INVITATION FOR BIDS

High Commission of India
Colombo, Sri Lanka
Grant No. Col/DC/228/11/2017

Invites bids from qualified ICTAD registered C3 or above (Building) Sri Lankan bidders and Indian bidders who are equivalent to C3 or above (Building) to undertake the “Construction of Auditorium, Dining Hall and Car Park at Pool Bank Vocational Training Center Hatton” estimated cost of SLR 130 Million (Excluding VAT).

Bid documents can be collected from the High Commission of India No. 36-38, Galle Road, Colombo-03 for a fee of Rs.5,000/- per document on any working day from 10.00 AM to 4.00 PM from 15 July 2019 to 01 August 2019 (Contact No. 077-1304611 / 011-2395007). These Documents can also be seen on the Mission’s website www.hcilcolombo.org before purchasing them.

The last date for submission of sealed Bids with all prescribed documents is 3.00 pm on 09 August 2019. Bids will be opened on the same day at 3.30pm.
Grant Name: Construction of Auditorium, Dining Hall and Car Park at Pool Bank Vocational Training Center Hatton

<table>
<thead>
<tr>
<th>Bid No</th>
<th>Description of Work</th>
<th>Estimated Cost/ (Rs in millions)</th>
<th>Contract Period</th>
<th>Required Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Col/DC/228/04/2016</td>
<td>Construction of Auditorium, Dining Hall and Car Park at Pool Bank Vocational Training Center Hatton</td>
<td>130 million</td>
<td>16 months</td>
<td>C3 and above</td>
</tr>
</tbody>
</table>

1. Government of India has approved a grant for Construction of Auditorium, Dining Hall and Car Park at Pool Bank Vocational Training Center Hatton and intends to apply part of the proceeds of this grant to payments under the Contract named above. The project consists of a 4 storied building with parking area on the ground floor, VIP guest rooms and stores on the upper ground floor, dining area on the 1st floor and an auditorium for 250 persons on the 2nd floor. With a total floor area of 18,784 sq.ft. and estimated to cost Rs. 130 Million. The building is on split levels with retaining walls at all levels. The structure is in concrete with hollow block/ brick walls and the roof is a steel structure with zinc alum roofing sheets. Walls are plastered and painted and floors are tiled.

2. Counsellor (Development Cooperation) on behalf of the High Commission of India now invites sealed bids from eligible and qualified bidders for construction of the above under national competitive bidding procedure.

3. The technical bid (Original & Duplicate) and the financial bid (Original & Duplicate) documents should be sealed by the bidder in separate covers duly superscribed and these four sealed covers are to be put in a bigger cover which should also be sealed and duly superscribed and marked “Construction of Auditorium, Dining Hall and Car Park at Pool Bank Vocational Training Center Hatton”.

4. To be eligible for contract award, the successful bidder shall not have been blacklisted and shall meet the requirements of ICTAD/CIDA registration as above.

5. Qualification requirements are indicated in the Bidding document. Additional details are provided in the Bidding Data & Contract Data.

6. The tender documents can be seen on the Mission’s website www.hcicolombo.org.

7. A complete set of Bidding Documents in English language may be purchased by interested bidders from the Development Cooperation wing, High Commission of India, 36-38, Galle Road, Colombo-03 from 15 July 2019 to 01 August 2019 between 0930 hrs and 1600 hrs upon payment of a nonrefundable fee of Rs. 5000/-. The payment should be made in cash.
8. Pre Bid conference will be held at the High Commission of India, 36-38, Galle Road, Colombo-03 commencing at **1500 Hrs** on **29 July 2019**.

9. Bids shall be submitted by hand to **Project Officer (Development Cooperation)** on behalf of the High Commission, 36-38, Galle Road, Colombo-03 on or before **1500 hrs on 09 August 2019**. Late bids will be rejected. Technical bids will be opened soon after closing, at **1530 hrs on 09 August 2019** at the same venue in the presence of the bidders' representatives.

10. Each bidder shall provide the name and contact details of an individual to act as a point of contact during the tender process. That person may be asked to clarify the bid to provide additional information during the evaluation process.

11. The High Commission of India, Colombo shall issue a corrigendum addressing all issues clarified during the pre bid conference.

12. Only communications that are in writing from the High Commission of India, Colombo may be considered as properly authorized expressions on the Mission's behalf.

13. In submitting a bid to the Mission, the bidder will be deemed to have understood this bidding document, obtained all requisite information and verified the correctness of any information to be relied upon.

14. In submitting a bid to the Mission, the bidder will be deemed to be fully informed and to have accepted the terms and conditions outlined in this tender document.

15. The bidding company and its sister company or subsidiary should not bid separately in the same bid. A certificate to this effect should be given by the bidding company at the time of bidding.

16. The decision of High Commission of India in deciding the eligibility of the company to take part in the tender process is final. The Mission reserves the right to accept or reject any or all Bid(s) and to annul the bidding process, at any time, thereby rejecting all bids, prior to any Contract being awarded.

17. The High Commission of India, Colombo reserves the right to clarify without restriction with bidders on any matter contained in the bids, without disclosing this to any other person.

18. The bidders should note that in the event of Contract having been awarded, the contractor will not assign in whole or in part its rights or obligations without the prior approval of the Mission.

19. The contract will also include provisions for the bidding company to adhere to all local laws applicable. The contract will also include provisions of Force Majeure, termination of contract, consequences of termination and re-tendering after termination of contract.

20. Any dispute or difference regarding the interpretation of the provisions of the Agreement/Contract shall be resolved amicably between the parties. If the dispute is not resolved through mutual consultations within a period of six months, either party may refer the dispute to arbitration in accordance with the Arbitration & Conciliation Act 1996 of India as amended from time to time. The number of arbitrators shall be one and that the place of arbitration shall be New Delhi, India. In such a situation the applicable law will
be the law of India. The language of the Tribunal shall be English. The cost shall be borne by the parties equally unless otherwise determined by the Arbitral Tribunal.

21. The Bid shall be valid up to 120 days from the date of closing of bids. All bids shall be accompanied by a Bid Security as in the Bidding Data.

Counsellor (Development Cooperation)
High Commission of India
VOLUME 1

Section 1 – Instructions to Bidders

Section 3 – Conditions of Contract

Section 5 – Standard Forms (Contract)
Section - 1

INSTRUCTIONS TO BIDDERS

Notes:
Instructions to Bidders shall be read in conjunction with Bidding Data under Section 2 (Volume 2). Matters governing the performance of the Contractor, payments under the Contract, or matters affecting the risks, rights and obligations of the parties under the Contract are included under Section 3 - Conditions of Contract (Volume 1) and Contract Data under Section 4 (Volume 2). However, a few such information is reproduced in this section to facilitate the bidders to price their bids.

Instructions to Bidders will not be a part of the Contract and will cease to have effect once the Contract is signed.

Note:
Please refer Volume 1 of the CIDA Standard Bidding Document, Procurement of Works, Major Contracts, CIDA/SBD/02, Second Edition - January 2007 including Addendum No.01October 2009 (not attached with this document) for the following sections

Section 01 - Instructions to Bidders
Section 03 - Conditions of Contract
Section 05 - Standard Forms (Contract)
Section -3

CONDITIONS OF CONTRACT

Conditions of Contract shall be read in conjunction with the Section 4 - Contract Data in Volume 2, which shall take precedence over the Conditions of Contract

Note:

Please refer Volume 1 of the CIDA Standard Bidding Document, Procurement of Works, Major Contracts, CIDA/SBD/02, Second Edition -January 2007 including Addendum No. 1 , October 2009(not attached with this document) for the following sections

   Section 01  - Instructions to Bidders
   Section 03  - Conditions of Contract
   Section 05  - Standard Forms (Contract)
Section - 5

STANDARD FORMS (CONTRACT)

Letter of Acceptance
Agreement
Performance Security
Advance Payment Security

Note:

Please refer Volume 1 of the CIDA Standard Bidding Document, Procurement of Works, Major Contracts, CIDA/SBD/02, Second Edition -January 2007 including Addendum No. 1 October 2009 (not attached with this document) for the following sections

Section 01  - Instructions to Bidders
Section 03  - Conditions of Contract
Section 05  - Standard Forms (Contract)
FORM OF LETTER OF ACCEPTANCE

[Letter heading paper of the procuring entity]

----------------------------------------
(date)
----------------------------------------

To: [name and address of the Contractor]

This is to notify you that your bid dated [insert date] for the construction and remedying defects of the [name of the Contract and identification number] for the Contract price of [name of currency] [amount in figures and words] as corrected in accordance with Instructions to Bidders and / or modified by a Memorandum of Understanding, is hereby accepted.

The adjudicator shall be [name and address of the Adjudicator, if agreed] / shall be appointed by the Institute for Construction Industry Development Authority (CIDA).

You are hereby instructed to proceed with the execution of the said Works in accordance with the Contract documents.

The Start Date shall be: [fill the date as per Conditions of Contract].

The amount of Performance Security is: [fill the amount as per Conditions of Contract].

The Performance Security shall be submitted on or before [fill the date as per Conditions of Contract].

Authorized Signature: [fill the signature]

Name and title of Signatory: [fill the title]

Name of Agency: [fill the name of agency]
FORM OF AGREEMENT

This Agreement made the .......... [day] of ............... [month] 200..... [year], between ........................................... [name and address of Employer] (hereinafter called and referred to as “the Employer”), of the one part, and ................................................................. [name and address of Contractor] (hereinafter called and referred to as “the Contractor”), of the other part:

Whereas the Employer desires that the Contractor execute ........................................... [name and identification no of Contract][hereinafter called and referred to as “the Works”) and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and remedying of any defects therein.

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract.

2. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract.

3. The Employer hereby covenants to pay the Contractor in consideration of executing and completing the Works and remedy any defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

4. The Agreement shall include the following annex documents;

   1. Annex – 1 Letter of acceptance
   2. Annex – 2 Performance Bond
   3. Annex – 3 Advance payment guarantee
   4. Annex – 4 Contractor’s All Risk Policy
   5. Annex – 5 Workmen’s Compensation Policy
   6. Annex – 6 Construction Work Programme

In Witness whereof the parties hereto have caused this Agreement to be executed the day and year aforementioned in accordance with laws of Sri Lanka.

..................................................  ..................................................
Authorized signature of Contractor       Authorized signature of Employer

COMMON SEAL                              COMMON SEAL

In the presence of Witnesses:

1. Name and NIC No. ..................................................
   Signature ..............................................................
   Address ................................................................

2. Name and NIC No. ..................................................
   Signature ..............................................................
   Address ................................................................
FORM OF PERFORMANCE SECURITY
(Unconditional)

Name and Address of Issuing Branch or Office

Beneficiary: Name and Address of Employer

Date: 

PERFORMANCE SECURITY No.: 

We have been informed that [name of Contractor] (hereinafter called "the Contractor") has entered into Contract No. [reference number of the contract] dated with you, for the [insert "construction"] of [name of contract and brief description of Works] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we [name of Agency] hereby irrevocably and unconditionally undertake to pay you any sum or sums not exceeding in total an amount of [amount in figures] [amount in words], upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the … day of 20---- [insert date, 60 days beyond the end of the defects Notification period] and any demand for payment under it must be received by us at this office on or before that date.

[signature(s)]
FORM OF ADVANCE PAYMENT SECURITY

-------------------------------------------------------------------------------------------------------------------------- [Bank’s Name, and address of Agency, and Address of Issuing Branch or Office]

Beneficiary:  --------------------------------------------------------------------------------------------------------------- [Name and Address of Employer]

Date:  ----------------------------------------------------------

ADVANCE PAYMENT GUARANTEE No.:  ----------------------------------

We have been informed that ___________________________________________________________ [name of Contractor] (hereinafter called “the Contractor”) has entered into Contract No. ______________________ [reference number of the contract] dated ____________ with you, for the _______________ construction of ___________________________________________[name of contract and brief description] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum ______________________ [amount in figures] (__________________________) [amount in words] is to be made against an advance payment guarantee.

At the request of the Contractor, we _________________________________________ [name of issuing agency] hereby irrevocably and unconditionally undertake to pay you any sum or sums not exceeding in total an amount of ______________________ [amount in figures] (__________________________) [amount in words] upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation in repayment of the Advance payment under the Contract.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor.

This guarantee shall expire on __________________________ [Insert the date, 60 days beyond the Intended Completion Date]

Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

____________________ [signature(s)]
VOLUME 2
SECTION - 2

BIDDING DATA


Note:

This section shall be read in conjunction with Section 1 - Instructions to Bidders and is intended to provide specific information in relation to corresponding clauses in Section 1. Whenever there is a discrepancy, the provisions in Section 2 - Bidding Data shall supersede these provided in the Section 1 - Instructions to Bidders.
Bidding Data

Instructions to Bidders
Clause Reference

1.1 Employer’s Name and Address

Name: The High Commission of India
Address: No. 36-38, Galle Road, Colombo 03.

Employer’s Representative

Name: Secretary
Address: Ministry of Hill Country New Villages Infrastructure & Community Development
No. 45, St. Michael’s Road, Colombo 03.

Scope of Works: The project consists of a 4 storied building with parking area on the ground floor, VIP guest rooms and stores on the upper ground floor, dining area on the 1st floor and an auditorium for 250 persons on the 2nd floor. With a total floor area of 18,784 sq.ft. The building is on split levels with retaining walls at all levels. The structure is in concrete with hollow block/brick walls and the roof is a steel structure with zinc alum roofing sheets. Walls are plastered and painted and floors are tiled.

1.2 Time for Completion

The Time for Completion for the whole of works shall be 16 months from the commencement date.

2.1 Source of funds -
The source of funds is Indian Government

4.1 Qualification Information

Following information shall be provided in Volume 3 of the Bidding Document
- CIDA Registration;
  - Registration number
  - Grade
  - Specialty
  - Expiry Date
- Quality Assurance Certificates
- VAT Registration number
• Construction Work Programme
• Attach Legal Status – attach certified copies of Memorandum of Articles/ Associations and details of company registration/ Incorporation of the company/ Business Registration.
• Authorization to sign/ commit the Bid – attach Power of Attorney or certified copy of Board Resolution as appropriate.
• Total monetary value of construction work performed for the last five years (to be confirmed by submission of Audited Financial Reports as proof for Item 4.2 (b) below).
• Experience in work of a similar nature and size for the last five years (as proof for Item 4.2 (c) below).
• Experience in building construction work with green concept.
• Major items of construction equipment proposed to carry out the Contract.
• Qualifications and experience of key Site Management, Project Management and Technical Personnel proposed for the Contract (as per 4.2(e)below).
• Details of credit facilities (as per 4.2(f)below).
• Details of work in hand (as per 4.2(h) below).
• Documentary proof showing the total value of work in affidavit form.
• Method Statement and all technical information.
• Proposed sub contractors’ details by the bidder.

4.2(a)  CIDA Registration Required

• Specialty – Building Construction
• Grade – C3 or above

4.2(b)  Average annual volume of building construction work performed in last 5 years average shall be at least Rs.146 Million.

4.2(e)  Experience in construction at least one building of similar nature, value and complexity equivalent to the proposed building work and value of at least Rs. 104 Million completed within 365 Days or higher value project within a proportionate period completed during the last Five (5) years.

4.2(e)  Qualifications and experience of the Staff employed by Contractor

Project Manager: Civil Engineer with B. Sc. Eng. (Civil) + 10 Years’ experience, visiting the site minimum once a week.

Site Engineer :B. Sc. Eng. (Civil) + 5 years post qualifying experience or National Diploma in civil engineering with 10 years’ experience. (full time)
Liquid assets and/or credit facilities required
The minimum amount of liquid assets and/or credit facilities, net of other contractual commitments and exclusive of any advance payments which may be made under the Contract, shall be not less than Rs.24 million.

Details of Work in Hand
Documentary proof to establish the availability of Working Capital requirement for the work in hand should be furnished.

Clarification of Bidding Documents
Employer’s address for clarification of bidding documents is:
Name of Officer: Counsellor, Development Cooperation, High Commission of India, 36-38, Galle Road, Colombo-3.
E-Mail : dc.colombo@mea.gov.in

Any queries to be raised outside the Pre-bid Meeting may be by electronic mail. Also the responses to such queries shall be conveyed to all Bidders, provided that queries are received within 7 Days before the closing the Bids.

Adjustment for change of cost
The Contract is not subjected to price adjustment

Period of Bid Validity
The Bid shall be valid up to 120 days from the date of closing the bid.

Amount of Bid Security
The amount of Bid Security is Sri Lanka Rupees 2,600,000/-

Validity of Bid Security
1. The Bid Security shall be valid up to 165 days
2. The Bid Security shall be irrevocable and unconditionally encashable upon the first written Demand from the Employer. The Bid Security shall be issued by a licensed commercial bank acceptable to the employer using the form of Bid Security in Section 11, Standard Forms
21.2 (a) **Pre-Bid meeting**
A Pre- Bid meeting will be held as follows:

Date: **29 July 2019**  
Time: 1500 hrs  
Venue: The High Commission of India, 36-38, Galle Road, Colombo -03

**Employer’s Address for Bid submission**

The Employer’s address for the purpose of Bid submission is

Name : The High Commission of India  
Address : No. 36-38, Galle Road, Colombo 03

21.2 (b) **Identification number of Contract**

Identification Number of the Contract is:.........................

22.1 **Deadline for submission of Bids**

Deadline for submission of Bids shall 1500 hrs. on 09 August 2019

25.1 **Bid opening**:

Venue: Name : The High Commission of India  
Address : No. 36-38, Galle Road, Colombo 03  
Time : 1530 hrs  
Date : 09 August 2019.

35.1 **Amount of Performance Security**

The Standard Form of Performance Security shall as per the format given in Section 5, and shall be a **Guarantee Irrevocable, Unconditional and en cashable on first written Demand** from a licensed commercial bank in Sri Lanka

The amount of Performance Security is 5% of the Initial Contract Price. The Performance Security Shall be valid until 60 Days beyond the expire date of Defects Notification Period.
FORM FOR AFFIDAVIT FOR THE CURRENT COMMITMENTS

………………………….
………………………….
………………………….

In accordance with the Clause No. 4.2.(f) of Bidding Data, I (We) declare that the outstanding Contract Commitments of
………………………………………………. (Name of the Bidder) are as follows. I (We) further declare that all the outstanding contract commitments are listed below.

<table>
<thead>
<tr>
<th>Name of the Contract</th>
<th>Name of the Client</th>
<th>Initial Contract Amount (Rs.)</th>
<th>Outstanding Work (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

……………………………………………….
Authorized Signature and the Stamp

Attested by :
Section 3 – Conditions of Contract

Section 3 – Conditions of Contract which is a part of the BIDDINGDOCUMENT - PROCUREMENT OF WORKS MAJOR CONTRACTS, CIDA Publication No. CIDA/SBD/02 (Second Edition, January 2007 including Addendum No.01 October 2009 (not attached with this document) ) published by the Institute for Construction, Training and Development (ICTAD) – Predecessor to Construction Industry Development Authority (CIDA), “Savsiripaya”, 123, Wijerama Mawatha, Colombo 07.

It is implied that the bidders/contractors are fully acquainted with the above set of documents and therefore, it will not be issued to the bidders/contractors under this Bid.

However, the bidders/contractors may purchase this set of Documents if necessary, from the Construction Industry Development Authority (CIDA), “Savsiripaya”, 123, Wijerama Mawatha, Colombo 07.
Note:

This Section shall be read in conjunction with Section 3 – Conditions of Contract, and is intended to provide specific information in relation to corresponding clauses in Section 3. Whenever there is a discrepancy, the provisions in Section 4 – Contract Data shall supersede those provided in the Section 3 – Conditions of Contract.
## CONTRACT DATA

**Note:** The clause numbers referred are the clause numbers of Conditions of Contract.

### Conditions of Contract Clause Number/s

<table>
<thead>
<tr>
<th>Clause</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.2.2 &amp; 1.3</td>
<td>Employer’s Name and Address&lt;br&gt;Name: The High Commission of India&lt;br&gt;Address: 36-38, Galle Road, Colombo-3</td>
</tr>
<tr>
<td>1.3</td>
<td>Employer’s Representative&lt;br&gt;Secretary, Ministry of Hill Country New Villages Infrastructure &amp; Community Development</td>
</tr>
<tr>
<td>1.3</td>
<td>Contractor’s Name and Address&lt;br&gt;Name: ………………………..&lt;br&gt;Address: …………………………..</td>
</tr>
<tr>
<td>1.1.2.4 &amp; 1.3</td>
<td>Engineer’s Name and Address&lt;br&gt;DH Wijewardene Associates&lt;br&gt;No. 176, Dutugemunu Street, Kohuwala</td>
</tr>
<tr>
<td>1.1.3.3</td>
<td>Time for Completion of the Works&lt;br&gt;Time for Completion is <strong>16 months</strong></td>
</tr>
<tr>
<td>1.1.3.7</td>
<td>Defects Notification Period&lt;br&gt;Defects Notification Period is <strong>365 Days</strong></td>
</tr>
<tr>
<td>2.1</td>
<td>Right to access to the Site&lt;br&gt;Within <strong>14 Days</strong> after Letter of Acceptance</td>
</tr>
</tbody>
</table>
3.1 **Engineer’s Duties and Authority**  
Engineer shall obtain the specific approval of the Employer before taking action under the following Sub-Clauses of these Conditions.

(a) Clause 13 where the final effect of the variations increase does affect the Contract Price.  
(b) Variation that involves a major design change which in his opinion requires the consent of the Employer.

4.2 **Amount of Performance Security**  
The Standard Form of Performance Security shall as per the format given in Section 5, and shall be a **Guarantee Irrevocable, Unconditional and en cashable on first written Demand** from a licensed commercial bank in Sri Lanka.

The amount of Performance Security is 5% of the Initial Contract Price. The Performance Security shall be valid until 60 Days beyond the expiry date of Defects Notification Period.

8.1 **Commencement of Work**  
Shall be within 14 Days after the contractor receives the letter of acceptance.

8.7 **Liquidated damages for the Works**  
0.05 % of the Initial Contract Price per Day

8.7 **Maximum amount of liquidated damages**  
10 % of the Initial Contract Price

12.2 (b) **Method of measurement**  
The Method of Measurement shall be:
Standard Method of Measurements of Building Works – **SLS 573 - 1999**

**Weightings of Inputs**  
**Price escalation not allowed**
14.2 Total Advance Payment

20% of the Initial Contract Price excluding provisional sums and contingencies, and paid in 2 equal installments. 1st 10% installment after submission of Advance Payment Security. 2nd installment after mobilizing to site and after showing documentary evidence of utilization of the 1st installment payment and submission of required documentation.
<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.3(c)</td>
<td>Percentage of retention</td>
<td>10% of the certified value of work done.</td>
</tr>
<tr>
<td>14.5</td>
<td>Limit of Retention Money</td>
<td>5% of the initial Contract Price</td>
</tr>
<tr>
<td>14.8</td>
<td>Minimum amount of Interim Payment Certificate</td>
<td>The payment milestone shall be minimum amount of Rupees 7 million whenever an interim payment certificate is submitted.</td>
</tr>
<tr>
<td>14.5</td>
<td>Alternative method for Payment of Retention</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>18.1</td>
<td>Insurance for Works and Contractor’s Equipment.</td>
<td>(a) The minimum cover for insurance of the Works, Plant and Materials is 115% of the Initial Contract Price. The maximum deductible for insurance of the Works and of Plant and Materials is 10% of each and every claim. (b) The minimum cover for loss or damage to Equipment is the replacement cost. The maximum deductible for insurance of Equipment is 10% of minimum cover for equipment.</td>
</tr>
<tr>
<td>18.2</td>
<td>Third Party Insurance (including Employer’s Property)</td>
<td>This amount of insurance per occurrence is Rs. ……………….and number of occurrences shall be unlimited. The insurance specified in this Sub-Clause: (a) shall be in the joint names of the Employer and Contractor. (b) shall be extended to cover liability for all loss and damage to the Employer’s property (except things insured under Sub-Clause 18.1 arising out of the Contractor’s performance of the Contract); The minimum cover for insurance of other property (other than the site is Rs.…………………………..)</td>
</tr>
</tbody>
</table>
Insurance for Contractor's Personnel:

- The maximum deductible for the insurance of other property is 10% of the loss due to the damage.
- The minimum cover for insurance of personal injury or death, for third party and employees of the Employer and other persons engaged by the Employer and the Engineer and his Employees in the Works is Rs. 5,000,000.00 per person per event. Number of occurrences of such events is unlimited.

- This Insurance Policy shall be taken specifically for this site.

- The minimum insurance cover for personal injury or death, for the Contractor’s Workmen shall be in compliance with the prevailing Workmen Compensation Act of Sri Lanka. The minimum insurance cover amounts shall be as per the values stipulated under this Act. Numbers of occurrences shall be unlimited.

- Contractor’s employees other than workmen is Rs. 5,000,000/= per person per event. Numbers of occurrences shall be unlimited.

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Adjudication Agreement, which incorporates this Appendix. In the Dispute Adjudication Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.
SECTION 06

SPECIFICATIONS

1. - General, ICTAD Reference
2. - Aluminum Works
3. – Steel roofing and purlins
4- Electrical System
5 - Plumbing (Water supply & Drainage )
6 - Fire Protection & Detection
7 - Overall Electrical Installation Works
SPECIFICATIONS REFERENCES

1. All material and constructions should conform to relevant standards specified in documents of Institute for Construction Industry Development Authority (CIDA) unless specified otherwise in the Contract Documents.
2. Use of all materials and constructions are subject to the satisfaction of the Employer/Architect/Engineer.
3. The works under the contract agreement shall be executed in accordance with specifications given in the following publications issued by the Institute for Construction Industry Development Authority (CIDA), Savsiripayya, 123, Wijerama Mawatha, Colombo 07 as applicable. The Specifications given in this Document, if any, shall take precedence over the CIDA documents wherever relevant.

i. Water Supply, Sewerage and Storm Water Drainage Works.
   Publication No. SCA/3/2
   2nd Edition (Revised) April 2002

ii. Reclamation Works.
    Publication No. SCA/3/3
    2nd Edition (Revised) December 1999

iii. Building Construction Works.
     Publication No. SCA/4 (Vol. 01)
     3rd Edition (Revised) July 2004

    Publication No. SCA/4 (Vol. 11)
    2nd Edition (Revised) October 2001

v. Construction and Maintenance of Roads and Bridges.
   Publication No. SCA/5
   Specification for Construction and Maintenance of Roads and Bridges Works, Sri Lanka
   2nd Edition June 2009

vi. Electrical & Mechanical Works.
    Publication No. SCA/8
    2nd Edition (Revised) August 2000

Eligible Bidders are expected to be fully acquainted with the above documents and hence these will not be issued to the Bidders with this Document.

Bidders may purchase same if necessary, from Institute for Construction Industry Development Authority (CIDA), “Savsiripayya”, Wijerama Mawatha, Colombo 07.
SPECIFICATION FOR ALUMINIUM WORKS  DOORS & WINDOWS

- **General**
  Aluminum glazed units shall be supplied with all hardware furniture and fittings.

  The Contractor shall submit to the Engineer the shop drawings and technical data and other relevant information for approval of the Engineer.

  The Contractor shall include in his rates the cost of tests generally required for ascertaining the suitability of aluminum extrusion, anodizing, strength of joints, gaskets and weather stripping, strength of joints and air water infiltration.

- **Materials**
  All selections shall be extruded from AA6063 aluminum alloy and sections shall be designed to give rebated internal and external faces.

  Aluminum sections for mullions, frames, transoms, heads and the sills and the other members should strictly comply with the requirements laid down in the following standard.

  B.S. 1161 of 1972 – Specification for aluminum all sections for structural purposes
  B.S. 1474 of 1972 - Wrought aluminum and aluminum alloys for general engineering purpose and external architectural application bars, extruded down tubes and sections.

- **Anodizing**
  Anodizing shall confirm to the British Standard B.S. 3987 of 1974 – Anodized Oxide coating on wrought aluminum for Architectural application. Two steps Anodizing/ Electro colour process shall be used.
  The thickness of anodizing shall be minimum20 microns or as specified in the drawings and of bronze colour or other approved colour. The coating thickness is measured on significant surfaces as per British Standard BS 1615 of 1987, BS 6469 of 1984.
  The Contractor shall submit a ten - (10) year guarantee for the anodizing finish.

  The Contractor shall allow for a minimum of 15 tests for checking the anodized coating.

  Powder coated material should be manufactured using architectural grade pure polyester powder with appropriate pre – treatment. Standard coating thickness is to be **60 – 80 microns** on the significant surface as per BS 1615. Powder used to coat the products shall meet GSB, Qualicoat and British Standards for weathering, adhesion, impact etc.

- **Wind Loading**
  The fabricated aluminum doors and windows shall be capable of withstanding a wind pressure load not less than 1500 Pascals (75M.P.H.)
• **Whether Stripping**
The weather stripping shall be vinyl or other plastic materials which are dimensionally stable and are resistant to ultra Violet trays, water absorption and are suitable to be used in marine atmosphere.

• **Screws Nuts etc.**
All screws, nuts, washers, bolts, rivets and other fastening devices should be of stainless steel. Aluminum alloy fasteners may be used in lieu of stainless steel fasteners with the written approval of the Engineer.

• **Ironmongery**
Ironmongery used shall satisfactorily perform the function for which it is intended. They shall be of aluminum die cast alloy, stainless steel or other non-corrosive materials compatible with aluminum. The Engineer shall duly approve all items of ironmongery before fixing in position.

• **Glass**
Glass shall be tinted float glass suitable for single glazing and having a thickness (minimum 4-mm) or as specified. Glass shall conform to the relevant British Standards including following, BS 952 of 1964 – The classification of glass for glazing and terminology for work and BS 952 Part 1 of 1978.

• **Assembly**
The design of windows should permit free movement of air from exterior environment to the immediate spaces between the window frame and ventilator to achieve pressure equalization. The windows should have snap on reusable extruded aluminum glazing beads and easily removable bottom rails. The glazing beds should not extend underneath the glass. The design of windows should permit re-glazing without disassembly all ventilator extrusions from the frame. All operable window sash corners should be mitered angle reinforced or mechanically staked and Epoxy painted. If frames with incompatible extrusions are used, then these extrusions should be mortised and toned.
A permanent watertight joint should be made to the junctions of the side frame members with all horizontal members. Window panels must be provided with minimum three weep holes, one at the center and one each between the jam and the setting block. Fixing of aluminum units to concrete shall be done with high quality roll plugs with stainless steel sections and other approved fixing devices. When weather friction stays are used the shop drawings shall clearly indicate the size of such stays. The joint between window farms, external door frames and concrete of masonry work shall be adequately caulked with a suitable caulking compound. Polysulphide or Silicon sealant may be used for his purpose. The Contractor shall furnish all literature and instructions published by the manufacture of the seal along with the Bid. Only caulking compound approved by the Engineer in writing shall be used.

• **Air and Water Infiltration**
The Contractor shall submit test certificates from the manufacturer of aluminum extrusions guaranteeing that the products comply with standards applicable to the country of origin of these materials. Fabrication and installation of aluminum units shall be thoroughly water and air tight.
SPECIFICATIONS FOR STEEL ROOFING AND CLADDING WORKS

GALVANISED STEEL PURLINS AND GIRTS

All Zed and C sections shall be rolled formed from zinc coated high strength steel strip. Standard thicknesses, exclusive of zinc coating shall be 1.6, 2.0 and 2.5 mm. The steel strip used shall conform to Australian Standard 1397 or equivalent, Hot dipped Zinc coated or Aluminium/Zinc coated Steel Sheet in the following grade:

1.6, 2.0 and 2.5mm base thickness – AS 1397 – G450 – Z275 or Equivalent
450 Mpa. minimum yield stress, 275 g/m2 minimum coating mass as determined by the triple spot test prescribed in AS 1397 or Equivalent.

The nominal size of all Zed sections shall be 100, 150, 200 and 250 and that of all C sections, 100, 150 and 200 mm depth.
The tolerances for Zed and C sections shall be:
Depth: ±- 1mm, Flange width: ±- 2mm, Overall length: ± 5mm, Hole centres: ±- 1.5mm,
Camber: Up to 1 in 500 depending on length, Bow: Up to 1 in 250 depending on length.

Punching of holes, locations and the size of bolts used for connecting the sections shall be as per manufacturer’s specifications and M12 grade 4.6 or grade 8.8 bolts shall be used as provided in the design.

The cleats shall be minimum 8 mm in thickness. All steel Zed or C purlins shall be bolted to the cleats with a gap of 10mm as per manufacturer’s recommendations.

All connections and extension to GI purlins, their spacing shall be done as per manufacturer’s specifications.

Zinc Aluminium Roofing / Cladding sheets:

All roofing sheets shall be of high tensile steel coloured or non colour as specified in the drawings and/or in the BOQ, with zinc aluminium coating done to Standard AZ 150 ( AZ 200 for buildings located up to ½ km. from the sea ) and with material strength to standard G 550 ( minimum yield strength 550 Mpa. ) with a cover width of min. 762 mm and with rib height of min. 29 mm.
The ribs shall be provided with anti capillary features.

The thickness of base metal shall be of min. 0.47 mm for roofing sheets and 04. mm for cladding sheets. All screws used for fixing the sheets shall be self tapping fasteners meeting AS 3566 Standard or equivalent.
The brand of the sheeting materials shall be BLUESCOPE LYSAGHT, METROOF, RINO or Equivalent product meeting above standards.
Translucent Sheets:

Translucent sheets shall be used to obtain natural lighting as per the drawings/ BOQ. They shall be of high quality fiberglass sheeting with excellent long term weathering properties. The exposed surface shall be covered with an ultra violet protection film to A 15 Standard based on DuPont’s Melinex technology or equivalent. The profiles shall match those of the normal roofing sheets.

The general Specifications of the product shall be as follows.

Surface Coating : 20 micron top film which is laminated complying with AS/NZS4256.3:1994 or Equivalent.

Resin System : General purpose grade Orthophthalic Polyester.

Glass Reinforcement : Glass Roving, minimum 22%.

Weight : 2400g/m2, nominal thickness 1.5 mm.

Light transmission : 70% (Clear), 58% (Opal)

UV Resistance : 99.9% (Clear), 100% (Opal)
SPECIFICATION

ELECTRICAL SYST

1.0 GENERAL

1.1 INTRODUCTION

The works described by this specification covers the supply, installation, testing, commissioning of Electrical services installation of the building in accordance with this specification and associated drawings, and without abrogating the more extensive details described elsewhere in the specifications and drawings including the followings.

1.2 SCOPE OF WORK

The scope of work for the electrical installations covered by this specification is described as follows:

- Supply and installation of Earthing and Lightning protection system including equipotential bonding and other accessories.
- Coordinating of the Power Receiving system with the power authority (CEB).
- Supply and installation of Low Voltage Power Distribution System. (Low voltage (LV) Main Distribution Board (MDB) with Automatic Transfer Switch (ATS), Sub Distribution Boards (SDBs), Final Distribution Boards (DBs).
- Supply and installation of cable management system including cable trays, cable ladders, cable trunkings etc, cable ties, cable markers and other accessories.
- Supply and wiring of final circuits for lighting, general power outlets, equipment power supply, etc.
- Supply and installation of lighting fixtures of appropriate type as per the drawings & Small power system.
- Testing commissioning and proper hands-on training of all the above systems.
1.3 APPLICABLE PUBLICATIONS AND STANDARDS

Standards and Publications of the following organizations form part of this Specification to the extent indicated by the references thereto unless superseded by Detailed Technical Specifications.

1. BS 7671 - The IEE Wiring Regulations for electrical Installation works (17th Edition: 2008 July)
2. BS CP 1003 - Earthing
3. BS 6004, 1984 - Cables
   BS 5467
4. BS 7846 - FR Cables
5. BS 4678 Part 1 & 2 - Cable Trays, Cable Trunking
6. BS 4568 Part 1 & 2 - Steel Conduits
7. IEC 60439-1 - Switch Boards
8. BS 5486 Part 12 & 13 - Distribution Boards
9. IEC 60947-1 to 7 - Circuit Breakers
10. BS 1363 - Switch Socket outlets
11. BS 3676 - Lighting Switches
12. IEC 1008 - Residual Current Circuit Breakers
13. BS 5839 - Fire Detection & Alarm System
14. BS 62305 - Lightning Protection System
   BS 6651

1.4 CLIMATIC CONDITIONS

All electrical equipment, accessories and fittings to be used in electrical installations shall be appropriate for climatic conditions of Sri Lanka having the following features:

- Maximum ambient temperature: 35°C
- Average ambient temperature: 30°C
- Maximum relative humidity: 85%

All electrical equipment and cables shall be rated for continuous operation at an ambient temperature of 30°C. In plant and machine rooms an ambient temperature of 35°C shall be assumed. Directly buried cables shall be rated for ground temperature of 20°C and soil thermal resistivity of 2°C m/w.

Unless otherwise mentioned, due allowance has been made in the design of the electrical installations described in the specifications and drawings for the prevailing climatic conditions and all equipment, cables, switches, etc., specified shall be satisfactorily selected accordingly.
1.5 SERVICE CONDITIONS

All electrical equipment, apparatus, accessories and fittings shall be so designed and manufactured to operate continuously in the electricity supply system having following characteristics:

- Voltage: 400 volts ± 5%, 3 Phase, 4 Wire
- Frequency: 50 Hz. ± 2%
- Neutral: Solidly earthed

1.6 DRAWINGS

The electrical drawings issued with the specification, indicate general arrangements of electrical equipment, cable trays and cable routes, location of panels, cable schedules, wiring/schematic diagrams. Drawings will also indicate any other relevant details relating to this particular project. The information given on the drawings is indicative and as accurate as surveys and planning can determine. Field conditions should be checked and electrical work shall be properly carried out, for maximum efficiency and to avoid any conflict with structures and any other work. Each item shall be verified for proper action and position before final connections are made.

1.7 SUBMISSION FOR APPROVAL

The Contractor shall submit to the Engineer the required documents to establish compliance with the specification. Submittal shall include at least the following documents:

- Equipment shop drawings.
- Equipment data.
- Test reports.
- Test certificates.
- As-built drawings.
- Operation and maintenance manual.

1.8 EQUIPMENT SHOP DRAWINGS

The Contractor shall submit three (3) prints of the shop drawings of all equipments. The Contractor shall check catalogues and shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to the Specifications and Drawings. This statement shall also list all exceptions to the Specifications and Drawings.
All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

The Shop Drawings shall show the position, dimensions, scheme, arrangement and fixing of all electrical equipment.

Equipment shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or installation work started if shop drawings are marked as "APPROVED AS NOTED - CONFIRM", "APPROVED AS NOTED - RESUBMIT"

1.9 WORKING DRAWINGS

In addition to manufacturer's equipment shop drawings, the Contractor shall submit three (3) sets of the following installation working drawings. The Contractor shall prepare the LV installation drawings to a scale agreed on with the Engineer and shall issue them in accordance with the requirements of the Contract having due regard to the time required for approval procedures.

The system installation drawings shall show the position, dimensions, scheme arrangements and fixing of all electrical equipment. The drawings shall comprise, but shall not limit to the following:

1. Dimensioned drawing of raceway systems showing layout of raceways and fittings, spatial relationships to associated equipment and adjoining raceways, if any.

2. Dimensioned drawings of cable routing showing accurately layouts of cables installations and their spatial relationship to associated equipment and details of installation.

3. Dimensioned drawings showing accurately scaled layouts of the location of the equipment and their spatial relationship to associated equipment.

4. Dimensioned drawings showing layout of the exact routing of all main earth/earth loops, details of connectors, earth/ground pits and spatial relationship to associated equipment.

5. Dimensioned drawing of lighting system showing reflected ceiling and lighting layout.

6. Wiring diagram schematic.
1.10 CO-ORDINATION

The LV installation work must be coordinated with the building work and work of other services. The drawings and specifications shall be carefully examined and information regarding building materials and equipment supplied by others obtained from the respective source to determine the extent, type and location of all wiring required. All holes and openings in slabs and walls which may be required for the passage of electrical conduits, trunking and cables must be determined and information regarding them passed on to building contractors so that they may be provided for at the time of pouring of concrete or construction of walls, breaking of concrete, cutting and patching of the structure shall be limited to a minimum and carried out only after securing the consent of the supervising Engineer. All cables and conduits passing holes must be made good by fire resistant incombustible material. Further protection of cables and conduits shall be given as instructed by the Engineer.

1.11 INSTALLATION

Any work not installed according to the Drawings and this Section shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.

Electrical equipment shall be protected at all times against mechanical damage or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters. Electrical equipment shall not be installed in its permanent location until structures are weather tight. If any apparatus has been subject to possible damage by water, it shall be thoroughly dried out and tested as directed by the Engineer, or shall be replaced at no additional cost at the Engineer's discretion.

Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.

Contractor shall repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer.

1.12 TESTING & COMMISSIONING

The Contractor shall be responsible for satisfying himself as to the correctness of the LV System connections to all work supplied and installed by him under the Contract before such work is put into operation.
After the connection of power supply to the installations, the Contractor shall commission all sections of the electrical installations and demonstrate to the Engineer or his Representative that the entire electrical installations are in perfect working order. Where equipment of a specialized nature is involved, the Contractor shall, if necessary or requested by the Engineer seek and obtain at his own cost the services of specialist and/or commissioning engineers from the suppliers/manufacturers.

1.13 TRAINING

The Contractor shall submit a full proposal of the recommended training necessary for the owner's personnel to attend to routine testing, maintenance service and minor repairs including an indication of the duration of such training.

The number of persons required to be trained shall be determined jointly by the Engineer, and the Contractor.

The scope of training shall include on-site training and such training shall be prior to hand-over of the system. Technical training and system operation instructions to the owner's personnel shall also be provided during the commissioning and performance tests phases of the system.

System operation instructions shall be given by an experienced and competent representative of the Contractor who is thoroughly conversant with the electrical system installed.

1.14 AS BUILT DRAWINGS

All drawings prepared or amended by the Contractor to show the works as constructed shall be known as "As Built" Drawings. All such drawings shall be prepared using S.I. Units and shall have the size of the Contract Drawings. Not more than 4 weeks after the date of the completion of the inspections or such other period of time as may be agreed with the Engineer, the Contractor will submit for the Engineer's approval two paper prints of each of the drawings. After checking the prints of "As Built" Drawings submitted by the Contractor the Engineer will return to the Contractor one copy marked to show his signed approval or comments.

The "As Built" Drawings shall accurately show the installed conditions of,

1. All equipment, conduits, trunkings, lighting fixture, receptacle and switch outlet locations, etc.

2. Circuit lists for each distribution board and such lists shall agree with lists fixed within distribution board doors.

3. Positions and nature of all earth electrodes installed and the route of the connecting copper conductors.
4. Complete electrical circuit details including lighting and power points suitably referenced to indicate type of fittings, manufacturer's name, catalogue number, lamp size and type.

5. Schematic diagrams, single line diagram, control wiring diagram and lighting fixture schedule, distribution board schedules, cable schedules, switchgear and control gear schedules.

6. Indicate all plant room installations in drawings to scale 1:50.

7. Legends which shall detail the symbols used and which shall conform in style and standard to those used in the working drawings.

8. Plan view, sizes and locations of switchgear, motor control centre & mechanical equipments.

1.15 OPERATION AND MAINTENANCE MANUALS

The contractor shall submit comprehensive Operation and Maintenance Manuals of all equipment supplied during the site training. It shall consist of all the detailed diagrams of the equipment, writing of the equipment and arrangements and instructions of the regular maintenance of the equipment. Further, a schedule shall be included which may be in the form of a material list giving all particulars together with ordering references of all replaceable parts for all the equipment which will be supplied.

1.16 GUARANTEES

Contractor shall provide one (1) years guarantees for products furnished under this Contract. However, such guarantees shall be besides and not in lieu of all other liabilities which manufacturers and the Contractor may have by law or by other provisions of the Contract.

All materials, items of equipment and workmanship furnished under this Contract shall carry standard warranty against all defects in materials and workmanship. Any fault due to defective or improper material, equipment, workmanship or Contractor's design that may develop shall be made good, forthwith, by and at the expense of the Contractor, including all other damage done to areas, materials and other systems resulting from this failure.

Guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.
2.0 ELECTRICAL SYSTEMS

2.1 LIGHTNING PROTECTION SYSTEM

2.1.1 Scope

The Contractor shall supply and install a lightning protection system conforming to the requirements of IEC 62305 for the building.

The system shall include, but not limited to, an air terminal, joints and bonds, test joints, earth termination, earthing pit and earth electrodes.

2.1.2 Air Terminals (ESE)

Air terminals shall be designed based on the early streamer emission technology. Level of protection (with average lightning discharges of 25 kA) should be at least 100m radius.

2.1.2 Earth Electrodes

Each earth electrode shall consist of 16mm diameter copper bonded steel earth rods complete with driving stud, coupling dowels and spike. Earth rod shall be made of molecularly bonded 99.9% pure electrolytic copper onto a low carbon steel core. Each earth rod shall be 2.4m long. (This shall be one 2.4m length rod or two 1.2m length rods connected by threaded coupling using driving stud.)

The Contractor shall measure the resistance of each earth electrode immediately after it is driven. If the earth resistance is more than the permitted value, the Contractor shall install additional rods which shall be coupled to the rod already installed to obtain acceptable value of resistance. Each earth electrode shall have a factory made, concrete inspection pit and cover provided.

2.1.3 Accessories

Lightning protection system shall be provided with all required test joints for down conductors, fixing clips and clamps for copper tapes and round conductors, earth rod clamps, bonds to metallic items/parts and other accessories.

2.2 EARTHING SYSTEM

This section specifies the detailed requirements of the supply, delivery, installation, testing, commissioning and maintenance during the defects liability period of the earthing system.
### 2.2.1 SYSTEM DESCRIPTION

TT earthing system shall be proposed for the electrical distribution. Separate earthing system shall be proposed for HT transformer as per the power authority requirement. Earth bar of the Main Switch Board, Bodies of the Generators will be taken to an earth panel and panel will be earthed solidly. Testing point shall be provided inside the earth panel. Neutral point of the generators and the transformer will be separately earthed.

All metal works associated with the electrical installation, but not forming part of a live conductor, including exposed conductive parts, shall be solidly and effectively bonded and earthed in accordance with the latest edition of IEE Wiring Regulations.

Clean earthing system will be proposed for the office floors where computer work stations are located.

### 2.2.2 EQUIPMENT SPECIFICATIONS

I. A solid copper main earthing terminal shall be provided at a position near the MSB room for the connection of the circuit protective conductors, the main equipotential bonding conductors and the earthing conductors to create the equipotential zone. The main earthing terminal shall be connected to earth via an earthing conductor to an earth electrode or a group of electrodes.

II. Earth electrode (copper plate 600x600x3mm) shall be installed at a minimum depth of 3m. Copper plate shall be connected to earth lead using cad weld joint or with 3x15mm ss bolts and nuts to the center of the plate. Fill the pit up to 1m level a mixture of charcoal and soil. Cover the pit with soil and compact 1:0.75 ratio; and fill up to finish level.

III. Earth electrodes shall be in rods of mild steel inner core with a bonded hard drawn copper sleeve of an approved type. The overall diameter of the rod shall not be less than 12.7mm and the thickness of the copper sleeve shall not be less than 2.0mm. The minimum length shall be 2.4m. Additional lengths, whenever required, shall each be of 1.2m, connected together by a coupling. The penetrating end of the rod electrode shall be a hardened steel point. Electrodes shall be driven into the ground within an earth pit. Only approved tools, e.g. electric hammer or pneumatic hammer, shall be used for their installation.

IV. In case the earthing resistance achieved by one rod is not sufficiently low for the purpose required, additional length or additional rods shall be installed.

V. The connection shall be contained within a concrete earth pit with a substantial removable cover to ensure accessibility and maintainability. Earth Resistance shall be less than 5 ohm for electrical system.
2.3 POWER RECEIVING SYSTEM

This specification covers the coordination of power receiving system with the power authority (CEB) and Supply & installation of underground LV cables from the transformer to main distribution board (MDB)

Electrical contractor shall coordinate all the works related to authority power supply to the premise after applying the requirement by the client. LV cable shall be as per the specifications described below and drawing shown. Cable shall be installed as per the details mentioned in the drawing and the best installation practices.

2.4 LOW VOLTAGE DISTRIBUTION SYSTEM

This section specifies the detailed requirements of supply, delivery, installation, testing, commissioning and maintenance during the defects liability period of the low voltage power distribution system.

The extent of work includes basically however not limited to the following,

(i) Supply and Installation of low voltage power distribution panels.

(ii) Supply and Installation of low voltage power cables.

(iii) Supply and Installation of cable management system.

2.4.1 SYSTEM DESCRIPTION

Low Voltage Power distribution system starts from the Main Switch Board (MSB). Feeder network shall be laid in the office premise to distribute power from the MSB. Sub distribution, Final distribution and motor control panels will be located as per the drawings to have flexible power distribution within the building.

2.4.2 EQUIPMENT SPECIFICATIONS

(A) LOW VOLTAGE POWER DISTRIBUTION PANELS

(a) MAIN SWITCH BOARD

CONSTRUCTION OF THE SWITCHBOARD

I. MSB shall be of floor-standing, totally enclosed type, built up from enclosed units housing the Moulded case circuit breakers (MCCB), fuses, contactors, relays, bus bars and other items of ancillary equipment as shown on the drawings.

II. MSB shall fully comply with BS EN 60439 – 1 and the segregation amongst the components of the switchboard shall be of Form 3b for all sections.
III. The bus bar system of the MSB shall be capable to withstand the electrical and mechanical stresses and temperature rise produced by a fault with a magnitude of 35kA for 3 seconds.

IV. The construction of the indoor type MSB shall be designed to have the degree of protection of IP42 or higher in accordance with the standard requirement of IEC 60529.

V. The construction of the MSB shall be modular construction metal enclosure by electro galvanized steel sheets not less than 2mm thick or epoxy power coated to BS 4800 to provide resistance to corrosion. The panel shall be built up on substantial framing with all necessary stiffeners and supports with no cross struts. The entire panel shall be vermin proof.

VI. Front access doors shall be provided and with hinges and lockable handles to facilitate inspection and maintenance. Removable gland plates shall be provided at the top and at the bottom of the switchboard with knockouts or blanked off openings for incoming and outgoing circuit cables.

VII. All doors shall have concealed hinges and where necessary, shall be interlocked with the switch mechanism. All doors shall be provided with dust excluding gasket of neoprene or other equal and approved material.

VIII. MCCB shall be of the heavy duty quick make, break type. Each breaker shall have on each phase a thermal over current release and also instantaneous magnetic trip both of the adjustable type.

IX. Four pole breaker shall have a common trip both with a single operating handle and designed so that any overload in one pole automatically cause all pole to open.

X. Breaker shall be trip free and each shall have a trip indication of ON or OFF position. To reset for the trip position the mechanism shall pass first through the OFF position. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF.
VOLTMEGERS
I. Voltmeter shall be of accuracy class 1 and have expanded scale of 100mm in total length. The range shall be 300V to 500V and the zero shall be marked. Voltmeters shall be connected to the incoming side of the power supply through fuses and links. Mechanical zero adjustment shall be provided.

II. The voltmeter selector switch shall be mounted on the front of the panel and shall be of the rotary type with break –before make contacts for selection to measure red-yellow, yellow-blue, blue-red and red, yellow, blue phase voltages with RY, YB, BR, R-Y-B marked clearly on the switch.

AMMETERS
I. Ammeter shall be of accuracy class 1 B.S. 89 and be capable of carrying their full load current without undue heating and shall not be damaged by the maximum fault level of the switchgear. All ammeters shall have a continuous overload capability of 120% of the upper limit of the scale for two hours. All ammeters are to be 100mm dial square flush pattern with quadrant scale.

II. Mechanical zero adjustment shall be provided and accessible from the front without dismantling.

III. The ammeter selector switch shall be mounted on the front of the panel and shall be of the rotary type with make-before-break contacts for selection to read red-yellow-blue-neutral currents with R-Y-B-N marked clearly on the switch.

NETWORK ANALYSER
I. The microprocessor based network power analyzer shall measure the electrical parameters including current, voltage, power factor, active and reactive power and frequency by means of microprocessor based technology.

II. The meter will be able to communicate with BMS via a common network protocol (such as Modbus/Lonworks via RS323/RS48S/Ethernet communication link) by means of plugging in communication module and without further modification of the basic unit.

SURGE PROTECTION
I. Surge protection device shall be suitable for application in electrical installation operating at 400V, 3-Phase/ 230V 1-phase and at frequency 50Hz.
II. The operation of surge protection device shall base on the use of metal oxide varistor or other similar technique to effectively limit over voltage under surge conditions and to safely divert the excessive surge energy to ground.

III. Surge protection device shall be manufactured by a reputable manufacturer which is continuously manufacturing surge protection products preferably for at least 5 years and the manufacturer shall have a local agent to provide full technical support and after sales services.

IV. Surge protection device shall be shunt or series connected to the concerned electrical installation to achieve maximum protection as recommended by the manufacturer. It shall be installed in strict compliance with manufacturer’s installation instruction and relevant safety standards and regulations.

V. The device shall be able to give protective performance in all modes, including phase and neutral, phase and earth, and neutral and earth.

VI. Surge protection device shall be able to withstand repeated electrical surges appeared in the electrical system without undue degradation of its surge protection performance under healthy condition.

BUS BARS

I. Bus bars and bulbar connections shall be constructed in accordance with the requirements of BS 158 and 159.

II. Bus bars shall be rectangular section, hard drawn high conductivity (HDHC) copper, adequately rated and supported by moulded insulators spaced at suitable intervals. The complete assembly shall be capable of withstanding the maximum mechanical stresses to which it may be subjected under fault conditions.

III. Full size neutral bars shall be provided.

IV. Bus bars installed in switchboards shall be so arranged that all conductors can be brought onto the bars without undue bending. Bus bars shall be coloured at strategic locations for phase identification.

V. Connection to circular section, bus bars shall be made with single bolt split type cable clamps for sizes up to 300amps. Higher rated connections will be made with high conductivity cast brass clamps.

VI. For rectangular section, bus bar connections shall be made with double split cast brass clamps. Drilling of the bars will not be permitted unless approved by the Engineer.
VII. Notwithstanding the above, all conductors between the bus bars, circuit breakers and fuse switches shall be high conductivity breakers and fuse switches shall be high conductivity copper bar, having a current rating of not less than that of the fuse switches to which they are connected. The conductors shall be colored to BS color code for phase identification.

VIII. Copper bus bars and connection joints shall be tinned to BS1432.

IX. A tinned copper earthing strip of dimension not less than 75 m² shall be provided for the full length of the switchboards and sufficient provisions made for earthing.

X. Connections of all electrical circuits. It shall be effectively connected to all metal parts other than current carrying conductors.

XI. Neutral bars shall be provided. Main bus bars of cubicle switchboard shall be run in a horizontal chamber over the full length of the switchboard (or the section of) with bolted links at the end.

XII. Removable bolted links shall be provided as indicated in the drawings for the accommodation of current transformers for metering and protection facilities without affecting the mechanical and electrical properties of the bus bars as a whole.

INTERNAL WIRING

I. All wiring shall be arranged in a regular manner with bends set at 90° and securely held in position with suitable clips and where convenient shall be installed in the upright and/or backstays.

II. Meter wiring for the switchboard shall be carried out in PVC insulated cable of not less than 1.5mm². All meter wiring shall be of similar colors to those of the respective bus bars to which connections are made. The cable terminations shall be made with approved lugs.

III. Wiring shall be carried out in such a manner as to make circuits and connections easily traceable.

DISCRIMINATION

I. Full discrimination is required within and between switchboards ensuring that short circuits or overload on sub-circuits will not trip the switchboard circuit breakers but will effectively isolate the faulty circuit, leaving the healthy circuits unaffected. The contractor shall be responsible for ensuring discrimination is maintained.
II. Where earth fault detection is provided, discrimination shall be ensured as for overloads above. Sufficient adjustment shall be provided ensuring that spurious tripping due to the inherent earth leakage of long cable runs and other equipment, does not occur, yet ensuring that discrimination is still maintained.

III. Where circuit protection devices are not provided with earth leakage detection they shall be arranged to trip on earth leakage by means of the over current protection by ensuring a low earth fault impedance in accordance with the IEE wiring regulation.

AUTOMATIC POWER FACTOR CORRECTION CAPACITORS

I. Automatic power factor correction capacitors (Capacitor bank) to correct the power factor to 0.98 shall be provided.

II. Capacitor bank shall be manufactured by the same switch board manufacture.

III. Selected capacitors shall be rated for 440V.

IV. Target power factor correction shall be able to adjust range of unity power factor to 0.93.

V. Solid-state, microprocessor-based controller, including the following feature shall be provided as main controller:
   - Under voltage relay that interrupts capacitor switching and disconnects capacitors for power supply interruptions longer than 15 minutes.
   - "Advance" and "Retard" push buttons on the control panel to permit manually controlled capacitor-bank switching.

TESTING

I. Following tests shall be included, but not limited to, at the manufacturers’ workshop during the cause of assembly and on completion immediately prior to transport to site.
   - Inspection of the switchboard including wiring, electrical and mechanical connections, external and internal finish, etc.
   - Check all measuring, protection and control circuits and associated components are operative.
   - Functional test of all control circuits.
   - Calibration of all measuring equipments.
   - Mechanical operation tests of all switchgears.
– Any other tests recommended by the manufacturer.

II. After transport and erection of switchboard on site, the following tests, but not limited to, shall also be carried out:
   – General inspection of the switchboard.
   – Mechanical tests.
   – Functional tests.
   – Continuity tests.

III. The following commissioning inspections and tests but not limited to shall be carried out before the switchboard is put into normal operation.
   – Voltage test between any two combination of each phase, neutral and earth.
   – Phase sequence test on each outgoing circuits.
   – Functional test, especially on the control devices.

(b) SUB AND FINAL SWITCH BOARD

CONSTRUCTION OF THE SWITCHBOARD

I. The panel board shall be type of wall mounting or floor standing type constructed to Form – 1 requirement. It shall be constructed minimum 1.6 mm thick electro-galvanized steel coated with high solid enamel polyester electrostatic spray and oven baked. The color shall be RAL 7032 and degree of protection minimum IP 42.

II. Bus bars shall be HDHC copper and rated for continues operation. The phase bar, neutral bar and earth bar shall be identified by approved color code. The neutral bar cross section should be same as phase bar. All circuit breakers, metering and bus bar shall be as per the approved load list.

RESIDUAL CURRENT CIRCUIT BREAKER (RCCB)

I. Residual Current Circuit Breakers (RCCB’s) shall comply with IEC 1008. They should be of the inherent current type and be independent of the line voltage.

II. An integral test device shall be provided on the front of the RCCB to enable the operation of the RCCB to be tested. Operation of this test device shall create out-of-balance conditions simulating an earth fault.

III. The main distribution board shall have the instruments shown on the drawings.
MINIATURE CIRCUIT BREAKER (MCB)

I. Single pole or triple pole miniature circuit breakers (MCB) are to be used for sub-circuit protection.

II. All MCB's shall conform to BS EN 60947-2. The body and base of the units are to be moulded Bakelite or similar material and the units are to be sealed after assembly.

III. The load handling contacts are to be silver I tungsten, and the contacts and operating mechanism are so designed as to give a wiping action both at make and break.

IV. The breaker operating mechanism is to be the trip free type. A thermal magnetic time tripping mechanism is to be included for circuit protection against overload and short circuit.

V. Short circuit level of MCB shall not be less than 6kA.

VI. On three phase circuits, triple pole circuit breakers shall be used and shall Interlocked so that an over load or fault on anyone phase will trip all phases of the breakers simultaneously. All breakers shall be calibrated at 40 deg C.

(B) LOW VOLTAGE POWER CABLES

The Power Cables and Conductors scope of work covers all electrical cabling and wiring required for the project. In general the wiring requirements are to the British Standards.

All low voltage feeder and sub-feeder cables will be copper conductor cables, multi-core XLPE/PVC cables laid on cable trays or ladders, or directly clipped to ceilings or walls in electrical shafts, or can be single core, non-armored XLPE / PVC insulated running in heavy gauge uPVC conduits.

In general sub-circuit wiring will be by means of single core PVC insulated copper conductors with earth continuity conductors run in conduits and protected by miniature circuit-breakers.

All circuits for both lighting and power applications will be loaded to not more than 75% of the actual net rated capacity of the protection circuit breaker.

Fire pumps/ Fire lift will be supplied through a separate fire rated feeders directly from the MSB.
XLPE/PVC CABLE

I. XLPE insulated PVC sheathed copper cables (XLPE/PVC) shall be of single core or multi-core with full neutral and shall be 600/1000V grade complying with BS 5467:1989. The cores of these cables shall be high annealed copper conductors complying with BS 6360:1991. Multi core conductors above 16mm² shall be shaped to reduce overall dimension and to give a smoother profile.

II. The PVC insulated cores shall be color coded and sheathed with an extruded layer of two or more tapes of PVC bedding. The cables shall be over sheathed with an extruded black PVC layer embossed with the voltage designation and the manufacturer’s identification.

III. The XLPE insulation shall be able to operate continuously at a conductor temperature of 90 deg. C.

IV. The minimum bending radius shall be not less than eight times the overall cable diameter.

PVC/PVC CABLE

I. PVC insulated PVC sheathed copper cables (PVC & PVC) shall be of single core or multi-core with full neutral and earth cable and shall be 600V/1000V grade complying to B.S. 6364:1969. The cores of these cables shall be high annealed copper conductors complying with B.S. 6360:1969.

II. The PVC insulated cores shall be colour coded and shall be sheathed with PVC.

III. The minimum bending radius shall be not less than eight times the overall cable diameter.

IV. The cable shall be properly supported on cable trays for horizontal and vertical runs. The exact installation method shall suit the site condition and subject to approve by the Engineer.

V. Brass cable gland complies with BS6121 shall be provided for terminating the cables.

PVC INSULATED CABLE

I. The cables shall consist of copper conductors insulated with PVC complying with B.S. 6004:1969. Cables for three phase and single phase circuits shall be 450V/750V grade.

II. The current carrying capacity of each circuit shall be in accordance with I.E.E Regulations and latest amendments and shall be limited to the specified voltage drop.
III. All wiring shall be carried out by the loop-in system and the wiring shall be enclosed in conduits or in metal trunking. Joints or connectors shall not be allowed in any such cable length, except that connectors may be used in accessible positions within fittings.

IV. The maximum number of cables that may be accommodated in a given size of conduit is not to exceed the limits given in the I.E.E Wiring Regulations.

V. For copper cables sizes 6mm2 and above, compression type cable connectors/lugs shall be used for all cable terminations. Connections to fixed equipment shall be by means of PVC cables in conduits; with the final connection being made by PVC covered pliable conduit, and suitable adaptor. A separate earth continuity copper earth in accordance with I.E.E. Regulations and B.S. 6004 of not less than 2.5mm2 shall be provided outside the flexible tube and solidly connected at each tube termination.

FLEXIBLE CORDS

I. Flexible cords shall be PVC insulated; PVC sheathed with copper conductors of 300V/500V grade to B.S. 6500 minimum size of cord shall be 1.5mm2.

FIRE RESISTANT CABLES

I. The fire resistant cable shall be of low smoke halogen free type which, has been approved by the Fire Services Department for the appropriate application.

II. The fire resistant cable shall have been flame tested by a recognized independent authority to BS 6387 Categories C, W and Z.

(C) CABLE MANAGEMENT SYSTEM

The cable support & duct systems scope of work covers all electrical installation required for the project. In general the requirements are for installation to British Standards.

Separate PVC conduits and accessories will be used for lighting circuits, power circuits and low current systems wiring.

PVC conduits accessories will be used for concealed and embedded installations. Galvanized steel conduits shall be used for exposed installations in machine rooms and car parks where mechanical damages can occur. Galvanized flexible conduits will be used for terminating all connections to motors and vibrating equipment.

Cable trays will be of powder coated sheet steel supported from ceilings or wall.
All conduits for branch-circuit wiring will be either embedded in concrete, concealed in walls and under floor tiles or exposed under the slab or simply exposed in mechanical and electrical rooms.

**CONDUITING SYSTEM**

**PVC CONDUITING**

I. PVC conduits shall generally be used for all areas.

II. The minimum size of conduit used in the electrical & ELV installation shall be 20mm diameter.

III. Before any work on the installation is started, the Contractor shall prepare drawings of proposed conduit runs showing the number, size and circuit reference of all conductors to the satisfaction of Engineer prior to the commencement of works. The Engineer’s endorsement shall not relieve the Contractor from liability in respect to the provision of an adequate number and/or sizes of conduits for the installation.

IV. Rigid plain PVC conduits and conduit fittings shall comply with B.S. 4607: Part 1 and B.S. 6099: Section 2-2. Conduits shall be type “a”, i.e. they shall be suitable for installation, storage or transport at temperatures not normally below minus 5ºC. (Couplers shall be of the slip-type).

V. Adaptable boxes and boxes for the enclosure of electrical accessories shall be made from insulation materials and shall comply with B.S. 4662. The dimensions of the plastic boxes shall be such that they can be interchangeable with steel boxes. The minimum wall thickness of boxes shall be 2mm.

VI. Boxes for the suspension of luminaires or other equipment, where considerable heat will be produced, shall be fitted with steel insert clips. Plastic boxes shall not be used in situations where the temperature of the box is likely to exceed 60ºC or where the mass suspended from the box exceeds 3-kg.

VII. Conduit bends shall have an internal radius of at least 4 times the outside diameter of the conduit.

VIII. The method of carrying out the conduit bends, conduit joints, fixing conduits to boxes without spouts, and the tools and materials to be used shall be as recommended by the manufacturer of the conduits.

IX. All empty conduits shall be provided with draw wire.
METAL CABLE LADDER

I. Cable ladder shall consist of hot-dipped galvanized to BS 729 mild steel to BS 1447 profiles riveted together having horizontal spacing between two rungs not exceeding 300 mm. The flanges shall not be less than 100 mm.

II. All accessories associated with the cable tray systems, including supporting rods, channels, shall be quick-fixing type to the Engineer's approval.

METAL CABLE TRAY

I. Cable trays are to be of perforated pattern 1.6mm minimum mild steel with returned edges and shall be electroplated with zinc or cadmium to BS3382: Part 1 and 2 with minimum plating thickness of 25µm. The color of the paint shall be agreed by the Engineer.

II. Trays shall be supported from the soffit of structural slabs and beams by rods not less than 8mm dia. and/or angle iron brackets fixed on wall. The rods and brackets shall have two layers of primer and enamel paint finish, the bolts and nuts for fixing shall be electroplated with zinc or cadmium to BS3382: Part 1 and 2 with minimum plating thickness of 25µm. The color of the paint shall be agreed by the Engineer.

III. Tray supports shall be spaced according to the number and size of cables being carried on the tray, but nowhere shall they be at greater than 1.2m intervals.

IV. Cables mounted on the trays shall be laid after installation of the tray and spaced in accordance with the I.E.E Regulations to avoid de-rating of the cables. Cables shall be grouped in circuits and individually clipped, cleated or tied at intervals of not less than 2m lengths on horizontal runs and 1 m lengths on vertical runs.

V. Notwithstanding the minimum gauge of metalwork specified, gauges shall be of sufficient strength to prevent sagging between supports.

VI. Cables leaving cable trays shall be installed properly without damage to cables by cutting edges of trays and rubber pads shall be inserted to underside of cables.

VII. Trays shall not be bent for change in direction of run. Proper bends or straight trays meeting at angle shall be employed at change of direction. Cable trays shall be supported at either sides of junction.

VIII. Where trays are exposed to the weather, they shall be coated with epoxy resin before painting. PVC coating is not acceptable.
METAL TRUNKING

I. Trunking and fitting shall be compatible to the requirements laid down in BS4678:Part 1 and shall be fabricated with metal enclosure by electro galvanized steel sheet or epoxy powder coated to BS 4800 to provide resistance to corrosion having a nominal thickness indicated hereunder:

<table>
<thead>
<tr>
<th>Nominal Size (mm)</th>
<th>Nominal Thickness (mm)</th>
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<tbody>
<tr>
<td>From</td>
<td>Up to</td>
</tr>
<tr>
<td>-</td>
<td>50 x 37.5</td>
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<tr>
<td>50 x 50</td>
<td>100 x 75</td>
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<tr>
<td>100 x 100</td>
<td>150 x 100</td>
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<tr>
<td>150 x 150 and above</td>
<td></td>
</tr>
</tbody>
</table>

II. Steel trunking shall be of square or rectangular cross section and no projection from screw or other sharp object will be allowed inside.

III. Manufacturer’s standard fittings such as tee or angle pieces, connectors etc. shall be used throughout unless prior endorsement has been obtained from the Engineer.

IV. Connection between adjacent lengths of trunking, tee or angle pieces, accessories, etc. shall be made by means of butt joints. The two adjacent ends of trunking shall be fixed so that no relative movement can occur between them.

V. Electrical continuity shall be achieved by means of connecting a tinned copper tape of adequate size across the two adjacent ends of the trunking.

VI. Trunking and fittings shall have removable covers extending over the entire length. The covers shall be of the same material and finish as those of the trunking body.

VII. Removable covers shall be held in position on the trunking either by the quick-fix pattern with centre captive screw or spring-on type.

VIII. Bends, tee junctions, etc. shall also be fitted with removable covers.
IX. Connection between trunking and apparatus shall be by a screwed coupler and brass male bush, or a standard flange coupling or an adaptor neck, fabricated or casted. Direct attachment of trunking to apparatus will only be permitted if cable entries are provided with smooth bore bushes or grommets and the return edge of the lid of the trunking is left intact.

X. Where connection is made between trunking and a distribution board, the cable entry or entries shall be sized to accept all cables from all used and ‘spare’ ways. No cable tray shall be allowed to connect trunking.

XI. Trunking shall be adequately supported through its length. Trunking support shall be fixed at regular intervals with maximum spacing as follows:

<table>
<thead>
<tr>
<th>Trunking Size</th>
<th>Maximum distance between fixings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50mm x 50mm</td>
<td>900mm</td>
</tr>
<tr>
<td>Up to 75mm x 75mm</td>
<td>1200mm</td>
</tr>
<tr>
<td>Up to 150mm x 150mm</td>
<td>1500mm</td>
</tr>
<tr>
<td>Up to 225mm x 150mm</td>
<td>1800m</td>
</tr>
</tbody>
</table>

XII. Overhead trunking shall be suitably supported by means of hangers, brackets or other approved devices, so that no visible sag is observed when loaded with cables. All hangers, brackets or other approved devices shall apply two layers of primer and enamel paint with blot and nuts electroplated with zinc or cadmium, the painting and electroplated standards shall be as described.

XIII. Cables penetrating through trunking shall be protected by conduits except for PVC insulated and sheathed cables if such cables from part of a surface wiring system. In such case, the holes in the trunking though which such cables penetrate, shall be fitted with suitable rubber grommets to BS 1767 or insulated bushes.

XIV. Whenever trunking passes through a fire resistant structural element, such as floor and wall, designated as fire barrier, the opening thus formed shall be sealed with approved type of fire resisting material according to the appropriate degree of fire protection required. In addition, suitable internal fire barriers shall also be provided to prevent the spread of fire or smoke through the trunking.
XV. In vertical trunking installations, internal fire barriers shall be provided between floors or at intervals of 5m apart, whichever is the less.

XVI. Every entry to the trunking shall be so placed as to prevent and/or to be protected against the ingress of water.

XVII. Holes in trunking shall be drilled, punched or cut by ring saw. After cutting, burrs and sharp edges on the trunking shall be removed and painted by galvanized paint to prevent abrasion of cables and rusting.

XVIII. Trunking, which is installed in such a position that the cables would fall out when the cover is removed, shall be fitted with cable retaining bars or other suitable devices to prevent the cables from falling out.

XIX. Trunking installed in a vertical plane shall contain sufficient supporting devices within the trunking to prevent strain on the cables due to the weight of the cables, and to prevent vertical movement of the cables.

XX. The number of cables put into a trunking shall be such that no damage is caused to the cables or the trunking. In determining the size of the trunking required for a particular installation, the method recommended by the IEE Wiring Regulations shall be adopted.

XXI. Where a common trunking is used to accommodate cables for different circuit categories, they shall be effectually segregated by means of partitions or dividers. The partitions or dividers shall be adequately secured to the body of the trunking.

2.5 FINAL CIRCUIT WIRING

This section specifies the detailed requirements of the supply, delivery, installation, testing, commissioning and maintenance during the defects liability period of the all related items in final circuit wirings.

The extent of work includes basically however not limited to the following,

(i) Supply and Installation of wiring system.

(ii) Supply and Installation of lighting fixtures.

(iii) Supply and Installation of lighting control system.

(iv) Supply and Installation of Switches, Socket Outlets and Isolators.

(v) Supply and Installation of cable management system.
2.5.1 SYSTEM DESCRIPTION

Final circuit wiring consists of switches, socket outlet, lighting fixtures, lighting control system and cable management system for final circuits.

2.5.2 EQUIPMENT SPECIFICATIONS

(A) WIRING SYSTEM

Concealed conduit wiring system shall be considered where concrete slab or brick wall are present. Within the machine room and services area as indicated in drawing, surface conduit wiring shall be used. The specification of conduit installation is the same as that stipulated in abovementioned relevant clauses of this specification.

In general, lighting circuits shall be wired from 1.5mm2 PVC insulated wires with separate protective earth wire of 2.5mm2. All circuits will be protected individually by 10A circuit breakers. 30mA sensitive Residual Current Circuit Breakers (RCCB) will also be provided for earth leakage protection.

All the 13A socket outlet circuits shall be Radial or Ring circuit arrangements. Both arrangements shall be wired with 2.5 mm2 PVC insulated wires with protective earth of same size. All radial/ring final circuits will be protected individually by 16A/20A circuit breakers while ring circuits. 30mA sensitive Residual Current Circuit Breakers (RCCB) will also be provided for each circuit or group of circuits as appropriate.

(B) LIGHTING FITTINGS

GENERAL

I. All the lighting fixtures of the building shall be supplied by the contractor. The Contractor shall supply and install cable and wiring for the fixtures.

II. Light fittings supplied under this contract by the contractor shall be manufactured by a reputable lighting manufacturer and shall bear the registered trade mark.

III. Fittings by alternative manufacturers may be considered provided that the performance and quality are the same or higher than the specified ones and shall be subject to the acceptance by the Engineer and shall comply with the following.

IV. Luminaries shall be well constructed and shall comply with the requirements of BS4533 and be chosen to suit the conditions under which it will operate. They shall be suitable for operation on 230 volts, single phase 50Hz supply.
OUTDOOR LUMINARIES

I. Outdoor luminaires shall be IP65 or otherwise specified and able to withstand weather. Metal work should be protected against corrosion, and luminaire parts which have to be removed for access to the interior should be properly gasket to restrict the entrance of moisture and dirt. Stir-up mounting and similar parts shall be heavily galvanized, and bolts shall either be made of stainless steel or be galvanized, and bolts shall either be made of stainless steel or be galvanized.

II. The adjustment nuts and bolts of the luminaires that will be mounted high on buildings or columns shall be captive to prevent loss or accident during servicing.

III. Safety device shall be provided to prevent luminaire mounted at high position dropping. The luminaires installed in such locations that are within hand reach shall be strongly constructed, fitted with an impact-resistant transparent or diffusing cover, and shall have secret key fixings for the cover to the body of the luminaires. Where necessary, wire guards shall be fitted over the cover to give extra protection.

IV. The termination of wiring to the fixture shall be done inside a weather-proof box of IP65.

EMERGENCY, EXIT AND FIRE EXIT LIGHTS

I. The emergency lights shall be maintained or non maintained type as mention in the drawings and fire exit lights shall be of the surface mounted type. Each unit shall be equipped with the following: All the maintained type emergency lights shall provide with additional fire rated wire from the relevant circuit breaker in order to satisfy the installation requirement.

- Seal-lead acid battery, 12V DC for minimum back-up time of 2 hour.
- Solid state charger.
- Low and high voltage cut-off.
- Overload and short circuit protection.
- Status indicating lamp for "Power On", "Fully Charged" & "Short Circuit".
- Corrosive-proof housing.
- The housing of luminaire shall be steel and diffuser shall be glass diffuser.
- The low voltage cut-off shall be set at 1.6 volts per cell.
INSTALLATION OF LIGHTING FITTINGS

I. Installation Method

Luminaries shall be surface mounted, pendant type or recessed type as indicated on the drawings. Outdoor security fixtures shall be pole mounted or wall mounted depend on the final position as approved by the Architect or Engineer.

II. Cable in Enclosed Luminaries

Cables within an enclosed type luminary shall be properly protected against damage due to the excessive heats generated by the lamp within the luminaries.

III. Protection shall be by means of sleeving the insulation of the cables with fibre glass or other equivalent heat resistant insulating materials. The sleeves shall be provided for all cables within the luminaire and shall extend to a distance of 150mm outside the luminaire.

IV. Alternatively protection shall be by means of using heat resisting cables selected in accordance with the IEE Wiring Regulations.

V. Joints and Connections in Light Fittings

No joint or connection shall be made within a light fitting, except in space incorporated therein for the purpose. Any cables used for wiring within a light fitting shall be of any type suitable for use at the operating temperature within the fitting.

(C) SWITCHES, SOCKET OUTLETS AND ISOLATORS.

GENERAL

Electrical accessories other than the switches provided under the lighting control system for office areas shall be generally in white colour, complying with BS. The wiring accessories inside the machine room area shall be metal clad type as approved by the Engineer.

I. Socket Outlet

Socket outlet shall be 3 pin 13A as shown on drawings. All socket outlets shall be switched, shuttered type complying with B.S. 1363 and 546 respectively.

Weatherproof type shall comply with BS 4343 provided with a push on cap and retaining ring or a screw-on cap with rubber gasket.
II. Fuse Connection Unit
Fuse connector unit shall be in comply with BS 1363 and provided with 2A to 13A cartridge fuse link having earthing facilities for connection to the metal work of current appliances being fed.

III. Lighting Switches
Switches for controlling lighting circuits shall be rocker operated to B.S. 3676 and rated at 10 amps.
A.C. circuit load shall not exceed 8 amps for tungsten type lighting fittings and 6 amps for fluorescent type lighting fittings. The switches shall be of polished metallic finish. The switch boxes shall be provided with earthing terminal to connect to the earthing system of the premises.

IV. Outdoor Switches
Switches mounted outdoors, or in positions where they may be exposed to rain or water, shall have watertight enclosures with IP54 in accordance with BS5490. Alternatively they may be mounted inside watertight enclosures but shall be subject to the satisfaction of Engineer.

**QUALITY OF ELECTRICAL FITTINGS**

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Relevant Standard Specifications</th>
<th>Recommended Brand Names</th>
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</thead>
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<td>B.S. 3676</td>
<td>Clipsal, Orange, Crabtree, Hager</td>
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<tr>
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<td>13A Switched Socket Outlets, Plugs &amp; Adaptors</td>
<td>B.S. 1363</td>
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<td>Consumer Unit</td>
<td>B.S. 5486 Part 1 &amp; Part 13 I.E.C. 439-1 or BS EN 60439 – 3 IEC 695-2-1</td>
<td>Polychrome, Scame, Hibox, Hager</td>
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<td>Manufacturers</td>
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<td>Cu/PVC/SWA/PVC Cables</td>
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<td>LED Lamps</td>
<td>BS EN 62504</td>
<td>Philips, Osram</td>
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<td>10</td>
<td>Lighting Fixtures</td>
<td>EN 60598 BS 4533</td>
<td>Imported Best Quality</td>
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<td>Steel Enclosures (Epoxy Powder coated finish)</td>
<td>I.E.C. 529 for degree of protection</td>
<td>Maggline, KIK, Elsteel, Cubic</td>
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Table 1
QUALITY OF ELECTRICAL EQUIPMENT & MATERIAL OFFERED

(TO BE COMPLETED BY THE TENDERER)

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<thead>
<tr>
<th>No.</th>
<th>Item</th>
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<th>Country of Origin</th>
<th>Country of Manufacture</th>
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<tr>
<td>01</td>
<td>Sunk Switches, 10 A</td>
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<tr>
<td>06</td>
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<td>09</td>
<td>LED Lamps</td>
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<td>10</td>
<td>Lighting Fixtures</td>
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<td>11</td>
<td>Steel Enclosures (Epoxy Powder coated finish)</td>
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<td>12</td>
<td>PVC Conduits</td>
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<td>G.I. Conduits</td>
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WATER SUPPLY, SEWERAGE AND WASTE WATER DISPOSAL SYSTEM

1. General

   General Conditions and Special Conditions of Contract as described herein before apply to work under this Section.

2. Drawings

2.1 The Drawings accompanying these specifications are design drawings and generally are diagrammatic. They do now show every offset; bend elbow or junction box, which may be required for installation in the space provided. The contractor shall follow the drawings as closely as is practical to do so and shall install additional bends, offsets and junction boxes where required by local conditions from measurements taken at the building, subject to approval and without additional cost to the Owner. The Architect reserves the right to make any reasonable changes in outlet location prior to roughing in. It shall be the Contractor’s responsibility to provide complete systems as indicated and as required by applicable codes. All connections and appurtenances shown in the various diagrams shall be included in the finished job. The Contractor shall visit the site prior to bidding to familiarize himself with all conditions.

2.2 It shall be the responsibility of each trade to co-ordinate with all others for proper and adequate installation clearances.

3. Ordinances, Codes and Regulations

   All clarifications and modifications which have been cleared with appropriate authorities are listed under the applicable sections. Unless otherwise approved, products shall bear the mark of approval of Sri Lanka / British Standards Institutions as required by governing bodies, codes and ordinances.

4. Equipment, Material and Workmanship

4.1 Determine that each piece of equipment meets the detailed requirements of the Contract Documents and that it is suitable for the installation shown. Notify the Consultant of any shortcomings found during the tender period.

4.2 Where two or more units of the same class of equipment are furnished, used product of the same manufacturer. Furnish all materials and equipment, new and free from defects and size, makes, type and quality herein specified and approved by the Consultant. All equipments shall be installed in a neat and workmanlike manner.

5. Shop Drawings

5.1 The Contract Drawings shall serve as working drawings for the general layout of piping, conduit, ductwork, and various items of equipment. 5 sets of detail shop drawings shall also be provided, wherever required for proper co-ordination. All changes to the above drawings should also be submitted in 5 sets.
5.2 Manufactures detailed shop drawings shall be submitted for approval. Specifications and data sheets for all equipment shall be furnished. It shall be the Contractor’s responsibility to see that all deviations from drawings and from specifications shall be specifically noted on these drawings and called to the Consultants attention otherwise approval shall be automatically voided.

5.3 Equipment shop drawing submittals shall be in quintuplicate and shall consist of a single sheet, or sheets if required for each piece of equipment, and shall give the specific data needed for consideration of approval. All pertinent data listed in the Specifications and in schedules shall be furnished, including all special features. In addition the items shall be identified with the building and Specification Section they appear in by number.

5.4 In order to avoid delays in submitted shop drawings, stragglers may be submitted at a later date for inserting in the previously submitted indexed loose – leaf folder. All shop drawings to be submitted shall be indexed, and the original submittal shall note which drawings are to be indexed at a later date. Marked up catalogues are not acceptable and will be returned. It shall be the Contractor’s responsibility to see that all submittals are in proper order, and that all equipment will fit in the space provided.

5.5 All shop drawings shall be submitted 30 days before execution of work covered by the said shop drawing.

6. Instruction Manuals

Three copies each of Manufacturers Instruction and Maintenance Manuals, which shall describe in detail the operation and servicing of the respective items of equipment shall be furnished. Furnish also 3 copies of spare parts list of items of equipment requiring servicing.

The above documents shall be furnished within 3 months of awarding of the contract.

7. As Built and Operation Manuals

Within 60 days of practical completion of work, the following shall be provided.

(1) 5 copies of as Built Drawings which shall be an accurate description of the Works as installed.

(2) 3 copies of Operation Manuals

(3) 3 copies of Data Sheets listing out set points of control system.

8. Adjustments and Instructions.

8.1 Make necessary adjustments for each system and piece of apparatus installed using factory - trained and employed personnel for such systems as Clock Programmed and Fire Alarm, Temperature Controls, and whenever practicable for other equipment, and instruct the operator and his staff in the operation of all Systems, during the currency of the project and commissioning period.
9. Excavation and Backfilling

9.1 General

Perform all necessary excavation and backfill required for the installation of Electrical and Mechanical work. Any conduit piping or other work damaged during excavation and backfilling shall be repaired at no expense to the Owner.

9.2 Water

Keep all excavations free of standing water. Excavations damaged or softened by water shall be re-excavated and filled back to original level with approved selected natural fill materials (placed and compacted as specified herein below under Item 9.vi) at no expense to the Owner. Provisions for storing, pumping, bailing out, draining out, dredging and disposal of subsoil water or rain water shall be made at no expense to the Owner.

9.3 Tests

During the progress of the work for compacted fill, the Owner reserves the right to provide compaction tests made under the direction of an independent testing agency.

9.4 Excavation

Excavate trenches to the necessary depth and width, removing rock roots and stumps. Cost of additional excavation, offsets, etc., shall be borne by the Contractor. Excavation material is unclassified. Width of trench shall be adequate for proper installation of piping or conduit.

The trench shall be widened if Consultant does not consider it wide enough for proper installation.

9.5 Bedding

Concrete bedding for drains shall, unless otherwise specified, be of Portland Cement Concrete having a mix proportioned in parts by Volume of 1:3:6, 150 mm thick, and of width indicated, benched half way both sides to the crown of the pipes.

9.6 Backfill

All backfill for trenches and other excavations shall be of on site stockpiled selected natural fill materials (unless otherwise specified), placed and compacted to the Consultant's approval. Backfill shall be compacted to 95 percent (90 percent permitted at sub grades below areas to be landscaped) of maximum density at optimum moisture content as determined by BS 1377.

9.7 Grading

Following backfilling, grade all trenches to the level of surrounding soil. All excess soil shall be disposed of at the site, stocked as directed.
10 Measurements, Lines and Levels

10.1 Check dimensions at the building site and establish lines and levels for the work specified in the Section.

10.2 All inverts, slopes and manhole elevations shall be established by instruments, working from an established datum point. Elevation, markers and lines shall be provided for the Consultant's use to determine that slopes elevations are in accordance with Drawings and Specifications.

10.3 Established grid and area lines shall be used for location of trenches in relation to building and boundaries.

11. Cutting Patching and Repairing

11.1 Cutting, patching and repairing required for the proper installation and completion of the work specified in each division, including plastering, masonry work, concrete work, carpentry work, and painting shall be performed by skilled craftsmen in these respective trades, all as specified in the appropriate divisions of the specifications. Holes, which are cut oversize, shall be fully filled so that it forms a tight fit on the pipe or other object passing through.

12. Foundations and Supports

12.1 Provide supports for all apparatus as specifically detailed and as required by the manufacturers of specific equipment.

12.2 All supports and bases of floor mounted equipment and airway casings shall be set on 50 mm minimum depth Portland Cement Concrete Pads. Concrete bases under Air Handling Units shall be higher to provide a minimum trap seal.

13. Machinery Guards

13.1 Provide 10 mm mesh guards of woven wire, with shaft holes for easy use of tachometers, for all moving machinery such as pulleys, belts and shafts. Guards shall be adequately framed to provide a sturdy installation. Maintain adequate clearance from moving parts.

14. Equipment Protection

14.1 Keep all pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect all piping, conduit, ductwork, fixtures, equipment or apparatus. Any such item damaged prior to Final Completion of the Work shall be restored to its original condition or replaced at no expense to the Owner.

14.2 Protect all bright finished shafts; bearing housing, and similar items, until in service, no rust will be permitted.

14.3 Equipment and materials stored on the job site shall be covered or otherwise suitably protected at the direction of and to the satisfaction of the Consultant.
14.4 Electrical switchgear, panel boards, transformers, motor control centers etc., shall be completely covered against moisture, dust and foreign material. If covering become torn, they shall be replaced until the equipment is connected and operating.

15 Accessibility

The installation of valves, thermometers, clean cut fittings and other indication equipment or specialties requiring frequent reading, adjustments, inspection, repairs, removal or replacement, shall be conveniently and accessibly located with reference to the finished building. Thermometers and gauges shall be installed so as to be easily read from the floor.

16. Access Panels

Furnish access panels, where indicated and where required to provide access to valves, junction boxes and other appurtenances, panels shall be the type as required for the wall or ceiling construction. Doors shall be 450 x 450 mm size unless otherwise indicated.

17. Inserts and Sleeves

17.1 General

Layout work in advance of placing of concrete slabs or construction of walls. Furnish and set inserts and sleeves necessary to complete the works. Cost of cutting or patching made necessary as a result of this operation shall be at no expense to the Owner.

17.2. Pipe Sleeves

17.2.1 Wall Sleeves

Interior wall sleeves shall be 22 gauge galvanized steel, flush with wall on both sides. Sleeves shall be large enough in diameter to provide caulking from both sides using fire resistance materials.

17.2.2 Floor Sleeves

Interior floor sleeves for general areas shall be 22 gauge galvanized steel extending 25 mm above finished floor. All pipes passing through sleeves shall be caulked with approved rope and mortar and water tight. Insulated pipes shall have insulation butted to floor sleeve and sealed with insulated cement on both sides.

17.3 SLEEVES

17.3.1. Wall / Duct Sleeves

Wall, Duct sleeves shall be same as interior wall duct pipe sleeves, except minimum 10 gauges and properly blocked to prevent collapse during construction.
17.3.2. Shaft Wall Sleeves

Shaft wall sleeves shall be a section of the duct or fire damper, a minimum of 18 gauge for rectangular ducts, properly blocked to prevent collapse during construction. Sleeve or fire damper shall be terminated at the wall and sealed with insulating cement on both sides. Minimum thickness of fire dampers shall conform to appropriate BS, or BS Codes of Practice.

17.4. Floor Sleeves

Floor sleeves shall be same as shaft wall sleeves.

17.5 Conduit Sleeves

17.5.1 Wall Sleeves

Exterior wall sleeves shall be galvanized steel, flush with wall on both sides. Sleeves shall be large enough to allow for chalking and should be made watertight.

17.5.2. Floor Sleeves

All pipes passing through sleeves shall be caulked with an approved rope and mortar.

Blocked out holes in the structure for electrical and telephone conduits and fuse duct shall be filled by means of 18 gauge metal plate on top and bottom and cavity filled with approved fibres with mastic binder between.

18. Cleaning

18.1 Electrical, mechanical and plumbing equipment fixtures, piping and duct work, shall be free of stamping and markings (except those required by codes, such as in lighting fixtures), iron cuttings and other foreign material.

18.2 Water steam and condensate systems shall be finished and flushed clean.

18.3 Hot, cold and drinking water system shall be cleaned thoroughly, filled with chlorinated water, and flushed with soft water.

18.4 Steam pipes and strainers shall be cleaned after 24 hours operation of the system, and thereafter until the system is thoroughly cleaned.

18.5 Air and gas system shall be blown through to clear dirt.

18.6 Electrical panels, switchboards, contractors and motor starters shall be vacuumed clean to be free of dust and debris, and bus-bars, coils and internal contacting surfaces blow free of dust.

18.7 Where transformers have been activated in excessively dusty areas the interiors shall be cleaned of construction dust.
19. **Operator**

19.1 The Contractor shall instruct thoroughly the Owner and his representative in the efficient operation of the entire system, in accordance with manufacturer's equipment manuals and instructions.

19.2 The entire mechanical and electrical apparatus shall operate at full capacity without objectionable noise or vibration.

19.3 Plant shall be operated for a period of one month before handing over.

19.4 Capacity of individual equipment as well as the entire system shall not be less than the specified values when tested and operated at field conditions.

20.3 Starters shall be furnished as suitable for performing the control functions required,(with the exception of system where the starters are furnished as part of the control package).

20.4 All interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise.

20.5 The low voltage distribution shall be 400 volts, 3 Phase, 50 Cycles.

20. **Piping Installation**

20.1 Install unions in all non-flanged pipe connections to apparatus and adjacent to all screwed control valves, traps and appurtenances requiring removal for servicing so located that piping may be disconnected without disturbing the general system.

20.2 Provide dielectric couplings, unions or flanges between galvanized steel, Aluminum and copper pipe or tubing.

20.3 Install all piping so as to vent and drain.

20.4 Run all piping parallel to the building structure and support it sufficiently to prevent sagging.

20.5 Support all piping independently at apparatus so that its weight shall not be carried by this equipment.

20.6 All piping connected to coils, and apparatus requiring tube cleaning or removal as heat exchanges, shall be run clear of such area, except for removable connections.

20.7 Provide anchors, pipe rests or supports where necessary to support risers and maintain slopes in position and to prevent movement of piping and damage to the building.

20.8 Piping shall not be located over electrical equipment without adequate insulating protection against condensation dripping.

20.9 Piping connected to vibrating equipment shall be resiliently supported throughout the building.
21. **Piping Joints**

1. **Bell and Spigot Joints**

   Bell and Spigot Joints Shall be carried out with molten lead. The spigot of the pipe must be forced well home into socket and must be entered, so that the joint may be of even thickness all round. At least one complete lap of clean white hemp spun yarn shall be drawn into the bottom of the socket without being forced through the joint into the pipe, as many laps of tarred yarn as may be needed to leave the space of not less than 25 mm required for the lead shall then be forced into the joint and caulked tight. The joints shall then be run with molten lead in sufficient quantity so that after being caulked solid the lead may project 3 mm beyond the face of the socket against the outside of the spigot but must be flush with outside of the socket.

2. **Screwed Joints**

   Pipe ends shall be reamed, dope or tape applied to male threads only, and be made up with not more than two threads showing beyond the fitting's end. Junctions of galvanized pipe to cast iron shall be made with tapped spigots or hand couplings screwed to the end of the galvanized pipe, with dope applied to the pipe thread (with the exception of brass joints, which shall be made with Teflon tape or equal).

3. **Flanged Joints**

   a. Flanges shall be cast iron or steel for screwed piping and steel welding neck or slip-on types for welded line necks and sizes. Pressure rating shall match the apparatus, valve or fitting to which they are attached.

   b. Gaskets shall be 2 mm thick, ring type, coated with graphite and oil to facilitate making a tight joint.

   c. Bolts and nuts shall be of adequate strength for the service intended and shall be dimensional compatible with the flanges as per relevant B.S.Code.

4. **Solder Type Joints**

   Solder type joints shall be brazed with phos-copper rod on wrought copper fittings, or silver brazing alloy with the flux recommended for that particular alloy on all fittings. Where silver brazing alloy is used, the copper tubing and fittings shall be thoroughly cleaned with steel wool before applying the flux. The copper tubing shall have all burrs removed, be reamed to full bore and be true and round for all joints. Heating shall be applied uniformly to secure the entire circumference of the joint to show proper penetration and sealing. Under no circumstances shall softer solders be allowed nor shall phos-copper be used on cast fittings.
5. **Welded Joints**

Welded joints shall be made by the arc welding process. Port openings to fittings must match the inside diameter of the pipe to which they are welded, conforming to the relevant B.S. Specifications and reinforced when required. All bends shall be full radius welded elbows and tees with welded tees. Reducing fittings must be used for size reduction.

6. **Copper Pipes (Flared Joints)**

All copper pipes up to 50 mm shall be with flared joints. The flaring shall be done evenly with proper tools and shall seat the nut firmly. All copper pipes above 50 mm will be flanged connection with soldered or brazed necks.

7. **P.V.C. Pipes**

All P.V.C. Pipe joints should conform to B.S. 4514 or any other specifications acceptable to the Consultants.

22. **Hangers and Supports**

22.1 Provide hangers to all pipes to clear insulation and guides where required, as well as to support piping. For attachment in concrete use swivel inserts of Uni struct manufacture continuous concrete type inserts, or equal.

22.2 Provide hangers within 1m of all changes in direction of mains and a minimum of three hangers per expansion bend. Provide all additional structural steel angles, channels or other members not specifically shown which are required for proper support.

22.3 Space hangers as noted below except on soil pipe, which shall have a hanger at each joint with a maximum of one per fitting. In areas of multiple fittings, sufficient hangers shall be provided to maintain proper slope without sagging.

<table>
<thead>
<tr>
<th>P.V.C. Pipes</th>
<th>Vertical run (m)</th>
<th>Horizontal Run(m)</th>
</tr>
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<tbody>
<tr>
<td>Size (mm)</td>
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<tr>
<td>32 - 40</td>
<td>1.2</td>
<td>0.5</td>
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<tr>
<td>50 - 63</td>
<td>1.2</td>
<td>0.6</td>
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<tr>
<td>75 - 110</td>
<td>1.8</td>
<td>0.9</td>
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<tr>
<td>160 above</td>
<td>1.8</td>
<td>1.2</td>
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<table>
<thead>
<tr>
<th>Galvanized Steel, cast Iron, Ductile Iron pipes</th>
<th>Vertical run (m)</th>
<th>Horizontal Run(m)</th>
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<td>25</td>
<td>3.0</td>
<td>2.4</td>
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<tr>
<td>32</td>
<td>3.0</td>
<td>2.7</td>
</tr>
<tr>
<td>40 - 50</td>
<td>3.7</td>
<td>3.0</td>
</tr>
<tr>
<td>65 - 75</td>
<td>4.6</td>
<td>3.7</td>
</tr>
<tr>
<td>100 above</td>
<td>4.6</td>
<td>4.0</td>
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</tbody>
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22.4 Provide floor stands, wall bracing, masonry piers etc., for all lines running near the floor or near walls and which can properly be supported or suspended by the walls or floors. Pipe lines near concrete or masonry walls may also be hung by hangers carried from wall brackets at a higher level than pipe. Hanging of any pipe from another is prohibited.

22.5 For all pipes above 100 mm the contractor shall ensure that all hangers and supports are designed to withstand any water hammer, which may occur during usage.

All hangers and supports shall be of hot dip galvanized finished with the minimum coating thickness of 85microne.

23. Pressure Gauges

Pressure gauges shall have not less than 100 mm dial face, steel body and gauge cock. Dial ranges shall be adequate for the pressure encountered.

24. Valves

24.1 General

Provide valves on branch pipe connection to mains and at connection to equipment where indicated. All valves shall be accessible and fully equal in size to piping. Support all valves where necessary. All valves should conform to the relevant B.S. Code.

24.2 Valves

1. All globe and check valves shall have working parts suitable for hot and cold water, oil and gas as required. Valves shall be tagged with permanent label under hand wheel indicating type of disc installed.

2. All valves in equipment rooms located over 2100 mm above floor shall be provided with chain wheels and chains extending to 1800 mm above floor.

3. All globe and gate valves shall have in excess of 25 percent Teflon impregnated packing.

24.3 Cocks

24.3.1 Gas

Leak proof brass cocks as required by the local gas Company Rules.
24.4 Foot Valves

Provide gunmetal foot valves with strainers of approved quality, where positive suction head is not available.

25 Pressure Service Valves

25.1 Fill Lines

On all systems, provide equilibrium type float valves with silencer tubes.

25.2 Strainers

Y-Pattern, with Monel mesh screen or perforated brass strainer. Screening area of strainer shall be a minimum of 500 percent greater than pipe area with 0.8mm inch maximum size holes. Strainers 3-inches and above shall have a flushing outlet with valve.

26 Air Elimination

Provide manual air vents, consisting of globe valve, where shown.

27. Piping Duct and Equipment Insulation

27.1 General

All tests shall be completed and all systems approved before the insulation is applied to equipment or piping. Apply all insulation in accordance with manufacturer's recommendation. Insulation shall be of approved manufactured type specifically intended for the service specified.

27.2 Piping

All piping insulation shall have the side and end joints butted tightly and the jacket applied smoothly with longitudinal and circumferential joint. All exposed ends shall be finished neatly with the jacket material and mastic. All jackets and adhesives shall be fire retardant. Vapour barrier of glass cloth covering shall be continuous over insulated fittings. Unions and expansion joints shall be built up 15 mm beyond adjoining insulation for identification. Use glass fibre insulation on flex connectors. All insulation with an integral vapour barrier shall have the joints and fittings covering sealed as recommended by the manufacturer.

All other piping insulation shall have the ends sealed with glass cloth at the fittings.

All piping insulation shall be the moulded type manufactured specifically for that purpose.
28 Tests

28.1 Test all pumping systems in the presence of the Consultant and Inspector from the local body where required. Provide ample advance notice of test dates. Provide all equipment material and labour necessary for inspections and tests and repair all work not passing tests. After repairs are made, repeat tests until entire systems are found satisfactory to the above authorities. Carry out all tests prior to concealing, insulating or backfilling over any piping. No exceptions will be made.

28.2 Test entire system of soil, waste and vent piping by water after the roughing in is completed and before the fixtures are set. After setting the fixtures, provide smoke test.

28.3 Water Tests

Test entire system or sections of system by closing all openings in piping except the highest opening and filling system with water to the point of overflow. If the system is tested in sections, plug each opening except the highest opening of the section filled with water. Keep the water in system or in portion under test for at least 45 minutes before inspection starts. The system must be tight at all joints.

28.4 Final Test

After fixtures are set, test system with smoke as follows:

28.5 Smoke Test

Fill traps with water, and then introduce into system a pungent thick smoke produced by one or more smoke machines. When smoke appears at stacks on the roof, plug stacks and allow pressure of 25 mm water column to build up in system. Maintain pressure for 15 minutes before inspection starts. The system shall be tight at all joints.

28.6 Test all down-spouts or rain leaders and their branches within the building by water as described for the above soil, waste and vent system.

28.7 All Cold Water Piping

All cold-water piping shall be hydrostatically tested for a minimum of 24 hours without drop in pressure and test pressure shall not less than 1.5 times the working pressure.

28.8 All systems shall be tested in sections as required to expedite the work of other trades and meet construction schedules.
29 Equipment and Piping Identifications

29.1 General

Each piece of equipment shall bear a permanently attached identification plate listing the manufacturer's name, capacities, sizes and characteristics. In addition a metal or Bakelite nameplate shall be secured to the unit housing or adjacent thereto giving the designations and system it services. A list of designations shall be furnished to the Consultant for approval prior to preparing the nameplate.

29.2 Pipe Markers

Each piping system shall be provided with colour bands corresponding to a colour code issued by the Consultant. Insulated pipes, which are not provided with sheet metal protection, shall be provided with G.I. band strips to which the colour band will be painted.

29.3 Valve Tags

Provide numbered brass disc attached by chain to each system main and branch valve for identification, including automatic valves etc., the tags shall be 6 mm dia. of standard manufacture, with numbers as indicated in line diagram provided by Consultant.

30. Air Balance and Operating Instructions

30.1 At the completion of the work, the adjustments of the system shall be done by a Professional Engineer who is approved by the Consultant.

30.2 The Mechanical Sub-Contractor shall furnish a helper and such ladders, scaffoldings and other equipment as necessary to make adjustment. Instruments shall be furnished by the Contractor and shall be calibrated and tested by an authority named by the Consultant. The mechanical sub-contractor shall make all adjustments as directed and then replace all covers, access panels, etc., removed during adjustment.

30.3 Include in tender the amount to cover the cost of balancing and adjusting the systems, setting up reset schedules, instructing the Maintenance Engineer in system operation and for preparing the operation and maintenance instructions.

31. Plumbing

31.1 Piping Materials

Provide piping materials as described for the following pipe system.

31.2 Soil and Waste, Storm Water

1. Underground piping and Main Horizontal Pipes Rigid PVC pipes and fittings conforming to BS 4514, BS 4660, BS 5255 Sewer and waste water main stacks from low noise polypropylene type to conform to comply with EN 1451-1 and DIN 19500.
31.3 Branch Wastes from Baths, Wash hand Basins and Sinks
1. Rigid PVC piping conforming BS 3943, BS 4514 and BS 5255 and fitting of rigid P.V.C. shall be moulded.

31.4. Above Ground
1. Rigid P.V.C. piping conforming to BS 4660, BS 5481, BS 4576, and Low noise polypropylene type as indicated in drawings.

31.5 Inspection Chambers and Manholes
1. 150 mm thick reinforced concrete walls and bed using 1:2:4 mix unless otherwise stated. A waterproof membrane shall be provided as specified in the drawing. Masonry shall be plastered internally and rendered waterproof using waterproofing plastering materials.

31.6 Drop Connections
1. Drop manholes to be constructed conforming to BS 8301: 1985.

31.7 Vent Piping

**Above Ground and Underground**

1. Rigid PVC pipes and fittings conforming to BS 4514, BS 4660, BS 5255.

31.8 Domestic Water Supply

**Above Ground and Underground**

1. Hot water pipes in Polypropylene pipes, type III manufactured to comply with DIN 8077-8078 for pipes and DIN 16962 for fittings. They shall be suitable for 20 bar operating pressure for cold water and 10bar operating pressure for hot water up to 60 °C.

2. Water supply pumping main rigid UPVC pipes type 1000 to SLS and with moulded fittings.

31.9 Traps

31.9.1 General

Provide traps on all fixtures connected to the waste systems, except for fixtures having integral traps. All traps shall have a seal of not less than 40 mm and not more than 100 mm.

31.9.2 Exposed Traps
Exposed traps for fixtures shall be chromium plated cast brass as per BS.

31.9.3 Cast Iron Traps

Traps installed in connection with cast iron pipe shall be of the same quality complying with BS 437, and grade of the pipe, the size of the outlet shall correspond to the socket of the pipe receiving it.

32. Chlorination

32.1 General

Upon completion of all tests and after necessary replacements have been made, disinfect all domestic water piping.

32.2 Method

After thoroughly flushing the system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine. After four hours retention, the system shall be drain101ed re-flushed and returned to service.

32.3 Drains

Provide floor and roof drains of the sizes and types as shown. Caulk inside joints. Provide clamping collars for drains where waterproof membranes occur and for location in supported slab. (Other than slabs - on ground).

33. Plumbing Fixtures

33.1 General

Provide plumbing fixtures of the type and quality indicated for location as shown on Architectural and Plumbing Drawings.

33.2 Fixtures

Complete with fittings, supports, fastening devices, faucets, valves, trap and appurtenances as required.

33.3 Vitreous Ware

As indicated in architectural drawings.

33.5 Porcelain Lined Ware

As indicated in Architectural drawings.

33.5 Fittings and Fixture

Heavy brass castings properly finished and chrome plated.

33.6 Escutcheons

Brass, chrome plated.

33.7 Warranty

All fixtures warranted not to erase, discolour, scale, or scratch.
33.8  **Fixtures Set and Connected**

To soil, waste, vent and water supplying in neat, finished and uniform manner.

33.9  **Connections**

Equal height, plumb and set at right angles to floor, wall or both unless otherwise indicated or directed.

34  **Specification - Water Supply**

34.1  **Scope of Work**

The work covered in this Section shall include, but not be limited to all materials, labour, equipment and services as stipulated in the drawings, specifications and schedule rates inclusive of the following:

a. The Municipal connection to the main water supply line, the supply line from Municipal mains to sump and the wash out lines from the sump to Main Waste Line as shown in Drawings.

b. The drain out and overflow pipes for all storage tanks inclusive of the supply installation of float valves, float switches and overflow alarms.

c. The wiring of all equipment up to the isolators and starters.

d. The entire hot and cold water piping distribution system including supply and installation of hot and cold water pipes and fittings, pressure reducing valves and accessories, isolating valves within the building.

34.2  **General**

This Special Specification is to be read in conjunction with the General Specification.

34.3  **Level Datum**

Levels quoted on the contract drawings are based on a fixed Datum at site. It shall be the Contractor's responsibility before commencing the contract to obtain from the Consultant in writing the location and value of the permanent benchmark to be used. All temporary benchmarks shall be referred thereto.

34.4  **Contractor to use Special Plant if required**

The Contractor shall if the Consultants so require supply and use such special plants and tools in executing the work as the Consultants may direct.

34.5  **Access and site Roads**

The Contractor shall be deemed to have fully informed himself as to the suitability of the roads to the site and the roads within the site. He shall exercise due care in the use of such roads and shall make good any damage caused by their use. The Contractor shall provide such temporary site roads as are necessary.
34.6 Submissions of Samples

Before incorporating the finished work, any materials or articles which contractor has to supply under the terms of the contract, the contractor shall submit to the Consultant's Representative for his approval a sample shall be delivered to and kept at his office for reference. All the respective kinds of materials and articles used in the works shall be at least equal in quality to the approved samples. Each and every sample shall be a fair average of the bulk material, or of the articles, which it represents. The Consultant's representative may decide the method by which the sample to be taken from bulk shall be obtained.

Any or all of the materials and manufactured articles supplied by the Contractor for use on any of the work through this contract shall be subject in advance to such tests as may be deemed necessary by the Consultants. Samples of all such materials and manufactured articles together with all the necessary labour, materials, plant and apparatus for sampling and for carrying out of tests on the site of all such materials and manufactured articles shall be supplied by the Contractor at his own expense.

The cost of special tests ordered by the Consultants to be carried out by an independent person at a place other than the site or place of manufacture or fabrication shall be borne by the Employer, provided the tests show that the materials, articles or workmanship are in accordance with the specification otherwise the costs of such special tests shall be borne by the Contractor.

34.7 Quality of Materials and Workmanship

The materials and workmanship shall be of approved quality.

34.8 Sri Lanka Standards and British Standards.

Sri Lanka Standards and British Standards current at the date of tender apply for materials and workmanship. Should there be any inconsistency between the two standards, then the Sri Lanka Standards shall apply.

34.8 Precautions against Contamination of the Works

The Contractor shall satisfy the Consultants that all his personnel working on the site are medically suitable to be in contact with a public water supply, and his personnel shall undergo any necessary medical test, at the Contractor's expense, to show that they are free from any infections diseases and are not carriers of any such diseases.

The Contractor shall at all times take every possible precaution against contamination of the works and existing waterworks.

Throughout the contract, the site and all permanent and temporary works shall be in a clean, tidy and sanitary condition. The Consultants will give the Contractor due notice of his intention to carry out any inspections during the period of maintenance and the contractor shall upon receipt of such notice arrange for a responsible representative to be present at the times and dates named by the Consultants. This representative shall render all necessary assistance and take note of all matters and things to which his attention is directed by the Consultant.
35 **Works Water Supply**

The Contractor shall make suitable arrangements and bear all costs in connection with the provision and maintenance of works water supplies on site.

The water shall be of a chemical and purity standard such that it will not pollute, injure or cause any deterioration of the works.

36 **Spoil Dumps**

The Contractor shall not deposit excavated materials on public or private land except where directed by the Consultants in writing or with the consent in writing of the Local Authority of the owner or responsible representative of the owner of such land and only then in those places and under such conditions as the Local Authority, owner or responsible representative may prescribe.

37 **Provision of Facilities for Consultants Inspection**

The Contractor shall provide necessary tackle access and labour to enable the Consultant and/or the Consultants Representative conveniently to carry out such inspection, as they may deem necessary at all times during the currency of the contract.

38 **Site**

The tenderer before tendering is advised to visit the site by previous appointment with the Owner.

39 **Nature of Tender**

The Contractor shall carefully study the drawings and satisfy himself that the quantities are correct and fill in the prices in at the attached Bill of Quantities. It is to be distinctly understood that the total quantity tendered for is to complete the project. No variation or extras will be allowed. Any omission should be notified by the Tenderer when tendering stating the value of such omission. No alteration shall be made without the written permission of the Consultants.

40. **Surplus Stock**

In ordering materials for this contract the Contractor shall not be solely guided by the quantity in the bill. He should by proper measurements at the site satisfy himself as to the correct quantity of materials required for the work. No compensation shall be paid by the Owner on completion of the work for any surplus stock of any materials obtained for the purpose of this contract.

On completion of the contract the Architect may retain certain surplus stocks, which would be useful for the maintenance of the scheme and pay at the prices agreed upon at that time by the Consultants and the Contractor.
41 **Pipe Trace**

The Contractor shall set out the pipe trace and get it approved by the Consultants prior to commencing of work.

42 **Pipe Measurement**

In measuring the linear feet of pipe work, the length of specials along the axis of the pipe trace will not be deducted. The Contractors rate for specials should take this into account.

43 **Literature on Materials**

The Tenderer shall submit with his tender detailed literature and specifications from the manufacturers in respect of all equipment and materials included in his offer and give the name of manufacturer and the country of manufacturer of the materials and equipment.

44. **PVC Pipes and Fittings**

All pipes and fittings shall be in every respect suitable for storage, installation, use and operation in the conditions of temperature and humidity appertaining to Sri Lanka.

All pipes and fittings shall be suitable for a working pressure of 10bar unless otherwise specified.

Pipes, bends, couplers and similar fittings shall comply with British BS 3505:1968. Specification for un-plasticised PVC pipe for cold water services, together with additional clauses set out in this specification of any other National Standard or Specification acceptable to the Consultants as providing equivalent or better quality of materials and workmanship than specified above together with the additional clauses set out in this specification.

Joints and fittings for use with PVC pipe shall comply with "BS 4346 Part 12: 1970" together with additional clauses set out in this specification or any other National Standard or specification acceptable to the Consultants as providing equivalent or better quality of materials and workmanship than specified above together with the additional clauses set out in this specification.

45. **Polypropylene pipes and fittings**

Polypropylene type III manufactured to comply with DIN 8077-8078 for pipes and DIN 16962 for fittings. They shall be able to withstand up to 20bar operating pressure for cold water and 10bar for hot water at 60°C.

46. **Flanges**

Dimensions of flanges shall be in accordance with B.S. 4504:1969. Flanges shall be suitable for a nominal pressure of 16kgf/cm² (NP 16).
47. **Taps and Stop Cocks**
Every tap when fully assembled shall be capable of resisting a pressure of at least 16 bar.

Every valve, spindle and other internal parts of the tap shall be made of a corrosion-resisting alloy.

Every tap shall have an efficient screw down valve.

The valve shall be made in one piece true all over and machined on the face on which the washer will be seated.

48. **Float Valves**
The valve body to be of gunmetal and float of brazed copper.

49. **Excavation and Backfilling Trenches**
The width of the trenches across the two vertical faces in original ground of the excavation for the various sizes of pipes shall be the minimum required for efficient working after allowance has been made for timbering and strutting and shall be approved by the Consultants.

Where pipes are not laid on concrete the bottom of the trenches as excavated shall be smooth and shall be free from stones and other projections.

Where rock is met with in the trenches the excavation shall be taken to a depth of 150 mm below the intended level of the bottom of the pipes and 150 mm selected filling (approved by the Consultants) placed on the rock and consolidated to form a firm even bed for the pipe.

50. **Trench Depth**
Where the pipelines are to be laid on roadways there should be a clear cover of 1000 mm above the top of the pipe.

In the case of other pipe lines a minimum of 300 mm clear cover over the top of the pipe should be allowed.

51. **Backfill**
The soil filled around and over the top of the pipes shall be free from stones, tree roots and other vegetable matter and filled with utmost care, so as to obtain the greatest possible compactness and solidity, the soil being screened if necessary to exclude material which would damage the pipe. The filling in the soil shall be compacted and where hand ramming is employed, in no case shall the number of men filling in be more than half the number of men ramming.
52. Pipe Laying

Pipe Jointing

Jointing of pipe to pipe or pipe to special fitting shall be carried out as recommended by the manufacture of the pipes. For pipes and fittings, jointing done with solvent joints shall be effectively protected from the direct rays of the sun immediately after they are laid until permission is given for the trenches to be refilled by the Consultant.

Cutting of PVC pipes - the cut shall be made in accordance with the manufacturer’s recommendation and tools specified by the manufacturer. Laying of polypropylene pipes should be as per manufacturer’s instructions.

53. Thrust and Anchor Blocks

Concrete thrust and anchor blocks shall be formed at bends, tees and valves in accordance with the typical sections shown on the drawings or otherwise as directed by the Consultants. The additional excavation shall be made after the bends etc., have been jointed and the concrete shall then be placed with all possible speed.

The concrete used for thrust and anchor blocks shall be 1:3:6. After placing the concrete, it shall be kept in view for not less than six hours. No pressure shall be applied in any section of main until the concrete has had at least three days curing.

At u - PVC fittings a polythene or equally suitable material membrane to the satisfaction of the Consultants shall be provided to separate the fitting from the concrete of the thrust or anchor block.

Anchors to prevent longitudinal slip shall be constructed where the slope of the pipe is greater than 1:3 or as otherwise directed by the Consultants.

54. Testing Water Mains

After each section of the pipeline has been laid, the ends shall be fitted with a blank clang; cap or plug and the section filled with water and free of air. The water in the pipe line shall then be put under pressure which shall be increased by means of a hand pump or other approved device to 50% above the highest working pressure in the section tested.

The leakage from the pipeline shall be ascertained from the net volume of water that has been pumped into the pipeline during the test periods. The leakage so ascertained shall not exceed the volume determined by the following formula.

For u - PVC pipelines –

\[
\text{Allowable leakage in gallons} = P.D.L. \text{ Gallons per 100 ft in 24 hours.}
\]

\[
\text{Where D} = \text{Nominal diameter of pipe in inches.}
\]

\[
\text{L} = \text{Length of pipeline under test in miles}
\]

\[
\text{P} = \text{Test pressure}
\]

83
55. **Cleansing Water Retaining Structures**

   The inside of all water retaining structure and all interior pipe work shall be thoroughly cleaned and washed to remove contamination and the water from these operations removed by squeegees and drained away.

56. **Sterilizing Water Retaining Structures and Pipe Lines**

   The inside of portable water retaining structures shall be filled to overflow with water containing 20 parts per million of chlorine and left for at least 24 hours. They shall then be drained and filled with clean water from which samples for analysis shall be taken as per the instructions of the Consultants. If the result of the analysis are unsatisfactory the serializing process, refilling and sampling shall be repeated until the results of the tests are satisfactory.

   After the pipe lines have been filled and flushed out of all debris and contamination matter, it shall be filled with chlorinated water containing not less than 10 parts per million free chlorine and left to stand 24 hours or such period as directed by the Consultants. The pipes shall be flushed and filled with treated water.

57. **Specification for Centrifugal Electric Pumping Sets and Accessories**

   **General Requirements:**

   This specification provides for the supply and installation of centrifugal electric pumping sets and accessories.

58. **Literature on Equipment and Materials:**

   The tenderers’ shall supply detailed literature and specifications from the manufacturers in respect of all equipment and materials included in his offer and give the names of all such manufacturers and the Country of Manufacturer of the materials and equipment.

59. **Calibration of Instrument and Meters**

   All instruments and meters shall be calibrated in the Metric Units as follows:-

   a. Pressures shall be indicated in metric water columns or Kg/cm2

   b. Flows shall be indicated in cubic meters/hour.

   c. Quantities shall be indicated in cubic meters.

   d. Water level shall be indicated in meters.

60. **Installation of Plant and Equipment**

   The Contractor shall be responsible for installing all plant and equipment supplied by him in accordance with the specifications and drawings provided.

   The supplying and fixing of all items such as brackets and supports, clamps and clips,
plugs, bolts, screws etc., shall be carried out by the Contractor. Details shall be submitted for approval by the Consultants before fixing.

The Contractor shall also carry out all the mechanical and electrical installations adjustments and tests and provide his tools and testing equipment for this purpose.

This tender also provides for the supply and installation of pipes and fittings from the suction side of the pump up to the delivery side indicated in the drawing.

The pumps shall be of the centrifugal type with end/side suction and vertical/horizontal delivery. The shaft shall be of stainless steel and the impellers and guide rings of bronze. Each pump shall be provided with a 100 mm dia pressure gauge calibrated to read according to the head of the pump and a vacuum gauge calibrated to read from 0 to 30 ft. (0 to 10m) on the suction side. The speed of the pump shall not exceed 2900 rpm. The stuffing boxes of the casing shall be of ample depth for the reception of the packing and shall be provide with suitable glands with adjustable water seals and drip catches with tapped connection for lead away.

61. Characteristics of Pump and Motor

The tenderer shall include the actual characteristics with the corresponding tolerances particularly of the following:-

1. **Pumps** - Discharge as a function of head, efficiency curve, power absorbed curve and other test reports.

2. **Motors** - Efficiency at full load and half load, power factor at full load and half load, heating at ambient temperature of 40 C. Starting current as compared to normal full load current.

62. Testing the Pumps at Manufacturer's Works

Manufacturers shall test pumps prior to shipping. Results of pump tests carried out at the manufacturers works shall be provided at the time of delivery of equipment.

63. Starter

Each pumping unit should be provided with automatically operated (push button type) star delta starters with overload release and provision for float control. When tripped the starter should return to the off position. The starter shall incorporate an isolating MCB and lamp to indicate pump on position.

64. Automatic Start and Stoppage of Pumps

An arrangement for automatically starting/stopping the pumps when the Sump/water tank is almost empty/full/fire reserve should be provided as specified in the controls drawing.
65. **Spares and Tools**

A complete set of tools shall be provided with each pumping set and list of these shall be submitted with the tender.

The successful tenderer shall supply 3 sets of spares lists with ordering references for the pumping set. The Tenderer should quote and submit an itemized and price list of spares required for each item of equipment namely pumps, motors, starters, etc., for the following.

1. Spares for keeping the unit in working order for 2 years of 7000 hours normal running.

2. Spares for complete overhauling of the units that are considered vital for the continued high efficient performance after 2 years of 7000 hours normal running.

The Tenderer should also hold out a guarantee that sufficient stocks or spares will be carried by him at all times. Manufacturer's leaflets should be submitted in support of each item.

66. **Testing**

The pumping unit shall be tested at Manufacturer's works prior to delivery and the manufacturer shall supply the test results of the pumping set including curves of Head, H.P. Input and overall efficiency plotted against 'Delivery' in gals/min. M3/hr).

After installation and setting to work of all the equipment the pumping sets shall be tested according to the satisfaction of the Consultants. The pumping sets shall be given continuous test runs for period of not less than six (6) hours to determine.

   a. That it is in satisfactory condition.

   b. That it is capable of delivering the specified quantity of water against the specified head when running at the specified speed.

   c. The power absorbed by pumps when doing such work.

   d. The efficiency and other specified characteristics.

The testing of pumps as detailed above and the other equipment for performance and accuracy shall be carried out by the Contractor and the costs of testing shall be borne by him.

67. **Commissioning of Equipment**

After satisfactory completion of all tests, the Contractor shall operate the equipment for 7 days and during this period instruct any person nominated by the Owner regarding the operation and maintenance of the equipment.
68. **Maintenance Period**

During the specified maintenance period, the Contractor shall attend to any repairs and make good all defects that may be detected or may arise to the equipment during the maintenance period. He shall also replace any equipment or part of the equipment, which fails or does not give satisfactory performance during the maintenance period.

These repairs and replacements shall be carried out within 10 days of being notified to do so and all expenses involved in this connection shall be borne by the Contractor.

69. **Details Requirements of Plant**

Electricity driven pumping unit, capacity and total head as specified in the B.O.Q.

Minimum overall efficiency expected is 40% (The efficiency of the pumps at the specified duty will be a consideration in evaluating the offer). An alternate offer for a pump of lower efficiency will be considered, if a suitable offer for a pump of the required efficiency is not available.

70. **Operating and Maintenance instructions, Circuit Diagrams, Spares List etc.**

The Contractor shall provide three sets of operating and maintenance instructions relating to all the equipment and detailed diagrams of wiring of the station and circuit diagrams for all switchboards etc.

A schedule which may be in the form of materials lists, giving full particulars together with ordering references of all replaceable parts for all the equipment should be supplied.

The Contractor shall be solely responsible for the provision of all labour, materials, plant and chemicals necessary for the carrying out of all testing operations. The water used for cleaning, flushing and sterilizing in accordance with this clause will be provided by the contractor. The contractor shall be responsible for all temporary works and other arrangements in connection with cleaning, sterilizing and flushing.
Fire Detection

&

Protection system
GENERAL TECHNICAL SPECIFICATION

2.1 General

This section of the specification includes the supply, installation, connection and testing of the microprocessor controlled, addressable automatic fire detection and alarm equipment required to form a complete, operative, coordinated system for the building. Fire detection and alarm system shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, annunciator, and power supply and wiring as shown on the drawings, listed in the bills of quantities and specified herein.

2.2 Scope of Work

The scope of work includes the following:

(a) Preparation of Installation shop drawings and obtaining approval from Local Fire Authority.

(b) Supply of all equipment and materials required for a new, microprocessor controlled fire detection and alarm communication system for the proposed office building. Provide all required labor and installation of the complete system.

(c) Preparation of shop drawings conforming to the requirements of Fire Services Department of Municipal council with any revisions required in layouts and points to conform to the requirements of authority.

(d) The contractor shall perform all the equipment and devices standard testing as directed by the Consulting Engineer. The Contractor shall bear the cost for such tests and any items found defective shall be replaced at no extra cost. Such replaced items shall be re-tested for verification.

(e) Obtaining certificate of conformity from Fire Services department on completion of work.

(f) The Contractor shall submit 3 hard copies + 1 soft copy of Operation & maintenance Manuals, which shall contain Product literature, Specific operating instructions and Maintenance instructions.

(g) Training of the employers staff for proper operation of the system.

(h) Maintaining the system during the defects liability period.

2.3 Applicable Standards / Publications

All equipment and material used and Fire detection and Alarm System shall meet the requirements of the relevant standards / publications.
A. British Standards Institution

BS 5445 Components of automatic fire detection systems
   Part 5: Heat sensitive detectors
   Part 7: Specifications for point type smoke detectors using
   scattered light transmitted light or ionization
   Part 8: Specifications for high temperature heat detectors

BS 5839 Fire detection and alarm systems for buildings
   Part 1: Code of practice for system design, installation and
   servicing
   Part 2: Specifications for manual call points
   Part 4: Specifications for control and indicating equipment

B. National Fire Protection Association (NFPA) - USA:

   No. 70 National Electric Code (NEC)
   No. 72-1996 National Fire Alarm Code
   No. 101 Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:

   No. 50 Cabinets and Boxes
   No. 268 Smoke Detectors for Fire Protective Signaling Systems
   No. 864 Control Units for Fire Protective Signaling Systems
   No. 268A Smoke Detectors for Duct Applications.
   No. 521 Heat Detectors for Fire Protection
   No. 464 Audible Signaling Appliances.
   No. 38 Manually Actuated Signaling Boxes.

   Power supplies for Fire Protective Signaling Systems.
D. Fire Regulations of Institute for Construction Training and Development, Sri Lanka

E. All requirements of the Fire Services Department of Municipality.

2.4 Approvals

A. The system must have proper listing and/or approval from one or more of the following internationally recognized agencies:

BSI  British Standards Institution

UL  Underwriters Laboratories Inc, USA

2.5 Basic Requirements

a. The fire detection and alarm system shall be a monitored addressable system.

b. The detection system shall include automatic fire detectors and manual call points.

c. Generally each detector shall have a unique address. However, if a room/compartment is provided with more than one detector, then all the detectors in that room/compartment may be grouped together and may have a single common address.

d. Each manual call point shall have a unique address.

e. Fire alarms shall be given by audio and visual devices. Each alarm device shall have a unique address.

f. An addressable fire alarm control panel shall be provided. It shall be possible to map inputs to outputs as required.

g. Power for initiating devices and notification appliances shall be from the main fire alarm control panel.

h. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

i. Alarm signals arriving at the main Fire Alarm Control Panel shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
2.6 Mode of Operation on Fire Signal

The contractor shall propose, for approval by the Engineer, complete mode of operation of the system.

2.7 Equipment and Materials

All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations.

2.8 Main Fire Alarm Control Panel

2.8.1 General

The main Fire Alarm Control Panel (FACP) shall contain a micro-processor based central processing unit (CPU). The FACP shall communicate with and control the equipment used to make up the system:

2.8.2 Functional Requirements

The main FACP shall perform the following functions:

1. Supervise and monitor all addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all initiating signaling and notification circuits throughout the facility
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
4. Visually and audibly annunciate any trouble, supervisory or alarm, condition on panel display

2.8.3 Alarm Functions

When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

1. The alarm indicator on the control panel shall flash.
2. A local audible device in the control panel shall sound a distinctive signal.
3. When the Acknowledge button is pushed the audible alarm shall stop and and indication light shall stop flashing and shall give a steady light.

4. A LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

5. Printing and history storage equipment shall log and print the event information along with a time and date stamp.

6. All system outputs assigned via pre-programmed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

2.8.4 Trouble Functions

When a trouble condition is detected and reported by one of the system initiating devices or appliances, trouble functions similar to alarm functions indicated in sub-clause 2.8.3 shall immediately occur:

2.8.5 Supervisory Functions

When a supervisory condition is detected and reported by one of the system initiating devices or appliances, supervisory functions similar to alarm functions indicated in sub-clause 2.8.3 shall immediately occur:

2.8.6 System Capacity

The control panel shall have the capacity for connection of 150 or more addressable detection devices & minimum 4 detection loops & the fire alarm control panel shall be expandable. Each detector loop shall be suitable for connection of not less than 120 addressable detector points.

All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

2.8.7. Central Processing Unit (CPU):

The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the central processing unit.
The CPU shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

The Central Processing Unit shall also provide a real-time clock for time annotation of all system displays. The Time-Of-Day and date shall not be lost if system primary and secondary power supplies fail.

The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment.

Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Failure of any peripheral device to respond to an interrogation shall be annunciated as a trouble condition.

2.8.8 Display

The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

The display assembly shall contain, and display as required, custom alphanumerics labels for all addressable detectors and modules.

The system display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide light-emitting-diodes (LEDs), which will indicate the status of the system parameters such as AC POWER, SYSTEM ALARM; SYSTEM TROUBLE, and DISPLAY TROUBLE.

The system display shall provide a key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

The system display shall include, but not be limited to, the following operator control switches: SIGNAL SILENCE, LAMP TEST, RESET, SYSTEM TEST, and ACKNOWLEDGE

2.8.9 Enclosure

The main fire alarm control panel shall be housed in a cabinet suitable for surface or semi-flush mounting. Cabinet shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

The door shall provide a key lock and include a transparent opening for viewing all indicators.
2.8.10 Power Supply

The main power supply shall operate on 230V AC, single phase, 50Hz, and shall provide all necessary power for the FACP. It shall provide all the necessary internal operating power for the FACP and power for operation of external alarm notification appliance circuits. It shall include a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.

It shall provide meters to indicate battery voltage and charging current.

*Upon loss of mains power, the power supply unit shall automatically revert to battery power.*

When main AC power is restored, the control unit shall automatically revert back to normal operation without need for any manual switching procedure.

2.8.11 Operators Terminal

The following standard operator full-system functions shall be provided:

1. Acknowledge Switch:
2. Signal Silence Switch:
3. System Reset Switch:
4. Lamp Test Switch:

2.8.12 Video Display Terminal

The Video Display Terminal shall provide a visual display and an audible alert of all changes in status of the system and shall annotate such displays with the current time-of-day and date. A detachable keyboard shall be provided that may be used for programming, testing, read status and control of the system.

2.8.13 Printer

Printer shall be of the automatic type, printing code, time, date, location, category, and condition.

The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desk top or table. The printer power shall be 230V AC, 50 Hz.
2.8.14 Field Programming

The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers or electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.

It shall be possible to program through the standard FACP keyboard all standard functions. All field defined programs shall be stored in non-volatile memory.

2.8.15 System Circuit Supervision

The FACP shall supervise all circuits to devices and annunciate loss of communications with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information in the history buffer and on the printer.

2.9 Manual Call Points (Break Glass Units)

The manual call points shall be of addressable type and electrically compatible with the automatic detectors. Manual call point shall be of the break-glass type in a shatter-proof, corrosion resistant housing of pleasant, streamlining appearance and design permitting its use as a semi-recessed unit.

All inscriptions, texts (which shall be in English) and markings shall be on the front plate of the manual call point or behind the glass and not on the glass, so that the glass may be easily replaced. The cover must be secured against unauthorized removal. Every removal of the cover shall release the alarm.

The alarm contacts shall be of a self-cleaning design to prevent failure after a prolonged period of inactivity in unclean environments.

It shall be possible to test the call point without breaking the glass.

It shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, it cannot be restored to normal use except by the use of a key.

All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

The exterior finish shall be in standard signal red.
2.10 Alarm Sounder

*Fire Alarm Sounder shall be an electronic sounder with frequency characteristics complying with the frequency requirements of BS 5839 Part 1 or equivalent. Sounder output shall be not less than 85 dB (A). A volume control shall be incorporated inside the unit enabling the sound output to set to suit a wide range of locations. Alarm sounder shall be suitable for surface mounting.*

2.11 Battery

Sealed lead-acid batteries shall provide emergency power.

Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours of alarm upon a normal AC power failure.

The batteries shall be completely maintenance free. No liquids shall be required. Fluid level checks refilling, spills and leakage shall not be required.

2.12 Battery Charger

Battery charger shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 230-volt 50 hertz single phase source.

It shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.

It shall have protection to prevent discharge through the charger.

It shall have protection for overloads and short circuits on both AC and DC sides.

2.13 Wiring

Wiring shall be in accordance with IEE Wiring Regulation-17th Edition and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 1.5mm² for Initiating Device Circuits and Signaling Line Circuits and Notification Appliance circuits.

In locations where PVC conduits are embedded in the concrete slab Fire Resistant CWZ cables shall be used for wiring the fire alarm system. In locations where embedded PVC conduits are not available cables drawn through exposed GI conduits, with fire resistance capability for at least 3 hr complying with BS 6387 shall be used for wiring.

All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal shall be activated until the system and its associated field wiring are restored to normal condition.
2.14 EXIT/ FIRE EXIT SIGN BOARDS

The following types of sign boards shall be used at the locations on drawings.

Exit sign board shall comply with BS 5378. Text and symbols on board shall be green on white background. Power supply to Exit sign board shall be obtained from ceiling rose type wiring point provided by others. Connection between ceiling rose and exit sign board shall be 1 mm² 60°C rubber and PVC cord to BS 6500.

Exit sign board shall be permanently illuminated and have 8 W fluorescent tube, electronic control gears, sealed batteries and battery charger of good quality. The set of batteries used when charge by its built in charger for a period of 2 hours from fully discharge condition shall then have sufficient power to illuminate the Exit sign board for 2 hours without mains power supply.

Low volt cut-off protection shall be provided to prevent battery over discharge and LED shall be provided to indicate that the battery is circuit and that it is being charged by the mains supply.

The following types of sign boards shall be used at the locations on drawings.

Fire Exit sign boards which indicate the EXIT route shall bear direction arrow and the international symbol for fire escape on one side or both sides wherever applicable.

Exit Sign boards which indicate on Exit door shall bear the text EXIT.

2.15 Installation

2.15.1 General

Installation shall be in accordance with the applicable standards, as shown on the drawings, and as recommended by the major equipment manufacturer.

2.15.2 Repeater Alarm Control Panel

Repeater control panel shall be surface mounted on the wall of the Security post.

2.15.4 Manual Call Points

Manual Pull Stations shall be suitable for surface mounting or semi flush mounting and shall be installed approximately 1.25m above the finished floor.

2.15.5 Alarm Sounders and Visual Signaling Units

*The locations of alarm sounders and visual signaling units, as shown on the drawings, are approximate. The contractor shall adhere strictly to the manufacturer's installation instructions when deciding the final locations and the method of installation. In areas where alarm sounder may be ineffective, ex. where the background noise is excessive, visual signaling units shall also be used.*
2.16 Tender Stage Documentation

Tenderer shall adequately and accurately describe the proposed system and concepts at the time of tendering, supported by a full set of drawings, specifications and catalogues describing the various components belonging to the fire detection and alarm system.

Sufficient information, clearly presented, shall be included to determine compliance with specified requirements as indicated in drawings and specifications.

Manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, and device arrangement shall be included.

2.17 Contract Stage Documentation

The Contractor shall provide a full set of documents in duplicate, related to concept, design, installation, commissioning and the maintenance of the entire system and its components.

The following sets of documents are required as a minimum per system components:
- System description and operating principle
- Installation instructions
- Connection diagrams
- Commissioning instructions
- Operating instructions
- Detailed maintenance instructions and trouble-shooting guide

The following drawings in detail are required as a minimum:
- System block diagrams
- Wiring diagrams
- Plans showing detector locations and zoning
- Termination diagrams
- General arrangement plans, layout and outline drawings of system components.
- Position plans and sectional installation details

On completion of the installation and commissioning activities, the documentation shall be revised to incorporate any changes from the original and the final ‘as-built’ documentation shall be submitted in triplicate to the Engineer by the contractor as stipulated under General Requirements of the main Electrical Specification, in conjunction with which, this specification shall be read.

2.18 Software Modifications

All hardware, software, programming tools and documentation necessary to modify the fire alarm system on site shall be provided. Modification includes addition and deletion of devices, circuits, and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
2.19 Guarantee

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this guarantee period shall be included in the submittal bid.

2.20 Commissioning and Testing

The Contractor shall provide all instruments and equipment together with commissioning Engineers and adequate assistance for carrying out the commissioning and testing activity which shall be done in accordance with the applicable standards.

The commissioning and testing activity shall demonstrate that all equipment provided complies with the Specification in all particulars and that they have been properly and completely installed.

As a minimum the following tests shall be carried out.

(a) Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

(b) Open initiating device circuits and verify that the trouble signal actuates.

(c) Open signaling line circuits and verify that the trouble signal actuates.

(d) Open and short-circuit notification appliance circuits and verify that trouble signal actuates.

(e) Ground initiating device circuits and verify response of trouble signals.

(f) Ground signaling line circuits and verify response of trouble signals.

(g) Ground notification appliance circuits and verify response of trouble signals.

(h) Check installation, supervision, and operation of all smoke detectors.

(i) Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

If any portion of the works fails to pass the tests, the Contractor shall, at his own expense, carry out such alterations or replacements as are required to the satisfaction of the Engineer. The Engineer shall be at liberty to call for further commissioning when such alterations have been completed to their satisfaction.

On satisfactory completion of the commissioning and testing activity, Contractor shall provide all necessary reports and records in triplicate set out to a format to be agreed with the Engineer.
The Contractor shall provide commissioning spares in sufficient quantities at his own expense. Spare parts earmarked for maintenance shall not be used during this period.

2.21 Instructions

Contractor shall provide instructions as required for operating the system. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."
WATERPROOFING AND TANKING

1.1 GENERAL

1.1.1 Warranty

1.1.1.1 Insulation, waterproofing and tanking shall be applied in accordance with the direction of the manufacturer of the material and components, and experienced specialist crew who shall fit for the application of complete systems in the works.

1.1.1.2 Notwithstanding maintenance requirements for the work, the contractor shall warrant the owner with the specialist contractor that basement, toilets, balconies, roofs and tanks shall remain waterproof and damp-proof in respect of workmanship and materials for a period of 10 year calculated from the time that the works are certified as substantially completed.

1.1.1.3 The form of guarantee offered by the specialist, applicator shall be submitted for the consultant’s approval prior to commencement of waterproofing. This guarantee shall in no way indemnify the contractor against the improper performance of the waterproofing systems.

1.1.1.4 All structural components that retained or exclude water or any other liquid should be applied with approved waterproofing material.

1.1.1.5 Roof slab should be externally waterproofed by an agent approved by the consultant.

1.1.2 Substructure

1.1.2.1 It shall be the Contractors responsibility to ensure that the specialist applicator takes note of the structure of the basement, roof or tank, including any movement joints provided, when designing his waterproofing systems.

1.1.2.2 The laying of a waterproofing system on a concrete or steel surface will be taken as signifying the acceptance of that surface, both in terms of surface quality, spacing and arrangement of movement joint by the contractor and his specialist applicator.

1.1.3 Application

1.1.3.1 Where applicable, aprons and other sections for roof-tanks penetration, trims, side laps, bends and corners shall be incorporated, corrected, finished and uniformly lined.

1.1.3.2 The waterproofing systems shall be dressed up all pipes and other penetrations to a minimum height of 250 above the top of the concrete/steel slabs.

1.1.3.3 Sharp corner are to be filled with screed or other fillets and waterproofing should be laid with generous over lap as per manufacturers’ instruction.

1.1.3.4 Where finishes such as concrete paving or tiles etc. are specified to be laid over waterproofing membranes laid on concrete floors, the floor shall be tested for water–tightness prior to laying...
of these tiles/paving etc. Sump, tanks, etc., shall also be tested after the application of waterproofing. The cost of carrying out these tests including that of blocking any outlets etc., shall be borne by the contractor. Where it is seen that watertightness has not been achieved, the contractor shall take whatever remedial measures as ordered by the consultants and the cost of all such measures order shall be borne by the contractor.

1.1.4 **Joints with abutting walls, columns, piping etc.**

1.1.4.1 Joints with abutting structures shall be carried out with materials as specified in the relevant Article of other trades, such as aluminum sealants etc., all as generally shown otherwise in typical details on the drawings.

1.1.4.2 Special joints, not shown on drawings or particular sections thereof requiring special attention, are deemed to be included in the Contractor’s Tender, and are to be executed in a workman like manner and in consent with and to the satisfaction of the Consultant.

**1.2 WP-1 WATERPROOFING SYSTEM TO BELOW GROUND STRUCTURES**

1.2.1 Concrete Screed

Concrete screed shall be mechanically batch mixed and laid over the well-compacted and approved formation of the sub base or otherwise directed by the Engineer. The concrete grade 15 shall be laid to produce a concrete screed of 75 mm thick. The screed shall be covered with wet sawdust, sand or equal method and kept damp for at least 5 days or as instructed by the Engineer. Before laying the waterproofing membrane, the concrete surface shall be thoroughly cleaned and dried out.

1.2.2 Material Specification-WP1

The prepared concrete surface shall be waterproofed by means of “Ecogum 4P” or equivalent 4.0mm thick sand finish, UV resistant, APP modified bituminous. Torch-applied membrane reinforced with 160gms/sqm. polyester fabric over the substrate after application of the approved primer. Application of waterproofing membrane shall strictly be in accordance with the manufacture’s instructions. At interruption of work the edges of the sheets have to be finished in such a manner that rainwater or dust shall not penetrate underneath. The contractor shall ensure timely submission to the engineer of details, type, make and composition of the waterproofing system together with certified proof from the manufacturer of the proposed system.
Prefabricated multi-layer sandwiched type membrane conforming to the following specifications.

I. Have a minimum nominal thickness of 4mm for torch-applied membranes.
II. Shall consist of a minimum of 2 layers of polymeric (APP) bitumen having a
III. softening temperature not less than 155\(^\circ\)C as per ASTM D36 and penetration
     12-16dmm at (25\(^{\circ}\)C) as per ASTM D5.
IV Shall consist of a polyester-reinforcing mat of minimum weight 160g/m\(^2\)
V Shall consist of flammable polyethylene film on one side and sand finish on the topside of the membranes.
VI Tensile strength as per UEAtc, Longitudinal direction 800N/5cm & transverse direction 600N/5cm minimum.
VII Elongation as per ASTM D-146 Longitudinal direction 45% & transverse direction 54% minimum.
VIII Impermeable to water vapors as per ASTM E96.
IX Resistance to Aging due to UV Radiation to ASTM G53 should show no signs of deterioration after 2000hrs.
X Water absorption to ASTM D 570 not greater than 0.15%.
XI Flexibility at low temperature to ASTM D146 –0C
XII Suitable for application ambient temperatures between -10 C to 100C
XIII Tear resistance as per ASTM D1004 Longitudinal direction 70N & transverse direction 90N minimum

1.2.3 Screed Cover

Mechanically batch mixed cement sand (1:3) screed shall be laid over the waterproofing membrane having a minimum layer thickness of 15mm. Waterproofing membrane should be laid 6m beyond the construction joints of the basement / raft slab and should be covered with the protective screed.

1.2.4 WATER PROOFING SYSTEM TO RETAINING WALLS

1.2.4.1 Surface preparation

Concrete/block wall shall be well cleaned and free from damp, laitance, dust and dirt; if contaminated by oil or grease or whatever nature, the patch shall be chiseled away and made good.

1.2.4.2 Material Specification-

WP1 – As per WP 1 Water proofing membrane or equivalent
1.2.4.3 Protection Board

Waterproofing membrane on the retaining walls shall be protected by “Armoproof 3.5” or equivalent tough, semi flexible, pre-moulded bituminous protection board by spot welding on to the waterproofing membrane.

Prefabricated semi flexible, pre-moulded bituminous protection board shall conform to the following specifications.

I. Have a minimum nominal thickness of 3.5mm.
II. Shall consist of a hard mix of bitumen, fillers and modifiers having a softening temperature not less than 159°C as per ASTM D36 and penetration 5.5 dmm (at 25°C) as per ASTM D5.
III. Shall contain minimum 56% bitumen.
V. Shall contain minimum 26% inorganic filler material.
VI. Shall weigh 9kg/m2.
VII. Water absorption to ASTM D 570 not greater than 0.52%.
VIII. Puncture resistance as per ASTM E154 1500N / 32mm.

WP 2 – WATERPROOFING SYSTEM TO WATER SUMPS AND LIFT PITS INTERNALLY

1.3.1 Material

Material used shall be “DeepSeal 200” or equivalent cementitious coating containing catalytic chemicals which migrate into the concrete using moisture and the hydrated cement in the concrete as migrating medium and which cause the moisture and the un-hydrated cement in the concrete to react causing the growth of non-soluble crystals of dendritic fibers in the voids and capillary tracks of the concrete that allow passage of water, thereby rendering the concrete itself waterproof.

1.3.1.1 Storage of material

All material shall be stored in original unchanged containers with manufacturer’s seal and labels intact. Material shall be stored off the ground in a dry enclosed area.

1.3.2 EXECUTION

1.3.2.1 SURFACE PREPERATION
1.3.2.1.1 General

All surfaces shall be examined for form tie holes and defects such as honeycombing, rock pockets, cracks etc. These areas shall be repaired repair mortar in accordance with the specifications and the manufacturer’s recommendations.
1.3.2.1.2Concrete Finish

Concrete surface shall have an open capillary system to provide tooth and suction and shall be clean, free from scale, excess form oil, laitance, curing compounds and any other foreign matter. Smooth surfaces or surface covered with excess form oil or other contaminants shall be washed or water blasted as required to provide a clean absorbent surface. Horizontal surfaces shall not be troweled or power troweled, and shall be left with a rough float finish. Vertical surfaces may have a sacked finish. Comply with manufacturer’s specification with requirement pertaining to minimum “age” of concrete deck surfaces scheduled to receive waterproofing.

1.3.2.1.3Surface Moisture

Waterproofing shall be applied to properly cured concrete, which has been thoroughly moistened with clean water prior to application. Free water shall be removed prior to application.

1.3.2.2Surface Preparation

Surface to be coated shall be structurally sound, even semi-smooth finish and free of dirt, loose mortar, particles, paint, films, protective coatings, efflorescence etc. Concrete to receive the application shall be carefully formed to provide an even surface, free from marks and in a condition to receive the coating to manufacture’s printed literature.

1.3.3Application.

1.3.3.1General

Apply all material under the direction of the Manufacturer’s representative.

1.3.3.2Construction joints and surface defects

Comply with waterproofing material manufacturer’s printed directions in the preparation and treatment of construction joint and surface defects.

1.3.3.3Coves, Sealing strips and control joint:

Comply with waterproofing material manufacturer’s printed directions in the preparation, built-in provisions and treatment of coves, sealing strips and control joins. Typically, provide continuous coves at all inside corners (Horizontal), except at perimeter edge beams of towers.
1.3.3.4 Surface application

After all repair, patching and sealing strip placement has prepared in accordance with manufacturers recommendations and approved by manufacturers representative, treat concrete surfaces with first coat slurry mix of crystalline waterproofing compound.

1.3.3.5 Brushing

Use a short bristle brush to work the slurry well into the concrete filling all hairline cracks and surface pores. Apply at the rate 0.75kg per Sqm.

1.3.3.6 Second Coat

Apply second coat white first coat is still “green” but after it has reached an initial set, all as recommended by the waterproofing material manufacturer at the rate 0.75kg per Sqm.

1.3.4 Curing

1.3.4.1 General

Curing shall begin as soon as the waterproofing material have set sufficiently so as not be damaged by a fine spray. Treated surfaces shall be fog sprayed three times a day for a two-day period. Allow material to set minimum 2 days before filling the structure with water (in the case of water sumps).

Follow manufacturer’s specifications if poor air circulation retards curing process to ensure completed curing in enclosed spaces.

Protect treated surfaces from damage-due to wind, sun, rain and temperatures below 35 degrees F for a period of 48 hours after application. Arrange protections to permit proper curing conditions for waterproofing materials

1.3.4.2 Clean-up

Remove all surplus material from the premises and leave all areas broom-clean. In the case of temporary protection, remove all such items carefully to avoid damage to treated surfaces.

Assemble all such materials and remove from premises followed by broom cleaning as noted.

1.3.5 TESTING

The waterproofed areas shall be provided and filled with water & kept for 3days to check any seepage of water or dampness.
1.3.6  PROTECTIVE SCREED

A cement sand (1:3) screed shall be laid soon after the water test is completed, taking care not to disturbed or damage the waterproofing application in any way. For the areas ceramic floor tiling to be done, cement sand screed (tile bed) shall immediately follow the water testing using this as the backing. Other areas shall be finished smooth with neat cement.

1.3.7  CERTIFICATE & WARRANTEE

The contractor shall submit jointly prior to acceptance of the work, written certificate stating that all materials and workmanship in connection with specified work have been furnished and installed in completed conformance with these specifications and with the approved manufacturer’s requirements for this work.

The contractor shall jointly with the manufacturer/supplier of the specialist waterproofing material furnish a warranty to the Employer valid for a period of 10 year after handing over of the work, against dampness and/or moisture penetration through treated surfaces due to defective material and/or defective workmanship.

The warranty shall provide not only the materials necessary to remedy a problem but also the labour and equipment to apply the material.
WP 3 – WATERPROOFING SYSTEM TO TOILETS, AND BALCONIES

Waterproofing shall be carried out in specified area of the concrete floor slab and up to 300mm minimum and 2m in shower areas above the finished floor level or water level on masonry walls

1.4.1 MATERIAL

The material used shall be “SpECtite CW 100” or equivalent 2 part polymer (acrylic), flexible cementitious waterproofing slurry to 1.5mm minimum thickness with sound bond properties to cement screed/mortar surfaces.

1.4.2 Surface Preparation

Concrete or brickwork, whether plastered or not, shall be well cleaned and free from damp, laitance, dust and dirt: if contaminated by oil or grease of whatever nature, the patches shall be chiseled away.

Uneven areas, rough areas and chiseled areas to be treaded with an approved repair mortar or epoxy-resin based un-pigmented primer, and to be leveled with a homogeneously mixed approved 2-component epoxy-mortar, applied while the primer is not fully hardened (wet-on-wet-method).

The smoothness and evenness of the surfaces of concrete or plastered brick work to which the waterproofing system is to be applied shall be to the entire satisfaction of the Consultant.

The primer shall be a cement paste (cement + resin dispersion) applied as a grouting for key of the mortar. The mortar shall consist of cement + sand + resin dispersion. The compressive strength of the fully hardened mortar shall not be less than 20 N/mm2.

Both primer and mortar shall be of an approved make and be mixed and applied in strict accordance with the manufacturer’s instructions.

The mortar to be finished smooth and straight using steel floats in a rotating movement and under even pressure, with rounded or covered fillets/edges as the position or purpose dictates.

1.4.3 DESCRIPTION OF WORK

The floor slab shall be thoroughly washed and cleaned to be free of dirt, loose mortar particles, paints, films etc.

Cement/sand (1:3) mortar plaster 6-15mm thick shall be applied to masonry wall and form mortar fillet at slab/wall joint.

The waterproofing liquid membrane shall be applied on the dampened screed surface and up to 300mm minimum on the cement/sand backing of masonry wall in conformity with the waterproofing material supplier/manufacturer’s printed literature and under the direction of supplier/manufacturer’s representative.
After the waterproofing membrane is sufficiently cured the relevant area shall be ponded with water for at least 3 days for observation of leaks.

A cement sand (1:3) screed shall be laid soon after the water test is completed, taking care not to disturbed or damage the waterproofing application in any way. For the areas ceramic floor tiling to be done, cement sand screed (tile bed) shall immediately follow the water testing using this as the backing. Other areas shall be finished smooth with neat cement.

1.4.4 CERTIFICATE & WARRANTEE

The contractor shall submit jointly prior to acceptance of the work, written certificate stating that all materials and workmanship in connection with specified work have been furnished and installed in completed conformance with these specifications and with the approved manufacturer’s requirements for this work.

The contractor shall jointly with the manufacturer/supplier of the specialist waterproofing material furnish a warranty to the Employer valid for a period of 10 year after handing over of the work, against dampness and/or moisture penetration through treated surfaces due to defective material and/or defective workmanship.

The warranty shall provide not only the materials necessary to remedy a problem but also the labour and equipment to apply the material.

WP 4 – WATERPROOFING SYSTEM TO FLOWER TROUGHS

1.5.1 Surface Preparation

Concrete or brickwork, whether plastered or not, shall be well cleaned and free from damp, laitance, dust and dirt: if contaminated by oil or grease of whatever nature, the patches shall be chiseled away.

Uneven areas, rough areas and chiseled areas to be treaded with an approved repair mortar or epoxy-resin based un-pigmented primer, and to be leveled with a homogeneously mixed approved 2-component epoxy-mortar, applied while the primer is not fully hardened (wet-on-wet-method).

The smoothness and evenness of the surfaces of concrete or plastered brick work to which the waterproofing system is to be applied shall be to the entire satisfaction of the Consultant.

The primer shall be a cement paste (cement + resin dispersion) applied as a grouting for key of the mortar. The mortar shall consist of cement + sand + resin dispersion. The compressive strength of the fully hardened mortar shall not be less than 20 N/mm2.

Both primer and mortar shall be of an approved make and be mixed and applied in strict accordance with the manufacturer’s instructions.

The mortar to be finished smooth and straight using steel floats in a rotating movement and under even pressure, with rounded or covered fillets/edges as the position or purpose dictates.
1.5.2 Material Specification – Torch-On Waterproofing Membrane

1.5.2.1 Waterproofing membrane shall be “Dermabit Garden” or equivalent 4.0mm thick, PE finish, root resistant, UV resistant, APP (Atactic Poly-Propylene) modified bituminous membrane reinforced with 180g/m² polyester fabric, weighing approx. 4.6 kg/m² Torch applied over the substrate after application of the approved primer.

An interruption of work the edges of the sheets have to be finished in such a manner that rain water and dust cannot penetrate underneath.

1.5.2.2 A prefabricated multi-layer sandwiched type membrane conforming to the following specifications.

II. Shall consist of a minimum of 2 layers of polymeric (APP) bitumen having a softening temperature not less than 155°C as per ASTM D36 and penetration 35dmm at (25°C) as per ASTM D5.

III. Shall consist of a polyester-reinforcing mat of minimum weight 180g/m²
IV. Shall consist of flammable polyethylene film on one side and PE finish on the top side of the membranes.
V. Tensile strength as per UEAtc, ASTM D146 Longitudinal direction 700N/5cm & transverse direction 550N/5cm minimum.
VI. Elongation as per ASTM D-146 Longitudinal direction 40% & transverse direction 50% minimum.
VII. Tear resistance as per UEAtc, Longitudinal direction 170N & transverse direction 180N minimum
VIII. Lap joint strength as per UEAtc Longitudinal direction 700N/5cm & transverse direction 550N/5cm minimum.
IX. Load strain as per UEAtc Longitudinal direction 32,000N & transverse direction 32,000N minimum.
X. Water absorption to ASTM D 570 not greater than 0.15%.
XI. Resistance to Aging due to UV Radiation to ASTM G53 should show no signs of deterioration after 2000hrs.
XII. Impermeable to water vapors as per ASTM E96.

1.5.3 Separation Layer

1.5.3.1 On top of the Waterproofing membrane, non woven geo-textile polyester mat “Dermatex 150” or equivalent shall be laid as the separation layer.

1.5.3.2 It should conform to the following specifications.

I. Have a density of 1.38kg/dm³ and weight of 150 g/m².
II. Have a thickness of not less than 1.5mm as per EN 29073 – 1.
III. Have a melting point of not less than 260°C.
IV. Tensile strength as per EN 29073-3, MD/CD not less than 400/300N/5cm.
V. Elongation as per EN 29073-3, MD/CD not less than 60% / 60%.
VI. Puncture resistance as per DIN 54307 not less than 600N.
VII. Tear resistance as per EN 29073-4, not less than 110N.
VIII. Normal Permeability as per CNR B.U.144, not less than 0.09m/s x 10^3.
XI Permittivity as per CNR B.U.144, not less than 0.68 s^{-1}

1.5.4 Concrete Covering Screed

Minimum 30-40mm thick grade 20 concrete covering screed shall be laid over the separation sheet.

**WP 5 – WATERPROOFING AND HEAT INSULATION SYSTEM TO ROOF TERRACES /ROOF SLABS**

1.6.1 Leveling Screed

1.6.1.1 Before laying the leveling screed the concrete surface shall be cleaned by removal of loose materials to the entire satisfaction of the consultant. Concrete that is contaminated by oil or grease shall be chiseled away and refilled.

1.6.1.2 Concrete slab shall be grouted with cement/water slurry before the laying of leveling screed.

1.6.1.3 Cement sand leveling screed shall be mechanically batch mixed and lay with a minimum thickness of 25mm. The falls to be achieved are not less than 1:200 or as shown on the drawings (Note that roof terrace shall be sloped accordingly to the structural drawing towards the drains) Screed shall be laid with slopes and internal and external corners shall have coves or fillets with a radius of at least 70mm. The screed shall be finished with a steel float.

1.6.1.4 The screeds shall be covered with wet saw dust, sand or equal method and kept damp for 5 days or ordered by the consultant. Screed shall be protected from rainfall. Water proofing membrane shall not be applied until the surface is thoroughly dried out.

1.6.2 Material Specification – Torch-On Waterproofing Membrane

1.6.2.1 Waterproofing membrane shall be “Ecogum 4P” or equivalent 4.0mm thick with sand finish on top, UV resistant; APP (Atactic Polypropylene) modified bituminous membrane reinforced with 160g/m² polyester fabric, with approximate weight 4.6 kg/m² and torch-applied over the substrate after application of the approved primer.

An interruption of work the edges of the sheets have to be finished in such a manner that rain water and dust cannot penetrate underneath.

1.6.2.2 A prefabricated multi-layer sandwich type membrane should conform to the following specifications.

I Have a minimum nominal thickness of 4mm for torch-applied membranes.
II Shall consist of a minimum of 2 layers of polymeric (APP) bitumen having a
softening temperature not less than 155°C as per ASTM D36 and penetration 12-16dmm (at 25°C) as per ASTM D5.

III Shall consist of a polyester-reinforcing mat of minimum weight 160g/m²

IV Shall consist of flammable polyethylene film on one side and sand finish on the topside of the membranes.

VTensile strength as per UEAtc, longitudinal direction 800N/5cm & transverse direction 600N/5cm minimum.

VI Elongation as per ASTM D-146 longitudinal direction 45% & transverse Direction 54% minimum.

VII Impermeable to water vapors as per ASTM E96.

VIII Resistance to Aging due to UV Radiation to ASTM G53 should show no signs of deterioration after 2000hrs.

IX Water absorption to ASTM D 570 not greater than 0.15%.

X Flexibility at low temperature to ASTM D146 –0C

XI Suitable for application ambient temperatures between -10°C to 100°C

XII Tear resistance as per ASTM D1004 longitudinal direction 70N & transverse direction 90N minimum

1.6.3 Insulation

1.6.3.1 On top of the waterproofing membrane “Isoboard ND” or equivalent extruded polystyrene insulation boards 25/50mm thick with thermal conductivity of not more than 0.03 W/mK (as per ASTM C518) shall be laid

1.6.3.2 Method should comply with the following standards ASTM D-1622, ASTM C-518, ASTMD2842 and ASTMD1621-95.

1.6.3.3 The boards shall have ship lap edges all round for interlocked laying, in sizes of 600 X 1200mm, tightly laid in stretcher bond.

1.6.4 Separation Layer

1.6.4.1 On top of the Insulation / Waterproofing membrane, non-woven geo-textile polyester mat “Dermatex 150” or equivalent shall be laid as the separation layer.

1.6.4.2 It should conform to the following specifications.
I. Have a density of 1.38kg/dm$^3$ and weight of 150 g/m$^2$.
II. Have a thickness of not less than 1.5mm as per EN 29073 – 1.
III. Have a melting point of not less than 260$^\circ$C.
IV. Tensile strength as per EN 29073-3, MD/CD not less than 400/300N/5cm.
V. Elongation as per EN 29073-3, MD/CD not less than 60% / 60%.
VI. Puncture resistance as per DIN 54307 not less than 600N.
VII. Tear resistance as per EN 29073-4, not less than 110N.
VIII. Normal Permeability as per CNR B.U.144, not less than 0.09m/s x 10$^3$.
IX. Permittivity as per CNR B.U.144, not less than 0.68 s$^{-1}$

1.6.5 Concrete Covering Screed

50mm thick, grade 20 reinforced concrete covering screed shall be laid over the separation sheet. A 50 X 50mm (3mm dia.) galvanize steel wire mesh shall be provided in covering screed to limit the concrete screed panel size approximately to 9-16Sqm. Expansion joints shall be coincided with the joints of the tile layer above and later filled by the approved joint sealant (SpECseal 625 or equivalent)

Floor tiles with approved colour and quality shall be laid over the screed as the finishing layer.

1.6.6 Specification for chicken wire mesh

Welded wire mesh should be of size 20 s w g.

Masonry abutting RCC members shall be secured with wire mesh of 150mm length of each side of member and cast into both internal and external plaster.

WP- 6 SPECIFICATIONS FOR WATER PROOFING TO CONCRETE ROAD/DRIVE WAY AND RAMPS

1.7.1 Scope Work

Waterproofing shall be carried out in specified areas of the concrete road/drive way and ramps.

1.7.2 Material Specification WP-6

1.7.2.1 Material for Horizontal Surfaces

The waterproofing solution shall be “Deepseal 2000” or equivalent, a non toxic, clear material which will penetrate into concrete and react with free calcium and water in concrete at ambient temperatures. The solution form a non water soluble calcium silicate hydrate gel complex which shall seal pores, capillaries & cracks up to 2.0mm width.
1.7.2.2 Material for Vertical Up stands

The material used shall be “SpECtite CW 100” or equivalent 2 part polymer (acrylic), flexible cementitious waterproofing slurry to 1.5mm minimum thickness with sound bond properties to cement screed/mortar surfaces. Waterproofing material shall be applied on concrete up stands up to 300mm (Measured Separately)

1.7.3 EXECUTION

1.7.3.1 SURFACE PREPERATION

1.7.3.1.1 General

All surfaces shall be examined for form tie holes and defects such as honeycombing, rock pockets, cracks etc. These areas shall be repaired repair mortar in accordance with the specifications and the manufacturer’s recommendations.

1.7.3.1.2 Concrete Finish

Concrete surface shall have an open capillary system to provide tooth and suction and shall be clean, free from scale, excess form oil, laitance, curing compounds and any other foreign matter. Smooth surfaces or surface covered with excess form oil or other contaminants shall be washed or water blasted as required to provide a clean absorbent surface. Horizontal surfaces shall be troweled or power troweled, or shall be left with a rough float finish. Vertical surfaces be either concrete finish or plastered masonry wall finish. Comply with manufacturer’s specification with requirement pertaining to minimum “age” of concrete deck surfaces (28 days) scheduled to receive waterproofing.

1.7.3.1.3 Surface Moisture

Waterproofing shall be applied to fully cured concrete, which has been reasonably dry in the case of horizontal surfaces. And verticals shall be moistened with clean water prior to application. Free water shall be removed prior to application.

1.7.3.1.4 Surface Preparation

RCC slab should be dry and at least 28 days old. Surface to be coated shall be structurally sound, even semi-smooth finish and free of dirt, loose mortar, particles, paint, films, protective coatings, efflorescence etc. Concrete to receive the application shall be carefully formed to provide an even surface, free from marks and in a condition to receive the coating to manufacturer’s printed literature.

1.7.3.1.4.1 Surface shall be thoroughly washed and cleaned to be free of dust, loose mortar particles, paint, films or any deposits of contaminants which could affect the bond between the waterproofing and the substrate.

1.7.3.1.4.2 All curing compounds must be removed prior to application.

1.7.3.1.4.3 When placing waterproofing application all water shall be removed so that surface is only damp or surface dry. In no case there shall be standing water or a shiny wet surface.
1.7.4 Application

1.7.4.1 General

Apply all material under the direction of the Manufacturer’s representative.

1.7.4.2 Construction joints and surface defects

Comply with waterproofing material manufacturer’s printed directions in the preparation and treatment of construction joint and surface defects.

1.7.4.3 Coves, Sealing strips and control joint:

Comply with waterproofing material manufacturer’s printed directions in the preparation, built-in provisions and treatment of coves, sealing strips and control joins. Typically, provide continuous coves at all inside corners (Horizontal), except at perimeter edge beams of towers.

1.7.4.4 Surface application to Horizontal Surfaces

After all repair, patching and sealing strip placement has prepared in accordance with manufacturers recommendations and approved by manufacturers representative, spray the solution with low pressure sprayer (weed sprayer) as per the manufacturer’s recommendation.

1.7.5 Curing

1.7.5.1 General

Curing shall begin as soon as the waterproofing material have set sufficiently so as not be damaged by a fine spray. Treated surfaces shall be sprayed 6 hrs after the application of solution and then after 24 hrs and 48 hrs after the first spray of water. Allow material to set minimum 2 days before filling the structure with water (in the case of water sumps).

1.7.6 Surface application to Vertical Surfaces

Cement/sand (1:3) mortar plaster 6-15mm thick shall be applied to masonry wall and form motor fillet at slab/wall joint.

The waterproofing liquid membrane “SpECtite CW 100” or equivalent 2 part polymer (acrylic), flexible cementitious waterproofing slurry to 1.5mm minimum thickness shall be applied on the dampened screed surface and upto 300mm minimum on the cement/sand backing of masonry wall and 30mm on the floor in conformity with the water proofing material supplier/manufacturer’s printed literature and under the direction of supplier/manufacturer’s representative.
1.7.7 Clean-up
Remove all surplus material from the premises and leave all areas broom-clean. In the case of temporary protection, remove all such items carefully to avoid damage to treated surfaces. Assemble all such materials and remove from premises followed by broom cleaning as noted.

1.7.8 TESTING
The waterproofed areas shall be provided and filled with water & kept for 3days to check any seepage of water or dampness.

If no leaks or dampness is observed in the floor slab, floor tilling or other finish should follow taking care not to disturb the top surface of water proofing.

1.7.9 PROTECTIVE SCREED
A protective screed is not necessary on the horizontal surfaces and a cement sand (1:3) screed shall be laid on the vertical surfaces soon after the water test is completed, taking care not to disturbed or damage the waterproofing application in any way. For the areas ceramic floor tiling to be done, cement sand screed (tile bed) shall immediately follow the water testing using this as the backing.

1.7.4 Certificate & Warranty
The Contractor shall submit prior to acceptance of the work, written certificate stating that all materials and workmanship in connection with specified work have been furnished and installed in complete conformance with these specifications, and with the approved manufacturer’s requirements for this work.

The Contractor shall jointly with the Manufacturer/ Supplier of the specialist waterproofing materials furnish a warranty to the Employer valid for a period of 10 years after handing over of the work, against dampness and or moisture penetration through surface due to defective material and / or defective workmanship.

The warranty shall provide not only the materials necessary to remedy a problem also the labour and equipment to apply the material.
SECTION 07

FORM OF BID
FORM OF BID

Note: Prior to the issue of the bidding documents, the Employer should insert relevant data for all items marked with an asterisk (*).

Name of Contract: *Construction of a 4 storied building for the Pool Bank Vocational Training Center in Hatton

To: Counsellor (Department of Cooperation), High Commission of India, 36-38, Galle Road, Colombo-03

Gentlemen:

1. Having examined the Standard Bidding Document - Procurement of Works – Major Contracts [CIDA/SBD/02 - Second Edition, January 2007], Specifications, Drawings and Bills of Quantities and Addenda for the execution of the above-named Works, we the undersigned, offer to execute and complete such Works and remedy any defect therein in conformity with the aforesaid Conditions of Contract, Specifications, Drawings, Bills of Quantities and addenda for the sum of Sri Lankan Rupees .............................................. (LKR ...................) or such other sums as may be ascertained in accordance with the said Conditions.

2. We acknowledge that the Contract Data forms part of our Bid.

3. We undertake, if our Bid is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer’s notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Contract Data.

4. We agree to abide by this Bid until the date specified in ITB Clause 16 ............ [insert date], and it shall remain binding upon us and may be accepted at any time before that date.

5. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding Contract between us.

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

7. We certify/confirm that we comply with the eligibility requirements as per ITB Clause 3 of the bidding documents.

Dated this ......................................... day of...................................................20.............

Signature ............................................. in the capacity of ..................................................

duly authorized to sign bids for and on behalf of

..............................................................

[in block capitals or typed]

Address:

........................................................................................................

Witness: ................................................................................................

119
SECTION 8

BILLS OF QUANTITIES
AND
PRICING PREAMBLES

(Issued Separately)
SECTION 09

SCHEDULES
## DAY WORK SCHEDULE - LABOUR

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QTY</th>
<th>RATE (Rs.)</th>
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<tbody>
<tr>
<td>1</td>
<td>Skilled Workman (Masons / Carpenters / Bar Benders etc.)</td>
<td>Day</td>
<td>1</td>
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<td>2</td>
<td>Skilled Workman (Electrician / Mechanic / Plumber etc.)</td>
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<td>3</td>
<td>Semi – Skilled Workman (Pump Attendant / Vibrator Operator / Gen –Set Operator etc.)</td>
<td>Day</td>
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<td>4</td>
<td>Semi – Skilled Workman (Asst. Mason / Asst. Carpenter / Asst. Bar Bender etc.)</td>
<td>Day</td>
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<tr>
<td>5</td>
<td>Unskilled Workman</td>
<td>Day</td>
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<tr>
<td>6</td>
<td>Truck Driver / Tractor Operator / Power Shovel Operator</td>
<td>Day</td>
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<tr>
<td>7</td>
<td>Light Vehicle Driver / Farm Tractor Trailer Driver</td>
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Allow 25% as Contractor’s Profit and Overheads.
## DAY WORK SCHEDULE - MATERIALS

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<tr>
<td>1</td>
<td>Ordinary Portland Cement</td>
<td>Bags</td>
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<tr>
<td>2</td>
<td>Mild Steel Reinforcing Bars</td>
<td>ton</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Deformed / Ribbed / Tor Steel Reinforcing Bars</td>
<td>ton</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Structural Mild Steel Sections (Angels/Channels)</td>
<td>ton</td>
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<tr>
<td>5</td>
<td>Concrete Aggregate -20mm graded</td>
<td>M³</td>
<td>1</td>
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</tr>
<tr>
<td>6</td>
<td>Concrete Aggregate – 35mm graded</td>
<td>M³</td>
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<tr>
<td>7</td>
<td>Concrete Fine Aggregate – River Sand</td>
<td>M³</td>
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<td>8</td>
<td>Burnt Clay Bricks – Standard Size</td>
<td>No</td>
<td>1</td>
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<tr>
<td>9</td>
<td>Rubble/Broken Stone – 150mm to 225mm Size</td>
<td>M³</td>
<td>1</td>
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<tr>
<td>10</td>
<td>Slake Lime, 20kg bag</td>
<td>Bags</td>
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<td>11</td>
<td>5mm Thick Clear Float Glass</td>
<td>M²</td>
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<td>12</td>
<td>Emulsion Paints (Proven Make)</td>
<td>Ltr</td>
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<td>13</td>
<td>Enamel Paints (Proven Make)</td>
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<td>14</td>
<td>Anti Corrosive Paint (Proven Make)</td>
<td>Ltr</td>
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</table>

Allow 25% as Contractor’s Profit and Overheads.
## DAY WORK SCHEDULE - PLANTS

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<th>QTY</th>
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<tr>
<td>1</td>
<td>3 Ton Truck with Driver with Fuel and Lubricants</td>
<td>8 hour day</td>
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<tr>
<td>2</td>
<td>Farm Tractor /Trailer with Operator with fuel and Lubricants</td>
<td>8 hour day</td>
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<tr>
<td>3</td>
<td>Wheel Tractor with front end half cubic meter power shovel or back hoe/ tractor half cubic meter bucket with Operator, Fuel and Lubricants complete</td>
<td>8 hour day</td>
<td>1</td>
<td></td>
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<tr>
<td>4</td>
<td>Concrete Mixer (state capacity ) with Operator with Fuel and Lubricants</td>
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<tr>
<td>5</td>
<td>Poker Vibrator – 50mm Size – with Operator only</td>
<td>8 hour day</td>
<td>1</td>
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<tr>
<td>6</td>
<td>Poker Vibrator – 35mm Size – with Operator only</td>
<td>8 hour day</td>
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<tr>
<td>7</td>
<td>Standby Generator Set ( state capacity) with Operator only</td>
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<tr>
<td>8</td>
<td>100mm dia. Water pump for dewatering</td>
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</tr>
<tr>
<td>9</td>
<td>50mm dia. Water pump for dewatering</td>
<td>8 hour day</td>
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Allow 25 % as Contractor’s Profit and Overheads.
SECTION 10

DRAWINGS
* ARCHITECTURAL DRAWINGS

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<td>GROUND FLOOR PLAN</td>
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<td>SECTION Y-Y</td>
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<td>DH/C/428/A-12</td>
<td>FRONT ELEVATION</td>
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<td>ELEVATION FROM THE SIDE ROAD</td>
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<td>REAR ELEVATION</td>
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## SERVICES DRAWINGS

### PLUMBING DRAWINGS

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<td>WATER SUPPLY SYSTEM - LOWER GROUND FLOOR</td>
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<td>02</td>
<td>DH/C/OPTIMUM/WS-02(B1)</td>
<td>WATER SUPPLY SYSTEM - UPPER GROUND FLOOR</td>
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<td>DH/C/OPTIMUM/WS-03(B1)</td>
<td>WATER SUPPLY SYSTEM - FIRST FLOOR</td>
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<td>04</td>
<td>DH/C/OPTIMUM/WS-04(B1)</td>
<td>WATER SUPPLY SYSTEM - MEZZANINE FLOOR</td>
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<td>DH/C/OPTIMUM/WS-05(B1)</td>
<td>WATER SUPPLY SYSTEM - ROOF TOP FLOOR</td>
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<td>DH/C/OPTIMUM/WS-06(B1)</td>
<td>WATER SUPPLY SYSTEM - ROOF TOP FLOOR</td>
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<td>DH/C/OPTIMUM/DS-01(B1)</td>
<td>DRAINAGE SYSTEM - LOWER GROUND FLOOR</td>
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<td>08</td>
<td>DH/C/OPTIMUM/DS-02(B1)</td>
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<td>DH/C/OPTIMUM/DS-03(B1)</td>
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<td>DRAINAGE SYSTEM - SECOND FLOOR</td>
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<td>WATER SUPPLY SYSTEM - UPPER GROUND FLOOR</td>
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<td>16</td>
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* ELECTRICAL DRAWINGS

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* AIR – CONDITIONING LAYOUT

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MECHANICAL VENTILATION SYSTEM DRAWINGS

<table>
<thead>
<tr>
<th>NUMBER</th>
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<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>01</td>
<td>DH/C/OPTIMUM/MV-01(B1)</td>
<td>MECHANICAL VENTILATION SYSTEM – LOWER GROUND FLOOR</td>
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<td>MECHANICAL VENTILATION SYSTEM - UPPER GROUND FLOOR</td>
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<td>03</td>
<td>DH/C/OPTIMUM/MV-03(B1)</td>
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<td>DH/C/OPTIMUM/MV-04(B1)</td>
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**FIRE PROTECTION DRAWINGS**

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<td>FIRE PROTECTION SYSTEM - SECOND FLOOR</td>
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<td>05</td>
<td>DH/C/OPTIMUM/FP-05(B1)</td>
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**STRUCTURAL DRAWINGS**

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<td>DH/PBKL/ST-01</td>
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<td>DH/PBKL/ST-03</td>
<td>COLUMN DETAILS &amp; LIFT PIT</td>
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<td>DH/PBKL/ST-03a</td>
<td>SECTIONS</td>
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<tr>
<td>DH/PBKL/ST-04</td>
<td>STAIRCASE DETAIL - 01</td>
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<td>DH/PBKL/ST-05</td>
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<td>DH/PBKL/ST-06</td>
<td>STAIRCASE DETAIL - 03</td>
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<td>DH/PBKL/ST-07</td>
<td>GROUND FLOOR BEAM LAYOUT</td>
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<td>ROOF BEAM DETAILS</td>
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<td>ROOF SLAB</td>
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<td>DH/PBKL/ST-22</td>
<td>VAULT DETAILS</td>
</tr>
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</table>
SECTION 11

STANDARD FORMS (BID )

Bid Security
FORM OF BID SECURITY

[this Guarantee form shall be filled in accordance with the instructions indicated in brackets]

-- [insert issuing agency’s name, and address of issuing branch or office]

Beneficiary:

Date:  ------------------------- [insert (by issuing agency) date]

BID GUARANTEE No.:  ------------------------- [insert (by issuing agency) number]

We have been informed that  ------------------------- [insert (by issuing agency) name of the bidder] (hereinafter called "the bidder") has submitted to you its bid dated  --------- [insert (by issuing agency) date] (hereinafter called "the Bid") for the execution of [insert name of Contract] under Invitation for Bids No.  ------------------- [insert IFB number] (“the IFB”).

Furthermore, we understand that, according to your conditions, Bids must be supported by a Bid Guarantee.

At the request of the bidder, we  ------------------------- [insert name of issuing agency] hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of  --------- [insert amount in figures]  ------------------------- [insert amount in words]) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

(a) has withdrawn its Bid during the period of bid validity specified; or
(b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter “the ITB”); or
(c) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Form, if required, or (ii) fails or refuses to furnish the Performance Security, in accordance with the ITB.

This Guarantee shall expire: (a) if the bidder is the successful bidder, upon our receipt of copies of the Contract signed by the bidder and of the Performance Security issued to you by the bidder; or (b) if the bidder is not the successful bidder, upon the earlier of (i) the successful bidder furnishing the performance security, otherwise it will remain in force up to  ------------------------- (insert date)

Consequently, any demand for payment under this Guarantee must be received by us at the office on or before that date.

[signature(s) of authorized representative(s)]
### Check List for Bidders

Bidders are advised to fill the following table

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ITB Clause</th>
<th>YES (tick)</th>
<th>REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Form of Bid</strong></td>
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<td>Addressed to the Employer?</td>
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<td>Completed?</td>
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<td>Signed?</td>
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<td><strong>Bid Security</strong></td>
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<td>Format as required?</td>
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<td>Issuing Agency as specified?</td>
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<tr>
<td>Amount as requested?</td>
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<td><strong>Qualification Information</strong></td>
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<tr>
<td>All relevant information completed?</td>
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<tr>
<td>Signed?</td>
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<tr>
<td><strong>Addendum</strong></td>
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<td>Contents of addendum (if any) taken into account?</td>
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<tr>
<td><strong>BID package</strong></td>
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<tr>
<td>All the documents given in ITB Clause 12 enclosed in the original Copy?</td>
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<tr>
<td>ITB Clause 19 followed before Sealing the Bid Package</td>
<td>19</td>
<td></td>
<td></td>
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</tbody>
</table>

*ITB – Instructions to Bidders in SECTION 1*