

TENDER DOCUMENTS

REFURBISHMENT OF INDIA HOUSE

21-23 Trinidad Crescent Federation Park

Architects

JASPAL BHOGAL ASSOCIATES

Mechanical & Electrical Engineers

JAIN CONSULTANTS T&T LIMITED

Structural Engineers

K S & P LTD

Quantity Surveyors

WR PARTNERSHIP

DEC 2019

No. Trin/872/12/2016/2
High Commission of India
Port of Spain

TENDER FOR SELECTING CONTRACTOR
FOR
Embassy Residence Renovation Project

Tender Documents

Tender Contents

A. Technical Bid Documents:

- Document I : Invitation to Tender
- Document I – S-I : Instruction to Bidders (Section-I)
- Document I – S-II : Introduction and Credentials of Bidder (Section-II)*
- Document I – S-III : Terms and Conditions of contract (Section-III)
- Document I – S-IV : Scope of Work (Section-IV)

B. Financial Bid Documents:

- Document II : Schedule of Quantity/Items/Bill of Quantities (BOQ) for calculating variations – Bidder is to provide anticipated quantity of each item along with rates as they would be supplied. Additional items may be quoted by Bidder. (Section-V)
- Document III : Form of Tender - Financial bid letter (Section-VI)
(Lump sum fixed price to be quoted on this form by Bidder)
- Document IV : Standard formats for Earnest Money Deposit (EMD)/Guarantee, etc. (Section-VII)
- Appendices:
1. Percentage Mark Up on Rates
 2. List of Tender Drawings
 3. Mechanical and Electrical Tender Documents

* Section-II - Documents about the credential of the bidder, resources, company brochures, construction methodology, experience, management techniques, and any other information about bidder – These documents are to be supplied and attached by the bidder.

A : TECHNICAL BID DOCUMENTS

Document 1: Invitation to Tender

**No. Trin/872/12/2016/1
High Commission of India
Port of Spain**

**NOTICE INVITING TENDER FOR SELECTING CONTRACTOR
FOR
*Embassy Residence Renovation Project***

The President of India acting through the **High Commissioner of India in Port of Spain, Trinidad and Tobago** requests proposals in sealed envelopes from appropriately qualified and adequately experienced Contractors for **Embassy Residence Renovation**. The proposal duly completed in prescribed format as per Notice Inviting Tender (NIT) along with Earnest Money Deposit (EMD) of **TT\$ 194,410.00 (VAT Incl.)** must reach office of **Mr. Ashoka Mandal, Second Secretary (CCP)**, cons.pospain@mea.gov.in, **Phone no. 3510758**) on or before **17.02.2021 (4.00 pm)**. The detailed tender document along with its annexure may be downloaded from Central Procurement Portal <https://eprocure.gov.in/cppp/> and also the official website of the **High Commission of India, Port of Spain** at [https:// www.hciapos.gov.in](https://www.hciapos.gov.in)

2. The objective of this Notice Inviting Tender is to select an appropriately qualified and adequately experienced Contractor by the **High Commission of India in Port of Spain, Trinidad and Tobago** for **Embassy Residence Renovation**.

3. Location and description of Property:

**Embassy Residence, Indian House Situated at #21-23, Trinidad Crescent,
Federation Park, Port of Spain, Trinidad W.I.**

The existing building is a simple two-story structure consisting of a traditional beam & column arrangement with timber & metal roof. During its life, several alterations have been carried out, to facilitate a particular function but lacks a central theme. This has created much conflict with different elements that no longer compliment the original design. The design is now antiquated and does not convey the stature of the Indian High Commission as it relates to Trinidad & Tobago.

The external works, particularly the forecourt driveway and main entrance, are in dire need of corrective works as they are hazardous to visitors and the occupants. The age of the existing building is also starting to show. This is particularly seen on the timber roof supports and certain areas internally which suffer from weathering and moisture rot. The residence was once a Centre for Cultural & diplomatic activities but these are no longer feasible.

The gross floor area is 9,900 ft² set on two levels. This is the area for the structural floor slabs measured across externally & internal walls. The property area is 23,573 ft². This is the area of land as taken from the cadastral survey plan; it includes the

ground floor area of the building, the paved portions of the yard and is measured across the swimming pool.

4. Scope of Work:

Repair, Renovation, Replacement & Upgradation of services at Indian House located at #21-23, Trinidad Crescent, Federation Park, Port of Spain, Trinidad W.I.

5. Period of Completion:

(12 months or 365 days from date of commencement)

6. Site visit: Physical visit to the site is advisable to have a general idea about the extent of works required and the amount of involvement by the Contractor. Interested firms can visit the site from **10.00 am on 22.01.2021** after prior appointment with **Mr. Ashoka Mandal, Second Secretary (CCP), cons.pospain@mea.gov.in, Phone no. 3510758 of the High Commission of India, Port of Spain.**

7. Submission: The proposals (bids) should be in a three-envelope system where:

Envelope 1: would contain the Bid Security. These are contained as Appendix 5 of the Tender Package.

Envelope 2: would contain the documents listed at section 3.2.2 and 3.2.3 of the Instruction to Tenderers (technical bid documents)

Envelope 3: would contain the priced bills of quantities and related appendices. (financial bid documents)

The last date of submission of sealed bids is 4.00 pm on **17.02.2021** in the office of **Mr. Ashoka Mandal, Second Secretary (CCP), cons.pospain@mea.gov.in, Phone no. 3510758** Technical bids will be opened on 5.00 pm on **17.02.2021** in the **High Commission of India, Port of Spain**. All pages of the submission document must be signed by authorised signatory.

8. Liquidated Damages @ 0.5% of accepted contract value per week basis subject to maximum of 10% of contract value to be levied for any delays in the execution of work, attributable to the Contractor.

Document S-1: Instruction to Bidders

No.Trin/872/12/2016/4
High Commission of India
Port of Spain

TENDER FOR SELECTING CONTRACTOR
FOR
Embassy Residence Renovation Project

Section-I

INSTRUCTIONS TO TENDERERS

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1.0 GENERAL

1.1. Description of Works

- 1.1.1. The Work is the Refurbishment and Extension of the India House – The Official Residence for the Indian High Commissioner to Trinidad and Tobago.
- 1.1.2. The site is located at Trinidad Road within the upscale Federation Park in Maraval. The tenderer should note the restriction in access to and limitations in the use of the site and he shall incorporate in his tender the cost for complying therewith.
- 1.1.3. Tenderers must examine the Drawings and Conditions of Contract (FIDIC, 1999 Edition), visit the site and satisfy themselves as to local conditions, means of access, necessity for the extent of temporary drainage, location of existing services, the extent and nature of the site and works, the restrictions and limitations, the conditions under which work will be carried out, conditions affecting the supply of labour and materials, storage space for materials and plant and generally of all conditions which may in any way affect their Tenders, as no claim on the grounds of lack of knowledge of any such matters will be entertained.
- 1.1.4. All existing roads, paving, services, drains, sewers, etc., serving the site must be protected and maintained during the contract period unless their removal is required as a result of the new work. In this case, approved temporary measures must be taken to maintain all services and Tenderers shall allow for all costs in connection with this.

1.2. Tenders

- 1.2.1. Tenders are invited for these works in open competition. Only firms who have satisfied the employer's pre-qualification requirements are invited to submit tenders.

1.3. Tender Documents

- 1.3.1. Tenders are invited for these Works on the basis of the information contained in the tender documents. The Tenderer shall allow in his tender for all the provisions of the Tender Documents. Should there be any divergence between the information contained in the bills of quantities and the tender drawings, for the purpose of tendering only, the bills of quantities shall take precedence.
- 1.3.2. One copy of the bills of quantities is issued and is to be returned on or before the closing date for receipt of tenders, duly priced with the Letter of Tender completed,

all in accordance with the instructions contained in the Letter of Invitation to tender. All supporting documentation inclusive of equipment literature must be submitted with the priced tender submission.

1.3.3. Provision has been made for the total of each page to be collected at the end of each section of these bills of quantities.

1.3.4. The Engineer will nominate sub-contractors for undertaking the mechanical and electrical installations associated with the works. The Employer would engage another contractor to supply and install the specialist equipment in the basement and the tenderer is to note that his works must be programmed to accommodate the installation of this equipment. A schedule showing the sequencing of installation of the specialist equipment is attached at Appendix 5 of the Tender Documents.

1.4. Cost of Tendering

1.4.1. 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 these costs, regardless of the conduct or outcome of the tendering process.

1.5. Site Visit

1.5.1. The Tenderer is advised to visit and examine the Site of the Works and its surroundings and obtain for himself all information necessary for preparing the tender and entering into a Contract. The costs of visiting the site shall be at the Tenderer's own expense.

1.5.2. The Tenderer and any of his personnel or agents will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon express conditions that the Tenderer, his personnel or agents, will release and indemnify the Employer and his personnel and agents from against all liability in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused, which, but for the exercise of such permission would not have arisen.

1.5.3. Specific date and time for site visit is as shown in the Letter of Invitation to Tender.

2.0 TENDER DOCUMENTS

2.1. Contents of Tender Document

2.1.1. The set of tender documents issued for the purpose of tendering includes the number of copies stated below of the following documents, together with any Addenda, thereto issued in accordance with Clause 8 and any minutes of the pre-tender meeting issued in accordance with Clause 20.

<u>Number of Copies</u>	<u>Document</u>
1	Bill of Quantities
1	Set of Architectural Drawings
1	Set of Structural Engineering Drawings

2.1.2. Tenderers shall return one original and one copy of the priced Tender Document, inclusive of the Services Installations sections, completely priced, and all Tender Drawings to the place of submission of Tenders as stated in the letter under which cover these on or before the closing date of Tenders.

2.1.3. The Tenderer is expected to examine carefully all instructions, conditions, forms, terms, specifications and drawings in the tendering documents. Failure to comply with the requirements of tender submission will be at the Tenderer's own risk. Tenders, which are not substantially responsive to the requirements of the tendering documents, will be rejected.

2.2. Drawings Provided

2.2.1. The drawings enclosed with the tendering documents are provided only to give general guidance to the Contractor in preparing his Tender. A full list of the tender drawings is provided at Appendix IV of the tender package.

2.2.2. Verify on drawings and on site all dimensions shown or given before commencing construction. Work to figured dimensions only and in the absence of any dimensions, or in cases of discrepancies between dimensions, bring the matter to the immediate attention of the Engineer for a decision. For the purpose of construction, the drawings shall take precedence over the Bills of Quantities but in all cases of discrepancies between the documents, bring the matter to the attention of the Engineer whose decision shall be final and binding.

2.3. Bills of Quantities and Specifications

- 2.3.1. The Bills of Quantities have been prepared in accordance with the Standard Method of Measurement for Building Works 5th Edition Metric as authorised by agreement between the Royal Institution of Chartered Surveyors and the National Federation of Building Trades Employer, except where specifically stated to the contrary.
- 2.3.2. Read the Specifications and Drawings as one document and carry out everything for the proper execution of the Works whether or not specifically described or shown therein, provided the same, may reasonably be inferred therefrom.
- 2.3.3. The Bills of Quantities shall not be held to gauge or limit the amount and description of the work to be executed by the Contractor.
- 2.3.4. Items in the Materials and Workmanship (Technical Specifications) section of these Bills of Quantities are deemed to qualify and to be part of every description of work to which they refer.

2.4. Clarification of Tendering Documents

- 2.4.1. A prospective Tenderer requiring any clarification of the Tender Documents may notify the Employer and the Engineer in writing, at the addresses indicated in the Tender Documents. The Employer through the Engineer will respond in writing to any request for clarification, which he receives earlier than 7 days prior to the deadline for submission of tenders. Written copies of the Engineer's response (including a description of the inquiry but without identifying its source) will be sent to all prospective Tenderers who have received the Tendering Documents.
- 2.4.2. Such answers, as are necessary, shall be given as a matter of assistance to the Tenderer but they shall not be construed as adding to or taking away from or otherwise altering the meaning and intent of the Tendering Documents, and/or the Tenderer's obligations thereunder, unless such answers are in writing and signed by the Engineer or his authorised representative.

2.5. Amendment of Tendering Documents

- 2.5.1. At any time prior to the deadline for the submission of tenders, the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective Tenderer, modify the Tender Documents by the issuance of an Addendum.

- 2.5.2. The Addendum will be sent in writing to all invited Tenderers and will be binding upon them. Tenderers shall promptly acknowledge receipt thereof to the Engineer and the Employer.
- 2.5.3. In order to afford prospective Tenderers reasonable time in which to take an Addendum into account in preparing for their tenders, the Employer may, at his discretion, extend the deadline for the submission of tenders.
- 2.5.4. No alterations in the text of the Bills of Quantities shall be made by the Tenderer, unless instructed in writing by the Engineer. Any unauthorized alteration, amendment, note or additions made to the Bills of Quantities by the Tenderer shall be ignored and only the reading of the printed text will be recognized. If the Tenderer wishes to make an observation as to the printed text in connection with the rates he has inserted, he shall do so in the form of a letter submitted with his tender.

3.0 PREPARATION OF TENDERS

3.1. Language of Tender

- 3.1.1. The tender prepared by the Tenderer and all correspondence and documents relating to the tender exchanged by the Tenderer and the Employer shall be written in the English Language.

3.2. Documents Comprising Tender

- 3.2.1. The Letter of Tender; the Bills of Quantities; and any Addendum and supplementary information required in accordance with the Instructions to Tenderers embodied in these Tendering Documents. The forms and Bills of Quantities provided in these Tendering Documents shall be used without exception.
- 3.2.2. His Company Profile showing financial capability, available human and equipment resources and track record in executing works of the nature herein intended.
- 3.2.3. A project specific method statement which should include the management structure, the management techniques, construction methodology and any other information about the tenderer's capability to satisfactorily undertake the works.

3.3. Tender Prices

- 3.3.1. Unless stated otherwise in the Tendering Documents, the contract shall be for the

whole Works described in these documents, based on the schedule of unit rates and prices submitted by the Tenderer.

- 3.3.2. The Tenderer shall fill in rates and prices, in indelible **ink**, for all items of Works described in the Bills of Quantities, which, is considered to have a money value, whether quantities are stated or not. Items against 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 Bills of Quantities. Lump sums are not to be given where unit rates are applicable.
 - 3.3.3. Unit rates may be used reciprocally in the settlement of accounts unless conflict between them occurs. The Tenderer is therefore to ensure that identical items occurring in different sections of the bills of quantities are not priced at different rates unless this is his deliberate intention.
 - 3.3.4. Where a “prime cost sum” for supply of a particular material is given in the description of the items contained in the bills of quantities, the Tenderer shall allow in his rate for the prime cost sum, overheads and profits on the prime cost sum, cost of the labour involved and his profits on labour, and every other cost associated with the proper execution of the Works.
 - 3.3.5. 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 closing date for submission of tenders, shall be included in the rates and prices and total Tender Price submitted by the Tenderer, and the evaluation and comparison of tenders by the Employer shall be made accordingly.
 - 3.3.6. Firm price; The rate and prices quoted by the Tenderer shall be firm for the duration of the contract and shall not be subjected to adjustment on any account except as otherwise provided in the Conditions of Contract.
- 3.4. Currencies of Tender and Payment
- 3.4.1. The unit rates and prices shall be quoted by the Tenderer entirely in Trinidad & Tobago Currency.
- 3.5. Time
- 3.5.1. Time is of the essence in this contract so that the agreed date for completion must be adhered to.

3.6. Income Tax

3.6.1. The Tenderer is to attach with his tender, a valid Income Tax Certificate issued by the Board of Inland Revenue.

3.7. Value Added Tax

3.7.1. The unit rates quoted by the Tenderer shall be deemed exclusive of Value Added Tax for which the Employer would be liable to the Tenderer under the V.A.T. Act of 1989. V.A.T. is to be added at the relevant line in the Main Summary page only.

3.7.2. To every payment certificate issued, V.A.T. will be allowed at the prevailing rate to the gross amount due on the certificates (i.e. before deduction for retention).

3.7.3. The Tenderer is to attach with his tender, a copy of his V.A.T. Registration Certificate and valid V.A.T. Clearance Certificate issued by the V.A.T. Registration office.

3.8. Tender Validity

3.8.1. Tenders shall remain valid and open for acceptance for a period of 180 days after the date of tender opening.

3.8.2. In exceptional circumstances, prior to expiry of the original tender validity period, the Employer may request the Tenderer for a specified extension to the period of validity. The request and the responses thereto shall be made in writing. A Tenderer may refuse the request without forfeiting his tender security. A Tenderer agreeing to the request will not be required nor permitted to modify his tender, but will be required to extend the validity of his tender security correspondingly.

3.9. Tender Security

3.9.1. A tender security in the sum of two hundred thousand dollars [Trinidad and Tobago Currency] must be submitted with the tender. A sample form of the instrument to be used is attached.

3.10. Variations in Tendering Conditions

3.10.1. Tenderers shall submit offers, which comply fully with the requirements of the Tender Documents, including the basic technical design as indicated in the drawings and specifications.

3.11. Obtaining Information

3.11.1. Neglect or failure on the part of the tenderer to obtain reliable information upon any matters affecting the execution, construction, completion and maintenance of the Works and the contract shall not relieve the Tenderer from any risk or liability for the completion of the Works, nor will any claim for increase of the Contract Price or extension of the Contract Period be allowed as a result of such neglect or failure.

3.12. Pre-Tender Meeting

3.12.1. The Tenderer or his official representative is advised to attend a pre-tender meeting which will be convened at the time and place stated in the Letter of Invitation to tender.

3.12.2. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at the stage.

3.12.3. The Tenderer is requested to submit any questions in writing, to reach the Engineer not later than one (1) week before the meeting.

3.12.4. Minutes of the meeting, including copies of the questions raised and responses given, will be furnished expeditiously to all those attending the meeting (and subsequently to all firms which have received the Tendering Documents). Any modification of the Tendering Documents listed in Sub-clause 4.4, which may become necessary shall be effected by the issuance of an Addendum pursuant to Clause 4.4, and not through the minutes of the pre-tender meeting.

3.13. Format and Signing of Tenders

3.13.1. The Tenderer shall prepare one original and one copy of the documents comprising the Tender as described in Sub-clause 10.1 of these instructions to Tenderers.

3.13.2. The original and copy of the tender shall be typed or written in ink and shall be signed by a person or persons duly authorised to bind the Tenderer to the Contract.

3.13.3. The complete tender shall be without alterations, interlineations, or erasures, except those to accord with instructions issued by the Employer, or as necessary to correct errors made by the Tenderer, in which case such corrections shall be initialled by the person or persons signing the tender.

3.13.4. Each Tenderer may submit only one tender. No Tenderer or his agents may participate in the tender of another for the same contract in any relation whatsoever.

4.0 SUBMISSION OF TENDERS

4.1. Packaging

4.1.1. A three-envelope system would apply where:

1.1.1.1 Envelope 1: would contain the Bid Security. These are contained as Appendix 5 of the Tender Package.

1.1.1.2 Envelope 2: would contain the documents listed at section 3.2.2 and 3.2.3 of these instructions.

1.1.1.3 Envelope 3: would contain the priced bills of quantities and related appendices.

4.2. Sealing and Marking of Tenders

4.2.1. Each of the envelopes identified at 4.1 above should be addressed as indicated below.

4.2.2. The three envelopes should then be placed in a single sealed envelope or otherwise securely bundled together.

4.2.3. The envelopes shall each be: -

1.1.1.4 be addressed to The Chairman, Tenders Committee, The Indian High Commission, 6A Victoria Avenue, Port of Spain.

1.1.1.5 bear the following identification:

(i) 'TENDER FOR THE REFURBISHMENT AND EXTENSION TO INDIA HOUSE' to be stated on the right side of the top of the envelope.

and

(ii) the words "DO NOT OPEN BEFORE.... (*insert time and date for receipt of tenders as stated in the letter of invitation or as amended by issuance of an Addendum*)".

and must be deposited as instructed in the Letter of Invitation to Tender.

- (iii) The name and address of the Tenderer should be stated on the left side of the bottom of the envelopes. {This should be retained so that the tenders for unsuccessful tenderers can be returned to them without opening the envelope}

4.2.4. If the envelopes are not sealed and marked as instructed above, the Employer will assume no responsibility for the misplacement or premature opening of the tender submitted. A tender opened prematurely for this cause will be rejected by the Employer and returned to the Tenderer.

4.3. Deadline for Submission of Tenders

4.3.1. Tenders must be received by the Employer at the address specified above not later than the time specified in the letter of invitation to tender.

4.3.2. The Employer may, at his discretion, extend the deadline for submission of Tenders by issuing an amendment in accordance with Clause 4.4, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline shall thereafter be subject to the new deadline as extended.

4.4. Late Tenders

4.4.1. Any tender received by the Employer after the deadline for submission of the tenders prescribed by the Employer in accordance with Clause 4.2.1 shall be returned unopened to the Tenderer.

4.5. Modification and Withdrawal of Tenders

4.5.1. The Tenderer may modify or withdraw his tender after tender submission, provided that the modification or notice of withdrawal is received in writing by the Employer prior to the prescribed deadline for submission of tenders.

4.5.2. Tenderer's modification or notice of withdrawal shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause 4.1 for the submission of tenders, with the envelopes additionally marked "MODIFICATION" or "WITHDRAWAL" as appropriate.

4.5.3. Subject to Clause 5.5, no tender may be modified subsequent to the deadline for submission of tenders.

5.0 TENDER OPENING AND EVALUATION

5.1. Tender Opening

5.1.1. On a date to be finalised, the Employer will open:

5.1.1.1. Envelope 1 in the presence of Tenderers' representatives who choose to attend. Should the contents of Envelope 1 fail to meet the requirements of the tender, the other two envelopes would remain unopened and would be returned to the tenderer

5.1.1.2. Envelope 2 in the presence of Tenderers' representatives who choose to attend on the same date as the opening of Envelope 1 at the address stated in the Letter of Invitation. The contents of envelope 2 would be evaluated for compliance.

5.1.2. Upon evaluation of the contents of envelope 2, the tenderers would be notified whether they have met the prequalification requirements. Only tenderers who have satisfactorily met the prequalification requirements would be invited to witness the opening of envelope 3. Should a tenderer fail to meet the requirements for envelope 2, his envelope 3 would be returned unopened.

5.1.3. On a date to be finalised, the Employer will open envelope 3 and declare the tendered amounts in the presence of Tenderer's representatives who choose to attend. At tender opening, the Employer will announce the Tenderer's names, the tender prices, written notifications of tender modifications and withdrawals, if any, and other such details as the Employer may consider appropriate.

5.1.4. The contents of envelope 3 would then be evaluated using prescribed criteria.

5.1.5. The Employer will notify Tenderers of the date and time of the tender opening.

5.1.6. Tenders for which an acceptable notice of withdrawal has been submitted pursuant to Clause 4.4 shall not be opened. The Employer will examine tenders to determine whether they are complete, whether the documents have been properly signed, and whether the tenders are generally in order.

5.2. Process to be Confidential

5.2.1. No information relating to the examination, clarification, evaluation and comparison of tenders, and recommendations concerning the award of contract shall be disclosed to Tenderers and other person or persons not officially concerned with

the procedures after the public opening of tenders and before the announcement of the award to the successful Tenderer.

- 5.2.2. Any effort by a Tenderer to influence the Employer in the process of examination, clarification, evaluation and comparison of tenders, and in decisions concerning award of contract, shall result in the rejection of the Tenderer's tender.

5.3. Clarification of Tenders

- 5.3.1. To assist in the examination, evaluation and comparison of tenders, the Employer may ask Tenderers individually for clarification of their tenders, including breakdowns of unit rates. The request for clarification and the response shall be in writing, but no change in the price or substance of the tender shall be sought, offered or permitted except as required to confirm the correctness of arithmetic errors discovered by the Employer during the evaluation of the tenders in accordance with Clause 5.5.

5.4. Determination of Responsiveness

- 5.4.1. Following the opening of tenders, the Employer shall ascertain whether material errors in computation have been made in the tenders, whether the required guarantees and sureties have been provided, whether the documents have been properly signed, whether the tenders are substantially responsive to the tendering documents and whether the tenders are otherwise generally in order.
- 5.4.2. For purpose of this Clause, a substantially responsive tender is one, which, conforms to all the terms, conditions and specifications of the Tendering Documents without material deviation or reservation. A material deviation or reservation is one which affects in any substantial way the scope, quality, or performance of the Works, or which limits in any substantial way, inconsistent with the Tendering Documents, the Employer's rights or the Tenderer's obligations under the Contract, and the rectification of which deviation or reservation would affect unfairly the competitive position of other Tenderers presenting substantially responsive tenders.
- 5.4.3. If a tender does not conform to the specification or is not otherwise substantially responsive, it shall be rejected by the Employer, and shall not subsequently be made responsive by the Tenderer having corrected or withdrawn the non-conforming deviation or reservation.

5.5. Correction of Errors

- 5.5.1. Tenders, which are determined to be substantially responsive, will be checked by the Employer for any arithmetic errors in computation and summation. Errors will be dealt with by the Employer as follows: -
- 5.5.2. If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit rate, in which event the total amount as quoted will govern and the unit rate will be corrected.
- 5.5.3. Where there is a discrepancy between amounts in figures and in words, the amount in words shall prevail.
- 5.5.4. The Tenderer will be notified of corrections due to significant arithmetical errors or obvious errors in pricing or errors in respect of (a) and (b) above and if he does not accept the correction of errors and stand by the tender price, his tender will be rejected.
- 5.5.5. Where errors are discovered after acceptance of the tender, the Tenderer would be deemed to have stood by his tender price. For the purposes of administering the contract and for interim payments and settlement of accounts all rates or prices (excluding preliminary items, prime cost and provisional sums) inserted therein by the Tenderer will be reduced or increased in the same proportion as the corrected total of priced items exceeds or falls short of the original total of such items. Alternatively, by agreement with the Tenderer, the total net error shall be added to or deducted from the total shown against Preliminaries, so that the tender sum remains the same.
- 5.5.6. The Contractor shall not alter or otherwise qualify the text of these Bills of Quantities. Any alteration or qualification made without the written approval of the Employer shall be ignored and the text of the Bills of Quantities as printed shall be adhered to.

5.6. Evaluation and Comparison of Tenders

- 5.6.1. The Employer will evaluate and compare only tenders determined to be substantially responsive to the requirements of the Tendering Documents in accordance with Clause 5.4.

- 5.6.2. The Employer reserves the right to accept or reject any variation, deviation or alternative offer. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the Tendering Documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in tender evaluation.
- 5.6.3. Any tender which in the opinion of the Employer is so unbalanced between various unit prices in the Bills of Quantities as to be detrimental to the interest of the Employer shall be rejected.
- 5.6.4. For a tender to be complete the Tenderer shall fill in all schedules and provide all subsidiary information, all of which will be taken into consideration in the evaluation of a tender and failure to complete all documents as required may render the tender non responsive.

6.0 AWARD OF CONTRACT

6.1. Award Criteria

- 6.1.1. Subject to Clause 6.2, the Employer will award the contract to the Tenderer whose tender has been determine to be substantially responsive to the tendering documents and who has offered the lowest evaluated tender price pursuant to Clause 5.6 but not necessarily the lowest submitted price, provided that the Tenderer has the capacity and resources to carry out the Contract effectively.

6.2. Employer's Right to Accept Any Tender and to Reject Any or All Tenders

- 6.2.1. Notwithstanding Clause 6.1.1, the Employer reserves the right to accept or reject any tender, and to annul the tendering process and reject tenders, at any time prior to award of contract, without thereby incurring any liability to the affected Tenderer or Tenderers of the grounds for the Employer's action.
- 6.2.2. The Employer is not obligated to accept the lowest or any tender. The Employer may declare the tendering process void when none of the tenders meet the intent of the specifications or when it is evident that there has been a lack of competition and/or that there has been collusion. In addition, all Tenders may be rejected if they are substantially higher than the official budget approved by the Employer. The award will be made to the Tenderer whose tender has been evaluated as the lowest in accordance with Clause 5.6 and 6.1.1 – except when intervening circumstances have changed the Tenderer's status. Individual tenders may be

rejected in cases where the particular tender is so much lower than the official estimate that it is reasonable to conclude that the Tenderer will not be able to complete the works within the specified time and at the price offered.

6.3. Notification of Award

6.3.1. Prior to the expiration of the period of tender validity prescribed by the Employer, the Employer will notify the successful Tenderer in writing by registered letter that his tender has been accepted. This letter (hereafter called "Letter of Acceptance") shall name the sum which the Employer will pay to 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 Conditions of Contract called "The Contract Price").

6.3.2. The notification of award will constitute the formation of the Contract.

6.3.3. Upon the furnishing by the successful Tenderer of a performance security in accordance with the provisions of Clause 6.5, the Employer will promptly notify each unsuccessful Tenderer.

6.4. Signing of Agreement

6.4.1. At the same time that he notifies the successful Tenderer that his tender has been accepted, the Employer will send the Tenderer the Contract Agreement provided in the Tendering Documents, incorporating all agreements between the parties.

6.4.2. Within 14 days of delivery of the Contract Agreement, and upon the furnishing of the performance security in accordance with Clause 6.5, the successful Tenderer shall sign the Contract Agreement and deliver it to the Employer.

6.5. Performance Security

6.5.1. Within 14 days of receipt of the notification of award from the Employer, the successful Tenderer shall furnish to the Employer a performance security in the form of a bank guarantee in an amount of five (5%) percent of the Contract Price or (at the Tenderer's option) a performance bond in an amount of five percent (5%) of the Contract Price in accordance with the Conditions of Contract.

6.5.2. If the performance security is to be 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.

- 6.5.3. If the performance security is to be provided by the successful Tenderer in the form of a bond, it shall be issued by a bonding or insurance company acceptable to the Employer.
- 6.5.4. The performance security must remain valid up to sixty days [60 days] beyond the issue of the Performance Certificate.
- 6.5.5. Failure of the successful Tenderer to comply with the requirements of Clause 6.4 or Clause 6.5 shall constitute sufficient grounds for the annulment of the award.

7.0 EXISTING CONDITIONS

7.1. Schedule of Existing Conditions

- 7.1.1. Before commencement of the Contract, a Schedule of Conditions of all areas surrounding the work site shall be agreed between the Engineer and the Contractor. On completion of the Contract, the Contractor shall reinstate these areas to their original condition.

7.2. Adjacent Buildings

- 7.2.1. The Contractor shall take care in carrying out any part of the work in close proximity to, or affecting adjacent buildings. He shall obtain the consent and approval of the owners of such properties and the Employer, prior to entering any adjacent property for the purposes of carrying out work and shall not enter upon the property or carry out any work unless and until such consent has been obtained.

8.0 SPECIAL INSTRUCTIONS

8.1. Schedule of Approved Sub-contractors for the Services Installations

- 8.1.1. The Tenderer is advised that the following is an approved list of sub-contractors for the Services Installations. Only quotations received from these sub-contractors would be recognized in the evaluation of tenders submitted by Tenderers. Should the tenderer elect to engage a specialist other than those listed hereunder, he should seek the approval of the M&E consultant at least 7 days prior to the date of

tender. The M&E consultant would require that the tenderer provide detailed financial and track record particulars of the proposed specialist before making a decision which decision would be final and binding upon the tenderer.

Air-conditioning Installations:

- i. Abel Building Solutions
- ii. Cool Caribbean Limited
- iii. Peake Technologies
- iv. Climate Control Limited.
- v. All Temp Limited
- vi. Daitech Limited

Electrical Installations:

- i. Russel Ramsammy Electrical Contractors
- ii. Trinitec Electrical
- iii. United Electrical
- iv. TEC Engineering

Plumbing Installations:

- i. WVA Engineering Co. Ltd
- ii. Haynes Plumbing [1990] Limited
- iii. Anthony James Plumbing
- iv. Complete Plumbing

Document S-II: Introduction and Credentials of Bidder

No. Trin/872/12/2016/5
High Commission of India
Port of Spain

**TENDER FOR SELECTING CONTRACTOR
FOR
*Embassy Residence Renovation Project***

Section-II

1. Introduction and Credentials of Bidder

(To be submitted by the bidder)

Note: This shall be submitted by the bidder. This should be a brief introduction, background, company details, credentials, VAT & other registration and past performance of the bidder. They may attach any other documents such as company profile, company brochures, achievement of the company etc.

Document S-III: Terms and Conditions of Contract

No. Trin/872/12/2016/6
High Commission of India
Port of Spain

TENDER FOR SELECTING CONTRACTOR
FOR
Embassy Residence Renovation Project

Section-III

CONDITIONS OF CONTRACT
Part I – General Conditions of Contract

The Conditions of Contract governing any contract arising from this tender will be the “Conditions of Contract for Construction” First Editions 1999, published by the Federation Internationale des Ingenieurs-Conseils (FIDIC), and shall comprise the **General Conditions of Contract**.

The full text of these General Conditions may be obtained from:

Federation Internationale des Ingenieurs-Conseils (FIDIC),

World Trade Centre II

P.O. Box 311

1215 Geneva 15

SWITZERLAND

Telephone: +41 22 799 4905

Facsimile: +41 22 799 4901

Email: fidic.pub@fidic.org

Website: <http://www.fidic.org>

The above General Conditions of Contract (GCC) are to be read in conjunction with the Particular Conditions of Contract which is set out in detail in the following section and which include amendments and additions to these General Conditions.

**No. Trin/872/12/2016/7
High Commission of India
Port of Spain**

**TENDER FOR SELECTING CONTRACTOR
FOR
*Embassy Residence Renovation Project***

Section-III

Terms and Conditions of Contract

Part II – Particular Conditions of Contract

[To be read in conjunction with the General Conditions of Contract]

1. CLAUSE I

2. GENERAL PROVISIONS

The following Sub-Clause to be read as:

3. Parties and Persons

1.1.2

Definitions

1.1.2.2

“Employer” is **THE INDIAN HIGH COMMISSION OF 6A VICTORIA AVENUE PORT OF SPAIN**

1.2.2.4

“Engineer” is **JASPAL BHOGAL ASSOCIATES**

1.1.3.4

“Day” means ‘Calendar Day’ unless specifically stated otherwise

4. Law and Language

1.4

The Contract shall be governed in accordance with the Laws of the Republic of Trinidad and Tobago. The Language in which the Contract Document are drawn up is the English Language and all correspondence, drawings, etc, in connection with contract shall be in the English Language.

Contract Agreement

1.6

The following is deleted from this Sub-Clause:

“The Contract Agreement shall... borne by the Employer.”

Details to be Confidential

1.15

New Sub-Clause added immediately after sub-clause 1.14:

“The Contractor shall treat the details of the Contract as private and confidential except to

the extent necessary to carry out obligations under it or to comply with applicable Laws.”

CLAUSE 2

THE EMPLOYER

<u>Permits, Licenses and Approvals</u>	2.2	First sentence deleted and replaced with the following Sub-Clause: The Employer shall (where it is in a position to do so) provide reasonable assistance to the Contractor at the request of and cost to the Contractor.
<u>Employer’s Financial Arrangements</u>	2.4	This Sub-Clause deleted in its entirety.

CLAUSE 3

THE ENGINEER

<u>Instructions of the Engineer</u>	3.3	The following inserted at the end of this Sub-clause: “The Contractor shall not vary any of the work or carry out extra work without proper instructions from the Engineer. In the event that the Contractor receives instructions from any person other than the Engineer or his duly appointed representatives to vary the work or to carry out extra work, he shall request and obtain the Engineer’s instructions to do so prior to proceeding. Whenever the Contractor considers that additional detailed drawings are required and/or necessary, he shall promptly apply to the Engineer for such additional detailed drawings not less than 14 days from the date on which the detailed drawings are required and scheduled for execution. The works shall at all times be executed in accordance with the Engineer’s detailed drawings except where same has been varied in accordance with Clause 13. Where any discrepancies, disagreement or difference of opinion arises due to errors which may be deemed clerical or draughtsman’s errors, detailed drawings shall
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take precedence over the general drawings and drawings made to a larger scale or for special instructions shall take precedence over drawings made to a smaller scale or for general instructions, but subject nevertheless in case of dispute or doubt to the summary decision of the Engineer and failure to comply with this instruction shall result in the rejection of any claim arising therefrom.

First sentence deleted from Sub-Clause 3.4.

CLAUSE 4

THE CONTRACTOR

5. Performance Security

4.2

Second paragraph deleted from Sub-Clause 4.2 and replaced with the following:

“The Contractor shall deliver the Performance Security to the Employer within fourteen (14) days after receiving the Letter of Acceptance and shall send a copy to the Engineer. The Performance Security shall be issued by a bank, insurance company or a financial institution:

- (i) located in; and
- (ii) registered and licensed to do business in the country.

The Performance Security shall be in a form approved by the Employer.”

The following is added to end of the second paragraph of Sub-Clause 4.2:

“Whenever the amount of the Performance Security becomes less than that stated in the Appendix to Tender (where applicable) due to additions to the Contract Amount (as determined by the Engineer) resulting from changes in cost and/or the Laws or a Variation which, in the aggregate, exceeds 15% of the Accepted Contract Price or the Contract Price the Contractor shall at the written instructions of the Engineer increase the value of the Performance Security in the same ratio as the increase in the Contract Price.”

Setting Out

4.7

The following sentence is added at the end of the first paragraph:

“Prior to setting out of the Works, the layout of the Works shall be approved by the Engineer.”

Safety Procedures

4.8

Sub-paragraph (a) of Sub-Clause 4.8 is replaced with the following:

- (a) comply with all applicable Laws and regulations regarding safety including but not limited to those contained in the Factories (Protective Measures) Order 1977, OSH Act of Trinidad and Tobago

and that attached at Appendix 5 of these Tender Documents, which are the approved standards of safety for this Contract and which shall be considered as part of these Conditions of Contract.

The following sub-paragraph is inserted after sub-paragraph (e):

(f) the Contractor shall provide industrial safety helmets for all personnel on site including sub-contractors (nominated or otherwise) staff, representatives of the Employer and the Engineer and all other authorized persons on site and the Contractor shall use all efforts to ensure that helmets are worn, when necessary, by all personnel on site.

Electricity, Water and Gas

4.19

Sub-Clause 4.19 deleted and replaced with the following:

The Contractor shall at his own cost and expense be responsible for the provision of all electricity, water, gas and other services be may require for the Works and any fluctuation in their price shall be at the Contractor’s sole risk and expense. The Contractor shall at his own risk and cost, provide any apparatus necessary for his use of these services and for measuring the quantities consumed and shall indemnify and keep the Employer indemnified and harmless from all such costs incurred.”

Employer’s Equipment and Free-Issue Material

4.20

Sub-Clause deleted in its entirety.

Progress Reports

4.21

“...in six copies.” deleted at the end of the first sentence of this sub-clause, and replace with the following:

“...one hard copy and one electronic copy on compact disc.”

The period (“.”) is deleted at the end of sub-paragraph (h) of Clause 4.21 and replace with the following”;

The following sub-paragraphs are added immediately after sub-paragraph (h): -

“(j) details of all claims arising including the Contractor’s estimate of costs and time adjustments required to the Contract Price.

(k) amend the schedule of payments as required under Clause 14.4.”

The Engineer shall read and comment upon the Contractor’s Progress Report and shall meet with the Contractor within 7 days after receipt of the Contractor’s Progress Report to discuss any problems the Contractor has highlighted therein.

CLAUSE 6

STAFF AND LABOUR

Rates of Wages and Conditions of Labour

6.2

Sub-Clause replaced with:

The Contractor must satisfy himself whether there is sufficient skilled and unskilled labour available locally for the carrying out of the work in accordance with his programme and must make arrangements for bringing to the Site all labour not available locally.

The Contractor shall observe hours and conditions of labour not less favorable than:

- a. The rates, hours and conditions established under any collective agreement between the Employer and Employer’s association and workers’ organization representative, respectively, of substantial proportions of Employers and workers engaged in the trade or industry, whether or not the Contractor is a party to such agreement.
- b. The rates, hours and conditions established in the absence of or subsequent to any collective agreement under any arbitration award for work of the same character in the trade or industry whether or not such award is binding on the Contractor.

- c. The minimum rates, hours and conditions prescribed by any Laws of Trinidad and Tobago for the time being in force.
- d. Such rates, hours and conditions paid and observed by Government for work of the same character in the trade or industry in the absence of any collective agreement, arbitration award or provision of law.

The Contractor or his sub-contractor shall post notices in conspicuous places at the establishments and work places concerned informing the workers of the rates of pay and other conditions of work.

The Contractor or his sub-contractor shall keep proper wages and time books and, in the event of work being paid for by results, work sheets shall be kept showing wages paid to, the time and/or the amount of work performed by workmen in and about the execution of the Contract, and the Contractor or his sub-contractor shall be bound whenever required to produce such wages and time books and/or work sheets for the inspection of any person authorized by the Employer's Representative.

The Contractor shall before commencing work under the Contract, notify the principals of the following:

- a. The number and categories of workers he proposes to employ.
- b. Their rates of pay.
- c. The date of commencement of the work.

The Contractor shall be prohibited from transferring or assigning directly or indirectly to any person or persons whatsoever, any part of this contract without the written permission of the Employer's Representative.

The Contractor shall be responsible for the observance of these stipulations of this Contract by any permitted sub-contractor.

The Contractor shall recognize the freedom of his work people to be members of registered trade unions.

Should the Contractor find that suitably qualified and experienced personnel required for the Works are not available in Trinidad and Tobago in sufficient numbers and should the Contractor wish to employ personnel of nationalities other than Trinidadian, the Contractor must obtain the necessary work permits from the Government of Trinidad and Tobago to permit foreign personnel to enter and work in Trinidad and Tobago.

The Contractor shall keep the Employer fully informed at all times of applications made by him for work permits for foreign staff and approvals given by the Trinidad and Tobago Authorities.

CLAUSE 7

PLANT, MATERIALS AND WORKMANSHIP

Manner of Execution

7.1

The following is added to the end of this Sub-Clause:

The insertion of the name of any firm in the Bills of Quantities is for the purpose of obtaining a class or quality of materials or workmanship and unless specifically stated to the contrary such goods or workmanship may be obtained from any other firm of equal repute subject to the approval of the Engineer. In all cases, such firm or firms shall not be held to be a "Nominated Supplier" or "Nominated Sub-contractor" under the Contract Conditions.

All materials specified shall be used and fixed strictly in accordance with the manufacturer's instructions, or where no such instructions exist, then in accordance with the best trade practice.

Where reference is made to British Standards (BS) or equivalent Codes of Practice (CP) the latest editions shall apply. Materials complying

with other authoritative standards other than those specified, will be acceptable, provided that the Contractor satisfies the Engineer that the standards are of equal or better standard than those specified.

No materials shall be ordered before applying to and receiving from the Engineer full particulars and details thereof, as no claim will be allowed for variation should the Contractor have wrongly assumed requirements. The Contractor must take the necessary particulars from the drawings and specifications supplied. Measurements must be taken from the building or Site. The Bills of Quantities should not be used for the purpose of ordering materials.

The workmanship shall be of best quality to the entire satisfaction of the Engineer and in accordance with all current Building Regulations and Codes of Practice.

All materials shall be delivered to the site, or to the Engineer, sufficiently in advance to allow samples and tests to be made before the materials are incorporated into the Works. No materials shall be used until approved. Samples of finished work, e.g. samples of blockwork, pointing, colours, finishes, etc., as are requested by the Engineer, shall be retained on site throughout the duration of the Contract.

CLAUSE 8

COMMENCEMENT, DELAYS AND SUSPENSION

6.	<u>Commencement of Works</u>	8.1	The second sentence of paragraph one of this Sub-Clause is replaced with: The commencement of work shall be not later than two (2) weeks from the date of the Letter of Instruction from the Engineer.
	<u>Programme</u>	8.3	Clause is replaced in its entirety with the following: Within seven days of the acceptance of his tender, the Contractor shall submit to the Engineer for his approval, a detailed construction programme showing the order of procedure and method in which he proposes to

carry out the Works and shall whenever required by the Engineer, furnish for his information, particulars in writing of the Contractor's arrangements for the carrying out of the Works and of the Constructional Plant and Temporary Works which the Contractor intends to supply, use or construction as the case may be.

The Contractor's programme shall provide the following basic information:

- a. The Contractor's analysis of the essential components of the Contract. The Engineer's ruling as to what constitutes an "essential component" shall be final.
- b. The Contractor's proposed time required for completion of each of these components.
- c. The Contractor's analysis of the sequential relationship of each of the components.
- d. Such other information as may be required to prepare a network by the Critical Path Method (CPM).
- e. The details to be supplied by the Contractor shall include all salient job features including construction activities, procurement of materials, testing, resource allocation, etc.
- f. A draft CPM network(s) for review and approval of the Engineer. Time shall be in increments of one (1) week.

The draft shall be in a form acceptable to the Engineer. Three (3) copies of the draft programme shall be supplied.

No payment for work done shall be allowed until the Contractor's programme has been received and approved by the Engineer.

Three (3) copies of the approved construction programme shall be given to the Engineer within seven (7) days of such approval.

The approved construction programme shall be used to monitor the progress of the Works.

On the fourth working day of each month, the Contractor shall report progress to the end of the previous month. The report shall give accurate estimates of work completed of each activity shown on the original CPM schedule and will be used to update the schedule. The Engineer may change or revise the Contractor's report if he believes it to be incorrect.

Provision of the above-mentioned project progress report by the Contractor will be required prior to issuance of the monthly progress payment certificates by the Engineer.

In the event that any part of the work falls in arrears of the approved programme, the Contractor shall submit proposals on one or more courses of action to be taken by him to accelerate the work programme. Such proposals, if acceptable to the Engineer, shall be implemented and kept in force until such time as the Engineer considers that the degree of completion of the works complies with the original programme.

Should the proposals submitted by the Contractor not be acceptable to the Engineer, the Engineer may require that one or more of the following courses be taken by the Contractor to accelerate the work programme:

1. Increase the number of hours of work per week.
2. Increase the work force.
3. Provide and utilize additional equipment.
4. Any other course of action, which is deemed necessary to recover the schedule.

All extra costs of any recovery work programme shall be for the Contractor's account.

The Employer shall be entitled to terminate the Contract if the Contractor fails to comply with any accelerated work performance required of the Engineer. All costs and damages incurred by the Employer arising out of any of the above, shall be for the Contractor's account and shall be deducted from any sums due to the Contractor by the Employer or recoverable as a debt due to the Employer by the Contractor.

CLAUSE 12

MEASUREMENT AND EVALUATION

<u>Work to be Measured</u>	12.1	The following is added at the end of this Sub-Clause: Work not visible in the finished project which is the subject of a variation and in respect of which no drawings are issued shall not be covered up until a record of it, suitable for measuring purposes, has been taken and agreed between the Contractor and Engineer.
<u>Method of Measurement</u>	12.2	Sub-Clause deleted and replaced with: The method of measurement shall be in accordance with the Standard Method of Measurement for Building Works 5 th Edition (metric) as authorized by agreement between the Royal Institution of Chartered Surveyors and the National Federation of Building Trades Employer, except where specifically stated to the contrary.

CLAUSE 13

VARIATIONS AND ADJUSTMENTS

<u>Right to Vary</u>	13.1	The following is added to the end of this Sub-Clause: The Engineer's instruction shall be sought before executing work, which is described in these Bills of Quantities as 'Provisional'.
<u>Daywork</u>	13.6	Notwithstanding that a Daywork Schedule is not included in the Contract, this Sub-Clause shall still continue to apply. A prime cost sum has been allowed in the Bills of Quantities for such

works, which are to be calculated in accordance with the 'Definition of Prime Cost of Daywork' as set out in the Bills of Quantities together with percentage additions to each section of the cost as set out by the Contractor in the Contract Bills.

Daywork sheets are to be signed by the Foreman. The rendering of daywork sheets is to provide a record of work and is not to be taken as deciding that work concerned is an extra or that it will be valued on this basis. These matters are to be agreed with the Engineer.

Adjustment for Changes in Cost

13.8

Sub-clause deleted and replaced with the following:

The contract sum shall be firm except for fluctuations in material prices due to a change in the exchange rate of the Trinidad and Tobago dollar. The following clauses shall be applicable to this contract: -

- a. The prices for imported materials and/or equipment or for materials with a partial imported content included in the tender sum is based on an exchange rate of Trinidad and Tobago dollar to the US current seven days before the date of tender.
- b. If after the date of tender, the prices for the said imported material or equipment or the material with a partial imported content is affected by a fluctuation in the exchange rate at (1) above, then the net increase or decrease as the case may be caused directly by the fluctuation of the exchange rate shall be added or deducted from the accepted tender sum.
- c. The Contractor shall be required to give notice of any price in material or equipment caused by a change in the exchange rate and shall make available all information as may be reasonably necessary or as may be requested by the Engineer to verify a claim.

- d. No adjustment shall be due unless the Contractor shall have actually incurred an increased or decreased cost arising from the fluctuation of the Trinidad and Tobago dollar and the adjustment shall not include an adjustment in the profit element of the contract sum. Adjustment shall only be due following acceptance by the Engineer of reasonable evidence that the Contractor has incurred an increase or decrease in the cost of the imported component due to the fluctuation of the Trinidad and Tobago dollar.
- e. When submitting claims, the Contractor shall provide proof that all reasonable measures have been taken to place orders sufficiently early to mitigate the effects of cost increases. Failure to satisfy this requirement will result in rejection of the claim.

CLAUSE 14

CONTRACT PRICE AND PAYMENT

The Contract Price

14.1

New item (e) added at the end of this Sub-clause:

The sum payable by the Employer to the Contractor in respect of Value Added Tax shall be calculated and paid by the Employer to the Contractor in accordance with the Value Added Tax Act 1989 of the Republic of Trinidad and Tobago or any amendment thereof to this Act.

CLAUSE 18

INSURANCE

Insurance against Injury to Persons and Damage to Property

18.3

The following should be noted in respect of this Sub-clause:

If the Contractor already bears an All Risk and Public Liability Insurance and Workmen's compensation Insurance covering his liabilities under Clause 18.3, and if such a policy already bears a general principal endorsement automatically

providing such indemnity to each and every Employer for whom the Contractor works, then the Employer may request the Contractor to make such endorsement in his favour and the costs incurred therein shall be borne by the Contractor.

CLAUSE 19: FORCE MAJEURE

Insert after 19.0

Force Majeure and EOT clause: In the event of force majeure i.e., unforeseeable events such as war, floods, earthquake etc. beyond the reasonable control of the Parties to the contract which prevent either party from meeting their obligations under the contract, the contractual obligations as far as affected by such event shall be suspended for as long as force majeure continues provided that the other party is notified within two weeks after occurrence of the force majeure. Force Majeure shall not include insufficiency of funds or failure to make any payment required hereunder. In the event of force majeure, either party shall be entitled to prolongation of this Contract equal to the delay caused by such force majeure.

CLAUSE 20

7. CLAIMS DISPUTES AND ARBITRATION

Sub-Clauses 20.2 and 20.3 deleted.

Obtaining Dispute Adjudication Board's Decision 20.4

Second paragraph of Sub-Clause 20.4 is deleted and substitute with:

The Engineer shall act as the Dispute Arbitration Board (DAB) in accordance with this Sub-Clause acting fairly, impartially and at the cost of the Employer. In the event that the Employer intends to replace the Engineer, the Employer's notice under Sub-Clause 3.4 shall include detailed proposals for the appointment of a replacement DAB.

8. Arbitration

20.6

Arbitration: In the event of any dispute or difference arising at any time between the parties relating to the construction, meaning or effect of this tender or any other cause or any content of the rights and liabilities of the parties or other matters specified herein or with reference to anything arising out of or incidental to this tender or otherwise in relation to the terms whether during the continuance of this tender or thereafter, such disputes or differences shall be endeavoured to be solved by mutual negotiations. If, however, such negotiations are infructuous, Arbitration shall be carried out as per provisions of UNCITRAL (United Nations commission on International Trade Laws) Arbitration Rules, as amended from time to time and the decision of the arbitrators as mentioned above shall be final and binding on the parties.

The venue of arbitration shall be Port of Spain, Trinidad & Tobago.

Any reference to arbitration shall be not relieve either party from the due performance of its obligations under this tender.

APPENDIX TO TENDER

	<u>Sub- Clause</u>	
Employer	1.1.2.2	The Indian High Commission
Engineer	1.1.2.4	To be replaced with 'Project Manager' and shall mean Jaspal Bhogal Associates of 8 Saddle Road Maraval
Law and Language	1.4	The Laws of the Republic of Trinidad and Tobago. The language for communications shall be the English language.
Performance Security	4.2	5% of Contract Price
Working Hours	6.5	6 days/week, 10 hours/day
Time for Commencement of Work	8.1	From Engineer's Order to Commence – Fifteen calendar days
Time for Completion of the Works	1.1.3.3 and 8.2	From Engineer's Order to Commence – _____ weeks*
Penalty / Delay Damages for the Works	8.7	0.5% of Accepted Contract Sum per week.
Bonus		Not Applicable
Defects Notification Period for Acceptance Certificate	1.1.3.7	12 Months
Adjustments for Changes in Cost	13.8	See Conditions of Contract, Part II: Conditions of Particular Application
Advance Payment	14.2	10% of the accepted contract amount recoverable in four consecutive equal installments starting with the third interim payment [of which the issue of the advance payment is counted as payment 1]

*** To be inserted by the Tenderer**

Initial of Signatory of Tender:

Dated:

APPENDIX TO TENDER (cont'd)

**Sub-
Clause**

Percentage of Retention	14.3	10% of accepted Contract Sum
Limit of Retention	14.3	5% of accepted Contract Sum with option for a retention bond only upon issue of Taking Over Certificate
Minimum Amount of Interim Certificate	14.6	TT \$500,000.00
Currencies of Payment	14.15	Trinidad and Tobago Dollars
Insurance against Injury to Person and Damage to Property	18.3	Any numbers of occurrences – TT\$2,000,000.00
Dispute Adjudication	20.2/3	Pre-arbitral decisions by Engineer
Arbitration	20.6	One (1) person – in accordance with the “Arbitration Ordinance Laws of the Republic of Trinidad and Tobago”

Initial of Signatory of Tender:

Dated:

Document S-IV: Scope of Work

**No. Trin/872/12/2016/8
High Commission of India
Port of Spain**

**TENDER FOR SELECTING CONTRACTOR
FOR
*Embassy Residence Renovation Project***

Section-IV

1. Scope of Work

Scope of work given below is tentative. The bidder is advised to inspect the site and understand the full scope of work.

Scope of Work:

S.No.	Element	Description
1	SUBSTRUCTURES	<ol style="list-style-type: none">1. Site preparation: Take out roof, ceilings, windows and doors, hack up tiles, isolate services and gut the entire building; demolish redundant walls and cart away arising from the site.2. Foundations: Reinforced concrete pads; reinforced concrete strip footings and ground beams; hollow concrete block base walls with cores reinforced and filled with concrete; imported sand filling beneath areas of new floor slabs.3. Slab on grade: Reinforced concrete slab on polythene sheet damp proof membrane on sand blinded hard-core; anti termite treatment to cut faces of excavation; jointing new to existing.
2	SUPER STRUCTURES	<ol style="list-style-type: none">1. Frame: Reinforced concrete columns and beams; mild steel girder framing.2. Upper floors: In-situ concrete suspended slabs on proprietary CFD deck pan; reinforced in-situ concrete slabs.3. Staircase & Balustrading: Provision for hardwood balustrading internally and moulded concrete balusters in reinforced concrete rails to external patios.

		<p>4. Roofing: Generally 'Bermuda' profiled corrugated steel sheeting on proprietary aluminium foil insulation on galvanised steel purlins on mild steel framing; light weight screed and felt water proofing to flat roof deck slab; seamless aluminium rainwater gutters and PVC down pipes.</p> <p>5. External & internal walls: Generally hollow concrete block walls in cement mortar; reinforced concrete ring beams and lintels; proprietary laminated plywood partitions and accessories to bathrooms.</p> <p>6. Windows & Doors: Generally aluminium casement windows; solid panel doors in aluminium frames internally and externally; sliding aluminium framed glass patio doors; louvered panel doors in aluminium frames to service rooms; up and over garage door set.</p>
3	ENGINEERING SERVICES	<p>1. Plumbing installations: Hot and cold water plumbing supplies to each bathroom; PVC soil vent and waste pipework from each appliance; sanitary appliances as indicated; pressure testing installations and connecting to existing mains already at site.</p> <p>2. Electrical installations: Provision for new mains, main panel and final circuits to lighting and small power outlets; standby generator; security system and lighting fixtures.</p> <p>3. Air conditioning installations: Provision for air-conditioning system for entire house.</p>
4	FITTINGS & FIXTURES	<p>1. Provision for vanities in bathrooms; bathroom accessories; kitchen cabinets and counter tops; linen closets; bedroom closets and shelving in study and laundry.</p>
5	FLOOR, WALL & CEILING FINISHES	<p>1. Floor finishes: Generally cement and sand screed with a porcelain tile finish throughout; hardwood skirting.</p>

		<ol style="list-style-type: none"> 2. Wall finishes: Generally cement and sand render both sides of all masonry surfaces; ceramic tiling to walls in bathrooms. 3. Ceiling finishes: Generally gypsum sheeting to galvanised mild steel concealed framing; ornamental cornice mouldings. 4. Painting & decorating: Exposed masonry surfaces decorated three coats emulsion paint; exposed wood or metal surfaces decorated three coats oil paint. Existing masonry surfaces decorated two coats emulsion paint; existing retained wood and metal surfaces decorated two coats oil paint.
6	EXTERNAL WORKS & SERVICES	<ol style="list-style-type: none"> 1. Upgrading fencing and new vehicular entry and exit gates. 2. Soft landscaping 3. Planter boxes filled with topsoil 4. Driveway and paving 5. Ramps and rails 6. Surface water drainage 7. Pool deck tiling and refurbishment of pool. 8. Ancillary buildings - security booth 9. Garbage disposal cubicle 10. Flag poles 11. Plinths for water tanks
7	SCOPE ADDITIONS	<ol style="list-style-type: none"> 1. Supply of ornaments 2. Termite treatment 3. Day work contingency

8	PRELIMINARIES	1. Allowance for setting up and maintaining site facilities; insurances during the course of executing the work; and scaffolding
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B: FINANCIAL BID DOCUMENTS

Document II: Schedule of Quantities/Bills of Quantities

Bill Nr. 1: Preliminaries

BILL NR 1: PRELIMINARIES

PRELIMINARY PARTICULARS

Names of Parties

- A **The Employer is:** The Indian High Commission
6A Victoria Avenue
Port of Spain

Telephone:
- B **The Architect is:** Jaspal Bhogal Associates
Architects and Design Consultants
8A Saddle Road
Maraval
Trinidad

Telephone: 1-868 628 1852
- C **The Services Engineer is:** Jain Consultants T and T Limited
54 Evans Street
St. Augustine

Telephone: 1-868 645 3650
- The Structural Engineer is:** KS & P Limited
Roberts Street
Port of Spain
Trinidad

Telephone: 1-868 622 0131
- D **The Quantity Surveyor is:** WR Partnership
Chartered Quantity Surveyors
Suite 4
44 Eastern Main Road
St. Augustine
Trinidad

Telephone 1-868 662 5938

Description of the Works

- A The work is the refurbishment of the India House, the residence for the Indian High Commissioner to Trinidad and Tobago.
- B It involves an extension to the existing facilities on two levels, the replacing of the roof over the entire building with new Bermuda Profile sheets, substantially modifying the layout of the interior with complete overhaul of the mechanical and electrical installations and upgrading the external paving and front fencing.
- C Finishes would be to a high standard and first class workmanship would be an essential consideration on the project. Such would entail porcelain tiling to floors, gypsum ceiling with bulkheads and ceramic tiling to the bathroom walls.
- D The joinery fit out would be comensurate with the quality of the finishes.
- E The new extension would be of reinforced concrete foundations, reinforced concrete frame and suspended slab and hollow concrete block walls.
- F Engineering services comprise electrical installations, plumbing installations, lift installations; air-conditioning installations and related medical gases associated with a hospital environment.

Location of the site

- G The site is located at 21-23 Trinidad Crescent within Federation Park in Maraval
- H The Contractor would be given possession of the compound for undertaking the works.
- I The Contractor is to note that the area is exclusive and is the home of other High Commissioners and diplomats and should take the extra precaution to ensure that his operatives do not trespass other properties in the area. Works requiring heavy equipment or other noise generating machinery would no be permitted after normal working hours as stipulated in the conditions of particular application.
- J Access to the site for the purpose of the works and for the purpose of tendering would be by negotiations with the Employer and the Project Manager; in any case access would be of Quenca Street.

Drawings and other documents

- K The Bills of Quantities have been prepared from the following drawings listed at Appendix 4 to the Bills of Quantities

CONTRACT PARTICULARS

Conditions of Contract

- A The Conditions of Contract comprise two parts, namely:
Part I – General Conditions
Part II – Conditions of Particular Application
- B The General Conditions of Contract shall comprise Part I – General Conditions of Contract for Construction for Building and Engineering Works (First Edition (1999) produced for Federation Internationale des Ingenieurs – Conseils (FIDIC). The full edition of the General Conditions of Contract can be inspected at the offices of the Project Manager during normal working hours.
- C The Contractor shall allow hereunder for any costs which may result from compliance with the various clauses.

Schedule of Clause Headings

- D The Clause numbers and headings area as follows. The Tenderer is advised to refer to Part II – Conditions of Particular Applications for amendment to these Clauses and for reference to additional Clauses applicable to these Works.

1. **GENERAL PROVISIONS**

- 1.1 Definitions
- 1.2 Interpretation
- 1.3 Communications
- 1.4 Law and Language
- 1.5 Priority of Documents
- 1.6 Contract Agreement
- 1.7 Assignment
- 1.8 Care and Supply of Documents
- 1.9 Delayed Drawings or Instructions
- 1.10 Employer's Use of Contractor's Documents
- 1.11 Contractor's Use of Employer's Documents
- 1.12 Confidential Details
- 1.13 Compliance with Laws
- 1.14 Joint and Several Liability

2. **THE EMPLOYER**

- 2.1 Right of Access to the Site
- 2.2 Permits, Licences or Approvals
- 2.3 Employer's Personnel
- 2.4 Employer's Financial Arrangements
- 2.5 Employer's Claims

3. THE ENGINEER

- 3.1 Engineer's Duties and Authority
- 3.2 Delegation by the Engineer
- 3.3 Instructions of the Engineer
- 3.4 Replacement of the Engineer
- 3.5 Determinations

4. THE CONTRACTOR

- 4.1 Contractor's General Obligations
- 4.2 Performance Security
- 4.3 Contractor's Representative
- 4.4 Sub-contractors
- 4.5 Assignment of Benefit of sub-contract
- 4.6 Co-operation
- 4.7 Setting Out
- 4.8 Safety Procedures
- 4.9 Quality Assurance
- 4.10 Site Data
- 4.11 Sufficiency of the Accepted Contract Amount
- 4.12 Unforeseeable Physical Conditions
- 4.13 Rights of Way and Facilities
- 4.14 Avoidance of Interference
- 4.15 Access Route
- 4.16 Transport of Goods
- 4.17 Contractor's Equipment
- 4.18 Protection of the Environment
- 4.19 Electricity, Water and Gas
- 4.20 Employer's Equipment and Free-Issue Material
- 4.21 Progress Reports
- 4.22 Security of the Site
- 4.23 Contractor's Operations on Site
- 4.24 Fossils

5. NOMINATED SUB-CONTRACTORS

- 5.1 Definition of "nominated Sub-contractors"
- 5.2 Objection to Nomination
- 5.3 Payments to nominated Sub-contractors
- 5.4 Evidence of Payments

6. STAFF AND LABOUR

- 6.1 Engagement of Staff and Labour
- 6.2 Rates and Wages and Conditions of Labour
- 6.3 Persons in the Service of Employer
- 6.4 Labour Laws
- 6.5 Working Hours
- 6.6 Facilities for Staff and Health
- 6.7 Health and Safety
- 6.8 Contractor's Superintendence
- 6.9 Contractor's Personnel
- 6.10 Records of Contractor's Personnel and Equipment
- 6.11 Disorderly Conduct

7. PLANT, MATERIALS AND WORKMANSHIP

- 7.1 Manner and Execution
- 7.2 Samples
- 7.3 Inspection
- 7.4 Testing
- 7.5 Rejection
- 7.6 Remedial Work
- 7.7 Ownership of Plant and Materials
- 7.8 Royalties

8. COMMENCEMENT, DELAYS AND SUSPENSION

- 8.1 Commencement of Works
- 8.2 Time for Completion
- 8.3 Programme
- 8.4 Extension of Time for Completion
- 8.5 Delays Caused by Authorities
- 8.6 Rate of Progress
- 8.7 Delay Damages
- 8.8 Suspension of Work
- 8.9 Consequences of Suspension
- 8.10 Payment for Plant and Materials in Event of Suspension
- 8.11 Prolonged Suspension
- 8.12 Resumption of Work

9. TESTS ON COMPLETION

- 9.1 Contractor's Obligations
- 9.2 Delayed Tests
- 9.3 Retesting
- 9.4 Failure to Pass Tests on Completion

10. EMPLOYER'S TAKING OVER

- 10.1 Taking Over of the Works and Sections
- 10.2 Taking Over of Parts of the Works
- 10.3 Interference with Tests on Completion
- 10.4 Surfaces Requiring Reinstatement

11. DEFECTS LIABILITY

- 11.1 Completion of Outstanding Work and Remedying Defects
- 11.2 Cost of Remedying Defects
- 11.3 Extension of Defects Notification Period
- 11.4 Failure to Remedy Defects
- 11.5 Removal of Defective Work
- 11.6 Further Tests
- 11.7 Right of Access
- 11.8 Contractor to Search
- 11.9 Performance Certificate
- 11.10 Unfulfilled Obligations
- 11.11 Clearance of Site

12. MEASUREMENT AND EVALUATION

- 12.1 Works to be Measured
- 12.2 Method of Measurement
- 12.3 Evaluation
- 12.4 Omissions

13. VARIATIONS AND ADJUSTMENTS

- 13.1 Right to Vary
- 13.2 Value Engineering
- 13.3 Variation Procedure
- 13.4 Payment in Applicable Currencies
- 13.5 Provisional Sums
- 13.6 Daywork
- 13.7 Adjustments for Changes in Legislation
- 13.8 Adjustments for Changes in Cost

14. CONTRACT PRICE AND PAYMENT

- 14.1 The Contract Price
- 14.2 Advance Payment
- 14.3 Application for Interim Payment Certificates
- 14.4 Schedule of Payments
- 14.5 Plant and Materials intended for the Works
- 14.6 Issue of Interim Payment Certificates
- 14.7 Payment
- 14.8 Delayed Payment
- 14.9 Payment of Retention Money
- 14.10 Statement at Completion
- 14.11 Application for Final Payment Certificate
- 14.12 Discharge
- 14.13 Issue of Final Payment Certificate
- 14.14 Cessation of Employer's Liability
- 14.15 Currencies of Payment

15. TERMINATION BY EMPLOYER

- 15.1 Notice to Correct
- 15.2 Termination by Employer
- 15.3 Valuation at Date of Termination
- 15.4 Payment after Termination
- 15.5 Employer's Entitlement to Termination

16. SUSPENSION AND TERMINATION BY CONTRACTOR

- 16.1 Contractor's Entitlement to Suspend Work
- 16.2 Termination by Contractor
- 16.3 Cessation of Work and Removal of Contractor's Equipment
- 16.4 Payment on Termination

17. RISK AND RESPONSIBILITY

- 17.1 Indemnities
- 17.2 Contractor's Care of the Works
- 17.3 Employer's Risks
- 17.4 Consequences of Employer's Risks
- 17.5 Intellectual and Industrial Property Rights
- 17.6 Limitation of Liability

18. INSURANCE

- 18.1 General Requirements for Insurances
- 18.2 Insurance for Works and Contractor's Equipment
- 18.3 Insurance against injury to Persons and Damage to Property
- 18.4 Insurance for Contractor's Personnel

19. FORCE MAJEURE

- 19.1 Definition of Force Majeure
- 19.2 Notice of Force Majeure
- 19.3 Duty to Minimise Delay
- 19.4 Consequences of Force Majeure
- 19.5 Force Majeure Affecting Sub-contractors
- 19.6 Optional Termination, Payment and Release
- 19.7 Release from Performance under the Law

20. CLAIMS, DISPUTES AND ARBITRATION

- 20.1 Contractor's Claims
- 20.2 Appointment of the Dispute Adjudication Board
- 20.3 Failure to Agree Dispute Adjudication Board
- 20.4 Obtaining Dispute Adjudication Board's Decision
- 20.5 Amicable Settlement
- 20.6 Arbitration
- 20.7 Failure to Comply with Dispute Adjudication Board's Decision
- 20.8 Expiry of Dispute Adjudication Board's Appointment

The Appendix to the Form of Contractor would be completed as shown on the Letter of Tender

OBLIGATIONS AND RESTRICTIONS IMPOSED BY EMPLOYER

Limitations in using the site.

A The site must be used exclusively for the sole purpose of the works.

Artists, Tradesmen, etc.

B None would be engaged by the Employer.

Accommodation for Engineer

C Provide, erect and maintain office accommodation for the Engineer in a location to be agreed with the Engineer and Employer. The office shall be approximately 20 square metres in area and of sound construction with lockable doors, windows, writing table, chairs, space for hanging drawings, pin up boards, drinking water and toilet facilities for the exclusive use of the Engineer. Provide daily janitorial services during the works and remove the structure and fittings on completion of the Works. Provide furniture suitable for seating ten (10) persons at site meeting

Limitations of Working Hours

D The Contractor must notify the Engineer allowing three (3) clear working days of any intention to operate overtime or weekend work. This is to ensure that proper arrangements are made for supervision of the works during execution.

Disposal of materials found on site

E Sand, gravel or other materials of value found during excavation will become the property of the Employer who will issue directions to the Contractor regarding salvage or disposal.

Testing

F Provide 2 No. steel test moulds with all plates and bolts for working tests in accordance with the British code of Practice CP 114 for the structural use of reinforced concrete in buildings

G Allow for 100 concrete cube tests; 5 gradation tests on aggregates and 5 density tests to ascertain compaction of materials in place

Site sign board

H Allow a provisional sum of ten thousand dollars for a site sign board.

10,000

Progress photographs

I Each month, the Contractor will be required to provide one print each of twelve standard size self dated photographs from a 35 mm camera to show progress of the Works. The photographs shall be taken from locations to be agreed eighth the Engineer. In addition, the Contractor shall allow for making five prints our of six selected photographs and for handing the negatives to the Engineer

Daily Records

J Provide and keep on the site a log book in which the Employer may confirm any oral instructions issued.

Contract Programme

A The Contractor is to prepare a Contract Programme within fourteen (14) calendar days of the award of contract for agreement with the Engineer In preparing his programme the Contractor shall allow sufficient time for:-

- i) Reasonable notice to be given to the Engineer. of the Contractors Requirements in respect of instructions, drawing details or levels.
- ii) Placing orders with specialist sub-contractor and nominated suppliers for the proper co-ordination of the work.
- iii) Complying with and giving notices etc. to Local Authorities or Statutory Undertakers in accordance with clause 4 of the conditions of contract.
- iv) Placing orders for materials in due time.
- v) A time contingency in respect of inclement weather.

B The Programme can be in form of a bar chart.

C For site meetings, the Contractor is to prepare and agree with the Engineer a progress report listing the activities as itemised on the contract and recording the following:

- i) A summary of the overall completion
- ii) Lengths of contract remaining including authorised extensions
- iii) Estimate of the length of time remaining for the completion of the Contract

This programme is in addition to the preliminary programme required at the time of submitting the tender.

E The Contractor will be responsible for the supervision and administration of all nominated suppliers, nominated sub-contractors, statutory undertakings etc., and will be required to arrange a programme with each organisation.

E After commencement of the work, the programme is to be reviewed each month and adjusted as necessary and to send two (2) copies of same for the Engineer.

Health and Safety

F The successful contractor would be required to submit a written statement of the safety practices and procedures which will be adopted for the duration of the construction period.

G The Contractor shall appoint a dedicated qualified and competent Safety Officer for the duration of the works whose responsibility shall included inter alia the monitoring and ensuring safety in executing the works.

H All personnel on site have protective clothing, safety boots and hard hats, dust masks, harnesses as necessary. It is mandatory that safety goggles and face shields be worn on operations where eye protection is needed.

- A Regular seminars/training sessions must be held with workers to keep them informed on safety procedures and practices.
- B Keep on site at all times a fully stocked first aid kit.
- C Allow for proper signage to ensure safety throughout the site.
- D Ensure that all persons employed on or visiting the site are adequately informed, instructed , trained, supervised and equipped such that they are able to carry out their duties safely.
- E Comply with the latest edition of the Control of Substances Hazardous to Health Regulations. Undertake COSHH assessments for all activities and substances provided or used on site to assess their potential health hazards. Copies of all relevant COSHH assessments must be issued to operatives concerned and strictly monitored. Particular attention should be given to the use of glues and sealants.

Method Statement

- F The Contractor shall submit with the tender a method statement which clearly illustrates the method by which the works will be carried out and the equipment which he proposes to use to address the requirements and constraints set out in the relevant tender document.

Trespass

- G The Contractor shall ensure that his men do not enter any grounds other than the site defined before, except insofar as is necessary to execute works outside the boundaries of the site. The Contractor shall take all measures necessary with regard to works carried out outside the boundaries of the site to prevent damage or injury, nuisance or inconvenience to occupants or licensees and shall make good any damage and keep indemnified the Employer against all losses, costs, demands, damages, expenses, claims incurred or sustained.

Advertising

- H No Advertising shall be permitted on hoardings, walls, fences, the Works, temporary buildings, etc. except for the display of the Contractor's sub-contractors, suppliers and professional advisors nameboards or as directed by the Employer.

GENERAL FACILITIES AND OBLIGATIONS

Plant, Tools and Vehicles

- A Provide for all mechanical and hand plant, tools, vehicles and all other items necessary for the proper execution of the works including those of the sub-contractors.
- B Provide adequate ladders, drains, plugs and such other plant as may reasonably be required by the Engineer to enable him to make inspections during and at the end of the Maintenance Period.

Scaffolding

- C Provide all necessary scaffolding for the proper execution and completion of the Works and pay all charges in connection.
Note: Items for the provision of scaffolds for nominated sub-contractors are included hereafter under “other attendances”.

Site Administration and Security:

- D Provide for all supervisory and administrative staff, attendance of staff, security, watching and maintenance.
- E Safeguard the Works, materials and plant against damage or theft including shelter and fuel for any watchmen so required.

Transport for Workpeople

- F Provide for all costs arising from the transport of workpeople to and from the Works.

Protecting the Works from inclement weather

- G Cover up otherwise protect all work liable to injury from abrasions, wet, excessive sun, heat or any other cause and clear away on completion and make good any damage to finished work.

Protection of Public and Private Services

- H Protect, uphold maintain all pipes ducts sewer service mains and overhead cables, etc., during the execution of the Works. The Contractor shall make good any damage due to any cause within his control at his own expense and pay costs and charges in connection therewith.

Water for the Works

- I Provide water for the Works and for the Works of the sub-contractors.
- J Make all temporary connections, provide temporary plumbing storage vessels, etc. and clear away at completion and make good all works disturbed.

Lighting and Power for the Works

- K Provide all temporary lighting and electricity for power for the Works and lighting for the works of the sub-contractors.
Note: Providing power for the works of nominated sub-contractors is provided for hereafter under “other attendances”
- L Provide all temporary apparatus and connections, clear away at completion and make good all works disturbed and pay all charges in connection.

A Temporary installation shall comply with the requirements of the Electricity Commission.

Temporary Roads, Hardstandings, Crossings and Similar Items

B Provide all requisite temporary tracks on or about the site as necessary for the execution of the Works, maintain during the progress of the works, clear away when no longer required, make good all services disturbed to the satisfaction of the Engineer and pay all charges in connection.

C Provide access across public footpaths as may be necessary. Each access shall be in accordance with the requirements of any local or other authority. The Contractor shall make good any damage to the footpaths to the entire satisfaction of the Authority concerned and pay all charges in connection.

Traffic Regulations

D Allow for complying with all traffic regulations in force on or adjacent to the Works. The obtaining of any easement of these regulations which the Contractor may deem necessary for the execution of the works will be the responsibility of the Contractor.

Temporary accommodation for use of the Contractor

E Provide, erect, maintain, shift as may be necessary during the progress of the Works, clear away when no longer required and reinstate all surfaces disturbed to the satisfaction of the Engineer and pay all charges in connection

- i) Suitable lock-up offices for the use of the Agent/Foreman and site staff with all requisite fittings, lighting telephone and attendance.
- ii) Suitable weather tight and secure lock-up storage sheds or accommodation for materials or goods including those sub-contractor, in the case of a nominated sub-contractor, this item is included in attendance to be provided.
- iii) Suitable welfare and safety measures and amenities including toilets, mess rooms, etc., for workpeople including those of sub-contractors on the site.

Temporary telephone

F Provide and maintain a telephone service for the Engineers and to such other offices of the Contractor's site staff as may be necessary, for the full period of the Works and pay all charges.

Safety, Health and Welfare of Workpeople

G Provide and maintain suitable welfare, safety measures and amenities which under or by virtue of the provisions of any enactment or regulation or the working rules of any industry the Contractor is required to provide for his own workpeople and those of the sub- contractors whether nominated or otherwise.

Disbursement arising from the employment of workpeople

A Provide for all additional costs arising from the employment of workpeople including:-

- i) National Insurance and pensions contribution
- ii) Redundancy Payments
- iii) Holidays with pay
- iv) Traveling time, fares, lodging allowances
- v) Transport from whatever district labour is obtained
- vi) Guarantee time
- vii) Non-productive time including time lost due to inclement weather
- viii) Incentive and bonus payments
- ix) Any other disbursement

Maintenance of public and private roads

B Maintain public and private roads, footpaths, kerbs etc. and keep the approaches to the site clear of mud, debris, etc. The Contractor shall make good any damage caused by his own or any sub-contractor's suppliers transport at his own expense and keep indemnified the Employer against all losses, costs, damages, expenses, claims and demands incurred or sustained.

Removal of rubbish, protective casings and coverings and cleaning the works on completion

C Clear away all rubbish and surplus materials from time to time as it accumulates and at completion.

D Wash off stains, clean off mortar marks and cement from all facings, bricks, steps, sills, paving, etc. clean out gutters and down pipes, clean sanitary fittings, rod out and flush down drains, ease doors, windows and ironmongery. Clean floors and pavings, clean glass both inside and out and leave the building clean and free from debris at completion.

Temporary fencing, hoardings, screens, fans, planked footways, guard rails, gantries and similar items including security

E Provide all hoardings, gantries, fans, temporary barriers and all else necessary for the proper execution of the works, for the proper protection of the contractor's workpeople, occupants or adjoining properties licenses and general public, and for meeting the requirements of any local or other authority and pay all charges in connection. The Contractor will be held responsible for any accidents, damage or losses occurring through lack of adequate protective measures and will be required to meet the cost of any repairs, replacements or compensation arising therefrom. Add to this clause the following : The contractor shall provide security including Police and necessary fencing for the duration of the construction and pay all charges associated with the provision of security

Setting out of the Works

F Provide all instruments and labour and fix all necessary lines, stakes, templates etc., as may be required for and set out the works including those of sub-contractors. Remove all pegs, templates, etc., when no longer required.

G Provide all instruments and labour required by Engineer for checking the setting out of the works.

Samples of work and materials

A Provide samples of all materials to be used and small portions of blockwork, pointing, plastering, decorations etc. These samples when approved by the Engineer will be retained as standards with which the whole of the work must comply.

Defects occurring during Defects Liability Period

B Comply with Engineer’s instructions given under the terms of Clause 15 of the Conditions of Contract which shall include making good shrinkage cracks in in-situ finishings. In the case of making good plaster, the decoration shall also be carefully matched and made good.

Control of noise, pollution and all other statutory obligations

C Take all measures to prevent damage or injury, nuisance annoyance or disturbances from noise, dust, vibration, smell or otherwise to any of the occupiers of the adjoining or neighbouring buildings or the general public and shall make good any damage and keep indemnified the Employer against all losses, costs, damages, expenses, claims and demands incurred or sustained.

D Comply with the Control of Pollution Act 1974 and in particular the Contractor shall be responsible for ascertaining from the Local Authority what requirements and restrictions shall apply to the Works in this respect and keep indemnified the Employer against all losses, cost, damages, expenses, claims and demands incurred or sustained.

E The contractor’s attention is drawn to British Standard 5228 “Code of Practice for noise control of construction and demolition sites”. The Contractor will be responsible for any delays, stoppage and extra costs resulting from failure to comply with this Condition.

Other General Facilities

A

Provide for any other disbursements not specifically listed herein above but which is considered necessary for the completion of the works. (Detail all such items hereunder).

NOMINATED SUPPLIERS, NOMINATED SUB- CONTRACTORS:
STATUTORY UNDERTAKINGS

Nominated Suppliers

A The Project Manager would nominate a supplier for ironmongery

Nominated Sub-contractors

B There would not be any nominated sub-contractors but the Project Manager must be satisfied that subcontractors chosen for the mechanical and electrical installations stated below are competent in their respective fields - see under Instructions for Tendering for further requirements.

i. Electrical Installations

ii. Air conditioning Installations

iii. Plumbing Installations

Statutory Undertaking

C There will be no work for execution by Statutory Undertakers

COLLECTION

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PRELIMINARIES

TOTAL TO MAIN SUMMARY

Bill Nr. 2: Specifications

MATERIALS AND WORKMANSHIP

PREAMBLES TO ALL WORK SECTIONS

GENERALLY

Descriptions to apply

- A Description of materials and workmanship referring to items which are not included or required in the works described in the Bills of Quantities shall be disregarded unless subsequently introduced as a variation.

Rates

- B The rates inserted by the Contractor shall include for complying with all provisions of this specification unless specifically stated otherwise, or measured.

Definitions

- C “Engineer” herein shall be as shown in Bill Nr 1: Preliminaries, under the heading ‘Names of Parties’
- D The term “the Works” shall mean “the whole of the works envisaged by the Contract”.
- E Words importing the singular only shall also include the plural and vice versa.

Defective Work

- F The Engineer reserves the right to check the work executed by the Contractor at such times as he deems fit; there is however, no duty on his part to make such checks and any failure by him to observe errors shall not relieve the Contractor of his responsibilities in these respects.

Materials and Workmanship

- G All materials and workmanship shall conform to the highest standard and quality, and shall always be to the approval of the Engineer.
- H Materials rejected by the Engineer shall be removed immediately from site and replaced with that in accordance with these specifications.
- I Materials rejected by the Engineer shall be taken down/demolished immediately, and the work re-done to the approval of the Engineer.

Calculations and Quantities

- J All work unless otherwise described has been measured net as fixed in position and the Contractor shall allow in his prices for waste, laps, etc. The Quantities therefore, are NOT suitable for the ordering of materials.

A Throughout these Bills of Quantities the following abbreviations have been used:

m ³	-	Cubic metre
m ²	-	Square metre
m	-	Linear metre
kg	-	Killogram
Nr	-	Number

B All weights and measures mentioned in these Bills of Quantities are those used in Trinidad and Tobago.

C Description of Materials and Workmanship given in any new work section shall apply equally to all work sections, unless otherwise described.

D Notwithstanding any of the foregoing, the whole of the material and workmanship section shall be subject to the approval of the Engineer.

Proprietary Products

E All proprietary products shall be used strictly in accordance with the manufacturer's instructions unless otherwise described.

PROVISIONAL AND PRIME COST SUMS

DEFINITIONS

General Attendance

F General attendance on Nominated Sub-Contractors, Local Authorities and Public Undertaking shall be as defined in the SMM Clause B 19-21 that is including "the use of Contractor's temporary roads, pavings 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 sub-contractor's own offices and for the storage of his plant and materials and the use of mess rooms, sanitary accommodation and welfare facilities".

G In addition, general attendance shall be deemed to include arranging with Local Authorities, Public Undertakings, Nominated Sub-Contractors and Nominated Suppliers the time for commencement of their work on the site or manufacture and delivery of their goods and materials, obtaining particulars of holes, mortices, chases, recesses, fixings and the like and supplying them with all dimensions and other information required for the proper execution of the works.

Nominated Sub-Contractors

- A The P.C. Sums given are for which the terms of Contract Condition 16 will apply.
- B Except for loss or damage by causes listed in Clause 13.1 of the Conditions of Contract the Nominated Sub-contractor shall be responsible for loss and damage and insurance against such loss or damage to any materials and goods brought onto or delivered to the site for his own use until such materials and goods have been fully, finally and properly incorporated in the Works except also for any loss or damage due to any negligence, omission or default of the Contractor, his servants or agents, or any other Sub-contractor of the Contractor, or of the Engineer of any person for whom the Engineer is responsible.
- C The Contractor shall make arrangements with the various Nominated Sub-contractors so that their work proceeds in accordance with the agreed programme and shall furnish to them all necessary dimensions, marks, lines, levels, pegs, etc., for setting out and shall be responsible for the accuracy of same.
- D Nominated Sub-contractors will be responsible for covering up and protecting their work during its execution but immediately upon its completion the Contractor shall assume this responsibility.

Nominated Supplies

- E The P.C. Sums given are for goods and materials to which the terms of Contract Condition 17 apply.
- F Notwithstanding the provisions of SMM clause B 21 (b) the costs required to be paid by the Contractor of conveying goods and materials to the site, of any special packing and the like, are included in the appropriate prime cost sums and particulars are not given in the measured items.
- G Fixing of goods and materials shall in addition to the provisions of SMM clause B 10.2 be deemed to include for distribution to final point of installation.

PROVISIONAL NET SUMS

- H Notwithstanding SMM Clause A.8 the Provisional net sums given are exclusive of any profit or cash discounts to the Main Contractor. An item of Profit is therefore included which the Contractor should price accordingly as part of his tender.

Test of Materials

- I The provisional net sum is for charges for testing materials which will be executed by the Laboratory named by the Engineer and to which the terms of Contract Condition 9.2 will apply.
- J The term Contractor's services in connection with these tests is to be read as take test sections of the work when required, store pack, label, record details and dispatch carriage paid to the testing laboratory.

General

- A The Contractor is advised to read the following clauses with care and to price the relevant items of the Bill on Site.

Definition

- B The term “remove” as used in this section shall mean the demolition of the structures by any means except the use of explosives and shall include grubbing up and sealing of drains and services.

Shoring and scaffolding

- C Shoring and scaffolding incidental to demolitions and alterations and making good all work disturbed thereby, shall be deemed to be included in the description.
- D Shoring and scaffolding incidental to demolitions of individual structure and making good all work disturbed by such shoring and scaffolding shall be deemed to be included in the description.

MATERIALS AND WORKMANSHIP

General

- E Description of materials and workmanship together with relevant preambles and pricing notes given elsewhere in these Bills shall be read as applying equally to the works described in these sections of the Bill.
- F All materials used in the making good or extending are, unless otherwise described, to be of equal quality to the old work and to match the original in appearance as nearly as possible.
- G Credit for old materials removed or suitable for re-use are to be given separately for each item in the column provided. If no credit amount is shown, it will be assumed that the Contractor considers them to be of no value to him.
- H The Engineer reserves the right to acquire from the Contractor any of the old materials arising from these Works at the rates quoted in the credit column.
- I All sound materials arising from the pulling down and alteration work may, if properly stacked, cleaned, reduced or adapted etc. and subject to the approval of the Engineer, be used in appropriate positions in the new work.
- J Rates for cutting openings in brick or block walls shall include for cutting out thresholds, cutting away over openings as necessary and providing and installing suitable lintels, pinning up between lintels and work over with slates in cement mortar and properly quoining up jambs.
- K All pulling down and alteration work shall be executed with as little noise and disturbance as possible.

- A The Contractor shall obtain the Engineer's permission before switching off, shutting off or disconnecting any live services to the existing rooms.
- B Rates for all work shall include for providing and erecting all necessary temporary casings and protections for work likely to be damaged during the alterations and all necessary tarpaulins, dust screens, temporary coverings, fans, temporary gutters, down pipes, chutes, etc., required for the protection of the general public, staff, etc., to the entire satisfaction of the Engineer and Local Authority.
- C Rates for all works shall include for the making good and reinstatement of damage or disturbance caused by their execution and the clearing away of all rubbish arising.
- D The Contractor shall at his own cost reinstate to match the existing any part or parts of the existing building which may suffer damage due to his building operations.

Note : Nominated Sub-contractors will be responsible for alteration and adaptations of existing mechanical and electrical services within the existing buildings.

- E The whole of the works shall be done at such times during the progress of the works as may be convenient and expedient and the Contractor must take responsibility for damage due to premature removal of brickwork, timber, etc.
- F Dimensions given in these sections of the Bill are approximate and are for the guidance of the Contractor in identification of the particular item and/or the extent of the work and do not relieve the Contractor in any way of his responsibility to assess the whole of the work involved.

PLUMBING, ENGINEERING AND ELECTRICAL INSTALLATIONS

- G The description of removing structures shall be deemed to include sealing off and making safe the mains to plumbing, Engineering and electrical installation. The descriptions of taking out equipment, appliances, ancillaries, fittings and electrical installation shall be deemed to include disconnecting from the associated gutter work, pipe work, duct work, conduits, cables and the like.
- H The Contractor shall give due notice to the Electricity and Water Authorities and shall allow them facilities for removing any fixtures, fittings or services which belong to them. The Contractor shall arrange for all electrical fixtures, wiring, sanitary fittings which come within the area to be demolished, to be disconnected and stored for handing over to the Engineer.

Demolitions and Materials arising

- I The pulling down is to be carried out in such a manner as to cause little inconvenience as possible to adjoining owners or the public and the Contractors will be held responsible for any claims which may arise from disregard of this Clause. Debris is to be kept well watered during the work to prevent dust arising.
- J Concrete materials resulting from the breaking up of foot paths and ground floor slab shall be deposited at the direction of the Engineer.

Temporary Screens, Hoardings and the like

- A Temporary screens shall be erected at the express request of the Engineer or his representative and shall be provided in the positions indicated by them.
- B Screens shall be constructed in such a manner as to satisfy the particular requirements of the subsequent measured items and in a manner approved by the Engineer. In addition, screens described as “dust-proof” shall be faced with as suitable rigid sheet of material so as to provide in addition to the functions previously stated, a reasonable measure of security.

PRICING

- C It will be assumed that in pricing the “Works to be priced on Site” the Contractor has viewed them on the site and included for all contingencies which he ought reasonably to have foreseen and for all works in connection reasonably implied by the descriptions.
- D No claim resulting from failure to do so will be entertained.

EXCAVATION AND EARTHWORK

General

- A The excavation is to be carried out to the lines and levels shown on the drawings or to such other dimensions as the Engineer or his representative may supply.
- B Excavation and backfilling shall be carried out in such a manner as to avoid damage to adjacent structures and the Contractor shall provide any temporary support that may be required. The Contractor shall be fully responsible for damages to any services or property which might be disturbed or damaged.

Nature of ground

- C Ascertain the nature of the ground and sub-soil and determine whether water, running sand or any other difficulties are likely to be encountered or whether cutting by hand or mechanical means must be used.
- D Using mechanical and/or pneumatic equipment for excavations the Contractor shall ensure the equipment capacity and suitability so as not to hinder the progress of the works. The Contractor shall employ experienced operators and take precautions so as not to disturb the material at the bottom of the finished excavation level. Over excavation may be carried out after obtaining a written permission from the Engineer and excavation shall be filled with mass concrete at the Contractor's expense.
- E Remove any large pieces of rocks encountered with wedges and levers or rock drills. Blasting will not be permitted on site without the written permission of the Engineer and the relevant governing Authority.
- F Excavations must be kept dry regardless of the source of the water. If sump holes are necessary, the positions are to be approved by the Engineer.
- G Measures must be taken to control and reduce seepage of water from higher levels on to the site as far as practicable.
- H Every precaution must be taken to ensure that moisture conditions in the soil are so controlled as to have no deleterious effect on the foundations. Excessive drying out or wetting must therefore be avoided during construction. Foundations are to be cast promptly after completion of excavation.

Surplus excavation

- I All excavated material shall be deposited on a spoil heap on site for reuse as fill. All cleared vegetation shall be burnt or otherwise disposed of by the Contractor as approved.

Water-level

- J Ground water level has not been established.

Approval of bottoms

- A The excavation for all foundations shall be inspected by the Engineer or his representative before any concrete is placed and the Contractor shall give a minimum of 24 hours notice that such an inspection will be required.
- B The bottom 75mm of excavation for concrete shall be removed on the same day as the concrete (or blinding layer) is placed on it. If the excavation should become disturbed or weakened by water or other means the Contractor shall be required to remove a further thickness of soil as the Engineer or his representative may direct and to backfill same with plain concrete with characteristic strength of 7.0N/mm² at the Contractor's own expense.

Level and Ram

- C Compaction of fill material in general and in confirmed areas is to be carried out with a suitable roller and pneumatic compactors respectively to compact excavated materials in layers not exceeding 150mm when loose. Stones likely to hinder proper compaction shall be removed before and during compacting operation.
- D Compaction of fill material is to be done with a 6 tonne roller or approved equipment in layers not exceeding 150mm compacted thickness. The Contractor is to allow for watering where necessary and for delays which may occur to allow soil to dry out to an appropriate moisture content. Any soft areas which may develop during compaction shall be removed and replaced with selected excavated material.

Excessive excavation

- E Should excavation be taken below the specified levels, the difference in level shall be made up in concrete 7N/mm² at the Contractor's own expense.

Backfill

- F Backfill shall be carried out with selected excavated material, free from wood, debris or other combustible material, vegetable matter or any other material subject to decay or disintegration alkaline debris such as lime, plaster and cement from current operations.
- G Backfilling shall be carried out around foundations and at the back of walls etc. up to original level or as directed. It shall be carried out in horizontal layers not exceeding 150mm loose thickness moistened or dried as required and thoroughly compacted by mechanical or other approved means to a dry density not less than the surrounding soil.
- H The Contractor shall take due precaution to ensure the safety of any block or reinforced concrete walls which may be subjected to excessive load during the compaction of the fill and/or hardcore by shoring or otherwise protecting these walls.
- I No fill material shall be placed where free water is standing on the surface of the area where the fill is to be placed and no compaction of fill will be permitted with free water on any point of the fill to be compacted.
- J No backfilling shall be carried out which covers work which has not been inspected and approved.

Fill under slabs on ground

- A Fill material to areas under floor slabs shall be material approved by the Engineer or his representative and compacted in layers not exceeding 150mm compacted thickness. Where rotten rocks, quarry overburden or similar approved materials have been used, the Contractor shall ensure that the moisture content is suitable for optimum density after compaction and shall water where necessary and allow for delays which may occur to allow the soil to dry out to an appropriate moisture content. Any soft areas which may develop during compaction shall be removed and replaced with selected materials as directed.

Materials arising

- B Materials found in the excavations are to be used in the Works with the written permission of the Engineer.
- C Hardcore is defined, for the purposes of this contract, as material that can be excavated by mechanical equipment including a D8 tractor with ripper. Rock is defined, for the purposes of this contract, as materials that can be excavated only by the use of wedges and levers or rock drills and blasting.

Planking and strutting

- D The Contractor shall provide adequate timbering to prevent collapse of the earth cuts where appropriate. The Contractor shall be entirely responsible for the excavations and any damage caused by them to other parts of the Works. Excavations are to be left exposed for as short a time as possible.

Hardcore

- E Hardcore other than pitrun is to consist of clean and crushed natural stone, broken block or gravel or concrete rubble approved by the Engineer, free from clay, silt or organic material, not exceeding 75mm maximum size and is to be consolidated with a 6 tonne roller or approved equivalent. The hardcore is to be well wetted and blinded with sand 50mm thick to present a uniform and even upper surface.
- F Where pitrun gravel is specified it shall be graded from 75mm down to fine and shall contain approximately 25% of natural clay for blinding purposes and well rolled with a 6 tonne roller or approved equivalent. No sand blinding shall be required where pitrun is used.

Damp proof membrane

- G The damp proofing is to be done using polythene (polyethylene) sheeting 0.127mm thickness.
- H The polythene sheeting is to be laid over blinded hardcore with minimum 300mm end and side laps and carried over walls for the full area of the ground floor slabs.

Subterranean Termite Treatment

- A Treatment of the site of the building shall be with an approved anti-termite treatment. In order for the Engineer to approve a chemical for application, the contractor would be required to provide sufficient information to show that the selected chemical is approved for use BY THE Guyana Environmental Protection Agency.
- B Toxicant emulsion shall be applied by spray immediately before pouring of concrete at the rate of 5 litres per m² of surface area of excavations and 2.5 litres per m² on filling and sand beds.
- C Treatment shall not be carried out when rain is falling or when the ground is wet. A warranty of at least 5 years shall be obtained against infestation.

PRICING

- D Prices for Excavation and Earthwork shall include :-
 1. All consideration arising from the specification.
 2. Hand and/or mechanical excavation and disposal in whatever types of soil and fillings are encountered excluding concrete and rock but including roots, drain pipes and other obstructions and the Contractor shall judge for himself the nature of the conditions.
 3. Separating vegetable soil from sub-soil including the provision of separate spoil heaps.
 4. Extra difficulties of getting out, disposal and the extra bulking of concrete and rock.
 5. Planking and strutting left in at the Contractor's volition.
 6. Temporary retention of fillings.
 7. Disposal of trees and other vegetation cut down and grubbed up.
 8. Excavation in gravel; coral, rotten rock and hardcore.
 9. Allow for excavation in items measured as "extra over excavation" for any additional cost of disposal.
 10. The description "get out" shall include for all wheeling, bucketing out, double handling or re-excavation from temporary spoil heaps of surplus material as may be necessary preparatory to removing from site.

CONCRETE WORK

PREAMBLE

General

- A Concrete shall be made with cement, fine aggregate, coarse aggregate and water. No other agent or ingredient shall be added to the concrete without the prior approval of the Engineer. The Contractor shall ensure that the use of any such approved additive will not adversely affect the strength, durability or appearance of the finished concrete works.

Definitions

- B The following terms whenever used in the specification shall be taken to have the meanings assigned to them below.
- C “Plain concrete” shall mean concrete used in members made with a structural grade of concrete listed, but not containing steel reinforcement.
- D “Structural props” shall mean those components of the strutting to formwork which will be retained in position when the shuttering is removed from concrete faces.
- E “Satisfactory” shall mean to the satisfaction of the Engineer’s representatives.
- F “Approved” shall mean approved by the Engineer’s representatives.
- G “Required” shall mean required by the terms of this specification, or any other contract document.
- H “Passed by the Engineer’s representative” shall mean accepted as complying with specification requirements as far as can be judged from visual inspection.
- I “Current Issue” shall mean latest issue at the date of tender invitation.
- J “Failure to comply with this specification” shall mean failure to comply satisfactorily with all the requirements of this specification.

Responsibility

- K No approval or acceptance by the Engineer or his representative shall in any way relieve the Contractor of his responsibility for the quality of materials and the standard of workmanship in the finished works and for the strength, durability and appearance of the finished concrete works.

DESIGN

Reinforced concrete

- L The reinforced concrete works have been designed generally in accordance with the recommendations contained in the British Standard Code of Practice for the Structural use of Concrete (CP8110 : 1985). The reinforced concrete works are to comply with the recommendations of this Code of Practice unless specifically excluded or modified hereafter.

Plain concrete

- A Plain concrete works shall comply with all the relevant requirements for reinforced concrete.

MATERIALS

General

- B All materials in the works shall comply in all respects to the best standard available locally, based on the relevant British Standard, except for any deviations specifically authorised in subsequent clauses of this Specification.
- C The constituent materials of concrete shall be cement, aggregates and water. No admixtures to this concrete shall be permitted without the prior approval of the Engineer.

Cement

- D Cement shall be ordinary Portland Cement complying with B.S. 12. All cement shall be delivered to site in bulk cement lorries of approved design or in sealed bags.
- E Minimum cement content of concrete shall be 290kg/m³ for all work below ground level and 250kg/m³ for all work above ground level. Maximum cement content of concrete shall not exceed 550kg/m³.
- F No rebagged cement will be permitted to be brought on to the site. On no account shall a change in the type of source of supply be permitted during the course of construction and every endeavour shall be made to ensure that the colour of the cement is constant throughout the contract except with permission of the Engineer.

Aggregates

- G Aggregates shall comply with the recommendations of B.S. 882. In special circumstances, a deviation from B.S. 882 in respect of grading of aggregate may be accepted, subject to the prior approval of the Engineer.
- H The nominal maximum sizes of coarse aggregates shall be 20mm, except where otherwise directed by the Engineer.

Water

- I Water to be used in the works shall be clean and free from all harmful matter, in suspension or solution, that would have adverse effects on setting, hardening and strength of Portland Cement. A continuous supply of water shall be available during all mixing, placing and curing operations.

Reinforcement

- J Mild steel reinforcement shall be hot rolled mild steel with a specified characteristic strength of 250N/mm² complying with B.S. 4449 or approved equivalent. Hot rolled high yield steel shall have a specified characteristic strength of 410N/mm² and comply with B.S. 4449 or approved equivalent. Cold rolled high yield steel shall have specified characteristic strengths of 460N/mm² for bars up to and including 16mm diameter and 425N/mm² for bars exceeding 16mm in diameter. Welded steel fabric shall comply with B.S. 4443 or approved equivalent.

Admixtures

- A Admixtures for improving the concrete may be permitted but only after the Contractors have satisfied the Engineer that it will be to the advantage of the Engineer. Use of the admixtures shall be made only on the written permission of the Engineer and in any case the permission to use the same shall not be construed to mean that extra will be paid.

Storage

- B All cements shall be stored in a weather proof shed of adequate size having a raised dry floor, or in silos of approved design.
- C Aggregates shall be stored on hard paved areas with adequate dividing walls, or in approved containers, to prevent mixing of different types of aggregate and be kept clean and free from contamination.
- D Cements and aggregates shall be used in the order in which they are received on site and their storage shall be arranged to facilitate this procedure.
- E Reinforcement shall be stored in racks clear of the ground.
- F Where materials are to be stored on suspended floors on roofs the Contractor shall ensure that such storage will not overload or distort the structural frame.
- G All materials which have been damaged or are contaminated, or have deteriorated or do not comply with the requirements of this specification shall be rejected and shall be removed from the site immediately at the Contractor's expense.

TESTS

General

- H Before the commencement of the Contract the Contractor shall submit to the Engineer for his approval the name of the Testing Authority he proposes to employ.
- I The Contractor shall provide all equipment necessary for carrying out all tests on site specified or described in this specification and he shall make and provide for all necessary arrangements for the delivery of all samples and test pieces to be tested by the approved Testing Authority.
- J The Contractor shall provide for maintaining all testing equipment on site in proper working order to the satisfaction of the Engineer.
- K The Contractor shall provide for sending copies of test results to the Engineer where these are required.
- L The Contractor shall be paid for all tests specifically required in this specification.
- M The Contractor will not be paid for any special tests called for by the Engineer in consequence of any failure by the Contractor to comply with this specification.
- N The Contractor will be paid, at rates to be agreed, for any other special tests called for by the Engineer unless the tests results show failure by the Contractor to comply with this specification.

Cement

- A The Contractor shall state his source of cement to be used on the site and verify that these are of the relevant B.S.
- B The manufacturer's certificate of tests including compressive strength tests, carried out in accordance with B.S. 12 for Portland Cement shall be supplied and kept on site for each consignment of cement delivered to the Works. At the commencement of the contract, the Contractor shall deliver a 22.68kg sample of each type of cement he intends to use to the approved Testing Authority.

Aggregates

- C Samples of aggregates to be used should be supplied if so requested by the Engineer.
- D All sampling and testing of aggregates shall be carried out in accordance with the relevant recommendations of B.S. 882.
- E At the commencement of the contract, the Contractor shall deliver to the Approved Testing Authority for inspection and analysis, 3 separate samples of each type of aggregate to be used in the structural concrete grades. For each type of aggregate, the 3 samples shall be taken at the proposed source of supply at intervals of not less than one day. For fine aggregate the samples shall be 22.68kg weight each and for coarse aggregates the samples shall be 45.36kg weight each.
- F To ensure that no significant variation in the grading of the aggregates occurs during the contract, sieve analyses shall be carried out on site at fortnightly intervals. The results of these analyses shall be recorded on a chart to be kept on the site and to be handed to the Engineer on completion of the structural concrete works.
- G If the grading of any aggregate is changed, the Engineer shall be notified before any of this aggregate is used in the works.
- H The quantity of water contained in the aggregate shall be determined by an approved method at least once a day, when concrete mixing is in progress.

Mixing Plant

- I Weight batching plant shall be checked weekly in the presence of the Engineer's representative. The checking shall be carried out with approved weights provided by the Contractor for this purpose.
- J The water gauge of the concrete mixer shall be inspected and tested daily when concreting is in progress.
- K If any fault in the mixing plant is detected by these tests or otherwise, the fault shall be rectified to the satisfaction of the Engineer's representative before any further use is made of the equipment.

Concrete Tests

L Concrete cylinders shall be made, cured and tested and the results recorded, in accordance with the recommendations of the current issue of ASTM C-31, 'Making and Curing Concrete Compression and Flexure Test Specimens in the Field', unless specifically modified in subsequent clauses of this specification. Test specimens shall be 6 in. x 12 in. cylinders made in steel moulds of approved design. The test cylinders shall be taken from typical batches of concrete as directed by the Engineer or his representative without prior notice. The test cylinders shall be properly packed, suitably labeled, and sent by the Contractor to the Approved Testing Authority.

- A The test specimens shall be 150mm cubes in steel moulds of approved design. The test cubes shall be taken from typical batches of concrete as directed by and in the presence of the Engineer's representative, without prior notice.
- B Subject to the Engineer's approval tests of works cubes may be carried out on site with a testing machine approved design, in the presence of the Engineer's representative. Otherwise the test cubes shall be properly paced, suitably labelled and sent, carriage paid, by the Contractor to the Approved Testing Authority.
- C Slump test or compaction factor tests of the mixed concrete shall be carried out at regular intervals and the results recorded and kept on the site.

Exposed concrete finishes

- D Where exposed concrete finishes are required, the Contractor shall provide in a suitable position, test samples of each type of finish to be used in the works. The test samples shall be approved by the Engineer before these finishes are put in hand in the works.

Load tests

- E Load tests of completed parts of the structure may be called for by the Engineer at any time.
- F The test procedure and the standard of acceptance will be specified by the Engineer.
- G Where the results of such tests indicate that any member or part of the structure does not comply with this specification, that part of the structure shall be classed as defective work.

CONCRETE

Concrete Mixes

- H For structural concrete mixes made with Ordinary Portland Cement, the average 28-day works strength shall be not less than that specified in the table below.
- I The following concrete mixes shall be required :-

GRADE	28-DAY WORKS STRENGTH IN N/MM2	PROPORTIONS	FINE AGGREGATE	COARSE AGGREGATE
Mass concrete	7.00	1 : 4 : 8	NIL	37mm all in
20	20.00	1 : 2 : 4	100 - 4mm	5mm - 19mm
30	30.00	1 : 1.5 : 4	100 - 4mm	5mm - 19mm

Mix proportions

- J Mix proportions shall be designed by the Contractor for each structural concrete mix listed in the table.
- K The concrete mixes shall be designed to have a target mean strength which exceeds the required characteristic strength by the following margin :-

Grade 20 - 10N/mm²

Grade 30 - 15N/mm²

A reduction in the current margin specified above may be permitted subject to the following conditions :-

- (i) The Contractor shall satisfy the Engineer that the standard of supervision and concrete control to be exercised on site for the duration of the structural works, justifies such a reduction.
- (ii) The average strength of the concrete used in the works shall be assessed according to a statistical method, applied to works cube tests results.
- (iii) Trial mixes are made from three separate batches of concrete which are prepared and three cube tests obtained from each batch.

The trial mix proportions will be approved provided that :-

- a) The mixes have sufficient workability to allow concrete to be placed and properly compacted by the methods to be used on site.
- b) The average strength of the mix cubes tested at 28 days exceeds the specified characteristic strength by the current margin less 3.5N/mm².
- c) Tests at an earlier age may be permitted provided that satisfactory age-strength relationships have been established by experiment.

A The mixes shall be designed to have sufficient workability to allow concrete to be placed and properly compacted by the methods to be used on site.

B Complete calculations for the mix proportions and the information and assumptions on which they are based, shall be submitted to the Engineer, for each mix listed in the table, before the cubes for the preliminary strength tests are made.

Preliminary strength

C Preliminary strength cubes test shall be carried out to check the calculated proportions for each structural concrete mix.

D Preliminary cubes shall be made for each mix from the three samples of aggregates and the sample of cement sent to the approved Testing Authority. From each sample aggregate 6 cubes shall be made, 3 for test at seven days and 3 for test at 28 days.

E Each set of three cubes tested at 28 days shall be accepted as satisfactory if, either all three cubes have a crushing strength greater than the preliminary design strength, or the average strength of the three cubes is greater than the preliminary design strength and the difference between the greatest and the least is not more than 20% of that average.

F If for any mix in the table, the test result of one set of three cubes tested at 28 days falls below this requirement, the mix shall be rejected, the proportions revised and the testing procedure repeated.

G For each structural concrete mix, the 28 day preliminary strength shall be calculated as the average of all the cubes tested at 28 days and the 7 day preliminary strength shall be calculated as the average of all the cubes tested at 7 days.

H Results of all preliminary tests shall be sent to the Engineer as soon as they are available.

Works strength

- A Compliance with the specified characteristic strength shall be judged by tests made on concrete cubes at 28 days. Tests at an earlier age may be accepted provided that satisfactory age-strength relationships have been established by experiment.
- B The minimum rate of sampling shall be for every 20m³ or every 20 batches of concrete supplied, whichever is the lesser volume. No variation in this sampling rate will be permitted without the prior approval of the Engineer.
- C Four cubes shall be made from each sample for testing at 28 days or at an earlier age approved by the Engineer.
- D The samples where practicable shall be taken at the point of discharge from the mixer or in the case of ready-mixed concrete, at the point of discharge from the delivery vehicle.
- E
 - (a) The average strength determined from any group of four consecutive test cubes exceeds the specified characteristic strength by not less than 0.5 x the current margin.
 - (b) Each individual test result is greater than 85% of the specified characteristic strength.
- F If at any time the mean strength or the standard deviation fails to satisfy the requirements given above, the Engineer shall be notified immediately and action shall be taken as the Engineer shall direct.
- G In all cases, an estimate of the corresponding 28 day strength may be obtained from the 7 day cube tests by assuming the ratio of 28 to 7 day strengths to be the same as that obtained from the average strengths of the tests for the trial mixes.
- H Results of all works cube tests and test analysis shall be kept on site and copies shall be sent to the Engineer as soon as the results are available. All records of works cube tests shall indicate clearly which part of the structure each sample of concrete represents.

Works test failure

- I If any set of 7 day cube tests results indicate a low 28 day strength to be expected the Engineer shall be notified immediately and no props shall be removed from the affected part of the structure until the cause is determined.
- J If any set of 28 day cube tests results fall below the specified strength, the Engineer shall be notified immediately and the cause of the failure investigated.
- K The extent of the area of the structure affected shall be as defined by the Engineer.

Site Control

- L The water-cement ratio determined in the calculation of proportions for each mix shall be accurately maintained. The amount of water used in each batch shall be controlled by direct measurement and due allowance shall be made for water content of the aggregate as determined by the daily test.
- M The slump test or compaction factor tests shall be used as a guide to the workability of the mixed concrete.
- N If a change in the grading of any aggregate is unavoidable, the proportions of all structural concrete mixes affected shall be revised to take account of the altered grading.

- A Permission must be obtained and the name of the supplier submitted before the use of ready-mix concrete. Permission must also be obtained to change the supplier of ready-mixed concrete and also to revert back to site-mixed concrete. The concrete must be discharged into the formwork within 1 hour of mixing. All the requirements for site mixed concrete, previously given must be complied with, except for time of discharge. Any ready-mixed concrete that has not been deposited within 1 hour of mixing, shall not be used and shall be removed from the site. If required to do so, certificates showing batch records of the ready-mixed concrete shall be produced by the Contractor. Experienced ready-mix truck drivers only will be allowed to deliver the ready-mixed concrete and they, if dry mix is delivered to the site then, when told to mix-up by the Contractor's Supervisor, the truck drivers will discharge into the mixer drum the exact amount of water required in accordance with previous clauses of this specification. The amount of water in the mix can only be changed on the authority of the Engineer.
- B Although testing is sometimes performed by the ready-mixed concrete suppliers, the Contractor must carry out his own testing in accordance with the requirements for site-mixed concrete. The concrete cubes shall be tested for strength by an independent authority and the results submitted to the Engineer without delay.

REINFORCEMENT

General

- C Reinforcement bending schedules will be provided listing the cut length, diameter or size, bending dimensions and location of each bar in the works.
- D Before the bars are cut to length the Contractor must check :-
- (1) That reinforcement schedules are provided for each part of the structure sufficiently in advance of his concreting programme.
 - (2) That each schedule includes the correct quantities of reinforcement as detailed on the drawing to which it relates.
 - (3) That the grades of reinforcement given in each schedule corresponds to those shown on the relevant drawing.
- E The Engineer shall be notified of any errors disclosed by these checks.
- F The Contractor shall be responsible for all delays and charges arising directly from failure to comply with these requirements.

Bending

- G All reinforcement bars shall be accurately shaped in a manner that will not injure the material, to the details shown on the drawings and bending schedules. Bars shall not be bent hot.
- H The minimum diameter of former to be used when bending high tensile bar shall be six times the bar diameter. The bar diameter shall be the diameter of the largest circle that can be inscribed in the cross section of the bar.

Cleaning

- A All reinforcement shall be free of all loose mill scale and thoroughly cleaned to remove all loose rust, oil, grease, or other harmful matter, immediately prior to being placed in position in the works.

Placing

- B All reinforcement shall be accurately placed, securely fixed and adequately maintained in the positions shown on the drawings.
- C The concrete cover to the reinforcement detailed on the drawings shall be maintained by the use of approved methods.
- D The Contractor shall supply and fix all necessary chairs required to maintain the reinforcement in the correct position. The spacing of chairs and the diameter of bars used in their manufacture shall be agreed with the Engineer.
- E All laps of fabric and all intersections of bars shall be securely connected with malleable iron wire of suitable size or by another approved method. The wire is to be arranged with ends bent away from the formwork so that the concrete cover is not reduced by more than the diameter of the wire.
- F No metal part of any device used for connection bars or for maintaining reinforcement in the correct position shall remain permanently within the specified minimum concrete cover to the reinforcement.
- G The concrete cover to reinforcement shall be as detailed on the structural drawings.

Welding

- H Welding of steel reinforcement is not required for structural purposes. No welding of reinforcement for fixing shall be put in hand without the written permission of the Engineer.
- I Welding of cold worked high tensile steel reinforcement will not be permitted.

FORMWORK

General

- J Before construction commences, the Contractor shall notify the Engineer of the general method and system of formwork he proposes to use for all the main structural members.
- K Formwork and its supporting members shall be sufficiently strong to carry the works and all incidental loading. The props and lateral supports shall be sufficiently closed spaced to prevent displacement or visible deflection of the shutters under the weight or hydraulic pressure of the wet concrete. All joints in the formwork and joints between the formwork and previous work shall be sufficiently tight to prevent loss of liquid from the concrete through these joints.
- L Methods of fixing and locating formwork which result in holes through the concrete section when the formwork is removed, shall not be used.
- M No metal part of any device for maintaining formwork in the correct location shall remain permanently within the specified concrete cover to the main reinforcement.
- N The use of concrete retarders or similar preparations on the formwork surfaces shall be subject to the prior approval of the Engineer.

Mortices, holes, chases in concrete

- A Fixing blocks, ends of brackets, bars, bolts, etc., shall be cast in the concrete at the time of placing and all mortices, holes, apertures, chases, groves, etc., shall be accurately set out in the formwork as the concrete is placed. No part of the concrete works shall be cut away for any such item, or for any other reason, without the Engineer's permission.
- B The Contractor shall obtain from all sub-contractors, complete information of their requirements regarding conduits, pipes, fixing blocks or boxes, chases, holes and any other items to be cast or formed in the concrete members, subject to the condition that failure of a sub-contractor to supply such information shall not be allowed to delay the progress of the Contract.
- C The Contractor shall ensure that all sub-contractors are informed of his programme for the structural works at the commencement of the Contract. He shall also ensure that sub-contractor's requirements relating to concrete members are approved by the Engineer before work is commenced.
- D At the commencement of the contract, the Contractor shall supply all sub-contractors with written copies of the items under this heading of the specification.

Propping

- E The vertical propping to all formwork shall be carried down sufficiently far to provide the necessary support without damage, overstress or displacement of any part of the construction.
- F Structural props shall be retained in position until new construction is sufficiently strong to support its own weight and any loads to be placed on it during the contract period.
- G Structural props for beams and slabs shall be positioned to divide the clear span of each member into equal lengths. The number of props provided in each span shall be at least 3 per span. For two-way spanning slabs, structural props as specified above shall be provided for each direction of span. For slabs spanning in one direction only, the spacing of props in the direction perpendicular to the span shall not exceed $\frac{1}{4}$ the span. All members with spans exceeding 12.00m shall be propped to the Engineer's satisfaction.

Beam and slab formwork

- H All formwork to soffits shall be constructed so that it can be removed without disturbing the structural props.
- I Unless otherwise detailed on the drawings the formwork of all floor beams and slabs shall be constructed with an upward camber giving a rise at mid-span of 3mm for each 3.00m of span. For roof beams and slabs, the formwork shall be cambered to give a rise at mid-span of 6mm for each 3.00m of span.

Final preparation

- J The internal faces of the formwork may be coated with an approved preparation to prevent adhesion of the concrete to the forms, provided that the use of this preparation will not stain the surface of the finished concrete. None of this preparation shall be allowed to touch the reinforcement.
- K Immediately before the concrete is placed in any section of the formwork, the interior of that section shall be completely cleared of all extraneous materials.

- L Each section of the formwork to structural members shall be inspected and passed by the Engineer representative immediately before the concrete is placed in that section. At least 24 hours notice shall be given when such an inspection is required.

Exposed concrete faces

- A Unless otherwise specified, all concrete faces to be exposed in the finished works shall be left as struck with a smooth fair face, true to line and level within the specified tolerances for the works.
- B After inspection, all superfluous fins and similar projections shall be carefully removed. No render or other applied finish shall be used to obtain a fair face to the concrete.
- C All concrete faces to be exposed in the finished works shall be adequately protected against damage and surface staining during the execution of subsequent works.
- D Any finished works which the Engineer shall judge inferior in any respect to the standard of the relevant approved sample or which is subjected to subsequent damage or surface staining shall be rejected and treated as defective work.

Formwork to produce a boardmarked finish

- E Form of form lining to consist of approved rough textured softwood boards seasoned to a moisture content of not more than 25% and not less than 18%.
- F Arrange boards of varying textures and uniform 100mm (4") width alternating the thickness by 10mm (3/8") to give indentations to the surface and a uniform overall pattern. Assemble boards to prevent penetration of grout between them and soak reassembled forms with clean water before erecting and keep damp until concrete is placed.
- G Obtain approval for use and type of release agent.
- H Do not use cover spacers without approval. Formwork ties to occur in a regular pattern in positions agreed with the Engineer.
- I The finish is to be left as struck. Making good will not normally be permitted.
- J The ribbed concrete external finish shall be achieved using timber moulds to achieve the profiles shown on the drawings.
- K The ribs shall be 50mm deep x 50mm wide (2" x 2") (extreme) splayed 6mm (1/4") from back to front on either face and shall be true, plumb and align exactly on each side of the other.
- L The concrete shall be finished fair as described elsewhere.
- M Obtain approval for use and type of release agent.
- N Formwork ties to occur in a regular pattern in positions agreed with the Engineer and filled with concrete to match surrounding work. The making good of holes for ties shall be finished 6mm (1/4") recessed from the general recessed surface of the ribbing.
- O All concrete faces to be exposed in the finished works shall be adequately protected against damage and surface staining during the execution of subsequent works.

- P Any finished works which the Engineer shall judge inferior in any respect to the standard of the relevant approved sample or which is subjected to subsequent damage or surface staining shall be rejected and treated as defective work.

CONSTRUCTION JOINTS AND EXPANSION JOINTS

Position of construction joints

- A The Contractor shall ensure that all construction joints are arranged to minimise the effect of shrinkage of the concrete. Generally the distance between construction joints in walls and slabs shall not exceed 9.00m.
- B The positions of all joints shall be agreed with the Engineer before work is commenced.
- C Concrete placing shall be carried out continuously between consecutive construction joints.
- D Construction joints between different grades of concrete and between concrete mixes using different cements shall be made and positioned as the Engineer will direct.

Treatment of construction joints

- E All construction joints other than horizontal joints shall be formed with proper stop-boards and the stop-boards shall be fixed vertically unless otherwise directed. All joints shall be joggled.
- F All construction joints shall be hacked and all laitance and honeycombed concrete removed from the contact face before the adjacent section is concreted. Where an adjacent face of the concrete is to be exposed in the finished works, hacking of the contact face shall be terminated 12mm away from the face to be exposed. Air and water jetting immediately after striking stop ends may be used instead of hacking subject to the prior approval of the Engineer. All loose materials shall be removed from contact face immediately after hacking or jetting has been completed.
- G When work is to be resumed at a construction joint, it shall be swept clean and treated with a 2 : 1 sand/cement slurry or approved bonding agent before starting the new pour.
- H At all vertical joints, the fresh concrete shall be placed directly against the hacked and treated contact face.

Expansion joints

- I Expansion joints shall be positioned and formed in accordance with the details shown on the drawings.
- J All expansion joints shall be filled with an approved compressible material, unless otherwise indicated on the drawings.

CONCRETING

Mixing

- L Concrete shall be mixed in an approved mechanical batch type concrete mixer. Mixing shall be continued until there is a uniform distribution of the materials in the mixer and the mass is uniform in colour. The mixing time for each batch shall not be less than the minimum period recommended by the mixer.
- M The volume of mixed materials in each batch shall not exceed the rated capacity of the mixer. Each batch of concrete shall be completely discharged before the mixer drum is recharged.
- N The mixer drum shall be thoroughly washed out whenever mixing ceases.

Transporting

- O Concrete shall be transported as rapidly as possible from the mixer to its final position without segregation or loss of any of the ingredients.
- A All plant and equipment used for transporting concrete shall be kept clean ; all containers used for transporting concrete shall be thoroughly washed out whenever mixing ceases.
- B Runs or gangways for concrete transporters and mains run for foot traffic shall not be supported or allowed to bear on the fixed reinforcement.

Placing

- C Concrete shall be placed while still sufficiently plastic for adequate compaction.
- D At all times when reinforced concrete is being placed, a competent steel fixer shall be continuous attendance on the concrete ; he shall adjust and correct the position of any reinforcement, which may be displaced.
- E The Contractor shall keep on site a complete record of the works showing the time and date when concrete is placed in each part of the works. This record shall be available at all times for inspection by the Engineer.

Compacting

- F Concrete shall be thoroughly compacted during placing and shall be carefully worked around all reinforcement and embedded fixtures and into the sides and corners of the formwork, using a heavy-duty, high frequency vibrator.

Curing

- G All surfaces of freshly placed structural concrete shall be covered with an approved material and kept constantly wet for 7 days except that for concrete made with rapid hardening cement, the minimum curing period shall be 3 days.
- H Soffit and side forms left in position will be regarded as effective in keeping those surfaces wet.
- I The Contractor shall notify the Engineer of the system and method curing he proposes to use for all structural concrete members before the works are commenced.

STRIKING OF FORMWORK

General

- J The structure shall not be distorted, damaged or overloaded in any way by the removal of the formwork from concrete members.
- K The responsibility for the safe removal of any part of the formwork or strutting shall rest with the Contractor.

Record of temperatures

- L A maximum and minimum thermometer of approved design shall be kept on site close to the works for measuring atmospheric shade temperature.

Minimum striking times

- M The minimum striking times for removing formwork to structural members shall be determined from the table below. The times are given in days, where each day is to be of 24 hours duration. Before the formwork is removed from any structural member, the Contractor shall ensure that the concrete in that member has attained sufficient strength for striking to proceed.

Location	Minimum Time O.P.C. Concrete
Slab soffits (structural props left in)	4
Beam soffits (structural props left in)	6
Slab structural props	10
Beam structural props	14

For a multi-storeyed structure, after striking the formwork of the suspended beams, the beams shall be propped as specified and the props shall be removed only after striking the formwork of the beams for the floor above.

CONCRETE IN WATERTIGHT CONSTRUCTION

General

- A All work required to be watertight in the finished works will be so indicated on the drawings.
- B The Contractor shall include in his rates for any waterproofing additives he proposes to use but the use of such additives shall be subject to the prior approval of the Engineer.
- C Where in the opinion of the Engineer, damp patches or leakage of water in the finished works are due to incorrect placing or inadequate compaction of the allowance for shrinkage, the affected work shall be made good at the Contractor's expense.

Water-bars

- D Where shown on the drawings, water-bars of approved material, make and design, shall be incorporated in construction joints in concrete in watertight construction. Water-bars shall be joined in an approved manner.
- E Before commencing the works, the Contractor shall obtain the Engineer's approval of the methods to be used to support and maintain the water-bars in the correct locations while the concrete is placed.

FINISHING WORK TO CONCRETE FACES

Generally

- F After removal of the formwork, no treatment of any kind other than that required for curing the concrete, shall be applied to the concrete faces until they have been inspected by the Engineer's representative.

Plastered concrete faces

- G All concrete faces which are to be plastered or rendered in the finished works shall be thoroughly hacked with a suitable tool to provide an adequate surface key.
- H The use of adhesives or other preparations on any concrete faces shall be subject to the prior approval of the Engineer.

STANDARD OF WORKMANSHIP

Working tolerances

Unless otherwise indicated on the drawings, the setting-out dimensions and levels of the finished works shall be within the maximum tolerances given below.

Description	Max. Tolerance
All dimensions of 3.00m and over	6mm
All dimensions less than 3.00m	3mm
Slab top surfaces levels (all points in the surfaces)	6mm

- A At any construction joint in a continuous concrete face any discrepancy in the face across the joint shall not exceed 3mm.
- B Columns and walls shall not be more than 6mm out of plumb in any one storey height and not more than 20mm out of plumb in the total height.

Defective work

- C Where in the opinion of the Engineer any of the finished works, or the materials or workmanship in any part of the works, do not comply with all the relevant requirements of this specification, that part of the works shall be classified as defective works.
- D All work classed as defective work shall be cut out and removed from the works and replaced to the satisfaction of the Engineer.
- E The extent of the work to be removed and the methods to be used in the removal and replacement of this work shall be in accordance with the Engineer's directions. In all cases, cutting out of defective concrete work shall be carried back to a satisfactory construction joint before the replacement of the defective work and any other work thereby affected is commenced.
- F All removal and replacement of defective work and all costs or charges arising from such removal or replacement shall be at the Contractor's expense.

PRECAST CONCRETE WORK

Generally

- G Except as provided herein the whole of the specification for Concrete Work shall apply.

Concrete strength requirements

- H The required minimum concrete strength or works cubes shall be :-

7 days after placing	24.0N/mm ²
28 days after placing	30.00N/mm ²

Concrete proportions

- A The concrete mix shall be designed by the Supplier, or where the Engineer chooses to precast they shall be designed by him.
- B The design of the mix shall be based on the method given in the U.K. Road Research No. 4, or other approved method. Complete calculations for the mix design and the information on which they are based, such as sieve analysis of the aggregates, the water/cement ratio, workability, etc. shall be submitted to the Engineer before the preliminary cube tests are carried out.
- C Preliminary cube tests shall be carried out to confirm the mix design calculations.
- B The mix must have sufficient workability to enable the concrete to be placed without difficulty.
- D When the mix has been decided upon, no variations must be made without the approval of the Engineer.
- E The design mix calculations shall be submitted to the Engineer, together with cube test results, for his approval.

Manufacture of precast units

- F The concrete in one precast piece shall be placed in one preparation. The moulds shall be such that the dimensions of the finished work are accurate within the limits of 0 - 6mm the surfaces and edges clean and true, not winding and free from all defects, with the ends square. The concrete shall be dense and homogenous of a colour to the Engineer's satisfaction. Pressure, vibration, or other effective methods shall be used to consolidate the material subject to the Engineer's approval.
- G Fixing plugs shall be accurately positioned, as indicated on the detailed drawings.
- H The concrete shall be "fairfaced" and free from mould oil staining.

Handling of precast units

- I No element shall be removed from the mould until sufficiently matured to ensure that no damage shall be done to it.
- J The units shall be delivered to site in such a manner as not to damage them during transport. The Engineer or his authorised representative shall be at liberty to reject any units which are damaged, or in any way do not comply with this specification. Such units must be removed from the site immediately.

Other Matters

- K Where additional information is necessary the recommendation of British Standard C.P. 11:1972 will be deemed to apply.

PRICING

- L Prices for Concrete Work shall include :-
 - 1. All considerations arising from the specification.

2. Where concrete is cast in earth cuts (ie not described as filled into formwork) for any additional concrete over the size stated or shown necessitated by the irregularity of the surface retaining the concrete.
3. Cutting, bends, hooks, tying wire, distance, blocks and ordinary spacers for reinforcement. The total weights of reinforcement given have been calculated at the weights given in the relevant British Standard.
4. All cleaning and oiling of forms and making good of exposed concrete surfaces after removal of formwork e.g. cutting off projecting fins, filling out small voids and brushing to exposed aggregate.
5. Where formwork is described as "wrought" or "dressed" for producing a fair face finish either by lining the formwork with suitable material and/or filling in voids, etc., and rubbing down to a smooth finish to the Engineer's approval.
6. Transporting concrete, hosing or lowering, placing in position, working around reinforcement where necessary and curing.
7. Formwork including all temporary supports and strutting, notches, overlaps and passings at angles, easing, striking and removing.
8. Precast units including hosing and fixing in position and bedding, jointing and pointing where necessary in cement mortar similar to that used in adjoining work.

BLOCKWORK

Cement and water

- A Cement and water shall be described under 'CONCRETE WORK'.

Sand

- B Sand shall be clean fine plastering sand, free from salt, organic matter, clay, loam, dirt or other deleterious matter.

Plasticiser

- C Plasticiser shall be "Rendaplas" or other equal and approved and used in accordance with the manufacturer's instructions.

Mortar

- D Mix mortar for blockwork of cement and sand (1:3) mixed on site in a similar manner to concrete including a plasticiser additive at the rate of 0.142 litre of plasticiser to every bag of cement and use within one hour of mixing. Mortar which has commenced to set is not to be knocked up again for re-use.
- E Mortar shall be mixed by placing one half of the water and sand in the operating mixer then adding the cement, plasticiser and the remainder of sand and water. After all the ingredients are in the batching mixer, they shall be mechanically mixed for not less than three minutes. Hand mixing shall not be employed unless specifically approved. Mortar should be tempered to maintain high plasticity but shall not be used after 1 ½ hours from the initial mixing time.

Clay blocks

- F Hollow clay blocks shall conform to BS 3921 ; Part 2 of 1969 of first quality good, hard and well burnt, true to shape and size, ribbed and scored for plaster, unless otherwise described.

Concrete blocks

- G Concrete blocks shall conform to BS CP 111-1970 Part 2 of first quality good, sound, hard and well cured and true to shape and size of the types described.
- H Load bearing blocks shall have an average crushing strength (average of 5 units) of not less than 7N/mm² measured over the gross area. Concrete masonry units shall be tested in accordance with ASTM C 140. The Contractor shall allow for testing 5 random units, prior to commencement of the job. The units shall be selected in the presence of the manufacturer's representative and the Engineer's representative.
- I No dimensions shall differ by more than 3mm from the specified standard dimension. "Standard Dimensions" refer to the manufacturer's designated dimensions and are not to be confused with "nominal dimensions" of modular size units which are equal to the standard dimensions plus 10mm, the thickness of one standard mortar joint.

A Minimum face-shell thickness and web thickness shall be as specified below :

Nominal Unit Width	Minimum face-shell	Web Thickness
150mm	25mm	25mm
200mm	31mm	25mm
250mm	35mm	28mm
300mm	38mm	28mm

B Measurements shall be the average of 5 units taken at the thinnest point.

Laying blocks

C At the time of laying all masonry units shall be free of excessive dirt and dust. Proper masonry units shall be to provide a minimum of cutting. Where cutting is necessary, cuts shall be neat and true. Where masonry is to be bonded to a concrete beam or footing, the concrete surface shall be clean with laitance removed. Unless shown otherwise, blocks are to be laid in uniform courses with regular running bond.

D Units shall be laid to preserve the unobstructed vertical continuity of the cells to be filled. Such cells shall be not less than 50mm x 75mm clear.

E Grouted cells are to be kept clear of all overhangs, mortar droppings and other material. Cleanout holes shall be provided for each pour by leaving out every other unit in the bottom course of this section being poured. These cleanouts shall be sealed after inspection.

F Mortar joints shall be straight, clean and uniform in thickness and shall be tooled as shown on the plans. Joints shall be tooled in a manner which compacts the mortar, pressuring the excess mortar out of the joint rather than ragging it out. The mortar shall be well bonded to the block at the edges. Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. Where walls are to receive plaster, the joints shall be struck flush. Joints which are not tight at the time of tooling shall be raked out, pointed and then tooled. If it is necessary to move a unit after it has once been set in place, the unit shall be removed from the wall, cleaned and set in fresh mortar. Joints shall be 10mm thick unless specified otherwise and shall have full coverage on face-shells, webs and vertical ends.

G Where reinforcement is used in horizontal mortar joints, the thickness of the joints shall be at least twice the thickness of the diameter of the reinforcement.

H When hot, dry weather exists, units shall be wetted with a light fog spray, but not immersed into any vessel. The work shall be carried up course by course and no one portion shall be raised more than four courses at any time. All perpend and quoins shall be kept strictly true and square and carefully leveled through every second course. Build cross walls at the same time with main walls and properly bond together.

I Thoroughly wet clay blocks before laying.

J Tool joints of exposed blockwork which are not plastered for a depth of 20mm before the mortar has set to form a flush joint and leave the edges of blocks well defined.

Grouting

- A Where vertical reinforcement is specified or described, the reinforced cells are to be grouted for the full height of wall.
- B Grout shall consist of concrete mix 20N/mm². Sufficient water shall be added to make a workable mix that will flow into all the parts of the masonry cell without separation or segregation. The slump of the grout should be in the region of 75mm x 100mm. Grout shall be placed before any initial set occurs and in no case more than 1 ½ hours after water had been first added. Admixtures may be used subject to prior approval by the Engineer.
- C Grout shall develop a minimum compressive strength of 20N/mm² at 28 days when tested as follows.
- D Grout shall be placed in a cell of a hollow concrete block of the type being grouted. The prism of grout so formed shall be separated and testing in compression in the same way as concrete tests cubes except that any rough surface may require to be capped. For each in separating the prism, the cell may be lined with porous paper. A minimum of ten preliminary tests will be required plus at least two tests for each day on which grouting is undertaken.
- E Grout shall not be placed to a height of more than 1 metre at one time and there shall be a minimum interval of 60 minutes between pours. When work is stopped for one hour or longer, the horizontal construction joints shall be formed by stopping all tiers at the same elevation with the grout 38mm below the top. Grout shall be compacted with a suitable pencil vibrator.
- F The final pour where a block wall is constructed to abutt a fixed soffit shall be carried out through a chute fixed to the side of the wall so that grout may be poured up to soffit level. The resultant surplus may be removed and cleaned off as soon as the grout has reached an initial set. After grouting, walls shall be hosed down to clean off scum and stains. No grout shall be placed until such time as the masonry mortar has sufficiently hardened to prevent "blow outs".
- G Where the top of the grouted wall is exposed, it shall be kept moist for curing purposes for at least three days after pouring.

Reinforcement

- H Block walls generally shall have 'Brickforce' reinforcement laid in the joints after every third course of blockwork in addition to any rod reinforcement as shown in Engineer's drawings. Blockwork described in measured work section as reinforced refers specifically to blockwork with the additional rod reinforcement.
- I When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six verticals. Vertical reinforcement shall be held in position at the top and bottom and at intervals not exceeding 192 diameters of reinforcement. Vertical reinforcing steel shall have minimum clearance of 6mm from the masonry and not less than one bar diameter between bars.
- J Wire reinforcement shall be completely embedded in mortar. Wire reinforcement shall be lapped in minimum of 225mm at splices and shall contain at least one cross wire of each piece of reinforcement in the lapped distance.

Chases and openings

- A No chases and openings whatsoever shall be allowed without written permission from the Engineer. Should chasing be necessary, they shall be not deeper than one-half the wall's thickness. No horizontal chase or the horizontal projection of a diagonal chase shall exceed 1.20m. Where openings are approved, they shall have lintels of reinforced concrete and such lintels shall have a bearing of 200mm minimum at each end.

PRICING

- B Prices for blockwork shall include :

1. All considerations arising from the specification.
2. All rough cutting (except raking, splay and curved cutting), cutting and pinning up at top of walls, cutting at ends and around openings, cutting and bonding at intersections and building off beams and plates, filling exposed ends with mortar and forming and filling reveals.
3. All labours implied by the use of reinforcement where described as reinforced.

ROOFING

Roof Sheeting

- A The roof covering shall be precoloured proprietary sheets. They are to be laid in full lengths in accordance with the manufacturer recommendations
- B The sheets shall be fixed to the roof members with proprietary roofing screws and clips in accordance with the manufacturer recommendations

Ridging and flashings

- C Ridge capping and hip cappings and flashings shall be of 24 gauge sheets to the same specifications as the sheeting. They shall be cut to appropriate shape and girth to suit the pitch of the roof and laid in long lengths with a minimum lap of 250mm.

Tests

- D The roof shall be tested on completion for proper falls and water tightness by the Contractor in the presence of the Engineer. All defects are to be remedied and the roof retested to the satisfaction of the Engineer and all costs in connection therewith shall be borne by the Contractor.

PRICING

- E Prices for roofing shall include for all considerations arising from these specifications.

CARPENTRY AND JOINERY

Timber generally

- A Timber shall be sound with reasonably straight or grain and at least 85% heartwood free from warp waney edges, splits, fringes, decay, infestation or other deformation and from sign of rot, worm and beetle and shall not contain large loose or dead knots, sapwood, shakes or other defects to such an extent or so situated in the piece as to render it insufficient in strength or stiffness for the work to be done.
- B Timber, which is in the opinion of the Engineer, inferior in quality or condition, or is not suitable for requirements of this work shall not be used. No piece of exceptionally light wood shall be permitted. Samples of materials shall be submitted to the Engineer for his approval before the start of the operations.
- C Unwrought timber shall be sawn full to the dimensions stated, except that occasional variations in sawing are permitted. No variations in sawing shall be more than 5mm under the stated dimension when this is less than 200mm, or more than 6mm under the stated dimension when this is more than 200mm.
- D Timbers specified "dressed" on one, or both opposite sides, shall not be more than 12mm less than the nominal dimension, unless stated to be "actual dimensions". Timber shall be held to be "dressed" by machine unless otherwise stated.

Pitch pine

- E Pitch pine shall be best imported quality of mature growth, free from gross defects, air seasoned and having a minimum density of 0.578 kg/cubic metre at 25% moisture content.

Plywood

- F Plywood shall be Surinam plywood to conform to BS 1455 Grade 2 Veneer bonded with "weather and boil proof" synthetic resin adhesive unless otherwise described.

Laminated plastic veneers

- G Laminated plastic veneer shall be 1/16" thick to comply with BS 3794 : 1964 and applied strictly in accordance with the manufacturer's instructions. All bench tops faced with plastic veneers shall be backed with a suitable compensating veneer.

Treated timber

- H All softwood timber is to be vacuum/pressure impregnated with "Wolmanise" preservative to a dry salt nett retention of 8.009 kg. Of "Wolmanol" per cubic metre of timber. Where timber is cross cut or bored after treatment all surfaces exposed should be liberally treated with "Wolmanol" preservative.

Exposed faces

- I Timber which is to be exposed in the finished work shall be "dressed" unless otherwise described.

Standards

A The following British Standards shall apply insofar as they refer :-

Isometric black hexagon bolts, screws and nuts	BS	4190
Nails	BS	1202
Wood screws	BS	1210
Workmanship and maintenance	BSCP	112 : Part 2
Preservative treatment for construction timber	BSCP	98

Shrinkage

B Arrange, joint and fix all joinery work in such a manner that shrinkage in any part and in any direction shall not impair the strength and appearance of the finished work and shall not cause damage to adjoining materials or structure..

Moisture content

C The moisture content of timber as delivered for the work shall not be more than 15 percent for joiner's work, nor shall this content be allowed to increase whilst work is in progress.

Joints

D The Contractor shall perform all necessary tenoning, grooving, matching, tongueing, housing, rebating and all other works necessary for the correct jointing. He shall provide all metal plates, screws, nails and other fixings that may be ordered by the Engineer or that may be necessary for the proper execution of the works, unless otherwise stated on the drawings.

E All joints are to be the type specified or as is most appropriate in the circumstances. The joints shall be designed and secured so that the stresses to which they are subjected may be either resisted or compensated. Loose joints are to be made where provision must be made for shrinkage or other movements acting other than in the direction of the stresses of fixing of loading.

F Glued joints are to be used where provision need not be made for shrinkage or other movement in the connections and where sealed joints are required. All glued joints shall be cross-tongued or otherwise reinforced.

G All nails, springs, etc. and other joinery works shall be accurately scribed to fit the contours or any irregular surface against which they may be required to form a close butt connection.

Nails

H All nails used shall be galvanised wire nails driven into pre-bored holes not exceeding 4/5 of the nail diameter.

Bolt holes

I Bolt holes should be large enough to permit easy access for the bolt but may not exceed $D + D/16$ or 4mm whichever is the larger, where D is the bolt diameter.

Tolerance

- A All structural timbers shall be sawn timbers to the section given on the drawings. Permissible tolerance on cross section dimension will be +6mm and -3mm with no allowance for wane.
- B Provide reasonable tolerance at all connections between joinery work and the building carcass so that any irregularities, settlements or other movements shall be adequately compensated for.

Ironmongery

- C Provide samples of all ironmongery for selection by the Engineer without charge.
- D Carefully wrap and protect all ironmongery until completion of the work and replace any which may be defaced or damaged without charge as the Engineer shall direct. Oil all locks and adjust and leave in perfect working order on completion and properly label all keys and deliver up in accordance with the Engineer's instructions.
- E Fix all ironmongery with screws of the same metal and finish as the fittings themselves. Remove and replace with new ones, all screws damaged when driven by the turn screw or from any other cause.
- F Remove all ironmongery when painting or carrying out other works likely to damage the fittings and replace on completion.

PRICING

- G Pricing for Carpentry/Joinery shall include for all considerations arising from the specifications.

STRUCTURAL STEEL WORK

Standards of Construction

- A Structural steel work and testing shall comply with the relevant Clauses of BS 449 or AISC Specification for the Design, Fabrication and Erection of Structural steel buildings.

Contractor to submit drawings

- B The Contractor shall include for the preparation of all shop details from the drawings supplied by the Engineer. All such details shall be approved in writing, by the Engineer before the work is put in hand.
- C Every drawing shall show the number and sizes of all rivets and bolts, complete details of welds, types of electrodes, welding procedure, whether the welds are to be made in the shop or elsewhere and any other relevant information.

Accuracy of Drawings

- D The Contractor shall be responsible for the correctness of his shop details and for shop fittings and site connections.

Erection Scheme

- E The Contractor shall submit to the Engineer for his approval, drawings showing the proposed erection scheme together with all calculations for erection stress etc. The approval by the Engineer will not absolve the Contractor in any way from his responsibility.

Dimensions to be verified

- F The Contractors shall take the dimensions from the site or buildings, and he shall verify all dimensions given on the drawings before the work is put in hand.

Copies of Orders

- G A copy of all orders for materials shall be supplied by the Contractor to the Engineer at the time of ordering, for identification purposes.

Rejection

- H Any portion of the work which, in the opinion of the Engineer is not in accordance with the drawings or specifications shall be rejected whether before or after delivery and must be removed from the site, if delivered, within a reasonable time after receipt of the Engineer's notice of rejection , at the Contractor's expense.
- I Any delay caused by this shall not relieve the Contractor from his responsibility to complete within the date stated in the contract.
- J If any welding is found to be defective, the cost of all remedial measures shall be borne by the Contractor including the cost of re-testing and subsequent inspection of welds.
- K The Contractor is responsible for good quality welding work and no exceptions will be made on the grounds that the Engineer has inspected and approved any part or parts of the work at some stage during production.

Temporary Erection

- A Trial erection of major units may be required at the Engineer's discretion. The cost of such temporary erection, testing, packing, marking, carriage and delivery is deemed to be included in the Contractor's tender figure.

Cutting

- B Cutting may be by shearing, cropping, sawing or machine flame cutting. Hand flame cutting may be permitted, subject to the approval of the Engineer.
- C Sheared or cropped edges shall, if necessary be dressed to a neat workmanlike finish and be free from distortion.

Holes

- D All matching holes for bolts shall register with each other so that a gauge 2mm less in diameter than the diameter of the hole will pass freely through the assembled members in a direction at right angles to such members. Finished holes shall not be more than 2mm in diameter greater than the diameter of the bolts passing through them.
- E Holes for bolts shall not be formed by a gas cutting process.

Damage

- F Any damage to materials on the site due to inadequate precautions being taken during the erection of the steel work shall be made good to the satisfaction of the Engineer at the Contractor's expense.

Fabrication

- G The Contractor shall fabricate all steel work off the site. The Engineer shall be informed of all work before fabrication, and the location of such work shall be stated. The Engineer shall have access at all reasonable times to all places where work is being carried out and shall be provided by the Contractor with all necessary facilities for inspection during fabrication and erection. The Contractor shall give at least 48 hours notice to the Engineer when the fabrication work is ready for inspection before delivery.
- H The Engineer shall at his discretion and at the Contractor's cost direct the tests be carried out on materials and workmanship to ensure that the Specifications and the assumptions made in design are being satisfied.

Straightness

- I All material before and after fabrication shall be straight and shall be free from twists.

Clearance

- A Care should be taken to ensure that the clearance specified are worked to. The erection clearance for cleated ends of members connecting steel to steel shall be not greater than 2mm at each end. The erection clearance at ends of beams without web cleats shall not be more than 2mm at each end.

Bolting

- B The bolt shall be provided with a washer of sufficient thickness, under the nut to avoid any threaded portion of the bolt being within the thickness of the parts bolted together.
- C The threaded portion of each bolt shall project through the nut at least 6mm.

Materials

- D Quality of Steel
- (a) Structural steel shall comply with BS 449 or ASTM A36
 - (b) Mild steel rivets shall comply with BS 4361 Part 1 and BS 449 or ASTM 502
 - (c) Structural steel tubes shall comply with BS 1775 and BS 449 or ASTM 500
 - (d) Mild steel and medium tensile steel electrodes or metal arc welding shall comply with the requirements of BS 639 or AWS.
 - (e) High tensile steel electrodes for metal arc-welding shall comply with the requirements of BS 2549 or AWS.
 - (f) All mild steel bolts, nuts and washers shall comply with the requirements of BS 4190, 3692 and 4320 or ASTM A307.
 - (g) All high tensile friction grip bolts, nuts and washers shall comply with the requirements of BS 4395 or ASTM A325 or A490.

Marking of Steel

- E Each piece of steel shall be so marked so as to trace the manufacturer or cast from which it was made and the consignment from which it came.
- F For rivets and small pieces of metal, tag marks will be sufficient.

Dimensions

- G The dimension and allied requirements of all structural steel sections shall be to the following British Standards or equivalent American Standards.
- H Rivets shall comply with the requirements of BS 275 for dimensions.

- A Black bolts, nuts, studs, lock nuts and washers shall comply with the requirements of BS 916 for dimensions and with BS 84 for screw threads, or with 2708 and BS 1580 for unified black bolts etc.
- B Turned bolts shall have the shank turned to the specified diameter allowing only a minus tolerance to 0.13mm.

Weights of steel

- C The weight of steel per metre given on the drawings do not include the shelf angles, brackets, riveted angles to web, nor the plates riveted or welded to flanges of structural rolled sections joists and other structural members.

Surfaces

- D All surfaces of steelwork shall be clean, free from loose mill scales and loose rust.

Tests and Inspection

- E Where and when required by the Engineer, the Contractor shall take and deliver samples of structural steel to him for testing. Should the results of the tests be unsatisfactory the whole consignment of steel which the sample represents shall be rejected and shall be replaced by other material of proper quality at the expense of the Contractor.
- F The Engineer shall be given at all reasonable times free access to the site of the works where work is being prepared for the site.

Paints

- G Prime for steel work shall be Zinc Chromate Anti-corrosive primer of equal and approved. Where bituminous paint is specified, it shall be black bituminous paint to BS 3416 type 1 or other equal and approved.

Workmanship

Generally

- H The whole of the fabrication and erection of the steelwork shall be carried out in accordance with BS 449 or AISC specifications.
- I Welding steel must conform to BS 1859 "General requirements for the metal-arc welding of mild steel" or AWS specification.
- J For welding any particular type of joint the Contractor shall provide evidence that the welder has satisfactorily carried out and completed the appropriate tests.
- K Any welder's tests shall be made at the Contractor's expense. The right to make such test to determine if the welds conform to the standards above, is reserved to the Engineer.

Work off Site

Shop Details

- A Except as noted on the drawings or as otherwise specified herein, shop details shall be governed by AISC specification for the Design, Fabrication and Erection of Structural Steel for Buildings or BS 449: Part 2 as revised and amended to date.
- B Substitution of sections or modifications of design details or both shall be made only when approved by the Engineer and at no additional cost to the Engineer.
- C All details shall develop full strength of main members and shall be of such design as to use the minimum amount of material. However, all connections of main members shall be as least equivalent of an AISC or BS 449 standard connection. In bracing and other work where members have been determined by using minimum size the connection shall develop 50% of the strength of the member, not less than 435kg. In beam and girder work, connections shall be equivalent to an AISC or BS 449 standard connection. Provide "DRAW" on all tension bracing.

Shop connections

- D All shop connections shall be welded unless otherwise noted or specified.
- E Field connections shall be made with high tensile steel bolts, except that standard bolts may be used where so indicated on the drawings or allowed by the Engineer.

Shop work

- F Shop work shall be governed by AISC specification for the Design, Fabrication and Erection of Structural Steel for Buildings, or BS 449 as revised and amended to date.
- G Rolled materials, before being laid out or worked, shall be straight within the tolerances allowed by ASTM specification A6 or BS 449. If straightening is necessary, it shall be done by methods that will not injure the metal.
- H Gas cutting shall preferably be done by a machine. Gas cut edges which will be subjected to substantial stress or which are to have weld metal deposited on them, shall be free from gouges. Any gouges that remain from cutting shall be removed by grinding. All re-entrant corners shall be shaped notch-free to a radius of at least 12mm.

Shop Painting

- J After inspection and approval and before leaving the shop, all steelwork shall be cleaned by wire brushing, or by other approved methods, of weld slag, flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed with a solvent cleaner. Area specified to have no shop paint shall, after fabrication, be cleaned of oil or grease and other foreign material by thorough sweeping with a fibre brush.
- K All structural steel shall be given one shop coat of paint. Surfaces not in contact but inaccessible after assembling shall have one additional shop coat of paint before assembling. Surfaces in contact after assembling need have no paint. Surfaces of "friction type" high strength bolted connections, and surfaces within 50mm of field welds shall not be painted.
- L Paint shall be fixed and applied in strict accordance with the paint manufacturer's printed directions. Paint applied to the steelwork, when dry, shall have a minimum thickness of 0.025mm.
- M Machine finish surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

- A Where noted on the drawings, structural members shall be shop-assembled, checked for alignment and match-marked to insure correct and accurate fit.

Shop Welding

- B Welding shall be done in accordance with the requirements of the American "Code for Arc and Gas Welding in Building Construction" of the American Welding Society or BS 639. All welding, whether shop or field, shall be done by the electric-arc method.
- C Every effort and precaution shall be taken and methods used in making continuous welds to avoid distortion of the member due to welding operations. Unless otherwise approved on the basis of results obtained, continuous welds shall be made up of intermittent welds spaced to prevent excessive heating of the metal and jointed into a continuous weld by filling in between intermittent welds with a series of short welds. Welds shall be solid and homogeneously a part of the metals joined and free from pits or slag or scale inclusions. Surfaces of welds shall be uniform and regular and shall be full area indicated or required to develop the necessary strength of the joint.
- G Welding plant, instruments, cables and accessories shall conform to the requirements of the appropriate British or American Standards and welding shall be carried out in accordance with BS 1856 or AWS requirements for the metal-arc welding of mild steel.
- E Electrodes used for the making of weld shall conform to the requirements of BS 639 or AWS.
- F Any electrodes which have areas of the flux covering broken away or damaged shall be discarded.
- G The welder shall ensure that the weld metal can be fully and satisfactorily deposited throughout the length and thickness of all joints, so that the distortion and shrinkage stresses are reduced to a minimum and that the welds meet the requirements of quality given under workmanship in BS 1856 or AWS.
- H The parts to be welded shall be maintained in their correct positions during welding and parts to be fillet welded shall be brought into as close contact as practicable and the gap due to faulty workmanship is incorrect fit-up should not exceed 2mm. If greater separation occurs locally, the size of fillet weld shall be increased at such positions by the amount of gap.
- I After making each run of welding all slag shall be thoroughly removed.
- J The weld metal, as deposited, shall be free from cracks, slag inclusions, gross porosity, cavities and other deposition faults. The surface of the weld shall be uniform with consistent contour and regular appearance.
- K Welding shall not be done under unsatisfactory weather or other conditions which might adversely affect the efficiency of the welding.

Work on site

Delivery

- L Fabricated steelwork shall be delivered to the job site in accordance with a sequence and schedule that will permit efficient, continuous erection. Steelwork shall be correctly and legibly marked and match-marked.

Unloading and Storage

- M Erection of the steelwork and joists shall include receiving, unloading and any necessary temporary storage of the fabricated material. Carriers shall be unloaded promptly. Any demurrage charges resulting from failure to do so shall be paid for by the Contractor.
- A Materials stored at the job site shall be so placed that no members shall be damaged and shall be protected against corrosion or deterioration of any kind. The Engineer reserves the right to reject material that has become damaged or corroded because of improper storage.

Schedule

- B The Contractor shall submit an erection schedule giving the proposed method and sequence of erection prepared to avoid delay or any damage to the work of other Contractors. The location of supports for cranes, hoists, rigging and material shall be carefully studied and shall be as approved by the Engineer.

Handling and Setting

- C The Contractor shall use care in handling and erecting all material and shall support same properly at all times to insure that no piece will be bent, twisted or otherwise damaged. Materials damaged due to the carelessness of the Contractor shall be corrected at his expense, to the approval of the Engineer.
- D All structural steel shall be set accurately to the lines and elevations shown on the drawings. All members shall be connected temporarily with sufficient bolts to ensure the safety of the structure until the permanent connections are made.
- E The Contractor shall assume full responsibility for the correct plumbing and alignment and for setting of all structural steel members. He shall provide all guys, braces, etc. necessary to maintain the structure plumb and in proper alignment until such time as the work of the other trades is in place, and in the opinion of the Engineer, the guys and bracing are no longer necessary.

Handling and Setting(continued)

- F The Contractor shall exercise utmost care in erecting steel to avoid endangering the structure, construction personnel, or other personnel having legitimate business at the site. The Contractor shall protect the work of other Contractors from damage and make good any damage caused by the installation of his work.

Fitting

- G If members do not fit properly in the field, corrections shall be made as directed by the Engineer. Any new holes necessary shall be drilled, material shall be cut with a hacksaw. No cutting with a torch will be allowed except where specifically approved by the Engineer. If consent is given, burned members shall be finished to an acceptable appearance, which shall be the equal of the finish.
- H Warped or bent members shall be straightened to the approval of the Engineer before being erected.
- I Only light drafting will be permitted to draw parts together. Drifting to match unaligned holes will not be permitted. Any enlargement of holes necessary to make connections shall be done by reaming with twist drills, and the proper size bolts used.

Connections

- J Field welding, unless shown on the approved shop drawings will not be allowed except where specifically approved by the Engineer.

- K High strength bolting methods shall be in accordance with the "Specification for Structural Joints using ASTM A-325 or A-490 Bolts", latest edition, as published by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation or BS 4395. The Engineer will require that all stipulations of this specification are met and shall approve the procedure for calibration of wrenches and installation of bolts. The Engineer will further observe the field installation to determine that these procedures are followed.
- A Where assembled, all connection surface, including those adjacent to the bolt head, nuts or washers, shall be free of scale, and shall also be free of burrs, dirt and other foreign material that would prevent solid seating of the parts. Where bolts and welds are used in the same connection, all bolts shall be fully tightened and inspected before welds are made.
- B Bolts shall be tightened with properly calibrated impact wrenches or by the turn-of-nut method. If required because of bolt entering and wrench operation clearances, tightening by either procedure may be done by turning the bolt while the nut is prevented from rotating.
- C Impact wrenches, if used, shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately ten seconds. Impact wrenches shall be calibrated with a Skidmore-Wilhelm calibrator not less than once daily in mild weather, not less than twice daily in cold weather, or as often as directed by the Engineer. Each bolting crew shall distinctly mark each joint so that it can be determined which impact wrench was used to tighten the joint.
- D If the turn-of-the-nut method is used, nuts and protruding bolt points shall be match-marked with a crayon or dab of paint before final tightening to permit inspection of the accuracy of final tightening.
- E The Contractor shall furnish for the Engineer, facilities, such as ladders, scaffolds, and safety assistance to permit inspection of any and all work. Co-operation in assisting and permitting access to all places of work is mandatory.

Clean up

- F After the erection of steel, the shop coat of paint shall be made suitable to receive the touch-up and finish coats. Where surfaces are damaged during erection or where necessary for the Contractor to scrape off shop coat and repaint same, or to remove clay, mud or other foreign materials, the cost of this work shall be borne by the Contractor.
- G Upon completion of this work, the Contractor shall remove all equipment, tools, and refuse occasioned by his work, and leave the site in a clean and orderly condition.

Pricing

- H Prices of Structural Steelwork shall include for all considerations arising from the Specification.

METAL WORK

Generally

- A Mild steel plates, bars, sections, tubes, etc. shall conform to B.S. 4360 : Part 2.
- B The surfaces of steel shall be smooth, clean and free from rust. Loose rust and scale shall be removed from the steel prior to dispatch for the Works and any subsequent accumulation of dirt, oil or grease shall be cleaned off immediately prior to erection.

Welding

- C Weld by approved method giving ductility and tensile strength comparable with that of the metal joined. Fillet welds only shall be used.
- D Grind all soldered or welded joints, seams, etc. to a smooth finish, remove all rough edges and leave the whole perfect to the satisfaction of the Engineer.

Forged work

- E Clean all forged work and put together in the best and most workmanlike manner, drill all holes and clean off burrs and ensure that all counter sinkings are concentric and treads and tappings are accurately fitted.

Bolts

- F All bolts unless otherwise described shall be British Standard Whitworth black bolts with hexagonal heads and nuts and round washers. Use splayed washers where necessary to effect tight joints.

Fixing

- G Form all mortices, chases, etc. and securely anchor to the structure all metalwork and make good the surfaces to which they are fixed.

Leave clean

- H Clean all exposed metal surfaces on completion with water or an approved petroleum product such as Methylated Spirit or Kerosene. Make good any damage caused by the use of an improper cleaning material.

PRICING

- I Prices for Metalwork shall include :
 1. All considerations arising from the specification.
 2. Assembling components together as necessary, screwing to timber, plugging and screwing to concrete or blockwork or building in fixing lugs and for bedding and pointing window and door frames internally and externally with an approved caulking compound all in accordance with the manufacturer's recommendations.

FLOOR, WALL AND CEILING FINISHINGS

General

Cement, sand, water and plasticiser

- A Cement and water shall be as described under "CONCRETE WORK".
- B Sand and plasticiser shall be as described under "BLOCKWORK"

FLOORS

Granolithic

- C Granolithic is to conform to B.S. 1201:1965 and composed of two parts of cement to five parts of blue limestone chippings, for an approved source, graded from 6mm down with not more than 20% fine material passing an ASTM No. 200 mesh sieve. The blue limestone chippings shall be angular and free from flaking particles.
- D Granolithic is to be floated onto ordinary concrete or screeded bed, to a pattern between diving strips, within twelve hours of the latter being laid, otherwise the concrete or screeded surface shall be hacked, cleaned and watered and afterwards treated with cement slurry before the paving is laid.
- E Immediately after spreading and compacting the topping, tamp surface with a wood float to ensure a level surface and trowel to a smooth finish.
- F Where paving is described as "brushed", wash and wire-brush surface to expose aggregate about one and a half hours after laying, the exact timing being related to the setting of the concrete.
- G Where paving is described as "polished" the surface shall be ground to expose aggregate and give a smooth even finish.

Screeded beds

- H Mix screeds of cement and sand in the proportions of one part of cement to four parts of sand and lay to the thicknesses described. Finish screeds with a keyed surface to receive granolithic concrete and clay tiles and with a trowelled smooth surface to receive vinyl asbestos tiles and carpets.
- I Thoroughly brush clean surfaces of all foreign matter to receive screeds. Provide an adequate bond between screeds and concrete either by the use of an approved concrete bonding agent or by will hacking, wetting and applying cement grout immediately prior to laying screed.
- J Fill joints of cracks with an approved plastic material and finish joints and cracks flush with surface. Prime chalky or dusty surface with primer recommended by the tile manufacturers.

Non-skid Tiles

- K Non skid tiles shall be semi-vitreous claytiles to conform to BS 6431 and of colours to be selected by the Engineer.

Clay Flooring Tiles

- A Clay flooring tiles and skirtings shall be made from refined natural clay. The tiles shall have a fine smooth non-skid surface and shall be of the colour selected by the Engineer.
- B The skirtings shall be covered at bottom and match the tile in colour, size and appearance.
- C The tiles and skirtings shall comply with the requirements of BS 6431 and shall be laid to the recommendations and instructions of the manufacturers.

Levels

- D Ensure that the levels of floors and pavings within any area and between adjoining areas are constant unless specifically described or shown to be otherwise. Make up for any variations in the thickness of floor and paving finishings and irregularities in the surface of the structural base by adjusting the thickness of the screed as necessary.

Protection

- E Protect all premoulded floor finishings from walking or other disturbances for five days after laying.
- F Wet all in-situ floor finishings and keep damp for at least seven days after laying by thickly covering with hessian or polythene membrane kept moist by frequent sprinkling with water.
- G Cover all floors up to the completion of the Works with a temporary covering. On completion of the Works, clean off temporary coverings, remove all stains, mortar splashes, etc., from the floors and leave perfect for handing over.

WALLS

Rendering

- H Mix rendering of cement and sand, in the proportion of one part cement and five parts sand and lay to the thicknesses as described with a plasticiser additive at the rate of 0.14 litre of plasticiser to every 42.5kg bag of cement, the plasticiser to be mixed before hand to the gauging water.
- I Proportion materials by measure and not by estimation and proper approved measuring boxes must be provided for this purpose. Make up mix on site in a close boarded platform with upstand edges and thrice turn over mix while water is being added through a rose director and use immediately thereafter.
- J Where approved mechanical batch mixers are employed, rotate each batch in the drum at least two minutes and use immediately thereafter.
- K Thoroughly wash out all platforms and mixers at the cessation of works each day and as necessary during the working hours.
- L Mix only quantities which can be used at once and reject rendering which has begun to set before being required.
- M Carefully float all work and finish to the stated thicknesses with surfaces perfectly flat to stand the straight edge every way, free from all cracks, blisters or after effects and leave perfectly clean.
- N "Throw" all rendering and plaster on to the wall and give the minimum "working" to ensure a plumb and even finish. Use only wood floating unless otherwise described.

- A Where possible complete each section of walling in one operation, but where this is not possible the existing edge shall be well hacked and wetted before commencing operations. Throughout the whole of the Works order sufficient sand to prevent any variation between the quality and colour of different renderings.
- B Allow for preparing and wetting all surfaces prior to commencement of all operations, for any additional thicknesses required in dubbing out and for working around and behind pipes with their connections and fixtures.

Glazed Wall Tiling

- C The tiles shall comply with BS 6431 and shall be fixed in accordance with the recommendations of BS 5385: part 1. Tiles shall fixed to a floated backing with cement and sand (1:1.5) and laid square to form a level surface.
- D Tiles shall be well soaked in clean water immediately prior to laying. Joints shall be pointed in white cement. On no account will any tile out or line with its neighbour be accepted.

CEILINGS

Rendering

- E Mix and apply rendering as described for walls.

Celotex Ceiling Lining

- F Celotex ceiling shall be in grids of 600 x 600mm x 12mm thick all to conform to BS 1142:1961, Section 3. Surface spread of Flame Classification 2A manufactured from wood or cane fibre. The sheet density shall not be less than 3.00kg/m² for a 12mm thick sheet.
- G Sheets shall be fixed to timber with galvanised clout nails.

PRICING

- H Prices for Floor, Wall and Ceiling Finishes shall include for all considerations arising from the specifications.

GLAZING

Qualification of SMM Rules

- A Description of glazing to wood and metal shall be deemed to include cleaning, sealing or priming rebates with one coat oil paint before fixing glass. Metal rebates to be cleaned and primed.

Materials

Generally :

- B Glass shall be obtained from approved manufacturer and shall conform to BS 952:1964. All glass shall be delivered in proper containers with maker's name guarantee, type of glass and thickness or weight of glass attached to the outside of the containers.

Sheet Glass

- C Sheet glass shall be selected glazing quality of the weights or thicknesses stated.

Float and Plate Glass

- D Float glass and plate glass shall be of the thicknesses stated and be perfectly flat and true.

Wire Glass

- E Wire glass shall be of the thicknesses stated, be polished georgian and be perfectly flat and true.

Anti-sun Glass

- F Anti-sun glass shall be of the thicknesses stated, be polished plate form and be perfectly flat and true.

Putty

- G Putty for glazing to wood shall be linseed oil putty, made of pure whiting and raw linseed oil and complying with BS 544.

- H Putty for glazing to metal shall be metal glazing putty or non-setting metal glazing compound.

Workmanship

Moisture

- I All glass surfaces to be kept dry during transit and storage. Glass becoming moist or damp shall be thoroughly dried and aired.

Edges of Glass

- J All glass shall have clean cut edges, and edges shall be clean and dry before glazing commences.

Putty Glazing

- K Glazing in linseed or metal casement putty shall be executed with proper bed, back puttied, springs, clips and splayed and mitred front putties. The back putties shall be trimmed off flush with the tops of the

rebates and the splayed front putties shall be finished 1/8" back from sight line to allow for sealing between glass and putty with paint.

Glazing with Bead

- A Glazing with bead with non-setting compound, there shall be a minimum of 1/8" bed of compound both sides of and around the glass.
- B Sealing strips shall pass round both sides of the glass, shall be mitred at corners and trimmed off flush with the rebate. Beads shall have an adequate number of fixing to prevent flexing or movement.

Patent Glazing

- C Patent vertical glazing to be comprised of metal glazing bars of patent design by an approved manufacturer or in accordance with manufacturers recommendations.

Broken Glass

- D All glass, broken, cracked or damaged during the progress of the works shall be replaced at the Contractor's own expense.

Cleaning

- E Clean off all glass both sides and leave clean and in perfect condition on completion.

General

- F All glass shall comply with the relevant section of BS 952.

Mirrors

- G Mirrors shall be of silvering quality polished plate or flat glass.
- H Silvering is to be protected by a copper backed filling, undercoat paint and final layer of enamel followed by stoving.
- J Mirrors are to be supplied complete with fixing holes drilled, dome-head mirror screws and plastic grommets and as described.

Workmanship

- I The edges of the mirrors are to be finished with a polished rounded edge. All edge work and drilling is to take place before silvering.
- J All glass broken, cracked or damaged during the progress of the works shall be replaced at the Contractor's own expense.

PRICING

- K Pricing is to include for all considerations arising from this specification.

PAINTING AND DECORATING

General

- A All materials used, unless otherwise stated shall be anti-fungus and shall not contain lead.
- B Supply paints on site in sealed cans and all thinning, mixing, etc., shall be in accordance with the manufacturer's instructions.
- C Produce vouchers as and when required by the Engineer to prove to his satisfaction that all materials supplied are genuine and as specified herein.

Preparation and application

- D Thoroughly dust and clean down all surfaces to be painted, cut out cracks, stop holes and clean steelwork rust in accordance with approved practice.
- E Apply paint by brush, roller or spray with the minimum or dilution.
- F Strain the prepared paint free from skins and similar impurities and immediately before application.
- G Allow to dry and well rub down each coat of paint before the next is applied and no two successive coats shall be to the same tint.
- H No paint shall be applied to a damp surface and no external painting shall be carried out during wet weather.
- I On no account allow employees to empty washings or painting materials into sanitary fittings or drainage systems, so provide a suitable receptacle outside the building to receive same.

Brand names

- J The paints which the Engineer will accept in these Works are those which are locally manufactured except where otherwise specifically described. Prepare surfaces and apply paints in strict accordance with the specification of the manufacturer of the brand chosen.

Masonry

- K Prepare masonry surfaces for painting by allowing to dry for as long as possible and removing all mortar splashes by rubbing with a pumice or flat stone and thoroughly brushing to remove dust.
- L Prime surfaces with one coat of emulsion and allow to dry. Fill all cracks, holes, etc., with patent filler which shall be allowed to set before sanding to a smooth finish before the application of two subsequent coats of emulsion paint.

Woodwork

- M Prepare surfaces of woodwork for painting by sanding smooth and cleaning free of dust. Treat knots and resin pockets with one coat of knotting varnish to prevent bleeding and allow to dry. Apply one coat of wood primer and one coat of oil paint after which all cracks, holes, etc., shall be filled with anti-fungus putty, which, which shall be allowed to set before sanding to a smooth finish before the application of a final coat of oil paint.

Metalwork

- A Prepare surfaces of metalwork for painting by removing dirt, grease, etc., with an approved solvent and rust and scale by wire-brushing, chipping and allowing to dry.
- B Paint metal surfaces with one coat of zinc chromate primer and two coats of oil paint allowing at least one hour drying between coats.

PRICING

- C Prices of Painting and Decorating shall include for the following:
 - 1. All considerations arising from the specifications.
 - 2. Varying colours in individual rooms or areas in accordance with the Engineer's colour schemes.
 - 3. Preparing fairly large sample panels of finishing colours as and when directed by the Engineer.
 - 4. All preparatory work to the surfaces to be painted.

FENCING

Chain Link Fencing

Generally

- A The Contractor shall furnish all labour, materials, tools, equipment and do all work necessary to construct the fence including gates, posts and accessories as shown on the plans, or as directed by the Engineer or as outlined in these Specifications.

Materials

Fabric

- B The fabric shall be woven with 10.5 gauge, zinc coated or aluminised steel and in a mesh of maximum size 60mm with the top selvage knuckled and the bottom selvage barbed.

Barbed Wire

- C All fence types requiring barbed wire shall have 3 No. strands. The barbed wire is to be of the four-point pattern composed of two (2) strands of 12 ½ gauge line wire with 14 gauge bards spaced at approximately 125mm centres.

Posts

- D All posts shall be hot-dipped galvanised steel of the following description:-

Line Posts:	40mm internal diameter British Standard Light Grade.
Terminal Posts:	50mm internal diameter British Standard Medium Grade.
Top Rail:	31mm internal diameter British Standard Light Grade.
Braces:	40mm internal diameter British Standard Light Grade.
Straining Line:	9 gauge galvanised wire.
Barb Arm:	Galvanised pressed steel or other similar and approved, notched at 125mm centres along its length to receive 3Nr. strands of barbed wire.
Concrete:	20kN/mm ² at 28 days.

Installation

- E All post holes are to be excavated in firm earth and shall be of minimum sizes of 800mm deep by 300mm diameter for corner posts and 500mm deep by 250mm diameter for intermediate posts.
- F Posts are to be placed at maximum centres of 3000mm and set plumb in concrete and left for 3 days prior to cutting and fixing top rail. Concrete shall be brought to a height of 40mm above ground level and graded to prevent the settlement of water around posts. Terminal posts shall be located where the direction or level of the fence changes or at centres not greater than 300mm.
- G Chain Link Fabric, barbed wire and straining wire shall be pulled taut using a mini mule or similar mechanical aid.

- A Chain Link Fabric, shall be tied to top rail with 10 ½ gauge galvanised wire at 600mm centres and to line posts at 350mm centres. Cut end of ties shall be bent inwards and laid flat against the pipes. Fixings at terminal posts shall be agreed with Engineer.
- B Straining wire shall be securely fixed to the bottom edge of the chain link fabric with hog rings or 10 gauge galvanised clips at 400mm centres.
- C Welded joints shall be cleaned of rust and deleterious matter coated with an epoxy and finished with two coats of red oxide and two coats of aluminium paint on site. All posts shall be capped in a manner approved by the Engineer.
- D On completion the bottom edge of the chainlink fabric shall at no point be more than 30mm above the level of the ground.

Gates

- E Unless otherwise indicated, gates for openings up to 1800mm wide shall be single leaf beyond 1800mm double leaf.
- F Where gate leaves are less than 1800mm wide construction shall be of galvanised pipe of 40mm, internal diameter British Standard Light Grade, without diagonal or cross bracing.
- G Gates of leaf sizes between 1800mm wide and 300mm shall be constructed as at above but including diagonal or cross bracing, and back bar i.e. vertical bar to hinge, which shall be of galvanised pipe of 50mm internal diameter British Standard Medium Grade.

Gate Posts

- H Gate Posts shall all be galvanised pipe British Standard Medium Grade. For gate sizes up to 900mm wide gate posts shall be of 50mm internal diameter, gate sizes between 900mm 1800mm shall be hung on posts of 75mm internal diameter, and gates between 1800mm and 3000mm on posts of 100mm internal diameter.
- I All posts shall be fixed with crabs and set plumb in holes excavated in firm earth. Holes shall be 900mm minimum depths and diameters of 400mm, 600mm and 800mm for pipe sizes 50mm , 75mm and 100mm respectively.
- J Concrete shall attain a minimum strength of 20kN/mm² in 7 days shall remain supported for this duration of time.
- K Method of hinging is to be as indicated on drawings or approved by Engineer.
- L Welding shall be cleaned of rust and deleterious matter, coated within an epoxy and finished with two coats of red oxide and two coats of aluminium paint on site. All posts shall be capped.
- M Unless otherwise indicated, gates shall be made up to match fence in respect of levels of top rail and barbed wire, projection of barb arms, chain link fabric infill , and fixing of fabric to gate frame.
- N The Contractor will be required to submit for approval shop drawings for all gates.

ROADS AND CAR PARK PAVING

General

Preambles Apply

- A The preambles for excavation and earthwork, concrete work and brickwork and blockwork, contained in the preceding trade sections shall apply to this work section so far as that are consistent with the clauses following.

Notices

- B The Contractor shall give all requisite notices and comply with all Acts, By-Laws and Regulations as applicable.

Scope of Work

- C Construct all roads, base courses and wearing courses of bituminous macadam to specified falls and slopes and cambers as shown or implied on the drawings.
- D The Contractor shall supply all records that may be required by the Engineer, including record sketches of the works as executed.

Liability

- E The Contractor shall take every possible precaution to prevent his operations, whether by carting or otherwise, from damaging or soiling roads in the vicinity of the works to be executed. Should the Contractor, notwithstanding such precautions, cause damage or injury to, or soil any roads, the Engineer shall have full power to the Highway or other Authority such costs as it may incur in repairing or cleaning the roads damaged or soiled by the Contractor. The Contractor shall not be allowed to make an extra charge for any work or cleaning under this clause.

Protecting Works

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

Approval by Engineer

- G No materials shall be used until they have been approved by the Engineer.
- H The formation on which the materials used in the construction of pavings are to be laid must be inspected and approved by the Engineer before such laying.

Materials

Excavation, Fillings Etc.

- I Excavate to remove topsoil, subsoil and fill to make up levels as necessary and as described to attain requisite levels and profiles.

- A Filling to make up levels shall be:
- (a) Dry, clean selected excavated materials approved by the Engineer free from vegetable soil, roots and rubbish consolidated in layers not exceeding 150mm thick
 - (b) Hardcore consolidated in layers not exceeding 150mm thick
- B Where the bottom is insufficiently firm, the Contractor shall excavate until, in the Engineer's opinion, a firm bottom is obtained and the level shall be made with material specified above and thoroughly consolidated.
- C After completion of excavation and filling the whole of the formation shall be rolled to the required contours, gradients and levels with an appropriate roller of not less than 8 tonnes.

Pitrun

- D Pitrun shall be approved as hardcore dug material suitably graded from a maximum 100mm aggregate containing silt/clay to ensure satisfactory binding.

Bitumen

- E Bitumen shall be straight run bitumen having a 90/100 penetration at 25°C unless otherwise approved or cut-back bitumen or viscosity 100 to 150 seconds at 40°C (Standard Tar Viscometer) unless otherwise approved.

Base Course

- F Gravel for use in bases where described on the drawings, shall be natural excavated gravel from an approved source. It shall be unwashed, but free from roots, grass or other vegetable or other deleterious matter. It is important that the fine clay particles inherent in the in-situ gravel beds shall be retained, but any gravel containing soil overburden or mud from overburden or mud deposit shall be rejected, and any such deposits shall be removed at source prior to the excavation of the in-situ gravel.
- G The gravel shall conform to the grading analysis given Table 1, unless otherwise approved by the Engineer.

Base Course Aggregate

Table 1

Sieve Size	% Passing by Weights
50mm	100
32mm	80 - 100
20mm	60 - 80
20mm	45 - 65
0.5mm	30 - 50
0.6mm	10 - 30
0.074mm	5 - 15

Bitumen Macadam

- A Stone used in the bitumen surfacing shall be best quality washed, crushed stone or natural gravel from an approved source. The rock shall be selected and shall be clean and free from geological defects such as decomposition of strata of inferior rocks of shales and shall be free from contamination by overburden, clay vegetable or other objectionable material. Quarry and crusher sites, loading points and lorries shall be kept clean and the Contractor shall provide a clean base for stockpiling. The crushed rock shall consist of clean, tough, durable fragments, free from excess or flaky and elongated particles, as defined in BS 812.
- B The stone for use in wearing courses shall have a maximum size and grading in accordance with the requirements of BS 2040, 1690 and 1621 as applicable.
- C Fine aggregate shall be approved clean natural sand or crushed rock, in accordance with the requirements of BS 1690, 2040 or 1621.
- D The gravel for use in wearing courses shall conform to the grading analysis given in Table 2, unless otherwise approved by the Engineer.

Table 2

Wearing Course Aggregate

Sieve Size	% Passing by Weights
19mm	100
12mm	80 - 100
9.5mm	70 - 90
5mm	50 - 70
2mm	35 - 50
0.6mm	18 - 29
0.3mm	13 - 23
0.15mm	8 - 16
0.07mm	4 - 10

Workmanship

Preparation of Underlying Course

- E Prior to placing bituminous concrete pavements this underlying course shall be prepared in the following manner:-

When the underlying courses is a crushed aggregate base or crushed aggregate levelling course, it shall be treated with a prime coat of medium curing asphalt MC 30 satisfying AASHO M-82 (i.e. "Colas")

Laying

- F Laying shall be in accordance with the relevant section of British Standard BS 4987.
- G Each course of macadam should be laid to such a thickness that on completion of compaction its final thickness is as specified on the drawings.
- H Laying should not proceed during heavy or continuous rains when material may not adhere or key to the base. Care should be taken to remove standing water from the base.

- A Where tack coats of bitumen penetration is required, care should be taken not to exceed the specified rates of application. Too much bitumen resulting in ponding on the bottom is not acceptable.
- B The roller shall not be less than 10 tonnes.

Compaction

- C The base shall be of the compacted thickness indicated on the drawings. The materials shall be laid in layers not exceeding a thickness of 225mm for gravel, and 115mm for crushed stone, before compaction, and shall be thoroughly compacted to the full depth of each layer by either smooth wheel or pneumatic type rollers or vibrating equipment. Compaction shall be carried out to 95% Standard Proctor Dry Density. The roller shall not be less than 10 tonnes.

Tolerances

- D The level of any point on the surface of each of the pavement courses of the paving shall, on completion of compaction, conform to that shown on the drawings within the tolerances stated in Table 3.

Table 3

Surface of Course	Tolerance from true surface level	Maximum depression tested with 3.00m straight edge placed on the surface parallel to the centre line of the paving.
Formation	+0	
	-50mm	--
Base (eg. pitrun)	+0 31.75mm	9.53mm
Base course	6mm	9.53mm
Wearing course) Hand laid)	12mm	6.35mm
Machine laid)	6mm	4.76mm

Standards

- E The provision of the latest revised editions of the following British Standards and Civil Engineering Codes of Practice shall be held to be incorporated in this Specification unless it is specifically stated otherwise.

BS 63	Single sized road stones and chippings
BS 594	Rolled Asphalt (hot process)
BS 4987	Specification for coated macadam for roads and other paved areas
BS 598	Sampling and examination of bituminous road mixtures.
BS 812	Sampling and testing of mineral aggregates, sand and fillers
BS 2003	Earthworks.

Bill Nr. 3: Provisional and Prime Cost Sums

BILL NO 3: PROVISIONAL AND PRIME COST SUMS

PROVISIONAL SUMS

Provide the following sums for works or costs which cannot be entirely foreseen, defined or detailed

A	Twenty thousand dollars for tests		20,000.00
B	Fifty thousand dollars for connections between new and existing construction.		50,000.00
C	Fifty thousand dollars for additional joinery works.		50,000.00
D	Thirty thousand dollars for additional builders works associated with engineering services		30,000.00
E	One hundred thousand dollars for surface water drainage		100,000.00
F	Fifty thousand dollars for termite treatment to existing		50,000.00
G	Two hundred thousand dollars for ornaments		200,000.00
H	Fifteen thousand dollars for water proofing flat roof ainternal rails		15,000.00
I	Fifty thousand dollars for internal stair rails		50,000.00
J	Thirty thousand dollars for a flag pole		30,000.00

Nominated suppliers

Provide the following sums for goods to be supplied by nominated suppliers

K	Eighty thousand dollars for supply of ironmongery		80,000.00
L	Profit	%	
Provide the following sums for goods to be supplied by nominated suppliers			
M	Two hundred thousand dollars for supply of mouldings		200,000.00
N	Profit	%	

BILL NR 3: PROVISIONAL & PRIME COST SUMS

TOTAL TO MAIN SUMMARY

Bill Nr. 4: Works to be Priced on Sitee

BILL NO. 4: WORKS TO BE PRICED ON SITE AND CREDITS

GENERALLY

- A The contractor is advised to price this section of the bill of quantities on site and to show credit for old materials removed or suitable for re-use in the credit column. Item

- B The term 'remove' shall be deemed to include for carting away any arisings to an approved dump unless noted otherwise. Item

- C The Employer reserves the right to acquire from the Contractor any of the old materials arising from these works at the rates quoted in the credit columns. If no credit is shown it will be deemed that the materials are of no value to the Contractor and the Employer would be entitled to acquire the materials without cost. Item

WORKS TO BE DONE

Internally

- D Remove all loose furniture and furnishings and deliver to a location to be identified by the Employer but not exceeding twenty five kilometres distant. Item

- E Isolate the electrical and plumbing installations; remove the sanitary appliances; air-conditioning units and other accessories for the plumbing, electrical and airconditioning installations and cart away. Item

- F Remove all windows and doors and prepare the jambs for either new units or for blocking up either partially or wholly. Item

- G Remove the joinery installations from the kitchen, kitchennete, bedrooms, bathrooms, storage rooms etc. Item

- H Remove the roof covering, structure and associated ceilings complete with associated rainwater installations. Item

- I Demolish redundant walls where shown on the demolition plans on the ground floor; remove balustrading and railss Item

- J Demolish redundant walls where shown on the demolition plans on the first floor; remove balustrading and rails. Item

- K Remove carpets, hack up tiles and other applied floor finish and grind floor to a smooth finish ready for new applied finishes. Item

- L Remove applied finishes from face of walls including but not limited to the tiles in the bathrooms. Item

- M Remove any remaining ceiling finishes not integral with the roof. Item

Value of credit

Value of work

4/1 Carried forward

Totals brought forward

A	Remove the structures adjacent to the main building on the northern side.	Item			
B	Remove the garage structure complete.	Item			
C	Remove the front fence and gates; maintain the security of the compound with a temporary hoarding whilst the fence is down and during the period of constructing a new fence; grub up the foundations to allow for new.	Item			
D	Remove the tiling from the entire forecourt area; fill in any imperfections in the slab under and generally prepare slabs for new tiling [measured elsewhere]	Item			
E	Remove the concrete slab in the area of the existing garage and prepare the ground under for new slab.				
F	Cut into the concrete slab between the back porch and the pool area to facilitate new foundations; extend slab and make good on completion of new walls - about 25.00m	Item			
G	Remove the tiling around the pool area; fill in any imperfections in the slab under and generally prepare slab for new tiling [measured elsewhere]	Item			
	Value of credits				
	Value of works				
	Less value of credits				
	<u>WORKS TO BE PRICED ON SITE</u>				
	TOTAL TO SUMMARY				

Bill Nr. 5: Substructures

BILL NR 5: SUBSTRUCTURES**PRICING NOTES**

A Tenderers should note that, notwithstanding anything to the contrary elsewhere in these documents, rock is defined as material which would require the use of pneumatic equipment or explosives to remove.

EXCAVATION AND EARTHWORKS**Excavation**

B	Excavating trenches for foundations not exceeding 1.50m deep starting at reduced ground level	m3	40
C	Excavating trenches for floor beams not exceeding 1.50m deep starting at reduced ground level	m3	50
D	Excavating pits for foundations not exceeding 1.50m deep starting at existing ground level	m3	102
E	Extra over all types of excavation for breaking up rock met with within the excavations.	m3	10
F	Excavated materials backfill around foundations	m3	166
G	remove from site	m3	42
H	Bottoms of excavation levelling; compacting to receive concrete	m2	267
I	levelling; compacting to receive hardcore	m2	168
J	Surfaces of excavations treating against termites; obtain a 5 year guarantee from specialist installer in the name of the Employer .	m2	672
K	Planking and strutting; next to existing buildings and roadways not exceeding 1.50m total depth; from existing ground level; sides of trenches	m2	42
L	not exceeding 1.50m total depth; from existing ground level; sides of pits	m2	195
Imported hardcore [pitrun gravel or equal]			
M	Beds 150mm thick; laid on earth bed; spread level and compact.	m2	168
N	Grading to falls	m2	10
Imported sand			
O	Blinding beds 50mm thick; laid on hardcore bed; spread level and compact.	m2	168

CONCRETE WORK			
Plain in-situ concrete; Grade 7			
A	Blinding beds to stanchion bases or ground beams 50mm thick	m2	267
Reinforced in-situ concrete; Grade 35			
B	Filling to cores of hollow block walls 150mm thick; each core filled	m2	119
Reinforced in-situ concrete; Grade 35; cylinder strenght			
C	Pad foundations over 300mm thick	m3	6
D	Footings for retaining walls and ground beams over 300mm thick	m3	4
E	Floor beams sectional area 0.05 to 0.10m2	m3	16
F	Steps over 300mm thick	m3	3
G	Cores of hollow walls 150mm thick walls	m2	119
H	Stub columns sectional area over 0.10m2	m3	3
I	Beds 150mm thick; screeded flat	m2	168
J	150mm thick; screeded to falls of ramp	m2	10
Reinforcement bars; BS 4483, plain round high yield steel bars, including bends, hooks, tying wire, distance blocks and ordinary spacers (provisional)			
All sizes in range 10mm to 25mm grouped together in:			
K	pad foundations	kg	900
L	foundations footings to base walls	kg	550
M	floor beams	kg	2,400
N	floor slabs	kg	1,000
O	steps	kg	500
P	beds or cores of block wall	kg	2,235
Q	stub columns and columns	kg	650
R	links	kg	600

A	Allow for preparing a bar bending schedule showing the requirements for each of the foregoing aspects of the installations	Item	
	Fabric reinforcement; Ref A142; 225mm side and end laps; (measured net with no allowance for laps)		
B	beds	m2	178
	Sawn formwork Pad footings		
C	over 300mm wide	m2	30
D	Face of ground beams over 300mm wide	m2	110
E	Footings for retaining walls or ground beams; vertical over 300mm wide	m2	32
F	Risers 175mm high	m	20
G	Ends of staircases 600mm wide; cut to profile of treads and risers	m	6
H	Faces of stub columns over 300mm wide	m2	10
I	Edge of ground slabs 150mm wide	m	185
	Wrought formwork Face of columns		
J	over 300mm wide	m2	10
	Concrete work sundries 500 gauge polythene sheet; 300mm side and end laps; (measured net with no allowance for laps)		
K	over 1300mm girth; horizontal on surfaces of sand blinding	m2	178
L	Casting into concrete ends of mild steel dowel 12mm diameter	nr	200
	Note The Engineer would not dictate the limit of slabs to be poured in one operation; should the contractor elect to construct the slabs in more than one pour; he should allow here for construction joints of the type to be approved by the Engineer.	Item	
M	Expansion joint; 'Flexcell' joint filler set vertically existing and new slabs; sealing top edges with Thioflex mastic		
N	150mm wide; allow for formwork to edge of bed and preparing face of existing	m	100

BLOCKWORK

Concrete blocks; 400mm x 200mm; in cement mortar

Base walls and walls

A 150mm thick; built over reinforcement bars at 200mm centres m2 119

Cement and sand mortar [1:4]

Rendering face of block retaining walls
over 300mm wide

B m2 210

END OF WORKS CLASSIFIED BY TRADES

Sundries on all sub-structures

Disposal of water

C keeping the surfaces of the ground and the excavations free of
general water. Item 1

Protection

D protecting all works in this section Item 1

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SUBSTRUCTURES

TOTAL TO MAIN SUMMARY

Bill Nr. 6: Frame, Roof, Floors and Staircases

**BILL NR 6: FRAME, ROOF, FLOORS AND STAIRCASES
CONCRETE WORKS**

Reinforced in-situ concrete; 20mm size aggregate; 35N/mm² cylinder strength; vibrated

A	Attached beams sectional area over 0.05m ² but not exceeding 0.10m ²	m ³	15
B	Ringbeams and lintels sectional area not exceeding 0.05m ²	m ³	15
C	Columns sectional area over 0.05m ² but not exceeding 0.10m ²	m ³	11
D	Suspended floors and roof 125mm thick (average) on composite metal floor decking (measured separately)	m ²	9
E	Suspended slabs 150mm thick	m ³	166
F	over 300mm thick	m ³	
G	Ramps generally	m ³	1
H	Steps or staircases generally	m ³	4
Reinforcement bars to BS 4449; high yield deformed steel bars including bends, hooks, tying wire, distance blocks and ordinary spacers [Provisional]			
I	Links, stirrups, binders, special spacers and the like 10mm diameter	kg	1,000
J	10mm diameter; helix spirals	kg	200
K	All sizes in range 6mm to 25mm grouped together in troughs of CFD deckpan	kg	100
L	steps or staircases	kg	600
M	attached beams	kg	2,250
O	beams or lintels	kg	2,250
P	suspended slabs	kg	3,000
Q	column	kg	1,650
R	Dowels 16mm diameter x 1250mm long, bent once (fixing measured separately)	nr	100

	Fabric reinforcement		
A	Ref A#142; 225mm side and end laps (measured net, no allowance for laps) in suspended slabs	m2	9
	Wrought formwork		
B	Vertical or battering sides of stanchion casings, columns, piers, pillasters and the like, including chamfers not exceeding 50mm wide generally	m2	60
C	Sides of beams including chamfers not exceeding 50mm wide generally	m2	138
E	Sides of ring beams or lintels generally	me	105
E	Faces of columns including chamfers not exceeding 50mm wide over 300mm girth	m2	145
F	over 300mm girth; curved to 300mm diameter	m2	15
G	Soffites of slab over 300mm wide.	m2	166
H	Edges of suspended slabs 150mm wide; edge of CFD pan' cut and fit to profile of pan	m	8
I	150mm wide	m	50
J	Soffites of staircases over 300mm wide; horizontal or sloping	m2	20
K	Ends of staircase flights 500mm extreme width; cut to profile of treads and riser	m	20
L	Risers 175mm wide	m	20
	Sundries in concrete work		
M	Casting into concrete 16mm diameter mild steel dowels	nr	800
	Sundries in concrete work as before		
N	Cut or form mortice in concrete 12mm diameter x 100mm deep (in existing concrete floor); include for fixing dowels (measured separately) with 'Lokset' cementitious grout	nr	50
O	Expansion joint; 'Flexcell' joint filler set vertically existing and new slabs; sealing top edges with Thioflex mastic 150mm wide; allow for formwork to edge of bed and preparing face of existing	m	30

STRUCTURAL STEELWORK: FRAMED WORK**Mild steel to BS 4360; welded fabrications with bolted and welded on site connections**

Plain girders

A 152 x 89 x 16kg/m UB kg 150

Hips, rafters, valleys or ridges

B 152 x 89 x 16kg/m UB kg 8,000

Struts or ties

C 152 x 89 x 16kg/m UB kg 650

Wirebrushing; rubbing down; apply two coats zinc chromate primerMembers of structural steelwork
at steelworks

D kg 8,800

Galvanised mild steel

Purlins or rails

E standard 'Z' profile; 152 mm deep weighing 3.12kg/m m 676

F C' section; 100mm x 49mm m 1,250

Hot dipped zinc coated (galvanised) cold rolled and corrugated steel sheets to ASTM A924-Rev. A-1997 and ASTM A 653 M - 1997; 0.96mm thick; 15.24mm side laps with interlocking fit; 100mm end laps; floor decking spot welded to steel girders at 300mm centresMetal composite floor decking; CFD 3
over 300mm wide

G m2 9

Sundries on framed steelwork

Shear connectors

H 20mm diameter x 127mm long 'Nelson' stud; fuse welded through metal decking to steel girders at 300mm centres nr 20

Angle cleats

I 75mm x 125mm x 100mm x 10mm thick; welded; two holes for 10mm diameter bolts nr 160

Purlin bolts

J 10mm diameter x 75mm long; nut and 4 washers nr 640

Anchor bolts

K 16mm diameter; allow mor mortice in blockwork 100mm deep nr 50

METAL ROOFING		
Sheet metal roofing; 24 gauge zinc coated aluminium alloy (galvalume) sheet metal with baked on paint finish of Kynar 500; series 2000 - 'Bermuda' profile supplied by Lifetime Roofing of Lot 26 C & F O'Meara Industrial Estate Arima (tel 646 5813, 4,5) or equal and approved; fixed in accordance with manufacturers written instructions.		
Sloping roof covering		
A	over 10degrees but not exceeding 50 degrees from horizontal [include in rate for standard Hat Channels]	m2 6,620
24 sheet metal flashings and gutters in zinc coated aluminium alloy (galvalume) with baked on paint finish of Kynar 500 colour matched to sheet metal roofing.		
Eaves fascia flashing		
B	550mm girth; screwed to metal supports and dressed under roof sheet.	m 180
Ridge capping or hip capping		
C	600mm girth; trimming to profile of roof sheets both sides	m 90
Valley flashing		
D	600mm girth	m 15
Apron flashing		
E	600mm girth; dressing over roof sheeting; wedging and caulking into groove in blockwalls; all for cutting chase in wall	m 65
Gutters; concealed fixing		
F	150mm 'Ogive' section; fixing with standard brackets to steel backgrounds	m 175
G	Extra for running outlets	20
H	Extra for stopped ends	30
Reverse standing seam sheets 28 gauge; colour matched to roof covering; fixed with screws to mild steel framing		
Under ceiling to roof soffites		
	over 300mm girth	m2 180
I	Extra for 50mm x 50mm angle framing	m 400
Prodex roof insulation sheet from Lifetime roofing; fixing to mild steel purlins in accordance with manufacturers recommendations		
6mm thick; 300mm side and end laps		
J	over 300mm; fixed over mild steel purlins	m2 6,620
Sundry metalwork; mild steel unless stated other wise		
Support for fascia, verge, hip or valley flashings		
K	50mm x 6mm thick; welded to steel frame	m 600

RAINWATER INSTALLATIONS

**uPVC pipes and fittings; non- pressure drain, waste and vent quality;
uPVC collars and solvent cement joints in the running length**

(Provisional)

A	100mm diameter down pipe; joints in the running length in and including mild steel brackets at 1200mm centres, fixed to backgrounds requiring plugging	m	140
B	Extra for 90 degree bends	nr	60
C	Extra; rainwater shoes	nr	20

END OF WORK BY GROUPS

Sundries on all trades

D	Protection protecting the works in this section	Item	
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FRAME, ROOF, FLOORS AND STAIRCASES

TOTAL TO MAIN SUMMARY

Bill Nr. 7: Finishing Works

**BILL NR 7: FINISHING WORKS [WALLS, WINDOWS,
DOORS, FINISHES ETC]**

WALLS AND PARTITIONS

CONCRETE WORK

**Reinforced in-situ concrete; 20mm aggregate size; grade 35;
vibrated**

Lintels

A sectional area not exceeding 0.05m² m3 15

Filling to cores of hollow blockwalls
150mm thick; every core filled

B m2 392

**Reinforcement bars; BS 4499, high yield deformed steel bars
including bends, hooks, distance blocks, tying wire and ordinary
spacers (Provisional)**

Links, strirrups, binders, special spacers and the like
10mm diameter

C kg 500

All sizes in range 6mm to 25mm diameter grouped together
lintels

D kg 1,500

Straight or bent bars in cores of hollow walls
16mm diameter

E kg 5,880

Dressed formwork

Sides and soffits of horizontal beam casings, beams, lintels and the
like; including chamfers not exceeding 50mm wide

F generally m2 50

BLOCKWORK

**Concrete blocks; 400mm x 200mm; bedding and jointing in
plasticised cement mortar (1:3)**

Walls or partitions

G 100mm thick for render both sides m2 110

H 150mm thick; built over reinforcing rods at 400mm
centres m2 392

I Extra for cutting face of blocks to set cores in top row
around reinforcement; allow for temporary boxing for
filling cavity with concrete m 45

Rough cutting at soffits
150mm thick walls

J m 125

Sundries in Blockwork

Building in aluminum door frames; 4nr lugs each jamb
for single door

K nr 30

L for double door nr 6

A	Brickforce or similar mesh reinforcement 75mm wide; build into courses of blockwork	m	300
B	Extra for fixing ends to existing masonry	nr	40
C	125mm wide; build into courses of blockwork	m	40
D	Extra for fixing ends to existing masonry	nr	60

GYPSUM DRYWALLS

Gypsum sheet; fire rated quality; fixed with drive screws at 600mm centres to 16 gauge mild steel channel framing; sheets taped with scrim cloth at joints and finished smooth with gypsum
16mm thick sheets to walls on metal studs at 600mm centres each way
[PROVISIONAL]

E	over 600mm wide; lined on two faces; fill cavity with sound attenuation blankets	m2	20
F	Extra for caulking at heads or soles	m	10
G	Extra framing for single door	nr	10

END OF WORK BY TRADES

Sundries on all work in this section

H	Protection protecting the works in this section	Item	
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WALLS AND PARTITIONS

TOTAL TO FINISHINGS SUMMARY

WINDOWS AND DOORS**Doors in softwood and plywood**

Flush doors to BS 459 Part 3; solid core; faced both sides with 1/4" thick plywood; hardwood lipped on all edges.

A	800mm x 2100mm x 44mm thick D1	nr	12
B	900mm x 2100mm x 44mm thick D2	nr	24
C	900mm x 2100mm x 44mm thick D4	nr	2
D	800mm x 2100mm x 44mm thick D61	nr	2
E	1000 x 2050 x 44mm thick; door D7	nr	4
F	600mm x 2100mm x 44mm thick D8	nr	2

Frames in 16 gauge aluminium; anodised

Door frames; 8nr lugs for building in

G	for openings up to 1000mm x 2050mm; single door	nr	30
H	for openings up to 1900mm x 2050mm; double door	nr	6

Doors in aluminum and glass

I	Allow this sum for refurbishment of existing aluminum sliding door	ps	1	4,000.00	4,000.00
---	--	----	---	----------	----------

Casement windows in heavy duty anodised aluminum frames and tinted float glass 6mm thick; standard accessories caulking all around and pointing with paintable silicone

Masonry opening sizes

J	600mm x 300mm; one top hung casement	nr	6
K	1200mm x 700mm; two equal top hung casements	nr	8
L	1200mm x 1050mm; two equal top hung casement	nr	11
M	1800mm x 1050mm; three equal side hung casements	nr	2
N	1800mm x 1350mm; three equal side hung casements	nr	3
O	1800mm x 1800mm; three equal side hung casement	nr	2

Ironmongery; supply included for elsewhere

Fix to metal or plywood; unless otherwise noted

P	butt hinges	nr	276
Q	sadle threshold	nr	5
R	door closer; face mounted	nr	42
S	push plates 90mm x 325mm	nr	20
T	push pull handles	nr	12

A	kick plates	nr	12
B	door stops	nr	42
C	door silencer	nr	42
D	flush bolts	nr	20
E	cylinder mortice locks	nr	42
F	deadbolts	nr	10
G	entry lockset	nr	5
H	lever furniture	nr	10
I	storeroom lock	nr	4
J	panic bolts	nr	4
K	sex symbols	nr	10

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WINDOWS AND DOORS

TOTAL TO FINISHING WORKS SUMMARY

FITTINGS AND FURNISHINGS

Preambles

The work in this section has not been measured in accordance with the rules contained in SMM5 Metric Edition. Instead, the Tenderer is advised to price the following items as lump sums in accordance with the details contained in the Architectural drawings.

Prices are to include for decorating the finished surfaces as indicated on the drawings and all associated ironmongery

FITTED UNITS - GROUND FLOOR**Male and female washroom as drawings A401**

A	Bobrick partitions, two cubicles with two doors, one divider, two front panels and one end panel; two doors	nr	1
B	Bobrick partitions, one cubicle, two end panels one front panel one door	nr	1
C	Urinal dividers	nr	2
D	Vanity 2418mm x 600mm x 915mm	nr	2
E	Mirrors 1200 x 800mm	nr	4
F	Take delivery and fix hand dryer	nr	2
G	Take delivery and fix paper tissue dispenser	nr	2
H	Take delivery and fix toilet paper dispenser	nr	3

Caretakers washroom as drawing A402

I	Shower enclosure 1500 mm x 1950mm; one tempered glass door; stainless steel fixing accessories.	nr	1
J	Hardwood pelment 19mm x 150mm high	m	2
K	Mirrors 1200 x 800mm	nr	1
L	Take delivery and fix paper tissue dispenser	nr	1
M	Take delivery and fix toilet paper dispenser	nr	1

Changing rooms as drawing A403

N	Bobrick partitions; single panel 1800mm x 1470mm; one door	nr	2
O	Wood bench 1450mm x 400mm x 425mm	nr	2

Washroom 1 and Powder Room		
A	Shower enclosure 1650 mm x 1950mm; one tempered glass door; stainless steel fixing accessories.	nr 1
B	Mirrors 1200 x 800mm	nr 2
C	Take delivery and fix toilet paper dispenser	nr 2
D	Vanity units 1650mm x 600mm x 915mm	nr 1
E	Vanity units 1500mm x 600mm x 915mm	nr 1
Main kitchen as drawings A405 and A406		
F	Low level bases complete about 20,000mm total length	m 20
G	High level wall cupboards about 15,000mm total length	m 15
H	Take delivery and fix hood and exhaust	item 1
FITTED UNITS - FIRST FLOOR		
Washroom 5 and laundry as drawing A408		
I	Shower enclosure 2050 mm x 1950mm; one tempered glass door; stainless steel fixing accessories.	Item 1
J	Mirrors 1200 x 800mm	nr 1
K	Vanity units 2050mm x 600mm x 915mm	nr 1
L	Take delivery and fix toilet paper dispenser	nr 1
M	Free standing cupboard in laundry 1200mm x 1800mm high	nr 1
Washroom 6 as drawing A409		
N	Shower enclosure 2250 mm x 1950mm; one tempered glass door; stainless steel fixing accessories.	Item 1
O	Mirrors 1200 x 800mm	nr 1
P	Vanity units 2050mm x 600mm x 915mm	nr 1
Q	Take delivery and fix toilet paper dispenser	nr 1
Washroom 7 and linen closet as drawing A409		
R	Shower enclosure 1980 mm x 1950mm; one tempered glass door; stainless steel fixing accessories.	Item 1
S	Mirrors 1200 x 800mm	nr 1
T	Vanity units 2050mm x 600mm x 915mm	nr 1
U	Take delivery and fix toilet paper dispenser	nr 1
V	Linen closet 1690mm x 2240mm	
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Washroom 8 as drawing A410		
A	Shower enclosure 2050 mm x 1950mm; one tempered glass door; stainless steel fixing accessories.	Item 1
B	Mirrors 1200 x 800mm	nr 1
C	Vanity units 2050mm x 600mm x 915mm	nr 1
D	Take delivery and fix toilet paper dispenser	nr 1
Kitchennette as drawing A410		
E	Low level bases complete	m 4
F	High level cupboards complete	m 4
Washroom 9 as drawing A411		
G	Shower enclosure 2500 mm x 1950mm; one tempered glass door; stainless steel fixing accessories.	Item 1
H	Mirrors 1200 x 800mm	nr 2
I	Vanity units 2450mm x 600mm x 915mm	nr 1
J	Take delivery and fix toilet paper dispenser	nr 1
Clothes closet as drawings A411 and A412		
K	Cupboard unit 3700mm x 2725mm	nr 1
L	Cupboard unit 1600mm x 2240mm	nr 1

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FITTINGS AND FURNISHINGS

TOTAL TO FINISHING WORKS SUMMARY

PREFORMED MOULDINGS AND BALUSTRADING AND STAIR RAILINGS**GRC preformed moulds; take delivery at site of works; assemble, plumb, temporary support and protect during construction**

Columns or column casings as drawings

A	300mm diameter x 3000mm long	nr	24
B	Extra for head plate	nr	24
C	Extra for sole plate	nr	24
D	300mm diameter x 2000mm long	nr	23
E	Extra for head plate	nr	23
F	Extra for sole plate	nr	23
G	Extra for cutting and fitting to accommodate railing	nr	68

Ornamental embellishers

H	300mm x 450mm fixed to concrete pedestals	nr	15
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Balusters

I	100mm diameter; ends cast into concrete rails	nr	260
---	---	----	-----

Moulding sets to heads, jambs and cills of windows; window size 600mm x 300mm

J		nr	6
---	--	----	---

K	1200mm x 700mm	nr	8
---	----------------	----	---

L	1200mm x 1050mm	nr	11
---	-----------------	----	----

M	1800mm x 1050mm	nr	2
---	-----------------	----	---

N	1800mm x 1350mm	nr	3
---	-----------------	----	---

O	1800mm x 1800mm	nr	2
---	-----------------	----	---

Moulding sets to heads and jambs of doors; door size

P	1000mm x 2000mm	nr	4
---	-----------------	----	---

Q	1800mm x 2000mm	nr	11
---	-----------------	----	----

Reinforced in-situ concrete; 20mm size aggregate; 35N/mm² cylinder strength; vibrated

Balustrade rails

R	150mm x 75mm; tightly packed to profile of rails	m	150
---	--	---	-----

Formwork and fair finish for painting

S	balustrade top rail; 325mm girth to profile as drawing	m	75
---	--	---	----

T	balustrade bottom rail; 325mm girth to profile as drawing	m	75
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Reinforcement bars to BS 4449; high yield deformed steel bars including bends, hooks, tying wire, distance blocks and ordinary spacers [Provisional]

A All sizes in range 6mm to 25mm in stair rails kg 200

To collection

COLLECTION

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STAIR RAILS AND BALUSTRADING

TOTAL TO FINISHING WORKS SUMMARY

FLOOR, WALL AND CEILING FINISHES**RENDERING WORK****Plasticised cement and sand (1:3); wood floated and finished with a slick coat of gypsum paste; internally**

12.5mm work to walls on blockwork or concrete base

A	over 300mm wide	m2	602
B	over 100 but not exceeding 200mm wide	m	250
C	Arris	m	250

Plasticised cement and sand (1:3); wood floated; externally

12.5mm work to walls on blockwork or concrete base

D	over 300mm wide	m2	402
E	over 100 but not exceeding 200mm wide	m	200
F	Arris	m	200

Cement and sand (1:3)

50mm thick (average) work to beds on concrete base

G	over 300 wide; for inflexible tile finish	m2	925
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INFLEXIBLE TILES**Porcelain tiles; BS 6431; non-skid quality; 6mm joints; fixed with thinset approved for use with porcelain tiles; grouting joints and flush pointing with coloured grout (colour to be approved by the Architect); internally**

600 x 600 x 20mm thick units to floors on cement and sand base (allow a Prime Cost Sum of \$100.00/tile for supply ex-store)

H	over 300mm wide	m2	925
I	over 300mm wide to landings	m2	40
J	raking cutting [provisional]	m	150
K	270mm wide treads	m	50
L	Fair ends	nr	100
M	175mm wide risers	m	50
N	Fair ends	nr	50
O	200mm high skirtings; rounded top edge	m	250

Nosing tiles PC \$75.00 per piece; bed in thinset; grout with coloured non-sanded grout

P	300mm long units work to corner of treads and risers 75mm wide	m	50
Q	Fitted ends	nr	100

	Ceramic tiles ; BS6431; glazed; 1.5mm joints; fixed with water proof adhesive; groutng joints and flush pointing with white cement; internally		
	250 x 450 x 6mm thick units to walls on cement and sand base (allow a Prime Cost Sum of \$20.00/tile for supply ex-store)		
A	over 300mm wide	m2	125
	Border tile; 200mm x 450mm x 6mm thick units to walls on cement and sand base (allow a Pprime Cost sum of \$35.00 per piece]		
B	200mm wide	m	250
	FITTED CARPETING		
	Carpeting; 'New Collegiate' 36 oz; product type - Broadloom; surface appearance - level heathered loop; nylon type - Colourstrand, SD nylon; heavy traffic quality; fixing with		
	Works to floors on cement and sand base		
C	over 600mm wide	m2	15
	Brass accessories		
	Cover strip		
D	37mm wide; screwed to backgrounds requiring plugging	m	106
	ASSOCIATED JOINERY WORK		
	Selected teak; kiln dried.		
	Skirtings		
E	25x 200mm; twice moulded; fixed to background requiring plugging; counter sinking and flush pelating.	m	300
F	External angles	nr	100
G	Internal angles	nr	100
H	Extra over for short lengths	nr	50
	CEILINGS		
	Gypsum sheet; normal bond; fixed with drive screws at 600mm centres to 16 gauge mild steel channel framing; tapered edge sheets taped with scrim cloth at joints and finished smooth with gypsum paste		
	12mm thick sheets to ceilings on supports at 1200mm centres each way fixed with 12mm hanging wire to backgrounds requiring plugging at a height not exceeding 4.20 m above floor level; internally		
I	over 600mm wide; lined on one face [provisional]	m2	600
J	Extra; for plugging	m	100
K	Extra; for angle beads	m	100
L	Cut openings for down lighters 150mm diameter	nr	50
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	12mm thick sheets to ceiling bulkheads on supports at 1200mm centres each way fixed with 12 gauge hanging wire to backgrounds requiring plugging at a height not exceeding 4.20m above floor level; internally		
A	over 600mm wide; lined on one face [provisional]	m2	250
B	Extra; for plugging	m	120
C	Extra; for angle beads	m	120
D	Cut openings for down lighters 150mm diameter	nr	120

Gypsum sheet; wbp bonded; fixed with drive screws at 600mm centres to 16 gauge mild steel channel framing; tapered edge sheets taped with scrim cloth at joints and finished smooth with gypsum paste

	12mm thick sheets to ceilings on supports at 1200mm centres each way fixed with 12mm hanging wire to backgrounds requiring plugging at a height not exceeding 4.20 m above floor level; internally		
E	over 600mm wide; lined on one face [provisional]	m2	75

MDF (Medium Density Fibreboard); butt joints; fixed with nails; counter sink and flush with paintable silicone

	Cornices; moulded		
F	250mm girth [Provisional]	m	200
G	External angles	nr	40
H	Internal angles	nr	40

END OF WORK BY GROUPS

Sundries in floor finishes

	Protection		
I	protect the porcelain floor	Item	
J	protect all other works	Item	

COLLECTION:

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FLOOR, WALL AND CEILING FINISHES

TOTAL TO FINISHINGS WORKS SUMMARY

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PAINTING AND DECORATING**NEW WORK INTERNALLY****Prepare and apply one coat sealer and two coats emulsion paint; silk finish**

A Cement rendered or gypsum surfaces of walls
over 300mm girth m2 642

B Gypsum ceilings
over 300mm girth m2 925

C Concrete soffites of staircases
over 300mm girth m2 15

D Faces of concrete mouldings in balustrading
200 to 300mm girth m 75

E Isolated balusters
200 to 300mm girth, 260 number m 208

F Ornamental columns, column heads or sole plates
over 300mm girth m2 45

One coat etching primer; two finishing coats gloss oil paint

G Aluminum frames
over 100 not exceeding 200mm girth m 210

Prepare knot, stop, one undercoat, two coats oil paint

H Wood doors
over 300mm girth m² 160

I Wood skirtings
over 200 not exceeding 300mm girth m 300

One coat oil primer

J Backs of wood skirtings before fixing
over 200 not exceeding 300mm girth m 300

NEW WORK EXTERNALLY**Prepare and apply one coat sealer and two coats emulsion paint; silk finish**

K Cement rendered or concrete surfaces of walls
over 300mm girth m2 402

REPAINTING AND REDECORATING WORKS INTERNALLY**Rub down, sand, prepare and apply two coats emulsion paint**

L Masonry of gypsum walls
over 300mm girth; ready painted m2 150

M Concrete ceilings
over 300mm girth m2 20

Rub down, sand prepare and apply two coats gloss oil paint			
	Wood doors		
A	over 300mm girth; ready painted	m2	24
Members of mild steel grilles			
B	not exceeding 100mm girth	m	250
REPAINTING AND REDECORATING WORKS EXTERNALLY			
Rub down, sand, prepare and apply two coats emulsion paint			
	Masonry of gypsum walls		
C	over 300mm girth; ready painted	m2	100
Rub down, sand prepare and apply two coats gloss oil paint			
	Steel doors		
D	over 300mm girth; ready painted	m2	20

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PAINING AND DECORATING

TOTAL TO MEASURED WORKS SUMMARY

FINISHINGS WORKS SUMMARY

WALLS AND PARTITIONS

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WINDOWS AND DOORS

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FITTINGS AND FURNISHINGS

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STAIR RAILS AND BALUSTRADING

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FLOOR, WALL AND CEILING FINISHES

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PAINTING AND DECORATING

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FINISHINGS WORKS

TOTAL TO MAIN SUMMARY

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Bill Nr. 8: Engineering Services

**BILL NR 8: ENGINEERING SERVICES
PLUMBING INSTALLATIONS**

Pricing note

A Notwithstanding the provision of the Standard Method of Measurement section S, the works in this section has not been measured in accordance with the said method of measurement.

Item

B Allow for the plumbing installations complete as attached specifications and drawings

Sum

All builders work

C Include for all cutting away and pinning of pipes and supports and the like and for roughing in with cement mortar for the entire installations.

Item

PLUMBING INSTALLATIONS
TOTAL TO ENGINEERING SERVICES
SUMMARY

ELECTRICAL INSTALLATIONS

Pricing note

A Notwithstanding the provision of the Standard Method of Measurement section T, the works in this section has not been measured in accordance with the said method of measurement.

Item

B Allow for the electrical installations complete as attached specifications and drawings

Sum

All builders work

C Include for all cutting away and pinning of conduits supports and the like and for roughing in with cement mortar for the entire installations.

Item

ELECTRICAL INSTALLATIONS
TOTAL TO ENGINEERING SERVICES
SUMMARY

AIR CONDITIONING INSTALLATIONS

Pricing note

A Notwithstanding the provision of the Standard Method of Measurement section S, the works in this section has not been measured in accordance with the said method of measurement.

Item

B Allow for the air conditioning installations complete as attached specifications and drawings

Sum

All builders work

C Include for all builders work in connection with the air conditioning installations

Item

AIR CONDITIONING INSTALLATIONS
TOTAL TO ENGINEERING SERVICES
SUMMARY

ENGINEERING SERVICES SUMMARY

PLUMBING INSTALLATIONS

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ELECTRICAL INSTALLATIONS

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AIR CONDITIONING INSTALLATIONS

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ENGINEERING SERVICES

TOTAL TO MAIN SUMMARY

Bill Nr. 9: External Works

BILL NR 9: EXTERNAL WORKS**LANDSCAPING****Excavation and earthworks**

Surfaces of ground

A grading to falls; filling in holes with excavated materials; preparing for topsoiling m2 300

Topsoil from spoil heaps on site

Filling

B to make up levels average 150mm thick; grading; preparing for grassing m2 300

Selected 'Zoyza' grass seedlings; planting at 200mm centres fertilize, water daily; trim and maintain in good order up to taking over

Grassing

C over 300mm wide m2 300

Sundries

Protection

D protecting the works Item

RE-TILING POOL DECK

Slate tiles; patterned as drawing C101; use PC \$60.00 per 400 x 400mm piece and \$30.00 per 200 x 200mm piece; 6mm joints; fixed with thinset approved for use with slate tiles; grouting joints and flush pointing with coloured grout (colour to be approved by the 400 x 400 x 20mm and 200 x 200mm x 20mm thick units to floors on cement and sand base

E over 300mm wide m2 133

F raking cutting [provisional] m 25

G cut and fit to profile of existing pool m 30

H Edge tile 100 x 200 x 20mm thick units [\$PC 30.00 each] to floors on cement and sand base m 50

200mm wide m 35

RE-TILING FORE COURT AREA

Slate tiles; patterned as drawing C102; use PC \$80.00 per 450 x 450mm piece; \$50.00 per 450 x 225mm piece, \$40.00 per 225 x 225mm and \$40.00 per 450 x 150mm piece; 6mm joints; fixed with thinset approved for use with slate tiles; grouting joints and flush 450 x 450 x 20mm, 450 x 225mm, 450 x 150mm and 225 x 225mm x 20mm thick units to floors on cement and sand base

I over 300mm wide m2 459

J raking cutting [provisional] m 91

K cut and fit to profile of existing floors m 30

	Edge tile 100 x 200 x 20mm thick units [SPC 30.00 each] to floors on cement and sand base	m	91
A	200mm wide	m	35
FENCING AND GATES TO FRONT BOUNDARY			
Excavation			
B	Excavating trenches or for foundations not exceeding 1.50m deep from existing ground level	m3	18
C	Planking and strutting not exceeding 1.50 total depth; sides of trenches or pits	m2	60
D	Bottoms of excavation levelling; compacting to receive concrete	m2	30
E	Excavated materials backfill around foundations; compact to 95% Proctor dry density	m3	8
F	spread and level on site in isolated areas average 75m from excavations.	m3	10
Plain in-situ concrete; grade 10			
G	Blinding beds to bottoms of pits or trenches 50mm thick	m2	30
Reinforced in-situ concrete; grade 25			
H	Pad footings or strip footings 250mm thick; poured against faces of excavation	m3	2
I	Pedestals generally	m3	4
J	Kerbs to fence base generally	m3	2
K	Extra for shaping sides to slopes average 75mm wide	m	50
L	Filling to cores of hollow block wall 150mm thick; both cores	m2	60
Reinforcement bars; BS 4483, plain round mild steel bars, including bends, hooks, tying wire, distance blocks and ordinary spacers (Provisional)			
M	6mm diameter beds of hollow walls	kg	200

	Reinforcement bars; BS 4483, plain round high yield steel bars, including bends, hooks, tying wire, distance and ordinary spacers (Provisional)		
A	12mm diameter bars in foundations	kg	1,200
B	cores of hollow walls	kg	700
	Wrought formwork; rub down on striking to finish fair for painting		
C	Sides of foundations 300mm high	m2	25
D	Sides of pedestals generally; including chamfers not exceeding 50mm wide	m2	40
E	Forming motifs in concrete column as drawing C103A; rubbing out as final finish	nr	30
F	Sides of fence kerb 150mm high	m	100
	Sundries on concrete work		
G	Mortice in concrete 10mm diameter x 100mm deep for expanding bolt	nr	40
	BLOCKWORK		
	Hollow concrete blocks 200mm x 400mm; in cement mortar		
H	Base walls in foundations 150mm thick built for render both sides; setting over reinforcement rods at 200mm centres	m2	60
	Sundries on blockwork		
I	Weep holes; 50mm diameter pvc pipes 150mm long; cut and fit to block base walls	nr	20
	METALWORK		
	Mild steel; welded fabrication with welds grounded to a smooth finish.		
J	Horizontal rails or vertical balusters of fencing 50 x 100mm RHS	m	100
K	16mm diameter x 1243mm long solid rounds; welded both ends	m	150
L	16mm diameter x 150mm long; splay fair cut one end; welded other end	m	50
M	16mm diameter x 200mm long; splay fair cut one end; welded other end	m	50

A	Expanding bolts 10mm diameter x 150mm long	nr	40
B	Gates; 50 x 100mm RHS top rail, bottom rail and stiles; 16mm solid round infill verticals at 150mm centres each fitted with one wrot iron collar; 16mm diameter solid round spikes at 150mm centres with splay cut end. 3546 x 2800mm; sliding; allow for tracks and wheels	nr	1
C	4242 x 2800mm; sliding; allow for tracks and wheels	nr	1
D	Extra for wrot iron rosette as drawing C103; cut and fit to verticals	nr	10
Wrot iron work; welding to mild steel; welds grounded to a smooth finish			
E	Rosettes at drawing C103 250 x 250mm extreme size; cut and fit between verticals	nr	40
F	Collar tie as drawing C 103 16mm diameter; welding to verticals	nr	60
RENDERING			
Plasticised cement and sand (1:3); wood floated; externally			
G	12.5mm work to walls on blockwork or concrete base over 300mm wide	m2	120
PAINTING AND DECORATING			
Prepare and apply one coat sealer and two coats vinyl emulsion paint with silk finish. [Sherwin Williams or other equal and approved]			
H	Work to walls on fair face concrete or blockwork base over 300mm girth	m2	120
Etch, one coat zinc chromate primer and two finishing coats oil paint [Sherwin Williams or other equal and approved]			
I	Steel members of open grilles or gates over 300mm girth	m2	200
J	not exceeding 100mm girth	m	200
K	over 100mm not exceeding 200mm girth	m	100
D	over 200mm not exceeding 300mm girth	m	50
L	Isolated members not exceeding 0.50m2 total surface areas Collars	nr	60
M	Rosettes	nr	50

END OF WORKS CLASSIFIED BY GROUPS

Sundries in all works

A Keep the surfaces of the site and the excavation free of surface water
and ground water item

B Protection
protect all works

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MEASURED WORKS

TOTAL TO MAIN SUMMARY

Bill Nr. 10: Dayworks

BILL NR 10: DAYWORKS

Generally

A In accordance with the Conditions of Contract, where works arising under a variation ordered by the Architect cannot be properly measured and valued, the Contractor shall be paid on a daywork basis. Such payments shall be paid at the prime cost of such work calculated in accordance with the following "Definition of Prime Cost of Daywork" and the percentage additions to each section of the Prime Cost at rates set out hereunder by the Contractor and recorded in the Appendix to the Conditions of Contract.

Definition of Prime Cost of Daywork.

This definition applies solely to daywork carried out hereunder or incidental to this building contract. It does not cover daywork ordered by the Architect to be carried out after the date of commencement of the Defects Liability Period which may be the subject of a separate agreement.

Section 1 - Labour

- 1 The amount of wages paid at the standard time rates applicable to workmen engaged on daywork and such extra payments as awarded by the recognised wage fixing bodies.
2. The amount of wages paid at the standard time rates applicable to workmen engaged on daywork and operating mechanically operated plant and transport, and erecting and dismantling other plant.
3. The time of principals, foreman, gangers and chargehands at the time rates for the trades practised when actually working with their hands, unless previously authorised.
4. The cost of overtime, where specifically ordered or subsequently sanctioned in writing by the Architect to be worked on dayworks.

Section 2 - Materials

1. The cost of materials, including delivery to the site.
2. Materials supplied from the Contractor's stock at current prices plus justifiable charges for handling and delivery to the site.

The cost of materials referred to in paragraphs 1 & 2 above is the cost less all trade discounts but including all discounts for cash not exceeding 5 percent

Section 3 - Plant

1. The use of mechanically operated plant and transport for the time engaged in dayworks.

Use of scaffolding, staging, trestles, tarpaulins and other non-mechanical plant, excluding hand tools, specifically provided for daywork operation for such time as the Architect considers reasonable.

Section 4 - Overheads

Overheads for the purposes of this Contract shall mean the following:

1. Head Office Charges
2. Site supervision and site staff
3. Overtime other than that allowed under Section (1) (4)
4. Time lost due to inclement weather.
5. Bonuses and all other incentive payments
6. Apprentices study time
7. Employers contribution to National Insurances, including graduated pensions
8. Contributions for annual and public holidays.
9. Fares and time allowance for travelling.
10. Subsistence and periodic leave allowance.
11. Safety and welfare facilities.
12. Third party and employer's liability insurance.
13. Sickpay or insurances in respect thereof.
14. Tool allowance
15. Use, repair and sharpening of small tools.
16. All non-mechanically operated plant, erected scaffolding and staging and trestles, protective clothing, artificial lighting, storage facilities and the like that may be in general use on the site.
17. All other liabilities and obligations whatsoever.

Overheads as defined in Section (4) above and profit shall be dealt with by means of a percentage addition to the total of the Prime Cost in each of the aforementioned sections (1), (2) and (3) at the rates stated hereafter.

Labour

Include the provisional sum of **one hundred thousand dollars (\$100,000)** for daywork labour.

100,000.00

Allow a percentage allowance on prime cost of labour for overheads and profit.

%

Materials

Include the provisional sum of one hundred **thousand dollars (\$100,000)** for daywork materials.

100,000.00

Allow a percentage allowance on prime cost of materials for overheads and profit.

%

Plant

Include the provisional sum of **fifty thousand dollars (\$50,000)** for daywork plant..

50,000.00

Allow a percentage allowance on prime cost of materials for overheads and profit.

%

Total to Collection

COLLECTION

Page 10/1

Page 10/2

Page 10/3

BILL NR 10 - DAYWORKS

TOTAL TO MAIN SUMMARY

Main Summary

MAIN SUMMARY

BILL NR. 1 - PRELIMINARIES	1/17
BILL NR. 2 - MATERIALS AND WORKMANSHIP	
BILL NR. 3 - PROVISIONAL AND PRIME COST SUMS	3/1
BILL NR. 4 - WORKS TO BE PRICED ON SITE	4/1
BILL NR. 5 - SUB STRUCTURES	5/7
BILL NR 6 - FRAME, ROOF , FLOORS AND STAIRCASES	6/5
BILL NR 7 - FINISHING WORKS	7/16
BILL NR. 8 - ENGINEERING SERVICES	8/4
BILL NR 9 - EXTERNAL WORKS AND SERVICES	9/5
BILL NR 10 - DAYWORKS	10/3

Sub-total

Add for Insurances as Conditions of Contract

Add for Performance Security

Sub-total

Add for Contigencies

10%

Sub-total

TOTAL TO LETTER OF TENDER (V.A.T. Exclusive)

Not Applicable

Appendices

Appendix 1: Percentage Mark up on Trades

APPENDIX 1 - PERCENTAGE MARK UP ON TRADES

Generally

A

In order that the rates tendered may be equitably used for pricing work not of a similar character or not executed under similar conditions to that described in these Bills, the Contractor shall state the average percentage allowed for profit and overheads in his foregoing rates under the following headings:

Average Allowance in Rates
for overheads and profit

Excavation and earthworks	%
Concrete works	%
Brickwork and blockwork	%
Roofing	%
Carpentry	%
Joinery	%
Structural steel work	%
Metalwork	%
Plasterwork and other floor, wall & ceiling finishes	%
Glazing	%
Painting and decorating	%
External works	%
 The Contractor shall state here the percentage he will require for overheads and profit on works identified as provisional sums in the Bills of Quantities	 %

Appendix 2: List of tender Drawings

Appendix 3: Mechanical and Electrical Bills

**REFURBISHMENT OF THE RESIDENCE FOR THE
INDIAN HIGH COMMISSION**

**TECHNICAL SPECIFICATIONS
FOR
PLUMBING SYSTEMS**

JAIN

JAIN CONSULTANTS T&T LTD

54 Evans Street

Curepe

Tel: 1 (868) 645-3650; Fax: 1 (868) 645-3650

Email:

trinidad@jainconsultants.com

May 28, 2018

REFURBISHMENT OF THE RESIDENCE FOR THE INDIAN HIGH COMMISSIONER

TECHNICAL SPECIFICATIONS

PLUMBING SYSTEM

SECTION 001

1. SCOPE OF WORK

The scope of works shall include the supply of all equipment, labour, materials and services required for the installation of the Plumbing System at the residence of the Indian High Commissioner. The works shall include the following:

a. PLUMBING SYSTEM

- Supply and install domestic water storage tanks as per drawings and specifications.
- Supply and install piping and valves from Domestic water tanks to Domestic water pumps.
- Supply and install materials and labour for the construction of plinths for Water tanks and Pumps
- Coordinate with the Electrical Installation contractor for the electrical supplies to the domestic water pump.
- Supply and install domestic water Duplex Pumps and pressure tanks.
- Supply and install domestic water piping from Water pumps to water supply outlets within the building.
- Supply and install valves and fittings for Domestic water system.
- Supply and install waste water piping fittings and fixtures for all toilet fixtures sinks faucets etc
- Supply and install floor drains with trap seals
- Supply and install domestic water supply piping including valves for plumbing fixtures in building as per drawing
- Supply and install brackets, supports fittings and fixtures for the installation of the domestic water supply and waste water lines as per drawings.
- Supply and install fire extinguishers as detailed in the Bills of Quantities.
- Supply and install toilet fixtures including Water closets, lavatory basins, sinks, faucets etc.

BASIC MECHANICAL REQUIREMENTS

SECTION 002

1. GENERAL

a. RELATED DOCUMENTS:

- Drawings and general provisions of Contract, including The General Conditions of the Contract for Construction and drawings.
- Related Sections: Refer to all sections on Electrical and Civil / Structural Works.

b. SUMMARY:

- This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of the Works including Civil /Structural and Electrical Works.
- The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections, system shutdowns and restart-up, flushing and filling both new and existing systems.
- Provide temporary ductwork and piping services where required to maintain existing areas operable, as shown on the drawings.
- Coordinate all services shut-down with the Owner; provide temporary services as shown on the drawings.
- The Contractor shall be responsible for the maintenance operation and servicing of all new mechanical systems which are to be used by the Owner during the time of any occupancy and use of any areas within the construction limitations before final completion or acceptance of the systems. A written record of maintenance, operation and servicing shall be turned over to the Owner prior to final acceptance.

c. PROJECT CONDITIONS:

- The Contractor shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work for these existing conditions.
- Field verify all existing conditions prior to submitting bids.
- Report any existing damaged equipment or systems to the Owner prior to any work.
- Protect all mechanical and electrical work against theft, injury or damage from all causes until it has been tested and accepted.
- Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair

or replace any part of the work which may show defect during one year from the final acceptance of all work. Provided such defect is, is in the opinion of the Engineer, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.

d. ACCESSIBILITY:

- Install equipment and materials to provide required access for servicing and maintenance.
- Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- Extend all grease fittings to an accessible location.
- Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, motors, fans, balancing cocks, and other operating devices requiring adjustment or servicing.
- The minimum size of any access door shall not be less than the size of the equipment to be removed or 12 inches x 12 inches if used for service only.
- Furnish doors to trades performing work in which they are to be built, in ample time for building-in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.
- Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed.
- Access doors in fire-rated walls and ceilings shall have equivalent U.L. label and fire rating.

e. ROUGH-IN:

- Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough-in requirements.

f. REQUIREMENTS OF REGULATORY

- Execute and inspect all work in accordance with the local Authority having Jurisdiction, applicable Codes and Standards as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the greater requirement shall be followed.
- Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.

- The handling, removal and disposal of regulated refrigerants shall be in accordance with U.S. EPA, state and local regulations.
 - The handling, removal and disposal of lead based paint and other lead containing materials shall comply with EPA, OSHA, and any other Federal, State, or local regulations.
 - After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.
- g. REQUIREMENTS OF LOCAL UTILITY COMPANIES:
- Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required for the project.
- h. PERMITS AND FEES:
- The **Contractor** shall pay all fees required for connection to public utility facilities.
 - Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.
- i. MECHANICAL INSTALLATIONS:
- Drawings are diagrammatic in character and do not necessarily indicate every required offset, valve, fitting, etc.
 - Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both.
 - Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.
 - Before any work is installed, determine that equipment will properly fit the space; that required piping grades can be maintained and that ductwork can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.
 - Coordinate the installation of mechanical materials and equipment above and below ceilings with suspension system, light fixtures, and other building components.
 - Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of priority.
 - Plumbing waste, vent piping and roof drain mains and leaders.
 - Supply, return and exhaust ductwork.

- Fire sprinkler mains and leaders
 - Electrical conduit.
 - Domestic hot and cold water.
 - BAS Control Piping or Wiring.
 - Fire sprinkler branch piping and sprinkler runouts.
- Verify all dimensions by field measurements.
 - Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
 - Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
 - Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
 - Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
 - Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
 - Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 - Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - The Contractor shall provide all labor and material necessary but not limited to the starting/stopping of all mechanical equipment, opening/closing of all valves, draining/refilling all mechanical systems and operating/verifying the operation of all mechanical systems controls as required to accomplish all work necessary to meet construction document requirements.
- j. BELTS, SHEEVES, IMPELLERS:
- The Mechanical Contractor shall coordinate with the Specialist Equipment Supplier and supply correctly-sized drive belts, sheeves, and trimmed impellers.

k. EXCAVATING AND BACKFILLING:

- General:
 - Provide all necessary excavation and backfill for installation of mechanical work in accordance with the specifications.
 - In general, follow all regulations of OSHA with respect to trenching and shoring.
 - Contact Owners of all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Also, prior to starting excavation brief employees on marking and color codes and train employees on excavation and safety procedures for natural gas lines. When excavation approaches gas lines, expose lines by carefully probing and hand digging.
 - Provide all necessary pumping, cribbing and shoring.
 - Walls of all trenches shall be a minimum of 6 inches clearance from the side of the nearest mechanical work. Install pipes with a minimum of 6 inches clearance between them when located in same trench.
 - Pipe Trenching:
 - Dig trenches to depth, width, configuration, and grade appropriate to the piping being installed. Dig trenches to 6 inches below the level of the bottom of the pipe to be installed. Install 6 inches bed of pea gravel or squeegee, mechanically tamp to provide a firm bed for piping, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal pipe protrusions.
 - Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be reviewed by the soils engineer. In no case shall lumber, metal or other debris be buried in with backfill.
 - Provide warning tape for marking and locating underground utilities. Tape shall be specifically manufactured for this purpose and shall be polyethylene film, 6 inches wide, 0.004 inches thick and have a minimum strength of 1750' psi. Tape shall carry continuous inscription naming the specific utility.
- G. Trench Backfill:
1. Backfill to 12 inches above top of piping with pea gravel or squeegee, the same as used for piping bed, compact properly.
 2. Continue backfill to finish grade, using friable material free of rock and other debris.
Install in 6 inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not

permissible.

- H. After backfilling and compacting, any settling shall be refilled, tamped, and finished at this contractor's expense.
- I. The contractor shall repair and pay for any damage to finished surfaces.
- J. Complete the backfilling near manholes using pea gravel or squeegee, installing it in 6 inch lifts and mechanically tamping to achieve 95 percent compaction.
- K. Use suitable excavated material to complete the backfill, installed in 6 inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper 30 inches below paving and slabs and 90 percent elsewhere.

1.12 CUTTING AND PATCHING:

- A. This Article specifies the cutting and patching of mechanical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.
- C. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.
- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work;
 - 2. Remove and replace defective work;
 - 3. Remove and replace work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed work as specified for testing;
 - 5. Install equipment and materials in existing structures;
 - 6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineer observation of concealed work.
- G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new work.
- H. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain an approved type of temporary partitions or dust barriers

adequate to prevent the spread of dust and dirt to adjacent areas. Temporary partitions must not impede access to building egress.

- J. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover.

1.13 TEMPORARY FACILITIES:

A. Light, Power, Etc.:

- 1. Responsibility for providing temporary electricity, and other facilities required for the mechanical works

1.14 PRODUCT OPTIONS AND SUBSTITUTIONS:

- A. Materials and equipment of equivalent quality may be substituted for those scheduled or identified by name on the drawings if so reviewed by the Architect/Engineer and approved prior to the order being placed . The submittal shall include all data necessary for complete evaluation of the product.

1.15 MECHANICAL SUBMITTALS:

- 1. All mechanical submittals shall be submitted by specification section submitted at one time. "Piece-Meal" or "Partial" submittals will be returned, unless prior approval from the Engineer has been obtained.
- 1 The Contractor shall identify any "long lead time" items which may impact the overall project schedule. If these submittal requirements affect the schedule, the Contractor shall identify the impacts and confer with the Engineer within two weeks of entering into the contract.
- 3. At least one copy of the first submittal package shall be provided in expandable, 3 post, and hard back binders, sized to fit all future submittals for this job. The cover shall be identified with the job name, Owner's project number, date, prime contractor's name, etc.
- 4. Each submittal shall be tabbed by the mechanical specification section it is specified in. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)

- c. Specification Section
 - d. Manufacturer and Model Number
5. Fire protection and coordination drawings do not apply to the above. These drawings may be submitted in a separate submittal.
- B. The manufacturer's material or equipment listed in the schedule or identified by name on the drawings are the types to be provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the scheduled names, the cost of any changes in construction required by their use shall be borne by Contractor.
 - C. All equipment shall conform to the local Energy Conservation Standards.
 - D. Submittal of shop drawings, product data, and samples will be accepted only when submitted by and stamped by the Contractor. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed unless prior written approval is obtained by the Contractor.
 - E. Before starting work, prepare and submit to the Architect/Engineer THREE(3) sets of all shop drawings and descriptive equipment data required for the project. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer will mark up two sets, keep one, and return the rest. Continue to submit THREE (3) sets of any individual shop drawings, product data or samples which were returned without a "make corrections noted" or "no exceptions taken" action, until they are so marked. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the operation and maintenance manual. Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process.
 - F. The Design Professionals review and appropriate action on submittals, such as shop drawings, product data, samples and other data, as required by the Design Professional, is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The Design Professional's review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional's judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component. The Design Professional

shall not be responsible for any deviations from the contract documents not brought to the attention of the Design Professional in writing by the Contractor. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

1.16 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:

A. Product Data:

1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
2. Delete or mark-out portions of pre-printed data which are not applicable.
3. Where operating ranges are shown, mark data to show portion of range required for project application.
4. For each product, include the following:
 - a. Sizes.
 - b. Weights.
 - c. Speeds.
 - d. Capacities.
 - e. Piping and electrical connection sizes and locations.
 - f. Statements of compliance with the required standards and regulations.
 - g. Performance data.
 - h. Manufacturer's specifications.

B. Shop Drawings:

1. Shop Drawings are defined as mechanical system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical pre-printed materials.
2. Prepare Mechanical Shop Drawings, except diagrams, to accurate scale, min 1/8"-1'-0", unless otherwise noted.
 - a. Show clearance dimensions at critical locations.
 - b. Show dimensions of spaces required for operation and maintenance.
 - c. Show interfaces with other work, including structural support.

C. Test Reports:

1. Submit test reports which have been signed and dated by the firm performing the test.
2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.

D. Required submittals:

1. Provide submittals for each item of equipment specified or scheduled in the contract documents.

E. If more than two submittals (either for product data, shop drawings, record drawings, or test and balance reports) are made by the contractor, the Owner reserves the right to charge the contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the contractor.

1.17 PRODUCT LISTING:

A. Prepare listing of major mechanical equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Architect.

B. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

Provide products which are compatible within systems and other connected items.

1.18 NAMEPLATE DATA:

A. Provide permanent operational data nameplate on each item of mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.19 DELIVERY, STORAGE, AND HANDLING:

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage or contamination during shipment, storage, and handling.

C. Store equipment and materials at the site, unless off-site storage is authorized in writing.

Protect stored equipment and materials from damage, dirt, dust and moisture.

D. Coordinate deliveries of mechanical materials and equipment to minimize

construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

- E. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- F. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- G. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or be packaging with durable, waterproof wrapping.

1.20 RECORD DOCUMENTS:

- A. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.
- C. Mark Drawing Prints to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices. Changes to be noted on the drawings shall include final location of any piping or ductwork relocated more than 1foot-0inches from where shown on the drawings.
- D. At the completion of the project, obtain from the Architect/Engineer a complete set of the Mechanical Construction Documents in the electronic format used by the design team. This set will include all revisions officially issued through the Architect/Engineer. The Contractor shall transfer all revisions noted on the record document prints to the electronic drawings. The Contractor shall transmit the final record documents in the electronic format used on the project to the Architect. This contract will not be considered completed until these record drawings have been received and reviewed by the Architect/Engineer.

1.21 OPERATION AND MAINTENANCE DATA:

- A. No later than four (4) weeks prior to the completion of the project, make up a **minimum of four sets of** operating and maintenance manuals
- B. In addition to the information required above for Maintenance Data, include the following information:
 - 1. Description of mechanical equipment, function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions, lubrication charts and schedules, including Contractor Lubrication reports.
 - 5. Manufacturer's service manuals for all mechanical equipment provide under this contract.
 - 6. Include the valve tag list.
 - 7. Name, Address and Telephone number of party to be contacted for 24-hour service for each item of equipment.
 - 8. Starting, stopping, lubrication, equipment identification numbers and adjustment clearly indicated for each piece of equipment.
 - 9. Complete parts list.
 - 10. Mechanical warranties.
- D. This contract will not be considered completed nor will final payment be made until all specified material, including testing report, is received in this operating and maintenance report and the manual is reviewed by the Architect/Engineer.

1.22 LUBRICATION OF EQUIPMENT:

- A. Contractor shall properly lubricate all mechanical pieces of equipment which he provided before turning the building over to the Owner. He shall attach a linen tag or heavy duty shipping tag on the piece of equipment showing the date of lubrication and the type and brand of lubricant used.
- C. Furnish the Engineer with a typewritten list included in the O and M manuals of each item lubricated and type of lubricant used, no later than two (2) weeks before completion of the project, or at time of acceptance by the Owner of a portion of the building and the mechanical systems involved.

1.23 DEMOLITION:

A During the demolition phase of this contract it is the responsibility of this Contractor to carefully remove existing equipment, piping or ductwork and related items either as shown on the demolition drawings as being removed, or as required for the work. These items shall be tagged, protected from damage, and stored as directed by the Architect. A list of all items stored shall be turned over to the Architect. At the completion of the remodeling work or when directed by the Architect, all stored items not reused or wanted by the Owner shall be removed from the premises. Disposition of items not reused is by the direction of the Owner/Architect/Engineer.

1 Return existing plumbing fixtures to the Owner.

C. The location of existing equipment, pipes, ductwork, etc., shown on the drawings has been taken from existing drawings and is, therefore, only as accurate as that information. All existing conditions shall be verified from field measurements with necessary adjustment being made to the drawing information.

D. If asbestos material, in any form, is discovered by this contractor in the process of his work, he shall report such occurrence to the Architect/Owner immediately. The Architect/Owner will determine the action to be taken for the asbestos removal, which is not a part of the work to be done under this Contract.

1.24 WARRANTIES:

A. Refer to individual equipment specifications for warranty requirements. In any case the entire mechanical system shall be warranted no less than one year from the time of acceptance by the Owner.

B. Compile and assemble the warranties into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference / the operating and maintenance manuals.

C. Provide complete warranty information for each item to include product or equipment to include date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.25 CLEANING:

Clean filters, strainers, and mechanical systems prior to final acceptance.

1.26 PROJECT CLOSEOUT:

A Contractor shall be responsible for providing the Mechanical checklist for the

item of equipment in accordance with the Manufacturers recommendations. Checks shall be carried out by the Contractor and reviewed by the Engineer prior to applying for certification of substantial completion.

1. Refer to individual specification sections for additional requirements.

SECTION 003
PLUMBING AND FIRE PROTECTION SYSTEM
TECHNICAL SPECIFICATIONS

PLUMBING AND FIRE PROTECTION INSTALLATION

TECHNICAL SPECIFICATIONS

Description

The work shall consist of the supply and installation of Plumbing fixtures, pumps, water supply lines, sewer pipes, piping, and venting together with all appurtenances including valves, fittings, supports and complete testing and commissioning of the systems.

Codes, Regulations, Standards and Special Conditions

The Works in this section include preparing all detailed drawings for statutory approval and supplying, installing and constructing all work in this section.

The Contractor shall obtain all permits including those for the lift stations and inspections required by building safety codes, ordinances, rules and regulations of any legal body having jurisdiction – WASA and the EMA.

All work covered by this specification shall be in accordance with the applicable local codes and regulations. Nothing shown on the drawing, or in these specifications, shall be considered as authorizing any installation that violates the requirements of the applicable codes, rules and regulations.

The installation shall conform to the conditions set out in the latest issue of the following:

- National Plumbing Code of Trinidad and Tobago
- WASA Guidelines
- EMA Requirements
- TTBS Standards
- ANSI-B31.1 – Code for Pressure Piping
- International Plumbing Code
- Other Local Guidelines, Rules and Regulations

Whenever requirements stated in this specification or on the drawings are of higher order than of the governing standards, codes and regulations, the provisions of this specification shall govern.

Statement of Work

Materials and Equipment

Materials and equipment have been carefully selected for this project and the Contractor is expected to provide all items as closely as possible to the specifications.

Job Co-ordination

The Contractor shall plan his plumbing work in advance and shall co-ordinate all space requirements with the other trades involved. Where conflicts occur, the Contractor shall request clarification from the Engineer.

Workmanship

It is the intent of these specifications to provide the best workmanship available. Poor workmanship will be rejected and the work reinstalled when, in the judgment of the Engineer, the workmanship is not of the highest quality.

Completeness

It is the intent of these specifications to provide a complete system. Completeness shall mean not only that all material and equipment have been installed properly, but that together they constitute a functional water distribution and waste water collection and treatment system within the building which in the opinion of the Engineer will operate as designed.

PIPING

Materials

Cold water supply, wastewater force main and underground fire protection pipes shall be PVC Schedule 40 to ASTM D1785. Fittings up to 100mm shall be socket type Schedule 40 to ASTM D-2466 and joints up to 100mm shall be solvent welded, solvent cement to conform to ASTM D-2564.

Hot water piping shall be CPVC.

Waste and vent piping shall be PVC Class "B" to BS 3505:1968 or Schedule 40 Fittings up to 100mm shall be socket type DWV to ASTM D-2467. Joints up to 100mm shall be solvent welded, solvent cement to conform to ASTM D-2564 and larger than 100mm shall be of the integral gasket type to ASTM D-1869.

Pipe-General

The erected piping shall be neat in appearance, convenient to operate, properly supported, and shall provide for proper expansion and drainage.

All valves shall be located so that they may be operated from floors or platforms. Stem extension or chains may be used where necessary to achieve this, but shall be avoided if possible.

Piping shall not interfere with access to valves or equipment or to obstruct passages of any kind. In general, minimum headroom shall be 2400 mm clear, under all piping, coverings and appurtenances.

Open ends of pipelines shall be properly capped or plugged during installation to keep dirt or other foreign matter out of the system.

At the completion of the pipe work, all valves shall have the packing glands and nuts properly adjusted to prevent leakage.

Opening, Sleeves

Sleeves for pipes passing through floors or walls shall be large enough to pass the full thickness of the insulation where this is used and shall be of sufficient diameter to allow for any lateral movement of piping due to expansion or contraction. All pipes passing through floors and concrete structures shall pass through sleeves.

Sleeves shall be flush with finished ceiling, wall faces and finished floors.

Holes for pipes 200mm diameter and smaller passing through concrete floors shall be provided with sleeves made from steel pipe.

Pipes passing through outside walls, fire walls or through walls, partitions, or floors, which are considered as serving as fire stops, and in partitions around washrooms shall have the space in the sleeve around the pipe packed with asbestos or other suitable, approved non-fragile, non-combustible grade and caulked watertight with oakum and plastic cement.

Piping Protection

All piping shall be dry, thoroughly clean and free from dirt and other foreign material.

Particular care must be exercised by the Contractor to prevent miscellaneous debris getting into the piping system and equipment.

Pipe Cleaning

Installed piping shall be flushed out prior to putting into service. The temporary piping and connections shall be approved by the field inspector prior to the

flushing operation. The Contractor shall supply and install all temporary piping connections and equipment for flushing purposes. Flushing of any element of a system will be considered complete when a one litre flushing sample is clean and free from suspended material.

All piping shall be flushed at no less than design velocity. On long risers, flushing shall be done in the direction of gravity.

Principal distribution headers shall be flushed before branch lines.

Vent, Traps, Cleanouts

Cleanouts shall be installed at the base of stacks, at all changes in direction and at other points as indicated on plans or as directed.

Cleanouts shall be full size of pipe up to and including 100mm and not less than 100mm for larger pipes.

Every fixture shall have a deep seal trap placed as near to the fixture as possible. Screw cleanouts plugs shall be provided for all traps.

Every fixture shall be properly vented and no vent shall be less than 40mm diameter.

All vents passing through the roof shall extend at least 300mm and shall be properly flashed.

All branch vents shall be free from sag and so graded and connected to drip by gravity to the soil or waster line.

Pitch of Piping

All horizontal drain lines shall be graded as follows:

Above Ground: Up to and including 100mm 1:50 min.

Below Ground: Up to including 150mm 1:100 min.

Vent piping shall be graded with a pitch of 1:100 min towards the fixture to which it connects.

Horizontal branches of all piping shall be graded downwards so that they may be drained.

Air Chambers and Drain Cocks

Air chambers shall be installed on each branch line serving a group of fixtures.

The air chambers shall be installed as close as possible to the point of closure for the fixture.

For long branch lines, air chamber shall be installed at spacing not exceeding 6m intervals. Top of cold water supply lines shall be extended at least 300mm forming an air chamber.

Drain cocks, 20mm shall be installed at the foot of each riser. Each cock shall be provided with a hose bib connection. Drain cocks shall be located in a position that will allow the line to be drained without interfering with the supply of the other risers.

Fixtures

Fixtures shall be supplied as per this specification.
All fixtures shall be securely supported to the building structure.

Pipe sizes for fixture connections shall not less than the following:-

<u>Fixtures</u>	<u>Drain Out (mm)</u>	<u>Supply In (mm)</u>
Water Closet	100	15
Lavatory	38	15
Urinal	50	15

All exposed pipes, escutcheons, fittings, associated with the fixtures shall be chromium plated.

Domestic Water Valves

Manufacturer

Valves shall be either Crane, Jenkins or Engineer approved equal, and all valves on the project shall be of the same manufacturer.

Gate Valves

This shall be of wedge disc type, permit straight line flow, complete shut-off and be so designed that when the valve is wide open, it can be repacked under pressure. Valves 50mm and smaller shall be bronze, with ends to suit pipe and non-rising stem. The valves shall have a deep stuffing box for long contact with the stem packing gland and filled with high quality packing. Valves 60mm to 100mm shall be iron body bronze mounted with ends to suit pipe and shall be of

non-rising type. Working pressure for bronze valves shall be 10.5 kg/sq.cm and iron valves 8.8 kg/sq.cm.

Globe Valves

This shall permit control of flow rate from full flow to complete shut-off and so designed that when the valve is wide open, it can be repacked under pressure, and have a deep stuffing box with gland and filled with high quality packing. Valves 50mm and smaller shall be bronze seat of not less than 500 Brinell hardness. Valves 65mm and larger shall be iron body bronze with ends to suit pipe, yoke bonnet, and disc guide. Working pressure for bronze valves shall be 10.5 kg/sq.cm and iron valves shall be 8.8 kg/sq.cm.

Check Valves

This shall be horizontal swing type with two piece hinges, disc construction seats to be bronze and discs bronze or with composition face depending on service. Valves 50mm and smaller shall be bronze to suit pipe ends and have full area Y pattern body and integral seats. Valves 65 mm and larger shall be iron body brass mounted and with ends to suit pipe. Working pressure for check valves shall be 8.8 kg/sq.cm.

Mounting

All fixtures shall be mounted and connected in strict accordance with the manufacturer's recommendations. The Contractor shall install the fixtures to the roughing-in dimensions shown on the approved shop drawings. All exposed water supply pipes to walls or floors shall be chromium-plated and have escutcheon plates.

Cleaning

All fixtures shall be cleaned and all construction dirt removed at the completion of the project.

Protection

All fixtures and chromium-plated trim shall be protected during the construction, and debris or other construction dirt shall not be allowed in the fixture. Excess pipe joint compound shall be wiped off as soon as installation is completed. Any chrome trim with wrench marks shall be removed and new trim installed.

Water Closets

Armitage Shanks or approved equal to architects specifications . WC'S to be close coupled 1.6 gpf with exposed flush tank.

Urinals

Armitage Shanks or approved equal to architects Specifications . Urinals to be Low Flow with top inlet spreader, Flush pipe (exposed), 1 ½" plastic splash reducing waste, 4.5 L Mura auto cistern, bottle trap and concealed steel hanger.

Lavatory

These shall be Armitage Shanks or approved equal to the Architects Specifications , center taphole with Basin Pillar tap to architects specifications . 1 ¼" plastic strainer waste and 1 ¼" plastic bottle trap

Cleaner's Sink

This shall be Armitage Shanks Alder Cleaner sink with Nimbus ½" bib tap, concealed wall mounts, unslotted strainer waste, built-in brackets and Domex screws.

Kitchen Sinks

Armitage Shanks to Architects Specifications stainless steel bowl sink with drainer pack complete with single lever sink monoblock mixer and 1½" basket strainer waste.

Floor Drains

These shall be from J.R. Smith drainage products, 2" with square cover complete with drain trap seal protection

Showers

These shall be Ideal Sanitary Ware Trevi CTV Built-in concentric Thermostatic valve with three function gravity handset shower kit, chromium plated

Alternatives

This can be offered but must have the Architects prior approval.

TESTING

General

The Contractor shall perform tests in accordance with this section. All lines shall be thoroughly cleaned internally and flushed out with water where permissible or blown out before pressure testing.

After satisfactory completion of testing:

All lines shall be completely drained.

All temporary blanks, plugs, strainers, valves and nipples shall be removed.

Safety valves, relief valves and piping which have been removed shall be installed with proper gaskets in place.

Threaded openings used during testing procedures and for which there is no use shall be plugged.

Insulation and painting shall then be completed

Orifice plates shall be installed after the pipeline has been tested.

Testing for Sanitary Drainage and Vent System

The entire sanitary drainage and vent system shall be tested in sections or in its entirety before all such work is concealed and fixtures have been set.

If the system is tested in sections, each section shall be tested with not less than 3.0 meters head of water. In testing successive sections at least the upper 1.5 meters of the last preceding section shall be tested.

The water shall be kept in the system or the portion under test, for at least 15 minutes at the stated head before inspection. The system or portion shall then be checked for leaks.

Retesting, if necessary shall be undertaken until the system is watertight.

WATER PIPING TESTS

Scope

All piping installed on the project unless specifically shown otherwise shall be hydraulically tested and specified herein. The Contractor shall provide all equipment required to make the tests specified herein.

Sectionalizing

The piping may be tested a section at a time in order to facilitate the construction.

Tests to be Performed

The Contractor shall fill the section of pipe to be tested with water and bring the section up to pressure with a test pump. These tests shall be conducted by the Contractor in the presence of the Engineer or his representative. These tests shall be conducted before any insulation is installed and any insulation installed prior to these tests shall be removed. Gauges used in the tests shall have been recently calibrated with a dead weight tester.

Duration of Tests

All tests shall apply full test pressure to the piping for a minimum of twenty-four (24) hours.

Pressure of Tests

All tests shall be conducted at 1.5 times operating pressure and potable water (hot and cold) at 10.5 kg/cm².

Inability to Hold Pressure

When the test pressure has fallen over 5 % percent during the twenty-four (24) hour test period, the point of leakage shall be found and corrected and the test repeated until the piping system has been proven absolutely tight.

Use of Compounds

The use of chemicals or so-called "stop leak" compounds will not be permitted at any time.

Leaks

Leaks developing subsequent to those tests shall not be repaired by mastic or other temporary means. All leaks shall be repaired by removal of the valve, fitting, joint, or section that is leaking and installing new material with joint as specified herein.

Testing Certificates

On the satisfactory testing of the system or sections thereof the Contractor shall apply to the Engineer for issue of a Test Certificate of Approval for the test undertaken.

Disinfection

All potable water supply lines shall be disinfected in accordance with local requirements.

Prices for Plumbing and Drainage Installations are to include for all considerations arising from the specifications.

TECHNICAL SPECIFICATIONS PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Pumps are to be fully factory fabricated and assembled and shall be installed as specified under this specification .
- B. Provide vibration control on all skid mounted pumps .
- C. Power supply wiring from power source to isolator will be provided by others , power connection from isolator to pumps including starters, disconnects, and required electrical devices, except where specified as furnished, is the responsibility of the plumbing contractor..
 - 2. Interlock wiring between pumps; and between pumps and field-installed control devices is the responsibility of the plumbing contractor
- E. Provide the following electrical work as work of this section:
 - 1. Control wiring between field-installed controls, indicating devices, and pump control panels.

1.2 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing pumps with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards".
 - 2. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps".
 - 3. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.
 - 4. Certification, Pump Performance: Provide pumps whose performances, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to plumbing pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Maintenance Data: Submit maintenance data and parts lists for each type of pump, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. Handle plumbing pumps and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged plumbing pumps or components; replace with new.
- B. Store plumbing pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with Manufacturer's rigging and installation instructions for unloading plumbing pumps, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. Water Pressure Booster Systems:
 - a. Armstrong Pumps, Inc.
 - b. PSF; Div. Messco Inc.
 - c. Peerless Pumps
 - d. Amtrol
 - e. Gould

2.2 PUMPS:

- A. General: Provide factory-tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump is listed in pump schedule. Provide pumps of same type by same manufacturer.

2.3 WATER PRESSURE PUMPS:

A. Potable Water Pump

General: Provide factory-fabricated and tested water pressure booster system consisting of diaphragm type water tank, centrifugal pumps, power and control panels, instrumentation, and operating controls. Provide size as indicated, capacities as detailed .

POTABLE WATER PUMP SHALL BE a Variable Frequency Drive duplex pump set with the capacity of each pump being 50 gpm at 60 psi.

DOMESTIC WATER PUMP

The package shall consist of:

- Two pumps and pressure tank(s) mounted on a common base
- Interconnecting piping and valves with isolating valves on the suction and discharge sides and one on the piping to the pressure tank
- Check valves on the pump discharge between the pump and isolating valve
- Control panel (On-Off-Auto) for alternating the pumps including Variable frequency drives.
- 100mm pressure gauge and drain valve
- The system shall be suitable for delivering potable water.
- The system shall be complete in all respects including all components for the variable frequency drives

Two pumps will be in operation with one on stand-by, controls allowing for equal operation of each pump.

- D. System Controls: Maintain system pressure with pilot- operated diaphragm type combination pressure regulating and non-slam check valve on each pump discharge line.
1. Provide low system pressure switch located on discharge header to sense drop in system pressure, and to activate alarm and automatically start standby pump.
 2. Provide adjustable vane type flow switch to sequence lag pump.

- E. Control Panel: Provide UL-listed, NEMA 1, hinged door, lockable control panel containing the following:
1. For Each Pump:
 - a. Fused disconnect switch.
 - b. Motor starter with 3-leg overload protection.
 - c. Running light.
 - d. Multiple position motor control switch.
 - e. Discharge pressure gauge.
 2. For System:
 - a. 115-v control transformer.
 - b. Control power switch.
 - c. Indicating lights.
 - d. Relays.
 - e. Visual alarm system.
 - f. Suction pressure gauge.
- F. Prefabrication: Factory-prefabricate booster system, mount all components on common structural stand. Provide interconnecting piping, isolation valves on suction and discharge of each pump, suction and discharge piping manifolds, shutoff cocks for gauges and pressure switches, and factory-wiring.
- G. Factory-Test: Provide electrical and hydraulic test on assembled unit prior to shipment.
Provide system operating flow test from 0 to 100 percent design flow rate at scheduled suction and discharge pressure conditions.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which plumbing pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PUMPS:

- A. General: Install plumbing pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that plumbing pumps comply with requirements and serve intended purposes.

- B. Access: Provide access space around plumbing pumps for service as

indicated, but in no case less than that recommended by manufacturer.

- C. Support: Install base-mounted pumps on minimum of 4inch high concrete base equal or greater than 3 times total weight of pump and motor, with anchor bolts poured in place. Set and level pump, grout under pump base with non-shrink grout.
- D. Support: Provide Vibration Control supports and mounting requirements for plumbing pumps.
- E. Basins: Install sump pump basins in indicated locations and connect to sewer lines. Brace interior of basin in accordance with manufacturer's instructions, to prevent distortion or collapse during concrete placement. Set cover over basin, fasten to top flange of basin. Install so cover is flush with finished floor.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- G. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.

3.3 ADJUSTING AND CLEANING:

- A. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturers' service representative.
- B. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

PREAMBLE TO BILLS OF QUANTITIES

1. GENERAL

Attention is directed to the Instructions to Tenders, the Form of Contract, Conditions of Contract, Specifications and Drawings. These documents are to be read in conjunction with the Bills of Quantities.

2. PRICING AND MEASUREMENTS

- (a) The prices and rates to be inserted in the Bills of Quantities are to be the full inclusive value of the work described under the several items, including all costs and expenses which may be required in and for the construction of the work described, together with all general risks, liabilities and obligations set forth or implied in the documents on which the tender is to be based; where special risks, liabilities and obligations cannot be dealt with as above, then the price thereof is to be separately stated in the item or items provided for the purpose.
- (b) A price or rate is to be entered against each item in the Bills of Quantities, whether quantities are stated or not. Items against which no price is entered are to be considered as covered by the other prices or rates in the bills.
- (c) Any special methods of measurement used are stated at the head of or in the text of the Bills of Quantities for the trades or items affected. All other items are measured net in accordance with the Drawings and no allowances have been made for waste.
- (d) All measurements in the Bills are taken strictly net. The principle of net measurement shall apply to all work executed under the Contract and no claims for extras based upon other methods of measurement will be entertained.
- (e) The prices and rates entered in Bills of all Electrical Works shall include the following:
 - (i) Installation of fixtures, inserts, anchors, hangers, supports, solvent cements, protection, pull wires, etc.
 - (ii) Excavation, backfilling, compaction including all equipment used for completion of work, etc.
 - (iii) All chasing, cutting, recess, etc.

3. REFERENCE TO SPECIFICATIONS

- (a) General directions and descriptions of work and materials given in the Specifications are not necessarily repeated in the Bills of Quantities. Reference is to be made to the Specifications for this information.

4. PREPARATION OF TENDERS

In preparing his Tender and pricing the items in the Bills, the Tenderer must cover himself and shall be deemed to have covered himself for:

- (a) All services and materials which according to the true intent and meaning the Contract Documents may reasonably infer as necessary for carrying out in a good and workmanlike manner the Works shown upon the Drawings and described in the Specifications whether expressly mentioned therein or not, and
- (b) All duties, obligations, liabilities and responsibilities which any of the Contract Documents place upon the Contractor in connection with or in relation to this Contract.
- (c) The Tenderer shall insert against each item in the Bills such rates and prices as he may deem necessary to cover the above requirements. Items shall not be bracketed together and where no rate or price is inserted against any item in the Bills the cost thereof shall be deemed to have been included and spread proportionately over all items priced by the Tenderer.
- (d) Unless separate items are provided the cost of all specified tests and the supply of all tests certificates shall be included in the rates in the Bills of Quantities.

5. CONTRACTOR'S OBLIGATION

The information in the Contract Documents as to the whereabouts of existing services and mains is believed to be correct but the Contractor shall not be relieved of his obligations under the Conditions of Contract. The Contractor shall include in his rates for keeping the Engineer informed of all arrangements he makes with the Statutory Bodies as appropriate and for ensuring that no existing mains and services are interrupted without the written consent of the appropriate authority.

6. QUANTITIES

- (a) Quantities stated in the Bills are estimated only. They are given in order that the Tenders may be both made out and compared on an equal basis and there is no guarantee that such quantities will in fact be required.
- (b) The Tenderer shall satisfy himself as to the quantities involved, including materials and equipment, and conditions of work involved having due regard to the fact that the description of the quantities of work and materials as included in the Bills of Quantities, is brief and is intended only to indicate the general nature of the work and to identify the said quantities with the detailed requirements of the Contract Documents. The quantities given in the Bills form no part of the contract and are only approximate. In no circumstance shall such quantities be considered as limiting or extending the amount of the work to be done by the Contractor and material to be supplied by him.

7. CLAIMS FOR FURTHER PAYMENTS

- (a) The Contractor shall have no claims for further payment in respect of any work or method of execution which may be described in the Contract although no item appears in the Bills of Quantities which specifically corresponds to the said work or method of execution.

8. REQUEST FOR INFORMATION

If the prices for items or work, in the opinion of the Engineer, are not realistic prices for that particular item of work, the Engineer may request additional information to substantiate the prices or reject the Tender.

9. TENDER RATES

The rates entered by the Tenderer in the Bills for taking delivery of materials from the Employer shall include inter alia for taking delivery, transporting to site, storing, etc. and no separate claims for profits, etc. on the cost price of such materials will be entertained.

10. COMPLETION OF BILLS OF QUANTITIES

All blank spaces in the Bills of Quantities and the Form of Tender must be filled in, in ink, in both words and figures where required. No change will be made in the phraseology of the forms. In cases of discrepancy between the amounts stated in words and amounts in figures the former shall govern.

11. P.C. SUMS

- (a) No items for which a P.C. sum is inserted shall be undertaken by the Contractor until the Engineer has given written instructions to this effect. The Contractor may be required to obtain competitive quotations and samples if required and shall submit these to the Engineer for approval. The Contractor shall produce to the Engineer the receipted accounts for all articles purchased under P.C. sum items and the amounts paid to the Contractor shall correspond with the amounts of such accounts including any discount for cost. No payments to the Contractor shall be made in respect of P.C. sum items until the said receipts have been presented to the Engineer. It shall be the duty of the Contractor to make an application to the Engineer sufficiently in advance of the progress of the work for instruction with regard to each P.C. sum item.
- (b) P.C. sums inserted in the Bills in respect of materials to be specially imported for the Contract by the Contractor shall be deemed to include insurance, freight, dock and all other charges involved in clearing materials from the docks. In the case of imported materials obtained through a manufacturer's agent in Trinidad, the P.C. sums shall be deemed to include in addition the agent's fees and charges.

BILLS OF QUANTITIES

REFURBISHMENT OF RESIDENCE FOR THE INDIAN HIGH COMMISSIONER

PLUMBING SYSTEM
BILLS OF QUANTITIES

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
A	PRELIMINARIES			
1	Protection of Public and Private Services			
2	Include for Attendances			
3	Include for Guarantees and Warrantees			
4	Include for Bonds and Insurances including Public Liability and Workmen's Compensation			
5	Protection of the works			
	CARRIED TO SUMMARY - A PRELIMINARIES			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
B	PROVISIONS			
1	Provide for the submission of Maintenance Manuals, As Built Drawings , tags, charts , Instructions, Electrical and Control Wiring diagrams , shop and Fabrication drawings enclosed in a hard rink binder together with a digital copy on CD			
2	Include for Coordination with other trades			
3	Include for Cleaning and Painting			
4	Include for Maintenance and Defects Liability Period			
5	Include for system testing , adjusting , commissioning and demonstrations			
6	Include for Interface with Utilities			
7	Include for Builders Works			
8	Include for Cleanup			
	CARRIED TO SUMMARY - B PROVISIONS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
C	DOMESTIC WATER SUPPLY AND WASTE			
C1	FIXTURES AND			
1.0	Floor Drain C/W Trap Seal protection 5 No.			
2.0	Potable domestic duplex water Pump set rated at 2 Hp EACH suitable for outdoor use			
3.0	Include for VFD start and VFD Drive and Control Panel for water pumps			
4.0	40 gall Pressure tank for domestic water			
5.0	Water Storage Tanks c/w low level switches and floats - 5 No 800 Gall Include for fence and gate for pumps and tanks			
6.0	Water Hammer Arrestors			
C2	PIPING			
1.0	Include for the supply and installation of 1 1/2" Schedule 40 PVC Water Supply Piping AS PER DRAWINGS			
2.0	Include for the supply and installation of 1 1/4" Schedule 40 PVC Water Supply Piping AS PER DRAWINGS			
3.0	Include for the supply and installation of 1" Schedule 40 PVC Water Supply Piping AS PER DRAWINGS			
4.0	Include for the supply and installation of 3/4" Schedule 40 PVC Water Supply Piping AS PER DRAWINGS			
	CARRIED FORWARD			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
	BROUGHT FORWARD			
5.0	Include for the supply and installation of 1/2" Schedule 40 PVC Water Supply Piping AS PER DRAWINGS			
6.0	Include for the supply and installation of 6" WASTE PVC Piping AS PER DRAWINGS			
7.0	Include for the supply and installation of 4" WASTE PVC Piping AS PER DRAWINGS			
8.0	Include for the supply and installation of 2" WASTE PVC Piping AS PER DRAWINGS			
9.0	Include for the supply and installation of 1 1/2" WASTE PVC Piping AS PER DRAWINGS			
10.0	Include for the supply and Installation of Vent piping as per drawings			
C3	EXCAVATION FOR EXTERNAL PIPING			
1.0	Include for excavation laying of external and Underground water supply and waste water PLUMBING ANF FIRE WATER pipes and backfilling AS PER DRAWINGS . Cater for 120 metres excavation			
	CARRIED FORWARD			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
	<p style="text-align: center;">BROUGHT FORWARD</p> <p>C4 MISCELLANEOUS ITEMS</p> <p>1.0 Include for piping to cleanouts and floor drains</p> <p>2.0 Include for water meter , pressure gauge, valves and strainer on main supply line</p> <p>3.0 Include for valves on water supply piping as per drawings</p> <p>4.0 Include for couplings, tees elbows, etc</p> <p>5.0 Include for supports, fittings , etc</p> <p>6.0 Include for the supply af water supply piping and valves to the guard booth</p> <p>7.0 Include for the supply and installation of waste water piping to Guard Booth</p> <p>8.0 Include for the supply and installation of materials and Labour for the construction of the septic tank and Soak away for the main building</p> <p>9.0 Include for the supply and installation of materials and Labour for the construction of the septic tank and Soak away for the Gusrd Booth</p> <p>10.0 Include for the supply and installation of Lavatory basin inn the Guard Booth</p> <p>11.0 Include for the construction of plinths for water tanks</p>			
	CARRIED FORWARD			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
12.0	Include for the supply and installation of close coupled water closet for the Guard Booth			
13.0	Include for relocation of pool pump and filter to new pump house			
14.0	Include for re routing pool piping from original location to new pump house			
15.0	Include for the supply and installation of new pool pump , filter and chlorination unit			
16.0	Include for water supply and waste to Guard Booth			
C5	MAINS CONNECTION			
1.0	Coordination with WASA			
2.0	Interconnecting Piping			
3.0	Obtain Statutory approvals			
4.0	Obtain Completion Certificate			
C6	TESTING AND DISINFECTION			
1.0	Pressure testing of Potable water lines			
2.0	Include for disinfection of potable water lines			
3.0	Include for Pressure testing of waster water lines			
	CARRIED TO SUMMARY C - WATER SUPPLY AND WASTE			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
<p>D</p> <p>1.0</p>	<p>PLUMBING FIXTURES</p> <p>Supply and Install the following bPlumbing Fixtures as per specifications and to Architects Approval</p> <p>12 No Water closets</p> <p>6 No Urinals</p> <p>12 No Lavatory Basing</p> <p>7 No Floor Drains with trap seal</p> <p>3 No Kitchen sink with drain board</p> <p>12 No pillar type faucets</p> <p>1 No Hose Bib</p> <p>6 Nom Shower Mixers</p> <p>1 No wash Sink</p> <p>1 No Bidet</p> <p>8 No point opf use tank less water heaters</p> <p>Include for angle valves</p> <p>Include for all appurtenances</p> <p>2.0 Include for the supply and installation of 8 No Toilet Paper holders</p> <p>3.0 Include for the supply and installation of 4 No Paper Towel Holders Paper holders</p>			
	<p>CARRIED FORWARD TO SUMMARY D- PLUMBING FIXTURES</p>			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
	SUMMARY SHEET A PRELIMINARIES B PROVISIONS C WATER SUPPLY WASTE WATER SYSTEM D PLUMBING FIXTURES SUBTOTAL ADD 5 % CONTINGENCY SUBTOTAL ADD VAT 12.5%			
	TOTAL			

**REFURBISHMENT OF THE RESIDENCE FOR THE
INDIAN HIGH COMMISSIONER**

**TRINIDAD CRESCENT
FEDERATION PARK**

**ELECTRICAL INSTALLATION
TENDER DOCUMENTS
TECHNICAL SPECIFICATIONS
AND
BILLS OF QUANTITIES**

Electrical and Mechanical Engineers



Jain Consultants T&T Ltd

54 Evans Street

Curepe

May 28, 2018

TEL: 1-868-645-3650; FAX: 1-868-645-3650

REFURBISHMENT OF THE RESIDENCE FOR THE INDIAN HIGH COMMISSIONER
ELECTRICAL INSTALLATION WORKS
TECHNICAL SPECIFICATION

SECTION 001

SCOPE OF WORK

The scope of works shall include the supply of all equipment, labor, materials and services required to construct, install and test the Electrical Systems at the Refurbishment of the Residence for the Indian High Commissioner at Federation Park .. The works shall include the following.

a. Electrical Systems

- i. Supply and install all materials and labor for the installation of the new 3 Phase , Low Voltage supply to the building .. Coordinate with T&TEC and make the necessary arrangements for the Low Voltage supply.
- ii. Coordinate with T&TEC and pay all associated fees for the electrical Supply.
- iii. Supply and install new Clients pole for low voltage supply including 200A, 3 Phase, 230 / 115 V Meter Base .
- iv. Supply and install automatic transfer switch and generator set in sound proof, weatherproof enclosure.
- v. Supply and install underground ducts, pull boxes and main LV cables from T&TEC supply point to electrical closet in building
- vi. Supply and install underground ducts and pull boxes including pull wires for telephone and CATV supply cables to the building
- vii. Supply and install main distribution panel board and sub distribution panel boards.
- viii. Supply and install generator set and ATS including cables from Generator set to ATS and distribution panels for emergency supplies to the building.
- ix. Supply and install main LV supply cables from main panel in electrical closet on Ground Floor to First floor Electrical Panels.

- x. Supply and install sub distribution panels on ground and First Floor as per drawing
- xi. Supply and install all conduit and boxes for power and lighting distribution
- xii. Supply and install all , cables, panels and breakers for all power supplies to water pumps, air conditioning system and all equipment as specified on the drawings.
- xiii. Supply and Install wiring for lighting and Power Distribution as per drawings .
- xiv. Supply and install external conduits and pull boxes for external supplies.
- xv. Supply and install all lighting fixtures, switches and outlets as per drawings.
- xvi. Supply and install new diesel generator set in weatherproof enclosure including automatic transfer switches and associated wiring as per drawings.
- xvii. Supply and install all materials for providing electrical supplies to Air Conditions units as per specification and drawings including isolation and switches.
- xviii. Supply and install xpel air fans and hand dryers in the toilets as per specifications.
- xix. Supply and install all conduit, fittings, cable trays, and boxes for the entire electrical system.
- xx. Supply and install wiring conduit, boxes and systems for the CCTV and Security System as per drawings.
- xxi. Coordinate all installation works with other trades such as the plumbing subcontractor, the air conditioning subcontractor and the main contractor as may be required.
- xxii. Testing and commissioning of system

REFURBISHMENT OF THE RESIDENCE FOR THE INDIAN HIGH COMMISSIONER
ELECTRICAL INSTALLATION WORKS
TECHNICAL SPECIFICATION

SECTION 002 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL:

1. RELATED DOCUMENTS:

- a. Drawings and general provisions of Contract, including General and Supplementary Conditions for Mechanical, Civil and Structural works apply to works of this section.

2. SUMMARY:

- a. This Section specifies the basic requirements for electrical installations and includes requirements common to all aspects of the works Including Plumbing, and Fire Protection works, Air Conditioning Works and Civil and Structural Works.

3. ACCESSIBILITY:

- a. Install equipment and materials to provide required code clearances and access for servicing and maintenance. Coordinate the final location with piping, ducts, and equipment of other trades to insure proper access for all trades. Coordinate locations of concealed equipment, disconnects, and boxes with access panels and doors. Allow ample space for removal of parts, fuses, lamps, etc. that require replacement or servicing.

4. ROUGH-IN:

- a. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- b. Refer to equipment specifications for rough-in requirements.

5. REQUIREMENTS OF REGULATORY AGENCIES:

- a. Execute and inspect all work in accordance with Underwriters Laboratories (UL), and all local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the more stringent requirement shall be followed. Follow

application sections and requirements and testing procedures of NFPA, IEEE, NEMA, CBM, ANSI, NECA, ICEA and NETA.

- b. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
- c. All material used on this project shall be UL listed and labeled and be acceptable to the authority having jurisdiction as suitable for the use intended.
- d. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.

6. REQUIREMENTS OF LOCAL UTILITY COMPANIES:

- a. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

7. PERMITS AND FEES:

- a. Contractor shall pay all fees required for connection to municipal and public utility facilities.
- b. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.

8. ELECTRICAL INSTALLATIONS:

- a. Drawings are diagrammatic in character and do not necessarily indicate every required conduit, box, fitting, etc.
- b. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both.
- c. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.
- d. Before any work is begun, determine that equipment will properly fit the space and that conduit can be run as contemplated without

interferences between systems, with structural elements or with the work of other trades.

- e. Coordinate the installation of electrical materials and equipment above and below ceilings with suspension system, luminaires and other building components. Ductwork and piping shall not be installed above electrical panel boards, switchboards, motor control centers, and transformers.
 - i. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, space for mechanical and electric systems within the cavity shall be allocated in the following order:
 - 1. Plumbing waste, vent piping and roof drain mains and leaders.
 - 2. Electrical conduit.
 - 3. Domestic hot and cold water.
- f. Verify all dimensions by field measurements.
- g. Arrange for chases, slots, and openings in other building components to accommodate electrical installations.
- h. Coordinate the installation of required supporting devices and sleeves to be set in poured-in- place concrete and other structural components, as they are constructed.
- i. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring an access path for positioning prior to closing-in the building or space.
- j. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- k. Where mounting heights are not detailed or dimensioned, install electrical conduits, boxes, and overhead equipment to provide the maximum headroom possible. In general, keep installations tight to structure.
- l. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting and removal with minimum of interference with other installations, consideration should however be given to the fact that the installation is in a Prison Environment and the installation should be tamperproof.

- m. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.
- n. All equipment and materials installed shall be new unless otherwise specified. Existing equipment and materials shall be reused where indicated. All major equipment and components shall have the manufacture's name, address, model number and serial numbers permanently attached.
- o. Equipment and materials shall comply with the specifications. Any variations from this, requires written approval from the "Engineer".
- p. Definitions: "Provide" shall mean "furnish and install", "Accept" or "acceptable" indicates only that the item is in "general conformance" with the design concept for the project.
- q. All penetrations through any wall for any reason shall be sleeved and fire caulked.

9. EQUIPMENT HOUSEKEEPING PADS:

- a. Provide 4" concrete housekeeping pad for all floor mounted equipment including, but not limited to: switchgear, switchboards, motor control centers, floor mounted distribution panel boards, floor mounted branch panel boards, and floor mounted dry type transformers. Fabricate pads as follows:
 - i. Coordinate size of equipment bases with actual unit sizes provided. Fabricate base 4" larger in both directions than the overall dimensions of the supported unit.
 - ii. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad.
 - iii. Place concrete and allow curing before installation of units. Use Portland cement that conforms to ASTM C 150, 4000-psi compressive strength, and normal weight aggregate.
 - iv. Anchor housekeeping pads to slab using #3 rebar bent in "L" or "Z" shape 12 inch on center on each side of slab.

10. EXCAVATING AND BACKFILLING:

a. General:

- i. Provide all necessary excavation and backfill for installation of electrical work in accordance with the Specifications.
- ii. In general, follow all regulations of OSHA

b. Coordinate with the Owner for all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Prior to starting excavation, brief employees on marking and color codes and train employees on excavation and safety procedures. When excavation approaches gas lines, expose lines by carefully probing and hand digging.

c. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be accepted by the Civil engineer. In no case shall lumber, metal or other debris be buried in with backfill.

d. Trench Backfill

- i. Backfill to 4 inches above top of conduits with sand, the same as used for conduit bed, compact properly.
- ii. Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6 inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not permissible.

e. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at contractor's expense.

f. This contractor shall repair and pay for any damage to finished surfaces.

g. Backfill near manholes or hand holes using sand, installing it in 6 inch layers to 4 inches above the shallowest conduit. Use suitable excavated material to complete the backfill, installed in 6 inch layers and mechanically compacted to seal against water infiltration. Compact to 95% below paving and slabs and 90% elsewhere.

11. CUTTING AND PATCHING:

- a. This Article specifies the cutting and patching of electrical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.
- b. Refer to the Civil Engineering Specifications covering cutting and patching for general requirements.
- c. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
- d. When coring is required or identified, coordinate with the Structural Engineer on the feasibility of such a core.
- e. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.
- f. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
- g. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - i. Uncover Work to provide for installation of ill-timed Work;
 - ii. Remove and replace defective Work;
 - iii. Remove and replace Work not conforming to requirements of the Contract Documents;
 - iv. Remove samples of installed Work as specified for testing;
 - v. Install equipment and materials in existing structures;
 - vi. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- h. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of conductors, conduit, luminaires, boxes, devices and other electrical items made obsolete by the new Work.
- i. Protect the structure, furnishings, finishes, and adjacent materials not

indicated or scheduled to be removed.

- j. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- k. Locate identify, and protect mechanical and electrical services passing through remodel or demolition area and serving other areas required to be maintained operational.

12. TEMPORARY FACILITIES:

- a. Light, Power, Water Etc.
 - i. Responsibility for providing temporary electricity, water and other facilities shall be as identified in these specifications.
- b. Building distribution equipment and devices (existing or new) shall not be used without written permission of the Owner. If used for temporary power, the equipment shall be properly maintained and any damage resulting from use shall be repaired by the Contractor. The warranty period for new equipment shall begin at the date of Substantial Completion.
- c. If AC power systems or their backup systems serving telecommunications, computer equipment, or their associated HVAC equipment and controls are taken out of service, for any reason, the Contractor shall be responsible for providing temporary systems during the period when the AC power systems or their backup systems are out of service. The Contractor shall be responsible for providing temporary power to all loads being interrupted.

13. ELECTRICAL SUBMITTALS:

- a. Refer to the Conditions of the Contract, covering shop drawings, product data, and samples for submittal definitions, requirements, and procedures.
- b. The manufacturer's material or equipment listed first in the specifications or on the drawings are the types to be provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the first names, the cost of any changes in construction required by their use shall be borne by this Contractor.
- c. All equipment shall conform to local Energy Conservation Standards.

- d. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Each submittal shall be reviewed for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Architect/Engineer. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed unless written prior approval is obtained by the Contractor.

- e. Before starting work, prepare and submit to the Architect/Engineer two (2) sets of all shop drawings, descriptive product data, and samples required for the project. Continue to submit two (2) sets, after each Architect/Engineer's action, until approval is given. Submittals shall include but not limited to the following specified materials :
 - i. Raceways including surface raceways and wireways.
 - ii. Cable trays or bridle ring assemblies.
 - iii. Cabinets, boxes, fittings, etc.
 - iv. Wiring devices, including tele/data/power poles.
 - v. Electrical equipment signs and labels.
 - vi. Switchboards
 - vii. Grounding
 - viii. Transformers
 - ix. Panelboards
 - x. Disconnect Switches
 - xi. Circuit breakers and fused switches for installation in existing panelboards or distribution centers.
 - xii. Motor control including motor control centers and individual manual and magnetic starters.
 - xiii. Automatic and manual transfer switches including all ancillary equipment.
 - xiv. Poles and Standards.
 - xv. Lighting
 - xvi. Emergency power supplies including unit type equipment.
 - xvii. Engine generator including transfer switches and all ancillary equipment.
 - xviii. Fire alarm and detection system.
 - xix. Paging and background music system.
 - xx. Intercom system.
 - xxi. Lighting control system.
 - xxii. CCTV System

- f. Submit proposed changes to electrical room or other equipment room layouts when revised from contract documents prior to installation.

- g. Mark submittals with designations as shown on the drawings and identify as required by Specification Sections. Identification shall contain the information as required in details and each label shall be submitted in list form with disconnects, MCC's, panel boards, switchboards, overcurrent protection devices and utilization equipment.
- h. All electrical submittals shall be assembled into a single package after approval of all sections.
 - i. Submittals shall be provided in expandable, three-ring, hard back binders.
 - ii. Each submittal shall be tabbed by the electrical specification section it is specified in.
 - iii. An index shall be provided which includes:
 - 1. Product
 - 2. Plan Code (if applicable)
 - 3. Specification Section
 - 4. Manufacturer and Model Number
 - iv. Submittals shall be provided for review within four (4) working weeks from award of contract to successful bidder.

14. PRODUCT OPTIONS AND SUBSTITUTIONS:

- a. The burden of proof that proposed equipment is equal in size, capacity, performance, and other pertinent criteria for this specific installation, or superior to that specified is up to the Contractor. Substituted equipment will only be allowed where specifically listed in a written addendum. If substitutions are not granted, the specified materials and equipment must be installed. Where substituted equipment is allowed, it shall be the Contractor's responsibility to notify all related trades of the accepted substitution and to assume full responsibility for all costs caused as a result of the substitution.

15. PRODUCT LISTING:

- a. Prepare a list of major electrical equipment and materials for the project.
- b. Provide a product listing within one (1) week from award of contract to successful bidder.
- c. Submit this listing as a part of the submittal requirement.

- d. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, steel bar stock, welding rods, solder, fasteners and similar items used in Work, except as otherwise indicated.
- e. For conduit, wire and fittings, the Contractor shall be required to submit manufacturer's information on the proposed materials for approval. All exposed conduit shall be steel. All fittings shall be compression type.
- f. Provide products which are compatible within systems and other connected items.

16. SCHEDULE OF VALUES:

- a. Provide preliminary schedule of values to Engineer in accordance with the Bills of Quantities as included herein.

17. NAMEPLATE DATA:

- a. Provide equipment with permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Install equipment so that nameplate is readily visible.

18. DELIVERY, STORAGE AND HANDLING:

- a. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- b. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage and weather.
- c. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

19. RECORD DOCUMENTS:

- a. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices, and any other relevant deviations from the Contract Documents.
- b. Mark shop drawings to indicate approved substitutions; Change Orders; actual equipment and materials used.
- c. Mark luminaire schedule on drawings to indicate manufacturer and complete catalog numbers of installed equipment.
- d. Mark schedules including panel board, switchboard, motor control center, mechanical, kitchen and similar equipment schedules on drawings to indicate installed equipment and materials used, and any deviations or revisions to electrical load data and calculations.
- e. During construction, the contractor shall maintain at the job site a set of updated construction documents for the singular purpose of recording the above information. All record drawings shall be completed in erasable pencil. These changes shall be updated weekly.
- f. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme.
 - i. Red shall indicate new items, deviations and routing.
 - ii. Green shall indicate items removed or deleted.
 - iii. Blue shall be used for relevant notes and descriptions.
- g. At the completion of the project, submit these documents to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.

20. OPERATION AND MAINTENANCE DATA:

- a. Upon completion of the project the Contractor is required to submit 4 complete sets of Operations and Maintenance Data for all items of equipment. The Operations and Maintenance data shall include the following information:
- b. Description of function, normal operating characteristics and limitations, fuse curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

- c. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions.
- d. Maintenance procedures for routine preventative maintenance and troubleshooting, disassembly, repair, reassembly; aligning and adjusting instructions.
- e. Servicing instructions, lubrication charts, and schedules.
- f. Complete list of parts and wiring diagrams.
- g. Names, addresses and telephone numbers of the Contractor, Sub-contractors and local company responsible for maintenance of each system or piece of equipment.
- h. All information shall be permanently bound in a 3-ring binder. The job name and address and contractor's name and address shall be placed on the cover and spine of each binder in a permanent manner.
- i. Copies of all test reports shall be included in the manuals.
- j. Provide manuals with dividers for major sections and special equipment. Mark neatly in ink the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
- k. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, is provided and the manual is reviewed by the Architect/Engineer.

21. PRE-ORDERED EQUIPMENT:

- a. To expedite delivery, the Owner may pre-order certain items of equipment as indicated on the drawings. Contractor shall include in his bid, in addition to the amounts given for the pre-ordered equipment, his costs for state and local taxes (if not included in the purchase order), rigging, installation of equipment and all accessories, and any other items required which are not furnished with equipment. The successful bidder shall accept Owner's purchase orders as written.
- b. The purchase orders, equipment submittals, and all responsibility for the above equipment will be turned over to the successful bidder after award of the contract. It shall be the responsibility of the successful bidder, after award of the contract, to provide the following.
- c. Provide breakdown of re-stocking charges of new equipment. After the following, should it occur:

- i. Release of order
 - ii. Shop drawings review
 - iii. Factory purchase of rough material
 - iv. Equipment on production line
 - v. Equipment off production line
- d. Credit information to suppliers of pre-ordered equipment, if required.
- e. Purchase orders written under his company name, to the suppliers to replace Owner's purchase orders, if required.
- f. Submittal data for all pre-ordered equipment.
- g. Operating and maintenance information for all pre-ordered equipment. Include in Operating and Maintenance Manual for entire project.
- h. Provide one year guarantee on all pre-ordered equipment. Warranty shall begin at date of substantial completion.
- i. Accessory items and other parts not pre-purchased but required for the installation of the pre-purchased equipment.
- j. Repair or replacement of equipment or parts damaged in shipping or at the jobsite.
- k. Handling, moving, and storage of pre-purchased items.
- l. Pre-ordered equipment consists of:
 - i. Panels
 - ii. Generator and Transfer switches
 - iii. UPS
 - iv. Lighting Fixtures
 - v. Control Panels

22. TESTING:

- a. Submit test reports for all tests carried out on equipment and systems
- b. Testing as required by these specifications shall pertain to all equipment, wiring, devices, etc. installed under this contract.
- c. General Scope:
 - i. Perform all tests and operational checks to assure that all

electrical equipment, both Contractor and Owner-supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

- ii. The tests and operational checks shall determine the suitability to energize.
 - iii. Schedule tests and give a minimum of two weeks advance notice to the Architect. Reschedule testing for Owner convenience if required.
- d. Test Report: Submit three copies of the completed report to the Architect no later than fifteen (15) days after completion of test unless directed otherwise. The test report shall be bound and its contents certified. The test report shall include the following:
- i. Project information including: Building, name, address, date, and other pertinent information.
 - ii. List of equipment tested.
 - iii. Description of test.
 - iv. List of test equipment used and calibration date.
 - v. Baseline, accepted, or published target value for test with code or standard reference indicating where value was derived.
 - vi. Test results that summarize all measured values with baseline values.
- e. Conclusions and recommendations.
- f. Appendix, including appropriate test forms that show all measured values.
- g. Failure to Meet Test:
- i. Any system material or workmanship which is found defective on the basis of performance tests shall be reported directly to the Architect.
 - ii. All failed tests shall be sent immediately by fax/email to Engineer with proposed corrective action and proposed re-test date and time.

- iii. Contractor shall replace the defective material or equipment as necessary and repeat test until test proves satisfactory without additional cost to the Owner.
 - iv. The Contractor or testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. Instruments shall be calibrated in accordance with the following frequency schedule:
 - 1. Field Instruments: 6 months
 - 2. Laboratory Instruments: 12 months
 - 3. Leased specialty equipment: 12 months.
 - v. Dated calibration labels shall be visible on all test equipment.
- h. Independent Testing Agency:
- i. The tests and/or operational checks indicated hereinafter in these Specifications shall be performed by a recognized independent testing agency engaged and paid for by the Contractor.
 - ii. The testing agency shall be responsible for implementing all final settings and adjustments on protective devices in accordance with Owner's specified values.
- i. Independent Testing Agency requirements shall apply to the following :
- i. HV Testing of Transformers, Cables and Switchgear

23. DEMOLITION/REMODEL WORK:

- a. The project involves renovation and remodel of an existing building. On the drawings, work may be denoted by showing items as bold or light line weight and certain renovation symbols are used. These indications and symbols are amplified as follows:
 - i. Bold Print (when used): Work included in this contract is denoted in bold print or line weight.
 - ii. Light Print (when used): Work shown lightly indicates existing conditions to remain.

- b. Existing equipment that is removed and not scheduled to be reused shall remain the property of the Owner and be delivered for disposition unless specifically indicated otherwise and shall be stored in a location designated by the Owner. Items which are removed and not wanted by the Owner shall become the property of the Contractor and shall be removed from the site.
- c. Existing equipment that is removed and is to be reused shall be cleaned, serviced and operable before being reinstalled.
- d. Revise panel board schedules to reflect removal or relocation of equipment. Circuit integrity of equipment in adjacent areas shall be left intact.
- e. Where remodeling interferes with existing circuits and equipment which are not to be removed, such circuits and equipment shall be reworked and relocated as required to complete the project.
- f. The Contractor shall remove all distribution equipment, conductors, etc., which are indicated to be removed or which must be removed to accommodate demolition. Equipment to be removed may require reworking conduit and wiring in order to maintain service to other equipment.
- g. Where remodeling interferes with circuits serving areas outside of the project or phase limits or which are remodeled in later phases of the project, circuits shall be reworked or temporary circuits provided as required.
- h. Existing equipment and circuiting shown are based on field surveys and/or Owner furnished drawings. The Contractor shall verify conditions as they exist with necessary adjustments being made to the drawing information.
- i. Coordinate the routing of all conduits with the existing mechanical and plumbing systems in order to avoid conflicts with ducts, pipes, etc. Where existing electrical boxes, conduit, or equipment interfere with installation of new ducts, plumbing, walls, soffits, luminaires, outlets, etc., the Contractor shall resolve the conflict with the appropriate trade.
- j. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated on the drawings or allowed under the appropriate section of the specifications.
- k. Electrical Outages: Electrical outages must be held to a minimum. The

Contractor shall submit a Method of Procedure (MOP) for each outage to the Owner detailing the reasons for the outage, areas affected, sequence of procedures to accomplish work, estimated maximum length of time, the date and time of day outage will occur. The Contractor shall meet with the Owner to set a schedule and date for the outage based on the MOP. Due to the critical implications of power outages, the Owner may direct the Contractor as to the time of day or night and date an outage may take place.

- i. The Contractor will be responsible for providing temporary power required for the duration of the outages. The required outages to connect and disconnect the temporary power will require a MOP as described above.
- l. If other suspected hazardous material, in any form, is discovered by this Contractor in the process of his work, he shall report such occurrence to the Architect immediately. The Engineer will determine the action to be taken. Hazardous material removed is not a part of the work to be done under this Contract.
- m. Contractor is responsible for sending removed lamps to be recycled.

24. WARRANTIES:

- a. Compile and assemble the warranties, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- b. Provide complete warranty information for each item. Information to include product or equipment description, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

25. CLEANING:

- a. Clean all luminaires, lamps and lenses per manufacturer's recommendation prior to final acceptance. Replace all inoperative lamps.

26. CONSTRUCTION REQUIREMENTS:

- a. The contractor shall maintain and have available at the jobsite current information on the following at all times:

- i. Up-to-date record drawings.
- ii. Equipment/Device/Product Submittals
- iii. Site observation reports with current status of all action items.
- iv. Test results; including recorded values, procedures, and other findings.
- v. Outage Information

TECHNICAL SPECIFICATIONS

INSTALLATION OF CABLES IN TRENCHES AND IN TUBINGS

SECTION 003

PART 1 - GENERAL

1. MEASUREMENT FOR PAYMENT

- a. Payment for the supply and installation of cables in trench and in tubings shall be per linear meter of trench.

PART 2 - PRODUCTS

1. Concrete type cable markers with word 'cable' or 'joint' impressed in the top surface with arrows to indicate change in direction of cable run.

PART 3 - EXECUTION

1. TRENCHING AND BACKFILLING

- a. Trench along routes for tubing and cables as shown on drawings.
- b. Before commencing work, establish location and extent of existing underground cables in areas of excavation. Use cable detector to locate underground cables. Avoid damaging existing underground cables throughout this contract. Make good and pay for damage to existing cables resulting from work.
- c. No guarantee is given on completeness or accuracy of known underground cables indicated.
- d. Do not commence backfilling until area of work to be backfilled has been inspected and approved by the Engineer.
- e. Areas to be backfilled shall be free from any debris.
- f. Place and compact fill materials in continuous horizontal layers not exceeding 300 mm loose depth.

- g. Use common or granular backfill material as indicated or directed.
- h. The surface shall be restored to its original level and condition.
- i. On areas open to traffic, obtain Engineer's written permission to undertake trenching.
- j. Sub-surface investigation report is included in the civil engineering section of this specification.
- k. Maintain one diameter width of tubing separation between tubing in common trench. Maintain 300 mm horizontal separation between low and high voltage circuits. Any circuits below 600 V rating are considered low voltage. When low voltage circuits cross high voltage circuits maintain 300 mm vertical separation with the low voltage circuits in upper position. Maintain 300 mm minimum lateral and vertical separation for control cables when crossing other cables with control cables in upper position.

2. CABLE INSTALLATION IN TUBINGS

- a. Install cables in tubing as indicated.
- b. Do not pull spliced cables inside tubing.
- c. Install multiple cables in tubing simultaneously.
- d. Use approved lubricants of type compatible with cable jack or reduce pulling tension.
- e. Before pulling cable into tubing and until cables properly terminated, seal ends of cables with moisture seal tape.
- f. After installation of cables, seal duct ends with duct sealing compound.

3. MARKERS

- a. Mark cable run in every change in direction.
- b. Mark underground splices.
- c. Where markers are removed to permit installation of additional cables, reinstall existing markers.
- d. Lay concrete markers flat and centered over cable with top 50 mm above

finish grade.

4. TESTING

- a. Perform tests in accordance with Section 002.
- b. Perform tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:
- c. Circuits are free from unspecified grounds; that resistance to ground of circuits is not less than 50 mega ohms.
- d. Provide the Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.

TECHNICAL SPECIFICATION

PANELBOARDS

SECTION 004

PART 1 - GENERAL

1. TYPE OF PANELBOARDS

- a. This specification covers distribution panel boards where applicable as well as lighting and appliance panel boards.
- b. Operating environment: Tropical and 32°C average ambient and 92% R.H.

2. SUBMITTALS

- a. Within one (1) month of order being placed, submit manufacturers' specifications on all products listed in this specification.

PART 2 - PRODUCTS

1. ENCLOSURES

- a. Provide galvanized sheet steel cabinet type enclosures, minimum 14 gauge thickness, in sizes and NEMA types as indicated.
- b. Design for surface mounting with ample wiring gutters on top, sides and bottom for all wires and connections.
- c. Provide sufficient number of adequately sized knock-outs for termination glands.
- d. Provide enclosures fabricate by same manufacturer as panel boards, and which mate properly with panel boards to be enclosed.
- e. Provide tropicalized, anti-corrosive treatment and baked gray enamel finish.
- f. Equip cabinet doors with flush locks.
- g. Provide with interior circuit-directory frame and card with clear plastic covering.

2. PANELBOARDS

- a. Construct with solid copper busbars, securely mounted and braced.
- b. Provide solder less lugs on the main bars, approved for copper conductors.
- c. Provide full sized neutral bus with suitable lugs for feeders requiring neutral connections.
- d. Provide a bare un-insulated grounding bar, bolted to enclosure, with suitable lugs for feeders requiring grounding connections.
- e. Provide molded case main and branch circuit breaker for each circuit.

3. CIRCUIT BREAKERS

- a. Provide molded case circuit breaker, tropicalized for 90% relative humidity at 40°C ambient.
- b. All breakers shall provide "over current" and short circuit protection.
- c. Plug-in type breakers are not acceptable.

PART 3 - EXECUTION

1. INSTALLATION

- a. Make good any damage to panel finishes arising during handling and erection.
- b. Provide panel schedule identifying the circuits associated with each breaker.
- c. Submit copy of panel schedule to the Engineer.

2. TESTING

- a. Arrange for testing and acceptance of the panel boards in the approved manner by the Government Electrical Inspectorate or relevant Authority.
- b. Submit copy of Acceptance Certificate to the Engineer.

PACKEGED DIESEL ENGINE GENERATOR

SECTION 005

GENERAL

1.01 SUMMARY

1. Diesel engine-generator set and accessories, with an outdoor, sound attenuating enclosure, skid mounted with a sub-base fuel oil tank and interconnecting piping, starting batteries and battery support, 120 volt charger, radiator exhaust and engine exhaust silencing system.

1.02 REFERENCES

A. General:

1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
3. Refer to Section 001 "General Requirements" for the list of applicable regulatory requirements.

B. ANSI/NFPA 70 - National Electrical Code.

C. ASTM International.

D. NFPA – National Fire Protection Association:

1. NFPA 30 – Flammable and Combustible Liquids
2. NFPA 37 – Standard for the Use and Installation of Stationary Combustion Engines and Gas Turbines
3. NFPA 70 - National Electrical Code (NEC).
4. NFPA 110 - "Emergency and Standby Power Systems".
5. NFPA 272 - "Standard Method of Test for Fire and Smoke Characteristics of Wires and Cables".

E. NEMA – National Electrical Manufacturers Association:

1. NEMA MG 1 – Standard for Motors and Generators

2. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 3. NEMA AB 1 - Molded Case Circuit Breakers.
 4. NEMA ICS2 – Industrial Controls and Systems: Controllers, Contactors and Overload Relays Rated 600 Volts
 5. NEMA KS1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Max.)
- F. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- G. UL – Underwriters' Laboratories:
1. UL 508 A Industrial Control Equipment.

1.03 PERFORMANCE REQUIREMENTS

- A. The unit shall be capable of operating continuously at rated loading at 1,000 feet above sea level with ambient conditions of 104 deg F (40 deg C) and 65 percent relative humidity. De-rating of the output shall be not more than one percent for every 10 deg F (-12 deg C) above 104 deg F (40 deg C) ambient. Combined unit noise level shall not exceed 73 dBA at 23 feet (7 m), as measured from any corner of the unit.

1.04 SUBMITTALS

- A. Submit catalog cuts with bids for all items proposed to be furnished and installed under this Section.
- B. Submit shop drawings to show physical arrangements, connections, finishes, provisions for connections, access requirements for installation and maintenance, physical size, mechanical and electrical characteristics and ratings, foundation and support details, and equipment weights, where such details are not indicated on the catalogue cuts. The drawings and sketches shall be prepared in AutoCAD 2010. Within twenty (20) days after the Award of Order, the vendor shall submit five (5) sets of complete shop drawings and product data along with the electronic drawing files on CD-ROM for review and approval. Provide specific data on the following:
1. Outline drawings showing overall assembly and drawings illustrating arrangement (plan, front, and side views) and lifting provisions.
 2. Certified outline plan, general arrangement (setting plan), and anchor bolt details, including locations, sizes and model numbers of seismic isolators.

- Drawings shall show the total weight and center of gravity of the assembled engine-generator set on the structural steel sub-base.
3. Arrangement detail of exhaust duct and muffler piping systems and the fuel oil piping systems.
 4. Arrangement, size, and location of all electrical interface points and detailed elementary, schematic, wiring, and interconnection diagrams of the generator, exciter, governor, and other integral devices. Provide a wiring diagram including a complete schematic diagram.
 5. Dimensional drawings or catalog cuts of the exhaust silencer, oxidation catalyst, intake filter, pumps, fuel oil tank, oil filters, starting equipment, battery chargers, batteries, battery racks, generator enclosure (if required) and dBA rating, and other auxiliary equipment.
 6. Arrangement or assembly drawings showing location of major auxiliary equipment in relation to the engine-generator set and details of fabricating all supports and connections thereto.
 7. Piping schematics for fuel oil showing pipe sizes and valve locations, tank construction, and tank monitor.
 8. Engine-generator control panel.
 9. Specifications for a suitable fuel showing consumption performance using this fuel.
 10. Certified factory prototype test.
- C. Calculations prepared by a Trinidad and Tobago registered Civil Engineer to demonstrate compliance with seismic requirements as set forth below, including bolting of the engine-generator skid to a concrete foundation.
- D. Maintenance Manuals:
1. Submittals shall include, but not be limited to, five (5) copies of the items listed below. CD-ROMs(s) shall be submitted with electronic files of all drawings and sketches using Auto CAD 2010. In addition, the vendor shall include any additional procedures judged necessary by the manufacturer to insure the maximum performance and service reliability for the engine-generator set.
 2. The diesel engine shop manual(s) including complete service instructions.
 3. Parts list with the manufacturer's or interchangeable part number.
 4. Drawings of the engine-generator set with center of gravity clearly indicated.
 5. Schematic and wiring diagrams of all power and control circuits for the engine-generator set and all its appliances and options.
 6. Fuel system piping diagram.

1.05 QUALITY ASSURANCE

- A. Anchorage of the system shall be designed to comply with the current CBC for a Type A seismic source within 2 kilometers of the source. The dead load assumed to resist overturning shall not exceed 0.75W.
- B. Manufacturer's Representative: Furnish the services of a qualified field engineer, experienced in the installation and operation of the type of systems being provided, to supervise the installation, testing, adjustment of the system, and to provide training for the clients personnel.
- C. Manufacturer's Responsibility:
 - 1. The engine-generator set shall be manufactured by a single manufacturer who has been regularly engaged in the production of engine-generator sets for a minimum of 10 years. The emergency generator system described herein, including these components shall be factory built, factory-tested at rated load, starting duty and power factor, and shipped by this single manufacturer, so there is one source of supply and responsibility for guarantee, parts, and service. This manufacturer shall have a local representative in Trinidad who can provide factory-trained servicemen, required stock of replacement parts, and technical assistance.
 - 2. The emergency generator system shall meet all requirements of NFPA 110, including design specifications, prototype tests, one-step full load pickup, and installation acceptance.
 - 3. The responsibility for performance to this Section in its entirety shall not be split up among individual suppliers of components comprising the system, but shall be assumed solely by the engine-generator set manufacturer. All controls shall be the standard of the engine-generator set manufacturer. Control parts shall be identified by parts numbers of this manufacturer and shall have second source listing where applicable. Control systems that are supplied by a vendor and not incorporated within the documentation drawings of the engine-generator set manufacturer are not acceptable.

1.06 EXTRA MATERIALS

- A. As a separate quote, the bidders shall submit a recommended spare parts list with prices for one year of operation, assuming a total run time of 100 hours. The list shall include as a minimum, elements for oil, fuel and water filters, and belt sets. The price list shall be valid for 90 days from the date of the equipment delivery.

1.07 WARRANTY

- A. The engine-generator unit shall be warranted for a minimum of 1 year from the date of commissioning against all defects in material, equipment and workmanship.

PRODUCTS

1.08 MANUFACTURERS

- A. Caterpillar
- B. Onan
- C. Kohler Power Systems
- D. FG Wilson

Other Equal Approved Manufacturers

1.09 ENGINE-GENERATOR SET

- A. The diesel-fuel, engine-generator set shall be rated for continuous standby service (defined as meeting NEMA MG 1 continuous temperature rise ratings for the duration of any power outage) at not less than the specified kW/kVA at 0.80 power factor. The generator shall be rated to operate at 220Y/127 Volts, three-phase, four-wire, wye-connected, 60 hertz, 1800 rpm.

1.10 CONSTRUCTION

- A. The engine-generator set shall consist of a diesel engine direct-connected to an alternating-current generator having a brushless excitation system and shall be provided with all necessary accessories, auxiliaries, appurtenances, control equipment, and cooling systems, resulting in a complete set and, except for external service connections, ready for operation. The engine-generator set shall be mounted on a structural steel sub-base sized to support the engine; generator-exciter, engine-generator control panel; lubricating oil filters, fuel oil filters and pumps; and interconnecting piping and wiring for all systems. The engine unit-mounted radiator and auxiliaries shall also be mounted on the engine-generator set sub-base. The engine-generator set shall include the electric starter, controls, and related wiring for electric starting. The batteries, battery racks, and engine mounted battery charger, and separate 120 volt

battery charger assembly shall be mounted on the engine-generator set sub-base/fuel tank.

- B. The engine-generator set shall be provided with vibration isolators between the engine-generator and its structural sub-base/fuel tank. The vibration isolators shall be suitable to meet the seismic requirements and shall be as recommended by the engine-generator set and vibration isolator manufacturers to suit the specific equipment involved but shall be not less than 6 steel-spring type, Korfund Series L, Type LKD, Mason Industries Type SSLFH, or equal. The engine and generator shall be factory aligned on the sub-base/fuel tank and securely bolted into place in accordance with the manufacturer's standard practice.
- C. The engine-generator set, after assembly, shall be painted overall with manufacturer's standard color. After tests and before shipping, the engine-generator set shall be thoroughly cleaned and the painting retouched as necessary to provide complete protection to the set. The manufacturer shall provide one gallon of the identical paint in the paint manufacturer's sealed containers with the engine-generator set.
- D. The engine-generator set shall be arranged for automatic unattended starting in addition to manual start-and-stop by the engine-generator control panel push buttons. Three-position toggle switches may be utilized in lieu of push buttons, if their use is the manufacturer's standard. Lighting-type toggle switches are not acceptable. The engine-generator set shall be capable of automatically starting, coming up to synchronous speed, and providing full rated power at rated voltage and frequency within 10 seconds after failure of normal power.

1.11 ENGINE AND ACCESSORIES

- A. Engine: The engine shall be an integral radiator anti-freeze cooled, full-compression ignition, four-cycle, single-acting, solid-injection unit, either in-line or V-type, made in the United States.
 - 1. The engine shall be turbocharged or naturally aspirated and a product of a nationally recognized manufacturer, regularly employed in the manufacturing of the type of unit specified.
 - 2. The engine shall be capable of satisfactory performance on a commercial grade Diesel Fuel.
- B. Governor: The solid state engine governor shall maintain isochronous frequency regulation from no load to full-rated load. Steady-state operating band shall be plus or minus 0.25 percent. The droop shall be within 0 - 5 percent from no load to full load and adjustable. The governor shall be capable of speed adjustment from the control panel.

- C. Protective Devices: Provide as a minimum pre-alarms for low coolant temperature, low lubricating oil pressure, and high coolant temperature. Provide as a minimum safety shutoffs for high coolant temperature, low oil pressure, engine over speed, and engine over crank, and other devices as recommended or normally provided by the manufacturer.
- D. Lubrication:
1. A gear-type lubricating oil pump shall be provided to supply oil under pressure to main bearings, crank pin bearings, pistons, timing gears, cam-shaft bearings and valve rocker mechanisms.
 2. Pistons shall be spray cooled.
 3. Effective full flow lubricating oil filters shall be provided and so located that lubricating oil is continuously filtered, except during periods when oil is bypassed to protect vital parts such as when filters are clogged. A sample cock on the filter inlet shall be provided.
 4. A suitable water-cooled, engine-mounted lubricating oil cooler shall be furnished.
- E. Fuel System:
1. When a sub-base fuel oil tank is specified, the sub-base fuel oil tank should have sufficient capacity for a minimum of forty eight (48) hours of full load operation.
 2. Injection pump and injection valves shall not require adjustment in service .
 3. The engine shall have at least one mechanical injection pump for the generator and one individual injection valve for each cylinder, any one of which may be removed and replaced from parts stock.
 4. Fuel injection pump shall be positive-action, constant-stroke pumps, actuated by a cam driven by gears from the engine crankshaft.
 5. Fuel lines between injection pump and valves shall be heavy seamless tubing, and to eliminate irregularity of fuel injections, shall be of the same length for all cylinders.
 6. Fuel system shall be equipped with replaceable fuel filter elements which may be easily removed without breaking any fuel line connections or disturbing the fuel pumps or any other parts of the engine.
 7. Fuel filters shall be conveniently located in one accessible housing ahead of the injection pump so that fuel shall have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies.
 8. Engine shall be equipped with a built-in, gear-type, engine driven fuel transfer pump, capable of lifting fuel as necessary from the sub-base tank to the engine and capable of supplying fuel through the filters to the injection pump at a constant pressure.

9. Provide a manual bypass valve around the solenoid fuel valve. The manual bypass shall be visible, accessible, and its purpose identified. This fuel valve shall not be the valve used for malfunction or emergency shutdown.
- F. Cooling System: The system shall include an engine-driven water circulating pump, fan guard, an engine-driven blower-type fan, and bypass-type thermostats. The water circulating pump shall be an engine-driven pump with all controls, automatic and manual, suitable for the engine-mounted radiator. The radiator cooling system shall have sufficient capacity for cooling the engine when the engine-generator set is delivering full-rated load in an ambient temperature of up to 40 deg C (104 deg F). Total air flow restriction to and from the radiator shall not exceed 0.5 inches (13 mm) of water nor as necessary to meet the manufacturer's requirements, whichever is less.
1. Coolant Level Switch: Provide a coolant level switch at the proper place in the cooling system to prevent the engine from running when the coolant level is sufficiently low to impair continued operation of the engine. Operation of the switch shall be an annunciated signal.
 2. The engine cooling system shall be pretreated by the engine supplier for the inhibition of internal corrosion.
- G. Exhaust System:
1. An internal critical grade exhaust silencer shall be provided. The silencer is to be provided with an appropriate size and type of flange fitting for connection to an exhaust flue (provided by others).
 2. Operating exhaust noise under full load shall not exceed 68 dBA at 23 feet (7000mm).
 3. Measurement shall be made with a sound level meter meeting or exceeding ANSI SI.4 and octave band filters meeting or exceeding ANSI SI.II.
- H. Oxidation Catalyst: An internal oxidation catalyst shall be provided to purify the engine exhaust. The catalyst shall clean emissions to a maximum of 0.01 g/hp-hr. The unit shall be clamped-type, Nett Technologies, Inc., Series "D" or equal.
- I. Air Cleaners: Provide one or more engine-mounted dry-type air cleaners or intake air filters of sufficient capacity to protect working parts of the engine from dust and grit.
- J. Engine Alternator: A battery charging alternator shall be supplied with a voltage and current regulator to provide quick recharge of the batteries after an engine start.

1.12 GENERATOR

- A. General Description: The 12 lead NEMA-Type generator shall be connected for the specified voltage, 3 phase, 4-wire, 60 Hz for the full kW rating of the diesel-generator unit at 0.8 pf standby operation as described under NEMA MG 1-22.84, and shall meet the short circuit requirement of NEMA MG 1-22.45 . The generator shall be open guarded construction and be free of injurious torsional and bending vibrations within a speed range from 10 percent below to 0 percent above synchronous speed. The generator shall have pre lubricated-type ball bearings.
- B. Windings: The generator shall be a direct engine driven synchronous, brushless type, with radio interference suppression. The rotor windings shall be amortisseur type, and the stator shall be skewed. Windings shall be copper with terminal markings conforming to NEMA MG 1-2.02. Windings shall have a Class F insulation rating or higher with operating temperature rise of Class B insulation. The generator terminal box shall be large enough to accommodate all necessary conductors (termination lugs shall be included).
- C. Wave Shape Deviation: The wave shape deviation factor for synchronous machines shall not be greater than is specified in NEMA MG 1-22.42. The telephone influence factor shall not be greater than is specified in NEMA MG 1-22.43.
- D. Nameplate Data: The generator shall have a rigidly fixed nameplate listing all data described in NEMA MG 1-22.61.
- E. Voltage Regulator: The generator shall be equipped with a solid state voltage regulator- zener diode referenced. Provide harmonic filters on the input to the regulator. Generator output voltage shall be maintained within the limits specified below: 0.8 percent RMS no load, to full load (0.8 to 1.0 PF) with a 5 percent speed change and a 20 deg C (68 deg F) ambient temperature change; transient dip not to exceed 15 percent upon application of full load including sufficient out-of-phase SCR loads to lower a unity power factor to 0.8; recovery to rated voltage and frequency shall occur within two seconds. A vernier adjustment shall be provided on the main control panel to allow a voltage adjustment of up to 5 percent either side of nominal.
- F. Starting Duty: The voltage dip during starting on full load shall not exceed 15 percent of the voltage rating.

1.13 FUEL OIL SYSTEM

- A. General: Conform to NFPA 30 and 37. The unit shall contain its own fuel storage tank, filler and vent piping, flexible connections to engine, low fuel level alarm system. The main fuel pump on the engine shall be capable of supplying fuel directly from the storage tank without the need of any intermediate pump.
- B. Sub-base Diesel Fuel Storage Tank: The storage tank shall be an integral part of the sub-base with enough capacity to operate the generator for at least 48 hours at full rated output. The tank shall be full capacity double containment within the housing made of heavy gage stainless steel. The tank shall not be galvanized. There shall be a float type fuel level gauge, tank, breather filter unit, and a filler neck with locking cap.
- C. Leak Detector: A fuel tank leak detector system shall be furnished and installed
- D. Low Fuel Alarm: A low fuel supply sensing device shall be installed on the storage tank. The sensing device shall be adjusted to signal low fuel level when the tank is less than one-quarter full. An audible horn shall sound, at least 80 dB at 10 feet (3050mm). A reset button shall silence the horn, but produce a red indicating light until the fuel level has been raised above the one-quarter full level.
- E. Tank Full Indication: A Tank Full sensing device with one (1) set of form C contacts shall be provided for the clients use. The contacts shall be terminated in the control panel for field wiring.
- F. Flexible Fuel Lines: Stainless steel flexible fuel lines at least 12 inches (305mm) long, with bronze braid, shall connect the fuel lines to the engine.

1.14 ELECTRIC STARTING SYSTEM

- A. A 24-volt direct-current starting battery installation shall be provided for starting of the engine-generator set utilizing an electric cranking system. The electric cranking system shall be capable of rotating the engine at a speed sufficient for rapid starting in an ambient temperature of 30 deg C. The signal for starting shall come from the engine-generator set control system or from external two wire control.
- B. Cranking: The electric cranking system shall be energized from the starting batteries' negative polarity grounded, direct-current (dc) electrical circuit. The cranking motor shall be of the heavy-duty type with adequate capacity to crank the engine continuously to start the engine. The drive mechanism for engaging the starting motor with the engine flywheel shall be designed to inherently

engage and release without binding. When the engine starts, a "stop cranking" switch shall be engine-speed actuated and shall cause disengagement of the starting gearing and the shutdown of the starting motor.

- C. Starting Battery Installation: The engine-cranking storage battery shall be of the sealed, nickel-cadmium type rated by the battery manufacturer in accordance with cranking rating requirement required by the engine manufacturer and shall be of sufficient size and capacity in a fully charged condition to crank the engine at the rated ambient for a minimum of five (5) minutes. Suitable battery racks or enclosures, properly ventilated shall be provided for the batteries and the battery charger. All necessary cabling shall be provided and installed integrally on the engine-generator set. Exposed cabling shall be installed in conduit. Batteries may be mounted in a separate free-standing battery rack, if such is the manufacturer's requirement for nickel cadmium batteries. All cable terminations and cell-to-cell interconnecting bus straps shall have insulating covers or caps.
- D. Starting Battery Charger: The battery charger shall be enclosed, automatic, dual-rate, solid-state, constant-voltage type having ac voltage compensation, dc voltage regulation, and shall be current limiting. The battery charger shall be located in the control panel or otherwise integrally mounted on the engine-generator set. The battery charger shall employ transistor-controlled magnetic amplifier circuits to provide continuous taper charging. The battery charger shall have two ranges, float and equalize, with a 0 to 24 hour equalizer timer, a dc cranking relay, silicon diode full-wave rectifiers, automatic surge suppressers, a dc ammeter, a dc voltmeter, and fused inputs and outputs. The battery charger shall have a continuous rated output of not less than 10 amperes. The battery charger shall conform to UL 1236.

1.15 ENGINE-GENERATOR SET CONTROLS

- A. General: An instrumentation and control panel with full annunciation of NFPA 110, Level 1 safety indications and shutdowns. The panel shall be a gasketed NEMA 1 rated enclosure within the weather-proof NEMA 3R housing and be mounted on rubber vibration isolators. The front panel shall be well laid out with all controls and indicators clearly marked on phenolic-engraved nameplates or other permanently etched or indented lettering.
- B. Visual Metering: Provide visual meters to display the following:
 - 1. AC voltmeter with range to 600 Volts, 3 1/2 digit LCD or LED display, 2 percent accuracy at mid-range.
 - 2. AC current to 800, 4-1/2 digit LCD or LED display, phase selectable. Accuracy shall be within 2 percent from 100 Amps to full scale.
 - 3. AC frequency, 60 Hz nominal, 3-1/2 digit LCD or LED display. Accuracy shall be within 2 percent for the range 10 percent each side of nominal.

4. Running time of unit to ten thousand accumulated hours in tenth of hour segments, jeweled movements, and shock resistant sealed cases. The meter shall not be resettable.
 5. Battery charging current from engine alternator shall show amount of charge and discharge in amperes.
 6. Engine coolant temperature to at least 240°F (116°C).
 7. Engine oil pressure readable in 5 psi (34.5kPa) increments.
 8. The regulator shall have a Vernier adjustment for the voltage.
- C. Visual Indicators: Provide visual indicators to display the following:
1. Overcrank condition (red)
 2. Low oil pressure (red)
 3. High coolant temperature (red)
 4. Overspeed condition (red)
 5. Low diesel fuel (amber)
 6. Generator supplying load (green)
 7. Low battery voltage (red)
 8. Low coolant temperature (red)
 9. Battery charger failure (red)
 10. Pre alarm low oil pressure (amber)
 11. Pre alarm high coolant temperature (amber)
 12. Air shutdown damper (if used) (red)
 13. Low coolant level (red)
 14. Lamp test (white)
 15. Control switch not in AUTO position (flashing red)
- D. Common Alarm: Provide Form "C" contacts that change state upon any pre-alarm, alarm, shutdown or trouble signal.
- E. Wiring And Identification: All wiring and interconnections shall be well laid out and neatly executed in accordance with NEMA ICS 2. All wiring is to be properly identified by numbering or unique color coding. Such numbering and coding shall agree with those on the wiring diagram. Wiring shall go to terminal strips for intermediate connection unless wiring is contained in a cable or in a harness with keyed connectors.
- F. Remote Annunciator: The annunciator shall be in a NEMA 1 enclosure completely wired with terminal strips for outgoing wires. Provide the annunciator with the following features for remote monitoring:
1. Over crank condition (red)
 2. Low oil pressure (red)
 3. High coolant temperature (red)
 4. Over speed condition (red)
 5. Low diesel fuel (amber)

6. Generator supplying load (green)
7. Generator running (green)
8. Low coolant temperature (red)
9. Battery charger failure (red)
10. Low battery voltage (red)
11. Prealarm low oil pressure (amber)
12. Prealarm high coolant temperature (amber)
13. Air shutdown damper (if used) (red)
14. Low coolant level (red)
15. Lamp test (white)
16. Control switch not in AUTO position (flashing red)
17. Alarm silence (red)

G. Generator Circuit Breaker:

1. As manufactured by Cutler-Hammer, General Electric or Siemens. Provide a 600V, 3 pole, molded-case circuit breaker, with an interrupting rating of 22 KA AIC, conforming to NEMA AB 1 and UL 489 and having a 100-percent ampere rating. Provide a stored-energy closing mechanism for rapid and safe closing of the circuit breaker against fault currents within the short-time rating of the circuit breaker independent of the operator's strength or effort in closing the handle and provide lugs for the indicated electrical connection. The Generator Circuit Breaker shall be interlocked with the Load Test Bank Circuit Breaker to allow only one circuit breaker to be closed at a time.

H. Load test Bank Circuit Breaker:

1. As manufactured by Cutler-Hammer, General Electric or Siemens. Provide a 600V, 3 pole, molded-case circuit breaker, with an interrupting rating of 22KA AIC, conforming to NEMA AB 1 and UL 489 and having a 100-percent ampere rating. The load Test Bank Circuit Breaker shall be located adjacent to the Generator Circuit Breaker. Provide a stored-energy closing mechanism for rapid and safe closing of the circuit breaker against fault currents within the short-time rating of the circuit breaker independent of the operator's strength or effort in closing the handle and provide lugs for the indicated electrical connection. The Load Test Bank Circuit Breaker shall be interlocked with the Generator Circuit Breaker to allow only one circuit breaker to be closed at a time.

- I. Engine Starting Switch: The switch shall be a three-position rotary, enclosed rear-mounting type. The switch shall be the maintained position type. The switch positions shall be "Automatic" or "Remote", "Off", and "Manual" and shall be connected to provide the following operations.

1. In the "Automatic" or "Remote" position, the engine-generator set shall start automatically in response to loss of voltage, all as more fully described in the paragraph entitled "Automatic Controls."
2. "OFF" Position: In the "OFF" position, the generator shall shut down. All controls shall be reset in this position.
3. "MANUAL" Position: In the "MANUAL" position, the engine shall start upon depression of the start button. The engine shall run but the load cannot be put on line until an automatic transfer switch transfers to the emergency position.

J. Automatic Controls:

1. Engine Cranking Relay: Provide to operate as follows:
 - a. Automatic operation shall commence when any remote control element in an automatic transfer switch detects a normal power failure and closes a command contact to actuate the engine starting system. The engine-generator set shall pick up load when the voltage and the frequency of the generator reaches the values required to actuate the automatic transfer switch mechanisms. Provide terminals for two start signals from automatic transfer switches.
 - b. Should the engine fail to start at once, cranking shall continue for 25 seconds (adjustable) after which a 10-second "off" period (adjustable) shall occur, followed by a 7-second starting period (adjustable) and another 7-second "off" period (adjustable). Durations of cranking and "off" periods listed above may be modified in accordance with the engine-generator set manufacturer's recommendations.
 - c. The above cranking cycle shall be repeated for three starting attempts.
 - d. If the engine still fails to start, the cranking device shall lock out further starting attempts until it is manually reset. When the cranking relay locks out, an alarm light shall be energized on the engine-generator control panel and remain lighted until it is manually reset.
2. Automatic Stopping: After the engine-generator set is fully unloaded as signaled by an automatic transfer switch, the engine-generator set shall continue to operate for a period of 1 to 30 minutes (adjustable), wherein the engine-generator set shall shut down.

- K. Engine Shutdown Relay: Provide and actuate by the engine protective devices. The shutdown relay shall disable all engine starting circuits until manually reset. Provide a reset push button on the engine-generator control panel.

1.16 WIRING

- A. Internal wiring for the engine-generator, and control panel shall be stranded copper conductor, No. 14 AWG minimum, with 600 volt insulation suitable for the application. All wiring to external points shall be brought to a common terminal block.

1.17 PAINTING

- A. Painting will not be required for parts of equipment that are manufactured of corrosion-resistant materials or are machine finished and normally left unpainted. All other parts of equipment and ferrous surfaces shall be painted with manufacturer's standard finish paint system.

1.18 SAFETY REQUIREMENTS

- A. The engine-generator set shall be furnished with adequate safety devices of the latest approved type. Moving parts which are hazardous to personnel shall be suitable protected. All equipment and components shall conform to the safety requirements of the Occupational Safety and Health Act (OSHA) and to State and local safety codes. Ample protection against electrical shock shall be provided.
- B. Heat Protective Devices: Suitable guards in compliance with OSHA requirements shall be installed to protect personnel from accidental contact with any parts of the exhaust gas system whose surface temperatures are expected to exceed 540 deg C (1000 deg F). Protective measures such as water cooled exhaust manifolds, insulated manifolds and piping, and metal screen protectors around exhaust silencers shall be employed.
- C. Use of mercury in gages is not permitted.

1.19 MAINTENANCE REQUIREMENTS

- A. All replaceable parts shall be manufactured to definite standards for tolerance, clearance, and finish in order that any such part may be field installed without further machining or fitting. All parts shall be permanently and legibly marked with the original manufacturer's part number where practical. Parts or assemblies that require "fitting" for proper assembly shall be identified and separately listed in the parts manual.

1.20 ENGINE-GENERATOR ENCLOSURE

- A. Outdoor Enclosure (if specified): A sound attenuating weatherproof enclosure designed and rated for outdoor use and be of rugged steel construction. The sound attenuating enclosure shall be securely mounted to the frame of the engine-generator unit but not rely on the engine-generator for any support. The sound attenuating enclosure shall have easily removable doors for access from all sides. The doors shall have padlockable 3-point latches, with welded hinges and gaskets. There shall be a proper amount of air intake and air discharge louvers with rain hoods to allow the engine-generator to perform at the specified capacity. Thermostatically controlled space heaters shall be provided to prevent the accumulation of condensation within the enclosure and on the equipment. The space heaters shall operate at 120V.
- B. Painting: The housing shall be thoroughly cleaned and prepared for painting. A rust inhibiting primer shall be applied inside and out and cover all metal surfaces, edges, and inside corners of fabricated pieces. The housing shall then be finished with two coats of high quality alkyd-resin automotive type paint system. Color of exposed portions of the housing shall be ANSI-61 gray.

EXECUTION

1.21 FACTORY PROTOTYPE TESTS

- A. The engine-generator set consisting of the engine, generator, governor, coupling and all controls shall have been tested as complete unit utilizing testing on a prototype model as required by NFPA 110. The tests, being potentially damaging to the equipment tested, shall not be performed on the engine-generator set supplied. These tests shall be certified by means of documentation accompanying submittal data . Prototype testing shall provide the following data:
- B. Load test for maximum power level (maximum kW).
- C. Load test for maximum motor starting capacity (maximum kVA) and voltage dip recovery within 7 cycles of applied load.
- D. Structural soundness (Short-Circuit and Endurance Tests).
- E. Torsiograph Analysis: The manufacturer of the engine-generator set shall verify that the engine-generator combination, as configured, is free from harmful torsional stresses. The analysis shall include correlation of empirical data from tests on a representative prototype unit. The empirical data shall include

spectrum analysis of the torsional transducer output within the critical speed range of the engine-generator set. Results of this analysis shall be made available to the Client on request. Calculations based on engine and generator separately are not acceptable.

- F. Engine-generator cooling air requirements.
- G. Transient response and steady-state speed control and voltage regulation.
- H. Generator temperature rise per NEMA MG 1.
- I. Harmonic analysis and voltage waveform deviation per MIL-STD-705B, method 601.4.
- J. Three-phase short-circuit testing for mechanical and electrical strength. With the system operating at rated voltage, amperage, power factor, and speed, the generator terminals shall be short circuited 10 times on all three phases for a duration of 30 seconds. The engine-generator set shall build up and perform normally without manual interventions of any kind such as resetting of a circuit breaker or other tripping devices when the short circuit is removed.
- K. Failure mode test for voltage regulator. With engine-generator set operating at no load, rated speed and voltage, the alternating current sensing circuit to the regulator shall be disconnected for a period of at least one hour. The engine-generator set shall be fully operative after the test and without evidence of damage.
- L. Endurance testing is required to detect and correct potential electrical and mechanical problems associated with typical operations.

1.22 FACTORY PRODUCTION TEST

- A. Test the complete engine-generator set including oxidation catalyst, exhaust silencer, exhaust piping and skid-mounted accessories such as the engine-generator control panel at the engine manufacturer's factory. Perform the test with the engine-generator set completely assembled on the permanent skid-mounting.
- B. Notify the Client in writing of the proposed test date not less than 15 working days prior to same, and allow representatives of the Client to observe tests.
- C. Perform start, transient load, and continuous load tests as follows:
 - 1. Engine coolant at 80 deg F (27 deg C) before start-up.

2. Start the engine and demonstrate that rated voltage and frequency are reached in 10 seconds or less.
 3. Immediately following the 10-second start period apply 125-percent rated kVA at 0.8 power factor. Voltage dip shall not exceed 15 percent. After 5 seconds decrease load so as to provide a 100-percent rated kW, 1.0 power factor load. Voltage rise shall not exceed 15 percent and shall return to plus or minus 0.5 percent of rated within 2 seconds. Record transients with an oscillograph, and include copies with the test reports.
- D. Include a 4-hour test period of continuous operation at 100-percent rated kW and 1.0 power factor generator output. Record the following at 15-minute intervals.
1. Ambient air, water, oil, and exhaust temperatures.
 2. Oil pressure.
 3. Generator output voltage, current, frequency, kW, power factor, and temperature rise.
- E. Submit 5 certified copies of report of both prototype and production test results to the Client, and obtain approval before shipment to the site.

1.23 FIELD INSTALLATION

- A. Verify that equipment pads are dimensionally correct and ready to receive the equipment.
- B. Verify that required utilities are available, in proper location and ready for use.
- C. Install equipment in accordance with manufacturer's instructions.
- D. Install safety labels to NEMA 260

1.24 JOB SITE TESTING

- A. Installation acceptance testing shall be performed in accordance with the procedures of NFPA 110 Chapter 5-13. A load test bank of sufficient size to test the engine-generator unit at its full standby rating shall be provided by the Subcontractor. The load test bank shall be connected to the load terminals of the Load Test Bank Circuit Breaker when performing the acceptance tests. Authorized representatives of the manufacturer shall perform the installation acceptance testing. The Client designated authority having jurisdiction will be present for the installation acceptance testing.

1.25 OPERATION AND MAINTENANCE TRAINING

- A. Operating personnel shall be instructed (a minimum of two hours) by the representative in the proper operation and maintenance of the unit on the test day.
- B. Formal operation and maintenance training shall be conducted by the vendor or manufacturer's representatives within two weeks of activation of the equipment. An outline of the proposed program shall be submitted for approval at least two weeks before date of commencement of training.

1.26 FINAL SUBMITTALS

- A. Five sets of bound copies of text and illustrations, delineating maintenance and repair procedures for engine, generator, engine-generator control, radiator, fuel oil day tank assembly, fuel oil tank gage, and other equipment related to the engine-generator set installation. Assemble data on like equipment in clearly identified and indexed three-ring binders or equal. Include the following:
 - 1. Lubrication charts showing types of lubricant, locations of lubrication points, and recommended lubrication frequency for all equipment.
 - 2. Parts list of replaceable parts and any special tools required.
 - 3. Lists of component items not the product of the manufacturer of equipment on which used, with local source of supply, catalog cuts, and all necessary information for ordering replacements.
 - 4. Complete AS-BUILT electrical schematic and connection diagrams with all internal and external connection points identified to match identification on equipment.
- B. Furnish a written guarantee that the equipment will meet the specified performance. In addition, the guarantee shall cover the equipment against any defects in design, workmanship and material for one year from date of start-up. Also, a one-year labor and material guarantee shall be provided which will be twelve (12) months from date of start-up.
- C. Posted Operating Instructions: Submit proposed operating instructions which shall be laminated between matte-surface thermoplastic sheets and be suitable for placement adjacent to applicable equipment. After approval, operating instructions shall be returned to the Subcontractor for installation where directed by the Project Manager.
- D. Test Reports: Submit certified test and inspection reports for all work performed in Paragraphs 3.2 & 3.4. A certified report verifying proper installation of all of the system shall be provided to the Project Manager and shall be approved prior to start-up of equipment.

TECHNICAL SPECIFICATION
AUTOMATIC TRANSFER SWITCHES

SECTION 006

PART 1 GENERAL

1.01 Scope

- A.** Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current rating as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. The transfer switches and control panel shall be the product of the same manufacturer.
- B.** Furnish an enclosure for the ATS that is for service entry. It shall provide all of the proper disconnecting, protection, grounding and bonding required for service entrance equipment.

1.02 Acceptable Manufacturers

Service Entrance Automatic transfer switches shall be ASCO Series 300SE. Any alternate shall be submitted to the consulting engineer in writing at least 10 days prior to bid. Each alternate bid must list any deviations from this specification.

1.03 Codes and Standards

The automatic transfer switches and accessories shall conform to the requirements of:

- A.** UL 1008 - Standard for Automatic Transfer Switches
- B.** NFPA 70 - National Electrical Code
- C.** NFPA 110 - Emergency and Standby Power Systems
- D.** IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- E.** NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

- F. NEC Articles 700, 701, 702
- G. International Standards Organization ISO 9001
- H. UL 891 According to this UL standard the equipment shall be labeled: "Suitable for use only as service equipment."
- I. UL 508 Industrial Control Equipment

PART 2 PRODUCTS

2.01 Mechanically Held Transfer Switch

- C. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
- D. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- E. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.
- F. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- G. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- H. Where neutral conductors must be switched, the ATS shall be provided with fully-rated neutral transfer contacts.
- I. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.02 Microprocessor Controller with Membrane Interface Panel

- A. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a

keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

- B.** The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.
- C.** The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1. ANSI C37.90A/IEEE 472 Voltage Surge Test
 - 2. NEMA ICS – 109.21 Impulse Withstand Test
 - 3. IEC801-2 Electrostatic discharge (ESD) immunity
 - 4. ENV50140 and IEC 801 – 3 Radiated electromagnetic field immunity
 - 5. IEC 801 – 4 Electrical fast transient (EFT) immunity
 - 6. ENV50142 Surge transient immunity
 - 7. ENV50141: Conducted radio-frequency field immunity
 - 8. EN55011: Group 1, Class A conducted and radiated emissions
 - 9. EN61000 –4 – 11 Voltage dips and interruptions immunity

2.03 Enclosure

- A.** The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
- B.** Controller shall be flush-mounted display with LED indicators for switch position and source availability. It shall also include test and time delay bypass switches.
- C.** The complete assembly shall be degreased, and thoroughly cleaned through a five-stage aqueous process. The finish shall be ANSI-61, light gray, electrostatically-charged polyester powder paint over a phosphate coating, at a minimum of 2.0 mils in density. Finish shall be suitable for indoor and outdoor environments.
- D.** For those automatic transfer switches that are less than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size cable. For those automatic transfer switches that are greater than 1000 amperes, the connection between the normal disconnecting device and the ATS shall be made with the appropriate size bus. Bus shall be silver plated copper rated no less than 1000 amps per square inch.
- E.** A pressure disconnect link shall be provided to disconnect the normal source neutral connection from the emergency and load neutral connections for 4-wire applications. A ground bus shall be provided for connection of the

grounding conductor to the grounding electrode. A pressure disconnect link for the neutral to ground bonding jumper shall be provided to connect the normal neutral connection to the ground bus.

- F. Control wiring shall be rated for 600 volt, UL 1015. Wires shall be placed in wire duct or harnessed, and shall be supported to prevent sagging or breakage from weight or vibration. All wiring to hinged doors shall be run through door terminal blocks or connection plugs.

2.04 Disconnecting and Overcurrent Protection Device

- A. For those automatic transfer switches less than 1000 amperes, the normal connection shall be provided with a thermal magnetic rated molded case circuit breaker with current ratings as shown on the plans. It shall have a thermal magnetic trip unit.
- G. For those automatic transfer switches rated above 1000 amperes, the normal connection shall be provided with a stationary mount, insulated case circuit breaker with a solid-state trip unit. The trip unit shall have an adjustable long time, short time, instantaneous, and ground fault trip settings. The insulated case circuit breaker shall trip open when the ground fault setting is exceeded.

PART 3 OPERATION

3.01 Voltage and Frequency Sensing

- A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.
- B. Single-phase voltage and frequency sensing of the emergency source shall be provided.

3.02 Time Delays

- A. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.
- B. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
- C. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
- D. A 5-minute cool down time delay shall be provided on shutdown of engine generator.
- E. All adjustable time delays shall be field adjustable without the use of tools.

3.03 Additional Features

- A. A set of gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
- B. A push-button type test switch shall be provided to simulate a normal source failure.
- C. A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.
- D. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.
- E. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.
- F. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
- G. **Engine Exerciser** - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.
- H. **In-phase Monitor** - An In-phase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer.
- I. **Selective Load Disconnect** - A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts shall be rated 6 amps at 28 VDC or 120 VAC.

Optional Accessories (Specify if Required)

- J. **Communications Interface** – Serial Module (5110) to allow local or remote communications with ASCO Power Quest or Site web communication products. To connect Series 300 Service Entrance Automatic Transfer Switches and ASCO ATS Annunciators to the serial network via an RS485 interface (Accessory 72A).

- K. Programmable Engine Exerciser** - A seven or fourteen day programmable engine exerciser with digital readout display. Shall include one form C contact for availability of normal and emergency. Include "with or without" load control switch for exerciser period. The exerciser shall be backed up by a permanent battery. (Accessory 11BG).
- L. Enclosure Heater** - A 125 watt enclosure heater with transformer and thermostat (adjustable from 30° to 140 ° F) (Accessory 44 G).

PART 4 ADDITIONAL REQUIREMENTS

4.01 Tests and Certification

- A.** The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- B.** The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

4.03 Service Representation

- A.** The ATS manufacturer shall have a factory trained local representative who will be able to provide backup service as required.
- B.** The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.
- C.** For ease of maintenance and parts replacement, the switch nameplate shall include drawing numbers, part numbers for main coil and control.

TECHNICAL SPECIFICATION

WIRES AND CABLES

SECTION 007

PART 1 - GENERAL

1. SCOPE

- a. The scope of work includes supply and installation of all wires and cables, together with connectors and other accessories necessary to complete all circuitry indicated by the drawings and schedules.

PART 2 - PRODUCTS

1. STANDARDS

- a. Material shall conform to the following or equal approved:
 - i. XLPE Cable - BS 5468 - 1977
 - ii. PVC Wire & Cable (non-Armored) BS 6004 - 1975
 - iii. PVC Wire & Cable (armored) - BS 6346 - 1969

2. LOW VOLTAGE CABLES & WIRE

- a. Low voltage wires and cables shall be stranded copper, 70°C, PVC insulated, 600/1000 volt grade, with steel wire Armour and PVC sheath where specified.
- b. No wire shall be smaller than 2.5 sq. mm.

3. MATERIAL SCHEDULE

- a. Provide wires and cables listed in schedule at the end of this section or shown on Drawings.

PART 3 - EXECUTION

1. WORK BY T&TEC

- a. Provide a 230 / 115 V, 3 PHASE, 60 Hz supply from the Utility grid.

- b. Bring Overhead supply to the client's pole.
- c. Provide Metering
- d. Coordinate with the contractor for the LV Connection.

2. WORK BY CONTRACTOR

a. General Installation

- i. Supply and installation of all LV cables , Conduits, boxes, wiring , panels fixtures and outlets as per drawings
- ii. All low voltage work as per drawings and bills.
- iii. Provide materials as per specifications , bills of quantities ,drawings and schedules.
- iv. Install wires and cables for lighting and convenience outlets in EMT or PVC conduits.
- v. Install armored cables as indicated on the Drawings or in an approved manner as agreed with the Engineer.
- vi. Use an extra conductor core in each circuit for equipment grounding. In the case of armored cables, the armor will provide additional equipment grounding.
- vii. Carry out all wiring in the `loop in' system. No jointing is permitted. All main feeder circuits shall run their entire length in continuous pieces without joints or splices.
- viii. Contractor shall make use of approved wiring methods using raceways, wire ways, and approved methods of support.

TECHNICAL SPECIFICATION

GROUNDING

SECTION 008

PART 1 - GENERAL

1. SCOPE

- a. The scope of the work includes grounding of the following:
 - i. Service Equipment
 - ii. Enclosures
 - iii. Utilization Equipment
 - iv. Computer Circuits.
 - v. Building Structural frame

PART 2 - PRODUCTS

1. STANDARDS

- a. Unless otherwise indicated, grounding shall conform to BSCP 1013: 1965.

2. COPPER CONDUCTORS

- a. Bare, stranded, tinned, soft annealed, sized as per Drawings.

3. ROD ELECTRODES

- a. Copper clad steel 19 mm diameter by 3 meters long.

4. COPPER FLEXIBLE JUMPER STRAPS

- a. Protect braid with copper blot hold ends.
- b. Use flexible jumper for grounding hinged doors to main electrical equipment enclosures.

5. PANEL GROUND BARS

- a. Provide full size ground bars in each lighting and appliance panelboard.

6. FIELD WELDING

- a. Use Caldwell joints for all below-ground connections.
- b. Obtain Engineer's approval for other types of joints.

7. BOLTED CONNECTORS

- a. Use bolted connectors for grounding connections to equipment provided with lugs.

PART 3 - EXECUTION

1. GENERAL

- a. Install accessories to manufacturers' instructions.
- b. Protect exposed grounding conductors from damage by enclosing in metallic tubing where applicable.
- c. Provide computer circuits with a separate grounding conductor direct from the supply panel ground bar.

2. INSPECTION

- a. Do not proceed with work until conditions are satisfactory.
- b. Do not cover up work until it has been inspected and approved by the Engineer.

3. TESTING

- a. Carry out ground resistance tests on completion.
- b. Where tests show resistance to ground is over 3 ohms, take steps to reduce resistance to 3 ohms or less by driving additional electrodes and/or chemical treatment of soil; re-test to check compliance.

TECHNICAL SPECIFICATION

RACEWAYS AND WIREWAYS FOR BUILDING WIRING

SECTION 009

PART 1 - GENERAL

1. TYPE OF RACEWAYS

- a. Types of raceways and wire ways in this section include:
 - i. Electrical metallic tubing (EMT)
 - ii. Surface metal raceways
 - iii. Rigid PVC conduits
 - iv. Rigid metallic conduits
 - v. Cable Trays.

2. SUBMITTALS

- a. Before commencement of work, prepare samples of material to be used for the Engineer's approval.

PART 2 - MATERIALS

1. GENERAL

- a. Provide raceway and wireway materials and fittings of types, grades and sizes for each service indicated. Where types and grades are not indicated, provide proper selection determined by Contractor to fulfill wiring requirements, and complying with applicable portions of IEE Regulations or other approved code for raceways.

2. EMT

- a. Electrical Metallic Tubing (EMT) to the following or approved equal:
 - i. CSA C22.2 No. 83 - 1976.

3. EMT FITTINGS

- a. Use Type 2 fittings for concrete tight connections.
- b. Use Type 3 fittings for other miscellaneous connections.

4. PVC CONDUIT AND TUBING

- a. Provide rigid PVC conduit and tubing to the following or approved equal:
 - i. CSA C22.2 No. 136 - 1966.
- b. Use NEMA Type 1 or equal approved metal for encasement in concrete.
- c. Use NEMA Type 2 and Type 3, Schedule 40 PVC or equal approved for normal above ground duty.

5. PVC CONDUIT AND TUBING FITTINGS

- a. Match with conduit/tubing type material.

6. SURFACE METAL RACEWAYS

- a. Provide surface metal raceways of sized indicated.
- b. Construct of heavy gauge aluminum with snap-on covers, and with 1/8" (3 mm) mounting screw knockouts in base approximately 200 mm O.C.

7. CABLE TRAYS

- a. Provide cable trays of sized indicated.
- b. Construct of hot dipped or electro-galvanized steel wire.
- c. All fixings and fittings to be of approved quality.

PART 3 - EXECUTION

1. INSTALLATION OF RACEWAYS

- a. Co-ordinate with other work as necessary.
- b. Level and square raceway runs and install at proper elevations.
- c. Complete raceway installation before installing corresponding cables / wires.

- d. Wherever possible, install horizontal raceway runs above water piping.
- e. Ensure that all raceways are free of obstruction and leave fish-wires in conduit/tubing for future pull-in of wires and cables.
- f. In exposed areas install all raceways embedded in concrete/block work unless physical constraints dictate otherwise.
- g. The Engineer's permission must be obtained for all surface wiring or surface installation of raceways.
- h. Raceways shall not be used as ground continuity conductor.

2. INSTALLATION OF CABLE TRAYS

- a. The entire installation shall be in accordance with NEC regulations.
- b. Cable tray shall not be used as a ground continuity conductor.

TECHNICAL SPECIFICATION

ELECTRICAL BOXES AND FITTINGS

SECTION 010

PART 1 - GENERAL

1. TYPE OF MATERIAL

- a. Types of material in this section include:
 - i. Outlet Boxes
 - ii. Junction Boxes
 - iii. Pull Boxes
 - iv. Conduit Bodies
 - v. Bushings
 - vi. Locknuts
 - vii. Knockout Closures

2. SUBMITTALS

- a. Submit samples of all materials for Engineer's approval

PART 2 - MATERIALS

1. INTERIOR OUTLET BOXES

- a. Provide outlet boxes of suitable sizes with threaded screw holes and corrosion resistant screws for securing box covers wiring devices.
- b. Provide outlet box accessories as required, which are compatible with boxes being used.
- c. Choice of accessories in Contractor's option.

2. WEATHERPROOF OUTLET BOXES

- a. Metallic weatherproof boxes shall be cast-metal.
- b. Weatherproof boxes shall have face plates, gaskets and corrosion resistant fasteners.

3. JUNCTION AND PULL BOXES

- a. Provide boxes suitable for each location and installation.
- b. Equip with stainless steel nuts, bolts, screws and washers or approved equal corrosion resistant material.

4. CONDUIT BODIES

- a. Provide conduit bodies suitable for each use and installation.
- b. Equip with removable covers and corrosion resistant screws.

5. BUSHINGS, LOCKOUTS AND KNOCKOUT CLOSURES

- a. Provide corrosion resistant materials of types and sized to suit each use and installation.

PART 3 - EXECUTION

1. INSTALLATION

- a. Co-ordinate installation of boxes and fittings with other work.
- b. Provide weatherproof closures to cap unused knockout holes where blanks have been removed.
- c. Install boxed and conduit bodies such as to ensure ready accessibility of electrical wiring.
- d. In exposed areas install boxes and fittings in such a way that covers finish flush with finished surfaces.
- e. The Engineer's permission must be obtained for all surface mounted boxes and fittings.

TECHNICAL SPECIFICATION

WIRING DEVICES

SECTION 011

PART 1 - GENERAL

1. TYPE OF DEVICES

- a. Types of devices in this section include:
 - i. Receptacles (convenience outlets)
 - ii. Switches
 - iii. Wall Plates

2. SUBMITTALS

- a. Submit samples of devices for Engineer's approval

PART 2 - MATERIALS

1. GENERAL

- a. Provide devices of types, color and electrical ratings as indicated and complying with the following or approved equal standard for wiring devices:
 - i. NEMA Standard Pub. No. WD1
- b. Provide white color devices and wall plates for office areas except as otherwise indicated.
- c. Color selection to be verified with Engineer.

2. RECEPTACLES

a. General Duty Duplex

- i. Provide 2-pole and earth, 3 wire grounding, 15 A, 120 V outlets, switched or un-switched.

b. Heavy Duty Duplex

- i. Provide 2-pole and earth, 3-wire grounding, 15 A, 120 V industrial outlet.

c. GFCI Receptacles

- i. Provide ground fault protected outlets 2 pole and earth, 3 wire grounding, 15 A, 120 V in all bathrooms and kitchens

3. SWITCHES

- a. Provide decorative flush single-pole switches, 20 A, 120 V. for all areas except outdoors
- b. Provide heavy-duty 20 A single pole switches for all other areas.

4. WALL PLATES

- a. Provide switch duplex outlet wall plates of types, sizes and with ganging and cutouts as indicated.
- b. Construct with metal screws for securing plates to devices; screw head colours to match finish of plates; plates coloured to match devices to which attached.

PART 3 - EXECUTION

1. INSTALLATION

- a. Delay installation of wiring devices until wiring work is complete.
- b. Delay installation of wall plates until painting work is complete.

2. GROUNDING

- a. Provide electrically continuous, tight grounding connections for wiring devices.

3. TESTING

- a. Prior to energizing circuitry, test devices for electrical continuity and proper polarity connections.
- b. After energizing circuitry, test devices to demonstrate compliance with requirements.

4. PROTECTION

- a. At time of substantial completion, replace those items which have been damaged, including those burned or scorched by faulty plugs.

TECHNICAL SPECIFICATION

ELECTRICAL CONNECTIONS FOR EQUIPMENT

SECTION 012

PART 1 - GENERAL

1. DESCRIPTION OF WORKS

- a. Extent of electrical connections for equipment is indicated by drawings. Electric connections are hereby defined to include, but not necessarily limited to, connections for providing electrical power to equipment.
- b. Types of electrical power connections specified in this section include but are not limited to the following:
 - i. Panel boards
 - ii. Outlets
 - iii. Earth
 - iv. Lighting fixtures

2. MANUFACTURERS

- a. Provide materials from manufacturers engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, electrical flux and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.

3. SUBMITTALS

- a. Product Data: Submit manufacturer's data on electrical connectors, terminals and materials.

PART 2 - PRODUCTS

1. GENERAL

- a. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors,

terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solder less wire nuts, and other items and accessories as needed to complete splices and terminations of types indicated.

2. METAL CONDUIT, TUBING AND FITTINGS

a. General

- i. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where type and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements; comply with NEC requirements for raceways. Provide materials in accordance with the following listing:

1. Electrical metallic tubing
2. EMT fittings
3. PVC conduit

3. WIRE, CABLE AND CONNECTORS

a. Wire

- i. Unless otherwise indicated, provide wires/conductors for electrical connections which match wires / conductors of wiring supplying power.

b. Connectors and Terminals

- i. Provide electrical connectors and terminals as recommended by connector and terminal manufacturer for intended applications.

c. Electrical Connection Accessories

- i. Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, wire nuts and cable ties as recommended for use by accessories manufacturers for the type services indicated.
- ii. Provide water-tight glands for connections to underwater light fixtures.
- iii. Provide water-tight flexible conduit or water-tight glands for connections to sump pumps.

TECHNICAL SPECIFICATION

INTERIOR LIGHTING

SECTION 013

PART 1 - GENERAL

1. MANUFACTURER

- a. Provide materials from manufacturers of interior lighting fixtures of types required, whose products have been in satisfactory use in similar service for at least 5 years.

2. FIXTURE CATALOG

- a. Fixture products of manufacturers other than those specified may be proposed, provided they are of similar design, equally efficient and are approved by the Engineer.

3. SUBMITTALS

- a. Submit two (2) copies of manufacturer's data on lighting fixtures, including photometric data, to the Engineer.
- b. Submit samples of fixtures for the Engineer's approval.

PART 2 - PRODUCTS

1. GENERAL

- a. Provide fixtures complete with housing, lamps, ballasts and all fittings and wiring.

1. LED LIGHTING LAMPS AND FIXTURES

4.1. General

All LED light engines (combination of diodes, driver, heat sink, housing and optics), whether screw-in or hardwired, shall meet all of the following criteria:

- The rated driver input wattage and total number of LEDs shall be published by the manufacturer for each funded Fixture Unit (driver and LED combination)
- Equipment submittals for retrofits of existing fixtures must cover all components.

- LED Retrofit Kits (including linear lamp and driver) must be on one of the approved lists mentioned below under Section 4.2, and must carry a safety certification by an approved testing laboratory (UL, CE, ETL, etc.).

4.2. Energy Star and Design Lights Consortium Lists LED lamps and fixtures that fall under an Energy Star or Design Lights Consortium (DLC) lighting product category must meet at least one of the following Measurement / Approval criteria as described below under sections 4.2.1 and 4.2.2. In general, integral lamps are more likely to fall under Energy Star, while fixtures are more likely to fall under Design Lights Consortium.

4.2.1 The product is approved and listed on the Energy Star Qualified Commercial LED Lighting List For Lamps – (<http://www.energystar.gov/productfinder/product/certified-light-bulbs/results>) For Fixtures – (<http://www.energystar.gov/productfinder/product/certified-light-fixtures/results>)

4.2.2 The product is approved and listed on the Design Lights Consortium (DLC) List (<http://www.designlights.org/QPL>)

Submit the following test reports:

- LM79 – This test report must come from a Nationally Recognized Testing Laboratory (NRTL).
- LM80 – This test report usually is performed by the manufacturer but can be performed by an NRTL (if available).

SOLAR POWERED LIGHTING SYSTEMS

DEFINITION: A stand alone solar photovoltaic (SPV) lighting system (SLS) is an outdoor lighting unit used for illuminating a street or an open area. It consists of photovoltaic (PV) module(s), LED lamp , lead acid battery, control electronics, inter-connecting wires/cables, module mounting Pole including hardware and battery box. The LED is fixed inside a luminaire which is mounted on the pole. The PV module is placed at the top of the pole at an angle to maximize incident solar radiation, and a battery is placed in a box attached to the pole. The module is mounted facing south, so that it receives solar radiation throughout the day, without any shadow falling on it. Electricity generated by the PV module will charge the battery during the day time. This system operates from dusk to dawn.

TECHNICAL SPECIFICATIONS & GENERAL SPECIFICATIONS:

1) DUTY CYCLE:

The system should automatically switch is ON at dusk, operate throughout the night and automatically switch is OFF at the dawn.

2) PV MODULE (S):

a. Both crystalline and thin film technology modules are allowed in the system. The PV module should have a certificate of testing conforming to IEC 61215 Edition II / BIS 14286 or IEC 61646 for crystalline and thin film PV modules respectively. The manufacturer should produce the certificate for a higher wattage module, in case the certificate is not available for the offered PV module. Further, the manufacturer should certify that the supplied module is also manufactured using similar material, design and process as that of the certified PV module. The certificate should be from an NABL or IECQ accredited Laboratory.

b. The power output of the module(s) under STC should be suitable to power the LED light fixture or combination of fixtures. In case of thin film technology PV modules, the specified values refer to the stabilized power output after the initial degradation. The module efficiency should not be less than 12%.

c. The operating voltage corresponding to the power output mentioned above should be 16.4 ± 0.2 V.

d. The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.

e. The terminal box on the module should have a provision for opening for replacing the cable, if required.

f. Each PV module must use a RF identification tag (RFID), which must contain the following information:

(i) Name of the manufacturer of PV Module.

(ii) Model or Type Number

(iii) Serial Number

(iv) Month and year of the manufacture

(v) I-V curve for the module

(vi) Peak Wattage of the module at specified voltage

(vii) I_m , V_m and FF for the module

(viii) Unique Serial No and Model No of the module Until March 2013, the RFID can be inside or outside the module laminate, but must be able to withstand harsh environmental conditions.

(g) A distinctive serial number starting with NSM will be engraved on the frame of the module. The distinctive number starting NSM will also be screen printed on the tedlar sheet of the module.

3) BATTERY

- (i) Lead Acid, tubular positive plate flooded electrolyte or Gel or VRLA Type.
- (ii) The battery will have a minimum rating of 12V, 75 Ah (at C/10 discharge rate).
- (iii) 75 % of the rated capacity of the battery should be between fully charged and load cut off conditions.

4) LAMP

- (i) The lamp should be 80 Watt LED lamp.
- (ii) The lamp should be housed in an assembly suitable for outdoor use, with a reflector on its back.
- (iii) No blackening or reduction in the lumen output by more than 10%, should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle).

5) ELECTRONICS

- (i) The inverter should be of quasi sine wave/ sine wave type, with frequency in the range of 20 - 30 KHz. Half-wave operation is not acceptable.
- (ii) The total electronic efficiency should be not less than 85 %
- (iii) The idle current consumption should not be more than 10 mA.
- (iv) The PV module itself should be used to sense the ambient light level for switching ON and OFF the lamp.

6) ELECTRONIC PROTECTIONS

- (i) Adequate protection is to be incorporated under no load conditions e.g. when the lamp is removed and the system is switched ON.
- (ii) The system should have protection against battery overcharge and deep discharge conditions.
- (iii) Fuses should be provided to protect against short circuit conditions.
- (iv) Protection for reverse flow of current through the PV module(s) should be provided.
- (v) Electronics should have temperature compensation for proper charging of the

battery throughout the year.

7) MECHANICAL HARDWARE

(i) A metallic frame structure (with corrosion resistance paint) to be fixed on the pole to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that the module(s) can be oriented at the specified tilt angle.

(ii) The pole should be made of mild steel pipe with a height of 6 metres above the ground level, after grouting and final installation. The pole should have the provision to hold the weather proof lamp housing. It should be painted with a corrosion resistant paint.

(iii) A vented, acid proof and corrosion resistant painted metallic box for outdoor use should be provided for housing the battery with a provision of lock and Key.

8) OTHER FEATURES

(i) The system should be provided with 2 LED indicators: a green light to indicate charging in progress and a red LED to indicate deep discharge condition of the battery.

(ii) There will be a Name Plate on the system, which will give:
(a) Name of the Manufacturer or Distinctive Logo.
(b) Serial Number.

(iii) Components and parts used in the solar street lighting systems should conform to the latest BIS specifications, wherever such specifications are available and applicable.

(iv) The PV module(s) will be warranted for a minimum period of 25 years from the date of supply and the street lighting system (including the battery) will be warranted for a period of two years from the date of supply. PV modules used in Solar Street Lighting System must be warranted for their output peak watt capacity, which should not be less than 90% at the end of Twelve (12) years and 80% at the end of Twenty five (25) years. The Warranty Card to be supplied with the system must contain the details of the system. The manufacturers can also provide additional information about the system and conditions of warranty as necessary.

(v) Necessary lengths of wires/cables and fuses should be provided.

(vi) An Operation, Instruction and Maintenance Manual, in English and the local

language, should be provided with the Solar Street Lighting System. The following minimum details must be provided in the Manual:

- Basic principles of Photovoltaics.
- A small write-up (with a block diagram) on Solar Street Lighting System - its components, PV module, battery, electronics and luminaire and expected performance.
- About Charging and Significance of indicators.
- Clear instructions about erection of pole and mounting of PV module (s)

6. FIXTURE TYPES

- a. Provide the fixture types as specified in the lighting schedule . In cases where substitute fixtures are being proposed the contractor is required to submit to the engineer all manufacturers technical data on the fixture and obtain prior approval ..
- b. Comply with additional fixture requirements contained in Lighting Fixture Schedule

PART 3 - EXECUTION

1. INSTALLATION

- a. Install fixtures in accordance with manufacturer's written instructions.
- b. Fasten fixture securely to structural support; ensure that solid pendant fixtures are plumb.
- c. Protect installed fixtures from damage during remainder of construction period.
- d. Clean fixtures of dirt and debris upon completion of installation.

2. FIELD QUALITY CONTROL

- a. Test fixtures upon completion of installation.
- b. Correct mal-functioning units; remove and replace with new units when necessary and retest.

- c. Replace defective and burnt out lamps for a period of one year after date of substantial completion.

3. GROUNDING

- a. Provide tight equipment grounding connections to each fixture as indicated.

IP CCTV SURVEILLANCE SYSTEM

TECHNICAL SPECIFICATIONS

IP CCTV SURVEILLANCE SYSTEM **TECHNICAL SPECIFICATIONS**

SECTION 014

1. INTRODUCTION

- a. The contractor shall supply and install all materials and labour for the provision of an IP Closed Circuit Television Surveillance System at the Residence for the Indian High Commissioner , Federation Park.

2. SCOPE OF WORKS

- a. Supply installation, testing and commissioning of a high quality, fast acting IP CCTV surveillance system along with power supply, power distribution and the required accessories.
- b. The entire system shall be as per the drawings , BOQ and technical specifications
- c. The price quoted shall include for all expenses incurred in commissioning of all cameras, power supplies accessories and other devices complete with software.
- d. The CCTV surveillance system consists of IP Fixed Dome Cameras (Indoor Type) PTZ and fixed bullet cameras (Outdoor Type), Software, server, power supply and cables.
- e. Video management software shall offer both video stream management and video storage management. Recording frame rate and resolution in respect of individual channels shall be programmable
- f. The system is presently designed for 19 cameras whereas not limited to the same and scalable up to unlimited cameras if required in the future.
- g. Provide supervisory specialists and technicians at the job to assist in all phases of system installation, start up and commissioning.
- h. Cat 6 / fiber cable connectivity with all required hardware up to the network switches in the communications Cabinet.

- i. POE supply to all cameras and devices.
- j. Power supply units as required for the cameras located in excess of 100 metres from the switch
- k. Integrated testing and commissioning of the CCTV system on the network
- l. Training and Handing-Over of all material equipment and appliances.
- m. No extra costs shall be paid for miscellaneous items if required to complete the installation as per the design concept.

3. RELATED WORKS SPECIFIED ELSEWHERE

- a. The works in the following sections apply to the works in this section. Other sections of the Specifications not referenced below shall also apply to the extent required for the proper performance of the works.
 - i. Basic Electrical Requirements
 - ii. Conduits and Raceways
 - iii. Wires and Cables

4. CODES AND STANDARDS

- a. The following commercial standards shall apply to these works
 - i. ANSI/IEEE241 Recommended Practice for Electrical Power Systems in Commercial Buildings
 - ii. ANSI / NEMA 250 Enclosures for Electrical Equipment
- b. All equipment furnished by the contractor shall be listed by and bear the label of underwriters Laboratories UL or of an Independent Testing Laboratory acceptable to the Engineer.

5. DESIGN CONCEPT

- a. The IP CCTV Surveillance System is designed to control and monitor the , building surroundings and , entrances to the propertyl.
- b. There shall, be two types on cameras as follows:

- i. IP Fixed dome cameras Indoor Type.
 - ii. IP Fixed bullet cameras indoor and outdoor type in weatherproof and vandal proof enclosures.
- c. The building surroundings are to be monitored from the Security booth
- d. IP Fixed cameras shall be mounted to monitor the driveway
- e. IP Fixed cameras shall be mounted on the building face to monitor the building perimeter
- f. All cameras shall be true IP Cameras
- g. All outdoor cameras shall be in IP 66 housings
- h. All outdoor items for cameras like JB, Power supplies, media Converters etc. shall be in vandal proof, weatherproof and dust proof housings.
- i. Tentative locations of Cameras are shown on the drawings enclosed with this tender.
- j. The CCTV network shall be stand alone .
- k. The CCTV subcontractor shall be responsible for the supply and installation_of all CAT 6 wiring, cameras, 24 port switches, NVR, CPU, Key board, external storage devices and monitors.**
- l. Monitors shall be 42" flat screen

6. CONTRACTORS SUBMITTALS

- a. The contractor shall submit the following in accordance with the General Conditions of the Contract. The contractor is required to submit the following information
- b. Drawings**
 - i. Block Diagram showing system relationship of major components and quantities and interconnection cable requirements.
 - ii. Drawings shall be submitted in standard sizes as indicated
 - iii. Four complete sets of submittal drawings shall be submitted
 - iv. Drawings shall be available in CD ROM

- v. Installation drawings – A3 Size
- vi. Bill of Materials – A4 Size
- vii. Cable connectivity drawings and cable schedule – A3 Size
- viii. Power distribution scheme – A3 size
- ix. Specifications and Data Sheets – A4 size
- x. List of Software and Software licenses A4 size

c. **System Documentation**

- i. System configuration Diagrams in simplified block format.
- ii. Manufacturer's instruction and drawings for installation, maintenance, and operation.
- iii. Overall system operations and maintenance instructions.
- iv. Receiving, unpacking and Installation Instructions.
- v. Maintenance Procedures.
- vi. Trouble shooting Procedures.
- vii. A thorough description of the system operation including all necessary operating procedures.
- viii. A complete block diagram of the system.
- ix. A wiring Designation schedule for the cameras and all other major equipment.
- x. A replacement parts listing to include the manufacturer, part numbers and current pricing information.
- xi. Address and Phone numbers or the local agent for the CCTV System.

d. **Quality Assurance**

- i. The entire system shall be installed and commissioned by a single vendor to assure reliability and continued service.

- ii. The vendor shall be required to train and instruct the client's personnel in the correct use, operation and supervision of the system prior to handing over the project.
- iii. The operation of the system shall be demonstrated to the Engineer and the owner's representative to prove under normal conditions that the coverage complies with the specifications.
- iv. The contractor shall respond to trouble calls during the warranty period with a competent repair person at the project site within 24 hours of the call.
- v. The supplier shall be responsible for inspection and Quality Assurance for all materials and workmanship furnished.

7. TECHNICAL SPECIFICATIONS

a. IP Video system overview

- i. Transmit and receive H. 264 and MPEG-4 Video and Bidirectional Audio Video and alarm management software under one single front end and should be on an open platform which supports well known IP cameras such as Axis, Pelco, Honeywell. Panasonic, Sony etc.
- ii. System should allow to be used as a distributed or central architecture with support to any number of cameras and any number of clients that may be added in the future.
- iii. System guarantees Bandwidth and Frame control.
- iv. Provide Broadcast quality video across IP network including internet.
- v. Provide multi failover and network resilience.
- vi. Provide real time recording at 25 fps with no frame loss.
- vii. Provide PTZ camera Controls & Binary INPUT / OUTPUT controls.
- viii. Support multiple IP Video Streams.

- ix. Secured recording for evidence purposes and user authentication to protect data integrity.
- x. Video Stream bit rate selectable from 32 to 4096 bps or better.
- xi. All IP cameras shall have SD Card slot for recording in SD card when network fail.

b. IP Fixed Bullet Camera (Outdoor Type)

- i. Latest Sony OR Axis, 1/3" or 1/4" interlaced imager/ progressive imager CMOS or approved equal.
- ii. Verifocal lense 5-50 mm.
- iii. Camera must provide at least 704x576 (PAL) active pixels @ 25 fps.
- iv. Color Resolution 540 TV Lines/ 704x576 pixels or better for sharp pick up of live video.
- v. Minimum Sensitivity of Day: 0.5 Lux; Day/Night: 0.5 lux in color / 0.05 lux mono.
- vi. Gain Control Automatic.
- vii. White Balance Mode: Auto; Fluorescent; Indoor; Outdoor.
- viii. Shutter Speeds 1/60 to 1/10,000 (NTSC), 1/50 to 1/100,00 (PAL) or Auto*.
- ix. Operating voltage: Power over Ethernet (802.3AF); 12V/24V AC/DC.
- x. The IP Camera should support a Receiver Driver Unit or a motorized zoom lens.
- xi. The hardware architecture must incorporate multiple processors to ensure best video quality and other functions even at maximum processor load.
- xii. The IP Camera system must offer a choice of either MPEG-4 Advanced Simple Profile or H.264 video compression standards, by

just upgrading the firmware over the network without dismantling the camera.

- xiii.** The IP Camera must run Linux Operating system for reliability.
- xiv.** The camera must have a built in firewall - SSL and other non-IP address specific security measures are deemed insufficient.
- xv.** Should support and allow configuration of the following video resolutions or better.
 - 1.** 352 X 288 (SIF)
 - 2.** 704 X 576 (4 SIF)
 - 3.** 704 X 288 (2 SIF)
- xvi.** When running on MPEG-4 / H.264 compression, the video codec should support at least 2 simultaneous streams at resolution between 4SIF and SIF.
- xvii.** Each of these streams must be independently configurable to view and record at different frame rate and resolutions simultaneously.
- xviii.** Each Video stream should in turn allow for TCP connections, UDP connections and an unlimited number of Multicast connections.
- xix.** Each stream must allow independent configuration of bit rate, frame rate, I frame interval, rate control mode and motion data.
- xx.** All streams must guarantee full frame (25fps) rate under high motion, PTZ operation and all conditions. A certification from the manufacturer is required to prove this and will need to be shown during demonstration.
- xxi.** The IP Camera must support Capped Bit Rate (CBR) control, to enable users to keep bandwidth utilization under a certain value without compromise on image quality irrespective of the level of motion in the scene.
- xxii.** The IP Camera must support Activity Controlled Frame Rate control to automatically adjust frame rate depending on motion in the

scene. During periods of negligible motion, the frame rate must drop to 1fps and when motion occurs the frame rate will return to full frame rate (30fps/25fps) within 100ms. It must be configurable using a Region of Interest editor (ROI) that can select regions of the scene where motion will be ignored.

- xxiii.** Support network protocol 802.3 and IETF Standards 10/100 Base-T Ethernet, RTP/RTCP, TCP, UDP, ICMP, SNMP, HTTP, FTP, TELNET, MULTICAST, ARP and IGMP.
- xxiv.** Each stream Bit-rate should be user configurable from 32 to 4096 Kbps or better.
- xxv.** The IP Camera will have a built in web server, making it accessible for configuration using a standard Internet browser.
- xxvi.** The IP Camera must be compatible to support advanced analytics software which should be able to perform the following:
 - 1. Intelligent motion Detection
 - 2. Virtual Trip wire
 - 3. Left Item Detection
 - 4. Theft Detection
 - 5. Object Tracking
 - 6. Counter flow detection Must have minimum 1 alarm inputs and 1 relay outputs
- xxvii.** The IP Camera must support redundant recording by streaming to multiple recorders at the same time.
- xxviii.** Should be able to detect motion based on localized area, object size & direction.
- xxix.** It must be possible to reset a unit back to Factory Default configuration without losing IP address information.
- xxx.** Video Output PAL/NTSC
 - 1. Composite Video

- xxxi.** Serial Data Port supporting RS232/ RS422/ RS485.
- xxxii.** Password protected Web interface for administration.
- xxxiii.** Should have onboard diagnostics facility for serial, Video & Network interface. System logging shall be possible to a remote IP address, the console port or the unit itself.
- xxxiv.** Must support a standard operating temperature range 0 to +50 ° C with extended temperature range units available from -10 ° C to +60 ° C.
- xxxv.** The system MUST be able to use one particular frame rate and resolution at Day time and automatically switch to another frame rate/resolution profile when low light conditions occur.
- xxxvi.** The system MUST allow for Telnet/FTP access into the units and also this access MUST be configurable, wherein when active access is allowed and when deactivated access MUST not be allowed.

c. IP PTZ Camera (Outdoor Type)

- i.** Latest Sony or Axis, 1/3" or 1/4" imager or approved Equal.
- ii.** Camera must provide at least 752x582 (PAL) active pixels.
- iii.** Color Resolution 480 TV Lines or better for sharp pick up of live video.
- iv.** Minimum Sensitivity of color 1.4 Lux (36x) and mono 0.02 Lux.
- v.** Signal/noise ratio >50 dB.
- vi.** Lens: 3.4 mm to 122.4 mm, F 1.6 to F 4.5.
- vii.** Zoom order options: minimum 36 x optical + 12 x digital.
- viii.** Scan mode: Progressive or Interlaced.
- ix.** Horizontal view angle: 1.7° to 57.8°.
- x.** Support Wide Dynamic Range.
- xi.** Inbuilt Image stabilization.

- xii.** Power 12V/24V AC/DC Dynamic privacy zones 24 with 8 present (min) on screen simultaneously.
- xiii.** Must provide at least 200 Presets.
- xiv.** Learned patrols 4 mimic tours - up to 30 mins duration each.
- xv.** Variable tilt speed 0.1 - 200 /sec, absolute positioning.
- xvi.** Variable pan speed/coverage 0.1 - 400 /sec, 360Deg continuous rotation, absolute positioning.
- xvii.** Tilt coverage +/- 90Deg.
- xviii.** Gain Control Automatic or fixed manual setting across a 32dB range.
- xix.** White Balance Mode: Auto; Fluorescent; Indoor; Outdoor.
- xx.** Shutter Speeds 1/60 to 1/100,00 (NTSC), 1/50 to 1/100,00 (PAL) or Auto*.
- xxi.** Operating voltage: Power over Ethernet (802.3AF); 12 V/24V AC/DC.
- xxii.** The hardware architecture must incorporate multiple processors to ensure best video quality and other function seven at maximum processor load.
- xxiii.** The IP Camera must offer a choice of either MPEG-4 Advanced Simple Profile or H.264 video compression standards, by just upgrading the firmware over the network without dismantling the camera.
- xxiv.** The IP Camera must run Linux Operating system for reliability.
- xxv.** The camera must have a built in firewall - SSL and other non-IP address specific security measures are deemed insufficient.
- xxvi.** Should support and allow configuration of the following video resolutions or better.
 - 1.** 704 X 576 (4 SIF)
 - 2.** 704 X 288 (2 SIF)

3. 352 X 288 (SIF)

- xxvii. When running on MPEG-4 / H.264 compression, the video codec should support at least 2 simultaneous streams at resolutions between 4SIF and SIF.
- xxviii. Each Video stream should in turn allow for TCP connections, UDP connections and an unlimited number of Multicast connections.
- xxix. Each stream must allow independent configuration of bit rate, frame rate, I frame interval, rate control mode and motion data.
- xxx. All streams must guarantee full frame (25fps) rate under high motion and all conditions. A certification from the manufacturer is required.
- xxxi. The IP Camera must support Capped Bit Rate (CBR) control, to enable users to keep bandwidth utilization under a certain value without compromise on image quality irrespective of the level of motion in the scene.
- xxxii. The IP Camera must support Activity Controlled Frame Rate control to automatically adjust frame rate depending on motion in the scene. During periods of negligible motion, the frame rate must drop to 1fps and when motion occurs the frame rate will return to full frame rate (30fps/25fps) within 100ms. It must be configurable using a Region of Interest editor (ROI) that can select regions of the scene where motion will be ignored.
- xxxiii. Support network protocol 802.3 and IETF Standards 10/100 Base-T Ethernet, RTP/RTCP, TCP, UDP, ICMP. SNMP, HTTP, TELNET, MULTICAST, ARP and IGMP. Each stream Bit-rate should be user configurable from 32 to 4096 Kbps.
- xxxiv. The IP Camera will have a built in web server, making it accessible for configuration using a standard Internet browser.

- xxxv.** The IP Camera must be compatible to support advanced analytics software which should be able to perform the following:
1. Intelligent Motion Detection
 2. Virtual trip wire
 3. Left item detection
 4. Theft detection
 5. Object tracking
 6. Counter flow detection
 7. Must have 1 alarm inputs and 1 relay outputs
 8. The IP Camera must support redundant recording by streaming to multiple recorders at the same time.
- xxxvi.** Should be able to detect motion based on localized area, object size & direction.
- xxxvii.** It must be possible to reset a unit back to Factory Default configuration without losing IP address information.
- xxxviii.** Video Output PAL/NTSC
1. Composite Video
- xxxix.** Serial Data Port supporting RS232/ RS422/ RS485.
- xi.** Password protected Web interface for administration.
 - xli.** Should have onboard diagnostics facility for serial, Video & Network interface. System logging shall be possible to a remote IP address, the console port or the unit itself.
 - xlii.** Must support a standard operating temperature range 0 to +50 ° C with extended temperature range units available from -10 ° C to +60 ° C.
 - xliii.** The system MUST be able to use one particular frame rate and resolution at Day time and automatically switch to another frame rate/resolution profile when low light conditions occur.

- xliv.** The system MUST allow for Telnet/FTP access into the units and also this access MUST be configurable, wherein when active access is allowed and when deactivated access MUST not be allowed.

d. IP Fixed Dome Camera (Indoor Type)

- i.** Latest Sony or Axis, 1/3 "or 1/4" interlaced imager or approved Equal.
- ii.** Camera must provide at least 752x582 (PAL) active pixels.
- iii.** Color Resolution 540 TV Lines or better for sharp pick up of live video.
- iv.** Minimum Sensitivity of Day: 0.5 Lux; Day/Night: 0.5 lux color / 0.05 lux.
- v.** White Balance Mode: Auto; Fluorescent; Indoor; Outdoor.
- vi.** Verifocal /Auto Iris DC drive lens options of 3.8 – 8mm or 5 – 50mm.
- vii.** Shutter Speeds 1/60 to 1/10,000 (NTSC), 1/50 to 1/10,000 (PAL) or Auto*.
- viii.** Operating voltage: Power over Ethernet (802.3AF); 12V/24V AC/DC.
- ix.** The hardware architecture must incorporate multiple processors to ensure best video quality and other functions even at maximum processor load.
- x.** The IP Camera must offer a choice of either MPEG-4 Advanced Simple Profile or H.264 video compression standards, by just upgrading the firmware over the network without dismantling the camera.
- xi.** The IP Camera must run Linux Operating system for reliability.

- xii.** The camera must have a built in firewall - SSL and other non-IP address specific security measures are deemed insufficient.
- xiii.** Should support and allow configuration of the following video resolutions.
 - 1.** 352 X 288 (SIF)
 - 2.** 704 X 576 (4 SIF)
 - 3.** 704 X 288 (2 SIF)
- xiv.** When running on MPEG-4 / H.264 compression, the video codec should support at least 2 simultaneous streams at resolutions between 4SIF and SIF.
- xv.** Each Video stream should in turn allow for TCP connections, UDP connections and an unlimited number of Multicast connections.
- xvi.** Each stream must allow independent configuration of bit rate, frame rate, I frame interval, rate control mode and motion data.
- xvii.** All streams must guarantee full frame (25fps) rate under high motion and all conditions. A certification from the manufacturer is required.
- xviii.** The IP Camera must support Capped Bit Rate (CBR) control, to enable users to keep bandwidth utilization under a certain value without compromise on image quality irrespective of the level of motion in the scene.
- xix.** The IP Camera must support Activity Controlled Frame Rate control to automatically adjust frame rate depending on motion in the scene. During periods of negligible motion, the frame rate must drop to 1fps and when motion occurs the frame rate will return to full frame rate (30fps/25fps) within 100ms. It must be configurable using a Region of Interest editor (ROI) that can select regions of the scene where motion will be ignored.

- xx.** Support network protocol 802.3 and IETF Standards 10/100 Base-T Ethernet, RTP/RTCP, TCP, UDP, ICMP, SNMP, HTTP, FTP, TELNET, MULTICAST, ARP and IGMP.
- xxi.** Each stream Bit-rate should be user configurable from 32 to 4096 Kbps or better.
- xxii.** The IP Camera will have a built in web server, making it accessible for configuration using a standard Internet Web Browser.
- xxiii.** The IP Camera must be compatible to support advanced analytics software which should be able to perform the following:
 - 1. Intelligent Motion Detection
 - 2. Virtual trip wire
 - 3. Left item detection
 - 4. Theft detection
 - 5. Object tracking
 - 6. Counter flow detection Page 15 of 30
- xxiv.** Must have minimum 1 alarm inputs and 1 relay outputs.
- xxv.** The IP Camera must support redundant recording by streaming to multiple recorders at the same time.
- xxvi.** Camera should be able to detect motion based on localized area, object size & direction.
- xxvii.** It must be possible to reset a unit back to Factory Default configuration without losing IP address information.
- xxviii.** Video Output PAL/NTSC
 - 1. Composite Video
- xxix.** Serial Data Port supporting RS232/ RS422/ RS485.
- xxx.** Password protected Web interface for administration.
- xxxi.** Should have onboard diagnostics facility for serial, Video & Network interface. System logging shall be possible to a remote IP address, the console port or the unit itself.

- xxxii. Must support a standard operating temperature range 0 to +50 ° C with extended temperature range units available from -10 ° C to +60 ° C.
- xxxiii. The system MUST be able to use one particular frame rate and resolution at Day time and automatically switch to another frame rate/resolution profile when low light conditions occur.
- xxxiv. The system MUST allow for Telnet/FTP access into the units and also this access MUST be configurable, wherein when active access is allowed and when deactivated access MUST not be allowed.

e. **VIDEO, Operation Management Recording and Processing Software**

- i. The Management system shall be a highly scalable, enterprise level software solution. It must offer a complete Video Surveillance solution that will be scalable from one to hundreds of cameras that can be added as and when required. It should allow for seamless integration of third party security infrastructure where possible. The system MUST be capable of working on latest Windows OS and Windows Server platforms. Should support client- server architecture.
- ii. The software must come as one unit and not multiple loadable units and should support free distribution of multiple clients to multiple machines.
- iii. **The software must not have operator seat based licensing. It must allow for any number of user seats/installations on the IP video network to be added for future scalability at no management software cost or licensing cost.**
- iv. The manufacturer supplied management software pack should open on open platform/ standard media player.

- v. The Management System should allow for video to be streamed on a video mosaic wall.
- vi. All upgrades and releases should be made available free of cost during warranty period .The system shall allow operation with/without a PC keyboard or mouse with touch screen PC monitors. Once system configured, virtual matrix functions can be carried out using CCTV keyboards and should have capability to configure with HDTV.
- vii. The Management System shall provide the following:
 1. Automatic search of components of proposed system on the network. They can be Cameras, Monitors, Alarm panels, NVRs. It should also capture video from various source like webcam, USB cam etc.
 2. The system should allow for live view, playback and system configuration of the IP video system.
 3. The system should allow for creation of multiple users and user groups and assign tasks to each. Drag & Drop functions for most functions on the system and also for set up of connection between cameras and monitors and also support to create custom layout by grouping of cameras from different server/ locations into groups for more efficient monitoring.
 4. Several simultaneous live picture connections of camera in network. It should be capable of showing video pane layouts including 2x2, 3x3, 4x4, 5x5, 8X8 various Hot Spots (1+5, 1+7, 1+9, 1+12, 1+16) and custom layouts.
 5. It shall be possible to display video and audio bit rates; frame rate and resolutions on each video pane as overlays.

6. The live view must be capable of highlighting motion as green rectangle overlays and displaying real-time alarm information overlaid on the live video feed.
 7. It shall be possible to listen to audio from individual codec (cameras) or Receivers.
 8. Audio must be simultaneously transmitted from the Operator to allow a two-way conversation.
 9. It must be possible to establish bi-directional audio connection on alarm. The user should also be able to disable listen when speaking to prevent feedback through the microphone.
 10. System setup for pre-defined surveillance tasks to be invoked at pre-defined times in the day.
- viii. Programming of automatic recording events on NVR, maybe based on events such as alarms and video analysis
1. Remote maintenance of IP Video components
 2. Off line construction of site 'tree' and addition of devices
 3. It shall be possible to show text on screen display (OSD) when video is displayed on a Receiver/Decoder.
 4. The location of the OSD must be configurable on the screen
 5. The system should provide Video Lockout facility where a super-user can prevent all other users from viewing live video and divert recorded video to another Networked Video Recorder. The super-user shall also be able to release the video lockout and restore the system to its original state. It should also support software watchdog for advance detection of problems and recovery at server.
- ix. The Management System shall allow the following:
1. Live display of cameras

2. Live display of camera sequences, salvos and guard tours
 3. Control of PTZ cameras digital zoom
 4. Playback of archived Video at speeds of x1/4 – x16
 5. Retrieval of archived Video using normal playback, thumbnails (motion, event or time based)
 6. Instant Replay of Live Video
 7. Use of site maps and Google map
 8. Configuration of system settings
- x. For each camera set up bit rate, frame rate, and resolution shall be set independent of other cameras in the system. Altering the setting of one shall not affect the settings of other cameras.
- xi. PTZ Operations:
1. Named presets (up to 256) and custom commands (up to 256) must be supported per camera, invoked from the Management System.
 2. User priority between 1 and 10 must be allocated for PTZ enabled Transmitters.
 3. The software should allow for using area maps /Google map.
- xii. The software system should be capable of handling camera and alarm icons on area maps. The area map should be configurable to pop up upon the receipt of an alarm received from a video codec on the map. This can be on the same or other monitors on the PC.
- xiii. The Software system should allow direct connection of control keyboard to the PC workstation running the Management System for virtual matrix operations. The software should be capable of monitoring the status of any camera in the network and should indicate when a device goes offline by any manner/alert.
- xiv. The system should be able to carry out a motion search on recorded video and highlight motion in the playback bar and also

provide motion event based thumbnails to navigate straight to that event in recording.

- xv. The alarm and map windows should have a docking facility on the main screen.
- xvi. The Management System shall have the following facilities:
 - 1. Search of recorded images based on motion, congestion, counter flow, time, date, alarm etc.
 - 2. Should support 64 Video streams concurrently.
 - 3. Should support up to 4 monitors for displaying live video.
 - 4. Shall allow multiple levels of user and Alarm prioritization.
 - 5. Should allow up to 32 cameras to be replayed simultaneously from one NVR.
 - 6. Auto-protecting of video recording on post and pre 'alarm' images.
 - 7. Exported recordings will be protected by an invisible watermark using hashing function with a 1024 bit key.
 - 8. Should have facilities for play, forward, rewind, pause along with fast forward and rewind for reviewing the recorded videos.
- xvii. The application should allow for time-synchronized playback of different cameras together in the same video pane. This will enable the operator to watch playback of an event in an area covered by multiple cameras from different angles as the event happens.
- xviii. The system must support absolute redundancy with 1 to N, N to 1 and N to N redundancy configurations. All this should be provided without a licensing model.
- xix. The system must support video bookmarks, where the system allows the user to create textual bookmarks at various places in a

recorded footage and allow access to these bookmarks through an intelligent bookmark management system.

- xx. The system must allow application of sorting and searching filters on bookmarks for faster retrieval and access to incidents in recorded footage.
- xxi. The user/operator must be able to drag a book mark into a video pane and the video of that book mark needs to start automatically.
- xxii. The software must allow for IRIS control of PTZ cameras either through the GUI or a connected Joystick controller.

f. Network Video Recorder

- i. Should be installable on a Linux/Windows PC.
- ii. The NVR/NAS should have no limitations on the kind of storage to be used (RAID, NAS, etc). The NVR/NAS must be capable of recording 64 cameras simultaneously.
- iii. The NVR/NAS must be providing for a disk management system which will automatically reap old recordings to overwrite with new ones when max disk usage is reached.

g. Raid Storage:

- i. RAID-5 compliant
- ii. Up to fifteen(15) 1-inch-by-3.5-inch SATA II hot-pluggable 3.0 Gbps hard drives at speeds of 7200 rpm
- iii. Loaded with 32 TB usable storage (after RAID 5 implementation) with hot-pluggable drives and minimum one spare drive. Maximum capacity up to 32TB using eight 4TB drives.
- iv. Upgradable for dual host support providing direct connectivity to drives 0 through 6 and a separate connectivity to drives 7 to 14

- v. LED indications for systems status, power, split mode, activity, drive indicator per drive, fan fault, SAS Port etc. Configured with RAID 5 support for RAID levels 0,1,5,10,50
- vi. Operating temperature up to 35 degree Celsius.

h. Cat 6 Cable

- i. 23 AWG Annealed bare solid copper, CAT-6 UTP Cable, Channel optimized to 350 MHz.
- ii. Meets EIA/TIA 568-B.2-1 Category 6 specifications, Passed UL 444 test and meets CM and CMR ratings.
- iii. Worst Case Cable Skew: 45 nsec/100 meters.
- iv. Characteristic Impedance: 100(+/- 3) Ohms 500MHz, Tested till 700 Mhz.
- v. Conductor Annealed copper wire Diameter 0.52 mm (nominal)
- vi. Insulation High Density polyethylene, Diameter 0.94 mm (nominal).
- vii. Support for Fast Ethernet and Gigabit Ethernet IEEE 802.3/5/12, Voice, ISDN, ATM 155 & 622 Mbps and Broadband.
- viii. DC Resistance Max: 6.6 Ohms/100m
- ix. UL Listed and Third Party verified by ETL to “ANSI/TIA/ EIA-568-B-2.1” specifications.
- x. Zero Bit Error verified by ETL
- xi. Sheath Fire retardant PVC Compound (FRPVC) Flame Rating : 60 deg. C As per UL 1685 CM
- xii. PAIRS Color code: Blue / White-Blue, Orange / White-Orange Green / White-Green, Brown / White – Brown
- xiii. Outer Sheath PVC compound Thickness Diameter 0.5 mm (nominal) Outer diameter 6.5 mm (nominal)
- xiv. ELECTRICAL CHARACTERISTICS at 20° C Input Impedance (0.772-100 MHz) : 100 + 15 Ohms 125-250 MHz) : 100 +/- 22 Ohms

- xv. Mutual Capacitance : 5.0 nF/100m Capacitance, unbalance (Max.) : 330pF/100m

- i. **Power Supply Cable**

- i. 3CX1.5 /2.5/4 sq mm, multi strand with standard annealed electrolytic copper conductor armoured cable/flexible cable as per IS 1554.
- ii. Primary insulation of 85° C PVC as IS-5831Type C
- iii. Color code Red, Black and Green
- iv. Inner and Outer Jacket : Extruded Flame retardant and 90° C PVC to IS 5831- Type ST2
- v. Inner and outer sheath - PVC Black
- vi. Armouring - Galvanized Steel Wire/ flat as per IS-544 part I

- j. **MONITORS**

- k. Monitors shall be 42 inch color, flat screen, multi quadrant type using solid state circuitry and quick disconnect circuit modules. The unit shall have regulated low voltage power supply and stabilized high voltage power supply. Monitors shall be Sony, Panasonic, RCA or approved equal.

8. EXECUTION

- a. **GENERAL**

- i. All materials and equipment shall be installed in accordance with the manufacturers written instructions and the requirements of the contract documents. Equipment shall be installed adequately ventilated and securely anchored.
- ii. Raceway systems shall be suitable for CCTV Systems

b. WORKMANSHIP

- i. Conductor terminations at screw terminals shall be accomplished with hooked, spade lugs. Shielding shall be continuous and shall be grounded at the monitor which shall be frame grounded. Wiring shall be cabled within enclosures and banded neatly to terminals.

c. INSTALLATION

- i. Cameras shall be mounted to maximize coverage of the areas being surveyed. Wiring throughout the system shall be identified in accordance with the shop drawings, identification shall be applied at all terminations and access fittings.
- ii. CAT 6 cables shall not be placed in trays with light and power cables.

PREAMBLE TO BILLS OF QUANTITIES

1. GENERAL

- a. Attention is directed to the Instructions to Tenders, the Form of Contract, Conditions of Contract, Specifications and Drawings. These documents are to be read in conjunction with the Bills of Quantities.

2. PRICING AND MEASUREMENTS

- a. The prices and rates to be inserted in the Bills of Quantities are to be the full inclusive value of the work described under the several items, including all costs and expenses which may be required in and for the construction of the work described, together with all general risks, liabilities and obligations set forth or implied in the documents on which the tender is to be based; where special risks, liabilities and obligations cannot be dealt with as above, then the price thereof is to be separately stated in the item or items provided for the purpose.
- b. A price or rate is to be entered against each item in the Bills of Quantities, whether quantities are stated or not. Items against which no price is entered are to be considered as covered by the other prices or rates in the bills.
- c. Any special methods of measurement used are stated at the head of or in the text of the Bills of Quantities for the trades or items affected. All other items are measured net in accordance with the Drawings and no allowances have been made for waste.
- d. All measurements in the Bills are taken strictly net. The principle of net measurement shall apply to all work executed under the Contract and no claims for extras based upon other methods of measurement will be entertained.
- e. The prices and rates entered in Bills of all Electrical Works shall include the following:
- f. Installation of fixtures, inserts, anchors, hangers, supports, solvent cements, protection, pull wires, etc.
- g. Excavation, backfilling, compaction including all equipment used for completion of work, etc.
- h. All chasing, cutting, recess, etc.

3. REFERENCE TO SPECIFICATIONS

- a. General directions and descriptions of work and materials given in the Specifications are not necessarily repeated in the Bills of Quantities. Reference is to be made to the Specifications for this information.

4. PREPARATION OF TENDERS

- a. In preparing his Tender and pricing the items in the Bills, the Tenderer must cover himself and shall be deemed to have covered himself for:
 - i. All services and materials which according to the true intent and meaning the Contract Documents may reasonably infer as necessary for carrying out in a good and workmanlike manner the Works shown upon the Drawings and described in the Specifications whether expressly mentioned therein or not, and
 - ii. All duties, obligations, liabilities and responsibilities which any of the Contract Documents place upon the Contractor in connection with or in relation to this Contract.
 - iii. The Tenderer shall insert against each item in the Bills such rates and prices as he may deem necessary to cover the above requirements. Items shall not be bracketed together and where no rate or price is inserted against any item in the Bills the cost thereof shall be deemed to have been included and spread proportionately over all items priced by the Tenderer.
 - iv. Unless separate items are provided the cost of all specified tests and the supply of all tests certificates shall be included in the rates in the Bills of Quantities.

5. CONTRACTOR'S OBLIGATION

- a. The information in the Contract Documents as to the whereabouts of existing services and mains is believed to be correct but the Contractor shall not be relieved of his obligations under the Conditions of Contract. The Contractor shall include in his rates for keeping the Engineer informed of all arrangements he makes with the Statutory Bodies as appropriate and for ensuring that no existing mains and services are interrupted without the written consent of the appropriate authority.

6. QUANTITIES

- a. Quantities stated in the Bills are estimated only. They are given in order that the Tenders may be both made out and compared on an equal basis and there is no guarantee that such quantities will in fact be required.
- b. The Tenderer shall satisfy himself as to the quantities involved, including materials and equipment, and conditions of work involved having due regard to the fact that the description of the quantities of work and materials as included in the Bills of Quantities, is brief and is intended only to indicate the general nature of the work and to identify the said quantities with the detailed requirements of the Contract Documents. The quantities given in the Bills form no part of the contract and are only approximate. In no circumstance shall such quantities be considered as limiting or extending the amount of the work to be done by the Contractor and material to be supplied by him.

7. CLAIMS FOR FURTHER PAYMENTS

- a. The Contractor shall have no claims for further payment in respect of any work or method of execution which may be described in the Contract although no item appears in the Bills of Quantities which specifically corresponds to the said work or method of execution.

8. REQUEST FOR INFORMATION

- a. If the prices for items or work, in the opinion of the Engineer, are not realistic prices for that particular item of work, the Engineer may request additional information to substantiate the prices or reject the Tender.

9. TENDER RATES

- a. The rates entered by the Tenderer in the Bills for taking delivery of materials from the Employer shall include inter alia for taking delivery, transporting to site, storing, etc. and no separate claims for profits, etc. on the cost price of such materials will be entertained.

10. COMPLETION OF BILLS OF QUANTITIES

- a. All blank spaces in the Bills of Quantities and the Form of Tender must be filled in, in ink, in both words and figures where required. No change will be made in the phraseology of the forms. In cases of discrepancy between the amounts stated in words and amounts in figures the former shall govern.

11. P.C. SUMS

- a. No items for which a P.C. sum is inserted shall be undertaken by the Contractor until the Engineer has given written instructions to this effect. The Contractor may be required to obtain competitive quotations and samples if required and shall submit these to the Engineer for approval. The Contractor shall produce to the Engineer the receipted accounts for all articles purchased under P.C. sum items and the amounts paid to the Contractor shall correspond with the amounts of such accounts including any discount for cost. No payments to the Contractor shall be made in respect of P.C. sum items until the said receipts have been presented to the Engineer. It shall be the duty of the Contractor to make an application to the Engineer sufficiently in advance of the progress of the work for instruction with regard to each P.C. sum item.
- b. P.C. sums inserted in the Bills in respect of materials to be specially imported for the Contract by the Contractor shall be deemed to include insurance, freight, dock and all other charges involved in clearing materials from the docks. In the case of imported materials obtained through a manufacturer's agent in Trinidad, the P.C. sums shall be deemed to include in addition the agent's fees and charges.

**REFURBISHMENT OF THE RESIDENCE FOR THE INDIAN HIGH COMMISSIONER
ELECTRICAL WORKS
BILLS OF QUANTITIES**

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
A	PRELIMINARIES			
1	Protection of Public and Private Services			
2	Provision of Site Supervision			
3	Provision of Plant Equipment and Tools			
4	Provision of Transport			
5	Compliance with Statutory Regulations , Local Codes , Government Electrical Inspectorate requirements etc			
6	Include for Attendances			
7	Include for Guarantees and Warrantees			
8	Provide for Cranage, haulage , scaffolding, ladders, lifting equipment and safety and personal protective equipment			
9	Include for Bonds and Insurances including Public Liability and Workmen's Compensation			
10	Protection of the works			
	CARRIED TO SUMMARY - A PRELIMINARIES			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
B	PROVISIONS			
1	Provide for the submission of Maintenance Manuals , tags, charts , Instructions, Electrical and Control Wiring diagrams , shop and Fabrication drawings enclosed in a hard rink binder together with a digital copy on CD			
2	Include for Coordination with other trades			
3	Include for Cleaning and Painting			
4	Include for Maintenance and Defests Liability Period			
5	Include for system testing , adjusting , commissioning and demonstrations			
6	Include for Interface with Utilities			
7	Include for the submission of As Built Drawings in hard copy and soft copy formats. Drawings shall be in Autocad format			
8	Include for Builders Works			
9	Include for Cleanup			
	CARRIED TO SUMMARY - B PROVISIONS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
C	ELECTRICAL SUPPLY			
1.0	Include for the installation of a 25 ft pole for the main electrical supply cable from T&TEC. Including for pole foundation painting etc			
2.0	Supply and install 46 metres 4 x 95 sq mm XLPESWAPVC , 600 / 1000 V , cable from T&TEC pole to MAIN CIRCUIT BREAKER . Include for glands at meter base and terminations			
3.0	Include for the supply and installation of 200 A, 230 V, 3 Phase plug in meter base on Pole			
3.0	Include for 32 Metres trenching and laying of PVC conduit for main supply cable installation, sand bed , cable tiles backfilling and compaction and making good surface			
4.0	Supply and install 3 cu metres concrete for driveway cable road crossing			
5.0	Include for T&TEC charges for 200 A, 3 Phase supply			
	CARRIED FORWARD -C- ELECTRICAL SUPPLY			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
D	GENERATOR AND ATS			
1.0	Supply and install 80 KVA, 64 KW, 230 /115 V, 3 phase,4 wire 60 hz,GENERATOR SET, with permanant magnet excitation.with 200 gall skid mounted base tank .Include for the supply and installation of sound proof weatherproof enclosure for the generator set			
2.0	Include for generator plinth			
3.0	Supply and install 200 A,230 / 115 V, 3 PHASE Main breaker in enclosure with thermal and magnetic trip and ammeter and voltmeter front face mounted on enclosure			
4.0	Supply and Install 1 No. 200A, 230/115V, 3 Phase, 4 wire, 60 Hz Automatic Transfer Switch Ref ASCO or Approved Equal			
	D- GENERATOR AND ATS CARRIED TO SUMMARY			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
E	PANELBOARDS			
1.0	Supply and install 42 cct 230/ 115 V, 3 Phase, 4 Wire Main Panel MP, with 300A Busbars in Main Electrical Closet with main and feeder breakers as per drawings.			
2.0	Supply and install 42 cct 230/ 115 V, 1 Phase, 3 Wire Panel LPG, with main and feeder breakers as per drawings.			
3.0	Supply and install 36 cct 230/ 115 V, 1 Phase, 3 Wire Panel GL, with main and feeder breakers as per drawings.			
4.0	Supply and install 42 cct 230/ 115 V, 1 Phase, 3 Wire Panel LPF, with main and feeder breakers as per drawings.			
5.0	Supply and install 36 cct 230/ 115 V, 1 Phase, 3 Wire Panel FL, with main and feeder breakers as per drawings.			
6.0	Supply and install 24 cct 230/ 115 V, 1 Phase, 3 Wire Weatherproof Panel PP, with main and feeder breakers as per drawings.			
7.0	Supply and install 1 No. 36 cct 230/115V, 3 Phase, 4 Wire, Weatherproof Panel AC with main breaker and feeder breakers as per drawings.			
8.0	Supply and install 24 cct 230/ 115 V, 1 Phase, 3 Wire Panel GB, with main and feeder breakers in Guard Booth as per drawings.			
	CARRIED TO SUMMARY -E PANELBOARDS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
F	CABLES			
1.0	Supply and install 4 X 95 sq mm XLPE SWA PVC from Main circuit breaker to ATS . Cater for 3 Metres Cable			
2.0	Supply and install 4 X 95 sq mm XLPE SWAPVC from Generator to ATS . Cater for 18 Metres Cable			
3.0	Supply and install 4 X 95 sq mm XLPE SWAPVC from ATS to Panel MP. Cater for 4 Metres Cable			
4.0	Supply and install 3 X 35 sq mm XLPE SWAPVC from Panel MP to Panel LPG. Cater for 4 Metres Cable			
5.0	Supply and install 3 X 16 sq mm XLPE SWAPVC from Panel MP to Panel GL. Cater for 5 Metres Cable			
6.0	Supply and install 3 X 16 sq mm XLPE SWAPVC from Panel MP to Panel GL. Cater for 5 Metres Cable			
7.0	Supply and install 3 X 50 sq mm XLPE SWAPVC from Panel MP to Panel LPF. Cater for 5 Metres Cable			
8.0	Supply and install 3 X 16 sq mm XLPE SWAPVC from Panel MP to Panel FL. Cater for 18 Metres Cable			
9.0	Supply and install 3 X 16 sq mm XLPE SWAPVC from Panel MP to Panel PP. Cater for 20 Metres Cable			
	CARRIED FORWARD -F CABLES			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
F	BROUGHT FORWARD F-CABLES			
10.0	Supply and install 4 X 70 sq mm XLPE SWAPVC from Panel MP to Panel AC. Cater for 21 Metres Cable			
11.0	Supply and install 3 X 16 sq mm XLPE SWAPVC from Panel MP to Panel GB. Cater for 30 Metres Cable			
	CARRIED TO SUMMARY - F CABLES			
G	ISOLATORS			
1.0	Supply and install 5 No 30A, 230 V, 1 PHASE isolators in weatherproof enclosures for 5 No 18000 BTU AC units			
2.0	Supply and install 7 No 20A, 230 V 1 PHASE isolators in weatherproof enclosures for 7 No 12000 BTU AC Units			
3.0	Supply and install 1 No 40A, 230V, 1 PHASE isolators in weatherproof enclosures for 30000 BTU AC Unit			
4.0	Supply and Install 1 No. 50A, 230 V, 1 Phase isolator in Weatherproof enclosure for 42000 BTU AC Unit			
	CARRIED TO SUMMARY G ISOLATORS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
H	GROUNDING AND EARTHING			
1.0	Supply and install grounding system for all electrical panels as per drawings			
2.0	Supply and install grounding system for Generator and ATS as per drawings including earth conductors , inspection boxes and earth rods			
	CARRIED TO SUMMARY H - GROUNDING AND EARTHIG			
J	EXTERNAL WORKS			
1.0	Excavation for the installation of external ducts for external lighting LV power Cables , and external CCTV distribution 600 mm x 600 mm wide trench . Cater for 185 metres excavation			
3.0	Supply and install 100 mm PVC duct Cater for 78 metres			
4.0	Supply and install 50 mm PVC Ducts . Cater for 188 Metres			
5.0	Supply and install 25 mm PVC Ducts . Cater for 77 Metres			
6.0	Backfilling and compaction of cable trenches			
7.0	Supply and install all materials and labour for 2 No. Pull boxes 1000 x 1000 x 1000 mm as per drawings . Include for 24" dia cast iron covers .			
	CARRIED FORWARD -J EXTERNAL WORKS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
K	EXTERNAL LIGHTING			
1.0	Include a provisional sum of \$30,000.00 for lans scape lighting			
	CARRIED TO SUMMARY -K EXTERNAL LIGHTING			
L	CONDUIT AND BOXES			
1.0	Supply and installation of all conduit and Boxes for 120 V Duplex Outlets as per drawings. Cater for 138 outlet points			
2.0	Supply and install conduit and boxes for 120 V lighting circuits and switches as per drawings . Cater for 325 lighting points			
3.0	Supply and install conduit and boxes for Telephone outlets . Cater for 3 points as per drawing.			
4.0	Supply and install conduit and boxes for CCTV system as per drawing .			
5.0	Supply and install conduit and boxes for Security System as per drawing .			
	CARRIED TO SUMMARY - L CONDUITS AND BOXES			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
M	WIRING			
1.0	Supply and install 1 x 2.5 sq mm PVC wires for all duplex outlets . Cater for 138 outlets			
3.0	Supply 1 x 1.5 sq mm PVC wires to all 120 V lighting circuits as per drawings . Cater for 325 lighting points			
	CARRIED TO SUMMARY - M WIRING			
N	WIRING DEVICES			
1.0	Supply and install 138 No. 120 V duplex flush mounted outlets as per drawings . Including DECORATIVE cover plates			
2.0	Include for wiring for , 20 A, 120 V flush mounted light switches and switch plates as per drawings			
	CARRIED TO SUMMARY N- WIRING DEVICES			
O	LIGHTING FIXTURES			
1.0	Supply and install lighting fixtures as follows Type A - 10 No. Type B - 2 No. Type C - 158 METRES . Type D - 3 No. Type E - 5 No. Type F - 12 No. Type G - 53 No. Type H - 9 No. Type I - 6 No. Type J - 9 No. Type K- 13 No. Type L- 35 No.			
	CARRIED FORWARD - O - LIGHTING FIXTURES			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
	<p align="center">BROUGHT FORWARD O LIGHTING FIXTURES</p> <p>Type M- 5 No. Type N- 6 No. Type O- 80 No Type P- 15 No Type R- 15 No. Type S- 28 No Type T- 4 No. Type U- 1 No Type V- 2 No Type W- 1 No. Type X- 3 No.</p>			
	CARRIED TO SUMMARY -O LIGHTING FIXTURES			
P	<p align="center">ANCILLARY SYSTEMS</p> <p>1.0 Supply and install 2 No automatic hand dryers as per drawings</p> <p>2.0 Include for conduit and Boxes for guard booth wiring for lighting and Power</p> <p>3.0 Include for wiring for electrical supply to Gate opener</p> <p>4.0 Include for wiring to Fountain as per drawing</p> <p>5.0 Include for wiring to Pump House</p> <p>6.0 Include for transfer of wiring from existing pool lighting to new pump panel</p> <p>7.0 Include for wiring to domestic water pump and pool pump</p>			
	CARRIED FORWARD - P- ANCILLARY SYSTEMS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
8.0 9.0	<p>BROUGHT FORWARD P-ANCILLARY SYSTEMS</p> <p>Include for the supply and installation of wiring for lighting and Power for Guard booth</p> <p>Include for the supply and installation of Intercom system from Guard Booth to three No stations in main house master bedroom, first floor living room and ground floor Kitchen</p>			
P	CARRIED TO SUMMARY -P ANCILLARY SYSTEMS			
Q 1.0 2.0 3.0	<p>CCTV SYSTEM</p> <p>Include for the supply and installation 6 No. 2MP IP digital fixed dome cameras with 8 mm lens in weatherproof enclosures as per specifications.</p> <p>Include for the supply and installation 10 No. 2MP IP digital bullet cameras with 8 mm lens in weatherproof enclosures as per specifications.</p> <p>Include for the supply and installation of 3 - 40 " flat screen LCD colour monitors</p>			
	CARRIED FORWARD - Q-CCTV AND SECURITY SYSTEM			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
	BROUGHT FORWARD Q-CCTV AND SECURITY SYSTEM			
4.0	Include for CAT 6 wiring for CCTV System			
5.0	Supply and install 1 No 16 channel NVR SYSTEM			
6.0	Include for 6 TB storage capacity			
7.0	Supply and Install CCTV Management System software			
8.0	Include for patch cords wiring devices, equipment and systems necessary to have the CCTV system fully functional			
9.0	Supply and install 1 No. desktop computer system for Video Management system in the security Office			
10.0	Include for 1.5 KVA UPS for CCTV systems			
11.0	Include for Items Not listed in the Bills but are required for full system functionality			
12.0	Include for the supply and installation of the security system including door contacts , break glass sensors and motion sensors			
13.0	Include for the supply and installation of the Security control panel			
14.0	Include for wiring for Security system as per drawings			
15.0	Include for arm disarm panels			
Q	CARRIED TO SUMMARY - Q CCTV SYSTEM			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
	SUMMARY SHEET			
A	PRELIMINARIES			
B	PROVISIONS			
C	ELECTRICAL SUPPLY			
D	GENERATOR AND ATS			
E	PANELBOARDS			
F	CABLES			
G	ISOLATORS			
H	GROUNDING AND EARTHING			
J	EXTERNAL WORKS			
K	EXTERNAL LIGHTING			
L	CONDUIT AND BOXES			
M	WIRING			
N	WIRING DEVICES			
O	LIGHTING FIXTURES			
P	ANCILLARY SYSTEMS			
Q	CCTV SYSTEM			
R	ITEMS OMITTED Include for items in the drawings but not listed in the bills			
	SUBTOTAL			
	ADD 5 % CONTINGENCY			
	SUBTOTAL			
	ADD 12.5% VAT			
	TOTAL			

RESIDENCE FOR THE INDIAN HIGH COMMISSIONER

TECHNICAL SPECIFICATIONS FOR AIRCONDITIONING AND VENTILATION SYSTEMS

The logo for Jain Consultants T&T Ltd, featuring the word "JAIN" in a bold, blue, sans-serif font. The letters are slightly shadowed, giving it a 3D appearance.

JAIN CONSULTANTS T&T LTD

54 Evans Street

Curepe

Tel: 1 (868) 645-3650; Fax: 1 (868) 645-3650

Email:

trinidad@jainconsultants.com

May 28, 2018

RESIDENCE FOR THE INDIAN HIGH COMMISSIONER

TECHNICAL SPECIFICATIONS

AIR CONDITIONING SYSTEM

SECTION 001

1. SCOPE OF WORK

The scope of works shall include the supply of all equipment, labour, materials and services required for the installation of the Air Conditioning and Ventilation system at the Residence of the Indian High Commissioner. The contractor is responsible for the supply and installation of the single zone mini split inverter type air conditioning units both high wall evaporator type and ceiling cassette types as detailed on the drawings . The supply and installation of exhaust fans for toilet areas and ducting and grilles for the range hood exhaust is also the responsibility of the contractor under this contract .

- Supply and installation of Single zone mini split inverter type high wall air conditioning units as per drawings
- Supply and Installation of Single zone , inverter type ceiling cassette type air conditioning units as per drawings
- Supply and installation of Toilet extraction systems.
- Supply and installation of Condensate Drains including insulation.
- Supply and installation of all mounting hardware for ac condensing units and evaporators
- Supply and installation of wiring from isolator to AC unit
- Provide shop drawings showing mounting details to the Engineer for approval.
- Coordinate with the Electrical Contractor for the provision of electrical supplies.
- Test and Commission all units.

BASIC MECHANICAL REQUIREMENTS

SECTION 002

1. GENERAL

a. RELATED DOCUMENTS:

- Drawings and general provisions of Contract, including The General Conditions of the Contract for Construction and drawings.
- Related Sections: Refer to all sections on Electrical and Civil / Structural Works.

b. SUMMARY:

- This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of the Works including Civil /Structural and Electrical Works.
- The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections, system shutdowns and restart-up, flushing and filling both new and existing systems.
- Provide temporary ductwork and piping services where required to maintain existing areas operable, as shown on the drawings.
- Coordinate all services shut-down with the Owner; provide temporary services as shown on the drawings.
- The Contractor shall be responsible for the maintenance operation and servicing of all new mechanical systems which are to be used by the Owner during the time of any occupancy and use of any areas within the construction limitations before final completion or acceptance of the systems. A written record of maintenance, operation and servicing shall be turned over to the Owner prior to final acceptance.

c. PROJECT CONDITIONS:

- The Contractor shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work for these existing conditions.
- Field verify all existing conditions prior to submitting bids.
- Report any existing damaged equipment or systems to the Owner prior to any work.
- Protect all mechanical and electrical work against theft, injury or damage from all causes until it has been tested and accepted.
- Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair

or replace any part of the work which may show defect during one year from the final acceptance of all work. Provided such defect is, is in the opinion of the Engineer, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.

d. ACCESSIBILITY:

- Install equipment and materials to provide required access for servicing and maintenance.
- Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- Extend all grease fittings to an accessible location.
- Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, motors, fans, balancing cocks, and other operating devices requiring adjustment or servicing.
- The minimum size of any access door shall not be less than the size of the equipment to be removed or 12 inches x 12 inches if used for service only.
- Furnish doors to trades performing work in which they are to be built, in ample time for building-in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.
- Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed.
- Access doors in fire-rated walls and ceilings shall have equivalent U.L. label and fire rating.

e. ROUGH-IN:

- Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough-in requirements.

f. REQUIREMENTS OF REGULATORY

- Execute and inspect all work in accordance with the local Authority having Jurisdiction, applicable Codes and Standards as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the greater requirement shall be followed.
- Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.

- The handling, removal and disposal of regulated refrigerants shall be in accordance with U.S. EPA, state and local regulations.
 - The handling, removal and disposal of lead based paint and other lead containing materials shall comply with EPA, OSHA, and any other Federal, State, or local regulations.
 - After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.
- g. REQUIREMENTS OF LOCAL UTILITY COMPANIES:
- Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required for the project.
- h. PERMITS AND FEES:
- The **Contractor** shall pay all fees required for connection to public utility facilities.
 - Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.
- i. MECHANICAL INSTALLATIONS:
- Drawings are diagrammatic in character and do not necessarily indicate every required offset, valve, fitting, etc.
 - Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both.
 - Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.
 - Before any work is installed, determine that equipment will properly fit the space; that required piping grades can be maintained and that ductwork can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.
 - Coordinate the installation of mechanical materials and equipment above and below ceilings with suspension system, light fixtures, and other building components.
 - Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of priority.
 - Plumbing waste, vent piping and roof drain mains and leaders.
 - Supply, return and exhaust ductwork.

- Fire sprinkler mains and leaders
 - Electrical conduit.
 - Domestic hot and cold water.
 - BAS Control Piping or Wiring.
 - Fire sprinkler branch piping and sprinkler runouts.
- Verify all dimensions by field measurements.
 - Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
 - Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
 - Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
 - Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
 - Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
 - Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 - Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - The Contractor shall provide all labor and material necessary but not limited to the starting/stopping of all mechanical equipment, opening/closing of all valves, draining/refilling all mechanical systems and operating/verifying the operation of all mechanical systems controls as required to accomplish all work necessary to meet construction document requirements.
- j. BELTS, SHEEVES, IMPELLERS:
- The Mechanical Contractor shall coordinate with the Specialist Equipment Supplier and supply correctly-sized drive belts, sheeves, and trimmed impellers.

k. EXCAVATING AND BACKFILLING:

- General:
 - Provide all necessary excavation and backfill for installation of mechanical work in accordance with the specifications.
 - In general, follow all regulations of OSHA with respect to trenching and shoring.
 - Contact Owners of all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Also, prior to starting excavation brief employees on marking and color codes and train employees on excavation and safety procedures for natural gas lines. When excavation approaches gas lines, expose lines by carefully probing and hand digging.
 - Provide all necessary pumping, cribbing and shoring.
 - Walls of all trenches shall be a minimum of 6 inches clearance from the side of the nearest mechanical work. Install pipes with a minimum of 6 inches clearance between them when located in same trench.
 - Pipe Trenching:
 - Dig trenches to depth, width, configuration, and grade appropriate to the piping being installed. Dig trenches to 6 inches below the level of the bottom of the pipe to be installed. Install 6 inches bed of pea gravel or squeegee, mechanically tamp to provide a firm bed for piping, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal pipe protrusions.
 - Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be reviewed by the soils engineer. In no case shall lumber, metal or other debris be buried in with backfill.
 - Provide warning tape for marking and locating underground utilities. Tape shall be specifically manufactured for this purpose and shall be polyethylene film, 6 inches wide, 0.004 inches thick and have a minimum strength of 1750' psi. Tape shall carry continuous inscription naming the specific utility.
- G. Trench Backfill:
1. Backfill to 12 inches above top of piping with pea gravel or squeegee, the same as used for piping bed, compact properly.
 2. Continue backfill to finish grade, using friable material free of rock and other debris.
Install in 6 inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not

permissible.

- H. After backfilling and compacting, any settling shall be refilled, tamped, and finished at this contractor's expense.
- I. The contractor shall repair and pay for any damage to finished surfaces.
- J. Complete the backfilling near manholes using pea gravel or squeegee, installing it in 6 inch lifts and mechanically tamping to achieve 95 percent compaction.
- K. Use suitable excavated material to complete the backfill, installed in 6 inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper 30 inches below paving and slabs and 90 percent elsewhere.

1.12 CUTTING AND PATCHING:

- A. This Article specifies the cutting and patching of mechanical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.
- C. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.
- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work;
 - 2. Remove and replace defective work;
 - 3. Remove and replace work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed work as specified for testing;
 - 5. Install equipment and materials in existing structures;
 - 6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineer observation of concealed work.
- G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new work.
- H. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain an approved type of temporary partitions or dust barriers

adequate to prevent the spread of dust and dirt to adjacent areas. Temporary partitions must not impede access to building egress.

- J. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover.

1.13 TEMPORARY FACILITIES:

A. Light, Power, Etc.:

- 1. Responsibility for providing temporary electricity, and other facilities required for the mechanical works

1.14 PRODUCT OPTIONS AND SUBSTITUTIONS:

- A. Materials and equipment of equivalent quality may be substituted for those scheduled or identified by name on the drawings if so reviewed by the Architect/Engineer and approved prior to the order being placed . The submittal shall include all data necessary for complete evaluation of the product.

1.15 MECHANICAL SUBMITTALS:

- 1. All mechanical submittals shall be submitted by specification section submitted at one time. "Piece-Meal" or "Partial" submittals will be returned, unless prior approval from the Engineer has been obtained.
- 1 The Contractor shall identify any "long lead time" items which may impact the overall project schedule. If these submittal requirements affect the schedule, the Contractor shall identify the impacts and confer with the Engineer within two weeks of entering into the contract.
- 3. At least one copy of the first submittal package shall be provided in expandable, 3 post, and hard back binders, sized to fit all future submittals for this job. The cover shall be identified with the job name, Owner's project number, date, prime contractor's name, etc.
- 4. Each submittal shall be tabbed by the mechanical specification section it is specified in. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)

- c. Specification Section
 - d. Manufacturer and Model Number
5. Fire protection and coordination drawings do not apply to the above. These drawings may be submitted in a separate submittal.
- B. The manufacturer's material or equipment listed in the schedule or identified by name on the drawings are the types to be provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the scheduled names, the cost of any changes in construction required by their use shall be borne by Contractor.
 - C. All equipment shall conform to the local Energy Conservation Standards.
 - D. Submittal of shop drawings, product data, and samples will be accepted only when submitted by and stamped by the Contractor. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed unless prior written approval is obtained by the Contractor.
 - E. Before starting work, prepare and submit to the Architect/Engineer THREE(3) sets of all shop drawings and descriptive equipment data required for the project. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer will mark up two sets, keep one, and return the rest. Continue to submit THREE (3) sets of any individual shop drawings, product data or samples which were returned without a "make corrections noted" or "no exceptions taken" action, until they are so marked. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the operation and maintenance manual. Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process.
 - F. The Design Professionals review and appropriate action on submittals, such as shop drawings, product data, samples and other data, as required by the Design Professional, is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The Design Professional's review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional's judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component. The Design Professional

shall not be responsible for any deviations from the contract documents not brought to the attention of the Design Professional in writing by the Contractor. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

1.16 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:

A. Product Data:

1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
2. Delete or mark-out portions of pre-printed data which are not applicable.
3. Where operating ranges are shown, mark data to show portion of range required for project application.
4. For each product, include the following:
 - a. Sizes.
 - b. Weights.
 - c. Speeds.
 - d. Capacities.
 - e. Piping and electrical connection sizes and locations.
 - f. Statements of compliance with the required standards and regulations.
 - g. Performance data.
 - h. Manufacturer's specifications.

B. Shop Drawings:

1. Shop Drawings are defined as mechanical system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical pre-printed materials.
2. Prepare Mechanical Shop Drawings, except diagrams, to accurate scale, min 1/8"-1'-0", unless otherwise noted.
 - a. Show clearance dimensions at critical locations.
 - b. Show dimensions of spaces required for operation and maintenance.
 - c. Show interfaces with other work, including structural support.

C. Test Reports:

1. Submit test reports which have been signed and dated by the firm performing the test.
2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.

- D. Required submittals:
 - 1. Provide submittals for each item of equipment specified or scheduled in the contract documents.
- E. If more than two submittals (either for product data, shop drawings, record drawings, or test and balance reports) are made by the contractor, the Owner reserves the right to charge the contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the contractor.

1.17 PRODUCT LISTING:

- A. Prepare listing of major mechanical equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Architect.
- B. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.
Provide products which are compatible within systems and other connected items.

1.18 NAMEPLATE DATA:

- A. Provide permanent operational data nameplate on each item of mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.19 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage or contamination during shipment, storage, and handling.
- C. Store equipment and materials at the site, unless off-site storage is authorized in writing.
Protect stored equipment and materials from damage, dirt, dust and moisture.
- D. Coordinate deliveries of mechanical materials and equipment to minimize

construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

- E. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- F. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- G. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or be packaging with durable, waterproof wrapping.

1.20 RECORD DOCUMENTS:

- A. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.
- C. Mark Drawing Prints to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices. Changes to be noted on the drawings shall include final location of any piping or ductwork relocated more than 1foot-0inches from where shown on the drawings.
- D. At the completion of the project, obtain from the Architect/Engineer a complete set of the Mechanical Construction Documents in the electronic format used by the design team. This set will include all revisions officially issued through the Architect/Engineer. The Contractor shall transfer all revisions noted on the record document prints to the electronic drawings. The Contractor shall transmit the final record documents in the electronic format used on the project to the Architect. This contract will not be considered completed until these record drawings have been received and reviewed by the Architect/Engineer.

1.21 OPERATION AND MAINTENANCE DATA:

- A. No later than four (4) weeks prior to the completion of the project, make up a **minimum of four sets of** operating and maintenance manuals
- B. In addition to the information required above for Maintenance Data, include the following information:
 - 1. Description of mechanical equipment, function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions, lubrication charts and schedules, including Contractor Lubrication reports.
 - 5. Manufacturer's service manuals for all mechanical equipment provide under this contract.
 - 6. Include the valve tag list.
 - 7. Name, Address and Telephone number of party to be contacted for 24-hour service for each item of equipment.
 - 8. Starting, stopping, lubrication, equipment identification numbers and adjustment clearly indicated for each piece of equipment.
 - 9. Complete parts list.
 - 10. Mechanical warranties.
- D. This contract will not be considered completed nor will final payment be made until all specified material, including testing report, is received in this operating and maintenance report and the manual is reviewed by the Architect/Engineer.

1.22 LUBRICATION OF EQUIPMENT:

- A. Contractor shall properly lubricate all mechanical pieces of equipment which he provided before turning the building over to the Owner. He shall attach a linen tag or heavy duty shipping tag on the piece of equipment showing the date of lubrication and the type and brand of lubricant used.
- C. Furnish the Engineer with a typewritten list included in the O and M manuals of each item lubricated and type of lubricant used, no later than two (2) weeks before completion of the project, or at time of acceptance by the Owner of a portion of the building and the mechanical systems involved.

1.23 DEMOLITION:

A During the demolition phase of this contract it is the responsibility of this Contractor to carefully remove existing equipment, piping or ductwork and related items either as shown on the demolition drawings as being removed, or as required for the work. These items shall be tagged, protected from damage, and stored as directed by the Architect. A list of all items stored shall be turned over to the Architect. At the completion of the remodeling work or when directed by the Architect, all stored items not reused or wanted by the Owner shall be removed from the premises. Disposition of items not reused is by the direction of the Owner/Architect/Engineer.

1 Return existing plumbing fixtures to the Owner.

C. The location of existing equipment, pipes, ductwork, etc., shown on the drawings has been taken from existing drawings and is, therefore, only as accurate as that information. All existing conditions shall be verified from field measurements with necessary adjustment being made to the drawing information.

D. If asbestos material, in any form, is discovered by this contractor in the process of his work, he shall report such occurrence to the Architect/Owner immediately. The Architect/Owner will determine the action to be taken for the asbestos removal, which is not a part of the work to be done under this Contract.

1.24 WARRANTIES:

A. Refer to individual equipment specifications for warranty requirements. In any case the entire mechanical system shall be warranted no less than one year from the time of acceptance by the Owner.

B. Compile and assemble the warranties into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference / the operating and maintenance manuals.

C. Provide complete warranty information for each item to include product or equipment to include date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.25 CLEANING:

Clean filters, strainers, and mechanical systems prior to final acceptance.

1.26 PROJECT CLOSEOUT:

A Contractor shall be responsible for providing the Mechanical checklist for the

item of equipment in accordance with the Manufacturers recommendations. Checks shall be carried out by the Contractor and reviewed by the Engineer prior to applying for certification of substantial completion.

1. Refer to individual specification sections for additional requirements.

SECTION 003

**AIR CONDITIONING AND
VENTILATION SYSTEM**

TECHNICAL SPECIFICATIONS

AIRCONDITIONING AND VENTILATION SYSTEM

GENERAL REQUIREMENTS

1.0 Codes and Standards

Installation shall meet or exceed the requirements of:

- ASHRAE Handbook and Standards
- SMACNA Standards
- CIBSE Guides
- CIBSE Commissioning Codes
- ARI Standards
- TTS 171: PART 1: 2002 Low Voltage Installations
- T & TEC 'Wiring for light and Power'
- Recommendations of the Government Electrical Inspectorate.

2.0 General specifications

1. Intent

It is the intention of these specification and drawings to call for finished work, tests and ready for operation. Wherever the word "provide' is used it shall mean 'furnish and install complete and ready for use'. Minor details not usually shown or specified, but necessary for the proper installation and operation shall be included in the work, the same as if herein specified or shown.

2. Drawings

Drawings are diagrammatic and indicate the general arrangement of systems and work included in the contract. Drawings are not to be scaled.

3. Shop Drawings

The Contractor shall submit for approval detailed shop drawings of all equipment and all material required for completing the project, and no material or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular materials or equipment. The shop drawings shall be complete as described herein. The Contractor shall furnish the number of copies required by the General Conditions of the contract, but in no case less than three (3) copies.

Prior to delivery of any material to job site, and sufficiently in advance of requirements to allow the Engineer ample time for checking, submit for approval detailed, dimensioned drawings or cuts, showing construction, size, arrangement, operating clearances performance characteristics and capacity. Each item of equipment proposed shall be a standard catalog product of an established manufacturer and of equal quality, finish, and durability to that specified. Samples, drawings, specifications, catalogs, submitted for approval, shall be properly labelled indicating specific service for which material or equipment is to be used, section and article number of specification governing, Contractor's name, and name of job.

Catalogs, pamphlets, or other documents submitted to described items on which approval is being requested, shall be specific and identification in catalog, pamphlet, etc, of item submitted shall be clearly marked in ink. Data of a general nature will not be accepted.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building condition. Where drawing are approved, said approval does not mean that drawing have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawing and specification.

Failure of the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of contract time, and no claim for extension by reason of such default will be allowed.

The Contractor shall provide the following for approval: prints of duct system assembly and details – before fabrication; data sheets and specifications of equipment before furnishing – immediately after letting of contract; control diagrams with description of operation; schedule of air quantities for balance system after balancing; maintenance and operating instructions, after installation.

Shop drawings/submittals are required for the following items:

- Condensing and evaporators
- Grilles, registers and diffusers
- Controls
- Composite wiring diagram

- Filters
- Fans and VRF indoor & Outdoor Units
- Vibration isolation
- Duct Fabrication drawings
- Refrigerant piping – sizing calculations, layout and isometric

4. Equipment Deviations

Where the Contractor proposes to the use an item of the equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign, and all new drawings and detailing required therefore, shall be prepared by the Contractor at his own expense and approved by the Engineer.

Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment for that specified or indicated on the drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation controllers, motors, starters, electrical wiring and conduct, and any other additional equipment required by the system, at no additional cost to the owner.

5. Co-operation with other Trades

This Contractor shall give full co-operation to other trades and shall furnish in writing to the Engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible inference or delay.

6. Protection

The Contractor shall protect all work and material from damage by his work or workmen, and shall be liable for all damage thus caused.

The Contractor shall be responsible for work and equipment until finally inspected, tested, and accepted; he shall protect work against theft, injury or damage; and shall carefully store material and equipment received on site when they are not immediately installed. He shall close open ends of work with temporary covers or plugs during storage and construction to prevent entry of obstructing material.

7. Scaffolding, Rigging, Hoisting

This Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

8. Material and workmanship

All materials and apparatus required for the work, except as specified otherwise, shall be new, of first class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first class standard article as approved by the Engineer shall be furnished.

9. Foundation, Support, Piers, Attachments

The Contractor shall furnish information on all necessary foundations, supports, pads, bases and piers required for all air conditioning equipment and for all other equipment furnished under this contract, and shall submit drawings to the Engineer giving all dimensions, clearances and weights.

All equipment, unless shown otherwise, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Engineer not strong shall be replaced as directed.

10. Electrical Connections

The Electrical Contractor shall furnish and install all wiring except:

1. Temperature Control wiring
2. Equipment control wiring
3. Interlock wiring.

The Electrical Contractor shall furnish and install all power wiring complete from power source to isolators located not more than 3 m from the units. This Contractor shall install all starters not factory mounted on equipment.

This Contractor shall, regardless of voltage, furnish and install all temperature control wiring and all interlock wiring and equipment control wiring for the equipment that he furnishes. This Contractor shall furnish and install starters.

After all circuits are energized and completed, this Contractor shall be responsible for all power wiring from the isolator and all control wiring. Motors

and equipment shall be provided for current characteristics as shown on the drawings.

14. Operating Instructions

Upon completion of all work and all tests, the Contractor shall furnish the necessary skilled labour and helpers for operating the system and equipment for a period of three (3) days of eight (8) hours each, or as otherwise required. During this period, instruct the Employer or his representative fully in the operations, adjustment and maintenance of all equipment furnished. Give at least forty-eight (48) hours' notice to the Employer in advance of this period.

The Contractor shall furnish to the Engineer, four (4) complete bound sets of typewritten or blue printed instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogues will not be acceptable for operating and maintenance instructions.

The Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract.

The Contractor shall furnish to the Engineer all temperature control diagrams , all piping diagrams and other as-built drawings.

15. Mechanical Maintenance

Scope:

The Contractor shall provide the necessary skills and labour to assure the proper operation and to provide all required current and preventative maintenance for all equipment and controls provided under this specification for a period of one year after substantial completion of the contract as defined in these specifications.

Operation:

The Contractor shall receive calls for any and all problems experienced in the operation of the equipment provided and shall take steps to immediately correct any deficiencies that may exist.

Maintenance:

The Contractor shall provide monthly inspections of all equipment and record the findings on a check list hereinafter specified.

Check List:

The Contractor shall provide a check list to the Engineer. The check list shall be a list of each piece of equipment found in these specifications. The check list shall have a space for each of the next 12 months to provide a space for check-off.

The Contractor shall certify on this check list that he has examined each piece of equipment and that, in his opinion, it is operating as intended by the manufacturer, it has been properly lubricated and that all necessary current and preventative maintenance has been performed as recommended by the manufacturer and by good and accepted practice.

Repairs:

All equipment that requires repairing shall be immediately serviced and repaired. Since the period of maintenance runs for one year concurrently with the warranty and guarantee, all parts and labour shall be furnished at no extra cost to the owner.

Control System:

Once each month, the Contractor shall check all controls in the building to ascertain that they are functioning as designed.

Filter maintenance shall be special part of this contract and this Contractor shall inspect all filters once every month and shall clean or replace filter, as necessary.

Emergency Service:

When emergency service is required beyond regular working hours to maintain the system in operation, the Contractor shall furnish such services.

16. As-Built & Record Drawings

The Contractor shall keep one copy of all drawings, specifications and approved shop drawings of the work, in good order, available to the Engineer and to his representatives. As the work progresses, the Contractor shall record changes to the project, as built. At the completion of the installation and before the final inspection the Contractor will liaise with the Engineer in ensuring the production of an accurate record of "As-Built" Drawings. The production of As-Built drawings shall be the responsibility of the Contractor and as such the cost of this item shall

be deemed to be included in the tendered sum. The Engineer shall provide one (1) set of transparencies of architectural backgrounds or working drawings upon request from the Contractor to assist in the preparation of "As-Built" drawings.

AIR CONDITIONING AND VENTILATION SYSTEMS

TECHNICAL REQUIREMENTS

2 EQUIPMENT & WORKMANSHIP

2.1 HIGH WALL AND ABOVE CEILING CASSETTE TYPE MINI SPLIT-TYPE HIGH EFFICIENCY SINGLE ZONE AIR-CONDITIONERS COOLING ONLY:

2.1.1 – General

The system shall be a single zone mini split system with Variable speed Inverter Compressor Technology . The unit shall consist of a Horizontal discharge single phase outdoor unit , a matched capacity indoor section that shall be equipped with a wireless remote control unit

2.1.2 System Description

1. Indoor, wall-mounted, or Ceiling Mount direct-expansion fan coils with remote air cooled condensing units.
2. Outdoor air-cooled Inverter (Variable Speed Compressor) condensing unit shall be suitable for on-the-ground or wall mount installation. Units shall consist of a rotary compressor, an air-cooled coil, propeller-type draw-through outdoor fan, metering device(s), and control box. Units shall discharge air horizontally as shown on the contract drawings. Units shall be used in a refrigeration circuit matched to duct-free cooling only fan coil units.

3. Starters and Isolators

The requirements for starters and isolators are:

- | | | | |
|----|---------------|---|--|
| a. | Enclosure | – | Weatherproof
NEMA Type 4 Watertight |
| b. | Starting Type | – | Direct On Line for mini
split ac condensing units |
| c. | Control | – | Remote Control units . |

2.1.3 Quality Assurance

1. The unit shall be tested by a Nationally Recognised Testing Laboratory
2. Unit shall be wired in accordance with the National Electrical Code (NEC) and Locally accepted codes
3. The unit shall be rated in accordance with the Air Conditioning , Heating and Refrigeration Institute (AHRI) Standard 240 and bear the ARI Certification Label
4. The unit shall be manufactured in a Facility registered to ISO9001 and ISO 14001
5. The outdoor unit shall be pre charged with R-410a for 70 ft of refrigerant tubing
6. Units shall be evaluated in accordance with UL standard 1995.
7. Units shall be listed in the CEC directory.
8. Unit cabinet shall be capable of withstanding 500-hour salt spray test per Federal Test Standard No. 141 (method 6061).
9. Air-cooled condenser coils shall be leak tested at 573 psig.

2.1.4 Delivery, Storage, and Handling

Units shall be shipped in one piece and shall be stored and handled per unit manufacturer's recommendations.

3 WARRANTY

The units shall have the manufacturer parts and Defects warranty for a period of five (5) years from the date of installation . The compressor shall have a warranty of five years from the date of installation if during this period any part should fail to function properly due to defects in workmanship or materials , It shall be repaired or replaced at the discretion of the manufacturer

4 PRODUCTS

4.1 AIR COOLED CONDENSING UNIT

4.1.1 Design

1. The outdoor unit shall be compatible with the indoor wall mount evaporator and shall be of the same capacity
2. The outdoor unit shall be equipped with an electronic controlled circuit board that interface with the indoor unit to perform all necessary operation functions

3. The outdoor unit shall be able to operate with a maximum height difference of 100 ft between outdoor and indoor units
4. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the variable speed compressor.

4.1.2 Cabinet

1. Unit cabinet shall be constructed of galvanized steel, finished with an electrostatically applied thermally fused acrylic or polyester powder coating for corrosion protection
2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
3. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.

4.1.3 Fan

1. Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall draw air through the outdoor coil.
2. Outdoor fan motors shall be totally-enclosed, single phase motors with class B insulation and permanently-lubricated ball bearings. Motor shall be protected by internal thermal overload protection.
3. Fan blades shall be of aerodynamic design for quiet operation and the fan motor bearing shall be permanently lubricated
4. Outdoor fan openings shall be equipped with PVC metal/mesh coated protection grille over fan

4.1.4 Coil

1. The condenser coil shall be of copper tubing with flat aluminium fins to reduce debris build up and to allow maximum air flow
2. The coil shall be protected with an integral metal guard
3. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) . The LEV shall be controlled by a microprocessor controlled step motor
4. All refrigerant lines between the condenser and the evaporator shall be of annealed refrigeration grade copper tubing ARC Type meeting ASTM B280 requirements . . Individually insulated in twin tube flexible closed cell CFC free elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU –inch/hour per sq ft /degree F

4.1.5 Compressor

1. Compressor shall be a frame compliant Scroll compressor with Variable speed Inverter drive technology.
2. The compressor shall be driven by inverter circuit to control compressor speed . The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system
3. To prevent liquid from accumulation in the compressor during the off cycle a minimal amount of current shall be automatically , intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant
4. Internal overloads shall protect the compressor from over-temperature and over-current.
5. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
6. Compressor assembly shall be installed on rubber vibration isolators.

4.1.6 Electrical

1. The electrical power to the unit shall be 230 V , 1 Phase, 3 wire , 60 Hz. The unit shall be capable of satisfactory operation within voltage limits 187 V to 253 V
2. Power for the indoor unit shall be supplied from the Outdoor unit using three 14 gauge AWG conductors plus ground
3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit

4.2 INDOOR WALL MOUNTED AND CEILING MOUNT CASSETTE TYPE DUCTLESS UNIT

1. Indoor, direct-expansion, wall-mounted or ceiling mount cassette fan coil. Unit shall be complete with cooling/heating coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral mounting bracket and mounting hardware.
2. Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.
3. Fan shall be tangential direct-drive blower type with air intake at the top of the unit and discharge at the bottom front for high wall units and air intake and discharge on the finished face of the cassette unit . Knockouts for

fresh air supply should be provided for the cassette type units . Automatic, motor-driven air sweep shall be provided standard.

4. Air sweep operation shall be user selectable. The vertical sweep may be adjusted (using the remote control) and the horizontal air direction may be set manually. Coil shall be copper tube with aluminium fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection. Units shall be equipped with condensate pumps.
5. Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.
6. Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 62_F to 84_F (16.67_C to 28.89_C).
7. The unit shall have the following functions as a minimum:
 - An automatic restart after power failure at the same operating conditions as at failure.
 - A timer function to provide a minimum 24-hour timer cycle for system Auto Start/Stop.
 - Temperature-sensing controls shall sense return air temperature.
 - Indoor coil freeze protection.
 - Wireless infrared remote control to enter set points and operating conditions.
 - Automatic air sweep control to provide on or off activation of air sweep louvers.
 - Dehumidification mode shall provide increased latent removal capability by modulating system operation and set point temperature.
 - Fan-only operation to provide room air circulation when no cooling is required.
 - Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.
 - Fan speed control shall be user-selectable: high, medium, low, or microprocessor controlled automatic operation during all operating modes.
 - Units shall have filter track with factory-supplied cleanable filters.
 - Units shall have a minimum listed SEER (seasonal energy efficiency ratio) of 13 at ARI conditions.
 - All units shall have refrigerant lines that can be oriented to connect from the left, right or back of unit. Both refrigerant lines shall be insulated.

5 CONDENSATE DRAIN

The condensate drain line shall be PVC and of the size shown in the Drawings. A static trap shall be provided in each drain line. Condensate pumps shall be provided for all drain pans . Traps and pipes shall be arranged for easy rodding or draining and shall be accessible.

6 SYSTEM TESTS

1. Air Conditioning System – The entire Air Conditioning system shall be tested at the completion of the building and it shall be established that all controls are calibrated accurately and performing satisfactorily and that all units are cooling satisfactorily. The system shall be checked for vibration and excessive noise and all such conditions corrected.
2. Ventilation System - The entire ventilation system shall be tested at the completion of the project and it shall be established that controls are performing satisfactorily and that all rooms are ventilating properly. The systems shall be checked for vibration and excessive noise and all such conditions corrected.
3. Final Clean – up - At the completion of all work all equipment on the project shall be checked and thoroughly cleaned including coils, plenums, under equipment and any and all other areas around or in equipment provided under this section. Any filters used during construction shall be replaced with new filters during final clean up.
4. Painting - At the completion of all work all equipment on the project shall be checked for painting damage and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal or especially covered areas that have been deformed shall be replaced with new material and repainted to match the adjacent areas.

PREAMBLE TO BILLS OF QUANTITIES

1. GENERAL

Attention is directed to the Instructions to Tenders, the Form of Contract, Conditions of Contract, Specifications and Drawings. These documents are to be read in conjunction with the Bills of Quantities.

2. PRICING AND MEASUREMENTS

- (a) The prices and rates to be inserted in the Bills of Quantities are to be the full inclusive value of the work described under the several items, including all costs and expenses which may be required in and for the construction of the work described, together with all general risks, liabilities and obligations set forth or implied in the documents on which the tender is to be based; where special risks, liabilities and obligations cannot be dealt with as above, then the price thereof is to be separately stated in the item or items provided for the purpose.
- (b) A price or rate is to be entered against each item in the Bills of Quantities, whether quantities are stated or not. Items against which no price is entered are to be considered as covered by the other prices or rates in the bills.
- (c) Any special methods of measurement used are stated at the head of or in the text of the Bills of Quantities for the trades or items affected. All other items are measured net in accordance with the Drawings and no allowances have been made for waste.
- (d) All measurements in the Bills are taken strictly net. The principle of net measurement shall apply to all work executed under the Contract and no claims for extras based upon other methods of measurement will be entertained.
- (e) The prices and rates entered in Bills of all Electrical Works shall include the following:
 - (i) Installation of fixtures, inserts, anchors, hangers, supports, solvent cements, protection, pull wires, etc.
 - (ii) Excavation, backfilling, compaction including all equipment used for completion of work, etc.
 - (iii) All chasing, cutting, recess, etc.

3. REFERENCE TO SPECIFICATIONS

- (a) General directions and descriptions of work and materials given in the Specifications are not necessarily repeated in the Bills of Quantities. Reference is to be made to the Specifications for this information.

4. PREPARATION OF TENDERS

In preparing his Tender and pricing the items in the Bills, the Tenderer must cover himself and shall be deemed to have covered himself for:

- (a) All services and materials which according to the true intent and meaning the Contract Documents may reasonably infer as necessary for carrying out in a good and workmanlike manner the Works shown upon the Drawings and described in the Specifications whether expressly mentioned therein or not, and
- (b) All duties, obligations, liabilities and responsibilities which any of the Contract Documents place upon the Contractor in connection with or in relation to this Contract.
- (c) The Tenderer shall insert against each item in the Bills such rates and prices as he may deem necessary to cover the above requirements. Items shall not be bracketed together and where no rate or price is inserted against any item in the Bills the cost thereof shall be deemed to have been included and spread proportionately over all items priced by the Tenderer.
- (d) Unless separate items are provided the cost of all specified tests and the supply of all tests certificates shall be included in the rates in the Bills of Quantities.

5. CONTRACTOR'S OBLIGATION

The information in the Contract Documents as to the whereabouts of existing services and mains is believed to be correct but the Contractor shall not be relieved of his obligations under the Conditions of Contract. The Contractor shall include in his rates for keeping the Engineer informed of all arrangements he makes with the Statutory Bodies as appropriate and for ensuring that no existing mains and services are interrupted without the written consent of the appropriate authority.

6. QUANTITIES

- (a) Quantities stated in the Bills are estimated only. They are given in order that the Tenders may be both made out and compared on an equal basis and there is no guarantee that such quantities will in fact be required.
- (b) The Tenderer shall satisfy himself as to the quantities involved, including materials and equipment, and conditions of work involved having due regard to the fact that the description of the quantities of work and materials as included in the Bills of Quantities, is brief and is intended only to indicate the general nature of the work and to identify the said quantities with the detailed requirements of the Contract Documents. The quantities given in the Bills form no part of the contract and are only approximate. In no circumstance shall such quantities be considered as limiting or extending the amount of the work to be done by the Contractor and material to be supplied by him.

7. CLAIMS FOR FURTHER PAYMENTS

- (a) The Contractor shall have no claims for further payment in respect of any work or method of execution which may be described in the Contract although no item appears in the Bills of Quantities which specifically corresponds to the said work or method of execution.

8. REQUEST FOR INFORMATION

If the prices for items or work, in the opinion of the Engineer, are not realistic prices for that particular item of work, the Engineer may request additional information to substantiate the prices or reject the Tender.

9. TENDER RATES

The rates entered by the Tenderer in the Bills for taking delivery of materials from the Employer shall include inter alia for taking delivery, transporting to site, storing, etc. and no separate claims for profits, etc. on the cost price of such materials will be entertained.

10. COMPLETION OF BILLS OF QUANTITIES

All blank spaces in the Bills of Quantities and the Form of Tender must be filled in, in ink, in both words and figures where required. No change will be made in the phraseology of the forms. In cases of discrepancy between the amounts stated in words and amounts in figures the former shall govern.

11. P.C. SUMS

- (a) No items for which a P.C. sum is inserted shall be undertaken by the Contractor until the Engineer has given written instructions to this effect. The Contractor may be required to obtain competitive quotations and samples if required and shall submit these to the Engineer for approval. The Contractor shall produce to the Engineer the receipted accounts for all articles purchased under P.C. sum items and the amounts paid to the Contractor shall correspond with the amounts of such accounts including any discount for cost. No payments to the Contractor shall be made in respect of P.C. sum items until the said receipts have been presented to the Engineer. It shall be the duty of the Contractor to make an application to the Engineer sufficiently in advance of the progress of the work for instruction with regard to each P.C. sum item.
- (b) P.C. sums inserted in the Bills in respect of materials to be specially imported for the Contract by the Contractor shall be deemed to include insurance, freight, dock and all other charges involved in clearing materials from the docks. In the case of imported materials obtained through a manufacturer's agent in Trinidad, the P.C. sums shall be deemed to include in addition the agent's fees and charges.

BILLS OF QUANTITIES

REFURBISHMENT OF THE RESIDENCE FOR THE INDIAN HIGH COMMISSIONER

BILLS OF QUANTITIES

ITEM	DESCRIPTION OF WORKS	MATERIAL COST US\$	LABOUR COST TT\$	TOTAL COST TT \$
A	PRELIMINARIES			
1.0	Protection of Public and Private Services			
2.0	Provision of Site Supervision			
3.0	Provision of Plant Equipment and tools			
4.0	Provision of Transport			
5.0	Compliance with Statutory regulations , Local Codes , Government Electrical Inspectorate Requirements , etc			
6.0	Include for Attendances			
7.0	Include for Guarantees and Warrantees			
8.0	Provide Cranage , Haulage, Scaffolding, Ladders, Lifting equipment and Safety Personnel and Protective Equipment			
9.0	Include for Bonds , Insurances , Public Liability and Workmen's Compensation			
	PRELIMINARIES - A CARRIED TO SUMMARY			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
B	PROVISIONS			
1.0	Provide for submission of Maintenance Manuals , tage , charts,Instructions, Electrical and Contriol Wiring Diagrams, Shop Drawings for Dusting and Equipment Installations, Fabrication Drawings enclosed in a hard cover ring Binder together with a Digital Copy on CD			
2.0	Include for Coordination with other Trades			
3.0	Include for Cleaning and Painting			
4.0	Include for Maintenance and Defects Liability Period			
5.0	Include for system Testing , adjusting, commissioning and demonstrations			
6.0	Include for submission of As built Drawings in hard copy and Soft Copy Digital Format. Drawings shall be in Autocad			
7.0	Include for Builders Work			
8.0	Include for cleanup			
	CARRIED TO SUMMARY - B PROVISIONS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
C	EQUIPMENT AND SYSTEMS			
1.0	Supply and install 5 No 12000			
	BTU Mini Split Inverter type			
	HIGH WALL AC units			
2.0	Include for condensate piping			
3.0	Include for electrical wiring for			
	supply to the units from the			
	isolator located within 3 metres			
4.0	Supply and install 1 No. 18000			
	BTU Inverter type Mini Split			
	High wall AC unit			
5.0	Include to condensate piping			
6.0	Include for copper piping and			
	insulation			
7.0	Include for electrical wiring for			
	supply to the units from the			
	isolator located within 3 metres			
8.0	Supply and install 1 No. 9000			
	BTU Inverter type Mini Split			
	ceiling cassette type AC unit			
9.0	Include to condensate piping			
10.0	Include for copper piping and			
	insulation			
11.0	Include for electrical wiring for			
	supply to the units from the			
	isolator located within 3 metres			
12.0	Supply and install 2 No 12000			
	BTU Mini Split Inverter type			
	Ceiling Cassette Type AC unit			
13.0	Include to condensate piping			
14.0	Include for copper piping and			
	insulation			
	CARRIED FORWARD - C - EQUIPMENT AND SYSTEMS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
C	BROUGHT FORWARD - C-EQUIPMENT AND SYSTEMS			
15.0	Include for electrical wiring for supply to the units from the isolator located within 3 metres			
16.0	Supply and install 2 No. 18000 BTU Inverter type Mini Split ceiling Castette type AC unit			
17.0	Include to condensate piping			
18.0	Include for copper piping and insulation			
19.0	Include for electrical wiring for supply to the units from the isolator located within 3 metres			
20.0	Supply and install 1 No. 30000 BTU Inverter type Mini Split ceiling Casette Type AC unit			
21.0	Include to condensate piping			
22.0	Include for copper piping and insulation			
23.0	Include for electrical wiring for supply to the units from the isolator located within 3 metres			
24.0	Supply and install 1 No. 42000 BTU Inverter type 2 ZONE Multi Split ceiling Casette Type AC unit with 1 No 24000 BTU and 1 No 18000 BTU Evaporators			
25.0	Include to condensate piping			
26.0	Include for copper piping and insulation			
27.0	Include for electrical wiring for supply to the units from the isolator located within 3 metres			
	CARRIED FORWARD - C - EQUIPMENT AND SYSTEMS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
C	BROUGHT FORWARD - C EQUIPMENT AND SYSTEMS			
28.0	Include for the supply and installation of Mounting brackets for 13 No air conditioning condensers and Evaporators as detailed above			
29.0	Supply and Install 9 No 200 CFM, 230 V, 1 Phase , ceiling mounted Exhaust Fans in toilets as per drawings			
30.0	Include for ducting from Exhaust Fans above ceiling to wall mounted exhaust grilles as per drawings for 9 No Fans			
31.0	Include for wiring from existing light switch circuit in Toilet			
32.0	Include for breaking of wall for installation of exhaust grilles and making good wall after installation of grille			
33.0	Supply and install external wall grilles for exhaust fans as per drawings			
34.0	Supply and install ducting for range hoods for Kitchen as per drawing			
35.0	Supply and install 2 No 36" range hoods for kitchen as per drawing			
36.0	Include for the supply and Installation of exhaust grilles for Range Hoods			
37.0	Include for wiring to Range Hoods as per drawings			
38.0	Include for Mounting Brackets			
	CARRIED TO SUMMARY - C EQUIPMENT AND SYSTEMS			

ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
D	COMMISSIONING AND STARTUP			
1.0	Include for leak testing of piping			
2.0	Include for testing of Condensing Units			
3.0	Include for testing of indoor air units			
4.0	Include for system startup			
5.0	Include for measurement of indoor conditions and make adjustments as required			
	CARRIED TO SUMMARY -D COMMISSIONING AND STARTUP			
ITEM	DESCRIPTION OF WORKS	MATERIAL COST TT\$	LABOUR COST TT\$	TOTAL COST TT \$
	SUMMARY			
A	PRELIMINARIES			
B	PROVISIONS			
C	EQUIPMENT AND SYSTEMS			
E	COMMISSIONING AND START UP			
	SUB TOTAL			
	ADD 10 % CONTINGENCY			
	ADD VAT			
	TOTAL CARRIED TO TENDER SUMMARY			\$ -