thermostat to prevent excessive frosting.

The evaporator coil shall be completely sealed off to ensure that maximum supply air flows over the coil.

The unit shall be efficient and extremely quiet in operation and the noise level shall not exceed 35 dB's on the "A" scale at a distance of three meters from the unit. Exposed units Shall be wrapped with low-density insulation shall be aluminium foil faced fibreglass FRK' insulation of a density not less than 36 kg/m

The units shall be self contained and set to deliver air that is filtered and cooled, or filtered and heated as may be required. The units shall be suitable for a single phase, 220V, 50 Hz, AC power supply and shall have nominal capacities as shown in the Detail Specification.

The above units are suitable for above ceiling, high static pressure installations where supply air is to be ducted to the diffusers and return air back to the unit.

Heating shall be by reverse cycle only.

PIPING INSTALLATION

The pipe routes shown on the drawings are generally diagrammatic. The runs and arrangements of piping shall be as indicated, subject to modifications as required to suit conditions at the building, to avoid interference with work of other services and for proper convenient and accessible location of all parts of the piping system. All required offsets, fittings, valves, traps, drains, etc. may not be indicated but allowance must be made in tenders for all such necessary items to be furnished.

Piping shall be installed as straight and direct as possible, neatly spaced and in general forming right angles with, or parallel to walls or other piping.

The pipe sizes shall be installed by the Air Conditioning Contractor for the sizes of units offered in accordance with the manufacturer's specifications and the schematic pipe layout indicated on the drawing. Any discrepancy between this specification and the

manufacturer's specification is to be brought under the attention of the Consulting Engineer.

The piping network shall be connected using REFNET joints complete with the necessary reducers with the matching insulation as supplied by "Daikin" or other approved.

Suction discharged and liquid pipes are to be insulated separately and not grouped together as for a single line. "Armaflex" or other approved pipe insulation as per 10.7 shall be used.

All piping shall be run so to avoid passing through ductwork, recessed light fixtures or interference with electric light outlets.

Where piping protrudes through building structures, pipe sleeves are to be installed, as part of the contract, to ensure easy removal thereof. No pipes may be built or plastered directly into the structure.

The Air Conditioning Contractor shall be responsible for the drilling of the holes and making good on the outside of the building to the plaster and paint.

Pipe sleeves must be of similar material as the pipe and must be large enough to allow enough free space for movement.

Where specified and where the opening between the sleeve and pipe is large and unsightly, blank cover plates must be installed.

Sleeves through outside walls, slabs and piping through roofs and windows must be sealed off watertight.

All sleeves must be installed neatly and made watertight. The opening between the pipe and sleeve must be sealed off by means of silicon rubber or any other approved product.

Where piping is installed through ceilings, approved blank cover plates must be used to ensure a neat finish.

DRAIN PIPING

Provision shall be made for the drainage of condensate to the outside by means of insulated plastic uPVC class 6 piping with diameter as specified by the air conditioning equipment manufacturers. The Air Conditioning Contractor shall install and connect uPVC Class 6 drain pipes to the drip trays and extend them to the gullies to ground level.

The first 3m shall be insulated with 15 mm thick armaflex insulation.

Piping shall run above ceilings and vertical down in the positions indicated on the drawings. All piping shall terminate at ground level where it shall be routed to the nearest drain point.

Drain piping shall be installed without any loops in the piping where condensate can accumulate. The pipes shall have a uniform slope of 1 in a 100 from the unit to the outside and shall be tested in the presence of the Consulting Engineer.

All drain piping in ceiling voids shall be insulated. Drain piping on external walls shall be un-insulated and painted to match the colour of the walls.

REFRIGERANT PIPING

All piping and fittings shall be of the best quality seamless, dehydrated, de-oxidised refrigeration class copper tubing, suitably sized for the unit installed and in accordance with the relevant BS Standard.

All refrigerant piping shall be “Maksal” Type RL hard drawn refrigeration copper tubing in accordance with ASTM B280-88 and to be of the high pressure type suitable for the gas and pressures of the system.

Only jointing by means of capillary fittings will be allowed except in cases where equipment needs to be removed from the piping system for regular maintenance or replacement. In such cases joints between the equipment and piping shall be with DZR brass compression fittings.

Capillary type fittings shall comply with relevant BS Standard.

Soldering flux shall be used to remove residual traces of oxides, to promote wetting and to protect the surface to be soldered from oxidation during heating.

The flux shall be applied to clean surfaces and only enough should be used to lightly coat the areas to be joined and should be applied as soon as possible after cleaning.

Resin core and acid core solder shall not be used at all.

No welding of refrigeration systems will be allowed unless the pipe system is continuously filled and under pressure using nitrous gas.

All soldered joints, on factory supplied equipment, shall be carefully checked before commissioning and remade if found damaged in transit.

Refrigerant piping shall be arranged so that normal inspection and servicing of the compressor and other equipment is not hindered. Locations where copper tubing will be exposed to mechanical damage shall be avoided.

A refrigerant charging connection shall be provided in the liquid line. Before charging the system with refrigerant the circuit shall be leak tested and dehydrated.

All pipes, vessels, etc. operating below ambient dew point shall be insulated and a vapour barrier provided.

An isolating valve shall be installed in both the liquid and gas l ines where connected to the evaporator unit. Valves shall be of the bronze body, ball type.

When completed, the installation shall maintain a complete vapour barrier and any signs of sweating or dripping shall cause the installation to be rejected.

All piping shall be rigidly supported, both vertically and horizontally.

Inside the building (ceiling voids) piping shall be installed on “Cabstrut” or other approved medium-duty galvanised welded wire mesh cable tray wide enough to accommodate both refrigerant pipes and the drain piping. The mesh pitch shall not exceed 100x50mm with longitudinal side-wall wires spaced at intervals of not more than 25mm.

Outside the building piping shall be installed on “Cabstrut PW100” or other approved

heavy-duty welded galvanised cable ladder wide enough to accommodate both refrigerant pipes and the drain piping, including galvanised sheet metal covers painted to colour match the walls. Rung spacing shall be at 300mm intervals.

All wire mesh cable trays shall be supported on “Unistrut P2000” or other approved 41x41x1.5mm galvanised channels including galvanised hold down saddles, bolts, nuts,

washers and screws. The channel shall be supported from 8mm diameter hanger rods including washers and nuts. Channels to be spaced at i ntervals not exceeding 1500mm.

Cable trays are to be installed to a fall of 1 in 100.

All cable ladders shall be supported on “Unistrut P1000” or other approved 41x41x2.5mm galvanised channels including galvanised hold down cup, bolts, nuts, washers and screws.

The channel shall be “Rawl” bolted directly to external walls or slabs. Channels to be spaced at intervals not exceeding 1500mm. Cable ladders to be installed to a fall of 1 in 100.

All piping shall be secured to cable trays and ladders with “Cabstr ut K-series” or other approved adjustable type galvanised cross rung clamps only. Care shall be taken not to pinch, compress or damage the pipe insulation when securing piping to cable trays and ladders. Any damaged insulation shall be completely removed and replaced to the satisfaction of the Consulting Engineer.

Strappings and cable ties will not be permitted.

Hangers and supports where piping penetrates through walls shall be designed to prevent transmission of vibration to the building.

Supports must be installed near to joints and fittings. Pipe clamps shall be installed at the following centre to centre distances:

PIPE INSULATION

The copper piping installed inside the building shall all be insulated with “Armaflex” or other approved insulation. Vapour barrier integrity will be critical to prevent dripping. No zip type insulation will be allowed. Liquid and gas lines shall be insulated separately.

The insulation material shall meet the following minimum requirements:

Temperature range -80°C + 120°C

Thermal conductivity 0,038 W/m K at 0°C

Thickness 15 mm

Density 35kg/m

Cellular Structure Totally closed

Fire Properties Self-extinguishing

The insulation shall be applied to form a continuous and homogenous vapour barrier over bends, supports, etc. All joints and seams shall be glued. Non-drip tape shall not be used for assembling seams and joints.

All fittings and valves shall be wrapped with black non-drip tape.

When completed, the installation shall ensure a complete vapour barrier and any signs of sweating or dripping shall cause the installation to be rejected.

Insulation shall be lagged and waterproofed where exposed to exterior conditions.

PRESSURE TESTING ON PIPING

All new copper refrigerant piping shall be hydraulically pressure tested to 1,5 times the working pressure or 2700 kPa, whichever is the largest. The test shall be carried out in the presence of the Consulting Services Engineer.

All piping shall be subjected to the test pressure for a period of one (1) hour during which time the system shall retain the pressure with no leaks or losses.

CONTROLS

INDIVIDUAL CONTROL UNIT

The Air Conditioning Contractor shall supply and install a wireless remote controller for each indoor unit or room as shown, and in the positions indicated on the drawings.

The controller shall perform the following functions:

- Start/Stop.
- Temperature setting.
- Airflow setting.

The controller shall display the following:

- Operation display.
- Filter sign.
- Temperature setting display.
- Timer display.
- Airflow display.
- Abnormal operation display.

The controller cradle shall be mounted to the wall according to the manufacturer's specification and the controller shall be neatly fastened to the cradle with double sided tape.

CENTRALISED CONTROL UNIT

If required in the detailed air- conditioning specification the Air Conditioning Contractor shall supply, install and commission a "Media Intelligent Touch" or other approved centralised controller where specified and indicated on the drawings.

The unit shall control up to 128 indoor units. Functions shall include scheduling of

operations to distribute electricity proportionally, auto heat/cool change over, temperature limitation, unified on/off control, yearly schedule and a 300 actions history.

SCHEDULE TIMER

If required in the detailed air- conditioning specification, the Air Conditioning Contractor shall supply, install and commission a "MEDIA" or other approved schedule timer.

The unit shall control up to 128 indoor units. On/off times shall be set by units of day, hour and minutes.

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DISTRIBUTION SYSTEM EXTERNAL TO BUILDINGS

GENERAL REQUIREMENTS

SCOPE

This specification covers the supply, installation and repair of underground d Electrical distribution systems.

RELATED DOCUMENTS

This specifications shall be read in conjunction with the conditions of contract, Particular Clause' and any supplementary specifications, schedules and drawings issued with it to tender. In the event of discrepancy between this specification and the drawings shall be followed.

REGULATIONS

The installation(s) shall comply with all relevant statutory instruments and regulations current at the date of tender (unless otherwise indicated) and in particular with the followed.:-

i. The I. E. E. Regulations for Electrical Equipment of Buildings
ii. Regulations under the electricity Acts
iii. Factories Acts
iv. Memorandum on the protection of PO Lines from low or medium voltage power lines issued by GPO Engineering Department.
v. Any special regulations issued by the local Electricity or Water Authorities.

COMPLIANCE WITH BRITISH STANDARDS

The equipment and/or installations shall comply with all relevant British Standards and Code of Practice except as these are modified by the current Code of practice for electrical installation(s) issued by the local Electricity Authority.

EXTENT OF WORK

The work shall comprise the whole of the labour and, unless otherwise indicated, all the materials necessary to form a complete installation and such tests, adjustments and commissioning as are prescribed in subsequent clauses and as may otherwise be required to give effective working installation to the satisfaction of the Engineer.

The words “complete installation” mean not only the major items of plant and equipment conveyed by this specification but all the incidental sundry components necessary for complete execution of the works and for the proper operation of the installation, with their labour charges, whether or not these sundry components are mentioned in details in the tender document issued in connection with the contract.

The works “as indicated”, “where indicated”, “unless otherwise indicated” refer to items or requirements elsewhere in the tender documents issued in connection with Contract.

Unless otherwise indicated feeder pillars will be supplied by the clients. The Contractor shall erect, join, test and leave them in the Service Condition. LV Distribution Boards for installation in sub-stations will be supplied by the client unless otherwise stated. The contractor shall be responsible for marking out for the holding down bolts and for installing the boards, jointing, testing and leaving them in wiring order.

Street lighting columns of steel, aluminium or cast iron or reinforced concrete shall be used where indicated. Lighting column of steel, aluminum or cast iron shall be betumastic coated to one foot above ground level.

TRENCHES, COVERS, DUCTS AND INSTALLATION ON CABLES

Underground cables shall be laid direct in trenches unless otherwise indicated. They shall be drawn through ducts where indicated. In open ground and under pavements, trenches shall be excavated to provide the minimum cover of 500mm for cables of 1.9/3. KV and above.

Under roadway subject of vehicular traffic, trenches shall be excavated to provide the minimum cover of 800mm for telephone coaxial and power cables not exceeding 0.61KV and 800mm for cables of 1.9/3.KV and above.

Under roadway subject to vehicular traffic, trenches shall be excavated to provide the minimum cover of 800mm for telephone coaxial and power cables not exceeding 0.61KV and 1000mm for cables of 1.9/3.KV and above.

Turf and top soil shall be removed carefully and preserved for reinstatement into their original positions.

The excavation shall be kept free of water and properly stored up. Other services uncovered shall adequately supported by slings or other means and protected.

Before cable are laid, the bottom of the trench shall be evenly graded, cleared of loose stones and then covered with 75mm layer of which has passed through a sieve with a maximum mesh of 12mm or, where local ground is suitable, with sand.

Power cables shall be pulled over, adequately spaces and shall be snaked across the width of the trench. In straight run trenches cable crossing is not permitted except where cables branch form the main run. At each draw-in points, joint or junction box the cable shall be left slack. Cables shall not be pulled out to straighten them after laying. Where more than one cable is laid in a trench, the cables shall be spaced apart in accordance with their current rating but subject to the minimum spacing specified in the table below.

MINIMUM SPACING OF CABLES

CABLES	HV	MV	TELEPHONE	CO-AXIAL	GAS WATER & OTHER PIPE SERVICES
-	mm	mm	mm	mm	mm
HV	25	300	300	300	300
MV	300	25	150	150	300
Telephone	300	150	50	50	250
Co-Axial	300	150	50	50	20
AGL	300	1150	150	150	250

The minimum distance between cables and other services shall be in accordance with the above table. When this is not possible 50mm thick concrete or stone tiles shall be used as a Separator. After laying, the cables shall be covered with enough fine sieved earth (or sand) to ensure a 50mm cover. After stamping, warning covers shall be laid over the cables and the trench filled in a compacted.

Reinstatement shall be effected by backing filling in 100m layers and hand ramming the first two layers.

Power rummers may be used for the remaining layers. The turf shall be replaced and the lower of the finished reinstatement shall not protrude more than 25mm above the normal ground level.

CABLE WARNING COVERS

Interlocking cable warning covers complying with BS 2484 shall be provided for cables laid direct in ground. The materials and dimensions of the covers shall be as specified in the table below.

CABLE WARNING COVERS

SERVICE COVER	MATERIAL FOR	NUMBER & CABLE	DIAMETER DIMENSION JOF LENGTH X WIDTH
MV	Earthenware	One not exceeding 50mm	229mm x 150mm (12ins x 9ins)
		One not exceeding 60mm	305mm x 229mm (9ins x 6ins)
HV	Reinforced	One not exceeding 50mm	914mm x 152mm (35ins x 9ins)
		One not exceeding 60mm	914mm x 178mm (36ins x 7ins)

CONCRETE CABLE MARKER

The location of all directly buried cables shall be marked by concrete slab markers 600 x 600 x 100mm (2ft square x 4inch thick as directed by the Engineer).

The Contractor shall impress the works “HV CABLE” or “MV CABLE” as appropriate one each cable marking slab. The letters shall be approximately 100mm high and 75mm wide.

CABLE JOINTS

The location of each underground cable joint shall be marked by a concrete slab placed over the joint with approximately 25mm slab projecting above the ground. The word “JOINT” shall be impressed on each slab in letters of the size specified in clause 2.14.

CABLE DUCTS

Ducts shall be 100mm (4ins) minimum bore. They shall be of the materials, manufacture and method of jointing approved by the Engineer. Ducts shall be laid so as provide the minimum cover and spacing specified in clauses 2.03, 2.04 and 2.09.

INTERNAL ELECTRICAL INSTALLATION TO BUILDINGS

GENERAL REQUIREMENTS

Scope

This specification covers the supply, assembly, installation, connecting up, testing and setting to work of new modified or additional electrical installations to buildings.

Related Documents

The specification shall be read in conjunction with the Conditions of contract, the "particular clauses" and any supplementary specification(s) and drawings (s) issued with it and enumerated in the invitation to tender. In the event of a discrepancy between this specification and any drawing the drawing shall be followed.

REGULATIONS

The installation(s) shall comply withal relevant statutory instruments and regulations current at the date tender (unless otherwise indicated) and in particular with the following:-

i. The I.E.E Regulations for the Electrical Equipment of Buildings.
ii. Regulations under the Electricity Acts.
iii. Any special regulations issued by the local Electricity Authority.

COMPLIANCE WITH BRITISH STANDARDS

The apparatus and/or installation(s) shall comply with all relevant British Standard and codes of practice except as these are modified by the current code of practice for Electrical Installation(s) issued by the Local Electricity Authority.

ELECTRICITY SUPPLY

Unless otherwise indicated all apparatus and wiring shall be suitable for use with three phase Wire 415/240 Volts, 50Hz earthed neutral system.

DEFINITIONS

For the purpose of this specification.

- The definitions as given by the I.E.E Regulations for Electrical Equipment of Building apply.

- The words "weatherproof" and "dust protecting" shall have the meanings ascribed to them in BS 2817 definitions 13 and 17 respectively.

- As applied to steel conduit and fittings the words "protection against corrosion in accordance with Clause 2: (or with class 4) shall have the meaning:

  Class 2 – Medium protection both inside and outside.

  Class 4 – Heavy protection both inside and outside.

- As applied to cable trunking the word "protection against corrosion in accordance with Clause 3" shall have the meaning:

  Class 3 – Heavy protection both inside and outside.

EXTENT OF WORK

The work shall comprise the whole of the labour and unless otherwise indicated all materials necessary to form a complete installation and such test adjustments and commissioning as prescribed in subsequent clauses and as may otherwise be required to give an effective working installation to satisfaction of the Engineer.

DRAWINGS

Unless otherwise indicated or directed by the Engineer the Contractor shall provide the following drawings.

- Four sets Builders work drawings

- Four sets of diagrams and dimensioned drawings of main distribution switch gear and large items of equipment.

- Four complete sets of purpose-made diagrams detailing separately all the composite electrical circuit and wiring layouts where applicable, within the installation.

BUILDER'S WORK DRAWINGS

Builder's work drawings shall show, fully dimensioned in metric units, all foundations, bases, plinths, sumps, hole required and the overall size and mass of the plant concerned. With the agreement of the Engineer, holes, fixings etc. other than in plant rooms may be marked and cut on site instead of indicating their drawings.

"AS INSTALLED" DRAWINGS

- During the progress of the Works, the information necessary for preparing the "As Installed" drawings shall be recorded on drawings in an approved manner. The marked up drawings shall be made available for inspection and checking upon request. The drawings shall be single service drawings i.e separate drawings shall be provided for each service e.g Lighting, Power, Telephone, Fire Alarm etc. in addition to composite drawings showing all services as directed. The details of "As Installed" drawings required are given in Section 4.2.22.0

CONDUITS

Wiring shall be carried out in PVC insulated cables drawn into conduit and/or laid in trunking.

Steel Conduit And Conduit Fittings

Conduit and Conduit fittings shall comply with BS 31, Class B welded and screwed (imperial sizes) or BS 4568 Parts 1 and 2 screw (metric sizes) unless otherwise indicated or directed by the Engineer. No conduit having an outside diameter less than 16mm (3/8in) shall be used.

Rigid PVC Conduit Fittings

Conduit and conduit fitting shall comply with BS 4607 Part 1 or Part 2. Conduit shall be type "A" (Metric sizes/or type AN light gauge (Imperial) Sizes) unless otherwise indicated or directed by Engineer.

Protection Against Corrosion

The protective coatings on conduit and associated Conduit fittings shall be of the same class. Conduit mounted outside a building, run in floor trenches subject to continued dampness, or accidental flooding r buried in the ground or where indicated or as directed by the Engineer, shall have protection against corrosion in accordance with Class 4. In all other situations conduit shall have protection against corrosion in accordance with Class 2.

Conduit boxes mounted outside a building shall have external fixing lugs. Boxes shall be of malleable cast iron Box covers and shall have a machined surface around the perimeter mating with a similar machined surface on the box. The Cover fixing screws shall be of brass.

Installation

Conduit shall be run neatly on the surface or buried within the carcass of the building(s) or in the ground as indicated.

Conduit runs shall be determined by the Contractor and agreed by the Engineer before any work is started. Conduit shall be run at least 150mm clear of plumbing and mechanical services.

Conduit run on the surface shall be run truly vertical or horizontal and parallel with the features of the building.

Conduit buried in concrete shall have at least 35mm depth of cover over its entire length. Conduit buried in plaster shall have at least 5mm depth of cover over its entire length.

Where conduit buried in carcass of a building or in the ground, all open ends shall be temporarily plugged to prevent ingress of foreign matter, moisture or water.

Where conduit buried in concrete crosses an expansion joint in the concrete it shall be wrapped with water proof building paper for a distance of 300mm one each side of the joint. Any alternative method of protecting the conduit against stresses due to expansion shall be approved by the Engineer.

Conduit shall be bent or set to suit local conditions.

Inspection type elbows, bends or tees shall only be used with the written consent of the Engineer.

Draw-in boxes shall be provided in all conduit runs exceeding 15m length. They shall be malleable iron heavy galvanized, and shall be so placed that there are not more than two 90 solid bends (or their equivalent) between them.

Conduit boxes, both standard and adaptable shall be fixed to the structure of the building independently of the conduit.

The length of thread on the ends of steel conduit shall suit the length of internal thread in the end of the fitting or accessory. Excess length of thread will not be permitted.

Where conduits connect to distribution boards, loop-in boxes and similar drilled entries, the connection shall be made with sockets and hexagonal male brass brushes connection between conduit and boxes shall be screwed metal to metal.

Spanners and purpose-made tools shall be used tighten hexagonal brushes. Pliers and toothed wrenches shall not be used.

METAL CABLE TRUNKING AND FITTINGS

Trunking and connectors shall comply with BS 4678 Part 1. The nominal thickness of materials for fittings shall accord with that specified for the associated trunking.

Trunking systems mounted within a building shall have protection against corrosion according to Class 2. Trunking system mounted outside a building or run in floor trenches subject to continues dampness or accidental flooding shall have protection against corrosion according to Class 3. the whole of the truning system shall be designed to be weather proof and as such all fixings shall be external to the trunking and fittings shall be provided as indicated or as
Directed by the Engineer or as required by I.E.E Regulations.

Trunking shall be run neatly on the surface of the buildings and truly vertical, horizontal or parallel with the features of the building.

Trunking runs shall be determined by the Contractor and agreed by the Engineer before any works is started. Trunking shall be run at least 150mm clear of plumbing and mechanical services.

Standard flanged couplings shall be used to terminate trunking as apparatus, at adaptable boxes and at appoints where it is desired to connect one section of trunking to another where a standard fitting is obviously unwarranted. The practice of cutting and bending the materials of the trunking to form flanged attachments will not be accepted.

Where connection is made between trunking and distribution board, the cable entry or entries shall be sized to accept all cables form all used and "spare" ways.

Holes in trunking shall be drilled, punched or cut by string saw.

Individual pieces of trunking shall be independently supported. On straight jrunks fixing shall be at regular intervals not exceeding 1.8m and fixing screws shall be of steel. Where weatherproof trunking is used, fixing screws shall be zinc plated complying with BS 1706 Class B coating. Trunking systems erected outside a building shall be weatherproof.

WIRING OF POINTS

The wiring of points shall be PVC insulated single core cables of 250V grade and shall comply with BS 2004. The colour identification of the cable insulation shall comply with Trade B4 of the I.E.E. Regulations, Final Sub-circuit wiring for lights and fans shall be of loop-in system with the loop connections made at the lighting points not at local switches.

Lighting and fan points conductors shall not be less than 2.5mm2 size and shall have up to 30A rating.

Final Sub-Circuit wiring for cooker control unit shall be carried out with PVC insulated single conductor not less than 4mm2 size and shall have one outlet per 30A fuseway.

Final Sub-circuit wiring for 15A switch socket outlet shall be carried out with PVC insulated single conductor not less than 2.5mm2 size and shall have one outlet per 15A fuse way.

JOINT IN CONDUCTORS

Joints in conductors shall be made using insulated terminal blocks.

The terminal blocks shall be 415V between terminals and 240voltss to earth.

The terminal blocks shall be contained in metal enclosure.

Adhesive tape for Electrical Purpose

Insulating tape shall comply with BS 3924 group 31/30 type TP (plasticized PVC) and have a thickness of 0-009 in (0.2mm).

SWITCH, DISTRIBUTION BOARD, CIRCUIT BREAKERS, BUSBAR CHAMBERS AND CONTACTORS

Rated Value

The rated voltage of switchgear and distribution boards shall be not less than 415 volts. A.C. between poles (240 volts to earth).

Enclosures

The type of enclosure as indicated or as directed by the Engineer shall be dust protecting for all apparatus mounted inside a building; weatherproof for all apparatus mounted outside a building. The enclosure of all apparatus shall be of metal.

Fuses

Semi-enclosed fuses or cartridge fuse links shall be provided as indicated or as directed by the Engineer.

Semi-enclosed fuses shall comply with BS 3036 (Category of duty SIA or SID) and shall only be used up to maximum current rating of 30 amperes.

Cartridge fuse-links shall comply with BS 88 or BS 1316. Cartridge fuse-links complying with BS 88 shall have a category or duty AC 46 and a fusing factor as for Class 01 fuses.

Where cartridge fuse links are used to provide back-up protection for Miniature circuit-breakers, their normal current rating and fusing factor shall be as indicated or as directed by the Engineer.

Switchgears

Air break switches and isolators for rated current not exceeding 200amps shall comply with BS 861 Part 1. For rated current in excess of 200 amps but not exceeding 800amps shall comply with BS 861 Part 2 Class 1 Switches.

Composite units of switches and fuses for rated current up to 200 amps shall comply with BS 2510 and for rated current in excess of 200 amps but not exceeding 800 amps shall comply with BS 3185.

Distribution Boards

Distribution boards shall be metal clad surface or flush mounted with hinged door, and with gaskets fitted to the doors to prevent the ingress of moisture, dust and vermin.

Each neutral busbar shall have an outgoing terminal conductor connected to it.

Fuse carrier associated with outgoing circuit designated “SPARE” on the drawing(s) shall not be provided with fuse elements or cartridge fuse-links.

Distribution boards incorporating semi-enclosed fuses or cartridge fuse links shall comply with BS 214.

Distribution boards incorporating miniature circuit breakers shall comply with BS 4649 Miniature circuit breakers shall have a category of duty M3 unless otherwise indicated or directed by the Engineer.

Provisions shall be made to enable their operating mechanism to be padlocked or otherwise held mechanically in the “OFF” position.

Consumers Electricity Supply Units

Consumers electricity supply units shall comply with BS 1454. The number of outgoing circuits and their respective current rating(s) together with the current rating of the main switch and form of protective device(s) required to the form of enclosure shall be as indicated.

Where miniature circuit breakers are incorporated, units with a current rating of 5amps shall have a category of duty according to Class M1 of BS 3871 Part 1. For units having current rating in excess of 5 amps, the category of duty shall be at least M1.5.

Moulded Case Circuit Breakers and Enclosures

Mould case circuit breakers shall comply with BS 3871 Part 2. Unless otherwise indicated, the standard a.c. rated short circuit capacity shall be; 10KA for standard rated current above 100amps up to and including 1200 amps.

Panel Board

Panel Board shall be fabricated from steel sheet and then treated with a rust protective iron phosphate and finished with bright colour to BS 381C. The Panel Board shall have removable ends, top and bottom plates, to assist easy access.

Identification of Switchgear and Distribution Board

Switchgear and distribution boards shall be permanently identified. Labels shall be of a laminated plastic material (white on black) unless otherwise indicated or as directed by the Engineer, shall be attached to the apparatus by adhesive or with screws.

The main control switch or circuit breakers shall be labeled ISOLATOR and numbered 1, 2 etc, if there are two or more incoming supplies . The characters shall be at least 10mm high and 1.5mm thick..

On all other labels the characters shall be at least 4mm high and 0.5mm thick.

On switchgear, the inscription should read designation number and circuit controlled. On distribution fuseboards, inscription should read designation number voltage and phase of supply. On TPN Distribution fuse boards and switchgear, an additional label reading DANGER 415 VOLTS written in red shall be fixed.

APPARATUS INCLUDING WIRING ACCESSORIES

Accessories

Accessories shall be of the surface mounting or flush mounting pattern as indicated or as directed by the Engineer.

Accessories mounted within a building shall be of the dust protecting type. Boxes shall have protection against corrosion in accordance with Class 2.

Accessories mounted outside a building shall be of the weather proof type.

Switchgear Boxes, Socket – Outlet Boxes

Switchgear boxes, socket outlet boxes and similar items shall comply with BS 4662

Switches

Switches shall comply with BS 3676 and shall be suitable for use on inductive or resistive loads. Their current rating shall be as directed by the Engineer (minimum 5 amps).

They shall be singled pole, unless otherwise indicated and where mounted adjacent one to another they shall be grouped in a single enclosure (multigang box) and share a common switch plate.

Cord Operated Switches

A minimum length of 1.5m operating cord as required by BS 3676 shall be provided unless otherwise indicated. The colour of the operating cord shall be white or neutral.

Switch with Pilot Lamp

The pilot lamp shall be a noon lamp with resistor and a red coloured lens unless otherwise indicated.

Plugs

Plugs shall not be provided unless indicated or directed by the Engineer.

Cooker Control Units

Cooker Control Units shall be of Form A complying with BS 4177. The control unit must not be more than 2m away from the cooker.

Time Switches

Time switches shall be of the self-starting, self winding synchronous motor driven type.

The rated voltage shall be 250 volts and the rated current shall be 20 amps unless otherwise indicated, incorporate the following; A 3-hous spring reserve to drive the mechanism during the electricity supply interruptions; an easily replaceable cartridge fuse –link complying with BS 646 or BS 2950, inserted in the motor circuit; a day-omitting device to render the switch in-operative; an ON-OFF manual switch to enable the circuit to be controlled at will without effecting the normal dial operation; a 24 hour dial with one ON and one OFF lever; and a single pole, single throw switch.

Photocell Switches

Photocell switches shall be self-operational with a photodiode sensor for On/Off operations, with a switching load capacity of 1000W and IP65 rated.

The rated voltages shall be 240V with a Switching Load of 1000W for resistive loads and for 1800VA inductive loads. Operaional Light Level of On - <20 lux, Off - >80 lux. A 10A maximum Switching Capacity and a Switching Delay: 10-15 seconds, Sensor: Photodiode, Life Expectancy: 5000 cycles. Photocell is made of a Polycarbonate material and has a Working Temperature of -20°C - 80°C.

PIR Sensor Switches

The PIR Sensor switches shall have a built-in daylight harvesting technology to achieve accurate constant light. Parameters can be adjusted by DIP switch, the transmitting Angle can be adjusted to accurately adjust the target sensor; Wide voltage 120-277vac input, common in European and American markets; Supports flush-mounted stand-alone installation.

Rated voltage of 120V/277VAC 50/60Hz with a Stand-by power <1W, Type of load Inductive or resistive. Load capacity of400W (Inductive) and a 800W (resistive) @277v AC. The Parameters shall conform to EN61058-1

CONTRACTORS

Contractors shall comply with BS 775. They shall be rated in accordance with "Uninterrupted duty" and utilizations category ACI unless otherwise indicated or directed by the Engineer.

Contractor coils shall be D.C. or rectified A.C. operated. They shall be wound for 240volts unless otherwise indicated and shall be protected by a cartridge fuse-link complying with the BS 646 or BS 2950.

SOCKET OUTLETS

Socket outlets shall be 13 amperes, two pole and earthing pin complying with BS 1363 or as indicated or directed by the Engineer

SWITCH SOCKET OUTLETS

Unless otherwise indicated or as directed by the Engineer switch socket outlets shall be 13 amperes, two pole and earthing pin complying with BS1963. They shall have single pole switches.

Fused Connection Boxes for Electric Clocks

Fused connector boxes for electric clocks shall be provided in one pole with a 3-ampere cartridge fuse link complying with BS 1362 and shall have facilities for earthing the metal works for clocks.

Installation of Switchgear and Associated Equipment

Where individual items of switchgear are shown on the drawing (s) to be grouped together or where it is reasonable to do so, they shall be formed into a composite switchgear panel. All apparatus (including associated equipment and accessories) shall fixed independently of the system of wiring. All fixing screws and bolts shall be of steel and where the apparatus has a protective coating of Zinc or is mounted outside a building the bolts or screws shall be Zinc-plated complying with BS 1706, Class B Coating.

LIGHTING FITTINGS AND LAMPS

Lighting fittings shall be of Light Emitting Device (LED) only and shall comply with BS EN 62504:2014. All Outdoor lights shall be of IP65 rating.

LAMPHOLDERS

Lampholders for use with LED lamps shall be suitable for use with the type of lamp cap specified.

Lampholders for use with flexible cords shall be the cord-grip type with shade carrier ring.

Lampholders incorporated in weatherproof fitting shall be of porcelain or brass.

Pendants

Plain pendants shall comprise a ceiling rose complying with BS 67.

BELL AND AUDIBLE WARNING SYSTEM

The wiring system shall be PVC insulated single core, non sheathed cable drawn into conduit or laid in cable trunking.

The conductors of PVC insulated cable shall be plain or tinned annealed copper complying with BS 6369 and having a nominal cross section area of not less than 0.85mm2. The insulation shall be PVC complying with BS 6746

Transformers

Transformers shall comply with BS 3535, section B. The rated output voltage shall be 4 volts and the rated output current shall be 1 ampere unless otherwise indicated.

Buzzers

Buzzers shall be provided with contactless movements and the base and cover shall be of plastics materials.

Pushes

Pushes shall be of the surface or flush pattern as indicated or directed.

Pushes shall have a current rating of 1 amp unless otherwise indicated.

In other than industrial areas pushes mounted inside a building shall be of plastics material. In Industrial areas eg. Workshops, the case and the front plates shall be of metal

Where mounted outside a building the case and front plate shall be of metal and the unit shall be weatherproof.

Indicator

Indicators shall be wood case or metal case. Conduit entries shall be provided in all metal cases indicator.

The number of signal shall be as indicated or directed by the Engineer.

TELEPHONES

The Post and Telecommunication Department will provide and install the telephone system. The electrical contractor shall provide and install a 25mm heavy gauge steel conduit in concealed system and telephone cord outlet point as specified in the scheduled and in accordance with the instructions from the telephone Authorities.

The conduits shall terminate in an adaptable flush mounting box complying with BS 4662 in the wall.

LIGHTING PROTECTION SYSTEM

Installation of lighting protection system shall comply with CP 326. It shall incorporate air-terminal mounted on a suitable brackets; a run of hard drawn copper tape fixed with suitable metal saddles at 4.0' intervals. At a position 3ft (0.9m) above ground level, a test connector shall be fitted to connect each down conductor to its earth electrode.

EARTHING

All electrical equipment such as metal clad switchgear busbar chamber, distribution fuse-boards, conduits and cable sheaths shall form a continuous bonded earthing system.

Any parts not solidly connected to the system shall be bonded with appropriate hard drawn copper tapes having its ends bolted to the frame of the equipment and the termination of the local conduits

The metal work of all lighting fitting shall be solidly bonded to the conduit system. The earth terminal of all sockets shall be solidly earthed.

The earthing system shall be as specified in the drawings.

The copper plate or copper rod shall be connected to the main switch board or the test clamp of a lighting protection system by hard drawn copper tape.

The tape to be taken to ground and turned out with on easy sweep at about 300mm below ground and continued to a distance of about 4.5mm from the building and bonded to the earth electrode.

MOUNTING HEIGHTS

The mounting height of fittings apparatus an accessories shall be given in on the chart for schedule of points.

"AS INSTALLED" DRAWING DETAILS

"As installed" drawings shall indicate the following:

(1) The position of all plant and apparatus.

(2) The sizes, type and routes of all pipework, cables and conduits.

(3) The exact routes and invert levels and the sizes, types and date of installation of all underground pipework and cables.

(4) The exact routes and invert levels and the sizes, types, makes and dates of laying of all underground cables

(5) The exact positions and descriptions of all underground joints boxes and earth electrodes and the name of the jointers responsible.

(6) The lengths of all underground cables between joints boxes and terminations.

(7) The locations of any other services or obstructions in the routes of underground pipe work and cables

(8) The positions and reference numbers of all valves. For plant rooms and boiler room layouts additional valve diagrams shall be provided where necessary for clarity. Reference numbers on drawings shall correspond with the numbers on valve labels.

(9) The reference numbers of all electrical circuits. Each circuit reference number shall be carefully checked against the installation and updated distribution diagrams produced compatible with the record drawings.

Record drawings shall also be provided for all plant and equipment which, together with the printed instructions provided, shall be sufficient to enable the plant and equipment to be operated, maintained, dismantle, re-assembled and adjusted.

All record drawings shall be submitted for approval. On receipt of approval, the following sets of record drawings shall be provided:-

(1) One complete set of negative drawing on tracing cloth or approve plastic materials.

(2) Two complete sets of prints on paper.

(3) One set of prints on approved plastic materials of those drawings showing plat, boiler and switch room layout, together with their associated valve diagrams and diagrams of main electrical connections. Each of these prints shall be mounted in a glaze frame and hung in the room housing the relevant equipment.

The relevant record drawings of plant and equipment and instructions shall be completed by the date of Practical Completion or Sectional Completion. If the record drawings are not available, the Services Engineer will not recommend the issue of a Certificate certifying completion.

FIRE ALARM SYSTEM

DETAIL SPECIFICATION FOR AN AUTOMATIC ADDRESSABLEANALOGUE FIRE DETECTION SYSTEM

General

This specification covers the provision and installation of a Fire Detection and Alarm System comprising of a Fire Panel, Mimic Panel, break glass units, optical and heat detectors, loop sounders and cabling as shown on the drawings.

The Fire Detection System shall be of **Gents Vigilon 1 Loop Analogue Addressable Fire Alarm Control Panel** complete with loop card and battery back-up.

If there is any discrepancy between drawings and specifications, the specifications shall be followed.

1.SUPPLEMENTARY SPECIFICATIONS AND DRAWINGS

When a specification or drawing is quoted, the latest issue of the specification or drawing shall be followed, unless otherwise specified.

2. INSPECTION

The Engineer reserves the right to arrange for the inspection of all goods forming part of any contract or order, at any stage before final acceptance and by means it may think fit and when such inspection is to be carried out, the relevant contracts, orders and sub-orders shall be endorsed accordingly.

When inspection at the contractor's works or warehouse is specified, the Engineer's authorised inspector and the Engineer shall have free access to the premises of the contractor at all times during working hours.

He shall be free to inspect work which is the subject of the contract or order, at any stage of manufacture and may reject any goods which are found to be incomplete, defective or in any way not in conformity with the terms of the contract or order and the contractor shall afford all reasonable facilities for such access and inspection.

The contractor shall supply, without charge to the Engineer's authorised inspector and the Engineer, all tools, gauges, templates and other equipment which may be required for checking the accuracy of the work; shall provide the labour necessary for inspecting the work in accordance with requirements specified in the contract or order and shall render all reasonable assistance in carrying out this checking and inspecting.

The contractor shall prepare and supply, without charge to the Engineer, all test pieces, samples and specimens; shall provide all labour and apparatus for carrying out tests and analysis in accordance with the terms of the contract or order and render all reasonable assistance in making such tests and analyses.

3. CERTIFICATE OF COMPLIANCE

The tenderer shall indicate, section by section, whether or not his quotation complies in every respect with this specification.

If alternative quotations are submitted, all divergences from this specification shall be clearly stated.

4. SAMPLES

Technical literature consisting of circuit diagrams, a circuit description and a flow chart using high level language shall be submitted for comparative evaluation, together with a sample of the system covered by this specification if called for. The sample shall be forwarded to the Engineer for approval. The sample will be regarded as being identical to the system for which this tender is submitted.

Failure to comply with the above will invalidate the tender.

5. GENERAL DESCRIPTION

The fire detection system shall comprise of a central control unit, connected by two wires to field devices, including fire detection devices, alarm devices and control devices, located throughout the building area.

The control unit shall continuously monitor the analogue status of all sensing devices, and initiate action when a fire or smoke condition is present.

The system shall be designed to provide an early warning utilising the most effective detection methods appropriate to the protected areas. In addition, preference should be given to detectors and sensing methods that are environmentally friendly and that do not contain hazardous substances. The following is the order of preference for detection methods.

1 -Optical and Heat smoke sensors

The alarm management shall be field configurable from the control panel via a key pad to enable the system to be tailored to suit the protected building, and to permit future changes. This configuration shall be maintained under power failure conditions.

The system shall be modular in design and shall conform to the BS5839 part 1.

The control unit shall have a front panel comprising of indicating LED's, control keyboard, and LCD display, as described in detail later.

Four levels of access into the system menu via the keypad are to be provided.

These are to be as follows:

- Level 1: Operator (no access code required)
- Level 2: Maintenance Technician (access code required)
- Level 3: Commissioning (access code plus key)

Facilities for "locking-off" controls are to be provided.

The control unit shall have the following approvals:

- Loss Prevention Certificate Board UK (LPCB)
- The control unit shall also conform to the following standards.
- Control Unit BS 5839-1:2019
- Smoke Detectors BS 5839 part 6
- Heat Detectors BS5446
- Multi sensors BS EN 54-29
- Call points BS 5839

6. POLLING SYSTEM

The system is to incorporate a polling system which polls each detector individually and reads information in analogue form. The idle value shall be continuously updated in order to compensate for ageing and atmospheric conditions. The panel shall make decisions based upon the information obtained from each detector. System polling time shall be less than two seconds for each complete scan of all devices attached.

Special quick scan algorithms shall be used in case of manual call point interrupts, smoke alarm interrupts and control output updates.

Communication circuit

A 2-wire circuit is to be used for power and communication between the panel and the detectors.

System control

All communication shall be under the control of the control unit, which shall sequentially poll each device in turn and authorise communication.

No device shall communicate with the control panel without authority.

The control unit must be able to read information from a device or send instructions to a device.

Device address

Each device on line must be uniquely identifiable by the control unit. This must be achieved by pre-setting the address of each device.

Removal of a detector head from its base must extend a fault condition to the control unit.

Device identification

The identification of each type of address unit and each type of sensor (i.e. ionisation detector, heat detector,

sprinkler switch) must be transmitted to the panel on each polling scan.

Device status

The condition of each line device, including circuit, calibration and contamination, must be transmitted to the panel on each polling scan.

Device sensitivity

Alarm sensitivity relative to each analogue line device is to be individually adjustable, device by device, by the control panel.

Not less than four levels of adjustment are required for each device as follows:

Smoke Detectors

1) 1,5%/m obs
2) 2,5%/m obs
3) 3,5%/m obs
4) 5,0%/m obs

Heat Detector

1) 42° C
2) 58° C
3) 70° C
4) 82° C

Alarm Verification

Every analogue detector must provide the facility for verifying the validity of an alarm signal over a 20 second period, before initiating an alarm. This alarm verification function must be able to be enabled or disabled, on a device by device basis, from the control panel.

Calibration

The system must check the calibration of each analogue line device and record changes caused by environmental contamination.

When maximum calibration adjustment is reached the panel must indicate a “maintenance” signal.

This must be a dedicated signal and must be separate from the “pre-alarm” signal.

Display And Indicators

All displays and indicators shall be LCD, or PLASMA display LED types.

The type, calibration, sensitivity and status of each device must be able to be displayed at the control panel.

Number of devices in alarm

There shall be no limit to the number of devices which may be in alarm simultaneously.

When a detector is in alarm an LED in its head or base shall be switched on.

7. SYSTEM WIRING

The system shall operate a single two-wire circuit, which shall be normally screened, to provide absolute reliability at all times and in all environments.

The system shall meet the requirements of European Union Directive CE336/89 for the ability to perform satisfactorily under conditions of electrical noise and transients, and shall comply fully with the requirements of the following standards as required by BS5839

IEC 801-2 Electrostatic discharges

IEC 801-3 Radiated Electromagnetic interference

IEC 801-4 Voltage transients - Fast transient bursts

Wiring is to be suitable for return loop arrangement and/or single direction arrangement. Tee-off's must be permitted, with full monitoring.

Line protection and monitoring

The addressable line shall be monitored for short circuit or open circuit.

Processor monitoring

A hardware "watchdog" circuit must be provided on the central processor module. In the event of a microprocessor failure the watchdog must cause a hardware reset of the microprocessor.

This reset action must continue until the processor has restarted. In the event that the processor will not restart within 20 seconds, then the panel must give an audible and visual alarm indication.

A watchdog counter must allow the viewing of the number of times that the processor has been restarted by the watchdog, for diagnostic purposes. This information must be stored in non-volatile memory, enabling it to be viewed even if the panel has been powered-down. The counter must only be able to be reset by an authorised engineer, under a level 3 access code.

The microprocessor must perform full diagnostic tests on all memory devices on start-up, as follows

RAM test(Running Data)

EPROM checksum verification (Programme Storage)

EPROM checksum verification (Site Configuration Storage)

Should any test fail an audible and visual fault indication must be given, and the

LCD display must indicate the nature of the fault.

The control unit shall perform periodic checksum tests, at intervals not exceeding 60 minutes, on the RAM,

EPROM, and EPROM memories, and give an audible, visual, and LCD text fault indication in the event of a discrepancy.

It must be possible to view the original and current checksums for all memories on the panel LCD display, as a maintenance (level 2) function

Line capacity

The capacity of the address line shall be at least 127 addressable devices. These must be input devices, such as smoke detectors, or output devices, such as sounders or relays.

Device types

It shall be possible to connect the following detectors/devices to the control unit.

- Ionisation smoke detectors - analogue type
- Optical smoke detectors - analogue type
- Multi sensors - optical / thermal type
- Heat detectors - analogue type
- Manual “break-glass” units
- Addressable relays i.e. Output devices
- Interface units i.e. input devices

- Loop powered addressable sounders
- Addressable remote LED indicators
- Sounder circuit controllers.

Minimum requirements for the analogue/addressable (intelligent) fire detectors and associated

devices Basic loop

The addressable “loop” shall be a two wire circuit starting and returning to the control panel. Separate terminals shall however be provided for outgoing and return conductors as well as for wiring screens.

The loop devices shall each have a unique address. Each device may be addressed as often as is required.

There shall be no pre-set order for addressing the devices. The devices shall be addressed appropriate to site conditions. This order will be determined during system design or commissioning.

Every design must be checked by the control panel every 2 seconds. In order to maintain system integrity the panel shall not by pass any detector during a scan.

The control panel will have the facility of determining if more than one device has the same address on the loop. A “double address” alarm shall be given if this occurs.

It shall be possible to fit isolators at a maximum spacing of one per 20 devices. The isolators shall protect against short circuits on the loop by isolating that section of the loop where the short circuit occurred, thus maintaining the integrity of the remainder of the system.

Fire condition LED indicators fitted to the devices and any remote indicators shall be remotely and separately operated from the control panel.

All fire condition LED indicators shall be reset from the control without removing power from the loop.

The communication to and from each device shall be based on one of the following:

Pulse current modulation

Pulse position modulation

Pulse width modulation

Digital amplitude modulation

Manual call points shall each have their own unique address and the panel shall be capable of identifying and responding to the operation of a call point within three seconds as required by BS 5839.

There shall be no electronics or electronic components in the mounting base of any field device.

The loop shall be capable of receiving information in addition to that from heat and smoke detectors. The source of this information shall be identified by its own unique address.

Any interface equipment used to achieve this requirement shall be from the standard product range of the same manufacturer as the smoke and heat detectors provided for the loop.

Only the two loop wires shall power the detectors, address, and carry data to and from the field devices by digitally encoded signals superimposed on the power voltage.

The control panel shall be able to identify what type of device is located at each address in order to protect against accidental fitting of an inappropriate sensor.

The control panel shall be able to identify the absence of a field device.

Intrinsically safe detectors shall be installed in all battery rooms.

These devices must be approved by a certified test laboratory.

Ionisation smoke detectors (analogue/addressable)

Ionisation smoke detectors shall comply with BS5839

The ionisation smoke detectors shall be suitable for detecting invisible products of combustion as well as visible smoke and be of the dual chamber dual source type to provide good stability in changing

environmental conditions.

The radioactive source shall be Americium 241 mounted in such a way that it is mechanically secure. The device shall have been certified by the National Radiological Protection Board or a similar body.

The detectors shall be suitable for connecting to a two-wire 24 V central system and operate satisfactorily within the supply voltage range of 17 V - 28 V DC.

An indicator LED shall be provided on the detector which illuminates when the detector has reached a preset alarm level.

The Indicator shall be operated independently of the detector from the central control panel.

Provision shall be made for an output from the detector suitable for operating a remote indicator or other device with a current limitation of 4mA. The output shall be operated independently of the smoke detector from the central control panel.

The detector shall be capable of operating within the following environmental limits.

Temperature operating range -20°C to +60°C (no condensation)

Humidity operating range 0 % to 95 % RH. (excluding condensation)

Wind resistance up to 10 metres per second without false alarming.

RFI resistance to 10v/m over a signal range of 1MHz to 1000 MHz and 50 v/m over signal ranges 450 - 466 MHz and 890 - 960 MHz cellular telephone.

Separate mounting bases shall be required which enable ready removal of the detectors for maintenance.

The bases shall be fitted with stainless steel terminal springs and stainless steel terminal screws and saddles.

The construction of the detector and bases shall be in white self-extinguishing polycarbonate plastic. Full circuitry must be protected against moisture and fungus. Smoke entry points must be protected against dust and insect ingress by corrosion resistant gauze. The detectors must be unobtrusive when installed.

The detector shall be capable of protecting an area up to 100 m² at a height of up to 12 m. The installation and sitting of the detectors must conform to BS5839 part 1 1980 or SABS 0139 or similar Standards.

Data transmission to and from the control panel from the detector shall be via a communications module which is factory fitted to the detector by the original detector manufacturer and forms a complete and integral part of the detector.

The detector shall be supplied complete and fully tested and calibrated.

The unique address of the detector shall be set up by the installer.

There shall be a facility on the base for attaching a label indicating the address of that detector. A similar facility shall be available on the detector. The detector and base labels shall be aligned when installed.

The build-up of dirt or similar contamination on the radioactive source will cause the output signal from the detector to gradually change. The control panel shall be capable of monitoring this slow change in signal and at a predetermined level indicate that the detector is in need of servicing.

The detector shall be capable of being remotely tested from the control panel by the transmission of a test instruction signal to the addressed detector. This shall result in a healthy detector transmitting back an

analogue value in excess of the recommended fire alarm threshold. The control panel will recognise this as a test signal and shall not raise an alarm against this signal.

Photoelectric (optical) smoke detectors (analogue/addressable)

The photoelectric (optical) smoke detectors shall be suitable for detecting visible smoke such as is produced by slow smouldering fires including burning PVC.

Photoelectric optical smoke detectors shall comply with the SABS EN 54-7 standards (1996)

They shall be of the light scattering type using a pulsed internal LED light source and a photocell sensor.

The detectors shall be suitable for connecting to a two-wire 24 V central system and operate satisfactorily within the supply voltage range of 17 V - 28 V DC.

An indicator LED shall be provided on the detector which illuminates when the detector has reached a pre-set alarm level. The indicator shall be operated independently of the detector from the central control panel.

Provision shall be made for an output from the detector suitable for operation of a remote indicator or other device with a current limitation of 4mA. The output shall be operated independently of the smoke detector from the central control panel.

The detector shall be capable of operating within the following environmental limits.

Temperature operating range -20°C to +60°C

Humidity operating range 0 % to 95 % RH. (no condensation)

Wind - not affected.

RFI resistance to 10v/m over a signal range of 1MHz to 1000 MHz and 50 v/m over signal ranges 450 - 466 MHz and 890 - 960 MHz cellular telephone.

Separate mounting bases shall be required which enable ready removal of the detectors for maintenance.

The bases shall be fitted with stainless steel terminal springs and stainless-steel screws and captive

clamping plates.

The construction of the detector and bases shall be in white self-extinguishing polycarbonate plastic. Full circuitry must be protected against moisture and fungus. Smoke entry points must be protected against dust and insect ingress by corrosion resistant gauze. The detectors must be unobtrusive when installed.

The detector shall be capable of protecting an area up to 100 m² at a height of up to 12 m. The installation and siting of the detectors must conform to BS5839 Part 1 1980 or SABS 0139 or similar Standards.

Data transmission to and from the control panel from the detector shall be via a communications module which is factory fitted to the detector by the original detector manufacturer and forms a complete and integral part of the detector.

The detector shall be supplied complete and fully tested and calibrated.

The unique address of the detector shall be set by the installer.

There shall be a facility on the base for attaching a label indicating the address of that detector. A similar facility shall be available on the detector. The detector and base labels shall be aligned when installed.

The build-up of dirt or similar contamination optical surfaces will cause the output signal from the detector to gradually change. The control panel shall be capable of monitoring this slow change in signal and at a predetermined level indicate that the detector is in need of servicing.

The detector shall be capable of being remotely tested from the control pane by the transmission of a 3-bit code to the addressed detector. This shall result in a healthy detector transmitting back an analogue value in excess of the recommended fire alarm threshold. The control panel will recognise this as signal and shall not raise an alarm against this signal.

Heat detectors (analogue/addressable)

The heat detector shall be electronic in operation.

Heat detectors shall comply with

The device shall monitor ambient temperature by means of a NTC thermistor.

The detectors shall be suitable for connecting to a two-wire 24 V central system and operate satisfactorily within the supply voltage range of 17 V - 28 V DC.

An indicator LED shall be provided on the detector which illuminates when the detector has reached a pre-set alarm level. The indicator shall be operated independently of the detector from the central control panel.

Provision shall be made for an output from the detector suitable for operating a remote indicator or other device with a current limitation of 4mA. The output shall be operated independently of the smoke detector from the central panel.

The detector shall be capable of operating within the following environmental limits.

Temperature operating range -20°C to +60°C

Humidity operating range 0 % to 95 % RH. (excluding condensation)

Wind - not affected

RFI resistance to 10v/m over a signal range of 1MHz to 1000 MHz and 50 v/m over signal ranges 450 - 466 MHz and 890 - 960 MHz cellular telephone.

Separate mounting bases shall be required which enable removal of the detectors for maintenance. The bases shall be fitted with stainless steel terminal springs and stainless steel terminal screws and captive clamping plates.

The construction of the detector and bases shall be in white self-extinguishing polycarbonate plastic. Full circuitry must be protected against moisture and fungus. The detectors must be unobtrusive when installed.

Each detector shall be suitable for protecting an area up to 50 m² at a height of up to 7.5 m. The installation and siting of the detectors shall be carried out in accordance with BS5839

Data transmissions to and from the control panel from the detector shall be via a communications module which is factory fitted to the detector by the original detector manufacturer and forms a complete and integral part of the detector.

The detector shall be supplied complete and fully tested and calibrated.

The unique address of the detector shall be set by the installer.

There shall be a facility on the base for attaching a label indicating the address of that detector. A similar facility shall be available on the detector. The detector and base labels shall be aligned when installed.

The build-up of dirt or similar contamination will cause the output signal from the detector to gradually change. The control panel shall be capable of monitoring this slow change in signal and at a predetermined level indicate that the detector is in need of servicing.

The detector shall be capable of being remotely tested from the control panel by the transmission of a 3-bit code to the addressed detector. This shall result in a healthy detector transmitting back an analogue value equivalent to the recommended fire alarm threshold. The control panel will recognise this as a test signal and shall not raise an alarm against this signal.

Multisensor detectors (analogue/addressable)

The multisensor detectors shall incorporate photoelectronic (optical) smoke sensors, and high sensitivity thermal sensors, software interlocked to provide early warning from all types of smouldering fires including, burning PVC.

Multisensors shall comply with BS standards ISO 7240-15 standards (draft 1996)

The smoke element shall be of the light scattering type using a pulsed internal LED light source and a photocell sensor.

The thermal element shall utilise high sensitivity, high speed thermistors optimised to measure small changes in temperature, and rate of change.

The elements shall measure both absolute smoke and thermal levels, but also rate of smoke and thermal change.

The smoke and thermal elements must report independently to the control panel, and must be software interlinked to enable intelligent high-level decision making.

The detectors shall be suitable for connecting to a two-wire 24V central system and operate satisfactorily within the supply voltage range of 17V - 28 V DC.

An indicator LED shall be provided on the detector which illuminates when the detector has reached a preset alarm level.

The Indicator shall be operated independently of the detector from the central control panel.

Provision shall be made for an output from the detector suitable for operation of a remote indicator LED. The output shall be operated independently of the smoke detector from the central control panel.

The detector shall be capable of operating within the following environmental limits as per the VDS requirements.

- Temperature operating range -20° C to +60° C
- Humidity operating range 0 % to 95 % RH (Without condensation)
- Wind - not affected
- RFI resistance to 10v/m over a signal range of 1MHz to 1000 MHz and 50 v/m over signal ranges 450 - 466 MHz and 890 - 960 MHz cellular telephone.

Separate mounting bases shall be required which enable ready removal of the detectors for maintenance.

The bases shall be fitted with corrosion resistant connector springs and terminal screws with captive clamping plates.

The construction of the detector and bases shall be in white injection moulded plastic. Full circuitry must be protected against moisture and fungus, and to achieve this the circuit board and components must be fully coated with a protective conformal coating. Smoke entry points must be protected against insect ingress by corrosion resistant mesh. The detectors must be unobtrusive when installed.

The detector shall be capable of protecting an area up to 100 m² at a height of up to 12 m. The installation and siting of the detectors must conform to BS5839 Part 1 1980, or SABS 0139, or similar Standards.

Data transmission to and from the control panel from the detector shall be via an integrated communication protocol which is factory fitted to the detector by the original detector manufacturer and forms a complete and integral part of the detector.

The detector shall be supplied complete and fully tested and calibrated.

The unique address of the detector shall be set by the installer.

There shall be a facility on the base for attaching a label indicating the address of that detector. A similar facility shall be available on the detector, enabling the fitting of a label indicating its address. When the detector is fitted to its base, both the detector and base address labels shall be visible, and aligned adjacent to each other.

The build-up of dirt or similar contamination on the optical surfaces will cause the output signal from the detector to gradually change. The control panel shall be capable of monitoring this slow change in signal and at a predetermined level indicate that the detector is in need of servicing.

The detector shall be capable of being remotely tested from the control panel by the transmission f a test instruction to the addressed detector. This shall result in a healthy detector transmitting back smoke and thermal analogue values in excess of the recommended fire alarm threshold. The control panel will recognise this signal as a test result and shall not raise an alarm.

Manual call point

The call point shall be manufactured from self-extinguishing red polycarbonate plastic.

Manual call points shall comply with either BS5839

The overall size of the call point shall not exceed 100 mm x 100 mm x 60 mm.

The call point shall be based upon a standard product manufactured by a reputable call point manufacturer.

It shall consist of an enclosure with a captive glass pane, and it shall incorporate an addressable

communications module. Breaking the pane shall initiate an alarm. The call point shall incorporate a plastic -laminated safety glass which will not produce sharp edges when broken.

An externally visible red LED shall be incorporated to indicate when the device is in alarm.

The word “Fire” shall appear in black letters across the top of the call point.

The LED shall illuminate when the call point is activated. However, the illumination of the LED will be by command from the control panel.

Device status

Each addressable device must be polled by the panel every two seconds or less.

The analogue status of each device must be read and stored in the panel on each scan.

The following information is to be recorded on each scan:

Device condition

Sensor type

Sensor status

Maintenance alarm thresholds

The alarm thresholds of each analogue detector shall vary individually in accordance with its idle status.

This includes alarm thresholds, rate algorithms, pre-alarm and maintenance thresholds.

When the threshold reaches its maximum limit, the panel must be able to indicate a "maintenance required" signal for the particular detector. This shall be a separate pre-alarm / maintenance signal. The use of a combined pre-alarm / maintenance signal is not acceptable.

Device monitoring

The panel shall monitor each device on every scan, and give a fault signal for any of the following conditions, within 30 seconds.

- Detector removed
- Address unit removed
- Incorrect device type
- Faulty calibration or sensitivity
- Alarm decision

All alarm decisions are to be taken by the control unit after checking the data from each device at least twice.

The control panel shall employ an algorithm in order to check that the automatic sensors do not give spontaneous false readings.

8. SIGNALLING AND ANNUNCIATION

General

Signaling and annunciation shall be as specified in BS EN 50136.

Fire indication shall be by zone, displayed on LED indicators, and on the LCD text display.

Fault, maintenance, pre-alarm, and device/zone disabled signals shall be indicated visually by LCD text display, and audibly, in the control unit.

The top portion of the LCD text display shall always show the first alarm received. The lower portion of the LCD text display shall show the last alarm received. It must be possible to manually scroll through all alarms on the lower portion of the screen, using “up” and “down” scroll buttons.

The display must show the total number of alarm events currently in the system.

Fire alarms shall take priority when displaying. However, it must be possible to view all events currently in the system, including, fire alarms, fault alarms, pre-alarms, maintenance alarms, disabled devices, and other events.

It shall be possible to view the devices, by address that initiated the alarm on the LCD text display, on manual request. When viewing the device, a 40 character location message specific to each device shall be displayed.

The visual indications must be arranged so that the different warnings are clearly distinguished. (i.e. amber for fault, red for alarm).

The internal audible signal device may be the same for all alarms, but either tone variation or time switching shall be used to differentiate.

Outputs shall be provided for audible alarms, control functions, remote mimics and connection for computers and printers.

Zoning

The panel shall have a minimum of four zones. The zones must be fully fielded programmable to permit detectors to be allocated to any zone.

Each zone shall be identified by a 40 character text label displaying on the LCD display. This shall be field programmable.

It must be possible for any number of addressable devices from 0 - 126 to be connected to any zone.

The zoning must be manually configured on system start-up or on request by an authorised operator.

The panel must provide facilities for the operator to inspect the zoning configuration, and inhibit, or activate devices. Facilities must be provided for identifying all active and inhibited addressed, and all connected device types.

Panel indicators

All visual indicators shall be LED's and no incandescent lamps are to be used.

The following LED's must be provided:

Minimum 4 - Zone alarm LED's

Minimum 4 - Zone fault LED's

1 - Supply healthy LED

1 - Supply faulty LED

2 - Common alarm LED's

1 - Pre-alarm LED or visual display

1 - Common fault LED

1 - Maintenance LED (or visual display)

1 - Processor running LED

1 - Battery supply fault LED

Panel displays Zone Display Mode:

- Type of alarm
- 2 Zones (first and last)
- Alarm count
- Total number of alarms
- 40 Character zone location message for each zone
- Time and date

The LCD display must be able to simultaneously display a minimum of

- Loop number, zone number, detector address
- Alarm count
- Zone in alarm
- Detector in alarm
- Alarm type

- Active or accepted
- Time and date

The LCD display must be at least a 160 character display.

Panel controls

The panel is to incorporate a keyboard and push-button with the following functions:

Numeric keyboard

System reset button

Alarm accept button/silence alarm button

Alarm sound button

Lamp test button

Function buttons for maintenance and commissioning

Buttons for controlling the operation of the two alarm outputs.

Alarm outputs (Fire)

The panel must incorporate at least two monitored audible alarm outputs for the switching- on of bells or electronic sounders.

These outputs must be continuously monitored for open and short circuit.

Each output must be rated at a minimum of 0,75 A at 24 V DC.

It shall be possible to independently disable either of the alarm bell outputs by means of a control push button.

A test facility shall be provided in order to test each of the alarm bell outputs. When the test is initiated the selected alarm bell will operate intermittently.

Both the alarm bells will have a delay facility which is selected by controls on the front panel. Manual call points will override this delay.

Alarm contacts (Fire)

One voltage free change-over contact must be provided. This must operate on a “fire” condition, and is to remain “on” until the system is reset.

The contacts are to be rated at 2 A at 24 V DC.

Alarm contacts (Fault)

One voltage-free change-over contact must be provided. This must release on a “fault” or “maintenance” condition, and is to remain “off” until the system is reset.

The contacts are to be rated at 2 A at 24 V DC.

Remote panel outputs

An optional monitored serial port shall be provided for connecting to remote panels and computers

The remote units must have the following displays and controls:

Remote 160 character LCD text display which repeats all events being displayed on the panel display.

Remote “alarm accept” input i.e. silencer alarm

Remote “system reset” input

Sound Alarm

Optional printer

A Forty column printer shall be available as an option.

The printer shall provide a hard copy of the following:

Alarms

Faults

Maintenance

Panel operations

Time and date

Operation of the printer shall not inhibit, delay or affect the functioning of the detection polling system in any way.

When supplied as an option, the printer must include all connecting cables, hardware, software and instructions.

Communication between the control panel and field devices

The basic criteria for any system is that a unique address be transmitted, recognised by a single field device, and the device status be returned to the control panel for processing.

The time taken to “poll” all devices and the integrity of the data received under worst case conditions, to re-act upon a fire status, should not be greater than eight seconds.

The integrity of the data should be such that noise generated by other devices in the area of operation cannot introduce false information that may result in the incorrect operation of the system. Noise immunity shall be as specified in IEC 801 parts 1 - 5.

Electrical medium

Both power and communications for the field devices shall be carried by a single pair of conductors.

The term “outgoing” and “incoming” refer to the control panel.

Outgoing address/data format

Each device shall have a unique address. The address shall allow a minimum of 126-devices per line.

The communication protocol shall be transmitted automatically by the control panel once every 2 seconds, and shall during that time communicate with all devices.

a) Switch on/off LED
b) Return device type
c) Return device status
d) Return device calibration
e) Test field device

The address and data bit stream shall automatically be transmitted once by the control panel. The field device shall reply on every transmission. The panel shall only accept messages if three consecutive replies are identical.

Outgoing transmissions

The outgoing message shall be modulated onto the positive leg of the power carrier at a level of 20 V.

The message must be encoded in the form of a digital pulse count or digital amplitude modulation.

The binary data rate shall be less than 1 kHz.

Address (data reception [field devices])

The field devices shall be equipped with an appropriate compatible integrated circuit configured as a pulse counter.

The address and data are passed to a decoding circuit and are compared with the on-board address. Each message is to be acted upon and the panel is to verify all data at least two times.

Field data transmission

The field devices may be commanded to transmit to the control panel at least five analogue values. These valves shall indicate at least the following:

- Device type correct at given address.
- Test of output status (High calibration).

Test of input status (Low calibration).

Analogue sensitivity output 1.

Analogue sensitivity output 2 (for multisensors)

Miscellaneous commands

The control panel may additionally send commands to the field devices to turn the alarm LED on or off and to test the field device electronics.

The control panel may additionally send commands to the detectors to initiate a self - test, to test the field device electronics.

The tests are to be arranged such that the simulation of smoke is to exercise the chambers exactly as though real smoke was present in the chambers.

This feature is to be available for both ionisation and optical smoke detectors.

A special test procedure shall be available on the control panel to enable an operator to activate the field device by introducing smoke or combustion gases. The panel will not generate the normal alarms but will light the remote LED and then after a period of time, automatically reset the field device.

A special test procedure shall be available on the control panel to enable a maintenance technician to place a zone into a “Walk Test Mode”. He may then activate the field devices in that zone by introducing smoke or combustion gases.

The panel will not generate the normal alarms but will light the remote detector LED and then after a period of time, automatically reset the field device. At the same time the panel will record all test alarms. Upon completion of the test, the contractor shall ensure that the panel operate correctly, and replace any faulty items that have failed.

If any alarms are received from a different zone to the one being tested, then the panel is to cancel the test, and initiate a genuine fire alarm. Similarly, if two detectors in the zone-under-test simultaneously give an alarm, then the panel is to cancel the test and initiate a genuine fire alarm.

9. ALARM MANAGEMENT

The annunciation and signaling outputs must be field programmable as described below.

Control outputs

Optional control outputs or relays shall be available.

A minimum of 4 optional relays shall be provided. The system shall however be able to support up to 32 relays. Each relay will be software programmable and will be allocated to loop, zone, line fault or coincidence.

The option relays must be able to be allocated in a different grouping or the same grouping as the zones.

Each optional relay shall have a changeover voltage free contact rated at 2 A at 24 V DC.

Double-knock (coincidence) operation

It shall be possible to programme any of the control outputs or addressable relays to operate upon an alarm from any two detectors in the programmed group.

Silencing operation

It shall be possible to programme any of the control outputs or addressable relays to operate in either “silencing” mode or “non-silencing” mode.

In “silencing” mode the relay or outputs shall de-activate when the “alarm accept” button is pressed, or when the “reset” button is pressed.

In “non-silencing” mode, the relay or output shall be de-activated only when the “reset” button is pressed.

Activation delay

It shall be possible to programme any of the control outputs or addressable relays to activate after a delay period from receipt of the control signal.

This delay shall be 0 - 16 minutes, in one second increments.

10. SYSTEM MAINTENANCE

General

The system shall be, as far as possible, self-testing and maintenance free.

The control unit shall continually update the idle state of each detector, and indicate a “maintenance required” signal in the event of a detector sensitivity being too high or too low.

Control unit test

The control unit shall have test facilities without interruption of the remainder of the system (short circuit test excluded) for the following:

Field tests

Detector tests

The control unit shall allow for detector test and inspection by a single person.

The test alarm triggered on each detector by the inspection person shall be indicated on the detector by a red LED and shall be automatically reset by the control unit. Alerting shall not take place.

Zones which are not switched to maintenance mode shall remain ready for normal alarm procedure.

The control panel shall keep statistics for each of the detectors and shall be displayed on demand.

The statistics must be:

Maximum value attained by the cursor as well as the date and time.

The minimum value attained by the cursor as well as the date and time.

The average idle value attained by the cursor as well as the date and time.

It shall be possible to put a detector in soak test mode. A detector in soak test mode will log its conditions in the event buffer without raising fire alarms.

Alarm test

The control unit shall allow for the testing of all audible and visual alarm devices and control relays, to check correct functioning of these devices.

Acceptance tests

The acceptance tests as stipulated in the "Acceptance Procedure for Fire Detection Systems installed in Equipment Buildings" shall be strictly adhered to.

Where the system is elsewhere installed (non-technical buildings), the onus shall be on the consultant/contractor to stipulate the Acceptance Procedures. These procedures shall be subjected to TFMC's approval.

11. SYSTEM POWER SUPPLY

Exchange building installation

The system supply shall be provided from two independent sources, a 231V AC or a 52-54 V DC supply from the exchange battery and an internal 24 V DC standby battery with charger within the control panel.

Office installation

The system supply shall be provided from two independent sources, mains 231 V AC and from an internal 24 V DC standby battery with charger within the control panel.

Power supply

The output of the power supply shall be capable of sustaining an alarm from all the connected alarm lines simultaneously. The power supply shall be an integral part of the control unit.

For equipment buildings it shall be possible to operate the system from the equipment power supply available in the building.

In the event of a failure of the mains 231 V AC or equipment 52-54 V DC supply, there shall be an automatic switch-over to the standby battery supply without an interruption of the load and without activating a fire alarm.

The central control unit shall be protected against reverse polarity on the voltage supply side.

The unit shall be suitable for use with a positively earthed 24 V DC or 52 - 54 V DC power supply system.

The unit and detectors must be protected against earth faults on both legs of the addressable line.

Tests shall be done as follows:

1. Short Circuit Addressable Line (+) to earth (+ 54 V) for one minute.
2. Short Circuit Addressable Line (-) to earth (+ 54 V) for one minute.
3. Short Circuit Addressable Lines (+) and (-) simultaneously to earth (+ 54 V) for three minutes.

After removing the shorts the system is to be tested and must function normally.

Standby battery

The standby battery must be capable of supplying the system in idle condition for the stated period of eight hours plus an hour in alarm condition after the stated period.

- An alarm shall be activated when:
- Failure of the recharging equipment to the battery occurs or
- When a low battery voltage occurs.

The supply failure message must be activated when the battery has 20 percent of its normal capacity. When the lowest voltage allowed by the manufacturer of the battery is reached, power to the unit and external sensors must be switched off in order to:

- Avoid malfunctioning of the control unit.
- Prevent battery from over discharging.
- Be able to reset the micro-processor properly when main supply returns.
- Note: Power to the control unit and external sensors will be switched on automatically only when the voltage is approximately 12 V.
- There shall be lightning protection on the power supply side.
- There shall be an indication that the power is on.

12. GUARANTEE

The tenderer shall guarantee that the equipment offered will give satisfactory service for a period of one year, from the date of completion of installation and to replace or repair with a minimum of delay and free of charge any components which may fail during this period, fair wear and tear excepted.

13. WIRING

The system shall operate on a two-wire circuit in a loop or spur configuration per zone.

The wiring shall basically consist of a 0,8 mm² two core (twisted pair) fire retarded cable equal and similar to screened type fire retardant cable.

The addressable line must be monitored for short circuit and open circuit.

14. TECHNICAL LITERATURE

The successful tenderer shall supply four handbooks, each consisting of full instructions, operating and maintenance instructions in English and descriptions thereof as well as a full component list indicating, not only component values but source/s of supply. Component placing diagrams together with full circuit diagrams of all printed circuit boards used in the system shall also be supplied.

15. AUDIBLE FIRE ALARM DEVICES

Audible alarm devices shall be installed above each fire panel. The power supply wiring shall form part of this contract. The audible alarm device shall be protected against ingress to at least IP65.

Audible alarm devices shall conform to the following performance characteristics:

- Housing - Red PVC
- Voltage - 24V DC
- Range - 80 dBA at 3,0m
- Tone/sounder - Dual tone adjustable, Piezo electronic

16. APPROVAL OF SYSTEM INFORMATION AND EQUIPMENT

All information and equipment relating to zoning, numbering of devices, cables or cable cores, terminal numbers, plant schedules, point indexes, interlocking, flow sheets, restarting functions, logs, limits, grouping of system components, manuals, etc. shall be subject to the approval of the

Engineer. Approval shall normally be given within 30 days from receipt of the relevant documentation. Equipment or drawings and numbers not complying with the Specifications and subsequently causing delays shall not be regarded as a valid base for claims. The Contractor may only commence manufacture or installation work subject to approval drawings, etc. after receipt of the approved documentation.

17. LABELLING AND NUMBERING

All equipment shall be labelled by means of a unique numbering system for ease of identification of the subsystem it is connected to as well as its location. The Contractor shall submit a numbering system as well as examples of the labels for approval by the Engineer. Silk screen printed labels shall be preferred.

All wiring and cabling shall be marked with PVC cable markers of proprietary manufacture. Each conductor shall have a unique number and the same number shall appear at both ends of each conductor. Wiring numbers shall appear on all as-built drawings.

18. SITE TESTS AND COMMISSIONING

The following minimum site tests shall be carried out by the Contractor and the results presented to the Engineer.

- system operation during normal conditions
- system operation during power fail conditions
- simulation of fire conditions at each detector
- simulation of signals at each unit
- functional test of each and every input and output
- operation of all peripheral devices
- printed confirmation of each test function and integrity of surge protection equipment

The Contractor shall be responsible to supply all the tools, materials, labour, and all equipment which may be required for testing.

19. AS BUILT DRAWINGS, OPERATING AND MAINTENANCE MANUALS

General requirements

The Contractor shall prepare and provide comprehensive as built drawings, maintenance and operating manuals of all the installations in accordance with the specifications as follows:

"As built" drawings of the complete fire detection system indicating floor layouts and detector positions on electronic format (Auto Cad and Pdf)

The documentation shall be neatly compiled in three sets of A4 sized manuals, which shall contain all the above information, reduced sized prints of the drawings and all other information which may be required in terms of the standard specifications as well as other information necessary to enable the employer to maintain, dismantle, re-assemble and adjust all parts of the works.

A pro-forma operating and maintenance manual shall be submitted to the Engineer for approval at least 3 weeks before the anticipated handing over date. Last minute attempts will not be acceptable.

The Contract will not be regarded as complete until all requirements in this regard have been met.

The manuals shall be detailed and shall be written to enable any supplier or maintenance organisation to maintain all components. The manuals shall contain at least the following as a minimum requirement:

Detailed fault finding procedures

Detailed fault finding procedures to be followed by maintenance personnel shall be listed. The procedures shall be clear, unambiguous and shall be so written to cover all eventualities in the event of failure or malfunction of any part of the system. The procedures shall also be so written, to enable maintenance personnel to perform detailed and accurate fault finding to card level using basic instruments.

The procedures shall list all readings which can be expected from a healthy or a faulty system. Test positions shall refer back to wire or terminal numbers as they appear on the wiring diagrams.

All special tool and test equipment which may be required shall also be listed.

20. REPAIR DURING THE 6 MONTHS DEFECTS LIABILITY PERIOD

The defects liability will be for a period of six months, calculated from the date of handing over of the project to the client. Payment of the balance of the retention money will be effected after the lapse of the defects liability, provided the installation has in the opinion of the Engineer, and been in satisfactory working order during this period.

The Contractor shall be responsible for the replacement of all faulty electronic equipment during the defects liability period.

Faulty equipment shall be attended to immediately and shall be replaced or repaired within 3 days of being instructed by the Engineer or the Engineer.

All repairs shall commence by written or verbal advice by the Engineer or the Engineer. Advice by facsimile shall be considered to be in writing. Should the Contractor fail to commence repairs to the faulty installation within 24 hours from the time of notification, the repair work shall be carried out by others and the cost thereof shall be deducted from funds held in retention. All repairs shall be carried out to the satisfaction of the Engineer.

All labour, material, transport and infrastructure costs incurred during the defects liability period shall be borne by the Contractor. No claims for payment in this regard will be considered.

21. TRAINING AND EVALUATION

The training of Staff forms part of this contract. Training shall commence at the outset of installation of the systems and continue during the commissioning period for each installation.

Comprehensive literature shall be supplied as part of the training course.

ELEVATOR / LIFT

Item	Technical Specification
Number of units	1
Type of service	Passenger Lift
Load	1000kg (13 Persons)
Speed	1m/s
Position of Macine	Shaft (Machine roomless)
Machine Type	Gearless synchronous
Number of stops / opening	5/5
Floors served	5
Entrances	Single
Control System	Microprocessor

Power drive	VVVF
Hoistway dimension	2000mm x 2000mm*
Pit Deph	1000mm
Overhead height	3800mm
Buffer type	Polyurethane buffer
Guide shoes	Sliding shoes
Car safety gear	Mechanical & Electrical actuated
Finishes & Design	
Faceplate	Stainless steel finish
Position Indicator	7segment
Call Button	Tactile - Illuminated
Car Door	
Type	Automatic sliding, centre opening
Door operator	VVVF
Door Finishing	Stainless steel finish
Obstruction sensing	Light curtain
Lock device	N/A
Sill	Extruded aluminium
Car Ceiling	
Type	Indirect lighting
Ventilation	Fan in ceiling with automatic switch
Car Walls	
Finishing	Stainless Steel**
Handrail	Stainless Steel
Car flooring	Granite
Arrival Gong	Yes
Hall finishes	
Call button	Tactile illuminated
Floor indicators	Overhead 7segment
Floor with indicators	All floors
Others	
Automatic Rescue Device	
Alarm & Emergency lighting	
Voice synthesizer	
Overload indicator (audio-visual)	
Door close & open push button	
Intercom	

* subject to final confirmation

**subject to clients final choice at no extra cost

SECTION VI

DRAWINGS

SECTION VII

BILLS OF QUANTITIES

BILL NO.1

GENERAL CONDITIONS OF CONTRACT AND PRELIMINARIES

Item	Description	Gh¢ GhP
A.	*Format of Bills of Quantities* These Bills of Quantities have been prepared in accordance with the "Standard Method of Measurement of Building Works",Seventh (7th) Edition (metric) Revised SMM7R (metric) dated July 1998 issued by the Royal Institution of Chartered Surveyors (R.I.C.S.) and the building Employers Confederation (B.E.C.) both of the United Kingdom. However, departures from this method of measurement (see General Notes on Method of Measurement) have been effected to reduce the number of measured Labour items and also to simplify certain other measured items. The Contractor must allow for this departures in his/her pricing so that his/her tender figure shall represent the total cost of all items of works involved in the project. No claim for extra payment will be entertained on the ground that method of the measurement adopted does not comply with the said Standard Method of Measurement.	
B.	*Prohibition of Use* The quantities given in the Bills of Quantities are not intended for ordering of materials/components. Quantities for use in ordering materials/components must be calculated by the Contractor by measurement on site or from contract drawings.	
C.	*Definition of Abbreviations* Abbreviations have been used in the Bills of Quantities for the units of measurement and the Contractor should take due notice of the under-mentioned: m^3/cu. m. - Cubic Metre m^2/sq. m. - Square Metre lm - Linear Metre mm - Millimetre kg - Kilogramme T/ton - Tonne No./Nr. - Number	
D	*Alterations to the Bills of Quantities* No alterations or qualifications of any kind whatsoever shall be made by the Contractor to the text of the Bills of Quantities unless authorised or directed in writing by the Engineer or Quantity Surveyor. If any unauthorised alteration or qualification is made by the Contractor, it will be ignored and the text prepared text will be rigidly adhered to.	
E	*Preamble References* To avoid long descriptions and repetitions, certain description of measured items contain only brief details of materials and/or workmanship and reference to a preamble clause. Whether specifically referred to or not, items in the preambles section in these Bills of Quantities are deemed to qualify and be part of every description of measured work to which they refer and shall be deemed to have been taken into consideration in pricing the whole of these Bills of Quantities.	
F	*Priced Bills of Quantities* Should there be a difference between a Contractor's Tender Sum and the arithmetically corrected Tender Figure of the "measured works" (after a complete technical and arithmetical check) an adjustment will be made to the rates by agreement. Conversely, a percentage adjustment shall be calculated by using the total amount of the errors in relation to the value of the "measured works" and thus leaving the original Tender Sum unaltered. Variations to the "measured works" in both approaches shall be subject to the same rate amendments or percentage adjustments respectively.	

	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*Provisional Sum* The Provisional Sum in these Bills of Quantities are used solely to indicate a gross amount inclusive of Contractor's profit and all other elements of loss. These sums will be expended or deducted in whole or in part as required by the Engineer and no claim for loss of profit will be entertained in this respect. The Contractor must not order expenditure against any work covered by Provisional Sums unless receipt of order in writing from the Engineer.	
B	*Prime Cost (PC) Sums* Prime Cost (PC) Sums included in these Bills of Quantities are for goods to be supplied by a Supplier or work to be executed by a Contractor both to be nominated by the Project Manager, P.C. Sums shall be understood to mean the NET amount expended in favour of such persons after deducting all discounts and shall include all taxes (where applicable) and the cost of packing, carriage/freight and delivery as specified. All such PC Sums are at the complete disposal of the Project Manager who may direct how they are expended, deducted in whole or in part from the Contract Sum. Following a PC Sum, provision has been made for the Contractor to insert an element of profit and attendance. The Contractor shall express the element of profit as a percentage of the PC Sum and that of attendance as a lump sum.	
C	*Price Adjustment* Adjustment for fluctuations in Basic Rates for labour and materials will be for the cost of inputs provided in the contract data and will be based on price adjustment formula at (Clause 47).	
D	*Description of the Works* The Works represented by these Bills of Quantities comprise: The removal of existing chain link fence and the design, supervision and construction of a new brick wall and 2no. security gate post. Prices for the above works are deemed to include for design, supervision and constructing of the works in the sequence required by the design as expressed in the contract documentation and as shown on the drawings accompanying these Bills of Quantities, including all necessary out of sequence working required by the form of construction, and the services installation. The sequence of works shall otherwise be at the Contractor's discretion.	
E	*Names of Employer and Consultants Named in the Contract* Employer: Minerals Commission of Ghana, P. O. Box M 258, Accra Consultant: Fasota Limited,Kumasi P.O. Box AH 8689, Kumasi . Drawings Refer to section VI for Drawings used in the preparation of these Bills of Quantities	
C.	*Tender Drawings* The drawings which have been used in the preparation of these Bills of Quantities but which are not supplied with the tender document may be inspected at the offices of the Project Manager by appointment only. The Contractor shall be deemed to have inspected a full set of the drawings other tender documents before tendering and no claim for want of knowledge in this respect will be entertained.	
	TO COLLECTION	

Item	Description	Gh¢ GhP

A.	*Definition of Terms* The following terms wherever used in this Schedule of Conditions of Contractor or in the Bill of Quantities shall have the various meanings set forth against them. "Employer" means Minerals Commission of Ghana. "Contractor" means the persons or partnership, firm or company who has or have signed this contract and includes his/her or their heirs, executors, assignees, successors and duly appointed representatives. "Project Manager" means person appointed from time to time by the Employer and notified in writing to the Contractor to act in that capacity or under him/her as his/her appointed representative to exercise any of his/her functions under the provisions of the contract. "Supervising Officer" means any Resident Engineer or Engineer or Clerk of Works or Works Superintendent appointed from time to time by the Project Manager or by the Consultant to watch and supervise the execution, completion and maintenance of the Works and to test and examine any materials to be used or workmanship employed in connection with the Works. "Quantity Surveyor" means any Quantity Surveyor appointed from time to time by the Project Manager or by the Consultant to act in that capacity. "Works" shall mean all or any portion of the works, materials/components and articles to be used in the execution of this project. "Site" means the land set apart and made available to the Contractor by the Employer upon which the Works under this contract are to be executed. "Drawing" means the drawings referred to any enumerated in the ARTICLES OF AGREEMENT and all supplementary drawings which the Project Manager may from time to time issue to the Contractor. "Extra Works" means any work not included in this Contract as shown on the Drawings or described in these Bills of Quantities or reasonably to be implied there from which the Consultant may direct the Contractor to execute during the performance of this contract. "Approved" means approved in writing by the Project Manager. "Direct" means directed in writing by the Project Manager.	
B.	*Conditions of Contract* The Articles of Agreement and Conditions of Contract shall be those contained in the Public Procurement Guidelines of the Public Procurement Authority of the Republic of Ghana Conditions of Contract for Medium Works as well as contained in this Contract. The following is a list of provisions referred to and the Contractor shall allow against each in his prices any sum or sums It may consider necessary to cover the cost involved in complying with them.	
C	*Clerk of works* Include the Provisional Sum of Gh¢85,000.00 to be paid to the Clerk of Works.	**85,000.00**
D	*Clerk of Works Accommodation* Include the provisional sum of (Gh¢30,000.00) for the provision of furnished residence for Clerk of Works	**30,000.00**
E	*Fuel for resident team* Include the provisional sum of (Gh¢60,000.00) for fuel allowance to the resident team	**60,000.00**
	TO COLLECTION	

Item	Description	Gh¢ GhP
A.	Clause No. 1 Definitions	

	Clause No. 2	Interpretation	
	Clause No. 3	Language and Law	
	Clause No. 4	Duties and Authority of Project Manager	
	Clause No. 5	Delegation	
	Clause No. 6	Communications	
	Clause No. 7	Subcontracting	
	Clause No. 8	Other Contractors	
	Clause No. 9	Personnel	
	Clause No. 10	Employer's and Contractor's Risks	
	Clause No. 11	Employer's risks	
	Clause No. 12	Contractor's Risks	
	Clause No. 13	Insurance	
	Clause No. 14	Site Investigations Report	
	Clause No. 15	Queries about the Contract Data	
	Clause No. 16	Contractor to Construct the Works	
	Clause No. 17	The Works to be completed by the Intended Completion Date	
	Clause No. 18	Approved by the Project Manager	
	Clause No. 19	Safety	
	Clause No. 20	Discoveries	
	Clause No. 21	Possession of the Site	
	Clause No. 22	Access to the Site	
	Clause No. 23	Instructions	
	Clause No. 24	Disputes	
	Clause No. 25	Procedure for Disputes	
	Clause No. 26	Replacement of Adjudicator	
	Clause No. 27	Programme	
	Clause No. 28	Extension of the Intended Completion Date	
	Clause No. 29	Acceleration	
	Clause No. 30	Delays Ordered by the Project Manager	
	Clause No. 31	Management Meetings	
	Clause No. 32	Early Warning	
	Clause No. 33	Identifying Defects	
	Clause No. 34	Test	
	Clause No. 35	Correction of Defect	
	Clause No. 36	Uncorrected Defects	
	TO COLLECTION		

Item	Description		Gh¢ GhP
	Cost Control		
	Clause No. 37	Bills of Quantities	
	Clause No. 38	Changes in the Quantities	
	Clause No. 39	Variations	
	Clause No. 40	Payments for Variations	
	Clause No. 41	Cash Flow Forecasts	
	Clause No. 42	Payment Certificates	
	Clause No. 43	Payments	
	Clause No. 44	Compensation Events	
	Clause No. 45	Tax	
	Clause No. 46	Currencies	
	Clause No. 47	Price Adjustments	
	Clause No. 48	Retention	

	Clause No. 49 Liquidated Damages Clause No. 50 Advance Payment Clause No. 51 Securities Clause No. 52 Dayworks Clause No. 53 Cost of Repairs Clause No. 54 Completion Clause No. 55 Taking Over Clause No. 56 Final Accounts Clause No. 57 Operating and Maintenance Manuals Clause No. 58 Termination Clause No. 59 Payment Upon Termination Clause No. 60 Property Clause No. 61 Release from Performance	
A.	*Performance Bond* The Contractor shall be required within fourteen (14) days of the signing of the contract to enter into a written, signed and witnessed bond to guarantee the due performance of the works in the sum of thirty percent (30%) or ten percent (10%) of the total amount of the contract for performance bond or performance guarantee respectively. The acceptance of a Performance Bond obtained by the Contractor with a Bank or Insurance Company shall be at the sole discretion of the Employer. The bond will remain in force until such time as the Contractor has made good the defects notified to him/her by the Engineer in accordance with the Conditions of Contract. It shall be deemed that the Contractor has made due allowance in his/her tender for the cost of obtaining the bond to collection the bond.	
B	*Advance Guarantee* Should any advance be given, the Contractor shall provide as a condition precedent, an acceptable advance guarantee from a Bank or Insurance Company covering the amount of the advance until its repayment in full.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*Direct Payments* The Direct Payment are for works, materials/components to be provided either by the Employer or by persons directly contracted to/or directly engaged by him/her. The sums will not be paid to or through the Contractor. They will be deducted in full from the contract sum as and when the works and materials/components are delivered.	
B	*Setting Out the Works* At commencement of the contract and during progress of the works, the Contractor shall set out the whole of the works in accordance with the drawings and in conjunction with levels and measurements taken on the site and shall be responsible for the accuracy thereof, and if inaccurate, for making alterations as required by the Engineer. The Contractor shall perform all setting out by a method to be approved by the Engineer and provide all instruments, templates, rods and setting out boards etc. as may be necessary for this purpose and where required maintain these for reference during the progress of the works. The Contractor shall protect and preserve all bench marks, site rails, pegs and other items used for setting out the works.	

C	*Existing Materials on Site* Sand, gravel, vegetable soil, turf and other materials obtained from the site shall remain the property of the Employer until removed from the site in accordance with the contract. Excavations shall not be made or enlarged for the purpose of obtaining such materials. These materials shall not be used for any purpose other than for the execution of the works.	
D	*Maintenance of Services* The Contractor shall protect, uphold, temporarily direct and maintain all pipes, ducts, drains, sewers, service mains, overhead cables and the like during the execution of the works. The Contractor shall make good damage to any cause within its control at its own expense or pay any costs and charges in connection therewith. Approval shall be obtained at least two (2) weeks in advance if any services have to be interrupted.	
E	*Temporary Accommodation for the Employer* The Contractor shall at his/her own expense provide and erect suitable offices of not less than fourteen (14) square metres in floor area for the exclusive sue of the Engineer, Clerk of Works, Engineer(s) and Quantity Surveyor consisting of two (2) separate rooms complete with plan chest, tables and chairs, other furniture and equipment including the supply of electricity. The Contractor shall provide and maintain temporary sanitary accommodation and facilities for the exclusive use of the Engineer, Clerk of Works, Engineer(s)) and Quantity Surveyor. After, shift and adapt from time to time as necessary and clear away on completion.	
F	*Temporary Name Board* The Contractor shall provide a timber notice board at the entrance of the site bearing the names of the Project, Contractor, and all Consultants. The size, design and colour of the notice board shall be subject to the approval of the Engineer.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*Advertising Right* The Contractor shall not display any other notice or advertisement in any form on any part of the site, works, hoardings or adjoining ground without the prior approval in writing of the Engineer.	
B	*Telephone for the Employer* The Contractor shall provide and maintain an independent telephone service to the Employer representative's temporary site office for the full period of the works and pay all connection charges and expenses. The cost of telephone calls made on behalf of the Employer from the telephone is given as a Provisional Sum.	**25,000.00**
C	*Confirmation of Verbal Instructions* The Contractor shall keep on site at all times a record of all verbal instructions and shall send copies to the Engineer and Quantity Surveyor within seven (7) days of these being given.	
D	*Surveying Equipments* The Contractor shall provide and keep on the works a level tripod and staff for the sole use of the Clerk of Works and other artisans employed directly by the Employer. The instrument shall be maintained in proper adjustment by the Contractor who shall also provide all necessary attendance. NOMINATED SUB-CONTRACTORS, SUPPLIERS AND PUBLIC BODIES	

E	*Nominated Sub-Contractors* The Contractor shall be responsible for the supervision and administration of any Nominated Sub-Contractor in accordance with the Conditions of Contract and will be required to arrange a programme with each Nominated Sub-Contractor. Works required to be executed by a Nominated Sub-Contractor are given as Prime Cost (PC) Sums.	
F	*Payments to Nominated Sub-Contractors* At the time of every valuation of the works for Interim Certificate purposes, the Contractor shall submit in duplicate (through Consultants as applicable) with one copy to the Quantity Surveyor, a statement from each of the Nominated Sub-Contractors showing: I. ► The gross amount (including cash discount and retention) claimed in the current valuation. II. ►The amount received from the Contractor to date before deduction of contra charges. Amount in respect of Nominated Sub-Contractors will not be included in valuation unless these statements are receive in good time. These statements will be accepted as "reasonable proof" of payments to the Nominated Sub-Contractor, however, in addition, the receipted invoices of Nominated Sub-Contractors, shall be submitted to the Quantity Surveyor as a proof of such payments.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*General Attendance* The Contractor shall allow against the items following each Prime Cost Sum described as "General Attendance" for nominated Sub-Contractors. This item is to include for use of the Contractors temporary roads, paving and paths, standing scaffolding, standing power, operated hoisting plant, the provision of temporary lighting and water supplies, clearing away rubbish, provision of space for the Nominated Sub-Contractors own offices and for the storage of plant and materials and the use of messrooms, sanitary accommodation and welfare facilities.. In addition, the Contractor shall give such facilities as the Engineer may consider reasonable to all Nominated Sub-Contractors or Companies employed upon the works. The Contractor shall give all such Nominated Sub-Contractors or Companies all information reasonably necessary to enable them to set out and execute their work properly in harmony with the surroundings and with other regards and shall not allow them to proceed otherwise.	
B	*Special Attendance* Where required, the Contractor shall allow against the items following some Prime Cost Sums described as "Special Attendance" for some Nominated Sub-Contractors shall be given as an item in each case giving particulars (e.g. unloading, storing, hoisting, placing in position, providing power and additional or special scaffolding). The Contractor will be required to produce evidence to the Engineer that a Sub-Contract agreement has been entered into with each Sub-Contractor and when required, produce relevant documents to the Engineer for inspection. The Engineer will require proof of payment of previously certified monies to Nominated Sub-Contractors before certifying any and/or final payment.	

C	*Provisional Sums Tendered for by Contractor* Should the Contractor tender for work covered in the Bill of Quantities by a Provisional Sum, the Contractor will be deemed to have included for all profit, overheads, discounts etc., required by him/her in his/her Sub-tender and the Provisional Sum included in these Bills of Quantities together with any profit shall be omitted if his/her tender is accepted.	
D	*Builder's Work* Unless otherwise stated, Builder's Work in connection with Nominated Sub-Contractor's Work shall be measured separately. The Contractor shall be responsible for ascertaining and co-ordinating Nominated Sub-Contractors requirements for all holes, chases, fixings and the like to structural concrete, block work and for obtaining the prior approval of the Engineer thereto. Holes and chases in concrete shall be formed at the time of casting the concrete and shall not be cut later, except with the approval of the Engineer. No claim shall be considered for the extra cost of cutting away work already built as a result of the failure of Contractor to obtain sufficient particulars before hand.	
E	*Nominated Suppliers* Nominated Suppliers are given at Prime cost Sums. The Engineer reserves the right to inspect the relevant contracts of sale of all Nominated Suppliers.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*Fix Only* The term 'FIX ONLY" used in connection with the fixing of goods and materials obtained from a Nominated Supplier shall be held to include in addition to the stipulations in the Standard Method of Measurement, the opening of crates and packages, inspecting goods and materials before taking delivery, notifying the Nominated Supplier of any breakages or deficiencies and ensuring rectification of any irregularities. No claim will be considered for extra costs or delay in consequence of any neglect on the part of the Contractor to carry out such inspection. The Contractor shall allow for taking delivery of goods at the Nominated Suppliers warehouse (where applicable and transporting it to site). It must allow in addition for providing adequate and effective insurance cover for all materials from the point at which the suppliers insurance liability ceases until the time that such materials components are installed.	
B	*Contractor's Responsibility* The Contractor shall be responsible for agreeing with each Nominated Sub-Contractor/Supplier the dates at which It will require their respective approved drawings so that the works can progress regularly and diligently and shall keep the Engineer informed of all such agreed dates. GENERAL FACILITIES AND OBLIGATIONS	
C	*Plant, Tools and Vehicles* The Contractor shall provide, maintain and remove on completion mechanical and other plant, transport, fuel, tols, tackle, scaffolding, stagging, instruments, implements and equipment of every description necessary for the full and complete execution of every part of the works. All work in connection with plant, scaffolding, staging, working accommodation, and the like shall be executed and maintained to the requirements of the Area Local Authority and to the satisfaction of the Engineer.	
D	*Grid of Levels* Immediately on hand over of the site and before any work has been commenced, the Contractor shall arrange for a grid of levels to be taken of the site in the presence of and	

	agreed by the Engineer and shall supply the Engineer and Quantity Surveyor with copies thereof.	
E	*Warning Lights* The Contractor shall provide and maintain all necessary temporary warning lights and notices in connection with scaffolding, fans, gantries, guardrail, hoardings and the like.	
F	*Working Drawings* The Contractor shall keep working drawings for all works on site at all times pasted on approved flat board and protected at all times from damage.	
G	*Articles of Value and Burial Remains* All coins or articles of value or antiquity which may be discovered in the excavations and/or on the site shall remain the property of the Employer and must be delivered up to the Engineer for instructions. The Contractor shall, on discovery on site of bones or burial remains, adequately protect same and inform the Engineer for instructions.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*Contractor's Supervision* The Contractor shall provide full and adequate supervision during the progress of the works and shall keep a competent and authorised person (approved by the Engineer) in-charge of the works at all reasonable times. Such a person in-charge shall be responsible for the supervision, co-ordination and administration of the works and must be able to receive and act upon (on behalf of the Contractor) all instructions, directions or orders issued by the Engineer or his/her representative.	
B	*Obligations of Contractor* The Employer may engage other specialists, artisans or workers to execute works not forming part of this contract. The Contractor shall be deemed to have made allowance for his/her responsibilities and obligations in connection with any persons directly engaged by the Employer.	
C	*Co-ordination etc. of Work not Forming Part of this Contract* The Contractor shall be responsible for the co-ordination of work not forming part of this contract with the remainder of the works. The Contractor shall provide the various Authorities or Specialist Companies carrying out such work with sufficient information regarding line, level etc. as shown on the drawings, to enable them to provide and lay mains, cables etc. along routes on or adjacent to the site without any undue delays or interruptions and to suit the programme for the works.	
D	*Temporary Sheds* The Contractor shall provide and maintain temporary water-tight lock-up sheds for the storage of materials, tools and tackle for the use of all persons employed on the site including Nominated Sub-Contractors/Suppliers and others. |After, shift and adapt from time to time as necessary. Those sheds used for storage of cement and other perishable materials and the like shall have raised floors. Reinforcing bars, pipes and the like shall be racked under cover. Clear away on completion and reinstate all works disturbed.	
E	*Temporary Office Accommodation* The Contractor shall provide and maintain adequate office and other temporary accommodation and facilities for the use of the Contractor's site staff and for site meetings. After, shift and adapt from time to time as necessary and clear away on completion.	

F	*Temporary Fencing, Hoardings, Screens Fans and Similar Items* The Contractor shall provide and maintain all necessary temporary hoardings, screens, fencing and gates to adequately enclose all the boundaries of the site for the duration of the contract for the protection of the public and for the proper execution of the works. Clear away on completion and reinstate all works disturbed.	
G	*Maintenance of Public and Private Property* The Contractor shall maintain public and private property (i.e. carriageways, footpaths, ditches, kerbs and the like) and shall keep the approach to the site free from excavated material, mud and debris. The Contractor shall be held responsible for and must make good at his/her own expense any damage caused in carriageways, kerbs, pavements, pavings, lamp posts, fencing, drain pipes, cables, main services etc. arising from the execution of the works.	
H	*Temporary Roads, Hardstandings, Crossovers and Similar Items* The Contractor shall provide and maintain as necessary all temporary roads, tracks, paths, hardstandings, shed bases, pavement, crossovers, and other temporary works and the like including those required by Nominated Sub-Contractors/Suppliers and others. Clear away on completion and reinstate all works disturbed.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*Temporary Sanitary Accommodation* The Contractor shall provide, maintain and keep in a hygienic condition adequate temporary sanitary accommodation and facilities for all persons employed on the works including Nominated Sub-Contractors. Alter, shift and adapt from time to time as necessary. On completion of the works, the Contractor shall remove/ clear the said facilities, disinfect the ground and leave same in a clean and orderly manner.	
B	*Site Meetings* The Contractor shall hold progress meetings which shall be attended by representatives of all Nominated Sub-Contractors/Suppliers engaged on the works, (and required by him/her to be present) to co-ordinate progress and ensure that the programme is met in all aspects. As soon as practicable, after the progress meeting, the Contractor shall convene a site meeting to be chaired and recorded by the Engineer and attended by all Consultants and such other parties as may be appropriate. The Contractor shall be responsible for circulating minutes to all appropriate Nominated Sub-Contractors and for informing them of meetings and for providing the usual facilities and services required by such meetings.	
C	*Site Security* The whole of the works including those of Nominated Sub-Contractors shall be under the protection of the Contractor until the works are formally handed over to the Employer. Therefore, the Contractor shall safeguard the works, materials and plant against damage or theft. It will provide all necessary watching and lighting for the security of the works and the protection of the public. It will provide shelter and fuel for any watchman as required. The Contractor shall be held responsible for the theft of any materials, plant, tools etc. while executing the works.	
D	*Protection of Works* The Contractor shall allow for protecting, in an approved manner, all parts of the works liable to damage from the effects of the sun, rain, drying winds or other unfavourable weather conditions. It shall further include for casing or otherwise suitably protecting all work of any description from any injury or damage arising out of the execution of the works. Should any part of the works become damaged, it must be reinstated to the Engineer's satisfaction and at the Contractor's sole expense.	
E	*Protection Against Damage and Injury*	

	The Contractor shall allow for providing all temporary fans, gantries, hoardings, guardrails, special protection and other means to all sides of the works and site as necessary to fully and efficiently protect adjoining property, persons, vehicles and the like from damage or injury and as required for the proper execution and completion of the whole of the works. It shall indemnify the Employer against all such damage or injury and reinstate and make good any damage caused.	
F	*Water for the Works* The Contractor shall provide water required for the works including that required by Nominated Sub-Contractors. The Contractor shall provide temporary arrangement for storing and distributing water on the site and alter, adapt and maintain as required and clear away on completion and pay all fees and charges in connection. All work in connection with the water supply shall be executed in accordance with the requirements of the Local Water Company.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A.	*Temporary Lighting and Power* The Contractor shall provide all necessary temporary electric lighting and power for the works, including that required by Nominated Sub-Contractors. The Contractor shall make temporary arrangement for distributing power on the site and alter, adapt and maintain as required and clear away on completion and pay all fees and charges in connection. All such electrical work shall be executed in conformance with the requirement or regulations of the Local Electricity Company	
B.	*Social Security Act* The Contractor shall allow for all costs arising out of the Social Security Act.	
C	*Fair Wages* The Contractor shall pay rates and wages and observe hours and conditions of labour which are not less favourable than the general level of wages, hours and conditions observed by other Building Trade Employers whose general circumstances in the Construction industry are similar.	
D.	*Police Regulations* The Contractor shall allow for all costs arising from restrictions that may be imposed by the Police or other Authorities upon the execution of the works.	
E.	*Programme Chart* Within fourteen (14) days of the order to commence the works, the Contractor shall prepare and submit for the Engineer's approval a comprehensive programme chart covering all aspects of the works showing earliest and latest start and finish dates for each activity including all Nominated Sub-Contract work. The Contractor shall allow for preparing four (4) sets at monthly intervals or at stages to be determined by the Engineer.	
F	*Safefty, Health and Welfare* The Contractor shall be responsible for the welfare of all work people engaged upon the works and shall maintain all Safety, Health and Welfare measures for their protection. Amenities are to be provided of a suitable standard and are to be in accordance with any statute applicable. The Contractor shall recognise and allow for all statutory and religious holidays and rites.	
G	*Hard Hat and Protective Clothing* The Contractor shall provide all site operatives with protective clothing such as hard hat and protective foot wear (i.e. wellington boots) to protect such operatives from head and foot injury. The Contractor shall also provide all visitors to the site including all resident construction professionals with protective clothing such as hard hat and wellington boots and insist on their use.	
H	*Expenses on Labour*	

	The Contractor shall allow for all emoluments and expenses arising out of Government, Trade Union and other applicable rules for the Construction Industry. Allow for all costs including transport in sending out or bringing labour to the site. Allow for all payments in respect of holidays with pay, the application of any bonus scheme and for all overtime and incentives which the Contractor may offer in order to attract and retain the necessary labour on the site and to achieve the date for completion.	
J	*Labour Returns* The Contractor shall keep an accurate record of the labour employed on the project. The details shall be submitted weekly to the Engineer for his/her records.	
K	*Dismissal of persons from Site* Any person employed on the works who in the opinion of Engineer is incompetent or who may act in an improper manner shall be immediately dismissed from the works by the instructions of the Engineer.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A.	*Working Hours and Overtime* The Contractor shall carry out the works during normal working hours. If the Contractor wishes, for any reason, to work overtime, It shall, except in the case of emergency, first obtain permission from the Engineer and give at least two (2) full working days notice. No extra payment will be allowed in respect of overtime working. The Contractor is required to state the basic working hours per day of his/her work people upon which his/her tender is based. This information shall be given prior to production on site.	
B.	*Adverse Weather* During adverse weather conditions, the Contractor shall suspend concreting and plastering for such time as the Engineer may direct and shall protect from injury all works then in the course of construction.	
C.	*Dayworks* Should it be found in the opinion of the Engineer that, by reason of their intricate nature or exceptional circumstances, works ordered by him/her cannot be fairly valued at the schedule of rates for measured works, It may order these to be carried out on time and material (daywork) basis as Contract Condition 10(d) and defined in Appendix IV. The Contractor shall give notice to the Engineer or his/her representative on the commencement and completion of any work for which It intends to submit Daywork Vouchers. The Contractor shall keep an accurate record of time spent and materials and plant used on each separate instruction given. Daywork voucher shall be numbered and shall describe fully the instructions to which they refer and they shall be summarised, fully priced and submitted to the Engineer each week with a copy to the Quantity Surveyor. The submission of such Daywork voucher does not necessarily mean that the works will be valued under Contract Condition 19(d).	
D	*Certificates and Payments* The Contractor shall supply the Quantity Surveyor with detailed priced statement of work executed and details of materials supplied to assist the Quantity Surveyor in the valuation of the amount to be certified by the Engineer for an interim payment. Preliminaries shall be valued on a proportion of work properly executed (rather than on a time basis) after due allowance having been made for initial site set up and final site clearance.	
E	*Removing Water* The Contractor shall allow for bailing, pumping or otherwise removing all water (whether arising from the nature of the ground, weather, springs, drains or any other source) which may accummulate in the excavation or elsewhere on the site during the progress of the works. The Contractor should allow here also for keeping the excavation and the works free from water in the ground below water level.	

F	*Removing Rubbish etc.* The Contractor shall remove all rubbish from site both as it accummulates from time to time and at completion. The Contractor shall clean the works inside and out, remove stains and touch up paintwork and polished work and shall leave the whole works clean, ready for occupation and to the satisfaction of the Engineer. On completion of the works, the Contractor shall remove from site all plant, building appliances, apparatus or equipment and unused or surplus materials together with all rubbish, debris, (including that of Nominated Sub-Contractors) all temporary buildings, sheds, barriers, scaffolidng and the like and shall make good all works disturbed.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A.	*Progress Photographs* The Contractor shall allow for supplying four (4) copies of progress photographs (in full plate size) monthly to the Engineer throughout the duration of the contract.	
B.	*Records Keeping* The Contractor shall keep accurate dated record in the form of "works diary" on the site recording the weather, the number of men employed in all trades, progress of the works, temperature, delivery of materials to the site, visitors and other events influencing the progress and quality of the works. Proper delivery notes of materials etc. (stating the name of the project) shall be kept and presented to the Engineer or his/her representative for inspection.	
C.	*Inspection of Invoices and Receipts* The Contractor shall, whenever required, produce for inspection all invoices and receipted account relating to the project. Such invoices and accounts may be retained by the Engineer and/or Quantity Surveyor for inspection and will be returned to the Contractor with all convenient speed.	
D.	*Checking Schedules, Drawings and Information* The Contractor shall be responsible for checking all schedules, drawings and all other information supplied by the Engineer. In the event of any discrepancy between the schedules, drawings and the like, the Contractor shall report the discrepancy to the Engineer for his/her instructions. Should the Contractor consider the need for a detailed drawn information It shall apply for such detailed drawn information at least four (4) weeks before the works concenred are to be executed.	
E.	*Quality of Materials and Workmanship* Where and to the extent that materials/components, products and workmanship are not fully described in these Bills of Quantities, such materials/components shall be deemed to be: 1. New materials/components 2. Suitable for the purpose of the works stated in or reasonably to be inferred from the Contract Documentation. 3. In accordance with good building practice.	
F	*Publicity* The contract documents and everything contained therein shall be treated as private and confidential. In particular, no information, drawing or photograph concerning the works shall be published unless previously approved in writing by the Engineer.	
G	*Materials Short Supply* The Contractor shall order in advance any material in short supply and shall allow in his/her tender for any additional cost of double handling, special storage requirement and the like.	
H	*Material Deliveries* The Contractor shall be responsible for ensuring that all building materials, plant etc. including that of Nominated Sub-Contractors are available at the site at the proper time for use in the works, and shall make all necessary enquiries, throughout the progress of the works to ensure continuity of supplies.	

	The Contractor shall make an allowance which It may consider necessary for additional handling of materials and provision of storage accommodation by reason of the necessity for him/her to accept deliveries of materials in advance of requirements so as to obviate any delays which may be occasioned by transport and delivery difficulties.	
J	*Responsibility for Offshore Materials* The Contractor shall take full responsibility for obtaining any offshore materials specified and where such materials are not readily obtainable locally, the Contractor shall obtain the necessary import licences and/or exchange control permits and all cost of obtaining licences, foreign exchange and all additional charges for importation and delivery to the site are deemed to be included in his/her rates.	
	TO COLLECTION	

Item	Description	
A.	*Equivalent Materials* Where applicable or processes are specified, the Contractor may propose an equivalent material or process as an alternative thereto but no such material or process shall be used in the works without prior consent in writing by the Engineer.	
B	*Testing of Materials* The contractor will be required to carry out geotechnical and materials test on site and to prepare,pack and dispatch when instructed to do so by the Consultant.	**30,000.00**
C	*Approval of Samples* Where and to the extent that products, materials/components and work are specified to be approved, or if the Engineer instructs or requires that they are to be approved, the same must be supplied and executed to comply with all other requirements and in respect of the stated or implied characteristics either: 1. To the express approval of the Engineer or 2. To match a sample expressly approved by the Engineer as a standard for the purpose. The Contractor shall provide all samples or other evidence of suitability and retain for comparison with products, materials/components and finjshed work included in the works and remove from site when no longer required. Inspection or any other action by the Engineer must not be taken as approval of materials/components, products or work unless the Engineer so confirm in writing stating: 1. Date of inspection 2. Part of the works inspected. 3. Respects of characteristics which are approved. 4. Extent and purpose of the approval. 5. Any associated conditions.	
D	*Fire Precuations* The Contractor shall take all the necessary precautions to eliminate all fire hazards and prevent fire damage works, building materials/components, equipment and all other property both public and personal involved or in connection with the project. All oil and petrol containers shall be kept in suitable sheds.	
E	*Defective Materials and Workmanship* The Contractor shall use only the specified materials in the execution of the works in a proper manner. All unspecified materials and faulty workmanship shall be rejected by the Engineer. Upon receipt of notice of any rejection, the Contractor shall remove such unacceptable materials and/or defective workmanship from the works and shall be replaced with the specified materials and workmanship in a satisfactory manner.	
F	*Examination of the Works* No completed part of the works shall be covered up until it has been examined and declared satisfactory by the Engineer.	

	The Contractor shall, if required by the Engineer, at his/her own cost open up completed works and search for the cause of any defect, imperfection or fault. The Contractor shall at his/her own cost repair, rectify and make good that defect, imperfection or fault to the Engineer's satisfaction.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
A	*Trespass and Nuisance* The Contractor shall take all reasonable precaution to prevent a nuisance or inconvenience to the Employer and owners, tenants or occupiers of adjoining properties and to the general public. The Contractor shall prevent his/her operatives from entering any adjoining land or property other than that in which It is actually employed, and the Contractor will be held responsible for any loss or damage which can be ascertained and proved to have been occasioned by his/her operatives.	
B	*Operating and Maintenance Manual* The Contractor shall arrange for and provide the Engineer at completion and handover of the works, with an operating and maintenance manual containing manufacturer's printed brochures covering all items of plant, equipment and controls used for electrical installation, cold and hot water installation and fire fighting equipment. The brochures shall also contain: i. Names and address of the Sub-Contractors nominated for the installation together with all the required guarantees. ii. Names, addresses and telephone numbers for component producers and places where services or spare parts may be obtained. iii. Complete, typed and detailed instruction sheets for correct identification of each item of equipment and/or controls. iv. A general description of the scope, purpose and manner of working of each system of automatic control apparatus. v. Data on general design parameters and associated normal operating temperatures, pressures etc. based on the commissioning tests. vi. Clear and comprehensive instructions for the starting up, running or shutdown of each system or apparatus. vii. Instructions in respect of the care of apparatus normally subject to seasonal disuse.	
C	*Handover of Completed Works* The Contractor shall allow for and comply with the following requirements for handover of the works or where the Employer with the consent of the Contractor shall take possession of any part or parts of same. The Contractor must give to the Engineer a written notice of time not more than eight (8) weeks and not less than four (4) weeks before the date by which the Contractor proposes that the works or any part thereof for handover shall reach Practical Completion. (The Engineer will require to obtain the Employer's agreement to all proposals made by the Contractor for handover of any part or parts of the Works). Following receipt of written notice from the Contractor of any proposed date(s) for handover(s), the Engineer will require to satisfy himself/herself that the Works or the relevant part(s) thereof, are in a sufficient state of readiness to attain Practical Completion by the date(s) proposed.	

	The Engineer will inspect the Works and subject to his/her being so satisfied will make provisional arrangements for handover and may issue to the Contractor a list of items requiring rectification or completion before handover. The issue of such a list does not relive the Contractor of any of his/her obligations under the Contract. (If the Engineer does not consider the Works or the relevant part(s) to be in a sufficient readiness, then it is for the Contractor to bring the Works or relevant part(s) up to that stage and to inform the Engineer in writing when It has done so). As soon as the Contractor has satisfied himself/herself that all such items have been completed or remedied, It shall notify the Engineer in writing. The Engineer will then make a preliminary check and provided this shows that no more than minor items of work remain to be attended to and the Contractor undertakes to do so before handover, the Engineer will agree on the date for the normal handover inspection. Such inspection will be made by the Engineer in the presence of duly authorised representatives of the Contractor and of the Employer. Subject to the Engineer being of the opinion that the Works or the relevant part(s) thereof are practically completed, within the meaning of Clause 2, 9, they shall be deemed to have reached Practical Completion on that day and the Engineer shall certify accordingly.	
	TO COLLECTION	

Item	Description	Gh¢ GhP
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SECTION VIII

SECURITY FORMS

ANNEX A FORM:

BID SECURITY (BANK GURANTEE)

Whereas, (name of Bidder) hereinafter called "the Bidder) has submitted his Bid dated (date) for the construction of (name of Contract) 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) 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 Sealed 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 the date (number) days after the deadline for submission of bids as such deadline is 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 of the Bank _____

Witness _____ Seal _____

_____

(Signature, name, and address)

ANNEX B FORM (ALTERNATIVE 2): PERFORMANCE BOND GUARANTEE (UNCONDITIONAL)

By this Bond, (Name and address of Contractor) as Principal (hereinafter called "the Contractor") and (name, legal title, and address of surety, bonding company, or insurance company) as Surety (hereinafter called "the Surety"), are held and firmly bound unto (name and address of employer) as Obligee (hereinafter called "the Employer") in the amount of (amount of Bond) (amount of Bond in words), 3 for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Contractor and the Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

Whereas the Contractor has entered into a Contract with the Employer dated [4] the (day) day of (month), (year) for (name of contract) in accordance with the document, plans, specifications, and amendments thereto, which to the extent herein provided for, are by reference made part hereof and are hereinunder referred to as the Contract.

Now, therefore, the Condition of this obligation is such that, if the Contractor shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise it shall remain in full force and effect. Whenever the Contractor shall be and declared by the Employer to be, in default under the contract, the Employer having performed the Employer's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

(1) complete the Contract in accordance with its terms and conditions; or

(2) obtain a Bid or bids from qualified bidders for submission to the Employer for completing the Contract in accordance with its terms and conditions, and upon determination by the Employer and the Surety of the lowest responsive Bidder, arrange for a Contract between such Bidder and Employer and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract Price; but not exceeding including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "Balance of the Contract Price," as used in this paragraph, shall mean the total amount payable by the Employer to the Contractor under the Contract, less the amount properly paid by the Employer to the Contractor; or

(3) pay the Employer the amount required by the Employer to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

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[1] An amount is to be inserted by the Surety, representing the percentage of the Contract Price specified in the Contract Data, and denominated either in the currency(ie) of the Contract or in a freely convertible currency of type and amount acceptable to the employer.
[4] Date of Letter of Acceptance or Agreement.

Any suit under this Bond must be instituted before the expiration of one year from the date of issuance of the Certificate of Completion.

No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Employer named herein or the heirs, executors, administrators, successors, and assigns of the Employer.

In testimony whereof, the Contractor has hereunto set its hand and affixed its seal, and the Surety has caused these presents to be sealed with its corporate seal duly attested by the signature of its legal representative, this (day) day of (month), (year).

Signed by _____

On behalf of (name of contractor) in the capacity of _____

In the presence of _____

Date _____

Signed by _____

On behalf of (name of Contractor) in the capacity of _____

In the presence of _____

Date _____

Annex C Form: Bank Guarantee for Advance Payment

To: (name and address of Employer)

(name of Contract)

Gentlemen:

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).[5]

We, the (Bank of 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). [6]

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/Financial Institution: _____
Address: _____
Date: _____

_____

[1] 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.

[6] 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.