



**TENDER DOCUMENT FOR REFURBISHMENT OF
POPE HENNESSY BUILDING AT PORT LOUIS
FOR MAUBANK LTD**

**MECHANICAL, ELECTRICAL, PUBLIC HEALTH
& ALLIED WORKS**

Launch Date & Time: 24th October 2025 at 12:00 noon

Closing Date & Time: 28th November 2025 at 12:00 noon

Pre-bid Visit: 31st October 2025 at 9:30am and 03rd November 2025 at 9:30am.

Request For Proposal (RFP)

Project	REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD
Client	MauBank Ltd
Title	RFP Document for Mechanical, Electrical, Public Health & Allied Works
Doc. No.	RFP/FMD/2025/0064 (to be communicated on all correspondence relating to this RFP

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INSTRUCTION TO TENDERERS

1. INTRODUCTION

This tender is for the refurbishment of an existing office building located at Pope Hennessy street Port Louis for MauBank Ltd.

2. SCOPE OF WORKS

The scope of works for Mechanical, Electrical, Public Health & Allied Works is in Annexure 1

3. General Instruction to Bidders

3.1. Bidder shall not have Conflict of Interest

Bidders should mandatorily declare conflict of interest situations. Bidders found to be in a conflict of interest situation, and which has not been disclosed, shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in a bidding process if, including but not limited to; a Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the goods and services that are the subject of the bid.

3.2. Fraud and Corruption

MauBank Ltd will reject a proposal if it determines that the Bidder has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or obstructive practices in competing for the procurement in question.

- “Corrupt practice” is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
- “Fraudulent practice” is any act or omission, including a misinterpretation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
- “Collusive practice” is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the action of a party;
- “Obstructive practice” acts intended to materially impede the exercise of the Bank inspection and audit rights.

3.3. Eligible Bidders

A Bidder that is under a declaration of ineligibility by the Government of Mauritius in accordance with applicable laws at the date of the deadline for bid submission or thereafter, shall be disqualified.

A Bidder who in the past failed to fulfil his contract with the Bank up to the level of our satisfaction shall be disqualified.

1. Registration

Bidders must be duly registered and in good standing with the Construction Industry Development Board (CIDB) and/or the Construction Industry Association (CIA) of

Mauritius in the appropriate category (Large, Medium I, or Medium II) covering MEP works.

2. Scope Capability

Only bidders with the proven technical and organizational capacity to undertake the full scope of Mechanical, Electrical, Plumbing, Fire Protection, and associated builders' works as defined in this tender shall be eligible. Submissions from bidders proposing to execute only part of the MEP scope will not be considered.

3. Experience & Track Record

Bidders must demonstrate, with supporting documentation:

- Successful completion of at least two (2) comparable MEP refurbishment projects of similar scale and complexity within the last five (5) years;
- Experience working in operational and occupied buildings, with proven ability to manage coordination, safety, and tenant interface;
- Availability of qualified technical staff and specialist subcontractors for associated civil/masonry works.

4. Financial Capacity

Bidders must provide audited financial statements for the last three (3) years to demonstrate adequate financial standing and capacity to undertake a project of this magnitude.

5. Single Responsibility

The Employer shall award the contract to one main MEP Contractor only. Splitting of the award among multiple contractors will not be permitted. The successful contractor shall assume single-point responsibility for execution, coordination, and delivery of the full scope.

3.4. Sections of Bidding Documents

The Bidder is expected to examine all instructions, forms, terms and specifications in this Bid document and amendments, if any, thereto. Bid documents shall be deemed to have been submitted after careful study and examination with full understanding of its implications. The proposal should be precise, complete and in the prescribed format as per the requirement of this Bid document. Failure to furnish all information required by this Bid or submission of a proposal not responsive to this Bid in every respect will be at the vendor's risk and may result in rejection of the proposal.

3.5. Amendment of Bidding Documents

At any time prior to the deadline for submission of bids, MauBank Ltd may amend the Bid Documents by issuing addendum. Any addendum issued shall be part of the Bid Documents and shall be communicated in writing to all those who have obtained the Bid Documents. In situations where, open advertising bidding method has been adopted, the Bank shall publish addendums in newspaper and Bank's Website to ensure all

bidders have the same information and understanding. To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Bank may at its discretion extend the deadline for the submission of bids.

3.6. Language of Bid Response

The Bid response prepared by applicants, as well as any communication or document involving the Bid, between the applicants and MauBank Ltd shall be in English only.

3.7. Cost of Bidding

The Bidder shall bear all costs (direct and indirect, associated with the preparation of the proposed solution including any demonstration, detailed discussions and proof of concept of the proposed solution). The Vendor will supply all necessary materials and equipment associated with the preparation and submission of its bid, and MauBank Ltd shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

3.8. Withdrawal, Substitution, and Modification of Bids

No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity period.

The withdrawal, substitution or modification of a bid after the deadline for submission of bids has expired will result in forfeiture of the bid security amount (If Any).

Bidder may withdraw its bid prior to the deadline for the submission of bids without forfeiting its bid security (If Any).

3.9. Confidentiality

This Bid is meant strictly for the invited Vendor and for the sole purpose of submitting a proposal in response to the Bid and may not be used or shared with any other party or for any other purpose without the express written consent of the Bank.

The information contained in this Bid is proprietary to the Bank and must be treated by the Vendor as CONFIDENTIAL. The information is to be used by each Vendor solely for the purpose of preparing a response to this Bid and may not be used or shared with any other party or for any other purpose without the express written consent of the Bank.

Information relating to the examination, evaluation, comparison, and post-qualification of bids, and recommendation of contract award, shall not be disclosed to bidders or any other persons not officially concerned with such process.

3.10. Clarification of Bids

To assist in the examination, evaluation, comparison and post-qualification of the bids, The Bank may at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder in respect to its Bid and that is not in response to a request by MauBank Ltd shall not be considered. The Bank's request for clarification and the response shall be in writing. No change in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors (if any) discovered in the Evaluation of the bids.

3.11. Correction of Arithmetic Errors

Provided that the Bid is responsive, MauBank Ltd shall correct arithmetical errors on the following basis:

- If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail.

3.12. Late Bids

MauBank Ltd shall not consider any bid that is received after the deadline and shall be declared late and rejected.

3.13. Right to accept or reject any /All Bids

MauBank Ltd reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders.

3.14. Mauritian Law

It is hereby agreed that all matters arising during the tendering exercise, shall be governed by the Laws of Mauritius, and it is agreed that both Bidder and Bank shall submit to the exclusive jurisdiction of the Courts of Mauritius.

4. DOCUMENTS

The tender must be based on all the tender documents. A complete set of the tender documents comprises of:

- a Instructions to Tenderers
- b Form of Tender
- c Bill of Quantities
- d Performance Specifications
- e Drawings.

5. SITE INSPECTION

The Tenderer is deemed to have inspected the site and made himself acquainted with the nature, extent, and requirement of the works. No claim for extra expenses or extension of time under the Contract will be entertained on the ground that insufficient information was given in the Tender Documents or that the Tenderer was not conversant with the conditions prevailing at the site or that during the course of the work, he encountered unexpected difficulty which could have been avoided by inspection of the site.

6. TENDER BOND

Tender bond representing 10% of quoted value should be submitted together with your response.

7. EXPENSES INCURRED IN SUBMISSION OF TENDERS

The Employer will not be responsible for, nor pay for, expenses or losses which may be incurred by any Tenderer in the preparation of the Tender or in visiting the site in connection therewith.

8. TENDER PRICE

The tender shall be on a **fixed price basis but exclusive of Value Added Tax** and shall be based on the Conditions of Contract, Performance Specifications, Drawings and Bills of Quantities and any requirement specified in the Tender document. The currency shall be in Mauritian Rupees abbreviated as "MUR" or "Rs".

9. SUFFICIENCY OF TENDER

The Tenderer must allow in his tender for all labour, materials, constructional plant, temporary works, and everything necessary for the execution and completion of the works in accordance with the tender documents and the tender will be deemed to comply entirely with the terms of the tender documents. The Tenderer's attention is particularly drawn to laws and regulations concerning safety and health, labour regulations, social insurance, labour taxes, and tax deductions, import restrictions and duties, Contractor's tax and Companies Registration requirements.

Unless otherwise stated, the Tenderer shall inform himself especially regarding labour availability. Under no circumstances shall any lack of manpower at any level, be acceptable as a valid cause of delay in the completion of the Subcontract.

Tenderers are invited to visit the proposed site before submission of the tenders. The successful Tenderer shall be deemed to have satisfied himself as to the nature and extent of the works. No claim for extra expense or for extension of time under the contract will be allowed on the grounds that insufficient information was given in the Tender documents, that the Tenderer was not conversant with the conditions prevailing

at the site or that during the course of the work, he encountered unexpected difficulty which could have been avoided by inspection of the site.

10. Specific Instruction to bidders

10.1. NDA (Annexure 2)

Vendors interested in participating in this Bid should sign, stamp and date the document.

10.2. Standard Contract Template (Annexure 3)

Standard Contract template to be signed off upon award.

10.3. Communication

The vendor shall follow strict instruction of this bid - From the issue date of this Bid until the selection is announced, responding vendors may not communicate, either orally or in writing regarding this Bid with any staff except as noted above. To ensure equal treatment for each responding vendor, all questions regarding this Bid must be submitted by email ONLY to the Contact Persons provided by the bank. All such questions will be answered by email. Replies to the questions / clarifications will be sent to all Suppliers who have intentions of submitting a response to the Bid. Vendors failing to comply with this requirement will be subject to disqualification

10.4. Acknowledgement of Vendor

By submitting the Proposal, it shall be deemed true that the applicant has:

- made a complete and careful examination of the Bid.
- received all relevant information requested from MauBank Ltd;
- acknowledged and accepted the risk of inadequacy, error or mistake in the information provided in the Bid or furnished by or on behalf of the Authority or relating to any of the matters referred to above.
- satisfied itself about all matters, aspects and information, necessary and required for submitting an informed Application proposal and performance of all of its obligations thereunder;
- acknowledged that it is not in a situation of Conflict of Interest; and agreed to be bound by the undertaking provided by itself under the terms and conditions hereof.

MauBank Ltd shall not be liable for any omission, mistake, or error on the part of the Applicant in respect of any of the above or on account of any matter or aspect arising out of or concerning or relating to the Bid or the Selection Process, including any error or mistake therein or in any information or data given by itself.

10.5. Documents comprising the Bid Response

The Bid response prepared by the applicant shall consist of the different parts as required by the bidding document. The Bid not in compliance with the requirements shall be immediately rejected.

10.6. Bid Submission Procedures

The following shall form part of the tender submission:

- a The offer, including the Forms of Tender dully filled and signed.
- b The priced Bill of Quantities (BoQ).
- c Name and address of the proposed surety for the Performance Security referred to in the Conditions of Contract.
- d Proposed materials, equipment, and plant.

A hardcopy of the tender shall be deposited in a designated Tender Box situated on ground floor of MauBank Head as per below mentioned address, **no later than 12:00 noon on 28th November 2025.**

Address:
MauBank Ltd
Ground Floor
25, Bank Street
Cybercity, Ebene 72201

All tender submission shall be in a single sealed envelope wherein two separate envelopes – one for financial and one for technical bearing the reference number of the tender on the top right-hand corner of each envelope.

10.7. Clarification of tender documents

A prospective bidder requiring any clarification on the bidding documents should contact through an official e-mail to procurement Department on procurement@maubank.mu at latest **10 days** before the bid submission deadline. If the Bank determines that it is necessary to amend the bidding document due of a clarification, it shall do so in accordance with internal procedure.

10.8. Bid Validity Period

The bid shall remain valid for a period of **120 days** after the bid submission deadline. The Bank shall reject a bid valid for a shorter period as non-responsive.

10.9. Bidders information Sheet

Information as required in **Annexure 4- Bidder's information sheet** should be provided along with the proposal.

11. INSTRUCTIONS FORMING PART OF CONTRACT

These Instructions to Tenderers shall form part of the Contract. I/We the undersigned have read the above Instructions to Tenderers and acknowledge them.

Signed by the said Contractor.

Signature:

Name:

In the capacity of:

Date:

FORMS

FORM OF TENDER SECURITY (TENDER BOND)

BY THIS SECURITY (BOND)

we.....

of (whose registered office is at)

.....

(hereinafter called the ***“The Contractor”***)

AND

.....

of (whose registered office is at)

.....

(hereinafter called ***“The Surety”***)

are held and firmly bound unto **MauBank Ltd** (hereinafter called ***“The Employer”***) in the sum of **One Hundred and Fifty Thousand Rupees (Rs 150,000.00)** for the payment of which sum we bind ourselves, our successors and assignors jointly and severally by these present.

WHEREAS..... of (whose registered office is at).....(hereinafter called ***“The Tenderer”***) has, by a tender (hereinafter called ***“The Said Tender”***) made to the employer, offered to enter into a Contract viz. **Refurbishment of Pope Hennessy Building at Port Louis for MauBank Ltd – Mechanical, Electrical and Public Health (MEP) & Allied Works** (hereinafter called ***“The Said Contract”***) for the refurbishment of an existing office building located at Pope Hennessy street, Port Louis for MauBank Ltd as therein mentioned and has undertaken to enter into a Performance Security (Bond) for the due performance for the Contract should the said tender be accepted by The Employer.

NOW THE CONDITION of this Security (Bond) is such that if the Tenderer shall maintain the said tender and shall enter into a Performance Security (Bond) for the due performance of the Contract within **fourteen (14) days** of receipt of notification of acceptance of the said tender by the Employer, then this obligation shall be null and void but otherwise shall be and remain in full force and effect for a period of **One hundred and twenty (120) days** from the date set for opening of the said tender.

Date, day of.....2025

SIGNATURE.....

WITNESS.....

FORM OF TENDER

Date:

The Chairperson,
Bid Opening Committee
MauBank Ltd
25, Bank Street, Cybercity
Ebene 72201
Republic of Mauritius

**Refurbishment of Pope Hennessy Building at Port Louis for MauBank Ltd
Mechanical, Electrical, Public Health & Allied Works**

- 1 Having examined the Drawings, Conditions of Contract, Specification, Bill of Quantities and Appendices thereto and Addenda No to..... for the above named works, We, the undersigned, offer to construct, complete and maintain the whole of the Works in Conformity with the said Drawings, Conditions of Contract, Specification, Bill of Quantities and Appendices thereto and Addenda No.....to.....for the sum of Mauritian Rupees.....
.....
.....
.....(MUR.....) or such other sum as may be ascertained in accordance with the said Conditions of Contract.
- 2 If our Tender is accepted and the Contract awarded to us, we undertake to commence the Works within such period after possession of site as stated in the Preambles and to complete the whole works comprised in the Contract within the time for completion stipulated in the same Preambles.
- 3 If our Tender is accepted, We will obtain within **fourteen days (14)** of receipt of notification of acceptance a Performance Bond from a local bank (to be approved by the Architect) to be jointly and severally bound with us in a sum equivalent to ten per cent of the Contract Sum for the due performance of the Contract under the terms of a Performance Bond to be approved by you in the Form enclosed herein.
4. We agree to abide by this Tender for the period of **One hundred and twenty days (120)** from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- 5 Unless and until a formal Agreement is prepared and executed this Tender or an adjusted tender together with your written acceptance thereof shall constitute a binding contract between us.
6. The Employer reserves the right to accept or reject any tender and to annul the tendering process and reject all tenders at any time prior to the award of contract without thereby incurring any liability to any bidder or any obligation to inform the bidder of the grounds for the Employer's action.

Date this.....day of.....2025

Signature.....

FORM OF PERFORMANCE BOND

BY THIS BOND

we _____

(hereinafter called "the Contractor") whose registered office is situated at

AND

(hereinafter called "the Surety") whose registered office is situated at

_____ are held and firmly
bound to _____

_____ (hereinafter called "the Employer") in the sum of

Mauritian Rupees _____ -

(Rs. _____)

for the payment of which sum we bind ourselves and, each of us, our successors, heirs, executors, administrators and assigns, jointly and severally by these presents.

WHEREAS by a Contract made between the Employer of the one part and the Contractor of the other part, the Contractor has contracted and agreed that he the Contractor will in such manner, within such periods and to such satisfaction, construct, execute, complete and maintain such works as in the Contract are mentioned namely **Refurbishment of Pope Hennessy Building at Port Louis for MauBank Ltd** – Mechanical, Electrical, Public Health & Allied works (hereinafter called the "Said Contract") and will perform and fulfil the other obligations imposed on the Contractor by the said contract.

NOW THE CONDITION of the above written Bond is such that if the Contractor shall well and truly perform and observe all the terms, provisions, conditions and stipulations which, under or by virtue of the said contract or any award made under the provisions therein contained, are on the Contractor's part to be performed and observed according to the true purpose, intent and meaning thereof or if on default of the Contractor the Surety shall satisfy and discharge the damages sustained by the Employer thereby up to the above written bond, then this obligation shall be null and void but otherwise shall be and remain in full force and effect for the duration of Contract. The surety shall only be excused when the principal for which it stands as surety is by law excused and in no other case.

PROVIDED ALWAYS, and it is hereby declared, that no alteration in terms of the said Contract made by agreement between the Employer and the Contractor or in the extent or nature of the works to be constructed, completed and maintained there under and no allowance of time by the Employer under the said contract or any forbearance or forgiveness or in respect of any matter or thing concerning the said contract on the part of the Employer or the Architect shall in any way release the surety from any liability under the above-written Bond.

("good for the sum of Mauritian

Rupees _____")

Signed, sealed and delivered by the said

for and on behalf

of _____

in the presence of (name address and description)

("good for the sum of Mauritian Rupees

_____) Signed,

Sealed and delivered by the said _____

for and on behalf of _____

in the presence of (name, address and description) _____

FORM OF AGREEMENT

The Employer is _____ of

The Contractor is _____ of

The Employer desires the execution of certain Works known as

**Refurbishment of Pope Hennessy Building at Port Louis for MauBank Ltd
Mechanical, Electrical, Public Health & Allied works**

OFFER

The Contractor has examined the documents listed in the Appendix which forms part of this Agreement and offers to execute the Works in conformity with the Contract for the sum of

_____ (in words)

(in figures) (_____)

or such other sum as may be ascertained under the Contract.

This offer, of which the Contractor has submitted two signed originals, may be accepted by the Employer by signing and returning one original of this document to the Contractor before

(date)

The Contractor understands that the Employer is not bound to accept the lowest or any offer received for the Works.

Signature: _____ Date: _____

Name: _____

Authorised to sign on behalf of (organisation name): _____

Capacity: _____

ACCEPTANCE

The Employer has by signing below, accepted the Contractor's offer and agrees that in consideration for the execution of the Works by the Contractor, the Employer shall pay the Contractor in accordance with the Contract. This Agreement comes into effect on the date when the Contractor receives one original of this document signed by the Employer.

Signature: _____ Date: _____

Name: _____

Authorised to sign on behalf of (organisation name): _____

Capacity: _____

Pre-Qualification Questionnaire (PQQ) – MEP Refurbishment Works

(To be completed and submitted by all bidders together with the tender submission)

Section 1 – General Information

- 1.1. Name of Company:
- 1.2. Registered Office Address:
- 1.3. CIDB/CIA Registration No. & Category (Large / Medium I / Medium II):
.....
- 1.4. Year of Establishment:
- 1.5. Contact Person (Name, Title, Email, Telephone):
.....

Section 2 – Legal and Regulatory Compliance

- 2.1. Confirm that your organisation is duly registered and in good standing with CIDB and/or CIA of Mauritius. *(Attach valid registration certificate)*
- 2.2. Confirm that your organisation has no outstanding legal disputes, debarments, or suspensions under the Public Procurement Act. *(Attach declaration)*

Section 3 – Financial Capacity

- 3.1. Provide audited financial statements for the last **three (3) years**.
- 3.2. State annual turnover for each of the last three years.
- 3.3. Provide details of available credit facilities or financial backing relevant to this project.
- 3.4 “Letter of Good Standing” from Bank

Section 4 – Technical Capacity & Experience

4.1. Provide details of at least **two (2) comparable MEP refurbishment projects** of similar scale and complexity executed within the last five (5) years. For each project, provide:

- Project Name & Location
- Employer/Client Contact Details
- Year of Completion
- Contract Value (MUR)
- Scope of MEP works (mechanical, electrical, plumbing, fire protection, associated civil works)
- Occupied/operational building? (Yes/No)
- Reference Letter (attach)

4.2. Provide details of experience in **coordination of MEP trades in refurbishment projects**, especially in **occupied buildings**.

Section 5 – Resources & Personnel

5.1. Provide CVs of key personnel proposed for the project (Project Manager, MEP Coordinators, Site Engineers, Safety Officer).

5.2. Provide evidence of access to competent **masonry/civil subcontractor(s)** for builders' works.

5.3. Provide details of in-house design/coordination capacity for specialist systems (fire protection, BMS, HVAC, etc.).

Section 6 – Health, Safety & Environment (HSE)

6.1. Provide your company's HSE Policy.

6.2. Provide records of accidents/incidents for the last 3 years.

6.3. Confirm your ability to maintain **fire alarm coverage, fire evacuation paths, and safe access** during works in occupied buildings.

Section 7 – Declaration

I/We hereby declare that the information provided is true and complete. We understand that providing false or misleading information will result in immediate disqualification.

Signed:

Name:

Position:

Date:

Appendix To Schedules of Conditions of Contract

This Appendix forms part of the Agreement.

[Note: with the exception of the items for which the Employer's requirements have been inserted, the Contractor shall complete the following information before submitting his offer.]

Item	Sub-Clause	Data
Documents forming the Contract listed in the order of priority	1.1.1	
Document		Document Identification
a) The Agreement b) Particular Conditions c) General Conditions d) The Specification e) The Drawings f) The Contractor's tendered design g) The bill of quantities		
Time for Completion	1.1.9	168 Calendar days (24 Weeks) Including weekends and public holidays
Law of the Contract	1.4	Laws of the Republic of Mauritius
Language	1.5	English Language
Provision of Site	2.1	On the Commencement Date
Authorised person	3.1	Mr Vikram Bhujun from Prodesign
Name and address of Employer's representative	3.2	Mr. Somduth Ramjatun Head of Facilities Management Facilities Management Department MauBank Ltd 25, Bank Street, Cybercity Ebene 72201 Republic of Mauritius
Performance security		
Amount	4.4	10% of the contract amount from a commercial bank.
Form	4.4	Performance security from Insurance company shall not be accepted.

Tender Document for Refurbishment of Pope Hennessy Building at Port Louis for
MauBank Ltd

* Employer to amend as appropriate

Item	Sub-Clause	Data
Requirements for Contractor's design	5.1	Full design of the project
Programme:		
Time for submission	7.2	Within days (7) of the Commencement Date.
Form of programme	7.2	Gantt Chart
Amount payable due to failure to complete	7.4	Rs 5,000 per day up
		to a maximum of 10% of sum stated in the Agreement
Period for notifying defects Variation procedure	9.1 & 11.5	365 days* calculated from the date stated in the notice under Sub-Clause 8.2
Daywork rates	10.2	Not applicable.
Valuation of the Works*		Monthly valuations on progress of works on site. No payment for materials off site.
Lump sum Price	11.1	This contract shall be fixed sum contract, re-measurable on completion of works.
Percentage of value of Materials and Plant	11.2	Materials 70%
		Plant 80%

Item	Sub-Clause	Data
Percentage of retention	11.3	5%
Currency of payment	11.7	Mauritian rupee
Rate of interest	11.8	Bank lending rate
INSURANCES	14.1	
Type of cover*	Amount of cover*	Exclusions*
The Works, Materials, Plant and fees	The sum stated in the contract Agreement plus 15%	
Contractor's Equipment	Full replacement cost	
Third Party injury to persons and damage to property	Rs 2 million Rs 5 million	
Workers		
Other cover*		
Arbitration		
Rules	15.3	UNCITRAL Arbitration Rules
Appointing authority	15.3	The Employer in consultation with contractor
Place of Arbitration	15.3	Mauritius

ANNEXURE TO CONDITION OF CONTRACT

The Conditions of Contract shall be the FIDIC Short Form of Contract, 1st Edition 1999, published by Fédération International des Ingénieurs-Conseils (FIDIC).

ANNEXURE 1 – Scope of Works

Mechanical & Allied Works



SCOPE OF WORKS MECHANICAL

The scope of works for the mechanical package shall be as described in this section.

1. General Requirements

Tenderers are advised that all civil and building works incidental to the MEP installations, and the coordination responsibilities among MEP trades, shall be governed by the provisions of **Annexure 5 – Special Provisions for Refurbishment Works**.

2. Demolition Works

2.1. General Ventilation and Air Conditioning Systems

- 1) Decommissioning, dismantling, and carting away of existing air conditioning Air Handling Unit (AHU) at each floor complete with all accessories and fixations from ground floor to sixth floor.
- 2) Decommissioning, dismantling, and carting away of existing treated fresh air (Primary Air) Air Handling Unit (AHU) complete with all accessories and fixations at roof level.
- 3) Decommissioning, dismantling, and carting away of existing exhaust air fan complete with all its accessories and fixations at roof level.
- 4) Dismantling and carting away of all treated fresh air (Primary Air) ducts complete with all fixation accessories from the treated fresh air AHU at roof level down to the air conditioning AHU at each floor, from sixth floor to ground floor. The main duct runs vertically at the core through the height of the building from roof level down to ground floor.
- 5) Dismantling and carting away of all return air ducts from each floor (Ground to roof level) to the exhaust air fan at roof level, complete with all fixation accessories. The main duct runs vertically at the core through the height of the building from ground floor up to roof level.
- 6) Dismantling and carting away of all secondary air ducts from air conditioning AHU to supply air diffusers at each floor from ground floor to 6th floor.
- 7) Dismantling and carting away of all supply and return (secondary air) diffusers / grilles fixed to false ceiling or otherwise.
- 8) Dismantling and carting away of all exhaust grilles fixed to wall or otherwise.

2.2. Chilled Water System

- 1) Decommissioning, dismantling, and carting away of existing air-cooled chiller located at roof level, complete with all accessories.
- 2) Decommissioning, dismantling, and carting away of existing twin volute chilled water circulation pump located at roof level, complete with all accessories.
- 3) Decommissioning, dismantling, and carting away of existing 2 Nos. chilled water buffer vessels located at roof level.



- 4) Decommissioning, dismantling, and carting away of existing chilled water pressurisation unit complete with pumps, pressure vessel, piping connections and all related accessories.
- 5) Dismantling and carting away of all chilled water pipes running from chiller to existing treated fresh air (Primary Air) Air Handling Unit (AHU) at roof level, and all existing air conditioning Air Handling Unit (AHU) at each floor, complete with all accessories (manual valves, motorised valves, double regulating valves, commissioning stations, strainers, pressure gauges, temperature gauges, sensors, etc.) and fixations from roof level down to ground floor.

2.3. Toilet & Kitchen Ventilation System

- 1) The existing toilet and kitchen ventilation system of the building consists of localised wall mounted extract fans fixed to the glass pane of the openable windows of the WC cubicles and kitchenettes.
- 2) Most of these fans operate on the respective light switches of the WC cubicle served.
- 3) All these localised toilet extract fans shall be decommissioned, dismantled, and carted away at all levels of the building from ground floor to sixth floor.

3. New Works

3.1. General Ventilation System

- 1) Supply and installation of a new treated fresh Air Handling Unit (AHU) / Dedicated Outdoor Air System (DOAS) at roof level, with direct expansion coil for dehumidification and dry bulb temperature control, variable speed inverter compressor for variable refrigerant flow in the DX coils, DX coil to recover hot exhaust gas bypass from compressor for heating back of dehumidified air (mandatory for heating to adjust dry bulb temperature of supply air), electronic 3-way refrigerant hot gas bypass, variable speed heat recovery wheel for both sensible and latent energy recovery from exhaust air stream to supply air stream, direct drive plug fans with ECM motors, variable speed condenser fans with ECM direct drive motors.
- 2) Supply and installation of new treated supply fresh air ducts with thermal insulation and vapour barrier on the outer surface of the duct, complete with all ductwork accessories and fixations, from the DOAS to all zones at all levels from roof level to ground floor level.
- 3) Supply and installation of new return air ducts, with thermal insulation and vapour barrier on the outer surface of the duct, from all floors from ground to roof levels, back to the DOAS.
- 4) Supply and installation of new treated fresh air supply air diffusers in all zones in the building.
- 5) Supply and installation of new return air grilles complete with filters in all zones in the building.
- 6) Supply and installation of new duct mounted acoustic silencers on supply and return air ducts at all floors.



- 7) Supply and installation of new duct mounted motorised volume control dampers at all floors to enable a demand-controlled ventilation strategy to be implemented.
- 8) Supply and installation of new duct mounted motorised fire dampers at all floors.
- 9) Supply and installation of new duct fitted constant volume flow regulators to maintain a constant designed air flow rate into a zone.
- 10) Supply and installation of new duct mounted motorised two opening levels (full designed flow rate / minimum flow rate) volume control dampers at zone levels.
- 11) Supply and installation of new recessed ceiling mounted presence/motion detector to activate zone level motorised volume control dampers for demand control ventilation strategy.
- 12) Supply and installation of new duct mounted carbon dioxide (CO₂) transducers to activate floor level motorised volume control dampers for demand control ventilation strategy.
- 13) Liaison with electrical Contractor for electrical feeder cables and power supply from new electrical distribution board.
- 14) Liaison with building Operator for coordination of works with Tenants at all times.
- 15) Testing and commissioning of the whole installation.
- 16) Record drawings and maintenance manuals.
- 17) Demonstration, instruction, and training of Employer's staff.
- 18) Any other items necessary to comply with the Performance Specifications and for the successful completion of the project to meet the design intent of the Consulting Engineer.

3.2. Toilet & Kitchen Ventilation System

- 1) A new centralised toilet & kitchen ventilation system has been designed for the building. The new centralised toilet & kitchen ventilation system consists of two extract fans working in duty standby auto changeover mode and connected to a new network of GMS ducts running from the fans at roof level down to ground floor level.
- 2) Supply and installation of new toilet and kitchen extract fans at roof level at high level inside an existing technical room.
- 3) Supply and installation of new wall mounted weatherproof exhaust grilles for the exhaust of air extracted from the toilet cubicles and kitchenettes by the extract fans.
- 4) Supply and installation of new duct mounted acoustic silencers.
- 5) Supply and installation of new duct fitted constant volume flow regulators to maintain a constant designed extract air flow rate from each WC cubicle and kitchenette.
- 6) Supply and installation of new manual volume control dampers at all floors.
- 7) Liaison with electrical Contractor for electrical feeder cables and power supply from new electrical distribution board. Liaison with building Operator for coordination of works with Tenants at all times.
- 8) Testing and commissioning of the whole installation.



- 9) Record drawings and maintenance manuals.
- 10) Demonstration, instruction, and training of Employer's staff.
- 11) Any other items necessary to comply with the Performance Specifications and for the successful completion of the project to meet the design intent of the Consulting Engineer.

3.3. Air Conditioning System

- 1) Supply and installation of a new Variable Refrigerant Flow (VRF) comfort air conditioning system using R32 refrigerant from a reputable Japanese or European manufacturer, like Daikin and LG.
- 2) The new VRF system outdoor units shall be installed on new purpose built reinforced concrete plinth on the existing roof slab of the building.
- 3) All the new VRF outdoor units shall be installed on special acoustic and vibration absorption plates similar and equivalent to MAFUND plate from Mupro.
- 4) The new VRF system outdoor units shall be divided into 3 clusters, each cluster consisting of 3 VRF outdoor units.
- 5) VRF Cluster 1 serves Roof, 6th and 5th floors.
- 6) VRF Cluster 2 serves 4th, 3rd and 2nd floors.
- 7) VRF Cluster 3 serves 1st and ground floors.
- 8) Supply and installation of new proprietary copper liquid and gas refrigerant piping complete with insulation from the VRF outdoor units to the VRF indoor units.
- 9) Supply and installation of new proprietary copper liquid and gas refrigerant piping accessories such as Y-branches, headers, fittings, etc., complete with appropriate insulation.
- 10) Supply and installation of new VRF indoor units, fully compatible with the VRF outdoor units.
- 11) Supply and installation of new proprietary wall mounted, wired, intelligent, BMS (Building Management System) and EMS (Energy Management System) compatible, networkable, thermostat for local and zone level control / group control of the VRF indoor units for temperature setpoint, ambient humidity and temperature display, fan speed control, schedule of operations of the VRF indoor units in the zones, etc.
- 12) Supply and installation of new proprietary wall mounted central controller compatible with the VRF systems installed for the monitoring, control, scheduling, trending, energy management, optimisation of operations, etc., of the complete VRF installation of the building.
- 13) Supply and installation of a new proprietary energy management system fully compatible with the new proposed VRF system for the billing of all the Tenants in the building. The system shall have the flexibility to adapt to varying tenancy occupation of the building through time. The system shall be fully transparent to the building operator and Tenants and shall generate monthly reports as per the energy consumption of the whole VRF system, each VRF cluster, each VRF outdoor unit, the energy consumption contribution of each floor, each zone at any floor and aggregate the energy consumption for each Tenant every month at a particular scheduled date, day and time, or as requested by the Operator at any time.



- 14) Liaison with electrical Contractor for electrical feeder cables and power supply from new electrical distribution board and plumbing Contractor for other trades coordination.
- 15) Liaison with building Operator for coordination of works with Tenants at all times.
- 16) Testing and commissioning of the whole installation.
- 17) Record drawings and maintenance manuals.
- 18) Demonstration, instruction, and training of Employer's staff.
- 19) Any other items necessary to comply with the Performance Specifications and for the successful completion of the project to meet the design intent of the Consulting Engineer.

Electrical & Allied Works



SCOPE OF WORKS ELECTRICAL

The scope of works for the electrical package shall be as described in this section.

1. General Requirements

Tenderers are advised that all civil and building works incidental to the MEP installations, and the coordination responsibilities among MEP trades, shall be governed by the provisions of **Annexure 5 – Special Provisions for Refurbishment Works.**

2. Demolition Works

- 1) Decommissioning, dismantling, and carting away of existing main LV switchboard located in technical room at ground level.
- 2) Decommissioning, dismantling, and carting away of existing cable trays which shall not be re-used.
- 3) Decommissioning, dismantling, and carting away of existing unused cables.
- 4) Decommissioning, dismantling, and carting away of existing old unused electrical distribution boards and control panels at all floors.
- 5) Decommissioning, dismantling, and carting away of existing old emergency luminaires complete with signages.
- 6) Decommissioning, dismantling, and handing over or carting away, as may be the case, of existing old and unused general lighting luminaires.
- 7) Decommissioning, dismantling, and carting away of existing old external luminaires.
- 8) Removal and replacement of damaged general purpose wall sockets.
- 9) Decommissioning, dismantling, and carting away of existing old unused electrical generator in electrical room at roof level.
- 10) Decommissioning, dismantling, and carting away or reuse, as may be instructed by Consulting Engineer, of existing Faraday cage lightning protection systems at roof level.

3. New Works

- 1) Supply and installation of new main LV panel on raised metallic support in electrical room in basement.
- 2) Supply and installation of new electrical sub-distribution board at all floors except where indicated otherwise.
- 3) Supply and installation of new main and sub feeder cables from existing CEB room at ground floor to new main LV panel and from new main LV panel to all sub distribution boards at all levels.
- 4) Reconnection of existing final lighting and small power cables to new terminals in new electrical distribution boards.
- 5) Reconnection of Tenants fibre connection to the new fibre distribution box at all floors.
- 6) Refurbishment of existing CEB cubicles at ground floor on site.
- 7) Refurbishment of existing generator set at ground floor.
- 8) New telecom room to be created in basement technical room.



- 9) Supply and installation of new earthing farms at ground/site level for main LV earthing and new lightning protection system.
- 10) Refurbishment of any earthing farms which are still in order.
- 11) Installation of new fibre optic main distribution frame in new telecom room in basement to serve whole building.
- 12) Installation of new fibre optic sub distribution box in existing electrical room from ground floor to roof level to serve each respective floor.
- 13) Supply and installation of new LV and ELV cable trays in basement and vertically in risers along the whole building height, at all floors and on roof level.
- 14) Supply and installation of new ESE lightning protection system at roof level.
- 15) Supply and installation of new general-purpose sockets.
- 16) Supply and installation of new localised double pole (DP) switches for VRF indoor units.
- 17) Supply and installation of new localised isolating switches for mechanical equipment.
- 18) Supply and installation of new indoor luminaires for general lighting, accent lighting and decorating lighting.
- 19) Supply and installation of new dual technology (PIR + ultrasonic) presence/motion detectors for operation of luminaires.
- 20) Supply and installation of new wall mounted toggle and push button lighting switches.
- 21) Supply and installation of new outdoor luminaires.
- 22) Refurbishment of existing electronic fire alarm system and relocation of existing ceiling mounted sensors as may be required by new design.
- 23) Supply and installation of new centralised Building Management System (BMS) and Energy Management System (EMS) for the monitoring, control, and billing of Tenants energy use (both electricity and air conditioning).
- 24) Liaison with mechanical and/or plumbing Contractors for electrical feeder cables and power supply from new electrical distribution board and for other trades coordination.
- 25) Liaison with building Operator for coordination of works with Tenants at all times.
- 26) Testing and commissioning of the whole installation.
- 27) Record drawings and maintenance manuals.
- 28) Demonstration, instruction, and training of Employer's staff.
- 29) Any other items necessary to comply with the Performance Specifications and for the successful completion of the project to meet the design intent of the Consulting Engineer.

Public Health & Allied Works



SCOPE OF WORKS PUBLIC HEALTH & FIRE FIGHTING

The scope of works for the public health and fire-fighting package shall be in this section.

1. General Requirements

Tenderers are advised that all civil and building works incidental to the MEP installations, and the coordination responsibilities among MEP trades, shall be governed by the provisions of **Annexure 5 – Special Provisions for Refurbishment Works.**

1.1. Demolition Works

- 1) Decommissioning, dismantling, and carting away of existing sump pump in basement complete with any electrical control panel.
- 2) Decommissioning, dismantling, and carting away of existing water pipe works and pipeline accessories (valves, float switches, ball cock valves, etc.) to existing water tanks (fire tank and domestic tank) in basement which shall not be reused as per new design.
- 3) Decommissioning, dismantling, and carting away of existing potable cold water transfer pump complete with any associated electrical and control panels.
- 4) Decommissioning, dismantling, and carting away of existing electrical and control panel serving existing firefighting pump (sprinkler pump).
- 5) Decommissioning, dismantling, and carting away of existing water pipe works and pipeline accessories (valves, float switches, ball cock valves, etc.) to existing water tank at roof level which shall not be reused as per new design.

1.2. New Works

- 1) Supply and installation of new sump pumps in basement complete with proprietary electrical and control panel.
- 2) Supply and installation of new packaged combined boosted cold-water service and fire hose reel (FHR) pump in technical room at ground level complete with proprietary electrical and control panel and all required accessories.
- 3) Supply and installation of new electrical and pump control panel for the existing firefighting pump (sprinkler pump).
- 4) Supply and installation of new fire hose reel (FHR) at all floors.
- 5) Supply and installation of new GMS, red colour painted FHR rising main and piping from basement to roof level and connection at all floors to FHR.
- 6) Supply and installation of new portable fire extinguishers at all floors besides the FHR as per new design.
- 7) Supply and installation of new uPVC boosted cold water service (BCWS) rising main and piping from basement to roof level and terminated at all floors in existing toilet/kitchenette blocks with an isolating valve.
- 8) Liaison with building operator and reconnection of existing water services to new isolating valves at each existing toilet/kitchenette blocks.



- 9) Supply and installation of new piping and piping accessories (valves, strainers, heavy duty ball cock valves, level switches, level sensors, etc.) at water tanks in basement and roof level as per new design intent.
- 10) Liaison with building operator for reconnection of existing firefighting (sprinkler) pump and new combined boosted cold-water service and fire hose reel (FHR) pump in technical room at ground level to existing and new pipework, as may be the situation, on suction and discharge sides of the respective pumps.
- 11) Liaison with mechanical and/or electrical Contractors for electrical feeder cables and power supply from new electrical distribution board and for other trades coordination.
- 12) Liaison with building Operator for coordination of works with Tenants at all times.
- 13) Testing and commissioning of the whole installation.
- 14) Record drawings and maintenance manuals.
- 15) Demonstration, instruction, and training of Employer's staff.
- 16) Any other items necessary to comply with the Performance Specifications and for the successful completion of the project to meet the design intent of the Consulting Engineer.

ANNEXURE 2 – NDA Template

MUTUAL CONFIDENTIALITY AGREEMENT ('Agreement')

DATE: th 202..

PARTIES

- I. MauBank Ltd, ("**MauBank** ") whose registered office is at 25, Bank Street, Cybercity, Ebene 72201, Republic of Mauritius
- II., whose registered office is at.....

.....

together, the "**Parties**" and each a "**Party**".

RECITALS

- A. In the course of discussions and correspondence between the Parties relating to the Proposed Transaction, each of the Parties will receive Confidential Information concerning the other, its Group, the Client and/or the Proposed Transaction.
- B. Each Party recognises and acknowledges the competitive value and confidential nature of such Confidential Information and that damage could result to the other Party if it is disclosed to any third party.
- C. This Agreement sets out the conditions on which each Party discloses to and receives from the other Party, Confidential Information.

1. DEFINITIONS

- 1.1 The following definitions apply in this Agreement:

"**Client**" means any underlying obligor or the company constituting the subject matter of the Proposed Transaction;

"**Confidential Information**" means all information relating to the Client, the Client Group and/or the Proposed Transaction, provided by the Disclosing Party (or disclosed on its behalf) to the Receiving Party and includes:

- (a) all information relating to the Proposed Transaction or associated with the activities of the Client and its Group (including, its business affairs, financial dealings, operations, commercial strategies, technical information, product information, clients and supplier information, goodwill and reputation, know-how, proprietary rights, designs, trade secrets and market opportunities); and
- (b) all documents that contain, reflect or use any information described in (a) above which can be either disclosed, offered, delivered, copied, acquired by observation or participation and communicated either directly or indirectly orally, in writing, electronically, in machine readable form, text, drawings, financial models, projections, plans, specifications, analyses, compilations, comparisons, evaluations, studies, designs, applications, notes, reports, records, extracts or any other means of representing or

recording and recalling information, marked as confidential,

but excludes information which:

- (i) the Receiving Party already controlled, possessed or developed independently, prior to receipt from the Disclosing Party; or
- (ii) was public knowledge at the time it was disclosed under this Agreement or becomes available to the public without breach of this Agreement; or
- (iii) the Receiving Party lawfully receives without any such restrictions or obligations of confidentiality from a third party who in turn (to the best of the Receiving Party's knowledge and belief) received such information legally and not in breach of any obligation of confidentiality.

"Disclosing Party" means, in relation to any Confidential Information, the Party or its Group member which discloses such information;

"Group" means, in relation to a Party or the Client, that Party or the Client, each of that Party's or the Client's holding companies and subsidiaries and each subsidiary of each of its holding companies and (where applicable) representative and branch offices in any jurisdiction;

"Permitted Person(s)" means the directors, employees, agents and professional advisors of the Receiving Party's Group that have a need to receive Confidential Information in connection with the Permitted Purpose and that are under a duty of confidentiality to the Receiving Party;

"Permitted Purpose" means evaluating and negotiating the Proposed Transaction;

"Proposed Transaction" means *sourcing exercise reference / Name: Services*; and

"Receiving Party" means, in relation to any Confidential Information, the Party or its Group member which receives such information.

2. CONFIDENTIALITY UNDERTAKING FROM THE RECEIVING PARTY

2.1 In consideration for the Disclosing Party agreeing to make available to the Receiving Party certain Confidential Information, the Receiving Party agrees to:

- (a) keep the Confidential Information confidential and not (without the Disclosing Party's prior written consent) disclose it to anyone other than Permitted Persons or as provided for by Clause 3 below;
- (b) keep confidential and not disclose to anyone the fact that the Confidential Information has been made available to the Receiving Party;
- (c) use the Confidential Information only for the Permitted Purpose (unless disclosed under Clause 3);
- (d) use reasonable endeavours to ensure that any person to whom the Receiving Party discloses any Confidential Information to (unless disclosed under Clause 3) is under a duty of confidentiality to the Receiving Party, similar to the Receiving Party's obligations under this Agreement;

- (e) not make enquiries of any Client Group member or any of their directors, employees, agents or advisers relating directly or indirectly to the Proposed Transaction; and
 - (f) provide secure storage for all such Confidential Information in the Receiving Party's possession or control and apply at least the same security measures or degree of care as that which it would apply to its own confidential or proprietary information.
- 2.2 The undertakings are given by the Receiving Party for the benefit of the Disclosing Party without implying any fiduciary obligations on the part of the Receiving Party.

3. PERMITTED DISCLOSURE

3.1 The Disclosing Party agrees that the Receiving Party may disclose Confidential Information:

- (a) to any insurers, auditors or service providers of the Receiving Party's Group;
 - (b) to any other person with the Disclosing Party's prior written consent provided that they are or will be under a duty of confidentiality to the Receiving Party;
 - (c) where requested or required by any court of competent jurisdiction or any applicable judicial, governmental, supervisory, regulatory or self-regulatory body;
 - (d) where required by the rules of any stock exchange on which the shares or other securities of any member of the Receiving Party's Group are listed; or
 - (e) where required by the laws or regulations of any country with jurisdiction over the affairs of any member of the Receiving Party's Group.
- [3.2 If disclosure is required in the circumstances contemplated in Clause 3.1 (c), Clause 3.1 (d) or Clause 3.1 (e), the Receiving Party will (except where the disclosure is to a supervisory or regulatory body during the ordinary course of its supervisory or regulatory function over a member of the Receiving Party's Group), to the extent permitted:
 - (a) notify the Disclosing Party of the disclosure (prior to such disclosure if reasonably practicable); and
 - (b) if deemed appropriate by the Receiving Party, discuss with the Disclosing Party the content and extent of such disclosure.]]'

4. NOTIFICATION OF UNAUTHORISED DISCLOSURE

- 4.1 The Receiving Party will promptly advise the Disclosing Party the circumstances (to the extent reasonably practicable and permitted) of any unauthorized disclosure, misappropriation or misuse by any Permitted Person or other third party of any Confidential Information upon the Receiving Party being put on notice of the same.

5. RETURN OR DESTRUCTION OF CONFIDENTIAL INFORMATION

- 5.1 All Confidential Information disclosed by the Disclosing Party (or on its behalf) will be deemed to be the property of the Disclosing Party and the Receiving Party and the Permitted Persons will

have no rights in title except as expressly agreed to by the Disclosing Party. If the Disclosing Party requests in writing, the Receiving Party will:

- (a) either return or destroy all Confidential Information in the possession of the Receiving Party;

and
- (b) use reasonable endeavours to procure that the Permitted Persons return or destroy such Confidential Information.

5.2 This Clause will not apply to the extent that any applicable law, rule or regulation or any applicable judicial, governmental, supervisory or regulatory body or the Receiving Party's internal policy requires it or any Permitted Person to retain any such Confidential Information. The obligations of confidentiality under this Agreement will continue to apply in such circumstances.

6. CONTINUING OBLIGATIONS AND EXPIRY

6.1 The obligations in this Agreement are continuing and will cease on the earliest of:

- (a) if either Party becomes a party to or otherwise acquires (by assignment or sub participation) an interest, direct or indirect in the Proposed Transaction;
- (b) the date of execution of a definitive agreement between the Parties with respect to the Proposed Transaction; and
- (c) twelve months from the date of this Agreement.

7. NO REPRESENTATION

7.1 The Receiving Party acknowledges and agrees that the Disclosing Party:

- (a) makes no express or implied representation or warranty as to, or assumes any responsibility for, the accuracy, reliability or completeness of any of the Confidential Information or any other information supplied by the Disclosing Party or any Client Group member or the assumptions on which it is based; or
- (b) is under no obligation to update or correct any inaccuracy in the Confidential Information or any other information supplied by the Disclosing Party or any Client Group member or be otherwise liable to the Receiving Party or any other person in respect to the Confidential Information or any such information.

8. REMEDIES

8.1 The Receiving Party acknowledges and agrees that the Disclosing Party or the Client Group members may be irreparably harmed by any breach of this Agreement and damages may not be an adequate remedy. It is agreed that the Disclosing Party is entitled to seek an injunction or specific performance or similar remedy against any conduct or threatened conduct which is or would be a breach of this Agreement.

9. MISCELLANEOUS

- 9.1 This Agreement sets out the full extent of the Parties' obligations. Failure or delay by the Disclosing Party to enforce any of its rights under this Agreement shall not be taken as or deemed to be a waiver of such right. No waiver or amendment of any provision of this Agreement shall be valid or binding unless the waiver or amendment is made in writing and signed by the duly appointed representatives of both Parties.
- 9.2 If any provision of this Agreement is found by any court of competent jurisdiction to be invalid or unenforceable, such provision shall not affect the other provisions of this Agreement, which shall remain in full force and effect. The Parties shall use reasonable endeavours to find a new provision, resembling the invalid one, taking the original intent and purpose into consideration.
- 9.3 All notices under this Agreement shall be in writing and shall be sent by fax or first class registered or recorded delivery post to the Party being served at its address specified above and marked for the attention of that Party's signatory of this Agreement. The date of service shall be deemed to be the day following the day on which the notice was transmitted or posted as the case may be.
- 9.4 Nothing contained in this Agreement shall be construed to create an exclusive contractual arrangement, association, trust partnership or joint venture or impose a trust or partnership or fiduciary duty, obligation or liability between the Parties other than provided in this Agreement or to create any duty, standard of care or liability to any third party.
- 9.5 This Agreement is personal to the Parties and shall not be assigned or otherwise transferred in whole or in part by either Party without the prior written consent of the other Party.
- 9.6 This Agreement may be executed in any number of counterparts and this has the same effect as if the signatures on the counterparts were on a single copy of this Agreement.
- 9.7 This Agreement constitutes the entire Agreement and understanding between the Parties and supersedes any previous agreement, understanding, warranties and arrangements between the Parties relating to the Confidential Information and the Proposed Transaction.

10. INSIDE INFORMATION

- 10.1 The Parties acknowledge that some or all of the Confidential Information may be price-sensitive information and that the use of such information may be regulated or prohibited by applicable legislation including securities laws relating to insider dealing, market abuse or market misconduct. The Parties undertake not to use any Confidential Information for any unlawful purpose.

11. THIRD PARTY RIGHTS

- 11.1 Unless stated otherwise in this Agreement:
- (a) a person not a Party to this Agreement has no right to enjoy or enforce any benefit under it; and

- (b) the consent of any person not a Party to this Agreement is not required to amend this Agreement.

11.2 Notwithstanding any provisions of this Agreement, the Parties do not require the consent of any Client Group member or any member of either Party's Group to rescind or vary this Agreement at any time.

12. LIMITATION OF LIABILITY

12.1 Each Party excludes all liability for indirect, consequential, special or punitive loss or damage, including loss of business, profit or goodwill (whether the loss arises in contract, tort, under any statute or otherwise in connection with this Agreement) even if:

- (a) the loss was reasonably foreseeable; or
- (b) the other Party knew of the likelihood of the loss.

12.2 Each Party remains liable for any direct loss the other Party suffers arising from the first-mentioned Party's fraud, gross negligence or willful misconduct.

13. GOVERNING LAW AND JURISDICTION

13.1 This Agreement and any non-contractual obligations arising out of or in connection with it is governed by the laws in force in Mauritius and the Parties submit to the non-exclusive jurisdiction of the courts of that place.

13.2 The Parties shall attempt to solve any dispute arising out of or in connection with this Agreement by means of alternative dispute resolution such as but without limitation mediation. Any dispute, controversy or claim which may arise under this Agreement or the breach, termination or invalidity thereof which could not be resolved amicably, shall be resolved by arbitration by three (3) arbitrators appointed as follows: each Party shall appoint one arbitrator and the third arbitrator shall be appointed by mutual agreement of the two arbitrators failing which, the latter shall be appointed by a Judge of the Supreme Court of Mauritius sitting in Chambers. The place of arbitration shall be Mauritius, the costs of arbitration shall be borne by the losing party, the language of arbitration shall be English and the decision of the arbitrator shall be final binding and enforceable on both Parties and not subject to any appeal.

EXECUTED AS AN AGREEMENT IN TWO ORIGINALS ON: / /2025

SIGNED for and on behalf of
MauBank Ltd
by its duly authorized representative:

Name: (Head of respective BU).....
Title:

SIGNED for and on behalf of

by its duly authorised representative in:

Signature of Representative
Name:
Title:

ANNEXURE 3 – Standard Contract Template

THIS AGREEMENT is made on the day of

BETWEEN: -

- I. MauBank Ltd hereinafter referred as the "Customer", having its registered office at 25, Bank Street, Cybercity, Ebene 72201, Republic of Mauritius bearing registration number duly represented by its Chief Finance Officer, Mr. Deepak Mohadeb and Head of Facilities Management, Mr. Somduth Ramjatun.
- II. hereinafter referred as the "Service Provider" or "SP", whose registered office is at bearing registration number duly represented by its, ... (Name of person)

together, the "Parties" and each a "Party".

WHEREAS-

- A. The Customer is licensed to carry on Banking Business in Mauritius.
- B. SP is willing to provide some of its services to the Customer.
- C. The Customer is willing to make use of those services on the terms and subject to the conditions hereinafter contained.

1. Scope of services

- i. **To be filled by Business Unit.**
- ii. Standard of Care: In providing the Services, SP will exercise the same degree of care as it has historically exercised in providing such Services to its Affiliates prior to the date hereof, including at least the same level of quality, responsiveness and timeliness as has been exercised by SP with respect to such Services.
- iii. Records: SP shall keep full and detailed records dealing with all aspects of the Services performed by it and:
 - (a) shall provide access to the related records to the Customer at all reasonable times; and
 - (b) shall maintain the records in accordance with good record management practices and with at least the same degree of completeness and care as it maintains for its other similar business interests.

2. Services outside the scope of this agreement

- i. For the avoidance of doubt, any service not contained within this agreement shall be subject to a separate agreement or amendment of this agreement.
- ii. Any variation to the scope of services that will be agreed upon, and any resulting additional work will be subject to an amendment of this agreement, prior to such work being performed.

3. Working principles

- i. SP will strongly support the Customer to ensure the timely allocation and availability of resources.
- ii. The Customer will be able to have access to a designated officer of the SP in case clarification or investigations are required to validate or confirm specific facts or information relating to or impacting the work that is being conducted.

4. The Customer Responsibilities

SP confirms that the definition and scope of the services detailed herein is agreed by the Customer to be sufficient to address the Customer's foreseeable needs. It is agreed that responsibility for providing support and assistance in the course of this agreement rests with the SP.

5. Fees

- i. Payment of invoices will be made as per particulars below:
 - Account Number:
 - Account Name:
 - Bank Name:
- ii. The Customer shall pay to the Supplier the Charges within thirty (30) days after the date on which the Customer receives a correct and error-free invoice.
- iii. All Charges and other sums payable under this Agreement are exclusive of Value Added Tax and equivalent taxes in other countries which will be payable at the applicable rate.

- iv. The Supplier shall, where requested by the Customer, comply with the Customer's invoicing requirements (electronic or otherwise)

6. Force Majeure

- i. SP shall be under no liability to the Customer to perform any obligation or delay in performance arising as a result of force majeure, namely, circumstances beyond the control of SP which shall include (but shall not be limited to acts of God, act of war, perils of the sea or air, fire, flood, drought, disease outbreaks including epidemics, pandemics explosion, sabotage, accident, embargo, riot, terrorist attacks, civil commotion, including acts of the government, inability to supply the Software, materials, breakdown of equipment or labour disputes of whatever nature, strikes and lockouts.

7. Limitation of liability

- I. Neither party limits or excludes its liability (i) in respect of any deceit, theft, fraud or fraudulent misrepresentation by it or its employees, and in the case of Supplier, by Supplier Personnel; (ii) for death or personal injury caused its negligence; (iii) under clauses 10 (Intellectual Property Rights); (iv) breach of clause 11 (Confidentiality); (v) reach of clause 12 (Data Protection); or (vi) to the extent such limitation or exclusion is not permitted by law. Subject to clause 7(i) the maximum aggregate liability of the Supplier to the Customer (other the liability covered by clause 7(i)) shall in respect of each default be limited to 150% of the Charges paid or payable under this Agreement.
- II. Subject to clause 7(i), the maximum aggregate liability of the Customer and its Affiliates (other than liability covered by clause 7(i)) shall, in each Contract Year, be limited to the total Charges paid for Goods and Services under this Agreement during such Contract Year.
- III. Subject to clauses 7(i), neither party will be liable to the other party for any indirect or consequential loss or damage including any indirect loss of business or profits, in each case whether arising from negligence, breach of contract or otherwise.

8. Third party rights

- i. The services will be provided only to and for the Customer in accordance with the terms of this agreement and for no other purpose.
- ii. Unless stated otherwise in this Agreement:

(a) a person not a Party to this Agreement has no right to enjoy or enforce any benefit under it; and

(b) the consent of any person not a Party to this Agreement is not required to amend this Agreement.

Notwithstanding any provisions of this Agreement, the Parties do not require the consent of any Client Group member or any member of either Party's Group to rescind or vary this Agreement at any time.

9. Termination

- i. This Agreement may be terminated for convenience by the Customer at any time by giving to the SP not less than 14 days prior written notice.
- ii. The following events shall allow the Customer to terminate this Agreement, in whole or in part, with immediate effect on giving written notice to the Supplier.
 - a) material breach by SP of this Agreement (being a single event or a series of events which are together a material breach) which is either not capable of being remedied, or, if the breach is capable of being remedied, the Supplier fails to remedy such breach within 30 days of receiving written notice requiring it to do so;
 - b) SP is affected by an Insolvency Event
- iii. Within 30 days of expiry or termination of this Agreement, SP will return or destroy all Personal Data and any copies thereof, unless legislation or regulation prevents it doing so, in which case the SP undertakes that it will no longer process such Personal Data and will comply with the provisions of clause 13 (Confidentiality) in relation to such Personal Data such that the Personal Data remains confidential.

10. Intellectual Property Rights

- i. All Intellectual Property Rights belonging to a party prior to the execution of this Agreement shall remain vested in that party.
- ii. None of the Intellectual Property Rights in the Customer's trademarks and brands shall be used by the Supplier for any purpose without the Customer's prior written consent;
- iii. SP hereby grants to the Customer, their agents and contractors, a worldwide, royalty-free, non-exclusive, perpetual, non-transferable licence (including the right to grant sub-licences) to use (i) any and all Intellectual Property Rights in the Goods, and (ii) any other Intellectual Property Rights to the extent necessary to:

- (a) receive or use the Services;
 - (b) to enable the full benefit of ownership of the Goods, and (c) perform its obligations or exercise rights under this Agreement.
- iv. SP shall at all times whether during or after termination or expiry of this Agreement indemnify and keep indemnified the Indemnified Parties against all losses suffered by, incurred by or awarded against any Indemnified Party or which are agreed by the Customer (or the relevant Indemnified Party) to be paid by way of settlement or compromise, arising out of or in relation to:
 - (a) any infringement or alleged infringement of any Intellectual Property Rights of any third party which is suffered by, incurred by or awarded against any Indemnified Party as a result of the Customer's (or the relevant Indemnified Party's) receipt of the Services or its use or possession of any Goods or Intellectual Property Rights provided or otherwise made available to any Indemnified Party; or
 - (b) any negligent or willful (or negligent and willful) act or omission of SP, its employees, agents or contractors in supplying, delivering or installing (or any one or more of them) the Goods whether or not such losses were foreseeable at the Effective Date

11. Governing law and jurisdiction

- i. The contract shall be governed by and interpreted in accordance with the laws of Mauritius. Should any dispute arise between the parties, the parties shall attempt to resolve the dispute amicably, in good faith by senior level negotiations. Mauritian Courts shall have exclusive jurisdiction over any complaint or disagreement relating to this Agreement that cannot be resolved by such negotiations.

12. Data Protection

- i. Notwithstanding the remaining provisions hereof, the Customer and SP hereby warrants and represents to the other that in the event that they Process any Personal Data, they shall comply with all Data Protection Legislation (to the extent directly applicable to the party in question) and such compliance shall include, but not be limited to, maintaining a valid and up to date registration or notification (where applicable) under the relevant Data Protection Legislation.
- ii. The Customer and SP hereby warrants and represents to the other that they have collected all necessary consents and done all such things as may be required under the Data Protection Legislation and any other applicable law relating to the protection of

privacy, for the transfer of the Personal Data to the other party for the purposes of the other party Processing it as contemplated by this Agreement.

- iii. SP shall not Process, transfer or permit access to any Personal Data outside the jurisdiction within or from which SP's obligations are being performed or the Personal Data is being Processed save to the extent notified to the Customer in writing in advance and in compliance with all Data Protection Legislation and any other applicable law relating to the protection of privacy or the access to information.
- iv. SP shall notify the Customer promptly and in any event within twenty-four hours of becoming aware of any actual, suspected or alleged loss, leak or unauthorised Processing of any Personal Data.
- v. SP shall notify the Customer promptly upon receiving a request for information made in terms of the Data Protection Legislation, claim, complaint or allegation relating to the Customer's compliance with the Data Protection Legislation in relation to the Personal Data (the Enquiry), and Supplier shall provide the Customer with all such assistance in dealing with and responding to such Enquiry as the Customer shall reasonably request, provided always that SP shall not take any other action in relation to any such Enquiry without the prior written authorisation of the Customer.
- vi. SP shall implement appropriate technical and organizational measures to protect Personal Data against unlawful Processing and against accidental loss, destruction, damage, alteration or disclosure of the Personal Data. Such measures shall be appropriate to the harm that might result from unauthorised or unlawful Processing or accidental loss, destruction or damage to Personal Data and to the nature of Personal Data to be protected and shall include taking reasonable steps to ensure the reliability of employees having access to the Personal Data.
- vii. In the event that a third party Processes any Personal Data on behalf of SP, SP shall procure compliance by such third party with the Data Protection Legislation
- viii. SP shall be responsible for the acts or omissions of such third party in relation to such Processing as though they were SP's acts or omissions.

13. Confidentiality

- i. Neither party will disclose to any third party without the written consent of the other party, any confidential information received as a result of or in connection with the receipt of, or the provision of, Services. Both parties agree that any confidential information shall only be used for the purposes of providing or receiving Services or any other contract between the parties. For the purposes of this Contract,

‘Confidential Information’ means any information relating to the Company’s business which for the time being is being treated as confidential.

- ii. Notwithstanding the above, either party will be entitled to disclose information (including know-how):
 - to their respective regulatory bodies or legal advisers; or
 - to a third party to the extent that this is required by any court of competent jurisdiction, or by a governmental or regulatory authority or where there is a legal duty or requirement to disclose
- iii. SP will promptly advise the Customer of the full circumstances (to the extent legally permitted) of any unauthorised disclosure, misappropriation or misuse by any person or other third party of any Confidential Information upon the SP being put on notice of the same.

14. Miscellaneous

- i. This Agreement is the complete and exclusive statement of the agreement between the Parties and supersedes all prior proposals, understandings and all other agreements, oral and written, between the Parties relating to the subject matter of this Agreement. This Agreement may not be modified or altered except by written instrument duly executed by both Parties.
- ii. Force Majeure: Any delay or failure by either Party in the performance of this Agreement will be excused to the extent that the delay or failure is due solely to causes or contingencies beyond the reasonable control of such Party.
- iii. If any provision, clause or part of this Agreement, or the application thereof under certain circumstances is held invalid or unenforceable for any reason, the remainder of this Agreement, or the application of such provision, clause or part under other circumstances shall not be affected thereby.

15. Acknowledgement and Acceptance

The Customer acknowledges its acceptance to the terms and conditions of this agreement by signing the confirmation below.

Written and signed in two copies, one for each party.

For and on behalf of MauBank Ltd (Customer)

Name: Deepak Mohadeb

Name: Somduth Ramjatun

Title: Chief Finance Officer

Title: Head of Facilities Management

Signature

Signature

Date.....

Date.....

For and on behalf of (Service Provider)

Name:

Title:

Signature

Date.....

ANNEXURE 4- Bidder's information sheet

Information Sheet

*[Please fill in this Form in accordance with the instructions indicated below where applicable.
No alteration to its format shall be permitted and no substitution shall be accepted.]*

1	Company Details	
	Legal Name:	
	In case of Joint Venture (JV), Legal Name of each party	
	Country of Registration	
	Year of Registration	
	Legal Address in Country of Registration	
	Name of the founder(s)/owner(s)	
List of Board of Director(s), if there is a Board		
2	Company Authorized Representative	
	Name	
	Address	
	Telephone/Fax Numbers	
	Email Address	

3	Related Party Transaction Declaration- As per Section 50 of BoM Act 2004 and Section 100 of Banking Act 2004 (section 28(4))		
		(Yes)	(No)
	Does your Organisation hold any shareholding in MauBank Ltd	☐	☐
	If Yes, Provide details.		
		(Yes)	(No)
	Does any of your organisation owner/s, directors, shareholders, senior executives, has any related party as described by the above regulations, at MauBank Ltd.	☐	☐
	If Yes, Provide details.		
<i>Any changes in the above should be communicated to MauBank Ltd</i>			
4	Politically Exposed Person, Family Members & Close Associates (PEP) status		
		(Yes)	(No)
	Does any of your company Owners, Directors, shareholders, has/have a PEP (Politically Exposed Person, Family members & close associate) status, as described by regulations in force?	☐	☐
	If Yes, Provide details- (Name of person & position)		
<i>This is to enable MauBank Ltd to comply with its obligations pursuant to Regulation 15 of the Financial Intelligence and Anti- Money Laundering Regulations 2018 and its underlying laws, relating to measures to combat money laundering and the financing of terrorism.</i>			
5	Financial Accounting Ratios	Year 20__	Year 20__
	Liquidity Ratio: - Working Capital Ratio	:	:
	: - Acid Test Ratio	:	:
	: - Cash Ratio	:	:
	Solvency Ratio: - Total Debt Ratio	:	:
	: - Debt to equity Ratio	:	:
<i>Bidders must compute the five ratios listed above.</i>			

6	Bank Account with MauBank Ltd		
	Would you be willing to have a bank account with MAUBANK, for ease of quick payment etc.?	(Yes)	(No)
	if you are providing services to the bank? –	☐	☐
	Share Account Details if you are already a client		
7	List of Documents to be attached with the Information Sheet		
	<i>Please tick boxes of documents that has been attached</i>		
	Company Profile	☐	
	In case of Joint Venture (JV), Letter of intent of JV or JV agreement	☐	
	Financial statement for the last three years	☐	
	Business Continuity Management Plan	☐	
	Environmental, Health & Safety Policy in place	☐	
	Certificate of Incorporation	☐	
	Vat Certificate (For Local Companies)	☐	
	Business Registration Certificate (For Local Companies)	☐	

ANNEXURE 5- Special Provisions for Refurbishment Works

Annexure 5 – Special Provisions for Refurbishment Works

1. General

This is a refurbishment project where no separate main civil contractor will be appointed. The MEP Contractor shall therefore assume full responsibility for carrying out, coordinating, and managing all associated civil works necessary for the proper execution and completion of the MEP Works.

2. Scope of Associated Civil Works

The MEP Contractor shall include in his Tender Price all minor and ancillary civil and building works required to facilitate his installations, including but not limited to: coring, cutting, breaking, trenching, forming and sealing of openings, installing sleeves/supports/fire-stopping, making good finishes, rebuilding or patching disturbed areas, reinstating waterproofing/fireproofing/acoustic treatments.

The Contractor shall employ a competent civil/masonry subcontractor for these works, with qualifications submitted to the Employer if requested.

3. Additional Provisions Specific to Refurbishment Works

- 3.1 Carting away and proper disposal of all demolished equipment, debris, and existing items shall be included in the Contractor's pricing wherever required, whether explicitly mentioned or not, and shall be carried out upon instruction from the MEP Consultant or Employer.
- 3.2 Waterproofing reinstatement shall be included as part of remedial works where new installations disturb existing waterproofing.
- 3.3 All builder's works required for the proper execution of the new design and installations shall be identified by the Contractor during tender preparation, based on tender drawings and site visits, and shall include builder's works through all types of building fabrics (including reinforced concrete). Claims of impossibility for drilling, coring, or breaking through such elements shall not be accepted after contract award.
- 3.4 The Contractor shall allow for removal and reinstatement of existing false ceilings wherever necessary to execute the new design properly for all trades.
- 3.5 The Contractor shall plan works with full awareness that the building is occupied by existing Tenants. Coordination of access, timing of works, noise control, and disruption minimisation shall be included in the Contractor's obligations.

- 3.6 Fire alarm coverage shall be maintained active and operational across all occupied areas, zones, and floors during the execution of the Works until the new fire alarm system and panel are fully implemented and commissioned.
- 3.7 Fire evacuation paths shall remain unobstructed and clear at all times during the Works.
- 3.8 Security arrangements for occupied zones/floors shall be coordinated with Tenants and the Employer unless otherwise agreed in writing.
- 3.9 The Contractor shall arrange and provide cleaning facilities to maintain the building, site, and work zones in a clean, tidy, safe, and secure condition at all times during execution.
- 3.10 The Contractor shall allow for all costs necessary to complete the installation in accordance with the tender documentation and site conditions observed during site visits. No claims for cost variations or extension of time shall be entertained after contract award for items reasonably foreseeable at tender stage.

4. Coordination of Trades and Works

The MEP Contractor appointed for the trade deemed by the Employer/Consultant to be the most complex and critical (typically HVAC or Electrical) shall act as Lead Coordinator.

Responsibilities include: preparation of coordinated shop drawings, sequencing of works, access/logistics planning, conflict resolution, and participation in coordination meetings.

Other contractors remain individually responsible but must cooperate fully.

5. Pricing and Claims

Contractors shall be deemed to have inspected the Site and understood the extent of civil works reasonably foreseeable. No claims for additional payment shall be entertained for civil/masonry/building works of a nature reasonably to be anticipated.

Omissions in the Contractor's tender shall not relieve him of responsibility to perform such works at no extra cost to the Employer.

6. Liability

The Contractor shall be fully liable for damage to existing finishes, structures, or installations caused during the Works and shall make good at his own cost. Failure to reinstate shall entitle the Employer to remedy at Contractor's cost, without prejudice to other contractual rights.

BILL OF QUANTITIES

BILL NO. 1: PRELIMINARIES AND GENERAL REQUIREMENTS

DESCRIPTION	AMOUNT (Rs.)
<u>PRELIMINARY PARTICULARS</u> 1) <u>PARTIES AND CONSULTANTS</u> i. <u>EMPLOYER</u> The term "EMPLOYER" shall mean MauBank Ltd 25, Bank Street, Cybercity Ebene 72201 Republic of Mauritius ii. <u>CONSULTING ENGINEER</u> The term "CONSULTING ENGINEER" shall mean Pro-Design Engineering Consultants Ltd 1st Floor, Building No. 2 Valentina Industrial Estate Phoenix 73553 Republic of Mauritius <u>320.000 PRICING AND COSTS</u> 320.010 GENERAL: This section details particular requirements for the pricing of the tender documentation and cost procedures during the contract. The Contractor shall be deemed to have allowed against each item or in his rates for the cost of complying with all the requirements of these preliminaries. All the items contained in the preliminaries shall apply to the whole of the works. The heading of the clauses in these Bills of Quantities shall not affect the interpretation thereof. 320.020 BASIS OF CONTRACT: The contract shall be • on a measured bill of quantities basis and accordingly shall be subject to re-measurement. • All additions or omissions shall be treated as variations. 320.080 OVERTIME AND ALLOWANCES: • Include for all necessary overtime and other expenses in the contract price that may be necessary in order to complete the Works in compliance with the contract programme. 320.090 SUBMISSION OF FINAL ACCOUNT: Submit a draft final account to the M&E Engineer using the contract procedures for checking purposes together with all the necessary supporting documents immediately after the practical completion of the contract Works. Prepare the valuation of variations, omissions and provisional work forming part of the Works and where appropriate in accordance with principles defined in this sub-clause. The basis for the determination of such valuation shall be the Bill Of Quantities shall be as per the provision of conditions of subcontract.	

DESCRIPTION	AMOUNT (Rs.)
All valuations as aforesaid prepared shall be submitted using the contract procedures to the M&E Engineer for approval. 320.100 INSTRUCTIONS AND VARIATIONS: All instructions shall be issued in writing and confirmed as per the provision of the subcontract. Submit the cost of each variation showing the quantities and rates applicable for all items of works, etc employed in accordance with the agreed contract schedule of rates. Submit to the M&E Engineer • Within 10 working days of the receipt of written instructions. No work will be certified for payment until all the necessary information is provided. 400.000 CONTRACT CONDITIONS 400.010 CONDITIONS OF CONTRACT: The conditions of the Contract are the FIDIC Short Form of Contract, 1st Edition 1999. 400.030 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS: The following order of precedence shall apply to the interpretation of the various documents that together constitute the conditions of Contract The order of precedence shall be: 1. The Contract Drawings 2. The Specifications 3. The Bill of Quantities I 410.000 PARTICULAR CONDITIONS 410.010 GENERAL: This section details particular conditions and requirements for the project. 410.020 INFORMATION PROVIDED BY OTHERS: Instructions, drawings, or other information required to be provided by the M&E Engineer and Client will be provided in due time upon written request provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary. Provide written request to the M&E Engineer in good time for any information required. 410.030 PROVIDE EVERYTHING NECESSARY: Provide everything necessary for the proper execution and completion of the contract works to the true intent and meaning of the contract documents. • Details of construction or materials which have not been referred to in the contract documents but the necessity for which may reasonably be implied or inferred from the said documents or which are usually or essential to the completion of the Works, shall be installed with no additional cost. 410.041 CO-ORDINATION OF TRADES: Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract.	

410.042 CO-OPERATION WITH OTHERS: Ensure that the contract works integrates with that of others and that full co-operation is maintained during the execution of the Works with that of others. Co-operate with the Contractor, other subcontractors, suppliers, local authorities and statutory undertakings in the execution of the Works. In the event of any extra costs being caused by failure to programme and arrange the execution of the Works so that it fully integrates with that of others, the installer of the Works may be liable for any additional costs thereby incurred. 410.060 NOISE AND NUISANCE: Ensure that the contract works are undertaken with as little noise as possible. • Ensure no nuisance by noisy working is caused to • the Employer • occupants of premises Take all necessary precautions to prevent nuisance from smoke, rubbish and other causes. Fit all compressors, percussion tools and vehicles with effective silencers of a type recommended by the manufacturer of the equipment. 410.080 PROGRAMME: Provide a detailed programme(s) clearly illustrating how the overall programme • Will be achieved within the contract period. Provide the detailed programme • Within 14 days from the award of the contract or such other dates as may be required by the Engineer Due allowance is to be made in the programme(s) for, but not limited to, the following: • The latest dates for release of final information required from the M&E Engineer and from the Client • Required method statements. • Ordering dates and manufacturing periods. The proposed delivery to site for each item of major plant to be clearly defined. • The period required for the production, approval and issue of: • builder's work information • co-ordination drawings • installation drawings • shop drawings. Allow adequate time for the examination and approval by the M&E Engineer. Actual activities of production, adjustment, resubmission and review must be identified • Installation periods for each system • Work resulting from instructions issued in respect to the expenditure of provisional sums. • Concurrent work by other trades. • Any temporary works necessary for the completion of the engineering services installations. • Period required for operating the systems, load simulation tests and final adjustment. • Environmental load testing. • Period for instructing the Employer training. • Pre-commissioning, commissioning and performance testing of the engineering	

DESCRIPTION	AMOUNT (Rs.)
services installations. • The period required and latest dates for the production, approval and issue of record drawings and operating and maintenance instruction manuals. • Provide programme information as • critical path network. • Gantt Charts • Provide a separate and detailed commissioning programme for agreement with the M&E Engineer. Make due allowance for the following. • Commissioning, demonstration and instruction procedures. • Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than fourteen days before the completion of the works • Demonstration to the M&E Engineer that test instruments and equipment are accurate. 410.110 CONTINUITY OF THE WORKS: No undertaking is given that the works will necessarily be able to proceed continuously. • No claim will be allowed for discontinuity of work due to the necessity to conform to the contract programme. 410.130 WORKING HOURS: Working hours shall be agreed with the <u>management</u>. 410.150 METHOD AND SEQUENCE OF WORK: The method and sequence of work has to be agreed with the <u>management</u>. 410.160 USE OF THE SITE: The site shall be exclusively use for the purpose of this project. It shall not be used for storing materials other than for this project 410.170 WORKING AREA: The space available to the contractor and the working areas shall be in accordance with the provisions of the contract. 410.200 STORAGE: All materials and equipment shall be stored in waterproof, safe and secured areas as per Client's requirements and to Services Engineer's approval. All materials and equipment and materials shall be offloaded, stored and transported in accordance with manufacturer's recommendations. All electrical equipment and components shall be kept dry and free from dust. Plug, cap or seal open ends on all tubes, conduit, trunking and associated equipment whilst in storage and during transportation to site. Provide racks to prevent distortion of pipes, conduit and similar materials. 410.280 DEFECTS LIABILITY: Liability for making good defects in the Works shall be for a period of 12 months from the date of issue of the certificate of practical completion for the installations. If it is necessary to replace or renew any portion of the contract works as part of liability for defects, the defects liability period in respect of that portion of the contract Works shall be deemed to commence from the date of such replacement or renewal. The M&E Engineer may require that new tests be carried out to demonstrate that the plant is continuing to work satisfactorily if the replacement or renewal may affect the	

DESCRIPTION	AMOUNT (Rs.)
efficiency of the Works or any portions thereof. - Prior to practical completion submit a method statement for the approval of the M&E Engineer in agreement with the Client outlining how the defects which arise during the defects liability period will be rectified to ensure that disruption to the use of the building is kept to a practical minimum. - No additional costs will be accepted for undertaking works executed out of normal hours. 410.290 RIGHT OF ACCESS DURING DEFECTS LIABILITY PERIOD: Right of access will not be unreasonably withheld, at all reasonable working hours and at own risk and expense, to any part of the contract works for the purpose of inspecting the working of the installations or to the records of the working and the performance thereof. Subject to Client's approval and in agreement with M&E Consultant, that shall not be unreasonably withheld, undertake any tests considered necessary at own risk and expense. During the defects liability period and all necessary remedial works and/or rectification of defective materials and equipment liaise closely with the Client in agreement with the M&E Consultant and the Employer's staff. All such work shall be carried out in such a manner as to avoid or minimise shut-down time and inconvenience to the Employer. 410.330 DAMAGE TO STRUCTURE: - Exercise due care and attention in carrying out the contract works and be fully responsible for any damage caused to the structure or building finishes. - Obtain permission from the Main Contractor subject to M&E approval before any holes are cut in floors, walls or steelwork, etc. 410.340 INSPECTION BEFORE CONCEALMENT: Whenever work requiring inspection or testing is subsequently to be concealed give the following the notice to the Client and to M&E Engineer so that inspections may be made or tests witnessed before concealment 5 days' notice 410.350 EQUIPMENT GUARANTEES: Plant and equipment guarantees shall commence at the date of practical completion and run for a minimum of <u>12 months after this date</u>; or such more periods as provided by the manufacturers. Any costs associated with this requirement shall be included in the contract price. 410.370 DIMENSIONS: - Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works. - Dimensions should not be scaled from drawings. - Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction tolerances and manufacturing tolerances can be accommodated. - Equipment should not be ordered or manufactured using quantities dimensions indicated on the Tender drawings.	

430.000	QUALITY	
430.020	WORKMANSHIP AND MATERIALS:	
All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings.		
All equipment and materials to be installed shall be new unless otherwise indicated.		
All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations.		
All materials considered by the M&E Engineer to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the M&E Engineer and the Main Contractor at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the M&E Engineer at no additional cost.		
The manufactured articles specified shall serve as a quality standard.		
Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The M&E Engineer shall approve these articles before their use is permitted.		
430.030	DEFECTS:	
Agree with the Client and the M&E Engineer a system of recording defects that should include		
• A reference to identify the defect • Description of the defect • Remedial works proposed • Agreement to remedial works proposed • Confirmation of defect clearance		
500.000	ORGANISATION AND DESIGN MANAGEMENT	
500.010	SITE STAFF:	
• Staff of sufficient number and competence in the opinion of the M&E Engineer and main contractor, shall be provided as necessary for design, drawing and technical information production, programming and administration to ensure efficient and satisfactory execution of the contract works. • Provide all necessary superintendence during the execution of the contract works. The said staff shall be in attendance on site during the whole time that work is in progress. • Employ on the site suitable qualified engineering staff to be in charge of the contract works from commencement to completion. The said staff shall be in attendance on site during the whole time that work is in progress. • Responsibility for all drawings and technical information production shall be undertaken by a competent and qualified engineering staff as approved by the M&E consultant. • Any change made to the appointment of staff during the contract works shall be agreed with the M&E Engineer with maximum notice being provided. • If the M&E Engineer is of the opinion that any member of the site staff has been guilty of a serious breach of his duties, he may by notice require that person to be replaced within 2 weeks of the notification.		
510.000	SUBMITTALS AND APPROVALS	

510.010 GENERAL: This section outlines the requirements and procedures for submittals to the M&E Engineer and to Client. 510.020 SUBMITTALS: Prior to any orders being placed the M&E Engineer shall review all drawings and manufacturer's details. Submittals shall be in a clear, definable and easily read format with the specified technical details, notes, performance data and calculations where applicable all in the English language. Where drawings are to be examined the manufacturer's details shown on the drawings must have been previously approved. Include all costs for attending meetings associated with the submittal review procedure. Meetings will be held at 7 days intervals, which will be attended by M&E Engineer as required. 510.060 REVIEW OF SUBMITTALS: Submittals will be examined for • compliance in principle with the design intent • Compliance with the specifications Such examination shall not relieve any responsibilities and obligations under the contract. 510.080 SAMPLES: Provide free of charge samples of material and workmanship proposed to be used in the Works. Samples shall include all alternative finishes available if required. In the case of articles of special construction: • drawings when approved will be retained until the articles concerned are supplied, as a sample The samples submitted and approved, shall remain the property of the Employer until the completion of the contract. Approval of the M&E Engineer shall be obtained before equipment is placed on order • The M&E Engineer will undertake to approve samples within 2 weeks from receipt. Samples to be submitted: • affixed to sample board in site office as directed by the Main Contractor subject to M&E Engineer's approval. Include all alternative finishes available for the following samples: 520.000 OBLIGATIONS AND RESPONSIBILITIES 520.010 GENERAL: This section details the specific obligations, duties and responsibilities undertaken as part of the contract works. 520.020 OBLIGATIONS: Undertake responsibility for all works defined in the work sections and shown on the drawings, and in particular the following:	

DESCRIPTION	AMOUNT (Rs.)
• Complete the design development • Undertake the responsibility for resolving final spatial co-ordination • Check the provisions for, and adequacy of builder's work information previously issued prior to the award of the contract • Co-ordinating the engineering services, with each other and with the building structure and fabric • Provide the following drawings as defined elsewhere: • Co-ordination • Installation • Manufacturing • Manufacturer's certified • Shop drawings • Installation wiring drawings • Provide builders work details based on the installation, manufacturing and shop drawings. • Negotiate with public and other authorities for provision of necessary incoming services. • Obtaining final approvals of any appropriate authority. • Prepare such reports, calculations and details as required for submission to any appropriate authority including the coordination of such information by suppliers, specialists, etc needed to be included in any submission. • Fully re-evaluate and take full responsibility for all parts of the design and building elements that may be affected by acceptance of alternative plant selections • Undertake specific detailed design tasks as defined in this work section • Undertake all on-site co-ordination with all other trades, disciplines, manufacturer's and suppliers • Provide: • suitable accommodation • workshops • stores • clearance on completion • Supply, deliver to site, unload, store, protect and co-ordinate movement of all plant, equipment and materials required for the works. • Including lifting and hoisting. • Fix and install correctly all plant, equipment and materials and ensuring that all associated works are correctly executed • Protection of the client's equipment and machinery during the project. • Undertake the fire stopping of all holes associated with the works • Install fire barriers where a fire rated partition is penetrated. • Carryout all builder's and civil works as required for the installation of the M&E services. • Clean and reinstitute the tenant to original operating condition once works are completed. • Inspect all plant, equipment and materials as delivered or where specified at the manufacturer's works • Inspection and/or tests to be carried out at the works jointly with the M&E Engineer for equipment as defined elsewhere • Include for the travel and other expenses of the M&E Engineer for the inspection and/or tests carried out at the works • Preparation of the operating and maintenance manuals, planned maintenance schedules.	

DESCRIPTION	AMOUNT (Rs.)
- Appoint a specialist responsible for the preparation of the operating instructions and maintenance manual - Undertake the testing and commissioning of the works. - Appoint an independent commissioning specialist responsible for the testing and commissioning of the works. 520.050 CO-ORDINATION OF SERVICES: All aspects of the works require detailed co-ordination to avoid any possible clash or conflict with other trades and disciplines. Undertake such co-ordination in relation to the works. - No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence. When any new, revised or updated architectural, structural or services information is issued by the M&E Engineer under the authority of an instruction, examine such information and if necessary modify the works accordingly to prevent any clashes or abortive work due to such instruction. - No extra cost or claim will be allowed to cover any clashes or abortive work that result from not requesting an explanation or seeking clarification in respect of any such revision. - No extra cost or claim will be allowed due to conflict of works or installations, where full liaison with other trades and disciplines would have prevented such an occurrence. 520.060 CO-ORDINATION OF SERVICES ON SITE: Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract either during or prior to their incorporation into the works. Where minor clashes of services occur on site that were not foreseeable at the design or co-ordination drawing stage then these clashes or minor co-ordination matters shall be resolved by discussion and agreement with other trades and disciplines. The Main Contractor shall be informed of the action to be taken by an approved means with copy to M&E Engineer. - No instructions will be issued to cover such minor clashes. 520.070 SURVEYS: - Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works. - Before commencing work, carry out a survey and examination of buildings, structure and engineering services affected by the works. - Examine all available drawings of the engineering services and report any discrepancies to the Main Contractor with copy to M&E Engineer. 520.080 SITE DIMENSIONS AND LEVELS: Install all engineering services using a laser levelling system wherever possible and co-ordinate the measurements with all other trades and disciplines to prevent any clashes. Obtain all dimensions and levels on site for the actual setting out of the works. As the development advances measure on site all works by others that may foreseeably	

DESCRIPTION	AMOUNT (Rs.)
affect the works. These dimensions shall be incorporated into the installation drawings or marked up on revised drawings if already issued. - No extra cost or claim will be allowed for any errors arising from inaccurate setting out or failure to check actual site dimensions. - Reimbursement will be sought for any abortive expenditure. 520.090 MAINTAINABILITY: Demonstrate that all plant and equipment incorporated into the Works can be safely and easily maintained in full compliance with: - Health and Safety legislation. - British Standards. Ensure that adequate space is provided for future replacement of plant or parts and that all access panels/doors are unobstructed. 520.120 STATUTORY AUTHORITIES: Orders for the incoming utility services shall be - included in this contract - Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the programme, in agreement with the Main Contractor. 530.000 LOCAL AUTHORITY REQUIREMENTS AND AIRPORT AUTHORITIES REQUIREMENTS. 530.010 GENERAL: This section details the requirements for compliance with Local Authority By-laws and Airport Authorities Requirements. 720.000 BUILDERS WORK 720.010 BUILDERS WORK PROVIDED: - Where structural and/or architectural facilities or provisions, for engineering services are already indicated check that these are correct, satisfactory and adequate for the purpose and confirm same in writing to the M&E Engineer with copy to the Client. Timescale: - Within weeks of the award of contract (no) 2 720.020 SCOPE OF BUILDER'S WORK: - Builder's work is included in the Works. - Builder's work includes drilling and/or plugging walls, floors, ceilings etc., for fixings for services and such work is included in the works. - Erection of block wall. - Finishing works that include, making good, painting, etc. - Provide the following as necessary for the complete installation - all supporting steelwork associated with Rooftop units and fans - brackets, clamps and fixings 720.030 MARKING OUT OF BUILDER'S WORK HOLES ON SITE: - If approved by the M&E Engineer and the Client, mark on site actual locations of minor non-structural holes through walls, partitions, floors etc and also chases in non fair-faced walls, etc for conduits, pipes and the like in preference to providing drawings	

DESCRIPTION	AMOUNT (Rs.)
of such builder's work requirements. The M&E Engineer is to be given the opportunity to inspect prior to work being carried out. • The M&E Engineer shall inspect all marking out on site prior to work commencing. • Establish a method of working with the Client and subject to M&E Engineer approval to ensure the works may proceed without hindrance. 740.030 STATIC TESTING: Progressive static testing shall include the following tests, but other tests may be required and witnessed: • Insulation resistance • Earth fault loop impedance • Earth continuity • Pressure testing of hydraulic systems The M&E Engineer shall be given the opportunity to witness all static tests. Advance notice of the tests shall be given to the M&E Engineer with copy to Client. Timescale: • days prior to test (no) 7 740.040 PRE-COMMISSIONING CHECKS: Ensure all pre-commissioning examinations and tests have been undertaken and that each system, including components, or item of equipment is complete and in a safe condition prior to start-up. All necessary notices shall be displayed. All costs related for the same are to be included in the tender price. 740.050 FUEL FOR TESTING: Fuel for testing and operating the Subcontract works shall be • included within the contract price and due allowance made within the tender. 740.060 SYSTEM DEMONSTRATION: • Subsequent to the completion of all testing and commissioning to the satisfaction of the M&E Engineer and Client and when directed operate the plant and demonstrate that the overall systems function correctly in accordance with the requirements of the specification. • Fully run and operate the following systems to demonstrate correct function in accordance with the requirements of the specification: • The period of operation shall be: • weeks (no) 1 • carried out during normal working hours. • allowed in the programme. • During this period be responsible for the recording of results and the operation and maintenance of the plant. • Provide the following: • An operational report of the demonstration 740.070 INSPECTIONS AND TESTS: Submit schedules indicating those parts of the contract works for which inspections and tests are required to substantiate conformity with the specification. Should any alternative item be proposed that does not carry appropriate certification, ensure independent testing is carried out at no expense to the contract works to confirm compliance.	

DESCRIPTION	AMOUNT (Rs.)
Provide method statements supported by risk assessments detailing the procedures for carrying out on site tests. Agree in advance with all parties procedures for inspections and tests including periods of notice. Where a test indicates non-compliance with the specification submit immediately details of the non-compliance and details for corrective action. Maintain records of all specified inspections and tests performed including third party and works testing. Maintain all records on site for inspection. 740.080 TEST CERTIFICATES AND RECORDS: Ensure that test certificates include: • project title • details and date of test • instruments used, serial numbers, calibration dates • signature of those witnessing test • installers name • specific location of the item in the contract works The number of copies of each test certificate to be issued to the Client with copy M&E Engineer • (no) 4 Time scale • within working days of the test (no) 3 740.090 ROTATING EQUIPMENT: Immediately prior to practical completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation. Ensure that temporary electrical supplies are provided to enable rotating plant items delivered and/or installed to be run at regular intervals to avoid damage or deterioration. If temporary electrical supplies are not available ensure that rotating plant is hand-turned. 900.000 COMPLETION AND HANDOVER 900.010 GENERAL: This section details the requirements and procedures for completion and handover. 900.020 HANDOVER REQUIREMENTS: As a pre-requisite to Practical Completion in respect of the contract works or part thereof, demonstrate to the satisfaction of the Client and M&E Engineer that: • All the Works are complete. • With the exception of minor snags or limited defects as agreed with the Main Client and M&E Engineer that could be reasonably completed within an agreed programme without causing disruption to the Employer's use of the building or part thereof. • All spares, keys, tools and other consumables as stated elsewhere have been supplied and handed over to the Employer, as approved by M&E Engineer. • The instruction of the Employer's staff in the use and correct operation of the installation has been completed satisfactorily. In particular, safety devices and controls demonstration. • All commissioning and testing completed • including the issue of a final commissioning report signed by an approved competent	

DESCRIPTION	AMOUNT (Rs.)
person • A complete demonstration of the Works with fully functional operational controls tested has been undertaken in the presence and to the satisfaction of the Client and M&E Engineer. • All necessary certification by the Employer's insurers has been completed. • All approved record documentation including record drawings, operation and maintenance manuals, etc is issued • All information required for the health and safety file is issued to the satisfaction of the M&E Engineer and relevant authorities. • All necessary Statutory Authority approvals have been undertaken and written confirmation established • Completion and issue of log books in accordance with Building Regulations. • in accordance with CIBSE TM31 Building Log Book Toolkit (standard templates) • Should adequate record documentation not be available, Practical Completion will not be issued. 900.040 RECOMMENDED SPARE PARTS: Before Practical Completion submit to the M&E Engineer with copy to the Client a schedule of spare parts as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works. Time scale • weeks before (no) 2 State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items that are additional to those specified for inclusion as stated elsewhere. 900.070 SUPPLY OF TOOLS: Provide all tools, keys and portable instruments as detailed elsewhere prior to practical completion and additional items if so instructed by the M&E Engineer with copy to Client. Time scale • Weeks before Practical Completion (no) 1 910.000 MAINTENANCE 910.020 PROVISION FOR 12 MONTHS MAINTENANCE CONTRACT: Allow the cost for providing a 12 months comprehensive maintenance contract from the date of Practical Completion for the whole of the works. The maintenance works shall include: ☒ Planned preventative maintenance to maintain the installations in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc as detailed in the specifications. ☒ Preparation of work schedules and recording activities ☒ Providing breakdown and emergency cover ☒ Planning and undertaking shut-downs for maintenance works ☒ Employing of all necessary specialist maintenance ☒ Attendance on and supervision of specialist maintenance ☒ Carrying out all necessary safety checks ☒ Carrying out system proving of the works to include the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values ☒ Liaison with the employer ☒ 24/7 Call out emergency services. ☒ Allow for all spares and replacement of damaged parts as may be required.	

DESCRIPTION	AMOUNT (Rs.)
Emergency maintenance response times during work days, week-ends and public holidays shall be less than 3 hours. Ensure that the maintenance recommendations set out in the appropriate standard can be achieved and are appropriate for the installations. Advise with the tender submission. Total ☒ Prior to Practical Completion submit to the Engineer a detailed planned preventative maintenance programme for the works within 3 weeks of Practical Completion.	
TOTAL FOR BILL NO. 1 CARRIED TO MAIN SUMMARY PAGE (RS.)	

BILL No. 2.1 –Public Health and Allied Works

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>INFORMATION PROVIDED</u>				
	The project is the refurbishment of an existing office building located at Pope Hennessy Street Port Louis				
	The building, of approximately 4,400m2, comprises of a basement, ground floor, 1st to 6th floors, and space (technical office and room) at roof level. There is a technical block at ground floor at the back of the building forming part of the main building.				
	The bill of quantities form part of and must be read in conjunction with the Specifications, which contain the full descriptions of the work to be done and material and equipment to be used. Unless otherwise described in these bills of quantities, reference should be made to the Specifications for the full meaning of descriptions of work to be done and materials and equipment to be used in this service.				
	The Contractor shall be responsible for interpreting the drawings, making due allowance for offsets to avoid the building structure or other services, whether indicated or not.				
	The Contractor shall take all necessary steps to fully acquaint himself with the nature and extent of the Works by visiting the site and by inspecting the architectural, structural and other MEP services and demolition works drawings.				
	No claim for loss or expense due to the above factors will be considered.				
	All quantities are provisional and shall be subject to remeasurement after execution of works. The contractor shall ensure that drawings are approved for exact quantities.				
	Public Health & Allied Works C10/C20-Removal of Complete Systems & Demolition	1	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
1	C10/C20 - REMOVAL OF COMPLETE SYSTEMS & DEMOLITION				
	Preambles				
	This bill section refers to the dismantling works comprising removal of complete systems & demolition, and builder's work involved in the refurbishment of the Pope Hennessy building at Port Louis for MAUBANK Ltd				
	All dismantled items shall be kept on site for NOT more than 24 to 48 hours, either on the roof or at the back of the building, depending where the items have been dismantled from, as indicated on the site plan.				
	The Client representative shall countersign all assets removed during the refurbishment project in an asset registry.				
	Upon receiving instruction from the Client for carting away of any dismantled parts and equipment, debris, etc., the Client representative shall again countersign on the asset registry and the Contractor shall cart away the asset from the site within 24 hours.				
	The contractor shall be responsible for the dismantling works and proper disposal of all obsolete cables, cable components, and cable containments systems, such as cable trays, wire trays, trunking, etc.				
	The contractor shall be responsible for the safekeeping, stock control of all the existing luminaires, accessories and the like and handover to client at a later stage. Proper records of luminaires and accessories shall be kept and countersigned off before and after handover to Client by Client representative.				
	The contractor shall be required to undertake a pre-bid survey, to access the exact extent of works. All the costs relative to this survey shall be borne by the contractor and shall not be reimbursed by the Client.				
	Public Health & Allied Works C10/C20-Removal of Complete Systems & Demolition	2	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	The Contractor is required to take all necessary health and safety measures to ensure the utmost safety of its personnel and people working in the building during the dismantling works.				
	Electrical isolation shall be done before any existing cables and electrical boards are decommissioned and disconnected. Warning signage shall be used profusely wherever required to warn people and passers by.				
	S10 - COLD WATER SERVICES				
	<u>BASEMENT</u>				
A	<i>Dismantling of existing cold water pipework and accessories from water tank in basement to cold water booster pump at ground floor in technical room at back of building.</i>	item	1		
B	<i>Decommissioning, Dismantling of existing sump pump c/w all accessories, connecting pipework and accessories up till position of pipe at high level in basement pump room.</i>	item	1		
C	<i>Dismantle, and remove fire tank cover of dimension 900 x 900 mm.</i>	nr	1		
D	<i>Dismantle and remove Ball cock valves in water tanks</i>	nr	2		
	<u>GROUND FLOOR</u>				
E	<i>Decommission, dismantle, and remove existing Cold water transfer pump of make Lowara, model Q120/332/BT c/w pressure vessel, electrical control panel, pipeworks and ancillaries.</i>	item	1		
F	<i>Decommission, dismantle, and remove existing electrical control panel for sprinkler pump for carting away.</i>	item	1		
	<u>ROOF</u>				
G	<i>Decommission, dismantle, and remove pipeworks from riser to roof water tank.</i>	item	1		
H	<i>Dismantle and remove Ball cock valve in roof water tank.</i>	nr	1		
	Public Health & Allied Works C10/C20-Removal of Complete Systems & Demolition	3	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.1		Public Health and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
A	New cover in galvanised metal sheet & tube of dimension 900 x 900 mm to be installed for roof tank.	nr	1		
	RISERS				
B	Decommission, dismantle, and remove existing pipework from cold water booster pump at ground floor in technical pump room to roof level passing through riser along whole building height.	item	1		
	Public Health & Allied Works C10/C20-Removal of Complete Systems & Demolition	4	Carried to Main Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
2	R11/12 - FOUL DRAINAGE ABOVE/BELOW GROUND				
	<u>BASEMENT</u>				
A	Decommission, dismantle, and remove 2 Nos existing sump pump, Make: Grundfos, Model: KP 300-1	item	1		
B	Flushing, cleaning and making good of existing installation, checking all stack access points and cleaning of all risers	item	1		
C	Sump pump, 3 phase, with operating point of 8.2 m ³ /h volumetric flowrate, and 6.1 m head, similar to Ebara DW 75.	nr	2		
	Testing & Commisioning, and Sundries				
D	Contractor to allow a sum for all civil works related to the execution of the new public health works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in- situ formworks for fine finish, paint touchups, and the like works.	sum	1		
	Public Health & Allied Works R11/12 - Foul Drainage Above/Below Ground	6	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.1		Public Health and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
3	S10 - COLD WATER INSTALLATIONS				
	Preambles:				
	Background to Project & Scope of Works				
	The project is the refurbishment of an existing office building located at Pope Hennessy Street Port Louis				
	The building consists of a basement, ground floor, 1st to 6th floors, a lower roof level and an upper roof level.				
	The scope of works for the refurbishment are in the following areas of the building (refer to drawings for more details):				
	• Basement around concrete water tanks • Ground floor in existing technical room housing water pumps • In all toilet blocks (2 Nos.) at each floor. • At lower roof level • At upper roof level for roof water tank				
	The scope of works encompasses:				
	• Decommissioning, dismantling and carting away • Builder's works for passing of new services • Making good of existing areas • Installation of new pumpset, pipeworks & ancillaries				
	The following section represents the installation of a cold water distribution network within the building as detailed in the S10 drawing series.				
	Water shall be stored in two water tanks at Basement level				
	A completely pressurised cold water network shall be provided. Cold water distribution shall be via a booster pump set located in the pump room.				
	A UV filter shall be provided for the cold water distribution network.				
	Public Health & Allied Works S10 - Cold Water Installations	8	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Pipes measured in this section are for cold water pipes running concealed, on surface and buried underground.				
	All cold water pipes on site shall be of HDPE PN10 material and all pipes concealed in floor shall be of PEX-a pipe inside sleeve. All pipes running surface inside riser / false ceiling shall be of uPVC PN10 for cold water and cPVC PN16 c/w insulation for hot water. Contractor shall allow for transitional piece for HDPE to PVC pipe as may required on site and include them in the bid.				
	The contractor is to determine the exact quantity of extra over pipes for uPVC elbows, tees, reducers, couplings which are required to complete the works successfully and include them in the bid in section below.				
	The contractor shall be required to ensure proper coordination of services with respect to other trades.				
	All pipeline fittings, valves and ancillaries shall be of UK origin and have BS Kitemark. They must comply to BS EN 1452 and be WRAS compliant.				
	All quantities are provisional and shall be subject to remeasurement after execution of works.				
	Contractor shall allow for transitional coupling from HDPE to uPVC pipe for above ground as may required on site and include them in the bid.				
	The contractor is to determine the exact quantity of extra over pipes which are required to complete the works successfully and include them in the bid.				
	All quantities are provisional and shall be subjected to re-measurement after execution of works.				
	Public Health & Allied Works S10 - Cold Water Installations	9	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>BASEMENT</u>				
	<u>Cold water pipes running Surface mounted</u>				
	uPVC pipes for cold water distribution to the floor to BS EN 1452, straight, dark grey, PN10, solvent-welded, running on surface and inside riser ducts, supported with pipe clamps of make Sikla Ratio LS with minimum M8 threaded rod connections and bolt anchors at specified intervals c/w sleeves thru beams, walls & floor slabs, couplings, temporary protection during construction, uPVC PN10 pipe fittings including bends, elbows, tees, couplers, reducers, adaptors, elbows, nipples, swivel nuts, stop ends, connectors, couplings and the like with solvent-welded joints to uPVC tubing, pipework supports, coding and labelling, related accessories, all as described and specified, of make similar or equivalent to PPP.				
A	Dia. 25 mm (for Bibtap)	m	38		
	<u>Equipment & Accessories</u>				
	Brass isolating/stop valves with stainless steel lever (ball type-lever operated) to BS 5154, of make similar or equivalent to Hattersley and BS Kitemark, with compression/threaded joints to the cold water uPVC tubing and hot water c-PVC tubing.				
B	Dia. 25 mm	nr	1		
	Heavy duty Brass diaphragm pattern ball float operated valve to BS1212-2, of make similar or equivalent to Hattersley, as described and specified to match the water feed pipe inlet dia.				
C	DN 40 mm	nr.	2		
D	Supply and install of a prefiltration unit of average flow rate of 7m3/h, with a working pressure of 10 bar, Max. operating pressure of 16 bar, and maximum operating temperature of 50 deg Celcius.	set	1		
	Hose union pattern, brass finish bibtaps of European standard and BS Kitemark, similar or equivalent to "PRESTEX bibtaps, pattern no. 141HU FGK" with compression/screwed joints to the copper tubing (Provisional)				
	Public Health & Allied Works S10 - Cold Water Installations	10	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Dia. 20 mm	nr	2		
	Servo assisted solenoid valve, flange connection, 12V DC supply voltage and in a normally open position complying to European Standards with brass/ stainless steel valve body, IP65 rated, class F insulation, suitable for cold water supply, c/w float switch control, all related accessories and be energised/ closed when the minimum water level inside tank for FHR reached.				
B	DN 50 mm	nr.	1		
C	Water level sensor with indicator and alarm panel for watertanks. c/w overflow warning alarm device with sounder. Alarm panel to be c/w cabling to monitor the following: - Low Level (Dry Running of pump set) - Overflow - Warning - Water Level	set	1		
D	New cover in galvanised metal sheet & tube of dimension 900 x 900 mm to be installed for fire tank.	nr	1		
	GROUND FLOOR				
	Primary Equipments (Located in Pump Room)				
E	Combined cold water booster & fire hose reel pumpset consisting of 2 pumps, working in duty/standby/auto changeover, self priming, with variable speed drive pumps, pressure tank 50L capacity, c/w all accessories, control panel, pressure gauges, suction and discharge s/steel manifolds, anti-vibration mountings, flexible couplings, dry contacts & pressure switches, pressure relief valve, float switches, gate and check valves, strainers, prefilters, test points, drain cocks and the like. Control panel to be of same make as pump and to be inclusive of local controller, all as per the schedules, similar and equivalent to Calpeda, Ebara, Wilo series or approved equal				
F	1.5 L/s at 7.6 bars	set	1		
	Public Health & Allied Works S10 - Cold Water Installations	11	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Cold water pipes running Surface mounted</u>				
	uPVC pipes for cold water distribution to the floor to BS EN 1452, straight, dark grey, PN10, solvent-welded, running on surface and inside riser ducts, supported with pipe clamps of make Sikla Ratio LS with minimum M8 threaded rod connections and bolt anchors at specified intervals c/w sleeves thru beams, walls & floor slabs, couplings, temporary protection during construction, uPVC PN10 pipe fittings including bends, elbows, tees, couplers, reducers, adaptors, elbows, nipples, swivel nuts, stop ends, connectors, couplings and the like with solvent-welded joints to uPVC tubing, pipework supports, coding and labelling, related accessories, all as described and specified, of make similar or equivalent to PPP.				
A	Dia. 25 mm	m	34		
B	Dia. 20 mm	m	8		
	<u>Pump room</u>				
	Brass pressure regulating valve, diaphragm operated, with compression/threaded joints, Max. Inlet Pressure: 10 bar and adjustable outlet pressure between 1.5 and 5 bar of European Origin.				
C	Dia. 50 mm	nr	1		
	Bronze pipeline strainer with flanged joints, Y pattern body, minimum 250% screen free area of pipe bore.				
D	Dia. 50 mm	nr	1		
	Butterfly stop valve, gear operated to BS 5155, nylon coated ductile iron body, elastomer encapsulated disc, flanges, secured with leather straps and padlocks, of make similar or equivalent to Hattersley.				
E	Dia. 50 mm	nr	1		
F	Glycerine vapour pressure type gauges complying with BS EN 837-1, 10 bar scale divisions of 0.2 bar with flanged/ threaded connections, stainless steel case for corrosion resistance, white enameled brass dial face with large numbers for easy reading	nr	1		
	Public Health & Allied Works S10 - Cold Water Installations	12	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Equipment & Accessories				
	Brass isolating/stop valves with stainless steel lever (ball type-lever operated) to BS 5154, of make similar or equivalent to Hattersley and BS Kitemark, with compression/threaded joints to the cold water uPVC tubing and hot water c-PVC tubing.				
A	Dia. 25 mm	nr	3		
B	Solenoid Valve, Dia. 50 mm	nr			
	Brass pressure regulating valve, diaphragm operated, with compression/threaded joints, Max. Inlet Pressure: 5 bar and adjustable outlet pressure between 1 and 2 bar and complying to European standard.				
C	Dia. 25 mm	nr.	1		
	FIRST FLOOR				
	Cold water pipes running Surface mounted				
	uPVC pipes for cold water distribution to the floor to BS EN 1452, straight, dark grey, PN10, solvent-welded, running on surface and inside riser ducts, supported with pipe clamps of make Sikla Ratio LS with minimum M8 threaded rod connections and bolt anchors at specified intervals c/w sleeves thru beams, walls & floor slabs, couplings, temporary protection during construction, uPVC PN10 pipe fittings including bends, elbows, tees, couplers, reducers, adaptors, elbows, nipples, swivel nuts, stop ends, connectors, couplings and the like with solvent-welded joints to uPVC tubing, pipework supports, coding and labelling, related accessories, all as described and specified, of make similar or equivalent to PPP.				
D	Dia. 25 mm	m	34		
E	Dia. 20 mm	m	8		
	Equipment & Accessories				
	Brass isolating/stop valves with stainless steel lever (ball type-lever operated) to BS 5154, of make similar or equivalent to Hattersley and BS Kitemark, with compression/threaded joints to the cold water uPVC tubing and hot water c-PVC tubing.				
	Public Health & Allied Works S10 - Cold Water Installations	13	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Dia. 25 mm	nr	3		
	Brass pressure regulating valve, diaphragm operated, with compression/threaded joints, Max. Inlet Pressure: 5 bar and adjustable outlet pressure between 1 and 2 bar and complying to European standard.				
B	Dia. 25 mm	nr.	1		
	SECOND FLOOR				
	Cold water pipes running Surface mounted				
	uPVC pipes for cold water distribution to the floor to BS EN 1452, straight, dark grey, PN10, solvent-welded, running on surface and inside riser ducts, supported with pipe clamps of make Sikla Ratio LS with minimum M8 threaded rod connections and bolt anchors at specified intervals c/w sleeves thru beams, walls & floor slabs, couplings, temporary protection during construction, uPVC PN10 pipe fittings including bends, elbows, tees, couplers, reducers, adaptors, elbows, nipples, swivel nuts, stop ends, connectors, couplings and the like with solvent-welded joints to uPVC tubing, pipework supports, coding and labelling, related accessories, all as described and specified, of make similar or equivalent to PPP.				
C	Dia. 25 mm	m	34		
D	Dia. 20 mm	m	8		
	Equipment & Accessories				
	Brass isolating/stop valves with stainless steel lever (ball type-lever operated) to BS 5154, of make similar or equivalent to Hattersley and BS Kitemark, with compression/threaded joints to the cold water uPVC tubing and hot water c-PVC tubing.				
E	Dia. 25 mm	nr	3		
	Brass pressure regulating valve, diaphragm operated, with compression/threaded joints, Max. Inlet Pressure: 5 bar and adjustable outlet pressure between 1 and 2 bar and complying to European standard.				
F	Dia. 25 mm	nr.	1		
	Public Health & Allied Works S10 - Cold Water Installations	14	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>ROOF FLOOR</u>				
	<u>Cold water pipes running Surface mounted</u>				
	uPVC pipes for cold water distribution to the floor to BS EN 1452, straight, dark grey, PN10, solvent-welded, running on surface and inside riser ducts, supported with pipe clamps of make Sikla Ratio LS with minimum M8 threaded rod connections and bolt anchors at specified intervals c/w sleeves thru beams, walls & floor slabs, couplings, temporary protection during construction, uPVC PN10 pipe fittings including bends, elbows, tees, couplers, reducers, adaptors, elbows, nipples, swivel nuts, stop ends, connectors, couplings and the like with solvent-welded joints to uPVC tubing, pipework supports, coding and labelling, related accessories, all as described and specified, of make similar or equivalent to PPP.				
A	Dia. 50 mm	m	7		
B	Dia. 25 mm	m	12		
	<u>Equipment & Accessories</u>				
	Brass isolating/stop valves with stainless steel lever (ball type-lever operated) to BS 5154, of make similar or equivalent to Hattersley and BS Kitemark, with compression/threaded joints to the cold water uPVC tubing and hot water c-PVC tubing.				
C	Dia. 50 mm	nr	2		
D	Dia. 25 mm	nr	1		
	Bronze stainless steel spring loaded non return valve to BS 5154 with flanged connections, as appropriate, of make similar or equivalent to Hattersley for cold water supply.				
E	Dia. 50 mm	nr.	1		
	Drain off cock (ball type-lever operated) to BS 5154, of make similar or equivalent to Hattersley and BS Kitemark, of European standard with compression/threaded joints to the uPVC tubing fix on main water header				
F	DN 20 mm	nr.	1		
	Public Health & Allied Works S10 - Cold Water Installations	19	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Heavy duty Brass diaphragm pattern ball float operated valve to BS1212-2, of make similar or equivalent to Hattersley, as described and specified to match the water feed pipe inlet dia.				
A	DN 90 mm	nr.	1		
B	Water level sensor with indicator and alarm panel for watertanks. c/w overflow warning alarm device with sounder. Alarm panel to be c/w cabling to monitor the following: - Low Level (Dry Running of pump set) - Overflow - Warning - Water Level	set	1		
	Hose union pattern, brass finish bibtaps of European standard and BS Kitemark, similar or equivalent to "PRESTEX bibtaps, pattern no. 141HU FGK" with compression/screwed joints to the copper tubing (Provisional)				
C	Dia. 20 mm	nr	2		
D	New cover in galvanised metal sheet & tube of dimension 900 x 900 mm to be installed for roof tank	nr	1		
	<u>RISER</u>				
	<u>Cold water pipes running Surface mounted</u>				
	uPVC pipes for cold water distribution to the floor to BS EN 1452, straight, dark grey, PN16, solvent-welded, running on surface and inside riser ducts, supported with pipe clamps of make Sikla Ratio LS with minimum M8 threaded rod connections and bolt anchors at specified intervals c/w sleeves thru beams, walls & floor slabs, couplings, temporary protection during construction, uPVC PN10 pipe fittings including bends, elbows, tees, couplers, reducers, adaptors, elbows, nipples, swivel nuts, stop ends, connectors, couplings and the like with solvent-welded joints to uPVC tubing, pipework supports, coding and labelling, related accessories, all as described and specified, of make similar or equivalent to PPP.				
E	Dia. 50 mm	m	31		
	Public Health & Allied Works S10 - Cold Water Installations	20	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.1		Public Health and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	Sundries				
A	Contractor to allow a sum for all civil works related to the execution of the new public health works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
B	Testing and commissioning of the whole of the system in accordance with the specifications and demonstration / instruction of operation to the client.	item	1		
C	Purpose made pressure pipe sleeves at least PN10 rated of non-combustible material through walls, floors, ceilings for supply pipes & Fire proof barriers with intumescent material for all pipe perforations and penetrations through walls/slabs.	item	1		
D	Intumescent fire proof stopping compounds to BS 476-22, barriers, seals, mortar, mastic with fire-rated material for all pipe perforations and penetrations through walls/slabs/ceilings of make similar or equivalent to Astroflame and of European Origin.	item	1		
E	Pipework and Valve Colour Coding Identification in strict accordance to BS 1710 - Identification of Pipelines & Services and as specified.	item	1		
	Public Health & Allied Works S10 - Cold Water Installations	21	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Fire Hose Reel to BS EN 671-1 and BS 5306-1, manually operated, swinging recessed mounted, maximum 10 bar inlet pressure, 25 mm inlet valve connection of make similar or equivalent to Chubb with 30 m length non-kinkable red hose, 25mm hose diameter, 6.35 mm jet/spray chrome-plated brass nozzle conforming to BS 5274, brass nozzle interlocking valve and related accessories, all as detailed and specified.	nr	8		
B	Supply and installation of semi-rigid Photoluminescent PVC fire signs on Perspex background screwed to background concrete to BS 5499. (Laminated PVC sheet incorporating a photoluminescent layer backed by a rigid white reflective substrate and protected by a tough, clear gloss PVC film, Thickness: 1Amm) Flammability: inherently fire retardant. Luminance performance: in excess of 23mcd/m' @ 10 minutes and 3mcd/m' @ 60 minutes.	nr	8		
	Pipeline Ancillaries				
C	Brass automatic air relief valve and stop valve, DN 50 mm fixed on hose reel pipe termination.	nr	1		
	Sundries				
D	Contractor to allow a sum for all civil works related to the execution of the new public health works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
E	Puddle flanged sleeves and masking plates for pipe penetrations through walls, and slabs.	item	1		
F	Intumescent fire proof stopping compounds to BS 476-22, barriers, seals, mortar, mastic with fire-rated material for all pipe perforations and penetrations through walls/slabs/ceilings of make similar or equivalent to make Astroflame.	item	1		
	Public Health & Allied Works S60-Fire Hose Reels	24	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
5	S72-PORTABLE FIRE EXTINGUISHERS				
	Preambles:				
	This section represents the supply and installation of portable CO2 and ABC powder fire extinguishers to be used by the occupants of the building as first-aid fire-fighting means as shown on S60/S72 drawing series.				
	All portable extinguishers shall be of European origin and must comply to BS 5423, BS EN 3 & BS EN 12416-2.				
	The location of these fire extinguishers shown in the S72 drawing are for guidance only. The contractor will liaise with and convene the Fire Services on site during implementation to have the exact location of these extinguishers. The contractor will also undertake all necessary liaisons with the Fire Services until the granting of the final clearance.				
	All quantities are provisional and shall be subject to remeasurement after execution of works.				
	Equipment				
A	4 kg portable Carbon Dioxide (CO2) fire extinguisher with minimum 3 m shooting range, 20 secs discharging duration, 55 Bar working pressure and s/steel wall bracket, similar or equivalent to make Chubb.(Carbon dioxide shall be in accordance with BS 5306-4.)	nr	16		
B	4 kg portable ABC fire extinguisher with minimum 3 m shooting range, 12 secs discharging duration, 14 Bar working pressure and s/steel wall bracket, similar or equivalent to make Chubb. (Carbon dioxide shall be in accordance with BS 5306-4.)	nr	16		
C	200 x 80 mm photoluminescent fire extinguisher identification signs incorporating graphical symbols for classes of fire from BS EN3.5: 1996: ABC with minimum 10 m viewing distance.	nr	16		
D	200 x 80 mm photoluminescent fire extinguisher identification signs incorporating graphical symbols for classes of fire from BS EN3.5: 1996: CO ₂ with minimum 10 m viewing distance.	nr	16		
	Public Health & Allied Works S72-Portable Fire Extinguishers	27	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.1		Public Health and Allied Works
Item	Description	Unit	Qty	Rate	Amount
6	TESTING AND COMMISSIONING				
	<u>Preambles:</u>				
	This section shall allow for the testing, commissioning, handing over and maintenance of the public health works as detailed in this bill.				
	The contractor is responsible to check the installation, set the equipment to work and set up the control system to ensure that everything works correctly in accordance with the system design intent. Provide full documentation on the system installation, components and control.				
A	<i>The contractor will allow for a full and comprehensive testing and commissioning of the installations including any equipment properly calibrated, materials, qualified personnel that will be required in line with the specifications and preliminaries and general requirements. The contractor will allow in his quote for witnessing AND assisting the testing and commissioning works for the complete system after completion of the works</i>	item	1		
B	<i>Training/ demonstration/ instruction of operation to the client/ facility manager/ personnel for a period of three days. Schedule of training to be provided.</i>	item	1		
C	<i>Allow for labelling of all pipework, accessories and the like in accordance with specifications. Allow for sealing of sleeves through fabrics for all services. Allow for fire proof barrier of 3hrs fire resistance around all pipework through holes, sleeves and openings.</i>	item	1		
Public Health & Allied Works Testing & Commissioning		30	Carried to Collection Page		

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BILL No. 2.2 –Mechanical and Allied Works

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	INFORMATION PROVIDED				
	This bill section refers to the refurbishment of the Pope Hennessy building at Port Louis for MAUBANK Ltd				
	The building, of approximately 4,400m2, comprises of a basement, ground floor, 1st to 6th floors, and space (technical office and room) at roof level. There is a technical block at ground floor forming part of the main building.				
	The bill of quantities form part of and must be read in conjunction with the Specifications, which contain the full descriptions of the work to be done and material and equipment to be used. Unless otherwise described in these bills of quantities, reference should be made to the Specifications for the full meaning of descriptions of work to be done and materials and equipment to be used in this service.				
	The Contractor shall be responsible for interpreting the drawings, making due allowance for offsets to avoid the building structure or other services, whether indicated or not.				
	The Contractor shall take all necessary steps to fully acquaint himself with the nature and extent of the Works by visiting the site and by inspecting the architectural, structural and other MEP services and demolition works drawings.				
	No claim for loss or expense due to the above factors will be considered.				
1	C10/C20 - REMOVAL OF COMPLETE SYSTEMS & DEMOLITION				
	Preambles				
	This bill section refers to the dismantling works comprising removal of complete systems & demolition, and builder's work involved in the refurbishment of the Pope Hennessy building at Port Louis for MAUBANK Ltd				
	All dismantled items shall be kept on site for NOT more than 24 to 48 hours, either on the roof or at the back of the building, depending where the items have been dismantled from, as indicated on the site plan.	<i>item</i>	<i>1</i>		
	Mechanical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	1	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.2		Mechanical and Allied Works	
Description	Unit	Qty	Rate	Amount	
The Client representative shall countersign all assets removed during the refurbishment project in an asset registry.					
Upon receiving instruction from the Client for carting away of any dismantled parts and equipment, debris, etc., the Client representative shall again countersign on the asset registry and the Contractor shall cart away the asset from the site within 24 hours.					
The contractor shall be responsible for the dismantling works and proper disposal of all obsolete cables, cable components, and cable containments systems, such as cable trays, wire trays, trunking, etc.					
The contractor shall be responsible for the safekeeping, stock control of all the existing luminaires, accessories and the like and handover to client at a later stage. Proper records of luminaires and accessories shall be kept and countersigned off before and after handover to Client by Client representative.					
The contractor shall be required to undertake a pre-bid survey, to access the exact extent of works. All the costs relative to this survey shall be borne by the contractor and shall not be reimbursed by the Client.					
The Contractor is required to take all neccesary health and safety measures to ensure the utmost safety of its personnel and people working in the building during the dismantling works.					
Electrical isolation shall be done before any existing cables and electrical boards are dicommissioned and disconnected. Warning signage shall be used profusely wherever required to warn people and passers by.					
All quantities are provisional and shall be subject to remeasurement after execution of works. The contractor shall ensure that drawings are approved for exact quantities.					
Mechanical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	2	Carried to Collection Page			

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>SIXTH FLOOR</u>				
A	Decommission, dismantle, remove, store on site and hand over to Client / cart away chilled water pipeworks, valves & accessories to AHU on Sixth floor	item	1		
	<u>ROOF</u>				
B	Decommission, dismantle, remove, store on site and hand over to Client / cart away chilled water pipeworks, valves & accessories to fresh air AHU on Roof, and Riser.	item	1		
C	Decommission, dismantle, remove, store on site and hand over to Client / cart away Package Air Cooled Chiller of Make: Trane, Model: RTAC 140 c/w chilled water control panel located indoor at the technician office/room at roof level.	item	1		
D	Decommission, dismantle, remove, store on site and hand over to Client / cart away twin volute circulation Pump of Make: Salmson, Model: IRL -25/7.5 c/w all valves and pipeline accessories, and control panel located indoor at the technician office/room at roof level.	item	1		
E	Decommission, dismantle, remove, store on site and hand over to Client / cart away chilled water Storage Tank of volume: 10 m3 and weight: 1200kg each when empty, c/w related pipeworks, valves and accessories.	nr	2		
F	Decommission, dismantle, remove, store on site and hand over to Client / cart away chilled water Expansion Vessel of volume: 80 lts, and weight: 100 kg c/w related pipeworks, valves and accessories.	nr	1		
	<u>RISER</u>				
G	Decommission, dismantle, remove, store on site and hand over to Client / cart away chilled water pipeworks, valves & accessories to AHU inside Riser from roof all along the building down to ground floor.	item	1		
	Mechanical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	4	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>SECOND FLOOR</u>				
	<i>AHU - Mechanical Room</i>				
A	Decommission, dismantle, remove, store on site and hand over to Client / cart away AHU, model 39FD450, AHU components, valves & accessories from Mechanical room in ground floor and cart away.	item	1		
B	Isolate from mains, Decommission, dismantle, remove, store on site and hand over to Client / cart away of AHU control panel located in mechanical room besides the AHU, c/w all power and control wiring from mains distribution board and to AHU equipment.	nr.	1		
	<i>Insulated Ductwork</i>				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
C	1000 x 400 mm	m	14		
D	900 x 400 mm	m	55		
E	300 x 150 mm	m	49		
	<i>Supply Air Grille</i>				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
F	300 x 300 mm	nr	25		
	<i>Return Air Grille</i>				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
G	300 x 150 mm	nr	49		
	<u>THIRD FLOOR</u>				
	<i>AHU - Mechanical Room</i>				
H	Decommission, dismantle, and remove AHU, model 39FD450, AHU components, valves & accessories from Mechanical room in third floor and cart away.	item	1		
	Mechanical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	7	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Supply Air Grille				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
A	300 x 300 mm	nr	25		
	Return Air Grille				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
B	300 x 150 mm	nr	49		
	SIXTH FLOOR				
C	Decommission, dismantle, and remove AHU, model 39FD450, AHU components, valves & accessories from Mechanical room in sixth floor and cart away.	item	1		
D	Isolate from mains, decommission, dismantle and hand over to Client / store on site for eventual carting away of AHU control panel located in mechanical room besides the AHU, c/w all power and control wiring from mains distribution board and to AHU equipment.	nr.	1		
	Insulated Ductwork				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
E	1000 x 400 mm	m	14		
F	900 x 400 mm	m	55		
G	300 x 150 mm	m	49		
	Supply Air Grille				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
H	300 x 300 mm	nr.	28		
	Return Air Grille				
	Decommission, dismantle, remove, store on site and hand over to Client / cart away:				
I	300 x 150 mm	item	44		
	Mechanical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	10	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Section C10/C20 - Removal of Complete systems & Demolition				
	Collection for Section C10/C20				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
2	T62 - VRF COOLING DISTRIBUTION / U60 - AIR CONDITIONING UNITS				
	<u>Preambles:</u>				
	This section represents the installation of a VRF air cooling systems for the general internal spaces of the building.				
	Due to technical limitations associated with a VRF installation, the building has been segregated into 3 zones. The roof, 6th and 5th floors cooling load is served by VRF Cluster 1. The 4th, 3rd and 2nd floors cooling load is served by VRF Cluster 2. The 1st and ground floors cooling load is served by VRF Cluster 3.				
	All the 3 VRF clusters are located on the roof level 1.				
	All external refrigerant pipes are to be protected against mechanical and climatic damages by means of aluminium cladding. The pipes running from the outdoor units to the inside of the building will run on heavy duty cable trays with metallic covers. Protection to be provided to pipes against mechanical damage.				
	Wall mounted and concealed ceiling mounted cassette type units shall be supplied complete with condensate drain pump and all related accessories as required by the manufacturer for a fully functional system to meet design intent.				
	All condensate drain pipes shall have thermal insulation c/w vapour barrier, as recommended by proposed thermal insulation manufacturer, to ensure no condensation even during worst case temperature and humidity conditions inside and outside the building.				
	Insulated condensate drain pipes shall connect to a dedicated condensate water stack through insulated P traps as indicated on drawings.				
	The contractor shall ensure that necessary acoustic measures have been allowed for and noise level shall not exceed NR 30 inside the building, and NR 25 inside the cellular office spaces.				
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	13	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Refrigerant shall be R32.				
	Outdoor units shall be fixed on anti-vibration mountings.				
	All outdoor units shall have anti-corrosion treatment and shall be certified for installation in tropical climates and near saline environments for long structural and operating life.				
	All refrigerant pipes to be supplied with thermal insulation and cladding and shall run on GMS medium duty refrigerant trays inside the building and on heavy duty covered GMS refrigerant trays outside.				
	The outdoor units shall be installed on concrete base on the roof. The contractor to allow for the cost of all crange and manutention of the outdoor units on the roof for accurate positioning and fixation.				
	All supports for outdoor units shall resist cyclonic winds of 270 km/h and all bolts, washers, nuts and the like to be in marine grade stainless steel to Structural Engineer's Approval.				
	Power supply to the VRF indoor and outdoor units is measured in the electrical BOQ. Electrical power connection of all VRF indoor and outdoor units shall be done by the electrical contractor under close supervision of the mechanical contractor. Electrical control connections shall be done by the mechanical contractor or specialist mechanical equipment configurator under close supervision of the electrical contractor.				
	The contractor to ensure all related accessories are provided for the functioning of the units in cascaded/series mode. All related control wiring shall also be allowed for.				
	Contractor is to include in his quote all related accessories and control elements for a fully efficient and functional system.				
	Indoor temperature to be between 20 and 24 deg C adjustable by user and relative humidity to be 50%.				
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	14	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.2		Mechanical and Allied Works	
	Description	Unit	Qty	Rate	Amount
	VRF outdoor units and compressors shall have a minimum 5 years warranty period.				
	All quantities are provisional and shall be subject to remeasurement after execution of works on site.				
	Contractor shall be required to ascertain the copper refrigerant pipes' dimensions during the installation works through detailed simulation using proprietary VRF softwares and calculation submitted to Consultant for verification.				
	Rates shall include for colour coding and direction of flow for ducts, pipes and labeling of all equipment.				
	Rates shall allow for the provision of test holes, access traps, plenum boxes and all related accessories in strict compliance with DW 144 and DW 143.				
	Rates shall allow for the testing and commissioning of the whole of the system in accordance with the specifications and demonstration / instruction of operation to the Client.				
	Rates shall provide for fire proof barrier of 2hrs fire resistance around all ductwork, insulated VRF refrigerant pipings, etc. through holes, sleeves and openings.				
	VERY IMPORTANT: All copper refrigerant pipings, Y Branches, Header Branchs, heat recovery units, piping accesorieslocal controllers, central controllers, plant managers, Power Distribution Indicators, etc., shall be proprietary and exclusively from same reputed VRF manufacturer as the main VRF equipment. For any other accesories, such as electrical power meters, manufacturer can be different but should be from reputed European manufacturers with complete mandatory compatibility.				
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	15	Carried to Collection page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>Sub Metering for VRF Air Conditioning : Multi-Tenant zones</u>				
	<i>Sub Metering method should allow for the disaggregation of total Outdoor VRF power consumption for each individual indoor units connected to said VRF outdoor unit(s), based on operating times, temperature setpoints and refrigerant flow on individual indoor units. Overall sub-metering strategy should be able to provide the combined Indoor and Outdoor electricity consumption (kWh) for each indoor AC unit (or clusters), based on actual consumption and NOT based on a uniform disaggregation basis.</i>				
	<i>Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.</i>				
	<i>Mechanical contractor shall liaise with electrical contractor for proper connection of communication and power cabling to respective sub-metering panels.</i>				
A	<i>Control cabling from Outdoor units to Indoor evaporating units.</i>	<i>item</i>	<i>1</i>		
B	<i>Sub-Metering Power Signal Cabling from Indoor Units to Outdoor Units</i>	<i>item</i>	<i>1</i>		
C	<i>Sub-Metering Ancillaries; including Control panels, modules, necessary controllers and software as per Manufacturer's requirements</i>	<i>item</i>	<i>1</i>		
	<u>Refrigerant Pipes and Accessories</u>				
	<u>Refrigerant Pipes</u>				
	<i>Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be clad with aluminium material. All external supports to be treated for saline environment.</i>				
D	<i>9.52:15.88 mm</i>	<i>m</i>	<i>300</i>		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	17	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
A	12.7:28.58 mm	m	3		
B	15.88:28.58 mm	m	3		
	Y Branch				
	Liquid				
C	Inlet pipe size = 19.05 mm, Outlet pipe size = 12.7 mm, and 15.88 mm	nr.	1		
	Gas				
D	Inlet pipe size = 34.9 mm, Outlet pipe size = 28.58 mm, and 28.58 mm	nr.	1		
	Condensate Drain Pipe				
	Condensate drain pipes, circular, UPVC PN4 solvent welded, complete with 19 mm insulation running inside false ceiling fixed to concrete background using stirrups at 1200 mm between centres. Condensate drain pipes to connect to 75mm diameter insulated condensate drain stack running vertically in left riser in mechanical rooms at all floors from roof level to basement level.				
E	Dia 50	m	4		
F	Dia 40	m	14		
G	Dia 32	m	46		
H	Dia 25	m	52		
	Header Branch				
I	10 Ports	nr.	2		
	Containment				
	Wire tray to withstand the UDL of refrigerant pipes, made of GMS, straight or curved, jointed by rustproof bolts and bonding jumper, c/w fittings, accessories, supports manufactured by 2.5 mm hot dipped galvanised U channels.				
J	100mm wide	m	70		
K	150mm wide	m	14		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	18	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
A	200mm wide	m	20		
B	500mm wide	m	5		
C	550mm wide	m	10		
	<u>Air duct lines</u>				
	Circular/ Rectangular rigid GMS duct supported by clips at specified mm centres plugged and screwed to concrete background for supply purposes, all as specified and constructed in accordance to DW 144/142. Contractor to ensure that the stirrups sustain the load of the ductwork as well as that pertaining to maintenance. All stirrups to be independent of false ceiling supports.				
D	300 x 250 mm	m	1		
E	Dia. 250 mm	m	10		
F	Dia. 160 mm	m	8		
	Flexible circular aluminium ducting supported by stirrups at specified centres plugged and screwed to concrete background for supply purposes c/w all accessories. All stirrups to be independent of false ceiling supports.				
G	Dia. 160 mm	m	2		
	<u>Supply Air Diffuser</u>				
H	Dia. 160 mm	nr.	4		
	<u>FIRST FLOOR</u>				
	<u>VRF Indoor Units</u>				
	VRF Indoor unit complete with control cabling for the indoor unit, condensate drain pump, all related accessories, fittings, supports, wired remote thermostats and controls, , central controller, and fuse spur. Units to be provided with integrated presence / motion sensor, as shown on drawings.				
	<u>Ceiling Mounted Cassette Type</u>				
I	0.71 kWc	nr.	1		
J	1.03 kWc	nr.	1		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	19	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.				
	Mechanical contractor shall liaise with electrical contractor for proper connection of communication and power cabling to respective sub-metering panels.				
A	Control cabling from Outdoor units to Indoor evaporating units.	item	1		
B	Sub-Metering Power Signal Cabling from Indoor Units to Outdoor Units	item	1		
C	Sub-Metering Ancillaries; including Control panels, modules, necessary controllers and software as per Manufacturer's requirements	item	1		
	Refrigerant Pipes and Accessories				
	Refrigerant Pipes				
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be clad with aluminium material. All external supports to be treated for saline environment.				
D	9.52:15.88 mm	m	267		
E	9.52:22.2 mm	m	6		
F	15.88:28.58 mm	m	3		
	Y Branch				
	Liquid				
G	Inlet pipe size = 15.88 mm, Outlet pipe size = 9.52 mm, and 9.52 mm	nr.	1		
	Gas				
H	Inlet pipe size = 28.8 mm, Outlet pipe size = 22.2 mm, and 22.2 mm	nr.	1		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	21	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Liquid				
A	Inlet pipe size = 19.05 mm, Outlet pipe size = 19.05 mm, and 15.88 mm	nr.	1		
	Gas				
B	Inlet pipe size = 19.05 mm, Outlet pipe size = 19.05 mm, and 15.88 mm	nr.	1		
	Condensate Drain Pipe				
	Condensate drain pipes, circular, UPVC PN4 solvent welded, complete with 19 mm insulation running inside false ceiling fixed to concrete background using stirrups at 1200 mm between centres. Condensate drain pipes to connect to 75mm diameter insulated condensate drain stack running vertically in left riser in mechanical rooms at all floors from roof level to basement level.				
C	Dia 50	m	4		
D	Dia 40	m	14		
E	Dia 32	m	42		
F	Dia 25	m	55		
	Header Branch				
G	10 Ports	nr.	2		
	Containment				
	Wire tray to withstand the UDL of refrigerant pipes, made of GMS, straight or curved, jointed by rustproof bolts and bonding jumper, c/w fittings, accessories, supports manufactured by 2.5 mm hot dipped galvanised U channels				
H	100mm wide	m	67		
I	150mm wide	m	9		
J	200mm wide	m	14		
K	250mm wide	m	8		
L	500mm wide	m	15		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	22	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.2		Mechanical and Allied Works	
	Description	Unit	Qty	Rate	Amount
	<u>SECOND FLOOR</u>				
	<u>VRF Indoor Units</u>				
	VRF Indoor unit complete with control cabling for the indoor unit, condensate drain pump, all related accessories, fittings, supports, wired remote thermostats and controls, , central controller, and fuse spur. Units to be provided with integrated presence / motion sensor, as shown on drawings.				
	<u>Ceiling Mounted Cassette Type</u>				
A	0.80 kWc	nr.	1		
B	1.57 kWc	nr.	1		
C	1.63 kWc	nr.	1		
D	2.40 kWc	nr.	1		
E	2.59 kWc	nr.	1		
F	2.77 kWc	nr.	1		
G	3.40 kWc	nr.	1		
H	3.45 kWc	nr.	1		
I	4.05 kWc	nr.	1		
J	4.06 kWc	nr.	1		
K	4.74 kWc	nr.	1		
L	6.33 kWc	nr.	1		
	<u>VRF Local Controller</u>				
M	VRF Local controller, wired, wall mounted, from same manufacturer as the VRF system to ensure total compatibility, with 4.3" screen colour display and user friendly interface, all as described and specified in schedules.	nr.	12		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	23	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>Sub Metering for VRF Air Conditioning : Multi-Tenant zones</u>				
	Sub Metering method should allow for the disaggregation of total Outdoor VRF power consumption for each individual indoor units connected to said VRF outdoor unit(s), based on operating times, temperature setpoints and refrigerant flow on individual indoor units. Overall sub-metering strategy should be able to provide the combined Indoor and Outdoor electricity consumption (kWh) for each indoor AC unit (or clusters), based on actual consumption and NOT based on a uniform disaggregation basis.				
	Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.				
	Mechanical contractor shall liaise with electrical contractor for proper connection of communication and power cabling to respective sub-metering panels.				
A	Control cabling from Outdoor units to Indoor evaporating units.	item	1		
B	Sub-Metering Power Signal Cabling from Indoor Units to Outdoor Units	item	1		
C	Sub-Metering Ancillaries; including Control panels, modules, necessary controllers and software as per Manufacturer's requirements	item	1		
	<u>Refrigerant Pipes and Accessories</u>				
	<u>Refrigerant Pipes</u>				
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be clad with aluminium material. All external supports to be treated for saline environment.				
D	9.52:15.88 mm	m	199		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
A	9.52:19.05 mm	m	3		
B	12.7:28.58 mm	m	3		
	Y Branch				
	Liquid				
C	Inlet pipe size = 15.8 mm, Outlet pipe size = 12.7 mm, and 9.52 mm	nr.	1		
	Gas				
D	Inlet pipe size = 28.58 mm, Outlet pipe size = 28.58 mm, and 19.05 mm	nr.	1		
	Condensate Drain Pipe				
	Condensate drain pipes, circular, UPVC PN4 solvent welded, complete with 19 mm insulation running inside false ceiling fixed to concrete background using stirrups at 1200 mm between centres. Condensate drain pipes to connect to 75mm diameter insulated condensate drain stack running vertically in left riser in mechanical rooms at all floors from roof level to basement level.				
E	Dia 50	m	4		
F	Dia 40	m	14		
G	Dia 32	m	40		
H	Dia 25	m	41		
	Header Branch				
I	10 Ports	nr.	2		
	Containment				
	Wire tray to withstand the UDL of refrigerant pipes, made of GMS, straight or curved, jointed by rustproof bolts and bonding jumper, c/w fittings, accessories, supports manufactured by 2.5 mm hot dipped galvanised U channels				
J	100mm wide	m	54		
K	150mm wide	m	12		
L	400mm wide	m	14		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	25	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>THIRD FLOOR</u>				
	<u>VRF Indoor Units</u>				
	VRF Indoor unit complete with control cabling for the indoor unit, condensate drain pump, all related accessories, fittings, supports, wired remote thermostats and controls, , central controller, and fuse spur. Units to be provided with integrated presence / motion sensor, as shown on drawings.				
	<i>Ceiling Mounted Cassette Type</i>				
A	1.5 kWc	nr.	4		
B	2.2 kWc	nr.	1		
C	2.8 kWc	nr.	4		
D	3.6 kWc	nr.	6		
E	4.5 kWc	nr.	10		
	<u>VRF Local Controller</u>				
F	VRF Local controller, wired, wall mounted, from same manufacturer as the VRF system to ensure total compatibility, with 4.3" screen colour display and user friendly interface, all as described and specified in schedules.	nr.	15		
	<u>Sub Metering for VRF Air Conditioning - Multi-Tenant zones</u>				
	Sub Metering method should allow for the disaggregation of total Outdoor VRF power consumption for each individual indoor units connected to said VRF outdoor unit(s), based on operating times, temperature setpoints and refrigerant flow on individual indoor units. Overall sub-metering strategy should be able to provide the combined Indoor and Outdoor electricity consumption (kWh) for each indoor AC unit (or clusters), based on actual consumption and NOT based on a uniform disaggregation basis.				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<i>Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.</i>				
	Mechanical contractor shall liaise with electrical contractor for proper connection of communication and power cabling to respective sub-metering panels.				
A	Control cabling from Outdoor units to Indoor evaporating units.	item	1		
B	Sub-Metering Power Signal Cabling from Indoor Units to Outdoor Units	item	1		
C	Sub-Metering Ancillaries; including Control panels, modules, necessary controllers and software as per Manufacturer's requirements	item	1		
	Refrigerant Pipes and Accessories				
	Refrigerant Pipes				
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be clad with aluminium material. All external supports to be treated for saline environment.				
D	9.52:15.88 mm	m	273		
E	9.52:22.2 mm	m	6		
F	15.88:28.58 mm	m	3		
	Y Branch				
	Liquid				
G	Inlet pipe size = 15.8 mm, Outlet pipe size = 9.52 mm, and 9.52 mm	nr.	1		
	Gas				
H	Inlet pipe size = 28.58 mm, Outlet pipe size = 22.2 mm, and 22.2 mm	nr.	1		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	27	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Liquid				
A	Inlet pipe size = 19.05 mm, Outlet pipe size = 15.88 mm, and 15.88 mm	nr.	1		
	Gas				
B	Inlet pipe size = 41.3 mm, Outlet pipe size = 28.58 mm, and 28.58 mm	nr.	1		
	Condensate Drain Pipe				
	Condensate drain pipes, circular, UPVC PN4 solvent welded, complete with 19 mm insulation running inside false ceiling fixed to concrete background using stirrups at 1200 mm between centres. Condensate drain pipes to connect to 75mm diameter insulated condensate drain stack running vertically in left riser in mechanical rooms at all floors from roof level to basement level.				
C	Dia 50	m	4		
D	Dia 40	m	14		
E	Dia 32	m	39		
F	Dia 25	m	52		
	Header Branch				
G	10 Ports	nr.	2		
	Containment				
	Wire tray to withstand the UDL of refrigerant pipes, made of GMS, straight or curved, jointed by rustproof bolts and bonding jumper, c/w fittings, accessories, supports manufactured by 2.5 mm hot dipped galvanised U channels				
H	100mm wide	m	55		
I	150mm wide	m	23		
J	200mm wide	m	11		
K	250mm wide	m	3		
L	300mm wide	m	6		
M	550mm wide	m	13		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	28	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>FOURTH FLOOR</u>				
	<u>VRF Indoor Units</u>				
	VRF Indoor unit complete with control cabling for the indoor unit, condensate drain pump, all related accessories, fittings, supports, wired remote thermostats and controls, , central controller, and fuse spur. Units to be provided with integrated presence / motion sensor, as shown on drawings.				
	<u>Ceiling Mounted Cassette Type</u>				
A	1.5 kWc	nr.	6		
B	2.2 kWc	nr.	6		
C	2.8 kWc	nr.	6		
D	3.6 kWc	nr.	4		
E	4.5 kWc	nr.	7		
	<u>VRF Local Controller</u>				
F	VRF Local controller, wired, wall mounted, from same manufacturer as the VRF system to ensure total compatibility, with 4.3" screen colour display and user friendly interface, all as described and specified in schedules.	nr.	17		
	<u>Sub Metering for VRF Air Conditioning : Multi-Tenant zones</u>				
	Sub Metering method should allow for the disaggregation of total Outdoor VRF power consumption for each individual indoor units connected to said VRF outdoor unit(s), based on operating times, temperature setpoints and refrigerant flow on individual indoor units. Overall sub-metering strategy should be able to provide the combined Indoor and Outdoor electricity consumption (kWh) for each indoor AC unit (or clusters), based on actual consumption and NOT based on a uniform disaggregation basis.				
	Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Mechanical contractor shall liaise with electrical contractor for proper connection of communication and power cabling to respective sub-metering panels.				
A	Control cabling from Outdoor units to Indoor evaporating units.	item	1		
B	Sub-Metering Power Signal Cabling from Indoor Units to Outdoor Units	item	1		
C	Sub-Metering Ancillaries; including Control panels, modules, necessary controllers and software as per Manufacturer's requirements	item	1		
	Refrigerant Pipes and Accessories				
	Refrigerant Pipes				
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be clad with aluminium material. All external supports to be treated for saline environment.				
D	9.52:15.88 mm	m	324		
E	9.52:22.2 mm	m	6		
F	15.88:28.58 mm	m	3		
	Y Branch				
	Liquid				
G	Inlet pipe size = 15.88 mm, Outlet pipe size = 9.52 mm, and 9.52 mm	nr.	1		
	Gas				
H	Inlet pipe size = 28.58 mm, Outlet pipe size = 22.2 mm, and 22.2 mm	nr.	1		
	Liquid				
I	Inlet pipe size = 19.05 mm, Outlet pipe size = 15.88 mm, and 19.05 mm	nr.	1		
	Gas				
H	Inlet pipe size = 41.3 mm, Outlet pipe size = 28.58 mm, and 41.3 mm	nr.	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>FIFTH FLOOR</u>				
	<u>VRF Indoor Units</u>				
	VRF Indoor unit complete with control cabling for the indoor unit, condensate drain pump, all related accessories, fittings, supports, wired remote thermostats and controls, , central controller, and fuse spur. Units to be provided with integrated presence / motion sensor, as shown on drawings.				
	<u>Ceiling Mounted Cassette Type</u>				
A	2.2 kWc	nr.	1		
B	3.6 kWc	nr.	8		
C	5.6 kWc	nr.	10		
	<u>VRF Local Controller</u>				
D	VRF Local controller, wired, wall mounted, from same manufacturer as the VRF system to ensure total compatibility, with 4.3" screen colour display and user friendly interface, all as described and specified in schedules.	nr.	10		
	<u>Sub Metering for VRF Air Conditioning : Multi-Tenant zones</u>				
	Sub Metering method should allow for the disaggregation of total Outdoor VRF power consumption for each individual indoor units connected to said VRF outdoor unit(s), based on operating times, temperature setpoints and refrigerant flow on individual indoor units. Overall sub-metering strategy should be able to provide the combined Indoor and Outdoor electricity consumption (kWh) for each indoor AC unit (or clusters), based on actual consumption and NOT based on a uniform disaggregation basis.				
	Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>SIXTH FLOOR</u>				
	<u>VRF Indoor Units</u>				
	VRF Indoor unit complete with control cabling for the indoor unit, condensate drain pump, all related accessories, fittings, supports, wired remote thermostats and controls, , central controller, and fuse spur. Units to be provided with integrated presence / motion sensor, as shown on drawings.				
	<u>Ceiling Mounted Cassette Type</u>				
A	2.8 kWc	nr.	9		
B	3.6 kWc	nr.	2		
C	4.5 kWc	nr.	8		
D	5.6 kWc	nr.	9		
	<u>VRF Local Controller</u>				
E	VRF Local controller, wired, wall mounted, from same manufacturer as the VRF system to ensure total compatibility, with 4.3" screen colour display and user friendly interface, all as described and specified in schedules.	nr.	14		
	<u>Sub Metering for VRF Air Conditioning : Multi-Tenant zones</u>				
	Sub Metering method should allow for the disaggregation of total Outdoor VRF power consumption for each individual indoor units connected to said VRF outdoor unit(s), based on operating times, temperature setpoints and refrigerant flow on individual indoor units. Overall sub-metering strategy should be able to provide the combined Indoor and Outdoor electricity consumption (kWh) for each indoor AC unit (or clusters), based on actual consumption and NOT based on a uniform disaggregation basis.				
	Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Mechanical contractor shall liaise with electrical contractor for proper connection of communication and power cabling to respective sub-metering panels.				
A	Control cabling from Outdoor units to Indoor evaporating units.	item	1		
B	Sub-Metering Power Signal Cabling from Indoor Units to Outdoor Units	item	1		
C	Sub-Metering Ancillaries; including Control panels, modules, necessary controllers and software as per Manufacturer's requirements	item	1		
	Refrigerant Pipes and Accessories				
	Refrigerant Pipes				
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be clad with aluminium material. All external supports to be treated for saline environment.				
D	9.52:15.88 mm	m	202		
E	12.7:28.58 mm	m	3		
F	15.88:28.58 mm	m	3		
G	19.05:34.9 mm	m	3		
	Y Branch				
	Liquid				
H	Inlet pipe size = 19.05 mm, Outlet pipe size = 19.05 mm, and 12.7 mm	nr.	1		
	Gas				
I	Inlet pipe size = 41.3 mm, Outlet pipe size = 34.9 mm, and 28.58 mm	nr.	1		
	Liquid				
J	Inlet pipe size = 19.05 mm, Outlet pipe size = 12.7 mm, and 15.88 mm	nr.	1		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	36	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>ROOF</u>				
	<u>Inside Tech room & office</u>				
	<u>VRF Indoor Units</u>				
	VRF Indoor unit complete with control cabling for the indoor unit, condensate drain pump, all related accessories, fittings, supports, wired remote thermostats and controls, , central controller, and fuse spur. Units to be provided with integrated presence / motion sensor, as shown on drawings.				
	<u>Ceiling Mounted Cassette Type</u>				
A	3.6 kWc	nr.	4		
	<u>VRF Local Controller</u>				
B	VRF Local controller, wired, wall mounted, from same manufacturer as the VRF system to ensure total compatibility, with 4.3" screen colour display and user friendly interface, all as described and specified in schedules.	nr.	2		
	<u>Sub Metering for VRF Air Conditioning - Multi-Tenant zones</u>				
	Sub Metering method should allow for the disaggregation of total Outdoor VRF power consumption for each individual indoor units connected to said VRF outdoor unit(s), based on operating times, temperature setpoints and refrigerant flow on individual indoor units. Overall sub-metering strategy should be able to provide the combined Indoor and Outdoor electricity consumption (kWh) for each indoor AC unit (or clusters), based on actual consumption and NOT based on a uniform disaggregation basis.				
	Sub-Metering system will also provide the status of all VRF systems in the project, via the touch screen panel installed in Technician's Office at Roof Level, in real-time. The system should allow for troubleshooting.				
	Mechanical contractor shall liaise with electrical contractor for proper connection of communication and power cabling to respective sub-metering panels.				
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	38	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
A	Control cabling from Outdoor units to Indoor evaporating units.	item	1		
B	Sub-Metering Power Signal Cabling from Indoor Units to Outdoor Units	item	1		
C	Sub-Metering Ancillaries; including Control panels, modules, necessary controllers and software as per Manufacturer's requirements	item	1		
	Refrigerant Pipes and Accessories				
	Refrigerant Pipes				
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be cladded with aluminium material. All external supports to be treated for saline environment.				
D	9.52:15.88 mm	m	13		
	Y Branch				
	Liquid				
E	Inlet pipe size = 19.05 mm, Outlet pipe size = 9.52 mm, and 19.05 mm.	nr.	1		
	Gas				
F	Inlet pipe size = 41.3 mm, Outlet pipe size = 15.88 mm, and 41.3 mm.	nr.	1		
	Header Branch				
G	4 Ports	nr.	2		
	Containment				
	Heavy Duty Wire tray to withstand the UDL of refrigerant pipes, made of GMS, straight or curved, jointed by rustproof bolts and bonding jumper, c/w fittings, accessories, supports manufactured by 2.5 mm hot dipped galvanised U channels. Refrigerant trays on roofs to be protected with metallic covers. Insulated refrigerant pipes inside building to be supported by mupro supports.				
H	400mm wide x 50mm deep	m	9		
	Mechanical & Allied Works T62 - VRF Cooling Distribution/ U60 - Air Conditioning Units	39	Carried to Collection page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>Outside on Roof Level 1</u>				
	VRF Outdoor Units				
	VRF outdoor units, air cooled, of cooling capacity as specified below complete with control system between indoor and outdoor units and all other related accessories as required by manufacturer for a complete and functional system to meet design intent and performance (as per schedule).				
A	VRF Cluster 1, consisting of a combination of 3 outdoor units, 115.73 kWc total, (serving Roof, 6th and 5th floors)	nr.	1		
B	VRF Cluster 2, consisting of a combination of 3 outdoor units, 115.73 kWc total, (serving 4th, 3rd and 2nd floors)	nr.	1		
C	VRF Cluster 3, consisting of a combination of 3 outdoor units, 115.73 kWc total, (serving 1st and ground floors)	nr.	1		
	<u>RISER</u>				
	Containment				
	Heavy duty wire tray to withstand the UDL of refrigerant pipes, made of GMS, straight or curved, jointed by rustproof bolts and bonding jumper, c/w fittings, accessories, supports manufactured by 2.5 mm hot dipped galvanised U channels				
D	400mm wide x 50mm deep	m	22		
	<u>Refrigerant Pipes and Accessories</u>				
	Refrigerant Pipes				
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be clad with aluminium material. All external supports to be treated for saline environment.				
E	9.52:15.88 mm	m	13		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Y Branch				
	Liquid				
A	Inlet pipe size = 19.05 mm, Outlet pipe size = 9.52 mm, and 19.05 mm.	nr.	1		
	Liquid				
B	Inlet pipe size = 41.3 mm, Outlet pipe size = 15.88 mm, and 41.3 mm.	nr.	1		
	Supply and return refrigerant pipes of copper material c/w insulation of thickness to BS 5422 running inside false ceiling and externally complete with supports and all related accessories. All external insulated refrigerant pipes to be cladded with aluminium material. All external supports to be treated for saline environment.				
C	19.05:41.3 mm	m	98		
	Condensate Drain Pipe				
	Condensate drain pipes, circular, UPVC PN4 solvent welded, complete with 19 mm insulation running inside false ceiling fixed to concrete background using stirrups at 1200 mm between centres. Condensate drain pipes to connect to 75mm diameter insulated condensate drain stack running vertically in left riser in mechanical rooms at all floors from roof level to basement level.				
D	Dia 75	m	29		
	Testing & Commisioning, and Sundries				
E	Contractor to allow a sum for all civil works related to the execution of the new mechanical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against inpact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
F	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
A	Allow for the colour coding of pipes and labelling of equipment and valves in strict accordance to BS 1710.	item	1		
B	Allow for the operation and testing of the AC, control and metering system by specialist suppliers.	item	1		
C	Testing and commissioning of the whole of the system in accordance with the specifications and demonstration / instruction of operation to the client.	item	1		
D	Allow for the provision of test holes, access traps, plenum boxes and all related accessories in strict compliance with CIBSE Guide B3, DW 144 and DW 143.	item	1		
E	Any other item as deemed required by the contractor for the successful operation of the whole foregoing installation. These shall be clearly mentioned and accompanied by a breakdown.	item	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
3	U10-GENERAL VENTILATION				
	<u>Preambles</u>				
	The following section represents the installation of a filtered and pre-conditioned fresh air supply and return air distribution system in the whole of the building.				
	The supply and return air distribution ductworks for the whole building shall be connected and fed from a single Dedicated Outdoor Air System (DOAS) Air Handling Unit (AHU) located on the flat roof slab on the roof level 1.				
	Noise level in all areas shall not exceed NR 30 with the building empty. Contractors shall ensure that this factor is considered during the selection of all equipment.				
	Power supply to the supply fans is measured in the electrical contract.				
	All ductworks, both internal and external, shall have minimum 19mm thick thermal insulation on the outside to reduce heat gain.				
	The DOAS AHU shall be either timed controlled with manual overrides or locally controlled. Contractor is to allow in his quote for control interface to fans.				
	Rectangular and circular GMS ducting to be with longitudinal seams, socket and spigot cross joints supported by stirrups at specified centres plugged and screwed to concrete background for air supply/extract purposes, c/w duct fittings, all as specified and described. Contractor to ensure that the stirrups and rawl bolts sustain the load of the ductwork as well as that pertaining to maintenance. All stirrups to be independent of false ceiling supports. Design calculations for stirrups to be submitted for Structural Engineer's Approval. Ductwork to be manufactured and installed in strict compliance to DW 144. Note: All externally insulated ducts are to be clad with aluminium material for resistance against weather conditions				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Rates shall include for labelling of ducts and fans, direction of flow and colour coding of ducts.				
	Rates shall allow for bends, elbows, tees, transition pieces for connection of rigid to flexible ducts and the like including any other items required for the system.				
	Rates shall allow for control cabling complete with conduit between fans, controllers and override switches.				
	Rates shall allow for the provision of test holes, access traps, plenum boxes and all related accessories in strict compliance with DW 144 and DW 143.				
	Rates shall allow for Testing and Commissioning the whole of the system in accordance with the specifications and demonstration/ instruction of operation to the client.				
	GROUND FLOOR				
	<u>Air duct lines</u>				
	Circular/Rectangular rigid GMS duct supported by clips at 1500 mm centres plugged and screwed to concrete background for extract/supply purposes, all as specified and described. Contractor to ensure that the stirrups sustain the load of the ductwork as well as that pertaining to maintenance. All stirrups to be independent of false ceiling supports.				
	Supply Air Duct				
A	Dia. 80 mm	m	34		
B	Dia. 125 mm	m	88		
C	Dia. 160 mm	m	54		
D	Dia. 200 mm	m	6		
E	Dia. 250 mm	m	12		
F	300 x 250 mm	m	4		
G	400 x 300 mm	m	4		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Return Air Duct				
A	400 x 300 mm	m	8		
	Flexible circular aluminium ducting supported by stirrups at specified centres plugged and screwed to concrete background for supply purposes c/w all accessories. All stirrups to be independent of false ceiling supports.				
B	Dia. 80 mm	m	3		
C	Dia. 125 mm	m	11		
	<u>Volume control damper</u>				
	Circular/ Rectangular galvanised steel damper fixed on duct by flanges supplied complete with manual controller and related accessories. Damper to be selected such that the total system pressure loss can be met by the fans and to provide control as described in schedule.				
D	Dia. 80 mm	nr	7		
E	Dia. 125 mm	nr	22		
	<u>Motorised Damper</u>				
F	Dia. 125 mm	nr	5		
G	Dia. 200 mm	nr	2		
H	Dia. 250 mm	nr	1		
I	400 x 300 mm	nr	2		
	<u>Fire Dampers</u>				
	Galvanised steel damper fixed on Fresh Air Duct as detailed on drawings, supplied complete retractable blade, intumescent joint, fusible link, control mechanism for interface to fire alarm panel and related accessories similar to Circe 4 from France Air. Damper to be selected such that the total system pressure loss can be met by the system.				
J	400 x 300 mm	nr	2		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>Volume control damper</u>				
	Circular/ Rectangular galvanised steel damper fixed on duct by flanges supplied complete with manual controller and related accessories. Damper to be selected such that the total system pressure loss can be met by the fans and to provide control as described in schedule.				
A	Dia. 80 mm	nr	7		
B	Dia. 125 mm	nr	13		
C	Dia. 160 mm	nr	2		
D	Dia. 200 mm	nr	3		
E	Dia. 250 mm	nr	1		
F	300 x 200 mm	nr	1		
G	350 x 250 mm	nr	1		
	<u>Motorised Damper</u>				
H	Dia. 125 mm	nr	9		
I	Dia. 160 mm	nr	2		
J	Dia. 200 mm	nr	2		
K	400 x 300 mm	nr	2		
	<u>Fire Dampers</u>				
	Galvanised steel damper fixed on Fresh Air Duct as detailed on drawings, supplied complete with retractable blade, intumescent joint, fusible link, control mechanism for interface to fire alarm panel and related accessories similar to Circe 4 from France Air. Damper to be selected such that the total system pressure loss can be met by the system.				
L	400 x 300 mm	nr	2		
	<u>Attenuator</u>				
M	400 x 300 mm	nr	2		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>Presence Detector</u>				
A	Ceiling-recessed Passive infrared detector (PIR) with 360° coverage, with 0-59min 59s OFF delay timer, with dual technology.	nr	13		
	<u>Supply Air Diffusers</u>				
B	Square diffuser, 4 way blow type, aluminium material of white colour, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 30 at design flow rate, complete with plenum box, mounting kits, and related accessories, similar and equivalent to DAP 40 type from France Air. Pressure drop not to exceed 15 Pa	nr	26		
	<u>Return Air Diffusers</u>				
C	Square diffuser, aluminium material of white colour, with 15x15mm square mesh, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 25 at design flow rate, complete with plenum box, mounting kits, return air filter grade minimum G3, resistant to fire M and certification, related accessories, similar and equivalent to AC 174 model from Aldes or approved equal. Pressure drop not to exceed 15 Pa.	nr	26		
	<u>SECOND FLOOR</u>				
	<u>Air duct lines</u>				
	Circular/Rectangular rigid GMS duct supported by clips at 1500 mm centres plugged and screwed to concrete background for extract/supply purposes, all as specified and described. Contractor to ensure that the stirrups sustain the load of the ductwork as well as that pertaining to maintenance. All stirrups to be independent of false ceiling supports.				
	<u>Supply Air Duct</u>				
D	Dia. 80 mm	m	14		
E	Dia. 125 mm	m	48		
F	Dia. 160 mm	m	48		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.2		Mechanical and Allied Works	
	Description	Unit	Qty	Rate	Amount
	<u>Fire Dampers</u>				
	Galvanised steel damper fixed on Fresh Air Duct as detailed on drawings, supplied complete retractable blade, intumescent joint, fusible link, control mechanism for interface to fire alarm panel and related accessories similar to Circe 4 from France Air. Damper to be selected such that the total system pressure loss can be met by the system.				
A	400 x 350 mm	nr	2		
	<u>Attenuator</u>				
B	400 x 350 mm	nr	2		
	<u>Presence Detector</u>				
C	Ceiling-recessed Passive infrared detector (PIR) with 360° coverage, with 0-59min 59s OFF delay timer, with dual technology.	nr	10		
	<u>Supply Air Diffusers</u>				
D	Square diffuser, 4 way blow type, aluminium material of white colour, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 30 at design flow rate, complete with plenum box, mounting kits, and related accessories, similar and equivalent to DAP 40 type from France Air. Pressure drop not to exceed 15 Pa	nr	29		
	<u>Return Air Diffusers</u>				
E	Square diffuser, aluminium material of white colour, with 15x15mm square mesh, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 25 at design flow rate, complete with plenum box, mounting kits, return air filter grade minimum G3, resistant to fire M and certification, related accessories, similar and equivalent to AC 174 model from Aldes or approved equal. Pressure drop not to exceed 15 Pa.	nr	29		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Supply Air Diffusers				
A	Square diffuser, 4 way blow type, aluminium material of white colour, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 30 at design flow rate, complete with plenum box, mounting kits, and related accessories, similar and equivalent to DAP 40 type from France Air. Pressure drop not to exceed 15 Pa	nr	33		
	Return Air Diffusers				
B	Square diffuser, aluminium material of white colour, with 15x15mm square mesh, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 25 at design flow rate, complete with plenum box, mounting kits, return air filter grade minimum G3, resistant to fire M and certification, related accessories, similar and equivalent to AC 174 model from Aldes or approved equal. Pressure drop not to exceed 15 Pa.	nr	33		
	FIFTH FLOOR				
	Air duct lines				
	Circular/Rectangular rigid GMS duct supported by clips at 1500 mm centres plugged and screwed to concrete background for extract/supply purposes, all as specified and described. Contractor to ensure that the stirrups sustain the load of the ductwork as well as that pertaining to maintenance. All stirrups to be independent of false ceiling supports.				
	Supply Air Duct				
C	Dia. 80 mm	m	12		
D	Dia. 125 mm	m	86		
E	Dia. 160 mm	m	24		
F	Dia. 200 mm	m	12		
G	Dia. 250 mm	m	12		
H	300 x 250 mm	m	4		
I	400 x 300 mm	m	4		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	Return Air Duct				
A	400 x 300 mm	m	8		
	Flexible circular aluminium ducting supported by stirrups at specified centres plugged and screwed to concrete background for supply purposes c/w all accessories. All stirrups to be independent of false ceiling supports.				
B	Dia. 80 mm	m	1		
C	Dia. 125 mm	m	10		
	<u>Volume control damper</u>				
	Circular/ Rectangular galvanised steel damper fixed on duct by flanges supplied complete with manual controller and related accessories. Damper to be selected such that the total system pressure loss can be met by the fans and to provide control as described in schedule.				
D	Dia. 80 mm	nr	3		
E	Dia. 125 mm	nr	5		
F	Dia. 200 mm	nr	1		
	<u>Motorised Damper</u>				
G	Dia. 125 mm	nr	6		
H	Dia. 160 mm	nr	1		
I	Dia. 200 mm	nr	2		
J	400 x 300 mm	nr	2		
	<u>Fire Dampers</u>				
	Galvanised steel damper fixed on Fresh Air Duct as detailed on drawings, supplied complete retractable blade, intumescent joint, fusible link, control mechanism for interface to fire alarm panel and related accessories similar to Circe 4 from France Air. Damper to be selected such that the total system pressure loss can be met by the system.				
K	400 x 300 mm	nr	2		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
	<u>Attenuator</u>				
A	400 x 300 mm	nr	2		
	<u>Presence Detector</u>				
B	Ceiling-recessed Passive infrared detector (PIR) with 360° coverage, with 0-59min 59s OFF delay timer, with dual technology.	nr	9		
	<u>Supply Air Diffusers</u>				
C	Square diffuser, 4 way blow type, aluminium material of white colour, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 30 at design flow rate, complete with plenum box, mounting kits, and related accessories, similar and equivalent to DAP 40 type from France Air. Pressure drop not to exceed 15 Pa	nr	22		
	<u>Return Air Diffusers</u>				
D	Square diffuser, aluminium material of white colour, with 15x15mm square mesh, for mounting to 600 x 600 mm grid type false ceiling or plaster board false ceiling, with noise level below NR 25 at design flow rate, complete with plenum box, mounting kits, return air filter grade minimum G3, resistant to fire M and certification, related accessories, similar and equivalent to AC 174 model from Aldes or approved equal. Pressure drop not to exceed 15 Pa.	nr	22		
	<u>SIXTH FLOOR</u>				
	<u>Air duct lines</u>				
	Circular/Rectangular rigid GMS duct supported by clips at 1500 mm centres plugged and screwed to concrete background for extract/supply purposes, all as specified and described. Contractor to ensure that the stirrups sustain the load of the ductwork as well as that pertaining to maintenance. All stirrups to be independent of false ceiling supports.				
	<u>Supply Air Duct</u>				
E	Dia. 80 mm	m	12		
F	Dia. 100 mm	m	24		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
A	Dia. 125 mm	m	42		
B	Dia. 160 mm	m	24		
C	Dia. 200 mm	m	20		
D	Dia. 250 mm	m	16		
E	300 x 200 mm	m	4		
F	300 x 250 mm	m	4		
G	400 x 300 mm	m	4		
	Return Air Duct				
H	400 x 300 mm	m	8		
	Flexible circular aluminium ducting supported by stirrups at specified centres plugged and screwed to concrete background for supply purposes c/w all accessories. All stirrups to be independent of false ceiling supports.				
I	Dia. 80 mm	m	2		
J	Dia. 100 mm	m	3		
K	Dia. 125 mm	m	7		
	Volume control damper				
	Circular/ Rectangular galvanised steel damper fixed on duct by flanges supplied complete with manual controller and related accessories. Damper to be selected such that the total system pressure loss can be met by the fans and to provide control as described in schedule.				
L	Dia. 80 mm	nr	5		
M	Dia. 100 mm	nr	1		
N	Dia. 125 mm	nr	6		
O	Dia. 160 mm	nr	3		
P	Dia. 200 mm	nr	1		
Q	Dia. 250 mm	nr	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.2		Mechanical and Allied Works	
	Description	Unit	Qty	Rate	Amount
	Testing & Commisioning, and Sundries				
A	Contractor to allow a sum for all civil works related to the execution of the new mechanical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
B	Testing and commissioning of the whole of the system in accordance with the specifications and demonstration / instruction of operation to the client.	item	1		
C	Allow for the provision of test holes, access traps, plenum boxes and all related accessories in strict compliance with CIBSE Guide B3, DW 144 and DW 143.	item	1		
D	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
	Mechanical & Allied Works Section U10-General Ventilation	66	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
4	U11/U12 - TOILET & KITCHEN VENTILATION				
	Preambles:				
	The following section represents the installation of a toilet ventilation system for the building.				
	The toilet ventilation system for the building is a centralised one. The whole building is served by one toilet extraction system consisting of 2 fans working in duty / standby / auto-changeover mode.				
	The control of the toilet extract fan system shall be done by a single control panel located inside a technical space at the roof level.				
	The control of the fans shall be on a configurable timer basis with the possibility of manual override, manual bypass, presence detectors override and electrical isolation. The control panel of the toilet extract fans shall have a seven days programmable timer to allow the fans to operate for a set period of time. Contractor to ensure that this requirement is taken into consideration.				
	Noise level in all areas shall not exceed NR30 with the building empty. Contractors shall ensure that this factor is considered during the selection of equipment.				
	Power supply to the toilet extract fans is measured in the electrical contract.				
	Rates shall include for labelling of ducts and fans, direction of air flow and colour coding of ducts.				
	Rates shall allow for bends, elbows, tees, transition pieces for connection of rigid to flexible ducts and the like including any other items required for the system to function satisfactorily as per design intent and manufacturers' requirements.				
	Rates shall allow for control cabling complete with conduit between fans, controllers and override switches.				
	Rates shall allow for the provision of test holes, access traps, plenum boxes and all related accessories in strict compliance with DW 144 and DW 143.				
	Mechanical & Allied Works Section U11/U12 - Toilet & Kitchen Ventilation	68	Carried to Collection page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.2		Mechanical and Allied Works
	Description	Unit	Qty	Rate	Amount
5	U13 - CAR PARKING VENTILATION				
A	General servicing of fans and control panel for fans No 1, No 2, and No 3. Troubleshoot, and refurbish Fan No 3 which is currently out of use.	item	1		
B	Control panel for Fan with automatic control	nr	1		
C	Supply grilles, surface mounted of Dimensions 600 x 600 mm, volumetric flow rate = 750 L/s, with a maximum NR 30 acoustic level, similar to GAV 51/52 from France Air.	nr	6		
	Testing & Commissioning, and Sundries				
D	Contractor to allow a sum for all civil works related to the execution of the new mechanical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
E	Testing and commissioning of the whole of the system in accordance with the specifications and demonstration / instruction of operation to the client.	item	1		
F	Allow for the provision of test holes, access traps, plenum boxes and all related accessories in strict compliance with CIBSE Guide B3, DW 144 and DW 143.	item	1		
G	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
	Mechanical & Allied Works Section U13 - Car Parking Ventilation	80	Carried to Collection page		

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BILL No. 2.3 –Electrical and Allied Works

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>INFORMATION PROVIDED</u>				
	The project is the refurbishment of an existing office building located at Pope Hennessy Street Port Louis.				
	The building, of approximately 4,400m2, comprises a basement, ground floor, 1st to 6th floors, and space (technical office and room) at roof level. There is a technical block at ground floor at the back of the building forming part of the main building.				
	The bill of quantities form part of and must be read in conjunction with the Specifications, which contain the full descriptions of the works to be done and material and equipment to be used. Unless otherwise described in these bills of quantities, reference should be made to the Specifications for the full meaning of descriptions of works to be done and materials and equipment to be used in this service.				
	The Contractor shall be responsible for interpreting the drawings, making due allowance for offsets to avoid the building structure or other services, whether indicated or not.				
	The Contractor shall take all necessary steps to fully acquaint himself with the nature and extent of the Works by visiting the site and by inspecting the architectural, structural and other MEP services and demolition works drawings.				
	No claim for loss or expense due to the above factors will be considered.				
	All quantities are provisional and shall be subject to remeasurement after execution of works. The contractor shall ensure that drawings are approved for exact quantities.				
1	C10/C20 - REMOVAL OF COMPLETE SYSTEMS & DEMOLITION				
	<u>Preambles</u>				
	This section refers to the dismantling works comprising removal of complete systems & demolition, and builder's works involved in the refurbishment of the Pope Hennessy building at Port Louis for MAUBANK Ltd.				
	Electrical & Allied Works				
	Section C10/C20 - Removal of Complete systems & Demolition	1	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	All dismantled items shall be kept on site for NOT more than 24 to 48 hours, either on the roof or at the back of the building, depending where the items have been dismantled from, as indicated on the site plan.				
	The Client representative shall countersign all assets removed during the refurbishment project in an asset registry.				
	Upon receiving instructions from the Client for carting away any dismantled parts and equipment, debris, etc., the Client representative shall again countersign on the asset registry and the Contractor shall cart away the asset from the site within 24 hours.				
	The contractor shall be responsible for the dismantling works and proper disposal of all obsolete cables, cable components, and cable containments systems, such as cable trays, wire trays, trunking, etc.				
	The contractor shall be responsible for the safekeeping, stock control of all the existing luminaires, accessories and the like and handover to client at a later stage. Proper records of luminaires and accessories shall be kept and countersigned off before and after handover to Client by Client representative.				
	The contractor shall be required to undertake a pre-bid survey, to access the exact extent of works. All the costs relative to this survey shall be borne by the contractor and shall not be reimbursed by the Client.				
	The Contractor is required to take all necessary health and safety measures to ensure the utmost safety of its personnel and people working in the building during the dismantling works.				
	Electrical isolation shall be done before any existing cables and electrical boards are decommissioned and disconnected. Warning signage shall be used profusely wherever required to warn people and passers by.				
	Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	2	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	All quantities are provisional and shall be subject to remeasurement after execution of works. The contractor shall ensure that drawings are approved for exact quantities.				
	<u>V10 - ELECTRICITY GENERATION PLANT</u>				
	<u>ROOF</u>				
A	Decommission, dismantle, and remove electrical generator plant from electrical room on roof for carting away.	item	1		
	<u>V12 / W10 - LV SUPPLY / PUBLIC UTILITY SUPPLY & TELECOMMUNICATIONS</u>				
B	Cable Trays shall be reused wherever possible as indicated in section V12. Unused cable trays shall be discarded from site/building or handed over to client as per instructions from Consulting Engineer and Client.				
	<u>BASEMENT</u>				
C	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
E	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
	<u>GROUND FLOOR</u>				
D	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
	Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	3	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
	FIRST FLOOR				
B	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
C	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
	SECOND FLOOR				
D	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
E	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
	THIRD FLOOR				
F	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
	Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	4	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
A	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
<u>FOURTH FLOOR</u>					
B	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
C	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
<u>FIFTH FLOOR</u>					
D	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
E	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition		5	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>SIXTH FLOOR</u>				
A	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
B	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
	<u>ROOF</u>				
C	Decommissioning, dismantling, and proper disposal of all obsolete cables, cable components relative to refurbishment work, and drawing series V12, V20, and, V21/V40/V41. This also includes all existing obsolete copper cabling works, trunking, and accessories relative to ELV (telephony, data cabling, etc.)	item	1		
D	Existing cable trays to be decommissioned as per new design drawings, dismantled and removed from original location. The contractor shall allow for stock control, and storage of cable trays in a safe location on site for possible re-use in new design upon instruction from Consulting Engineer.	item	1		
	<u>V20 - LV DISTRIBUTION</u>				
	<u>BASEMENT</u>				
	The contractor shall be responsible to dismantle all existing distribution boards and obsolete cabling works in the basement				
E	Dismantle existing Basement distribution board and cart away from site.	nr.	1		
F	Allow for temporary isolation of main electrical cables as may be required on site.	item	1		
	Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	6	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3	Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	<u>SECOND FLOOR</u>				
	The contractor shall be responsible to dismantle all existing distribution boards and obsolete cabling works on the second floor.				
A	<i>Dismantle existing distribution board on second floor and cart away from site.</i>	<i>nr.</i>	<i>1</i>		
B	<i>Allow for temporary isolation of main electrical cables as may be required on site.</i>	<i>item</i>	<i>1</i>		
	<u>FOURTH FLOOR</u>				
	The contractor shall be responsible to dismantle all existing distribution boards and obsolete cabling works on the fourth floor.				
C	<i>Dismantle existing distribution board on fourth floor and cart away from site.</i>	<i>nr.</i>	<i>1</i>		
D	<i>Allow for temporary isolation of main electrical cables as may be required on site.</i>	<i>item</i>	<i>1</i>		
	<u>FIFTH FLOOR</u>				
	The contractor shall be responsible to dismantle all existing distribution boards and obsolete cabling works on the fifth floor.				
E	<i>Dismantle existing distribution board on fifth floor and cart away from site.</i>	<i>nr.</i>	<i>1</i>		
F	<i>Allow for temporary isolation of main electrical cables as may be required on site.</i>	<i>item</i>	<i>1</i>		
	<u>SIXTH FLOOR</u>				
	The contractor shall be responsible to dismantle all existing distribution boards and obsolete cabling works on the sixth floor.				
G	<i>Dismantle existing distribution board on sixth floor and cart away from site.</i>	<i>nr.</i>	<i>1</i>		
H	<i>Allow for temporary isolation of main electrical cables as may be required on site.</i>	<i>item</i>	<i>1</i>		
	Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	7	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>ROOF</u>				
A	The contractor shall be responsible to decommission, dismantle and remove all defective light fittings & switches on the roof. The contractor shall allow for storage and stock control of the light fittings and switches and handover to client at a later stage. All Emergency lighting fixtures, signage, cable and cable components shall also be dismantled and taken in stock. Replacement with new emergency lighting fixtures, cables and cable components are measured in Bill 2.3.	item	1		
	V22 - GENERAL LV POWER				
	<u>BASEMENT</u>				
B	The contractor shall be responsible to decommission, dismantle and replace all damaged and defective sockets, and install new sockets where required. The contractor shall allow for storage and stock control of damaged and defective sockets and handover to client at a later stage. Replacement of sockets are measured in Bill 2.3.	item	1		
	<u>GROUND FLOOR</u>				
C	The contractor shall be responsible to decommission, dismantle and replace all damaged and defective sockets, and install new sockets where required. The contractor shall allow for storage and stock control of damaged and defective sockets and handover to client at a later stage. Replacement of sockets are measured in Bill 2.3.	item	1		
	<u>FIRST FLOOR</u>				
D	The contractor shall be responsible to decommission, dismantle and replace all damaged and defective sockets, and install new sockets where required. The contractor shall allow for storage and stock control of damaged and defective sockets and handover to client at a later stage. Replacement of sockets are measured in Bill 2.3.	item	1		
	Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	11	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>SIXTH FLOOR</u>				
A	<i>The contractor shall be responsible to decommission, dismantle and replace all damaged and defective sockets, and install new sockets where required. The contractor shall allow for storage and stock control of damaged and defective sockets and handover to client at a later stage. Replacement of sockets are measured in Bill 2.3.</i>	item	1		
	<u>ROOFTOP</u>				
B	<i>The contractor shall be responsible to decommission, dismantle and replace all damaged and defective sockets, and install new sockets where required. The contractor shall allow for storage and stock control of damaged and defective sockets and handover to client at a later stage. Replacement of sockets are measured in Bill 2.3.</i>	item	1		
	Electrical & Allied Works Section C10/C20 - Removal of Complete systems & Demolition	13	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
2	V12 - LV SUPPLY & PUBLIC UTILITY SUPPLY				
	<u>Preambles</u>				
	This section represents the installation works associated with the incoming power supply to the development.				
	An existing 250kVA transformer is currently supplying the building. The transformer is located outside at the south east corner of the building under a shed covered with corrugated iron sheets.				
	A 105kVA prime rated generator is already present on site. It is to be noted that air conditioning load will be shed off for non-critical zone, that is capable of taking the full building electrical load. Control cabling between the generator control panel and the Automatic changeover switch will be carried out by the electrical contractor.				
	The Automatic Transfer Switch Panel shall be provided by the electrical contractor. The electrical contractor will be required to assist the generator contractor for the connection of the control cabling to the ATSP.				
	The contractor will be required to liaise with the CEB for all works pertaining to the supply of electricity to fit in the schedule of works.				
	Copper cables shall be used for power distribution. Cables feeding distribution boards shall be XLPE insulated cables to BS 5467.				
	Existing cable trays/cables shall be decommissioned as per new design drawings, dismantled, removed from original location and stored by contractor in a safe location on site. This item shall be measured in BOQ-C10/C20.				
	Dismantled cables/cable trays shall be cleaned on site and reused as may be instructed by the consulting engineer.				
	Unused cables/cable trays shall be discarded from site/building or handed over to client as per instructions from consulting engineer and client.				
	Electrical & Allied Works	15	Carried to		
	Section V12-LV Supply & Public Utility Supply		Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Extra-over				
A	Liaison with the CEB for all works pertaining to the transformer room and metering cubicle where only CEB has access. This shall include but not restricted to the following works to be undertaken by the contractor: - Calling the engineers, technicians/officers of the concerned CEB section for verification of all civil works including any alteration to the existing transformer room, cable ladders/trays, access doors to the transformer room, access doors to the metering/busbar/breaker cubicles. - Calling the engineers, technicians/officers of the concerned CEB section to intervene on site for any works related to laying of HV sleeves, installation of RMU, installation of transformers, installation of the HV and LV switchgears, etc. - Attend to any additional requirements that are requested by the engineers, technicians/officers of the concerned CEB section during the construction stage.	item	1		
B	Supply and install wall-mounted solid marine board for fixation of CEB meter, breaker cubicle c/w related fixing accessories, all in accordance with the CEB governing specifications.	item	1		
	Testing & Commissioning and Sundries				
C	Allow a sum for the refurbishment of the existing genset of 105 kVA which shall include: General Maintenance with normal consumables, Replacement of AVR, Replacement of AMF	item	1		
D	Allow a sum for the reconstruction of the RMU and the transformer room	Item	1		
E	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
	Electrical & Allied Works Section V12-LV Supply & Public Utility Supply	18	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
3	V20 - LV DISTRIBUTION				
	Preambles				
	This section represents the LV distribution associated with the project.				
	All the feeder cables and some of the final circuit cables are measured in this section. The rest of the final circuit cables which are mainly for lighting and socket points are measured in section V21-V40 and V22 sections respectively.				
	All quantities are provisional and shall be remeasured after execution of works. The contractor shall ensure that drawings are approved for exact quantities.				
	Contractor shall provide Intumescent fire proof stopping compounds to BS 476-22, barriers, seals, mortar, mastic with fire-rated material for all perforations and penetrations through walls/slabs/ceilings of make similar or equivalent to Astroflame and of European Origin.				
	The contractor shall allow in his quote for all other items that he deems necessary for the successful completion of the installation. Any such items shall be clearly highlighted in the offer and accompanied with a breakdown.				
	CEB Switch - Moulded Case Circuit Breakers				
A	<i>Adjustable MCCB, TPN 400A with LSI protection including earth fault leakage sensor and adjustable earth fault relay for switching, rated current to be 630 A at 50 °C, 50 kA Icu at 380/415 V AC 50Hz conforming to IEC 60947-2, complete with all fixation accessories and cable terminations. Specifications of MCCB shall comply fully with the requirements of the CEB.</i>	nr	1		
	Electrical & Allied Works Section V20-LV Distribution	21	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Automatic Transfer Switch Panel (ATSP)</u>				
	Automatic Transfer Switch Panel (ATSP) with 2 Nos. 400/400A, 4 pole, transfer switches, electrically and mechanically interlocked with base frame and controller having selector switch for automatic & forced operation on normal and emergency sources. ATS must have monitoring of normal source, automatic changeover, test facility, transfer switches' status indication (Essential, Normal), 3 phase Under-voltage protection and Phase Sequence Protection inbuilt in the controller or separately provided. ATS must have indicators, ventilation unit, protective devices, isolators, keys and barrel locks. 4P 400A Switch disconnectors integrated in the ATS to be provided for both incoming normal and essential power. Contractor shall refer to schedule for other details of the ATSP.				
A	ATSP rated at 4P 400A	nr	1		
	<u>Main Low Voltage Switchboard</u>				
	The Main Low Voltage Switchboard shall be located in the electrical room of the basement and the dimensions of the electrical room are (L x W): 2.7m x 1.5m.				
	Low Voltage Switchboard, floor or wall-mounted panel of Form 2b separation with 30% spare space, bottom/top cable entry as appropriate for location where switchboard is to be fixed c/w busbar sized and rated as per schematic, ventilation unit, protective devices, phase indicators, door mounted multi-function metering & measurement units with ModBus Rs-485 interface for communications, voltage surge protectors, circuit breakers, control devices, switch disconnector, control cabling, locks and keys and related accessories as per tender drawings. DIN rail mounted smart multifunction energy meter for measurement of voltage, line current, power factor, power & energy to be provided as shown in tender drawings. The meters shall conform to standards IEC 62053-21/23, IEC 62052-11 and IEC 61010-1, to have MID compliance, for connection with current transformers (CTs) of 5A - 4 modules and having network connectivity via RS-485, ModBus and pulse output. RS 485 to IP Ethernet TCP/IP converter module to be provided. VERY IMPORTANT: Contractor to ensure that the electrical distribution board fit in a maximum width of 2500mm.				
	Electrical & Allied Works Section V20-LV Distribution	22	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	MLVS	nr.	1		
B	Provision of a metallic support made of hot dipped galvanised steel of 300mm height to support the main distribution board in the electrical room.	Item	1		
	Sub Low Voltage Switchboard				
	Sub-Distribution Boards, wall-mounted panel of Form 2b separation with 30% spare space, bottom incoming main cable entry, top outgoing final circuit cables c/w busbar sized and rated as per schematic, ventilation unit, protective device, phase indicators, smart micromodules, energy meters, voltage surge protectors, circuit breakers, control devices, switch disconnecter, control cabling, locks and keys and related accessories as per tender drawings. DIN rail mounted smart multifunction energy meter for measurement of voltage, line current, power factor, power & energy to be provided as shown in tender drawings.				
	Fed from MLVS:				
C	DB-B	nr.	1		
D	DB-GF (provisional)	nr	1		
E	DB-1F (provisional)	nr	1		
F	DB-2F	nr	1		
G	DB-3F (provisional)	nr	1		
H	DB-4F	nr	1		
I	DB-5F	nr	1		
J	DB-6F	nr	1		
K	DB-ROOF	nr	1		
L	DB-B-MECH	nr	1		
	Fed from DB-ROOF:				
M	DB-ROOF-MECH	nr	1		
	Electrical & Allied Works Section V20-LV Distribution	23	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Main feeders - Low Voltage Conductors (multi-core cables)</u>				
	Low Voltage steel wire armoured cables, XLPE insulated, LSF, copper conductors complying to BS5467 / IEC 60502-1, c/w glands, terminations and all accessories supplied and installed as detailed and specified. Separate copper cable to be used as circuit protective conductor (cpc) where indicated, as measured below. All cables to have LSF Insulation.				
	From 250kVA TX to ATSP				
A	1 run of multi-core 240 mm ² conductor, three (3) Phase and one (1) Neutral - total length measured for the three phases and one neutral.	m	60		
	From 105kVA generator to ATSP				
B	1 run of multi-core 120 mm ² conductor, three (3) Phase and one (1) Neutral - total length measured for the three phases and one neutral.	m	45		
	From ATSP to MLVP				
C	1 run of multi-core 240 mm ² conductor, three (3) Phase and one (1) Neutral - total length measured for the three phases and one neutral.	m	10		
	<u>Main feeders - Circuit Protective Conductors (single-core cables)</u>				
	Low Voltage steel wire armoured cables, PVC insulated, LSF, copper conductors complying to MS 274 / BS 6346 / IEC 60502-1, c/w glands, terminations and all accessories supplied and installed as detailed and specified. All cables to have LSF Insulation. CPC to be insulated Yellow/Green stripe.				
	From 105kVA generator to ATSP				
D	1 run of Single core 70 mm ² - total length measured (provisional)	m	45		
	From ATSP to MLVP				
E	1 run of Single core 120 mm ² - total length measured	m	8		
	Electrical & Allied Works Section V20-LV Distribution	24	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Sub Feeders / Final circuit cables - Low Voltage Conductors (Multicore cables)</u>				
	Low Voltage steel wire armoured cables, XLPE insulated, LSF, copper conductors complying to BS5467 / IEC 60502-1, c/w glands, terminations and all accessories supplied and installed as detailed and specified. Separate copper cable to be used as circuit protective conductor (cpc) where indicated, as measured below. All cables to have LSF Insulation.				
	From MLVP to				
A	DB-B, 1x1x5c 6 mm2	m	12		
B	DB-GF, 1x1x5c 6 mm2	m	15		
C	DB-1F, 1x1x5c 6 mm2	m	20		
D	DB-2F, 1x1x5c 6 mm2	m	25		
E	DB-3F, 1x1x5c 6 mm2	m	30		
F	DB-4F, 1x1x5c 6 mm2	m	35		
G	DB-5F, 1x1x5c 6 mm2	m	40		
H	DB-6F, 1x1x5c 6 mm2	m	45		
I	DB-ROOF, 1x1x4c 95 mm2 + CPC 50 mm2 (multicore 3P+N and separate CPC)	m	50		
J	DB-B-Mech, 1x1x5c 16 mm2	m	45		
	From DB-ROOF to				
K	DB-ROOF-MECH, 1x1x4c 95 mm2 + CPC 50 mm2 (multicore 3P+N and separate CPC)	m	8		
Electrical & Allied Works Section V20-LV Distribution		25	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Sub Feeders / Final circuit cables - Low Voltage Conductors (Multicore cables)</u>				
	Low Voltage steel wire armoured cables, PVC insulated, LSF, copper conductors complying to MS 274 / BS 6346 / IEC 60502-1, c/w glands, terminations and all accessories supplied and installed as detailed and specified. All cables to have LSF Insulation. CPC to be insulated Yellow/Green stripe.				
	From DB-ROOF-MECH to				
A	3P+N+E 16A switch disconnecter for toilet extract fan (Duty), 1x1x5c 2.5mm2 (multicore 3P+N+E)	m	8		
B	3P+N+E 16A switch disconnecter for toilet extract fan (Stand-by), 1x1x5c 2.5mm2 (multicore 3P+N+E)	m	8		
C	3P+N+E 63A switch disconnecter for AHU fresh air, 1x1x5c 25mm2 (multicore 3P+N+E)	m	8		
	From DB-ROOF-MECH to VRF Cluster 1				
D	3P+N+E 50A switch disconnecter for Outdoor unit no.1 of VRF unit of cluster 1, 1x1x5c 16mm2 (multicore 3P+N+E)	m	25		
E	3P+N+E 50A switch disconnecter for Outdoor unit no.2 of VRF unit of cluster 1, 1x1x5c 16mm2 (multicore 3P+N+E)	m	27		
F	3P+N+E 50A switch disconnecter for Outdoor unit no.3 of VRF unit of cluster 1, 1x1x5c 16mm2 (multicore 3P+N+E)	m	30		
	From DB-ROOF-MECH to VRF Cluster 2				
G	3P+N+E 50A switch disconnecter for Outdoor unit no.1 of VRF unit of cluster 2, 1x1x5c 16mm2 (multicore 3P+N+E)	m	25		
H	3P+N+E 50A switch disconnecter for Outdoor unit no.2 of VRF unit of cluster 2, 1x1x5c 16mm2 (multicore 3P+N+E)	m	27		
I	3P+N+E 50A switch disconnecter for Outdoor unit no.3 of VRF unit of cluster 2, 1x1x5c 16mm2 (multicore 3P+N+E)	m	30		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	From DB-ROOF-MECH to VRF Cluster 3				
A	3P+N+E 50A switch disconnecter for Outdoor unit no.1 of VRF unit of cluster 3, 1x1x5c 16mm2 (multicore 3P+N+E)	m	25		
B	3P+N+E 50A switch disconnecter for Outdoor unit no.2 of VRF unit of cluster 3, 1x1x5c 16mm2 (multicore 3P+N+E)	m	27		
C	3P+N+E 50A switch disconnecter for Outdoor unit no.3 of VRF unit of cluster 3, 1x1x5c 16mm2 (multicore 3P+N+E)	m	30		
	From DB-B-MECH to				
D	3P+N+E 32A switch disconnecter for combined cold water and Fire-Hose Reel pump set, 1x1x5c 6mm2 (multicore 3P+N+E)	m	45		
E	3P+N+E 32A switch disconnecter for sprinkler pump set, 1x1x5c 6mm2 (multicore 3P+N+E)	m	45		
	From ATSP to DB Switches for load shedding				
F	Load shedding cable, 1x1x3c 1.5mm2	m	70		
	Sub Feeders / Final circuit cables - Low Voltage Conductors (Multicore cables)				
	Fire resistant, low voltage steel wire armoured cables, PVC insulated, LSF, copper conductors complying to MS 274 / BS 6346 / IEC 60502-1, c/w glands, terminations and all accessories supplied and installed as detailed and specified. The cables shall be of at least 1-hour fire resistance in accordance with BS 6387.				
	From DB-B-Mech to				
G	3P+N+E 16A switch disconnecter for Car Park Extract Fan 1, 1x1x5c 2.5mm2 (multicore 3P+N+E)	m	30		
H	3P+N+E 16A switch disconnecter for Car Park Extract Fan 2, 1x1x5c 2.5mm2 (multicore 3P+N+E)	m	35		
I	3P+N+E 16A switch disconnecter for Car Park Extract Fan 3, 1x1x5c 2.5mm2 (multicore 3P+N+E)	m	40		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	3P+N+E 16A switch disconnecter for Car Park Extract Fan 4, 1x1x5c 2.5mm2 (multicore 3P+N+E)	m	65		
	The cables shall run in GMS tube, fixed to soffit of basement.				
	GMS Tube to be of diameter 20mm, painted red, complete with all fittings, accessories and fixations				
	Protective GMS Tube for power cable from DB-B-Mech to:				
B	Car Park Extract Fan 1	m	30		
C	Car Park Extract Fan 2	m	35		
D	Car Park Extract Fan 3	m	40		
E	Car Park Extract Fan 4	m	65		
	<u>Earthing cable - Low Voltage Conductors (Single-core)</u>				
	Low Voltage steel wire armoured cables, XLPE insulated, LSF, copper conductors complying to BS5467 / IEC 60502-1, c/w glands, terminations and all accessories supplied and installed as detailed and specified. Separate copper cable to be used as circuit protective conductor (cpc). All cables to have LSF Insulation. CPC to be insulated Yellow/Green stripe.				
	From MLVP to Main Earth Bar (MEB)				
F	1x1x1c 120 mm2 (provisional)	m	5		
	<u>Switchgear</u>				
	Switch disconnectors for power supply to fixed equipment c/w IP 65 PVC enclosure for rating less than 50A and IP 65 Metallic enclosure for rating above, all as specified and detailed. For fixed equipment, exact position to be co-ordinated with mechanical services drawings.				
	<u>Basement</u>				
G	Switch disconnecter for Car Park Extract Fan, 4P 16A c/w IP65 Metallic enclosure.	nr.	4		
	Electrical & Allied Works Section V20-LV Distribution	28	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
B	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
C	Allow a sum for the repositioning of the existing newer distribution boards (DBs) on Ground, First and Third Floors and reconnection to existing cables and/or new cables.	item	1		
D	Allow a sum for cable dressing of existing cables on new cable trays in electrical room and at all floors wherever required.	item	1		
E	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications and the IEE regulations.	item	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
4	V21 / V40 - GENERAL & EMERGENCY LIGHTING				
	<u>Preambles</u>				
	<u>Background to Project & Scope of Works</u>				
	The project concerns the refurbishment of an existing office building located at Pope Hennessy Street Port Louis				
	The building consists of a basement, ground floor, 1st to 6th floors, a lower roof level and an upper roof level.				
	The scope of works for the refurbishment w.r.t this section, consists of all floors and areas.				
	The scope of works encompasses:				
	• Builder's works for passing of new services • Making good of existing areas • Installation of new Luminaires and accessories				
	The following section represents the installation of general, emergency, and external lighting within the building as detailed in the V21/V40/V41 drawing series.				
	This section comprises all cabling works from electrical distribution boards to all general, emergency & external light fittings via local switches, timers, presence/motion detectors.				
	The contractor is to determine the exact quantity of conduits, conduits boxes, fittings and sleeves required and include in the bid.				
	Light fittings shall be procured by the contractor. The Contractor shall be required to ensure timely delivery, management and installation of light fittings on site.				
	All accessories shall be approved by the Client/Architect/ID prior to procurement. Contractor shall be required to submit sample for approval.				
	Trunking shall be included in the rate for wiring point. The contractor is to determine the exact quantity of trunking required and include in the bid.				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	The contractor shall be required to include in his offer all required materials/equipments needed to comply with the lighting strategy. Any such item shall be clearly highlighted in the offer.				
	Rates shall include for testing and commissioning of the whole of the foregoing installation.				
	<u>BASEMENT</u>				
	<u>Wiring points</u>				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
A	3 core 1.5 sq mm from distribution board to light points.	nr	17		
B	3 core 1.5 sq mm to switch	nr	6		
	<u>Light fittings</u>				
C	Type B - LED Batten 40W, IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in pump room	nr	6		
D	Type B/E - LED Batten 40W c/w emergency battery pack, IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in pump room	nr	3		
E	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	1		
F	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	3		
G	Type E3 - Illuminated Emergency Escape sign - Arrow Right, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	1		
H	Type E4 - Illuminated Emergency Escape sign - Arrow Left, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Light fittings</u>				
A	Type A -LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	70		
B	Type A/E -LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	17		
C	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	7		
D	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	5		
E	Type C - LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	6		
F	Type C/E- LED circular panel c/w emergency battery pack, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	3		
G	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	23		
H	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	8		
I	Type I1- Recessed downlight, 19W, 2250 lm, 118 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus II S PRE in entrance lobby on ground floor	nr	5		
J	Type I1/E - Recessed downlight, 19W, c/w emergency battery pack, 2250 lm, 118 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus II S PRE in entrance lobby on ground floor	nr	4		
K	Type I2 - Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover	nr	8		
	Electrical & Allied Works Section V21/V40-General & Emergency Lighting	35	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
A	Type L - Pendant Light, 31W, Black Colour, 2700 lm, 4000k, similar or equivalent to SLV Supros PD, Prod No 1003278 above entrance lobby table	nr	2		
B	Type J - LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON in electrical room, Misc room	nr	3		
C	Type S -LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	6		
D	Type S/E -LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	6		
	<u>Accessories</u>				
	<u>Switches c/w boxes and face plates.</u>				
E	Dual technology ceiling-mounted motion detector for indoor use 360° detection area, Coverage: 10mx10m, with adjustable 30sec-30minutes OFF time delay, In-built light level sensor similar to DT-355 from LEGRAND.	nr	8		
F	Switch 1 way 1 gang similar to Legrand Synergy (provisional)	nr	21		
G	Switch 1 way 2 gang similar to Legrand Synergy (provisional)	nr	2		
H	Switch 2 way 1 gang similar to Legrand Synergy (provisional)	nr	3		
I	Switch 2 way 2 gang similar to Legrand Synergy (provisional)	nr	4		
J	Push button	nr	3		
	<u>Sundries</u>				
K	Labelling of all circuits and switches.	item.	1		
L	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
	Electrical & Allied Works Section V21/V40-General & Emergency Lighting	36	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	FIRST FLOOR				
	Wiring points				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
A	3 core 1.5 sq mm from distribution board to light points.	nr	148		
B	3 core 1.5 sq mm to switch	nr	31		
C	3 core 1.5 sq mm to presence detector	nr	5		
	Light fittings				
D	Type A -LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	44		
E	Type A/E -LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	20		
F	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	2		
G	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	3		
H	Type C - LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	14		
I	Type C/E- LED circular panel c/w emergency battery pack, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	10		
J	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	20		
	Electrical & Allied Works Section V21/V40-General & Emergency Lighting	37	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	3		
B	Type H - Pendant light, White with LED, 7.5W, 800 lm, 2500K, similar or equivalent to SLV, FITU E27, Product No 132691 with LED Prod. No 1005265 on ceiling void on first floor	nr	9		
C	Type I2 - Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover	nr	2		
D	Type J - LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON in electrical room, Misc room	nr	3		
E	Type K - Downlight, 20W, White Colour, 2120 lm, UGR 16 similar or equivalent to SLV Numinos M, Ø 8.5, Dali, 4000K, Prod No 1004527 on ceiling void on first floor	nr	8		
F	Type S -LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	5		
G	Type S/E -LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	5		
	<u>Accessories</u>				
	<u>Switches c/w boxes and face plates.</u>				
H	Dual technology ceiling-mounted motion detector for indoor use 360° detection area, Coverage: 10mx10m, with adjustable 30sec-30minutes OFF time delay, In-built light level sensor similar to DT-355 from LEGRAND.	nr	5		
I	Switch 1 way 1 gang similar to Legrand Synergy (provisional)	nr	22		
J	Switch 1 way 2 gang similar to Legrand Synergy (provisional)	nr	3		
K	Switch 2 way 1 gang similar to Legrand Synergy (provisional)	nr	1		
	Electrical & Allied Works Section V21/V40-General & Emergency Lighting	38	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3	Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
A	Switch 2 way 2 gang similar to Legrand Synergy (provisional)	nr	2		
B	Push button	nr	3		
	Sundries				
C	Labelling of all circuits and switches.	item.	1		
D	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
	SECOND FLOOR				
	Wiring points				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
E	3 core 1.5 sq mm from distribution board to light points.	nr	148		
F	3 core 1.5 sq mm to switch	nr	30		
G	3 core 1.5 sq mm to presence detector	nr	5		
	Light fittings				
H	Type A -LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	43		
I	Type A/E -LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	19		
J	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	2		
K	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	3		
	Electrical & Allied Works Section V21/V40-General & Emergency Lighting	39	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Light fittings</u>				
A	Type A -LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	47		
B	Type A/E -LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	14		
C	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	2		
D	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	3		
E	Type C - LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	16		
F	Type C/E- LED circular panel c/w emergency battery pack, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	15		
G	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	22		
H	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	3		
I	Type E3 - Illuminated Emergency Escape sign - Arrow Right, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	3		
J	Type I2 - Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover	nr	2		
K	Type J - LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON in electrical room, Misc room	nr	3		
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	Section V21/V40-General & Emergency Lighting				

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Type S -LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	7		
B	Type S/E -LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	8		
	<u>Accessories</u>				
	<u>Switches c/w boxes and face plates.</u>				
C	Dual technology ceiling-mounted motion detector for indoor use 360° detection area, Coverage: 10mx10m, with adjustable 30sec-30minutes OFF time delay, In-built light level sensor similar to DT-355 from LEGRAND.	nr	7		
D	Switch 1 way 1 gang similar to Legrand Synergy (provisional)	nr	20		
E	Switch 1 way 2 gang similar to Legrand Synergy (provisional)	nr	5		
F	Switch 2 way 1 gang similar to Legrand Synergy (provisional)	nr	2		
G	Push button	nr	3		
	<u>Sundries</u>				
H	Labelling of all circuits and switches.	item.	1		
I	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>FOURTH FLOOR</u>				
	<u>Wiring points</u>				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
A	3 core 1.5 sq mm from distribution board to light points.	nr	165		
B	3 core 1.5 sq mm to switch	nr	34		
C	3 core 1.5 sq mm to presence detector	nr	10		
	<u>Light fittings</u>				
D	Type A -LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	51		
E	Type A/E -LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	23		
F	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	2		
G	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	3		
H	Type C - LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	19		
I	Type C/E- LED circular panel c/w emergency battery pack, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	18		
J	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	30		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	3		
B	Type E3 - Illuminated Emergency Escape sign - Arrow Right, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	1		
C	Type E4 - Illuminated Emergency Escape sign - Arrow Left, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	1		
D	Type I2 - Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover	nr	2		
E	Type J - LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON in electrical room, Misc room	nr	3		
F	Type S -LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	5		
G	Type S/E -LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	4		
	<u>Accessories</u>				
	<u>Switches c/w boxes and face plates.</u>				
H	Dual technology ceiling-mounted motion detector for indoor use 360° detection area, Coverage: 10mx10m, with adjustable 30sec-30minutes OFF time delay, In-built light level sensor similar to DT-355 from LEGRAND.	nr	10		
I	Switch 1 way 1 gang similar to Legrand Synergy (provisional)	nr	21		
J	Switch 1 way 2 gang similar to Legrand Synergy (provisional)	nr	4		
K	Switch 2 way 1 gang similar to Legrand Synergy (provisional)	nr	6		
L	Push button	nr	3		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Sundries</u>				
A	Labelling of all circuits and switches.	item.	1		
B	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
	<u>FIFTH FLOOR</u>				
	<u>Wiring points</u>				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
C	3 core 1.5 sq mm from distribution board to light points.	nr	144		
D	3 core 1.5 sq mm to switch	nr	23		
E	3 core 1.5 sq mm to presence detector	nr	10		
	<u>Light fittings</u>				
F	Type A -LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	75		
G	Type A/E -LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	18		
H	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	2		
I	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	3		
J	Type C - LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	8		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Type C/E- LED circular panel c/w emergency battery pack, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	7		
B	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	13		
C	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	3		
D	Type E3 - Illuminated Emergency Escape sign - Arrow Right, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	1		
E	Type I2 - Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover	nr	2		
F	Type J - LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON in electrical room, Misc room	nr	3		
G	Type S -LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	5		
H	Type S/E -LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	4		
	<u>Accessories</u>				
	<u>Switches c/w boxes and face plates.</u>				
I	Dual technology ceiling-mounted motion detector for indoor use 360° detection area, Coverage: 10mx10m, with adjustable 30sec-30minutes OFF time delay, In-built light level sensor similar to DT-355 from LEGRAND.	nr	10		
J	Switch 1 way 1 gang similar to Legrand Synergy (provisional)	nr	12		
K	Switch 1 way 2 gang similar to Legrand Synergy (provisional)	nr	6		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3	Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
A	Switch 2 way 2 gang similar to Legrand Synergy (provisional)	nr	2		
B	Push button	nr	3		
	Sundries				
C	Labelling of all circuits and switches.	item.	1		
D	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
	SIXTH FLOOR				
	Wiring points				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
E	3 core 1.5 sq mm from distribution board to light points.	nr	140		
F	3 core 1.5 sq mm to switch	nr	29		
G	3 core 1.5 sq mm to presence detector	nr	4		
	Light fittings				
H	Type A -LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	47		
I	Type A/E -LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE for office spaces	nr	17		
J	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	2		
K	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	3		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Type C - LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	16		
B	Type C/E- LED circular panel c/w emergency battery pack, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN in corridors/lobbies	nr	14		
C	Type D - Suspended LED Batten, 48W 1.5M IP20 , 4000K similar or equivalent to ROBUS CAESAR for meeting rooms	nr	2		
D	Type D/E - Suspended LED Batten c/w emergency battery pack, 48W 1.5M IP20 , 4000K similar or equivalent to ROBUS CAESAR for meeting rooms	nr	3		
E	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	19		
F	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	3		
G	Type I2 - Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover	nr	2		
H	Type J - LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON in electrical room, Misc room	nr	3		
I	Type S -LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	5		
J	Type S/E -LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	4		
	Electrical & Allied Works Section V21/V40-General & Emeragncy Lighting	49	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	<u>Accessories</u>				
	<u>Switches c/w boxes and face plates</u>				
A	Dual technology ceiling-mounted motion detector for indoor use 360° detection area, Coverage: 10mx10m, with adjustable 30sec-30minutes OFF time delay, In-built light level sensor similar to DT-355 from LEGRAND.	nr	4		
B	Switch 1 way 1 gang similar to Legrand Synergy (provisional)	nr	15		
C	Switch 1 way 2 gang similar to Legrand Synergy (provisional)	nr	7		
D	Switch 2 way 2 gang similar to Legrand Synergy (provisional)	nr	4		
E	Push button	nr	3		
	<u>Sundries</u>				
F	Labelling of all circuits and switches.	item.	1		
G	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
	<u>ROOF</u>				
	<u>Wiring points</u>				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
H	3 core 1.5 sq mm from distribution board to light points.	nr	13		
I	3 core 1.5 sq mm to switch	nr	7		
	<u>Light fittings</u>				
J	Type B - LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	3		
	Electrical & Allied Works Section V21/V40-General & Emeragncy Lighting	50	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	Type B/E - LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN in technical rooms, toilet corridors, kitchen and technical offices on roof	nr	2		
B	Type E1 - Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	2		
C	Type E2 - Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS	nr	2		
D	Type J - LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON in electrical room, Misc room	nr	2		
E	Type S/E -LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE	nr	2		
	<u>Accessories</u>				
	<u>Switches c/w boxes and face plates.</u>				
F	Switch 1 way 1 gang similar to Legrand Synergy (provisional)	nr	4		
G	Switch 1 way 2 gang similar to Legrand Synergy (provisional)	nr	1		
H	Push button	nr	2		
	<u>Sundries</u>				
I	Labelling of all circuits and switches.	item.	1		
J	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
5	V22 - GENERAL LV POWER				
	<u>Preambles</u>				
	Conduit will be included in the rate for wiring point. The contractor is to determine the exact quantity of flexible/rigid conduit required and include in the bid.				
	All cable trays are measured elsewhere.				
	All power outlets will comply with BS 1363:Part 2.				
	2 gang socket outlets have been measured as a single socket outlet for wiring purposes only.				
	All power sockets, fused spurs and double pole switches will be flush mounted with rust proof screws and will be of make Legrand Synergy or similar equivalent. Exact color finish of outlet is provisional and can be subject to change. Legrand Plexo grey finish or a similar equivalent will be used for waterproof sockets.				
	Samples of all accessories will be submitted to the Consulting Engineer for approval prior to procurement.				
	The contractor will refer to the Mechanical services drawings for the exact location of all mechanical equipment.				
	The contractor will be required to ensure proper coordination of services with other trades. The contractor will be required to liaise and coordinate with other trade installers for provision of conduits and power cables to mechanical and electrical equipment of the building as required.				
	All quantities are provisional and will be subject to remeasurement after execution of works. The contractor will ensure that the shop drawings are approved for exact quantities.				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	Basement				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
A	Power supply to General Purpose Socket in Pump Room with 3 core 2.5mm2 cable.	nr.	1		
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
B	General Purpose Socket, 1x13A	nr.	1		
	Ground Floor				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
C	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm2 cable.	nr.	11		
D	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm2 cable.	nr.	2		
	Electrical & Allied Works Section V22-General LV Power	55	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
A	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	11		
B	General Purpose Socket, 1x13A	nr.	1		
	First Floor				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
C	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm2 cable.	nr.	16		
D	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm2 cable.	nr.	2		
E	Power supply to AC units in IT room with 3 core 4mm2 cable	nr.	2		
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
F	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	16		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
A	General Purpose Socket, 1x13A	nr.	1		
	Second Floor				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
B	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm2 cable.	nr.	14		
C	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm2 cable.	nr.	2		
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
D	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	14		
E	General Purpose Socket, 1x13A	nr.	1		
	Third Floor				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
F	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm2 cable.	nr.	15		
G	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm2 cable.	nr.	2		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
A	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	15		
B	General Purpose Socket, 1x13A	nr.	1		
	Fourth Floor				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
C	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm ² cable.	nr.	16		
D	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm ² cable.	nr.	2		
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
E	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	16		
F	General Purpose Socket, 1x13A	nr.	1		
	Electrical & Allied Works				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Fifth Floor				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
A	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm2 cable.	nr.	9		
B	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm2 cable.	nr.	2		
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
C	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	9		
D	General Purpose Socket, 1x13A	nr.	1		
	Sixth Floor				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
E	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm2 cable.	nr.	16		
F	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm2 cable.	nr.	2		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
A	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	16		
B	General Purpose Socket, 1x13A	nr.	1		
	Roof-top				
	Final Sub Circuits				
	Wiring in concealed conduits/ trunking, sleeves buried in ground, surface conduits / laid on trays etc using three core flexible copper cables c/w conduits, conduit boxes and all related accessories all as specified, detailed and described including flexible conduit connections/ terminations to sockets and equipment from sub distribution boards. All outlets to be properly earthed.				
C	Power supply to 20A DP switch for VRF Indoor units with 3 core 2.5mm ² cable.	nr.	2		
D	Power supply to General Purpose Socket in Mech and Elec Room with 3 core 2.5mm ² cable.	nr.	2		
	Accessories				
	Accessories for recess or surface mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Synergy or Plexo for waterproof sockets.				
E	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling	nr.	2		
F	4P 50A Proximity Switching Isolating Switch (Rotary Isolator), IP 65, with auxiliary contact similar or equivalent to Legrand for Outdoor unit	nr.	9		
	Electrical & Allied Works Section V22-General LV Power	60	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Sub Feeders / Final circuit cables - Low Voltage Conductors (Multicore cables)</u>				
	Low Voltage steel wire armoured cables, PVC insulated, LSF, copper conductors complying to MS 274 / BS 6346 / IEC 60502-1, c/w glands, terminations and all accessories supplied and installed as detailed and specified. All cables to have LSF Insulation. CPC to be insulated Yellow/Green stripe.				
	From DB-B to				
A	General Purpose Socket in Pump Room with 3 core 2.5mm ² cable.	m	25		
	From DB-GF to				
B	General Purpose Socket in Mech Room with 3 core 2.5mm ² cable.	m	25		
C	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm ²	m	200		
	From DB-1F to				
D	General Purpose Socket in Mech Room with 3 core 2.5mm ² cable.	m	25		
E	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm ²	m	350		
F	AC units in IT room with 3 core 4mm ² cable	m	25		
	From DB-2F to				
G	General Purpose Socket in Mech Room with 3 core 2.5mm ² cable.	m	25		
H	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm ²	m	300		
	From DB-3F to				
I	General Purpose Socket in Mech Room with 3 core 2.5mm ² cable.	m	25		
J	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm ²	m	300		
	Electrical & Allied Works Section V22-General LV Power	61	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	From DB-4F to				
A	General Purpose Socket in Mech Room with 3 core 2.5mm2 cable.	m	25		
B	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm2	m	350		
	From DB-5F to				
C	General Purpose Socket in Mech Room with 3 core 2.5mm2 cable.	m	25		
D	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm2	m	200		
	From DB-6F to				
E	General Purpose Socket in Mech Room with 3 core 2.5mm2 cable.	m	25		
F	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm2	m	350		
	From DB-Roof to				
G	4P 20A Double Pole Switch with red LED indicator similar or equivalent to Legrand Synergy, in false ceiling to Indoor Unit, 1x1x5c 2.5 mm2	m	40		
	The contractor shall check existing sockets in common spaces and allow for their replacement wherever required in case of defective and damaged sockets.				
	Basement				
H	General Purpose Socket, 1x13A (provisional)	nr	5		
	Ground Floor				
I	General Purpose Socket, 1x13A (provisional)	nr	7		
	First Floor				
J	General Purpose Socket, 1x13A (provisional)	nr	7		
	Electrical & Allied Works Section V22-General LV Power	62	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Second Floor				
A	General Purpose Socket, 1x13A (provisional)	nr	7		
	Third Floor				
B	General Purpose Socket, 1x13A (provisional)	nr	6		
	Fourth Floor				
C	General Purpose Socket, 1x13A (provisional)	nr	6		
	Fifth Floor				
D	General Purpose Socket, 1x13A (provisional)	nr	6		
	Sixth Floor				
E	General Purpose Socket, 1x13A (provisional)	nr	7		
	Rooftop				
F	General Purpose Socket, 1x13A (provisional)	nr	5		
	Testing & Commissioning and Sundries for all floors				
G	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications and the IEE regulations.	item	1		
H	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
I	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
	Electrical & Allied Works Section V22-General LV Power	63	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
6	V32 - UNINTERRUPTIBLE POWER SUPPLY				
	Preambles				
	This section represents installation of UPS for the CCTV system in the basement.				
	All batteries shall be maintenance free, hot swappable & user replaceable and shall be located in separate rack for UPS capacities higher than 2kVA.				
	Uninterruptible power supply systems are to comply to BS EN 62040.				
	Equipment				
	UPS Power Backup for Security Camera Systems with features:				
	1000VA 600 Watt				
	5 x 5-15R Battery/Surge Protected Outlets				
	4 x 5-15R Surge Protected Outlets				
	1 x Serial DB9; 1 x USB 4-pin				
	User replaceable 12V 9Ah battery included inside				
	Warranty: 3 years on site				
	Origin: European				
A	1 kVA UPS Power Backup Equipment floor mounted c/w battery, surge protected outlets and all other related accessories.	nr.	1		
	Testing & Commissioning and Sundries				
	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications and the IEE regulations.	item	1		
	Electrical & Allied Works Section V32 - Uninterruptible Power Supply	65	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
7	V41 - EXTERNAL LIGHTING				
	Preambles:				
	This section represents all the related cabling, accessories and wiring works for the external lighting in the project. All façade luminaires shall be removed and replaced with new ones.				
	The light fittings shall be procured by the contractor. The Contractor shall be required to ensure timely delivery, management and installation of light fittings on site.				
	All LED lamps used shall be from a reputed manufacturer and shall have the warranty specified (minimum 25,000 hours). LED lamps shall be from the luminaire manufacturer.				
	All LED luminaires and strips to be provided with power supply and drivers. Contractor to determine the number of power supplies and drivers needed for the various circuits shown in the lighting layouts. Rate to also include the waterproof connection boxes.				
	Rates shall include for labelling of circuits				
	Conduit shall be included in the rate for wiring point. The contractor is to determine the exact quantity of flexible conduit required and include in the bid.				
	Rates shall include for testing and commissioning of the whole of the foregoing installation.				
	<u>Light points</u>				
A	<i>Wiring in concealed conduits/ on unistrut lighting support and fitting using three core 2.5 sqmm copper cables or wiring in conduits or on cable trays c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified. Contractor to include in quote any other accessories and fittings for a complete and operational lighting installation including labelling of all circuits.</i>	nr.	131		
	Electrical & Allied Works Section V41 - External Lighting	67	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Light fittings c/w bulbs - Supply and Install</u>				
	<u>Ground</u>				
A	Type F - Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO for external areas (provisional)	nr	20		
	<u>First</u>				
B	Type F - Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO for external areas	nr	20		
	<u>Second</u>				
C	Type F - Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO for external areas	nr	20		
	<u>Third</u>				
D	Type F - Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO for external areas	nr	20		
	<u>Fourth</u>				
E	Type F - Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO for external areas	nr	20		
	<u>Fifth</u>				
F	Type F - Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO for external areas	nr	20		
	<u>Sixth</u>				
G	Type F - Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO for external areas	nr	20		
	Electrical & Allied Works Section V41 - External Lighting	68	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Rooftop</u>				
A	Type G - Weatherproof LED Floodlights IP65 - Warm White (3000K) 20W - 2000 lm(178x165mm) similar or equivalent to Legrand	nr	6		
	<u>Switch points</u>				
	<u>Rooftop</u>				
B	Wiring in concealed conduits/ on unistrut lighting support and fitting using three core 2.5 sqmm copper cables or wiring in conduits or on cable trays c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified. Contractor to include in quote any other accessories and fittings for a complete and operational lighting installation including labelling of all circuits.	nr.	1		
	<u>Accessories</u>				
	Accessories for recess mounting to BS 1363 white moulded type except otherwise stated, with neon rocker switch c/w mounting boxes, support frames, cover plates and the like fixed to partition/masonry or plaster background or skirting trunking c/w all clips, accessories etc, similar or equivalent to make Legrand Plexo for waterproof socket.				
C	Switch 1 way 2 gang flush mounted similar to Legrand Plexo	nr.	1		
D	Twilight sensor	nr.	2		
	<u>Twilight Sensor - Wiring points</u>				
	Wiring in trunking c/w conduits, conduit boxes, looping boxes, covers and all related accessories all as specified.				
E	3 core 1.5 sq mm to twilight sensor	nr	2		
	<u>Twilight Sensor - Wiring</u>				
F	Wiring from Twilight sensor to External lighting on floors with 3 core 1.5 sq mm cable	m	60		
	Electrical & Allied Works Section V41 - External Lighting	69	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Extra-over</u>				
A	Labelling of all circuits	item.	1		
B	Any other accessories and fittings for a complete and operational lighting installation.	item.	1		
	Testing & Commissioning and Sundries for all floors				
C	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications and the IEE regulations.	item	1		
D	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
E	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
Electrical & Allied Works Section V41 - External Lighting		70	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
8	W10 - TELECOMMUNICATION				
	Preambles:				
	This section represents the upgrading of fibre to business infrastructure to all Tenants and removal of obsolete copper infrastructure inside the building.				
	It includes the installation for incoming fibre optic telecom cable to the development and associated data cabling distribution in the building.				
	A main telecom cubicle shall be provided in the pump room located on the basement of the building. This room will be used for the termination of telecom fibre optic cables and to main telecom equipment.				
	The contractor shall undertake a survey to locate the position of entrance of any existing communication fibre cable from any ICT company/Telecom services provider and reroute same to new proposed Telecom room in basement.				
	The Contractor shall allow for liaison with the Service Provider (Mauritius Telecom) for the provision of the incoming telecommunications lines for connection.				
	Cable tray for ELV services has been measured in this section.				
	All quantities are provisional and shall be remeasured after execution of works.				
	The contractor shall include in his offer all other items deemed necessary for the successful completion of the works. Any such item shall be clearly highlighted in the offer and accompanied with a breakdown.				
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3	Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	<u>Support Components for cables</u>				
	<u>Wire Tray - To be colour coded</u>				
	Wire tray as appropriate to withstand the UDL of cables, made of galvanised mild steel, straight or curved, jointed by rustproof bolts and bonding jumper, c/w fittings, accessories, supports manufactured by 2.5 mm hot dipped galvanised U channels, installed to any background for ELV services cabling all as specified and detailed.				
	<u>Inside riser (2 Cable Trays : One for Data Transmission and One for Fire Alarm System & Others)</u>				
A	100 mm wide (Total Length Measured)	m	100		
	<u>Basement</u>				
B	100 mm wide	m	30		
	<u>Ground floor to Sixth Floor</u>				
C	100 mm wide	m	600		
	<u>Testing & Commissioning and Sundries</u>				
D	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications and the IEE regulations.	item	1		
E	Liaison with the Internet Service Provider company for provision of fibre optic connection to the main telecom room. This shall include but not limited to the following: - Calling the engineers, technicians/officers of the Internet Service Provider for verification of all civil works including the construction of the telecom manholes, trenches, laying of telecom sleeves, installation of the puddle flanges, cable ladders/trays, access doors to the MT room. - Calling the engineers, technicians/officers of the Internet Service Provider to intervene on site for laying of the fibre optic cable and terminating in the Main Distribution Frame. - Attend to any additional requirements that are requested by the engineers, technicians/officers of the Internet Service Provider during the construction stage.	item	1		
	Electrical & Allied Works Section W10 - Telecommunications	73	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
9	W30 - DATA TRANSMISSION				
	Preambles				
	The contractor shall be required to coordinate all the works with other services.				
	The contractor shall be required to liaise with the Data Transmission system specialist subcontractor for the exact position of the system's equipment and devices.				
	The main fibre distribution frame shall be located in the pump room at the Basement floor level.				
	The contractor shall ensure that all existing data cabinets in the building are maintained in place. However, they shall move these data cabinets to suit the new design intent of the consulting engineer.				
	The contractor shall include in his offer all other items deemed necessary for the successful completion of the works. Any such items should be clearly highlighted in the offer.				
	All quantities are provisional and shall be remeasured after execution of works.				
	<u>Cables from Main Fibre distribution frame in Telco room in basement to Sub-fibre distribution box on:</u>				
	<u>Ground Floor</u>				
A	8 core OM3 Multi-Mode tight buffered fibre optic cable, 50/125um, Armoured LSZH outer jacket to EIA/TIA FOTP standards, IEC 60332-1, IEC 60794 and IEC 332/1C laid generally in PVC sleeves running buried, on cable trays, all as specified and detailed c/w terminations and all accessories. (Total measured for 2 runs)	m	35		
	<u>First Floor</u>				
B	8 core OM3 Multi-Mode tight buffered fibre optic cable, 50/125um, Armoured LSZH outer jacket to EIA/TIA FOTP standards, IEC 60332-1, IEC 60794 and IEC 332/1C laid generally in PVC sleeves running buried, on cable trays, all as specified and detailed c/w terminations and all accessories. (Total measured for 2 runs)	m	40		
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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Second Floor</u>				
A	8 core OM3 Multi-Mode tight buffered fibre optic cable, 50/125um, Armoured LSZH outer jacket to EIA/TIA FOTP standards, IEC 60332-1, IEC 60794 and IEC 332/1C laid generally in PVC sleeves running buried, on cable trays, all as specified and detailed c/w terminations and all accessories. (Total measured for 2 runs)	m	45		
	<u>Third Floor</u>				
C	8 core OM3 Multi-Mode tight buffered fibre optic cable, 50/125um, Armoured LSZH outer jacket to EIA/TIA FOTP standards, IEC 60332-1, IEC 60794 and IEC 332/1C laid generally in PVC sleeves running buried, on cable trays, all as specified and detailed c/w terminations and all accessories. (Total measured for 2 runs)	m	50		
	<u>Fourth Floor</u>				
D	8 core OM3 Multi-Mode tight buffered fibre optic cable, 50/125um, Armoured LSZH outer jacket to EIA/TIA FOTP standards, IEC 60332-1, IEC 60794 and IEC 332/1C laid generally in PVC sleeves running buried, on cable trays, all as specified and detailed c/w terminations and all accessories. (Total measured for 2 runs)	m	55		
	<u>Fifth Floor</u>				
E	8 core OM3 Multi-Mode tight buffered fibre optic cable, 50/125um, Armoured LSZH outer jacket to EIA/TIA FOTP standards, IEC 60332-1, IEC 60794 and IEC 332/1C laid generally in PVC sleeves running buried, on cable trays, all as specified and detailed c/w terminations and all accessories. (Total measured for 2 runs)	m	60		
	<u>Sixth Floor</u>				
F	8 core OM3 Multi-Mode tight buffered fibre optic cable, 50/125um, Armoured LSZH outer jacket to EIA/TIA FOTP standards, IEC 60332-1, IEC 60794 and IEC 332/1C laid generally in PVC sleeves running buried, on cable trays, all as specified and detailed c/w terminations and all accessories. (Total measured for 2 runs)	m	65		
	Electrical & Allied Works Section W30 - Data Transmission	77	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
10	W50 - FIRE DETECTION & ALARM				
	<u>Preambles:</u>				
	The building has an existing fire detection and alarm system, which is an addressable one with the main fire alarm panel (FAP) located at basement level.				
	The fire detection and alarm system is fully functional and in good operating condition.				
	This section describes the works involved with the repositioning of existing devices, located mostly in the false ceiling, which comprises the addressable fire detection and alarm system, as a result of the new design proposed for the refurbishment of the building.				
	All quantities are provisional and will be subject to remeasurement after execution of works.				
	All conduit will be included in the wiring section.				
	Wiring to fire alarm field devices inside the building shall generally be in the form of concealed conduits, unless otherwise specified.				
	Sensors (Heat detectors and optical smoke detectors) should be compatible with the existing fire detection and alarm system.				
	<u>Accessories and Equipment</u>				
A	Addressable surface mounted optical smoke detector c/w base fully compatible with the fire alarm panel, termination plate and all related accessories.	nr.	50		
B	Addressable surface mounted, Fixed temperature heat detector c/w base fully compatible with the fire alarm panel, termination plate and all related accessories.	nr.	10		
	Electrical & Allied Works Section W50 - Fire detection & Alarm	81	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Allowance for repositioning of fire alarm devices as per new design layouts</u>				
A	Repositioning of existing devices (optical smoke detector, heat detectors) located in the false ceiling, which comprises the addressable fire detection and alarm system, to suit the new proposed design layouts.	nr.	200		
	<u>Allowance for damaged or short-wiring which shall be replaced</u>				
B	Wiring from fire alarm panel to fire alarm field devices, interface units, sounders with strobelights and manual callpoints with red coloured 1.5 sqmm fire retardant cable in concealed UPVC conduits/laid on trays/surface PVC conduit etc c/w conduits, conduit boxes, looping boxes, covers and related accessories.	nr.	100		
	<u>Extra-over</u>				
C	Liaison with plumbing, fire fighting, mechanical and other specialist contractors for the interfacing of other trades with the fire alarm system.	item	1		
D	Liaison with Fire Services for obtaining fire certificate and approval of plans. The contractor shall prepare the necessary floor plans for issue to the Mauritius Fire and Rescue Services in order to obtain the fire certificatie for permanent occupancy of the building.	item	1		
E	Liaison with Fire Services and Police for automatic dialling to these services in case of fire.	item	1		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	Testing & Commissioning and Sundries				
F	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications and the IEE regulations.	item	1		
I	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
J	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
	Electrical & Allied Works Section W50 - Fire detection & Alarm	83	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
11	W51 - EARTHING & BONDING				
	<u>Preambles</u>				
	This section represents the installation of an earthing and bonding for the project in accordance with BS7430 and BS7671.				
	A TT earthing arrangement has been implemented for the whole development.				
	The Earth loop resistance for all earthing installations should not exceed 5 ohms to allow for proper operation of the protective devices in compliance with BS7671 and BS7430.				
	The generator neutral earthing, along with bonding of the generator frame is to be done by the electrical contractor and has been measured in this BOQ. The electrical contractor will have to liaise with the generator supplier/contractor to carry out the bonding of the generator frame with the main earth bar.				
	Main protective earthing will be carried out by the electrical contractor in accordance with the tender drawings. Contractor shall try to connect main earth bar to an existing bare structural bar.				
	All cable trays, mechanical items and metal parts shall be bonded to the earthing system.				
	All quantities are provisional and subject to re-measurement after execution of works.				
	The contractor shall include in his offer all other items deemed necessary for the successful completion of the works. Any such item shall be clearly highlighted.				
	<u>Earth Impedance Testing</u>				
A	<i>Contractor to do an earth resistance test and advise consulting engineer about the earth resistance value obtained. Methodology of earth resistance testing shall be vetted by the consulting engineer prior to the execution of the test. Tests shall be done at minimum two positions on the site as shall be instructed by consulting engineer.</i>	<i>item</i>	1		
	Electrical & Allied Works Section W51 - Earthing & Bonding	85	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>Cables and Accessories</u>				
	<u>Generator Earthing</u>				
A	4 Ways Solid copper earth bar 50 mm x 6 mm thick c/w all perforations and accessories to connect cpc cable, fixed to concrete background in the electrical room next to the generator. (GNE)	nr	1		
B	Single core 120mm ² striped yellow/green PVC insulated copper cable from generator neutral to Generator Neutral Earth Farm c/w all poprietary fittings. (provisional)	m	30		
C	Copper bonded steel rods 19 mm dia, 1800 mm long c/w clamps and accessories.	nr	3		
D	Allow for a concrete medium duty earth inspection pit (RC manhole cover with frame (300 mm. x 300 mm) to be installed at first connection point to coper bonded steel plate.(Total measured for both TX1 & TX2)	nr	1		
E	Single core 70mm ² copper cable for bonding of the Generator frame to the Main Earth Bar.	m	45		
F	Connection of Generator Frame to Main Earth Bar	item	1		
	<u>Main Protective Earthing</u>				
G	4 ways solid copper earth bar 50 mm x 6 mm thick (Earth Bar Dimensions mm (L x W x H): 450 x 100 x 90) c/w all perforations, twin disconnecting links, termination lugs, insulating supports and accessories to connect cpc cables, fixed to concrete background as shown in tender drawings. (MEB)	nr.	1		
H	PVC insulated copper cable for earthing purposes, 120mm ² (Total length measured)	m	60		
I	Copper bonded steel rods 19 mm dia, 1800 mm long c/w clamps and accessories. (provisional)	nr	3		
J	Allow for a concrete medium duty earth inspection pit (RC manhole cover with frame (300 mm. x 300 mm) to be installed at first connection point to copper bonded steel plate.	nr.	1		
	Electrical & Allied Works Section W51 - Earthing & Bonding	86	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Testing & Commissioning and Sundries				
A	Allow for bonding of all exposed and extraneous metal parts on the roof, façade and on site.	item	1		
B	Allow for electrical bonding of all mechanical plants and equipment in basement, all floors, risers, and roof	item	1		
C	Allow for 25kg bag of earth enhancement material. (Provisional)	nr.	5		
D	Allow for equipotential bonding of all cable trays (LV, ELV, and Refrigerant cable/wire trays)	item	1		
E	Allow for connection of main earth bar to an existing bare structural bar of the building	item	1		
F	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
G	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
H	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications. The contractor shall provide suitably qualified personnel and properly calibrated test equipment as may be required for testing and commissioning purposes.	item	1		
Electrical & Allied Works Section W51 - Earthing & Bonding		87	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
12	W52 - LIGHTNING PROTECTION				
	Preambles:				
	This section represents the complete replacement of the existing lightning protection system for the building.				
	The existing lightning protection system is a Faraday cage one, located at roof level 2.				
	Contractor shall be required to dismantle the existing lightning protection system.				
	The new proposed lightning protection system shall be an ESE one.				
	The ESE terminal shall be fixed to the side masonry wall on roof as shown on the W51-W52 drawing series. The copper tape shall drop, surface-mounted on the screens and then fixed on concrete blocks. The copper downconductors shall run fixed on surface of roof on cubicle concrete blocks, then, drop fixed to surface along the backside of the building and terminate at ground level connected to an earthing farm. The contractor shall refer to the W51-W52 drawing series for further clarity on the routing of the copper downconductors				
	The contractor shall be required to strictly follow the recommended installation methodology from a specialist ESE terminal supplier. Fixation of the ESE terminal on roof should be able to sustain cyclonic winds of 300 km/h. Calculations are to be submitted to Structural Engineer for approval prior to installation.				
	All quantities are provisional and subject to re-measurement after execution of works.				
	The contractor shall include in his offer all other items deemed necessary for the successful completion of the works. Any such item shall be clearly highlighted.				
	Electrical & Allied Works Section W52 - Lightning Protection	89	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	Lightning Protection				
A	Early Streamer Emission (ESE) terminal similar to ERICO INTERCEPTOR ESE i-series air terminals SL60i, having a height of 2m, protective radius of 30m and a triggering advance of 60µs as specified and detailed in tender drawings. ESE terminal to be supplied c/w counter. ESE terminal shall be c/w telescopic marine grade stainless steel mast, fixing base, rawl bolts, washers, lock bolts and nuts, tape connection clamp, ridge saddles, fixing guides and related accessories to resist cyclonic winds of 270 km/h and 30m minimum coverage radius.	nr	1		
B	PVC insulated down conductor copper tapes for lightning protection system to be used as down conductor, 25 x 3 mm c/w insulated clips as per manufacturers recommendations fixed on concrete background @ 500mm interval vertically along any wall and on cubicle concrete blocks on roof surface horizontally at every one metre interval and bonded to the earth rods.	m	130		
C	Copper bonded steel rods 19mm dia, 1800 mm long installed in crowfoot arrangement for the lightning protection system and connected to the earthing system via the transient earth connector as detailed in schematic. Polymer/Concrete light duty earth pit to be provided for inspection.	nr.	6		
D	Lightning strike counter to be fixed at 1.8m AFFL to the 2Nos. downconductors.	nr.	2		
E	Transient earth clamps for equipotential bonding of the lightning protection system to the Main Earth Bar.	nr.	1		
Electrical & Allied Works Section W52 - Lightning Protection		90	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	Testing & Commissioning and Sundries				
A	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications. The contractor shall provide suitably qualified personnel and properly calibrated test equipment as may be required for testing and commissioning purposes.	item	1		
B	Allow for 25kg bag of earth enhancement material. (Provisional)	nr.	5		
C	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
D	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
	Electrical & Allied Works Section W52 - Lightning Protection	91	Carried to Collection Page		

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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
13	W60 - BUILDING MANAGEMENT SYSTEM				
	Preambles:				
	A new state of the art building energy management system (BEMS) shall be designed and implemented for the building.				
	The BEMS shall be a simple smart metering system for Tenant billing.				
	This section represents all the related cabling, accessories, equipment and wiring works for the BEMS in the project.				
	Conduit will be included in the rate for wiring point. The contractor is to determine the exact quantity of flexible/rigid conduit required and include in the bid.				
	All cable trays are measured elsewhere.				
	All quantities are provisional and will be subject to remeasurement after execution of works. The contractor will ensure that the shop drawings are approved for exact quantities.				
	Rates shall include for testing and commissioning of the whole of the foregoing installation.				
	The contractor shall allow in his quote for all other items that he deems necessary for the successful completion of the installation. Any such items shall be clearly highlighted in the offer and accompanied with a breakdown.				
	The contractor shall be required to provide electrical meters, multi-function measuring unit, pulse concentrators and all other related equipment and accessories required in the BEMS communication network.				
	Electrical & Allied Works Section W60 - Building Management System	93	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>In Main Switch Board on basement</u>				
A	Multi-function measuring unit similar or equivalent to Legrand EDMX3 Premium Cat. No 4 120 53	nr.	1		
B	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
C	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	10		
	<u>In DB-B-Mech</u>				
D	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	2		
	<u>In DB-GF</u>				
E	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
F	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
	<u>In DB-1F</u>				
G	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
H	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
	<u>In DB-2F</u>				
I	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
J	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
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PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	In DB-3F				
A	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
B	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
	In DB-4F				
C	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
D	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
	In DB-5F				
E	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
F	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
	In DB-6F				
G	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
H	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
	In DB-Roof				
I	Pulse concentrator similar or equivalent to Legrand Cat. No 4 120 65	nr.	1		
J	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	1		
	Electrical & Allied Works Section W60 - Building Management System	95	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD			Bill No. 2.3		Electrical and Allied Works
Item	Description	Unit	Qty	Rate	Amount
	<u>In DB-Roof-Mech</u>				
A	Electrical energy meter - Three phase meter 63 A - 4 modules, with direct connection and pulse output, MID compliant, similar or equivalent to Legrand EDMX3 electrical energy meters Cat. No 0 046 82	nr.	5		
	<u>Equipment in Technical Office at lower roof level</u>				
B	RS485/Ethernet converter for communication interface, similar or equivalent to Legrand Cat No. 0 04689	nr.	1		
C	Energy management multi-support web server similar or equivalent to Legrand Cat No. 0 261 78 for 32 pulse modules	nr.	1		
D	Dedicated software for measurement similar or equivalent to Legrand Cat. No 0 261 89 for 255 metering devices	nr.	1		
	<u>Final circuit cables</u>				
	RS 485 Fieldbus Shielded Twisted Pair, with characteristic impedance of 120 ohms, 24AWG.				
E	From Multi-function measuring unit in MSB to Pulse Concentrator in DB-GF	m	15		
F	From Pulse Concentrator in DB-GF to Pulse Concentrator in DB-1F	m	15		
G	From Pulse Concentrator in DB-1F to Pulse Concentrator in DB-2F	m	15		
H	From Pulse Concentrator in DB-2F to Pulse Concentrator in DB-3F	m	15		
I	From Pulse Concentrator in DB-3F to Pulse Concentrator in DB-4F	m	15		
J	From Pulse Concentrator in DB-4F to Pulse Concentrator in DB-5F	m	15		
K	From Pulse Concentrator in DB-5F to Pulse Concentrator in DB-6F	m	15		
L	From Pulse Concentrator in DB-6F to Pulse Concentrator in DB-Roof	m	15		
M	From Pulse Concentrator in DB-Roof to RS 485/Ethernet converter (Gateway)	m	30		
	Electrical & Allied Works Section W60 - Building Management System	96	Carried to Collection Page		

PRO-DESIGN ENGINEERING CONSULTANTS LTD.					
REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Bill No. 2.3		Electrical and Allied Works	
Item	Description	Unit	Qty	Rate	Amount
	<u>Testing & Commissioning and Sundries</u>				
A	Testing and commissioning of the whole of the foregoing installation in accordance with the specifications. The contractor shall provide suitably qualified personnel and properly calibrated test equipment as may be required for testing and commissioning purposes.	item	1		
B	Contractor to allow a sum for all civil works related to the execution of the new electrical works as described in this section. This includes cut-outs in existing blockworks, slabs, etc., coring in existing slabs and walls, protection of existing flooring and walls against impact of falling debris as a results of these civil works, carting away of debris, making good of newly perforated walls and slabs with appropriate in-situ formworks for fine finish, paint touchups, and the like works.	sum	1		
C	Provide fire proof barrier of 2hrs fire resistance around all perforations through building fabric, sleeves and openings.	item	1		
	Electrical & Allied Works Section W60 - Building Management System	97	Carried to Collection Page		

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Main Summary

PRODESIGN ENGINEERING CONSULTANTS LTD**POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD****Main Summary of Tender**

Item	Description	Amount
Bill No.1	Preliminaries & General Requiremnts	Rs.
Bill No.2.1	Public Health and Allied works	Rs.
Bill No.2.2	Mechanical and Allied works	Rs.
Bill No.2.3	Electrical and Allied works	Rs.
	Provide the sum of MUR 900,000.00 for Contingencies to be expended or deducted in whole or in part at the discretion of the Engineer/Employer.	Rs. 900,000.00
	Total Amount of Fixed Price Tender exclusive of Value Added - Tax (VAT) Carried to Form of Tender	Rs.

Amount in Words:
.....
..... excluding Value Added Tax (VAT)

Dated this..... Day of 2025

Signed.....

Name.....

In the capacity of.....

Duly authorised to sign on behalf
.....

PREAMBLE TO SPECIFICATION

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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

1. PREAMBLES TO SPECIFICATIONS

1.1. Specialist Installations and Supplies:

Where specialist installations and supplies are specified for particular plant or equipment, they shall be completed in accordance with the specification and integrated with all other Works.

The Contractor shall submit maintenance and call out details with the tender, and as requested by the Engineer. Call out periods shall be appropriate for the system/item supplied and its usage as determined by the Engineer.

The Contractor shall submit full commissioning details which shall clearly indicate when support services are to be available and shall agree with the Building Services Contractor time periods in accordance with the main programme.

1.2. Ordering of Materials and Equipment

The Contractor shall:

Require every effort to be made to obtain materials and delivery to accord with the work programme and avoid delays by the early placing of orders following instructions to proceed.

Shall include for submission of alternatives for the Engineers consideration if the possibility of delay exists.

1.3. Materials and Workmanship

The Contractor shall allow for all plant and material to be new, undamaged, free from corrosion, not sub-standard and conform to the requirements of the specification.

Where quality or standard of materials are not specified, they shall be of adequate quality and equivalent standard to specified items.

The contractor shall allow for all work to be carried out by competent staff in an expeditious and workmanlike manner under skilled supervision.

All equipment supplied under this contract shall be fit for its purpose and suitable for the type of application, environment and building where it is installed. All equipment and plant shall be suitable for the office building and clean environment. They shall withstand the variation of temperature and other atmospheric conditions prevailing in Port Louis without affecting their performance and causing any distortion, deterioration or setting up of undue stresses in any part.

All exposed metal works shall be hot dipped galvanised before installation.

Equipment which are easy to maintain shall be selected.

1.4. Inspection and Measurement of Work

The contractor shall include all assistance necessary to enable the Engineer to examine or measure the Works with no section of the Works covered concealed or insulated prior to completion of a witnessed satisfactory test.

The Engineer shall require 15 days' notice to be given when Works which are to be covered or concealed are ready for examination and/or measurement.

The Contractor shall keep on site a full set of testing and measuring equipment for the whole of the works. These shall include but not limited to Insulation testers, multimeters, sound level meters, lux meters, flow meters, thermometers, earth loop testers, soil resistivity testers, tachometers.

1.5. Building in Occupation

The contractor shall be required to comply with any 'permit to work' system in operation on the premises.

The contractor shall include in the Tender for carrying out work in existing buildings shown on the relevant drawings whilst the buildings are occupied by staff and/or patients unless otherwise specified.

The Contractor shall take all reasonable steps to keep noise to a minimum particularly in the proximity of patients and staff.

1.6. Existing Engineering Materials

The Contractor shall be required to comply with all of the requirements of Environmental Protection Act 2002 and associated regulations. The contractor shall comply with the guidance given in "Waste Management - The Duty of Care - A Code of Practice" (HMSO 1991 - 1996 Revision).

1.7. Dimensions

Where plant or equipment is to be installed within or close to existing buildings or structures, the site dimensions shall take precedence over dimensions shown on the Contract Drawings or supplied under the Contract, with any discrepancy found drawn immediately to the attention of the Engineer.

1.8. Protection and Storage

The Contractor shall include for adequate and safe storage for all material plant and equipment necessary in respect of own Works.

Purpose made racks for storage of conduits, pipes and similar materials shall be provided to prevent bending and distortion. It shall include purpose made end caps to protect threads, nozzles etc.

The contractor shall include protection by means of paint, tallow or grease for bright and machined surfaces and cleaning and polishing immediately before handover.

Suitable racks and storage for plant, equipment, and materials unable to be stored in huts or buildings shall be provided on site.

The Contractor shall include protection for electrical cables and seal cable ends using methods and materials recommended by cable manufacturers.

Plant and equipment shall be left in a condition ready for painting where specified as part of the work or by others. Parts liable to corrosion shall be painted immediately after removal of temporary protection.

The Contractor shall replace material, plant, or equipment where deterioration or damage has occurred prior to handover.

1.9. Position of Plant and Equipment and Installation to Drawings

Plant and equipment shall be positioned in accordance with the drawings scheduled in the specification which show the layout arrangement and equipment but may not detail the whole work involved and are diagrammatic in certain particulars.

Notwithstanding the provision of the drawings, positions shall be determined by dimensions and particulars taken from site for the work specified.

Installation drawings based on the latest available information shall be submitted for the Engineers consideration at a reasonable time before work is commenced. This shall be under no circumstances be less than 7 working days.

The Contractor shall give due consideration to all services detailed on co-ordination and zoning drawings where provided with the specification.

The Contractor shall provide for contractual distribution of all information and drawings necessary to achieve complete co-ordination. He shall incorporate in his work information provided similarly by other trades and specialist suppliers like medical equipment, public utilities, and the like. The Contractor shall be responsible for the production of coordinated shop drawings including reflected ceiling plans and the like based on the latest architectural and internal designer's layouts. These drawings shall give due regard to the needs of inspection, efficient maintenance, and replacement.

1.10. Positions of Outlet Points

Where detailed integrated layout drawings have not been issued with the tender, the contractor shall allow for fixing outlet points up to 1.5 metre from the position specified or shown on the drawings at no extra cost.

1.11. Alternatives

Alternatives to the make or models specified shall be accepted only when they conform to the same intent, specifications, origin, standards, design, the same details of coordination and be compatible with other elements of work (services or other trades). The cost of such an exercise and/or any subsequent costs arising due to the same purpose directly or indirectly, or due to the changes induced to other equipment and/or work of other trades shall be borne by the Contractor and under no circumstances form any claim.

1.12. Samples for Approval

Samples shall be submitted for the Engineer's consideration and comprise such samples of workmanship, materials and equipment intended for execution of the Works as the Engineer considers necessary. Samples will remain in the possession of the Engineer until contract completion or be embodied in the installation. Mock-ups shall be produced with the samples provided if requested by the Engineer, free of charge.

Samples shall be submitted in sufficient time to allow the Engineer to Consult the Architect or Client representative for approval and comments. The Contractor shall allow for samples to be submitted in the RAL colours requested by the Architect.

The Contractor shall be responsible for the submission of alternative samples until the approval of the Architect and or the Engineer is obtained.

1.13. Technical Submittals

Technical documentation in 3 coloured copies shall be issued for approval to the Engineer for each item of plant and equipment prior to ordering.

Submittal shall highlight the proposed model, demonstrate that it complies to the specified standards, show how selection was undertaken, include noise and efficiency data etc for the Engineer to assess and approve.

The Contractor shall highlight any impact on the design and performance specifications issued by the Engineer by the plant or equipment being proposed.

Alternatives to the specified systems shall not be considered after the tender is awarded.

1.14. Working in Confined Spaces

The attention of the Contractor is drawn to the fact that he may be required to work in confined spaces within the existing building. He shall ensure that a detailed risk assessment is conducted and that the works are carried out by competent persons.

Such works shall be undertaken in accordance with an appropriate 'Permit to Work' procedure where such procedure is in operation on the site. If no 'Permit to Work' System is in operation, it shall be undertaken only after full investigation and resolution of the following matters has been completed and the Engineer informed in writing of the proposals.

- Assessment of the task to be undertaken.
- Identification of the hazards of the task.
- Decision on methods of working to avoid hazards.
- Implementation of a system of work to incorporate these methods.
- Monitoring of the operation of the system of work.

The contractor shall ensure that before commencing work and before personnel enter the space, it has been demonstrated to be safe by testing that no toxic or asphyxiated gases are present and that adequate oxygen levels are present. This shall include an assessment of the likelihood of the conditions remaining as found, the impact of any materials or equipment to be taken into the confined space or found there (deposits, sludge, residues etc.) and the possibility of any hazardous gases or vapours being able to enter the space.

Working in confined space shall be restricted to trained personnel only. It shall be undertaken after consideration of the following: -

- the provision of safe means of access and egress;
- the presence of personnel to keep watch outside;
- the provision of effective communications between personnel inside and outside;
- the provision of suitable protective equipment, including harnesses if possible and self-rescuing breathing apparatus if appropriate;
- the availability of gas detection equipment and staff trained in its use;
- a means of effecting a rescue in the event of an emergency.

1.15. Method Statements

The contractor shall include for preparing detailed method statements and risk assessments prior to undertaking major work packages or work to existing services. This shall include a detailed method statement for the overall project to address the problems of programming, completion to suit specific contractual requirements. It shall address the following issues with regard to each activity.

- Health and Safety
- Method of working
- Programme
- Enabling Works
- Specialist attendances/tools/materials
- Work required by third parties
- Quality assurance
- Contingency measures (i.e., failure of break-in or ability to bring existing service back on-line in accordance with programme)
- Permit to work system

The Contractor shall submit the method statements/risk assessments to the Engineer and site representative within a reasonable time prior to undertaking such work for comment, where applicable. Copies shall be forwarded to client's representative i.e. Energy Services Division. Where requested, the method statements/risk assessments shall be prepared and submitted to the Main Contractor when required for incorporation into the Health and Safety plan.

1.16. Testing of Equipment at Manufacturer's premises.

The Contractor shall arrange for the Engineer to inspect and test / witness tests of equipment at the manufacturer's factory wherever provided in the Bills of Quantities.

The Contractor shall provide the Engineer with fully flexible business class air tickets, accommodation, land transportation and bear all subsistence costs during the stay of the Engineer at the Manufacturer's factories. The Engineer shall be notified well in advance of the proposed dates for such visits and the exact dates of travel shall be at the sole discretion of the Engineer. The Engineer may delegate his representative to attend these tests on his behalf. The Engineer may request the Contractor to provide multiple economy class tickets in lieu of business class tickets if more than one person is to attend these tests.

1.17. Contractor Design and Coordination responsibilities

The Engineer has based his design on specific equipment data based on manufacturers as generally specified in the tender document. The Selection of specific and alternative equipment shall impact on the design and the Contractor shall be responsible for completing the design to take account for these plant selection and alternatives. The following shall be designed and coordinated by the Contractor:

- Brackets, supports and suspension systems-
- Acoustic treatment to meet noise criteria specified
- Resizing of ducts and other services if necessary for spatial coordination based on the design and commissioning information provided by the Engineer.
- Expansion and contraction.
- Interfaces and connections to other equipment and BMS.
- Steel walkways, cat ladders, stairs, handrails and the like in connection with plant and equipment for access and maintenance.
- Plant, equipment, and systems to meet performance criteria where specified.

1.18. Connections to Existing Services

The contractor shall include specified new connections into existing services with, unless otherwise stated, the buildings being assumed to be in full commission.

Works shall be carried out in a manner that does not interfere with the routine working of the buildings and in accordance with the programme for the Works.

The contractor shall include for isolating and reconnecting as required for the permanent and/or temporary connections and making good insulation and decoration affected by the Works.

The contractor shall not isolate any equipment or section of any existing service unless the time and date of isolation has been agreed, via the site procedure for isolation.

The Contractor shall ascertain site procedure for isolations and shall note that on some sites and some systems isolations may only be carried out by site engineers.

The Contractor shall bring to the attention of the Engineer before commencing work if the condition of the existing services is not considered satisfactory for connections to be made.

The identification, draining down, refilling, venting, and balancing of any disturbed piped services shall be allowed for and undertaken immediately after such pipes are disturbed.

1.19. Connections to Appliances

The contractor shall allow for technical co-ordination of connections to all plant and equipment specified and for disconnecting and reconnecting of existing items requiring moving.

1.20. Painting

Painting shall be in general compliance with the recommendations of BS 5493. It shall be where possible include for all installed material to have a factory paint finish and all damaged paintwork to be immediately made good. It shall include for the application of one coat of lead-free rust inhibiting primer on to thoroughly wire brushed and cleaned fabricated steel before erection. Damaged paintwork shall be made good after erection.

All engineering equipment and associated supports in external and damp situations unless intrinsically weatherproofed, shall be hot dipped galvanised.

1.21. Tools and Accessories

The contractor shall provide two complete new sets of any special tools and accessories required for correct running and maintenance of the plant, each set being contained in a steel toolbox fitted with a padlock and two keys. These tools shall be un-used prior to handover. Set of tools shall be provided for all major plant including but chillers, generator, AHU, Pumps, fans and any other such equipment requiring special tools for maintenance and repairs.

1.22. Electrical Interference and Suppression

Shall be provided on all equipment supplied or used for own Works to the requirement of BS 800: 1988 and Health Technical Memorandum 2014 to eliminate interference with electrical, radio and television equipment.

1.23. Deleterious materials

None of the following deleterious materials shall be provided for the works:

- Asbestos based products.
- Calcium silicate bricks or tiles.
- High alumina cement.
- High alkali cement not conforming to British standards.
- CFC's or any product using CFC's in its manufacture.
- Chloride based mixtures unless they comply with BS 8110: Part.1.
- Glass fibre reinforced concrete.
- Timber which is not obtained from a managed regulated sustainable source.
- Lead, except where particularly specified for connection to existing cast iron drainage pipes.
- Asbestos substitutes or any naturally occurring or manmade mineral fibres (including rock-wool or slag wool) with a thickness of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to prevent migration of fibres.
- Vermiculite plaster.
- Urea-formaldehyde polyurethane, isocyanurates, polyisocyanurates in foams or materials which may release gases in quantities which may be hazardous, with reference to the limits set from time to time by the Health and Safety Executive.
- Polytetrafluorethylene (known as PTFE) except when used as non-stick sealing with valves or as an isolating tape.
- Materials, which emit Radon gas.
- Other substances which, at the time of Tender, have been publicised by the Health and Safety Executive, Building Research Establishment, British Standards Institution or other Specialist Authority as being deleterious to Health or Safety, shall not be incorporated into any part of the Works.

1.24. Noise Attenuation

Sound attenuation equipment and materials shall be provided to prevent transmission of sound through ducts, pipework and structures as specified in the subsequent sections of the specifications.

The Contractor shall ensure that all tools and equipment being used for the works are fitted with silencers and attenuators so as not to cause any disturbance.

1.25. Guards

Safety guards shall be provided to all moving parts of machinery in accordance with the requirements of the Health and Safety at Work Act. They shall comply with BS 5304 and provide easy access for maintenance together with access to shaft ends for tachometer attachment.

1.26. Plant Drives, Pulleys and Keys

Flexible couplings for flange and vee belt drives for pulleys shall be provided where appropriate. Flange or pulley drives on motors, fans and pumps shall be truly balanced and secured in position by shaft keys or patent locks readily accessible for withdrawal or adjustment.

1.27. Fixing Building Services, Plant, etc to the Building Fabric

No plant or equipment shall be fixed to the building fabric without the approval of the Structural Engineer

All fixing supports, gantries, secondary steel works, channels etc shall be designed by the contractor.

All supports, brackets, clamps, fixings etc that are required for a complete installation, whether or not shown on the tender drawings, shall be provided.

Support to heavy equipment shall be designed by a qualified structural Engineer and all relevant calculations shall be submitted for approval to the Consulting Structural Engineer prior to any works being undertaken on site. These calculations shall be performed in a format to be agreed with the Consulting Structural Engineer.

All fixing elements and support systems shall be hot dipped galvanised after fabrication. Cold galvanising treatment shall be kept to strict minimum, only when on site welding was unavoidable.

All fixing shall be done with proprietary supports like MUPRO, SIKLA, CADDY or equivalent. Samples of all fixing shall be produced for approval.

1.28. Plant Bases and Anti-Vibration Mountings

It shall be ensured that all concrete bases for plant and machinery have a minimum perimeter clearance of 150mm, with each item of plant adequately fixed, supported and aligned, in accordance with the manufacturers' recommendations.

Holding down bolts, for all items of plant, including anti-vibration materials and mountings for units having rotating or moving machinery shall be provided. Anti-vibration material which is to be cast into plinths to have a waterproof membrane on both bearing surfaces and be handed to the building contractor before casting commences.

No equipment shall be solely supported by threaded rod or any resilient support. All plant, equipment, ducting, systems and the like shall be supported with rigid brackets and supports at regular interval in addition to any resilient supports. Anti vibration pads shall be provided between all system and the rigid support.

No part of the pipework, ducting, trays or other engineering services shall be used as support system for other engineering installations. Equipment shall be supported independently of such systems.

All equipment shall operate without any undue vibration being imparted to other or adjacent systems.

1.29. Lubrication

Lubrication shall comprise the supply and servicing of plant and machinery with lubricants to the manufacturer's recommendations before attempting to operate, ensuring lubricant levels are correct and providing a list of the manufacturer's recommended lubricants. This shall include the supply of lubricant dispensers for each pattern of nipple and cup fitted.

Shall be where necessary for purposes of servicing, include extension pipes with lubricant nipples.

1.30. Bonding and Earthing

The Earthing and bonding shall include all necessary materials and connections as described in the drawings and schedules to ensure that all installations and equipment are efficiently and continuously bonded to an earthing system at all times, in accordance with the IEE Wiring Regulations (BS 7671 - Requirements for Electrical Installations).

1.31. Spare Parts

The Contractor shall furnish all spare parts required and recommended by the supplier for the proper running and maintenance of the plant and equipment supplied. Full list of these spares shall be submitted with the tender.

Spares shall be ordered at the same time as orders are placed for the plant and equipment and raise for consideration any spare items which should be added to the Schedule of Spares.

All spares shall comply with the plant specification and be interchangeable with the corresponding parts on the plant.

Parts shall be numbered and described for identification and prepared for storage by protective enclosures and/or greasing or painting.

The Contractor shall produce delivery notes and ensure these are signed by the client's representative for all spares and tools handed over. Posting or delivery to site of any items without obtaining evidence that they have been received by the client's representative may result in further spares being required at no additional cost to the contract.

1.32. Colours of Indicator Lights, Push Buttons, Annunciators and Digital Readouts

Shall conform to the conventions of **BS EN 60073**.

1.33. Handover

The Commissioning and Testing is an important and lengthy task to be undertaken prior to handover of a completed project. The contractor shall prepare and submit a Commissioning Programme as part of the Contract Programme, in conjunction with other contractual parties and with agreement of the Engineer, to describe the commissioning/demonstration and instruction Procedures, dates and personnel involved. The Programme to be agreed and distributed at least six weeks before commissioning is due to commence.

The contractor shall make arrangements to enable the Engineer or his representative to witness tests, or test and inspect at site or at the manufacturer's premises. The equipment to be tested at factory premises are indicated further in the specifications. As a general guidance they include the Chillers, Air Handling Units, Standby Generators, Boilers, Main Low Voltage Panel, Fire Alarm Panel. The Contractor shall provide two fully flexible business class tickets to the Engineer and his delegated staff to witness these tests. Five days accommodation shall also be provided for two persons for each of these tests.

The Contractor shall appoint an approved engineer, from the contractor's own staff or an independent commissioning company, (known as the Commissioning Engineer) who is fully conversant with the operation of the Works and competent to supervise the whole of these procedures, which are to be carried out by persons fully trained in the operation of specialist installations and equipment.

The Engineer and his representatives to witness the proceedings, confirm the recorded results and determine whether the specified requirements have been met. The Engineer shall only witness final tests and commissioning procedures. Pre-tests and pre-commissioning procedures shall be undertaken by the Contractor under the supervision and control of the Main Contractor M&E coordinator.

The Engineer shall be given adequate written notice of the date and place of each (or series of) test, inspection, commissioning or demonstration procedure. Tests at manufacturer's premises outside Mauritius shall be notified 28 days before.

All Testing instruments, meters and recorders shall be calibrated by an approved agency or the manufacturer before testing commence for this project. Any certificate issued 30 days prior to the date of commissioning shall not be considered and new certificates will have to be produced.

The Contractor shall provide within his price for all labour, materials including fuel and energy and apparatus required for carrying out the testing, commissioning.

All testing and commissioning shall be undertaken prior to handing over.

1.34. Testing

The Contractor shall include the provision of a separate set of drawings and/or report sheets to be used to accurately record the following test and inspection information: -

- Plant, section and installation under test.
- Manufacturers reference number where applicable.
- Date, time, duration of test (and weather conditions if appropriate).
- Test results with itemised readings including records of all other checks and tests.
- The Contractor shall allow for the testing of all equipment, material and services installations as detailed elsewhere in the specification and if the first inspection or test fails, repetition of the procedure within a reasonable time, adhering to the time cycles and other requirements as specified for the first test.
- All tests shall be completed before any paint, cladding or similar materials are applied or before services are concealed.

The Engineer will: -

- Give twenty-four hours written notice of his intention to be represented at the test.
- If he decides after inspection or testing, that such plant or any part thereof is defective, or not conforming with the specification, reject such defective parts by written notice within a reasonable time, indicating the area of dispute.
- If he considers the tests are being unduly delayed, arrange for instructions to carry out the tests within 10 days.

1.35. Commissioning

Commissioning shall be following satisfactory completion of the foregoing tests and when the installation is in a safe and satisfactory condition, include for setting it to work and regulation and adjustment as necessary to the design requirements.

Commissioning shall in general terms include the following procedures:

- Shall be setting to work all systems as specified and ensuring that the performance requirements have been achieved.
- Shall be balancing and regulating all systems to meet specified performance requirements.
- Shall be making final adjustments and before practical completion, demonstrating by commissioning procedures detailed elsewhere in this specification, that the provisions of the contract have been met in total by completing the previous testing and setting to work procedures and by showing that the completely integrated installation will function in accordance with the specified performance requirements.
- Shall include records of all test results on the sheets provided, completing all commissioning documents and at all stages ensuring that the Engineer has certified the documents and/or arranged for instructions for any remedial work.

1.36. Commissioning Procedures

The Contractor shall ensure that the following requirements are observed when, commissioning the engineering works: -

- Progressive static testing will be witnessed by the Engineer(s) when the work is presented as ready for testing. This will include Insulation Resistance Tests, Earth Continuity Tests, Water, Gas Pipeline and Air Ducting Tests.
- The Contractor shall complete all pre-commissioning examination and testing to ensure that each system or item of equipment is complete, in a safe condition and all notices displayed before the Engineer (s) are convened for the final testing and commissioning. Completion for operational purposes implies the bulk of the snagging of work has been offered to the Site Engineer(s) and remedial work completed. All fans, pumps etc., will have been checked for operation and all polarity testing, phase sequence testing, loop impedance testing etc., carried out.
- The Engineer, Site Engineer, Commissioning Adviser and other members of the contractual team to discuss the Commissioning Programme (previously prepared) take account of any problems arising, availability of related services, agree access required for controls, agree documentation to be used and adjust programme as necessary for a clear understanding of the position.
- Demonstration of agreed systems and equipment to the programme to be witnessed on behalf of the Employer/Client by the Commissioning Adviser/Site Engineer/Engineer and results examined for final acceptance.
- Instructions to the users staff to be completed by handover.
- Any outstanding final acceptance testing such as for sterilisers, theatre extract/flow systems, boilers, refrigeration and generators are to be listed and dates agreed in the defects liability period when reasonable demands for consumer requirements are available.
- All commissioning shall be undertaken in compliance with the CIBSE Commissioning codes and the BSRIA commissioning manuals. Example pro formas contained in the BSRIA commissioning codes shall be used for all checking, verification, pre-commissioning and final testing and commissioning. The Contractor shall purchase and keep a copy of all these commissioning codes on site for consultation.

1.37. Instruction Period

The Contractor shall, on completion of an installation (or part of) as the programme dictates, the provision by the Engineer of the names of the user Health Authority staff to be involved, in the operation and maintenance, before planning, preparing and formally recording arrangements for the instruction period.

This Shall include instructing the Health Authority's staff in the safe operation and maintenance of all systems and items of equipment and where necessary running, maintaining and supervising, in each case under normal working conditions, for an adequate and reasonable period of time based on manufacturer's recommendations, or alternatively at the manufacturers' works.

1.38. Handover Procedures

The contractor shall prepare the following mechanical or electrical documents to be available not less than one month before Practical Completion of any part of the Contract. It shall include for incorporating the following documents into one or more volumes of durable finish service manuals, with format and contents agreed with the Engineer. Three sets to be provided on completion.

- Index of Contents
- Description of Design Intent & Operational Policy
- Commissioning Documents and Reports
- Manufacturers Operation/Service & Maintenance Manuals
- Manufacturers Spares List & Ordering Procedure
- Operational & Maintenance Routines, Procedures for Fault Finding
- Line Diagrams of Plant Control Systems & Descriptions of Control Operation incorporating all set points.
- Schematic Layouts locating Valves, Switches etc. to Incorporate all Equipment Identification Numbering
- Schedule of Installed Equipment with Specific Commissioned duties
- Description Working Drawings for each main item of plant/equipment, showing safety features etc.
- Emergency call-out service - personnel & telephone contacts
- Copies of all charts posted elsewhere in building
- List of tools, keys & special requirements for handing over
- Guarantees, Test Certificates & Reports
- List of Record Drawings (drawings separately available)
- Health and Safety plan

The documents shall be provided in 3 hard copies and 3 sets of CD.

1.39. Record Drawings

The Contractor shall modify the installation drawings as necessary to record the “as installed” changes which may have occurred and thus form the basis of the final “As Fitted” drawings.

The record drawings which shall be available not less than one month before practical completion of any part of the contract.

The record drawings shall indicate to a suitable scale agreed by the Engineer (which shall be in any case not less than the tender or installation drawings or 1:50) the layout, identity, size and position of all services installed together with valves, control items, plant, conduit routes, lighting fittings, switches, socket outlets, distribution boards etc. The drawings shall show the results of all commissioning tests i.e. air-flow rates as measured at grilles, measured flow rates through calibrated valves, pumps or orifice plates, controls settings media temperatures etc. The size, type and length of each ELV, LV and HV cable (to the nearest metre) shall also be given together with the measured earth fault loop impedance where applicable. All fuse or breaker current rating shall be shown as well as all trip settings.

Inter connections between items of equipment, including those provided by others and terminal numbering and cable core identification of all alarm and control circuits shall be given. The drawings shall be amplified with schedules and/or diagrammatic presentation.

Particular attention shall be paid to the location and depth of buried services including those carried out for Gas, Water or Electrical system etc. Similarly, the drawings shall include all sub-letting and specialist works i.e. medical gases and ventilation ductwork etc., together with a schematic diagram of the application of automatic controls and instruments etc. The diagrams and drawing shall wherever possible have valves etc. marked to coincide with the marking of valves labels etc., called for in the relevant Sections of this Specification.

1.40. Valve Charts and Schematic Diagrams

A chart indicating valve references and identifying valve service and function shall be produced.

The Contractor Shall produce for each system, a schematic diagram indicating plant and its references, pipework/ductwork, commissioning settings, control components and their references, normal operating temperatures and pressures, filter dirty settings and other operational conditions.

Each diagram and valve chart shall be laminated and framed and permanently mounted in the relevant space in a clearly visible position.

1.41. Labelling & Fixing

Table 1: Labelling

Equipment	Colour & Size of Label	Colour & Size of Lettering	Title	Fixing Requirement	Label Material
VALVES	WHITE 80mm x 25mm	BLACK 4mm high		Brass ring fitted around spindle	Brass or ivory
CONTROL PANELS	WHITE to suit nomenclature 80mm x 25mm	BLACK 6mm high		Brass round head screws	Ivory, Perspex or laminate
THREE PHASE EQUIPMENT	RED 100mm x 80mm	WHITE 10mm high	DANGER 400 Volts	Brass around head screws	Ivory, Perspex or laminate
SWITCHGEAR & DISTRIBUTION BOARDS	WHITE 100mm x 80mm	BLACK 6mm high	Circuits and apparatus-controlled cable size	Brass round head screws	Ivory, Perspex or laminate

Equipment	Colour & Size of Label	Colour & Size of Lettering	Title	Fixing Requirement	Label Material
DISTRIBUTION BOARDS CIRCUIT CHARTS	-	-		Non-flammable transparent pockets sliding into metal channels on inside of cover	Typewritten chart indicating outlets controlled, circuit no, fuse and cable size
BUS BARS	Phase colours	-	-	At all cases points	PVC sleeving
ESSENTIAL SUPPLIES EQUIPMENT	WHITE	RED		As specified in Parts C and D	As specified in Parts C and D
GENERAL EQUIPMENT	WHTIE	BLACK		As specified in Parts C and D	Ivoryine, Perspex or laminate

Table 2: Fixing Building Plant to the Building Fabric

Heavyweight equipment or equipment subject to vibration, shock or heavy handling	Normal strength brickwork, masonry and concrete	Dry	Expansion bolts or self-drill anchors
		Damp and/or corrosive	Galvanised or cadmium plated expansion bolts
	Normal strength brickwork, masonry and concrete	Dry	Expansion bolts
		Damp and/or corrosive	Galvanised or cadmium plated expansion bolts
	Poor brickwork, masonry or concrete in which it is difficult to drill neat fixing holes	Dry	Cement-in sockets or bolts
	Any material of low strength per unit area	Any condition	MS brackets and/or plates to spread the load. All brackets to be painted red lead primer and two finishing coats. Bolts to be galvanised, cadmium plated or normal to suit the conditions.
Any fixing and/or clips	Structural steelwork	Any condition	Clamps, finish of clamps and bolts etc. to suit the conditions. All brackets to be painted red lead primer and two finishing coats.

Equipment to be Fixed	Material	Environment	Fixing
Lightweight equipment subject to movement, excessive vibration, shock or heavy handling	Good brickwork, masonry and concrete	Clean, dry	Fibre or plastic plugs, steel woodscrews
		Clean, damp	Plastic plugs, brass woodscrews
	Normal strength brickwork, masonry and concrete	Clean, dry, high temperature	White bronze plugs, steel woodscrews
		Corrosive, any temperature	Proprietary white bronze plugs, cadmium plated steel woodscrews
	Brickwork and masonry with ragged or irregular holes	Any condition	Proprietary plugs compound and woodscrews to suit environment i.e.: - dry - steel damp - brass corrosive – cadmium-plated steel
	Good timber blockboard and plywood exceeding 12.5mm thick	Dry	Steel woodscrews
		Damp	Brass woodscrews
	Sheet and cellular material of high strength per unit area e.g. sheet steel, sheet aluminium, hollow concrete blocks, hollow clays blocks, plywood less than 12.5mm thick chipboard.	Any condition	Threaded brass/neoprene inserts, plated gravity toggles, plated toggles
	Sheet and cellular material of low strength per unit area e.g. building boards, plaster board, laminated plastic	Any condition	Plated gravity toggles, plated spring toggles

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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

MECHANICAL SPECIFICATIONS

1. GENERAL

1.1. INTRODUCTION

- 1.1.1. The project is the refurbishment of an existing office building located at Pope Hennessy Street Port Louis. The building, of approximately 4,400m², comprises of a basement, ground floor, 1st to 6th floors, and space (technical office and room) at roof level. There is a technical block at ground floor at the back of the building forming part of the main building.
- 1.1.2. Services plants are located on the roof and in the basement. Most of the HVAC plant are located on the roof.
- 1.1.3. Building services equipment shall be tested at manufacturer's premises as far as possible before erection on site. The consulting Engineers shall be witnessing all these tests at the contractor's costs. A full schedule of factory tests is described in the Inspection and Testing Sections of this specification.
- 1.1.4. The building is being designed to comply with all local regulations and by laws. Where specified, the building shall comply to some sections of the British Standards and the Guidelines of the National Health Service of the UK and South African Bureau of Standards.
- 1.1.5. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances and the responsibility to provide a complete installation fit for its purpose-the purpose being a building for the provision of office spaces to the public and private sectors.
- 1.1.6. This specification sets out the standards of materials and workmanship for the project. All materials shall comply to the latest issue of the European Standards, or the Standards specified elsewhere in the Sections / Drawings or Bills of Quantities. All electrical equipment used within the contract shall primarily comply to the Requirements of BS 7671 and MS 63.
- 1.1.7. The installation shall include for all aspect of Health and Safety for those who are going to operate and maintain the installation.

1.2. SERVICES DESCRIPTION

1.2.1. General Ventilation System

- 1.2.1.1. The general ventilation system shall generally consist of an Air Handling Unit (AHU) connected to a network of duct and diffusers. Fresh air shall be filtered and dehumidified by the AHU prior to distribution.
- 1.2.1.2. The fresh air AHU is located on the roof of the building.

- 1.2.1.3. The return air from the building is returned to the AHU on the roof through a network of insulated ducts.
- 1.2.1.4. The return air from the rooms / zones enters through return air grilles, into the ceiling void plenum and back to a central part of the floor where it is aspirated through an attenuator back to the main return air duct running vertically through the building.

1.2.2. General exhaust & Toilet Extraction

- 1.2.2.1. There is no general exhaust in the building.
- 1.2.2.2. The building is maintained at a positive pressure at all times through a reduced amount of return air with respect to the supply air.
- 1.2.2.3. The toilet extraction system is a centralised one. There are 2 fans working in duty/standby/auto changeover mode located in technical room at roof level.
- 1.2.2.4. The toilet extract system works at all times during predefined time periods, usually during office working hours.

1.2.3. Air Conditioning

- 1.2.3.1. A VRF air conditioning system has been designed for the building. The following spaces are air conditioned:

Table 1: Zones to be air conditioned.

Description	Floor level	Spaces	Comments
Zones conditioned by VRF units	Ground – 6 th floor	Office, Reception, etc.	-

2. BASIS OF DESIGN

2.1. GENERAL

- 2.1.1. This section sets out the design parameters applicable to the Mechanical Services Installation.

2.2. OUTSIDE TEMPERATURES

- 2.2.1. The maximum summer external conditions for general design purposes shall be 35°C db, 85% RH.
- 2.2.2. The minimum winter external design conditions for general design purposes shall be 20°C, saturated.

2.3. INSIDE TEMPERATURES

Function of Space	Design Dry Bulb Temperature / °C	% Relative humidity
Office	21-24	50
Reception	21-24	50
Waiting Area	21-24	50
Boardroom	21-24	50
Meeting room	21-24	50

2.4. COOLING LOAD CONDITIONS

- 2.4.1. In addition to the solar and transmission loads, the supply air quantities, equipment, and refrigeration duty shall be designed for the internal loads.
- 2.4.2. Heat gains due to occupants:
- 2.4.2.1. People at rest 70 w (sensible); 45 w (latent)
- 2.4.2.2. People at work 75 w (sensible); 55 w (latent)

2.5. VENTILATION RATES

- 2.5.1. The ventilation rates have been allowed as per ASHRAE 62.1, augmented by 30% to allow for enhanced ventilation to gain credit points for building certification.

2.6. ACOUSTIC CRITERIA

- 2.6.1. The systems shall be designed, and equipment selected to achieve the following noise levels within the building:

Office / Cellular Office	NR 30 / NR 25
Circulation spaces	NR 30
Reception	NR 30
Waiting Area	NR 30
Boardroom	NR 30
Meeting room	NR 30

Note: $\text{dB(A)} = \text{NR} + 6$

- 2.6.2. The services installation shall be isolated from the structure to ensure that the frequency and acceleration of structural borne vibration falls within the 1.4 curve for continuous vibration and the 20 curve for intermittent vibration with up to 3 occurrences per day as shown in fig A1.22 of the CIBSE guide.

3. COMMON MECHANICAL SERVICES

3.1. GENERAL

3.1.1. Scope

- 3.1.1.1. This specification covers the standard of materials and workmanship for the mechanical services installations for the project. Particular specifications shall be described further in the document and in the schedules. This specification must be read in conjunction with the Schedules attached.

3.1.2. Standard References

- 3.1.2.1. The materials, components and completed installations shall conform as applicable with the following Standards, including all amendments, current at the time of tendering. Construction products should comply with European Standards and Technical Specifications (ESTS). Wherever reference is made to a British Standard a corresponding ESTS (generally ISO series) shall be equally acceptable.
- 3.1.2.2. Where available all materials, equipment etc forming part, or whole, of the services specified in the Contract, should be obtained from BS EN ISO 9000 "Quality Assurance" certified manufacturers and preferably "kite marked" or EC equivalent.
- 3.1.2.3. The latest dates and amendments of standard references are given at the time of issue of this Section.

BRITISH STANDARDS

Pipes

BS EN 10226-1:2004	Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads - dimensions, tolerances and designation (incorporating corrigendum October 2010)
BS EN 10226-2:2005	Pipe threads where pressure tight joints are made on the threads. Taper external threads and taper internal threads - dimensions, tolerances and designation (incorporating corrigendum April 2016)
BS EN 10226-3:2005	Pipe threads where pressure-tight joints are made on the threads. Verification by means of limit gauges (incorporating corrigendum April 2016)
BS EN 10224:2002	Non-alloy steel tubes and fittings for the conveyance of water and other aqueous liquids - Technical delivery conditions (incorporating corrigendum No. 1 and amendment No. 1)

BS EN 10311:2005	Joints for the connection of steel tubes and fittings for the conveyance of water and other aqueous liquids
BS EN 10255:2004	Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions
BS EN 1057:2006	Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications
BS EN ISO 1452-1:2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - unplasticized poly(vinyl chloride) (PVC-u). General (ISO 1452-1:2009)
BS EN ISO 1452-2:2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - unplasticized poly(vinyl chloride) (PVC-u). Pipes (ISO 1452-2:2009)
BS EN ISO 1452-3:2010	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - unplasticized poly(vinyl chloride) (PVC-u). Fittings (ISO 1452-3:2009, corrected version 2010-03-01) (incorporating corrigendum August 2015)
BS EN ISO 1452-4:2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - unplasticized poly(vinyl chloride) (PVC-u). Valves (ISO 1452-4:2009)
BS EN ISO 1452-5:2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - unplasticized poly(vinyl chloride) (PVC-u). Fitness for purpose of the system (ISO 1452-5:2009)
BS EN 10220:2002	Seamless and welded steel tubes. Dimensions and masses per unit length
BS EN 10216-1:2013	Seamless steel tubes for pressure purposes. Technical delivery conditions - Non-alloy steel tubes with specified room temperature properties
BS EN 10312:2002	Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption. Technical delivery conditions

BS EN 545 : 2010	Ductile iron pipes, fittings, accessories and their joints for water pipelines – requirements and test methods.
BS EN 598 : 2007	Ductile iron pipes, fittings, accessories and their joints for sewerage applications – requirements and test methods. (+A1:2009)
BS EN 969	Ductile iron pipes, fittings, accessories and their joints for gas pipelines – requirements and test methods.
BS 5391:	Specification for acrylonitrile - butadiene-styrene (ABS) pressure pipe.
BS EN 12201-2:2011+A1:2013	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE) - Pipes
Flanges	
BS EN 1759-1:2004:	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, class-designated - Steel flanges, NPS 1/2 to 24
BS 4190	Specification for ISO metric black hexagon bolts, screws and nuts.
BS 4320	Specification for metal washers for general engineering purposes. Metric series.
BS EN 1092-1:2018	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated - Steel flanges
Fittings	
BS 143 & BS 1256	Specification for malleable Cast Iron and Cast Copper Alloy threaded pipe fittings.
BS EN 1254-1:2021	Copper and copper alloys - plumbing fittings. Capillary Fittings for soldering or brazing to copper tubes
BS EN 1254-2:2021	Copper and copper alloys - plumbing fittings. Compression fittings for use with copper tubes
BS 1042:	Measurement of fluid flow in closed conduits.
Part 1:	Pressure differential devices.

BS EN ISO 5167-1	Specification for square-edged orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full.
BS 1740	Specification for wrought steel pipe fittings (screwed BS 21 R-series thread).
Part 1: 1971	Metric units.
BS 1965:	Specification for butt-welding pipe fittings for pressure purposes.
Part 1 : 1963	Carbon Steel.
BS 4346:	Joints and fittings for use with unplasticised PVC pressure pipes.
Part 1 : 1969	Injection moulded plasticised PVC fittings for solvent welding, for use with pressure pipes, including potable water supply.
Part 2 : 1970	Mechanical joints and fittings principally of unplasticised PVC.
BS 4368 : Part 3 : (1984)	Compression couplings for tubes. Specification for light series couplings (metric).
Part 4 : 1984	Specification for type test requirements.
BS 5114: 1975	Specification for performance requirements for joints and compression fittings for use with polyethylene pipes.
BS 5245: 1975	Specification for phosphoric acid based flux for soft soldered joints in Stainless Steel.
BS 5392-1:2006	Acrylonitrile-butadiene-styrene (ABS) fittings for use with ABS pressure pipe. Specification
Jointing	
BS EN ISO 9453:2020	Soft solder alloys. Chemical compositions and forms
BS EN 14324:2004	Brazing. Guidance on the application of brazed joints
BS 1845 : 1984	Specification for filler metals for brazing.
BS 2494 : 1990	Specification for elastomeric seals for joints in pipework and pipelines.
BS 2789 : 1985	Specification for spheroidal graphite or nodular graphite cast iron.
BS 4346:	Joints and fittings for use with un-plasticised PVC pressure pipes.
Part 3 : 1982	Specification for solvent cement.

BS 7668: 1994	Specification for weldable structural Steel. Hot finished structural hollow sections in weather resistant Steels.
BS EN 10029: 1991	Specification for tolerances on dimensions, shape and mass for hot rolled Steel plates 3mm thick or above.
BS EN 10113: 1993	Hot-rolled products in weldable fine grain structural Steels.
10113-1	General delivery conditions.
10113-2	General delivery conditions for normalized rolled Steels.
10113-3	Delivery conditions for thermomechanical rolled Steels.
BS EN 10137:1996	Plates and wide flats made of high yield strength structural Steels in the quenched and tempered or precipitation hardened conditions.
EN 10137-1	General delivery conditions.
EN 10137-2	Delivery conditions for quenched and tempered Steel.
EN 10137-3	Delivery conditions for precipitation hardened Steels.
BS EN 10155: 1993	Structural Steels with improved atmospheric corrosion resistance. Technical delivery conditions.
BS EN 10210: 1994	Hot finished structural hollow sections of non-alloy and fine grain structural Steels.
BS EN 10210-1	Technical delivery requirements.
BS EN 1514	Flanges and their joints – Dimensions of gaskets for PN designated flanges.
EN 1514-1:1997	Non metallic flat gaskets with or without inserts.
EN 1514-2:1997	Spiral wound gaskets for use with Steel flanges.
BS 5245 : 1975 (1990)	Specification for phosphoric acid based flux for soft soldered joints in Stainless Steel.
BS 5292: 1980	Specification for jointing materials and compounds OBSOLESCE for Installations using water, low pressure steam or 1st, 2nd and 3rd family gases. (partially superceded by BS 6956 Parts 1, 5, 6 and 7)
BS EN ISO 9000:	Quality systems

BS 6681 : 1986	Specification for malleable Cast Iron.
BS EN 10025: 1993	Hot rolled products of non-alloy structural Steels. Technical delivery conditions.
BS 7786: 1995	Unsintered PTFE tape. General requirements.
Safety Valves	
BS 6759	Safety Valves.
Part 1 : 1984	Specification for safety valves for steam and hot water.
Part 2 : 1984	Specifications for safety valves for compressed air or Inert gases.
Part 3 : 1984	Specification for safety valves for process fluids.
Valves and Gauges	
BS 1010	Specification for draw-off taps and stop valves for water services (screw down pattern).
Part 2: 1973	Draw-off taps and above ground stop-valves.
BS 1552 : 1995	Specification for open bottomed taper plug valves for 1st, 2nd and 3rd family gases up to 200 mbar.
BS 1780 : 1985	Specification for bourdon tube pressure and vacuum gauges.
BS 2879 : 1980	Specification for draining taps (screwdown pattern).
BS 5150 : 1990	Specification for Cast Iron gate valves.
BS 5151 : 1974	Specification for Cast Iron Gate (Parallel Slide) valves for general purposes.
BS 5152 : 1974	Specification for Cast Iron globe and globe stop and check valves for general purposes.
BS 5153 : 1974	Specification for Cast Iron check valves for general purposes.
BS 5154 : 1991	Specification for Copper Alloy globe, globe stop and check, check and gate valves.
BS 5155 : 1984	Specification for butterfly valves.
BS 5156 : 1985	Specification for diaphragm valves.
BS 5157 : 1989	Specification for Steel Gate (parallel slide) valves.
BS 5158 : 1989	Specification for Cast Iron plug valves.

BS 5159 : 1974	Specification for Cast Iron and Carbon Steel ball valves for general purposes.
BS 5163 : 1986	Specification for predominantly key -operated cast iron gate valves for water work purposes.
BS 5235 : 1975	Specification for dial-type expansion thermometers.
BS 5433 : 1976	Specification for underground stop - valves for water services.
BS 7350 : 1990	Specification for double regulating globe valves and flow measurement devices for heating and chilled water systems.
Pipe Supports	
BS 1494	Specification for fixing accessories for building purposes.
Part 1 : 1964	Fixings for sheet, roof and wall coverings.
BS 3974	Specification for pipe supports.
Part 1 :	Pipe hangers, slider and roller type supports.
Part 2 :	Pipe clamps, cages, cantilevers and attachments to beams.
Miscellaneous	
BS 12 : 1996	Specification for Portland cement.
BS 729 : 1971	Specification for hot dip galvanised coatings on Iron and steel articles.
BS 1710 : 1984	Specification for identification of pipelines and services.
BS 3059	Steel boiler and superheater tubes.
Part 2 : 1990	Specification for carbon, alloy and austenitic Stainless Steel tubes with specified elevated temperature properties.
BS 3382	Specification for electroplated coatings on threaded components.
Parts 1 & 2: 1961	Cadmium on Steel components. Zinc on Steel components.
BS 3416 : 1991	Specification for bitumen based coatings for cold application, suitable for use in contact with potable water.
BS 4027 : 1996	Specification for sulphate-resisting Portland cement.

BS 4147 : 1980	Specification for bitumen based hot-applied coating materials for protecting Iron and Steel, including suitable primers where required.
BS 4800 : 1989	Schedule of paint colours for building purposes.
BS 5493 : 1977	Code of practice for protective coating of Iron and Steel structures against corrosion.
BS 5834	Surface boxes, guards and underground chambers for gas and water works purposes.
Part 1 : 1985	Specification for guards, including foundation units.
Part 2 : 1983	Specification for small surface boxes.
Part 3 : 1985	Specification for large surface boxes.
Part 4 : 1989	Specification for preformed chambers.
BS 6129	Code of practice for the selection and application of bellows expansion joints for use in pressure systems.
Part 1 : 1981	Metallic bellows expansion joints.
BS 6281	Devices without moving parts for the prevention of contamination of water by backflow.
Part 1 : 1992	Specification for Type A air gaps.
Part 2 : 1982	Specification for Type B air gaps.
Part 3 : 1982	Specification for pipe inter-rupters of nominal size up to and including DN42.
BS 6282	Devices with moving parts for the prevention of contamination of water by backflow.
Part 1 : 1982	Specification for check valves of nominal size up to and including DN54.
Part 2 : 1982	Specification for terminal anti-vacuum valves of nominal size up to and including DN54.
Part 3 : 1982	Specification for in-line anti-vacuum valves of nominal size up to and including DN42.
Part 4 : 1982	Specification for combined check and anti-vacuum valves of nominal size up to and including DN42.
BS 6700 : 1997	Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their cartilages.

BS 7671 : 1992	Requirements for electrical installations IEE Wiring Regulations. Sixteenth Edition.
Code of Practice	
BS 1306 : 1975	Specification for Copper and Copper alloy pressure piping systems.
BS 806 : 1993	Specification for design and construction of ferrous piping with land boilers.
BS 5410	Code of practice for oil firing.
Part 2 : 1978	Installations of 44 kW and above output capacity for space heating, water and steam supply purposes.
CP 312	Code of practice for plastics pipework (thermoplastics material).
Part 1 : 1973	General principles and choice of material.
Part 2 : 1973	Unplasticised PVC pipework for the conveyance of liquids under pressure.
Part 3 : 1973	Polyethylene pipes for conveyance of liquids under pressure.
BS 6880	Code of practice for low temperature hot water heating systems of output greater than 45kW.
Part 1 : 1988	Fundamental and design considerations.
Part 2 : 1988	Selection of equipment.
Part 3 : 1988	Installation, commissioning and maintenance.
CP 342	Code of practice for centralised hot water supply.
Part 2 : 1974	Buildings other than individual dwellings.
BS 8313 : 1997	Code of practice for accommodation of building services in ducts.
BS 8010	Code of practice for pipelines.
Part 2:	Pipelines on land : design, construction and installation.
Section 2.1 : 1987	Ductile iron.
Welding	
BS 639 : 1986	Withdrawn and replaced by:
BS EN 499 : 1995	Welding consumables. Covered electrodes for manual metal arc welding for non-alloy and fine grain Steels.

Classification.

BS 1453: 1972	Specification for filler materials for gas welding.
BS 2640: 1982	Specification for Class II oxy-acetylene welding of carbon steel pipework for carrying fluids.
BS 2910 : 1986	Methods for radiographic examination of fusion welded circumferential butt-joints in steel pipes. Replaced by BS EN 1435 : 1997.
BS 2971 : 1991	Specification for Class II arc welding of carbon steel pipework for carrying fluids.
BS 3923	Methods for ultrasonic examination of welds.
Part 1: 1986	Methods for manual examination of fusion welds in ferritic steels.
Part 2: 1972	Automatic examination of fusion welded butt joints in ferritic steels.
BS 4872	Specification for approval testing of welders when welding procedure approval is not required.
Part 1 : 1982	Fusion welding of steel.
BS EN 970 : 1997	No-destructive examination of fusion welds – visual examination.

HVCA – Code of Practice – TR/5 Welding of Carbon Steel Pipework (1990)

HVCA – Code of Practice – TR/3 Jointing of Copper and its Alloys (1990)

STATUTORY REQUIREMENTS

Electricity Act

Health and Safety Act

Building Regulations

OTHER EUROPEAN STANDARDS

BS EN ISO 9002: 1994. Quality Systems – Model for Quality Assurance in Design/Development, Production, Installation and Servicing (for designers of systems)

DIN 2391 Seamless steel precision tube cold drawn or cold rolled

DIN 2393 Welded steel precision tubes

DIN 2394 Welded and sized precision tubes

3.2. PIPEWORK INSTALLATION

3.2.1. Quality of Installation

- 3.2.1.1. Installations shall be to specification and comprise new materials assembled to a high standard of workmanship under the supervision of qualified personnel. Sub-standard work will not be accepted and the following clauses list examples of materials and work that will be rejected:-
- 3.2.1.2. The use of damaged parts, incorrect types, standard, sizes, materials, markings, etc.
- 3.2.1.3. Carbonaceous residues left in the bores of copper pipes by the manufacturer.
- 3.2.1.4. Damage to parts by tools, soldering, brazing, welding, etc.
- 3.2.1.5. The use of long screws, back-nuts or reducing bushes.
- 3.2.1.6. Pipes not cut clean and square with the axis or removed of burrs, or pipes cut with bevel wheel cutters.
- 3.2.1.7. Pipes or fittings with broken or damaged threads and more than 2 threads extending beyond fittings when screwed up.
- 3.2.1.8. Joints misaligned or distorted and not true with pipe axis.
- 3.2.1.9. Pipework runs without the required gradient.
- 3.2.1.10. Pipes supported from other pipes or not capable of individual removal without disturbing other pipes.
- 3.2.1.11. Misaligned or distorted supports, fixings and pipework.
- 3.2.1.12. Insecure supports or restrictive of proper expansion, contraction, or lateral movement as required for the pipeline, or branch pipes used as supports for risers.
- 3.2.1.13. Pipes supported on the sleeve of fire stopping, or the fire stopping not fitted correctly or to the required standard.
- 3.2.1.14. Bores of pipes and fittings which are blocked or contaminated by foreign matter.
- 3.2.1.15. Eccentric fittings assembled the wrong way up-the taper should rise in the direction of flow.
- 3.2.1.16. Valves difficult for access for operation or maintenance.
- 3.2.1.17. Any items not installed to manufacturers recommendations.
- 3.2.1.18. Disregard of requirements for preservation of water quality including use of pastes, compounds, greases or lubricants, on joint faces of hot and cold water services.
- 3.2.1.19. Inadequate protection against electrolytic action.
- 3.2.1.20. Other faults may also apply including any disclosed by weld inspections, testing and commissioning.

3.2.2. Pipe Ends and Cutting

- 3.2.2.1. Pipes shall be cut clean and square with the axis by machine, pipe cutter or saw as appropriate to materials, but not by flame cutting or bevel wheel cutter.
- 3.2.2.2. Pipes shall be prepared for capillary fittings on copper and stainless steel pipes by deburring and re-rounding.
- 3.2.2.3. Pipes shall be prepared for threading of steel pipes by removing burrs.
- 3.2.2.4. Pipes shall be prepared for butt welded steel pipelines by machining bevels and removing burrs.
- 3.2.2.5. Pipes shall be prepared on plastic pipelines in accordance with the manufacturer's instructions, to suit solvent or heat fusion techniques for jointing.

3.2.3. Screwed Threads

- 3.2.3.1. Screw threads shall be to BS 21 taper on pipes and adaptors. They shall be cut clean, concentric and unbroken with all oil, swarf, etc removed.
- 3.2.3.2. Shall be provided by means of capillary screwed adaptors on copper or stainless steel pipes with a limit of 2" BSP maximum.
- 3.2.3.3. Shall be painted on the exposed threads of mild steel pipes immediately the fitting has been screwed on.

3.2.4. Thread Sealants

- 3.2.4.1. For Hot and Cold Water Services:-
 - 3.2.4.1.1. Shall be approved to Water Research Centre tests UK as suitable for potable water and proof against bacterial growth, i.e. ptfe unsintered tape applied with 50% overlap to BS 7786 for threads 2" BSP and below, or jointing materials to BS 5292 (Obsolescent) and BS 6956 parts 1,5,6 & 7.
- 3.2.4.2. For Gas Service:-
 - 3.2.4.2.1. Shall be as approved by Local Gas Suppliers PTFE unsintered tape applied with 50% overlap to BS 4375 for threads 2" BSP and below, the tape quality being subjected to pressure tests.
- 3.2.4.3. For Other Services:-
 - 3.2.4.3.1. Shall comprise PTFE tape as CWS for steam 1½" BSP and below, or 2"BSP and below for other services.
 - 3.2.4.3.2. Shall consist of proprietary brands of sealants or compounds for threads 2½" BSP and above such as galvanised flanges if ptfe is not suitable.

3.2.5. Pipe Unions, Flanges and Gaskets

- 3.2.5.1. Unions shall be limited to 2" BSP maximum size, or less if otherwise specified by the Engineer.
- 3.2.5.2. Unions shall be assembled without the use of pastes or lubricants on the joint faces when used on hot and cold water services.
- 3.2.5.3. Flanges shall be provided on pipes 65mm diameter and above and on smaller pipes where specified in drawings, to suit particular requirements.
- 3.2.5.4. Flanges shall be metric sizes to details given on the pipework materials tables.
- 3.2.5.5. Flanges shall be screwed or welded true and square with pipe axis on steel and ductile iron pipes and have raised joint faces with continuous spiral grooved finish.
- 3.2.5.6. Flanges shall be composite type on copper or stainless steel pipes with manufacturers standard finish on joint face.
- 3.2.5.7. Flanges shall be composite type on plastic pipework, solvent or heat welded on as appropriate.
- 3.2.5.8. Gaskets shall be free of asbestos materials.
- 3.2.5.9. Gaskets shall be metric sizes to suit the flanges.
- 3.2.5.10. Gaskets shall be as recommended by the manufacturer to suit the service conditions and flange finish, to provide an effective seal without the use of jointing compounds.
- 3.2.5.11. Gaskets shall be provided with non-stick surfaces where flanged joints are required to be easily opened.

3.2.6. Pipe Runs, Gradients, Break Points

- 3.2.6.1. Pipes shall be generally parallel with walls on horizontal runs and set neatly round piers and projections where a good appearance is required.
- 3.2.6.2. Pipes shall be set plumb and without offsets on vertical runs.
- 3.2.6.3. Pipes shall be arranged without joints where pipes pass through the thickness of walls, floors and structures.
- 3.2.6.4. Pipes shall be arranged with adequate clearance of walls and ceilings to allow easy access to valves.

3.2.7. Gradients

- 3.2.7.1. All services shall be graded to rise or fall in the direction of flow, at 1 in 250, except for gravity condensate and drainage from air handling units which shall be graded at 1 in 100.
- 3.2.7.2. Provided with the following break points:-
- 3.2.7.2.1. Unions on pipes 50mm diameter and below (except refrigeration)
- 3.2.7.2.2. Break points shall be provided at each branch from headers, mains and risers, at connections to plant and equipment, at 18m intervals for unions and 10m for flanges.

3.2.8. Open Ends of Pipework

- 3.2.8.1. Shall be temporarily sealed by the use of purpose made plugs, blanking caps, or blank flanges during pipework erection including valves at the end of pipework runs which shall be closed and sealed.

3.2.9. Pipework Clearances and Segregation

- 3.2.9.1. Minimum clearance between uninsulated pipes, finished face of insulation on pipes and adjacent surfaces shall be as follows:-

Walls	25mm
Ceilings	100mm
Finished Floors	150mm
Adjacent pipes, both insulated	25mm
Adjacent pipes, both un-insulated	25mm
Adjacent pipes, one only insulated	75mm
Insulated pipes adjacent to conduit or trunking	100mm
Un-insulated pipes adjacent to conduit or trunking	150mm
Un-insulated pipes adjacent to electrical cables not in conduit or trunking	150mm
Insulated pipes adjacent to electrical cables not in conduit or trunking	100mm

3.2.9.2. The spacing of services shall provide for:-

- The application of thermal insulation and valve and flange boxes.
- Increased spacing to accommodate pipeline fittings.
- To pipes and electrical services for ease of installation, maintenance and inspection.
- Layout and segregation of services to be in accordance with BS 8313.
- Cold water pipes to be spaced from hot pipes to minimise heat gain.

3.2.10. Sleeves and Cover Plates

- 3.2.10.1. Sleeves shall be provided for pipes passing through walls, floors and partitions of similar material to pipe and copper or steel, for plastic pipes.
- 3.2.10.2. Sleeves shall be generally one or two sizes larger than pipe as necessary and positioned true with pipe to provide adequate clearance and allow for lateral movements of pipeline if required.
- 3.2.10.3. Sleeves shall be finished flush with finished face of wall, floor and ceilings.
- 3.2.10.4. Sleeves shall be projected 75mm above floors in wet areas with the gap sealed with waterproof mastic.
- 3.2.10.5. Sleeves shall be supplied with lugs to locate in floors and ceilings.
- 3.2.10.6. Sleeves shall be fire-stopped in gap between pipe and sleeve in all fire rated structures to Building Regulations Approved Document B – (UK) Fire Spread, using asbestos-free material approved by the Fire Authority, without restricting pipework movement.
- 3.2.10.7. Sleeves shall have thermal insulation sections stopped short each side.
- 3.2.10.8. Sleeves shall have caulked in gap between pipe and sleeve in external walls using asbestos-free, weather and vermin proof material.
- 3.2.10.9. Sleeves shall be oversize if insulation is to be carried through non-fire rated wall or partition as shown on the drawings.
- 3.2.10.10. Cover plates shall be according to installation materials.

3.2.11. Pipe Fittings

- 3.2.11.1. Shall be low resistance type bends, sweep tees, etc. Fittings shall be square type only on final draw off pipe runs and if necessary to facilitate venting and draining, or at steam trap sets for venting, draining or relaying.
- 3.2.11.2. Shall be eccentric pattern on horizontal pipes at changes of diameter to facilitate venting and draining, with the taper of the fitting to rise in the direction of flow.

3.2.12. Draining and Venting

- 3.2.12.1. Draining taps shall be Drain cocks on systems containing glycol shall have warning notices affixed prohibiting drainage direct to mains drains loose key operated to BS 2879 lockshield pattern of chromium plated finish, where fitted, to chromium plated tube.
- 3.2.12.2. Draining taps shall be supplied with three loose keys for each size of drain cock fitted.
- 3.2.12.3. Air vents shall be provided at all high points in water systems to facilitate complete removal of air.
- 3.2.12.4. Air vents shall be automatically operated unless specified.
- 3.2.12.5. Air bottles shall be provided at all high points where self-venting through the mains or taps cannot take place or would not prove satisfactory.
- 3.2.12.6. Air vents shall comprise a square branch (the diameter of the pipe being vented, connected to an air bottle formed from 50mm tube, not less than 250mm long, (or size agreed with the Engineer), fitted with a cap and 8mm gunmetal needle seat type air valve with loose keys.
- 3.2.12.7. Air vents shall be have a bleed pipe run from the top of the bottle to a convenient position 1.4m from floor level and terminate with an air valve as before.
- 3.2.12.8. Air vents shall be run and discharge to a convenient position as indicated on the drawings or to the nearest drain system.
- 3.2.12.9. Automatic air eliminators shall be fitted to an equal square tee on the main, together with the necessary reducers.
- 3.2.12.10. Automatic air eliminators shall be of non-ferrous metal with non-corrodible ball valve and seat.
- 3.2.12.11. Automatic air eliminators shall from the outlet have a male or female iron to copper union adaptor with an 8mm copper bleed pipe to BS EN 1057, R250/R220, arranged to discharge in a convenient position as indicated on the drawings.

3.2.13. Inaccessible or Concealed Pipe Joints Within Buildings

- 3.2.13.1. Pipe joints which will unavoidably be built-over or otherwise be difficult for access to be of the welded, or capillary type only, and satisfactorily tested before concealment.

3.2.14. Flange Bolts, Nuts and Washers

- 3.2.14.1. Shall be of forged steel 400N/mm² tensile minimum to BS 1092 and shall be all hot dipped galvanised.
- 3.2.14.2. Shall be faced under the head, machined on the shank and screwed ISO metric coarse in the case of bolts.
- 3.2.14.3. Shall be faced on one side in the case of nuts.

- 3.2.14.4. Shall be faced on both sides in the case of washers and fitted under both bolt head and nut.

3.2.15. Pipe Supports

- 3.2.15.1. Shall be generally to the following standards.

- 3.2.15.1.1. Shall be BS 1494 Part 1, for pipe clips, brackets etc. All threaded rods/hangers shall be of at least 16mm diameter.

- 3.2.15.1.2. Shall be BS 3974, Part 1 for hangers, sliders and rollers.

- 3.2.15.1.3. Shall be BS 3974, Part 2 for clamps, cages, cantilevers and beam attachments.

- 3.2.15.1.4. Shall be as detailed on the drawings and fastened only to the building structure at the specified positions. The shall be proprietary support systems hot dipped galvanised and from a reputed manufacturer like Mupro or Caddy.

- 3.2.15.1.5. Shall be arranged to support each pipe run independently of others, to permit differential expansion and maintenance without disturbing adjacent pipes.

- 3.2.15.1.6. Shall be installed so that pipes may expand and contract freely within the design figure and in the intended direction without overstressing pipes, joints or connections to equipment.

- 3.2.15.1.7. Shall be provided at base of vertical pipes, bends, tees, flanges, unions, and changes of direction, each side of valves, in conjunction with the normally spaced supports on horizontal and vertical runs.

- 3.2.15.1.8. Shall be fabricated from standard hot dipped galvanised mild steel rolled sections, or alternatively proprietary sections if specified in drawings, where built into walls or floors of ducts and subways.

- 3.2.15.1.9. Shall be provided oversize with load bearing insulation incorporated as specified in drawings for installation as the pipework is erected on the following services:-

- Steam, condensate, M & HTHW pipes, of all sizes.
- Chilled water pipes and refrigeration pipes of all sizes.

3.2.16. Spacing of Supports

Table 2: Table of Maximum Spacings For Pipework Supports

Horizontal Spacings - Metres				Vertical Spacings - Metres		
Nominal Pipe Size mm	Steel or Iron Pipes	PVC or ABS Pipes	Copper or Stainless Steel Pipes	Steel or Iron Pipes	PVC or ABS Pipes	Copper or Stainless Steel Pipes
15	1.8	0.8	1.2	2.4	1.2	1.8
20	2.4	0.8	1.2	3.0	1.2	1.8
25	2.4	0.9	1.5	3.0	1.3	2.4
32	2.4	1.0	1.8	3.0	1.5	3
40	2.4	1.1	1.8	3.7	1.6	3
50	2.4		1.8	3.7		3
65	3		2.4	4.6		3.7
80	3		2.4	4.6		3.7
100	3		2.4	4.6		3.7
125	3.7		3.0	5.5		3.7
150	4.5		3.7	5.5		3.7
200	6		-	8.5		-
250	6.5		-	9.0		-
300	7		-	10.0		-

3.2.17. Electrolytic Action

- 3.2.17.1. Shall be prevented by ensuring that dissimilar metals are not in contact where the presence of water or moisture could promote electrolytic action.
- 3.2.17.2. Shall be prevented where copper pipes connect to ferrous cisterns or equipment, whether galvanised or not, by means of approved fibre washers or gaskets.
- 3.2.17.3. Shall be prevented by avoiding the need to join copper pipes to steel pipes.
- 3.2.17.4. Shall be prevented by using pipe supports as under:-
 - 3.2.17.4.1. Galvanised malleable iron or steel for steel or iron pipes.
 - 3.2.17.4.2. Brass or gunmetal for copper, stainless steel or plastic pipes.

3.2.18. Compression Unions

- 3.2.18.1. Shall be of the single ferrule type and permit a butt flat face to face connection between the body of the union and ferrule.
- 3.2.18.2. Shall be such that the seal between the union and the ferrule is metal to metal, no washers, gaskets, jointing compound or similar material will be accepted.

- 3.2.18.3. Shall be installed such that the pipework does not protrude through the ferrule into the body of the union.
- 3.2.18.4. Shall provide for the attachment of the ferrule to the pipe to be such that the pipe is "necked" rather than being cut or notched by the ferrule.
- 3.2.18.5. Shall be generally comply with the performance requirements of BS 4368.

3.3. PIPEWORK MISCELLANEOUS

3.3.1. Expansion Devices

- 3.3.1.1. Shall be fitted where expansion cannot be accommodated by natural offsets and changes of direction.
- 3.3.1.2. Shall in the case of expansion bellows, comply with BS 6129 Part 1, be installed strictly to the manufacturers instructions including the provision of associated guides and anchors, which are approved by the bellows manufacturer.
- 3.3.1.3. Shall in the case of expansion loops, be manufactured from the same material as the pipe with additional thickness to allow for bending without undue thinning and formed in one length with ends flanged.
- 3.3.1.4. Shall be marked with a suitable plate giving manufacturers name and detail, maximum working pressure, direction of flow, maximum and minimum working lengths and amount of cold draw.

3.3.2. Cold Draw

- 3.3.2.1. Shall be applied by means of flanges secured to the ends to be pulled together and long high tensile steel bolts and nuts.
- 3.3.2.2. Shall be checked to the design figure for correct gap plus allowance for gasket thickness before final pull is made.
- 3.3.2.3. Shall be changed to standard bolting when gap is closed.

3.3.3. Anchors

- 3.3.3.1. Shall be generally to BS 3974 Part 1 and BS 3974 Part 2 with steel brackets rigidly attached to the building structure or concrete blocks and/or as shown on the drawings.
- 3.3.3.2. Shall be suitable for test pressure loading.
- 3.3.3.3. Shall be positioned not nearer than 600mm to welded joints on steel pipes and secured so that the pipe is not deformed or overstressed by clamps, or where welded or brazed attachments are made, which shall be inspected and passed.
- 3.3.3.4. Shall be provided at stop ends, bends, junctions, valves and gradients steeper than 1 in 6. For buried mains of the non self anchoring type.
- 3.3.3.5. Shall be provided on polyethylene buried mains as above and at mechanical joints where these are not designed to take end loads.

3.3.4. Guides

- 3.3.4.1. Shall be incorporated at all roller and slider supports.
- 3.3.4.2. Shall be provided at expansion joints as recommended and be capable of adjustment to give correct alignment of the pipework and device before being rigidly fixed.

3.3.5. Testing

- 3.3.5.1. General
 - 3.3.5.1.1. All individual parts forming the pipework circuit shall have been pressure tested by the manufacturers to British Standard or other recognised standards and certificates of soundness provided.
 - 3.3.5.1.2. The installation shall then be pressure tested to prove soundness of joints and of the parts as installed.
 - 3.3.5.1.3. When air pressure tests are conducted or gas pipework is purged with gas the area shall be cleared of personnel.

3.3.6. Flushing Out and Draining

- 3.3.6.1. Shall be undertaken before pressure tests are conducted and carried out using water or air as appropriate, with parts that will restrict flow or sustain damage removed.
- 3.3.6.2. Shall be witnessed to demonstrate that there are no blockages and that no foreign matter remains.
- 3.3.6.3. Shall be undertaken again when water is drained off or air released after pressure testing to establish that the systems are still clean. On completion, all strainer cages shall be removed and cleaned and all dirt pockets opened up and cleaned.
- 3.3.6.4. Shall be arranged so that water systems are left dry after testing until setting-to-work and air systems left charged with reduced pressure air, monitored by a gauge to show any damage by other trades up to handover.

3.3.7. Filling

- 3.3.7.1. Shall be carefully controlled in the case of hydraulically tested systems, to ensure that water hammer does not occur and demonstrated to show that all air has been vented off and the system is full and ready for testing.
- 3.3.7.2. Shall be similarly controlled when systems are re-filled for regulating, balancing, setting-to-work etc.

3.3.8. Pressure Tests

- 3.3.8.1. Shall be to the pressures as detailed in the appropriate pipework service elements of this specification.
- 3.3.8.2. Shall be carried out in stages if advantageous and finally on the whole of each completed circuit or system.
- 3.3.8.3. Shall be undertaken before pipework is concealed by structures, covers, partitions, ceilings, insulation, backfilling over joints, final painting etc and when there is no danger of the water tested systems freezing.
- 3.3.8.4. Shall be carried out with all parts not designed to withstand the test pressure, removed or blanked off and the pipeline suitably anchored to withstand test pressure load.
- 3.3.8.5. Shall be witnessed and test certificates signed when the test is satisfactory.

3.3.9. Provision for Testing, Commissioning, Instruments and Controls

- 3.3.9.1. Shall require all necessary connection points to be included as the pipework is erected.
- 3.3.9.2. Shall require the positions to be shown on the drawings and details agreed with the commissioning engineer, including positions of regulating valves and metering station.
- 3.3.9.3. Shall require test plugs to be of the self-sealing type with brass bodies having captive blank closing caps screwed on.
- 3.3.9.4. Shall require thermometer pockets to be to BS 2765, Part 1, Part 2 and of brass (non-dezincifiable material on hot and cold water services) screwed BSP thread and filled with heat conducting grease.
- 3.3.9.5. Shall require connection points for chemical dosing to be included where shown.
- 3.3.9.6. Shall require suitable bosses welded or brazed on to the pipes and screwed to suit pockets, gauges, sensors, etc to details shown on the drawings.
- 3.3.9.7. Shall require to fit all such controls or test equipment to the pockets/bosses.
- 3.3.9.8. Shall require all work involved in attaching the bosses and drilling and screwing to be done before the pipework length is installed, so that all oil, swarf, etc can be completely removed.
- 3.3.9.9. Shall require orifice plates to be to BS EN ISO 5167-1 and made of copper alloy or stainless steel as appropriate.

3.3.10. Painting

- 3.3.10.1. Shall require protection of iron and steel structures in accordance with BS 5493.
- 3.3.10.2. Shall require all pipework, valves, and fittings, to be supplied with manufacturer's standard finish or protective coating.
- 3.3.10.3. Shall require all fabricated steelwork and steel pipework other than galvanised to be thoroughly cleaned of all scale, corrosion, grease, etc, after erection and painted with

corrosion resistant lead, copper, zinc, tin or aluminium free paint or coating suitable for service conditions.

3.3.11. Service Identification

- 3.3.11.1. Shall require all services to be identified to Model Specification C82 Colour coding for identification of building services published by the NHS Estates. A copy shall be purchased by the Contractor.
- 3.3.11.2. Shall require labelling and notices to be provided in accordance with Model Specification BO1 of the NHS.
- 3.3.11.3. Shall require all valves to have labels attached as per Model Specification BO1 to identify service, valve function, valve reference number and size.
- 3.3.11.4. Shall require the approval of the Engineer before notices and labels are manufactured and attached.

3.3.12. Protection of Services

- 3.3.12.1. Shall be ensured by internal pipework services not being installed until the building envelope is reasonably watertight/weatherproof in order to protect the services from corrosion.

3.4. WELDING OF LOW CARBON STEEL PIPEWORK

3.4.1. General

- 3.4.1.1. The inspection, testing and approval of the welders and the welding of low carbon steel pipework must be carried out by an independent inspecting authority .The contractor shall ensure that all welders possess a competency certificate for welding issued by a reputed institution and welders must have at least 5 years of experience. These certificates shall be issued to the Engineer for verifications prior to appointment of welders on site.
- 3.4.1.2. Oxy-acetylene welding will not be accepted for pipework above 100mm diameter or pipe flanges of any size.
- 3.4.1.3. Welding shall be in accordance with the recommendations in HVCA Code of Practice TR/5 for pipe not exceeding 200mm size and 20mm wall thickness.
- 3.4.1.4. Welding shall be to Class II by electric arc process to BS 2971 using welding materials to BS EN ISO 2560 for pipe exceeding 200mm size and 20mm wall thickness. BS 2460, (withdrawn and replaced by BS 1709).

OR

- 3.4.1.5. Welding shall be to class II by oxy-acetylene process using welding materials to BS EN 12536.

- 3.4.1.6. Welding shall be utilised for all joints on steam, condensate, steel chilled water, and LPHW services located in boiler houses, plantrooms, tank rooms, ducts and concealed spaces together with services run externally or in ceiling voids.

3.4.2. Competency of Welders and Test Welds

- 3.4.2.1. Welders shall be supervised by the Contractor's qualified welding supervisor.
- 3.4.2.2. Welders shall have their names and certificate numbers submitted on a list by the Contractor and produce their certificates for inspection by the Engineer before welding commences.
- 3.4.2.3. Welders shall only be employed on the work on or off site provided that they hold a currently valid Certificate of Competency for Oxy-Acetylene welding Grade 'A' or Metal Arc welding as appropriate to the work in hand or alternatively a currently valid welders performance certificate issued by a competent body.
- 3.4.2.4. Welders shall if holding a currently valid provisional certificate of either of the above, only carry out welding covered by the certificate subject to being under the constant supervision of a person currently competent for the work in hand.
- 3.4.2.5. Welders shall be required in either case before the work to carry out a specimen butt (without backing) and branch pipe connection fusion test at site in accordance with BS 4872 Part 1 procedures and acceptance levels for which a welder approval test record to Appendix B of the standard shall be kept for each test.
- 3.4.2.6. Welders shall be replaced, if unable to meet the requirements of BS 4872: Part 1, by a competent welder who will also be subjected to the same test requirements.
- 3.4.2.7. Welders shall not be allowed to continue welding on the work on or off site if their standards of workmanship prove to be unsatisfactory.

3.4.3. General Welding Requirements

- 3.4.3.1. In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have standard fittings to BS EN 10253, without the use of segmental or cut-and-shut bends. The work shall
- have continuous welding of each weld run of a welded joint, with cleaning and inspection by the welder before further run applied. The
 - work shall have no welding done in extremely severe weather conditions which would affect weld quality. The work shall have
 - faulty weld sections removed and made good by welding-in lengths of pipe not less than 300mm long subject to supervisor/inspector's instructions.
- 3.4.3.2. In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have all branch welds made by the set-on method, with the centres of adjacent branch welds at a distance not less than twice the diameter of the largest pipe as a minimum, in conjunction with a suitable gap between flanges. The work shall have
- welded joints located not less than 600mm from an anchor point or pipeline guide.

- 3.4.3.3. The work shall have end faces of pipes and fittings machined and bevelled (not flame cut) at right angles to axis of bore.
- 3.4.3.4. The work shall have welded-on flanges at intervals of not more than 10 metres to provide break points.
- 3.4.3.5. In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have joint faces of the pipe within 25mm of the face completely cleaned to remove all foreign matter before welding and on completion of the weld, cleaned around the joint for the visual inspection procedure. Finally cleaned and primed within four hours of the inspection, or after satisfactory testing. The work
 - shall have adjacent to each weld the welders certificate of competency number stamped on the pipe by the welder. Provisional Certificates will not be accepted.

3.4.4. Inspection, Testing and Rectification of Faulty Welds

- 3.4.4.1. Shall require all joints to have a visual inspection of completed weld to BS 2971 and BS EN ISO 17637 requirements, this may be carried out by the independent inspection authority to be appointed by the Contractor.
- 3.4.4.2. Shall require 1% of joints tested in addition to the visual inspection, carried out by the independent inspecting authority.
- 3.4.4.3. Shall require any weld found not to be stamped with the welder's Certificate of Competence number to be non-destructively tested at the Contractor's expense.
- 3.4.4.4. Shall require depending upon the method of NDT specified the following standards to apply:-
 - 3.4.4.4.1. BS EN ISO 17637 for radiographic examination
 - 3.4.4.4.2. BS EN ISO 17640 for ultrasonic examination

3.4.5. Records of Inspection and Testing

- 3.4.5.1. Shall require accurate records of inspections, welding procedures, tests and dates to be kept and submitted by the welding inspector and the results made available for inspection within ten days of the test.
- 3.4.5.2. Shall require each result to have the welders certificate number appropriate to the weld recorded on it and a description of the exact location of the joint by reference to the drawing.
- 3.4.5.3. Shall require the AOTC welding inspector to advise which welds are satisfactory and which have failed and the extent of rectification work required which he may mark on the actual joint.
- 3.4.5.4. Shall require the Contractor to satisfactorily carry out the rectification work which may call for an increase in the number of NDT tests until a satisfactory standard is achieved. Rectification work to be carried out at no cost to the client.

3.4.6. Protection of Persons and Material from Weld Damage

- 3.4.6.1. Shall be generally in accordance with Health and Safety Executive (UK) Booklet No 38 (Electric arc welding).
- 3.4.6.2. Shall comprise opaque screens to be used and positioned around fusion operations to prevent weld flash being visible to persons other than the welder.
- 3.4.6.3. Shall include for heat-resistant mats to be used to prevent fire and damage to other materials during the welding procedures.
- 3.4.6.4. Shall include for the provision of two portable fire extinguishers located in the immediate vicinity for emergency use and suitable for type of hazard present.
- 3.4.6.5. Shall require employment of mechanical extract ventilation where an unacceptable concentration of fumes may occur.
- 3.4.6.6. The Contractor shall carry out a risk assessment for welding processes in each location.

3.4.7. Failure of Welded Joints During Pressure Test

- 3.4.7.1. Shall be notified immediately to the Engineer and the joint rectified in accordance with his instructions.
- 3.4.7.2. Shall require a further pressure test to be applied.
- 3.4.7.3. Shall be entered on the welding and pressure test record sheets with details of repair work carried out.
- 3.4.7.4. Shall include for all the above work to be carried out by the Contractor at no additional cost to the Client.

3.5. CAPILLARY JOINTING OF COPPER OR STAINLESS STEEL PIPEWORK

3.5.1. Capillary Soldered Joints

- 3.5.1.1. Shall be to BS EN 1254 using integral ring fittings with lead-free solder and marked accordingly, for hot and cold water services and for all other services to standardise on site inspection requirements.
- 3.5.1.2. Shall be made using the correct grade of flux to suit the service requirements as detailed on the pipework materials tables.

3.5.2. Capillary Brazed Joints

- 3.5.2.1. All brazed joints shall be to BS 14323 Part. They shall be in accordance with the recommendations in HVCA Code of Practice TR/3.
- 3.5.2.2. Shall be made and inspected generally in accordance with procedures as specified for capillary soldered joints. This shall exclude bronze weld.

- 3.5.2.3. Shall be made using the correct grade of silver brazing alloy and flux to BS EN 1044 to suit the service conditions as indicated on the pipework materials tables and to meet the requirements for potable water quality in the case of hot and cold water services.
- 3.5.2.4. Shall have brazing of copper water pipework carried out using a filler rod complying with BS EN 1044 to suit the circumstances involved. Where copper is to be joined these rods may be considered to be self-fluxing, but where copper alloy fittings are to be joined to copper the manufacturer's recommended flux to be used.
- 3.5.2.5. Shall include for silver brazing on condensate mains assembled from copper tube and heavy duty fittings where a brazing alloy to BS EN 1044 or similar approved filler should be used (the pipe end only being fluxed). The flux to be as recommended by the manufacturer.
- 3.5.2.6. Where brazing of copper to gunmetal/bronze is required, these shall have joints made using a copper-silver-zinc brazing alloy to BS EN 1044 or similar approved filler together with an appropriate flux as recommended by the manufacturer, the process to be carried out under controlled conditions and in a clean condition suitable for use as appropriate for the service intended, with no traces of flux, grease or other matter on the completed items. Each person producing brazed joints shall be provided with a steel marker die with which to mark all completed joints with his identification symbol.
- 3.5.2.7. Shall where applicable be tested in accordance with BS 14323, and HVCA Code of Practice TR/3.
- 3.5.2.8. Shall include the cost for any additional testing of joints required by the Engineer or his representative during the Contract.

3.5.3. Precautions/Hazards During Brazing

- 3.5.3.1. Attention is drawn to the Health and Safety at Work etc Act, as the above processes present health hazards, comprising not only the explosion risks from oxygen and fuel gases but also from the vapours from cleaning solvents, fluxes and over-heating filler metals etc.
- 3.5.3.2. The Contractor shall ensure that the area of operation is safe for carrying out the work involved and free from combustible waste materials etc.
- 3.5.3.3. The Contractor shall provide adequate heat shielding and where necessary heat sinks.
- 3.5.3.4. The Contractor shall carry out a risk assessment for each process/location.

3.6. MECHANICAL JOINTS ON CARBON STEEL PIPEWORK

3.6.1. General

- 3.6.1.1. Shall be used in lieu of unions, welded, flanged or screwed pipe connections, except where the water temperature exceeds 95°C.
- 3.6.1.2. Shall be suitable for use on carbon steel pipe that has been grooved in accordance with the joint manufacturers' specifications.
- 3.6.1.3. Shall be self-centering and engage and lock in place the grooved pipe and/or pipe fitting ends to form a positive watertight assembly whether rigid or flexible.

- 3.6.1.4. Shall be manufactured in malleable cast iron to BS 6681, ductile iron to BS EN 1563 or carbon steel to BS EN 10025 GRADE Fe 430A and consist of two or more segments which enclose and control a synthetic elastomeric gasket, so designed that the internal water pressure increases the watertightness of the seal. The coupling assembly to be securely held together by two or more trackhead, square, D-shape or oval-neck carbon steel bolts and nuts. All pipe fittings connected to mechanical pipe joints to have the ends grooved to suit the joint dimensions and fully comply with the joint manufacturers' specifications.

3.6.2. Pipe and Pipe End Preparation

- 3.6.2.1. Shall utilise the mechanical pipe joints manufactured from carbon steel and comply with BS EN 10255, BS 3601 or other recognised standard that is fully compatible with the mechanical joints. Pipe ends to be either cut or roll-grooved using appropriate machines to provide a rectangular groove in the outside surface of the pipe end to meet in every respect the joint manufacturer's dimensional requirements.
- 3.6.2.2. Shall include for the method of grooving to take full recognition of the pipe wall thickness, diameter and service conditions.
- 3.6.2.3. Shall require the Contractor to provide evidence of sufficient training of personnel in respect of pipe end preparation, and obtain such training from the grooving machine manufacturer or supplier as necessary to ensure the full familiarity of personnel with the grooving equipment and procedures.

3.6.3. Pressure Rating and Testing

- 3.6.3.1. Shall for mechanical joints be 1.5 times the continuous working pressure rating of the system. The systems to be pressure tested without leakage prior to commissioning at a pressure of up to 50% higher than the continuous operating pressure of the system.

3.6.4. Gaskets

3.6.4.1. Mechanical Joints

- 3.6.4.1.1. Shall be provided with elastomeric gaskets made from synthetic rubber which meets the requirements of BS EN 681
- 3.6.4.1.2. Shall for use on oil or hydrocarbon fuel systems, be fitted with gaskets meeting the requirements of BS EN 681 and BS EN 682.
- 3.6.4.1.3. Shall not comprise pressure responsive gaskets on manufactured gas systems or on other flammable or toxic gas systems.

3.6.4.2. Corrosion Protection

- 3.6.4.2.1. Shall comprise a chlorinated rubber transit coating as a minimum standard of protection for interior service. This coating to be suitable for overcoating with normal decorative or bitumen paints.
- 3.6.4.2.2. Shall when galvanised coating is required, comply with the requirements of BS EN ISO 1461.
- 3.6.4.2.3. Shall in view of the engagement tolerances of the joint and pipe groove coating thicknesses, at all times comply with the joint manufacturers' recommendations on both pipes and joint. BS EN ISO 9002).

3.6.4.3. Manufacturing Requirements

- 3.6.4.3.1. Shall require all mechanical joints for grooved steel pipe to be manufactured by a company operating a recognised quality assurance scheme and additionally be covered by a current certificate of the British Board of Agreement.

3.6.5. Installation and Training

3.6.5.1. The Contractor:

- 3.6.5.1.1. Shall provide for systems using mechanical joints on grooved steel pipes to be installed in accordance with the manufacturer's instructions. These instructions must have been trained to all workman operating on the pipework.
- 3.6.5.1.2. Shall ensure that each pipe length is less than 6 metres.
- 3.6.5.1.3. Shall include for normal support spacings, according to pipe diameter, but with a maximum of about 6 meters. Externally applied loads should be considered separately.
- 3.6.5.1.4. Shall ensure that pipes are not supported in the central third of any pipe length.
- 3.6.5.1.5. Shall ensure that supports are not placed closer together than 1/3 of the pipe length.
- 3.6.5.1.6. Shall not support the pipe rigidly close to both sides of any joint.
- 3.6.5.1.7. Shall have each bend or reducer supported either directly, or to one side of the fitting within one third of the adjacent pipe length.
- 3.6.5.1.8. Shall have each tee or cross supported either directly or at least at any two of the immediately adjacent pipes within one third of the pipe length.
- 3.6.5.1.9. Shall be within the manufacturer's recommended tolerance for linear expansion and angular deflection.
- 3.6.5.1.10. Shall where the amount of linear expansion provided by a mechanical grooved joint is insufficient, utilise bellow expansion joints to provide the requisite amount of expansion movement in accordance with manufacturer's recommendation.

- 3.6.5.1.11. Shall have an approved gasket lubricant used in the installation of all mechanical joints to aid seating of the gasket and prevent pinching between the housing sections. This lubricant to be suitable for use on elastomeric gasket and potable water systems.
- 3.6.5.1.12. Shall require the provision of proof that all fitters and other personnel involved with the installation of the pipework system are fully familiar with the operation and installation of the mechanical joints, include training to achieve this. If necessary, the installer must provide for appropriate training to be given by the joint manufacturer.

3.6.6. Electrical Continuity

- 3.6.6.1. Electrical Continuity shall be preserved by mechanical flexible joints being fitted with a properly designed bonding conductor and accessory clips which provide equipotential bonding between adjacent pipes in the system.

3.7. THERMOMETERS, ALTITUDE/PRESSURE GAUGES ETC

3.7.1. General

- 3.7.1.1. Similar make and style of thermometers and altitude/pressure gauges are to be fitted, where suitable, to items of plant (e.g. calorifiers/boiler etc.) and/or pipework connections on each side of plant items such as calorifiers/heater batteries/pumps/mixing valves etc. and in positions indicated on the drawing or as specified in Bill of Quantities. All such devices shall be of UK origin preferably

3.7.2. Thermometers

- 3.7.2.1. Shall be to BS EN 13190: mercury in steel dial type with 100mm minimum diameter dial, white faced with black figured scale, complete with integral vertical or centre stem and separate pocket (brass or steel) to suit the immersion position and matt paint finish to casing and bezel.
- 3.7.2.2. Shall be installed using heat conducting grease.
- 3.7.2.3. Shall be calibrated in Celsius with divisions at 1°C intervals and numbered at 10°C intervals, the scale ranges being:-
- 0 - 50°C Cold Water Service
 - 0 - 100°C Hot Water Service
- 3.7.2.4. Where a fixed working temperature is being measured, have a loose red pointer set to that point.

3.7.3. Altitude and Pressure Gauges

- 3.7.3.1. Shall be generally to BS EN 837-1, with 100mm minimum diameter dial, white faced with black figures scale calibrated in bar or metre head to approximately 1.5 times the working pressure, complete with lever handle (pressure gauges to have a ring or "U" pattern siphon) and adjustable red pointer set at normal working pressure/head of the system.

- 3.7.3.2. Shall be finished matt paint for both casing and bezel.
- 3.7.3.3. Shall be calibrated in metres head of water for altitude gauges, bar or millibar for pressure gauges (0.10 bar) and millimetre Hg or kilo Pascals (kPa) for vacuum.
- 3.7.3.4. Shall be steel tube to BS 3059, Part 2 filled with water prior to being put into service in the case of siphons.

3.7.4. Pressure Relief Valve (Calorifiers)

- 3.7.4.1. Shall be to BS EN ISO 4126 enclosed spring loaded pattern, fitted with a padlock and discharge pipe run clear of any insulation to terminate 150mm from floor level.

3.8. PRESS FITTINGS FOR CARBON STEEL TUBES

3.8.1. General

- 3.8.1.1. Shall be used where specified in Bill of Quantities or drawings, in lieu of Unions, welded flanged, screwed connections or mechanical joints, except where the water temperature exceeds 110°C.
- 3.8.1.2. Shall be used only on Chilled Water System and Compressed Air (non-medical) Services.
- 3.8.1.3. Shall be suitable for use on carbon steel pipe that meets the manufacturer's requirements.
- 3.8.1.4. Shall be self-centering and must be pushed onto the pipe until the stop is reached.
- 3.8.1.5. Shall be manufactured from unalloyed steel heat treated and consists of the fitting and 'O' ring seals, completed by pressing with an electro-mechanical tool, as per manufacturer's specifications.

3.8.2. Pipe and Pipe End Preparation

- 3.8.2.1. Shall be manufactured from unalloyed thin wall carbon steel conforming to DIN 2391/2393/2394, BS EN ISO 9002.
- 3.8.2.2. Shall be cut square with any internal and external burrs removed, as per joint manufacturer's requirements.
- 3.8.2.3. Shall require the Contractor to provide evidence of sufficient training of personnel in respect of pipe end preparation and obtain such training from the press fitting manufacturers or suppliers as necessary to ensure the full familiarity of personnel with the press fitting equipment and procedures.

3.8.3. Pressure Rating and Testing

- 3.8.3.1. Shall be 1.5 times the continuous working pressure rating of the system.
- 3.8.3.2. Shall be pressure tested without leakage prior to commissioning at a pressure up to 50% higher than the continuous operating pressure of the system.

3.8.4. Press Fitting Joints

- 3.8.4.1. Shall be provided with 'O' rings made from synthetic rubber (Butyl) which meets the requirements of type H for hot water, type W for chilled water, as appropriate according to the temperature rating of the system.

3.8.5. Corrosion Protection

- 3.8.5.1. Shall comprise a coat of paint, followed by the application of a coat of Polypropylene for pipes.
- 3.8.5.2. Shall comprise a suitable paint against external corrosion for pipe fittings. The paint shall be approved for use on water pipes.
- 3.8.5.3. Shall use manufacturer's recommended inhibitor for closed Chilled Water System.

3.8.6. Manufacturing Requirements

- 3.8.6.1. Shall be that all press fittings for thin wall carbon steel be manufactured by a company operating a recognised quality assurance scheme in accordance with European Community equivalent ISO 9001.

3.8.7. Installation

- 3.8.7.1. Shall be installed in accordance with the manufacturer's instructions.
- 3.8.7.2. Shall have length of pipes not exceeding 6 metres.
- 3.8.7.3. Shall have anchor points where necessary, not to be located close to both sides of any fittings or directly on any fittings.

3.8.8. Spacing of Supports

3.8.8.1. Shall be as shown in the table below :

Pipe Size	Maximum Horizontal and Vertical Spacings between Supports
mm	metres
15	1.20
22	1.50
28	1.80
35	2.10
42	2.30
54	2.60

Supports to be provided within 300mm on both sides of a bend/elbow tee or change direction

3.8.9. Expansion

3.8.9.1. Shall be within the manufacturer's recommended tolerance for linear expansion and angular deflection.

3.8.9.2. The Contractor shall utilise bellows expansion joints to provide the requisite amount of expansion movement in accordance with the manufacturer's recommendations. It is the Contractor's responsibility to determine the number and spacings of all expansion bellows required. All calculations are to be submitted with the shop drawings for the expansion bellows positioning.

3.8.10. Proof of Training

3.8.10.1. Shall require the Contractor to provide proof that all fitters and other personnel involved with the installation of this pipework system are fully familiar with the operation and installation of this press - fit joints.

3.8.11. Electrical Continuity

3.8.11.1. Shall be provided by the direct contact of the pipe and fitting through the pressing of the joint.

4. INSULATION

4.1. GENERAL

4.1.1. Scope

- 4.1.1.1. This section describes thermal insulation materials, coverings and the required standards and methods/practices of their installation when applied to engineering services for Health Care Premises.

4.1.2. Services to be Insulated

- 4.1.2.1. Insulation shall be applied to hot and chilled pipework, calorifiers, feeds and vents etc. but excluding any pipework or any final connections that are so located as to contribute heat to the space, in addition to the heat emitter.
- 4.1.2.2. Shall be applied to hot and cold water services systems including calorifiers, cylinders and storage cisterns.
- 4.1.2.3. Shall be applied pipework and vessels etc. in a heat recovery, refrigeration or chilled water system.
- 4.1.2.4. Shall be applied pump bodies and pipe fittings on chilled water systems to prevent condensation.
- 4.1.2.5. Shall be applied Condensate systems including accumulators, pipework, condensate receivers.
- 4.1.2.6. Shall be applied safety valve discharge pipes for steam, heating and hot water where required to prevent danger to personnel.
- 4.1.2.7. Shall be applied steam equipment e.g. humidifier bodies where required to prevent danger to personnel.
- 4.1.2.8. Shall be applied boiler flues, smoke boxes, grit arrestors and ID fans, internal and external.
- 4.1.2.9. Shall be applied on supply air handling plant including heater or cooler batteries with intake ductwork to plant insulated to prevent condensation.
- 4.1.2.10. Shall be applied ductwork carrying heated, cooled, tempered or conditioned supply air or extracted air for use by re-circulation, or for extracted air forming part of a heat recovery system.
- 4.1.2.11. Shall be applied air extract ducting to atmosphere - where such ducting passes through occupied areas and contributes to the heat gain/loss of the occupied area.
- 4.1.2.12. Shall be applied any pipework with heated/cold/chilled fluid, within hollow partition, "boxed in", floor screeds and all pipework subject to potential frost conditions.
- 4.1.2.13. Any further services or equipment detailed in drawings or bill of quantities or schedules.

4.1.3. Pipework Clearances

- 4.1.3.1. There shall be sufficient clearance between each pipe/service to allow for the thickness of insulation specified in the tables of this Specification and to comply with the requirements of pipework section specifications. Additional space/clearance may be required where insulated pipesleeves are used e.g. cold and chilled water services and heated/cooled etc. ductwork.
- 4.1.3.2. Shall allow for any/all electrical cabling, conduit and trunking between or adjacent to any/all pipework services, to cater for the thickness of insulation as detailed in this Specification and all statutory and best practice clearances between such electrical and mechanical services.

4.1.4. Alternative Makes

- 4.1.4.1. The use of other forms of insulation, or other manufacturers' products, may be considered provided they comply fully with the requirements laid down in this Specification and are equal and acceptable in all respects. This approval shall be at the sole discretion of the Engineer.

4.1.5. Availability of Materials

- 4.1.5.1. The specified materials and/or their thicknesses may not always be stock items. Delays to the contract due to their poor or non-availability etc. will not be accepted.

4.2. MATERIALS

4.2.1. General

- 4.2.1.1. All insulation materials shall be obtained, where available, from a BS 5750/ISO 9000 "Quality Systems" certified manufacturer. The insulation materials shall be new and totally free of asbestos.
- 4.2.1.2. All insulation materials shall be covered/finished by materials of weatherproof quality for outdoor (external) situations. This shall be as specified on drawings or in the Bill of Quantities. Where not indicated in these two documents, the protection shall be aluminium sheet of thickness indicated in Table 4.4-1.
- 4.2.1.3. All insulation materials shall be so protected, manufactured, constructed and installed as to prevent electrolytic action, corrosion or decay.
- 4.2.1.4. All insulation materials shall be chosen to ensure that they are durable for the expected life of the installation.
- 4.2.1.5. All insulation materials shall be rot proof, non-hygroscopic, free from animal hair or settling under vibration and resistant to attack and damage by vermin and to the growth of fungi.
- 4.2.1.6. All insulation materials shall be suitable for specified conditions of use without the physical properties falling outside the tolerances allowed in the appropriate British Standard for the material.

- 4.2.1.7. All insulation materials shall be free from objectionable odours at the temperature range at which they are to be used (transient effects during the initial period of use may generally be ignored).
- 4.2.1.8. All insulation materials shall be free of chemicals which may contribute to the corrosion or degradation of the insulated surface or surface finish.
- 4.2.1.9. All insulation materials shall be to the thicknesses calculated and thermal characteristics stated, all in accordance with the Tables of this Specification.
- 4.2.1.10. All insulation materials shall be delivered to site new and fully dried out and so stored and maintained throughout the Contract.
- 4.2.1.11. All insulation materials shall be applied to individual pipes or ducts. Adjacent parallel pipes or ducts shall not be married together with one common insulation covering unless specifically detailed on the drawings.
- 4.2.1.12. All insulation materials shall be applied such that plant and equipment can be inspected, tested via installed test points, cleaned and allowance made for removal of access covers, bolts and nuts etc. without damage to the insulation.
- 4.2.1.13. All insulation materials shall be applied after the particular service installation section has been successfully pressure tested and steel pipework painted by the Mechanical Contractor. All pipework surfaces and other surfaces to be fully prepared as detailed in BS 5970 and in compliance with the manufacturer's recommended installation instructions.
- 4.2.1.14. All insulation materials shall be installed when the Engineer or his representative informs the Contractor that the works above have been completed to his satisfaction.
- 4.2.1.15. All insulation materials shall be identified with coloured bands to BS 1710 unless the existing colour code is different. For further details see Section "Colour coding for identification of building services".
- 4.2.1.16. All insulation materials shall be if exposed to view (internal or external) and below 2 metres from finished floor level, complete with mechanical protection.

4.2.2. Insulation

- 4.2.2.1. Shall NOT cause a known hazard to health at the time of application or while in use.
- 4.2.2.2. Shall NOT incorporate any material containing asbestos in either composition or surface finish.
- 4.2.2.3. Shall NOT be used in kitchens, food preparation or food storage areas (including ceiling voids and ducts, and access from these areas etc.) nor in air conditioned/aseptic spaces, if it contains glass or rock fibre.
- 4.2.2.4. Shall not be of a lesser thickness, density and fire rating or of a higher thermal conductivity to that specified herein.
- 4.2.2.5. Shall NOT be bonded (or covered) by any adhesive/sealant or banding which may cause a fire hazard or emit dense smoke or toxic fumes, if subjected to excessive heat such as in a fire, unless specified in Part D.
- 4.2.2.6. Shall NOT suffer deterioration at a maximum temperature under the specified conditions of use.

- 4.2.2.7. Shall NOT suffer permanent deterioration as a result of contact with moisture due to condensation or other sources.
- 4.2.2.8. Shall NOT be supported on wood, cork or polystyrene etc., blocks or segments used as insulating pads/collars.
- 4.2.2.9. Shall NOT contain or incorporate any materials that contain CFCs (chlorofluoro-carbons)
- 4.2.2.10. Shall NOT be painted with aluminium-based paints where used in the vicinity of flammable liquids or flammable gases, nor in the vicinity of pipes carrying flammable liquids or gases, due to the possible risk of an explosion.

4.2.3. Damage

- 4.2.3.1. Insulation and protective coverings shall be applied only after the completion cleaning and pressure testing of the service.
- 4.2.3.2. Insulation and protective coverings shall be protected during the progress of the work.
- 4.2.3.3. Insulation and protective coverings shall be maintained dry as appropriate.
- 4.2.3.4. Insulation and protective coverings shall be fabricated to allow for expansion, contraction, ease of access for maintenance, testing, operation or replacement of equipment without damage to the service or insulation.
- 4.2.3.5. Insulation and protective coverings shall be protected against the mechanical damage where run/exposed on the surfaces in vulnerable areas e.g. an installation at low level in a corridor which may be subject to impact by cleaning machines, trolleys etc.
- 4.2.3.6. Insulation and protective coverings shall be protected by the Contractor against damage to new and/or existing pipework, ductwork and plant etc. throughout the progress of the work. This requirement also to apply to new and/or existing services insulation. Any damage shall be rectified prior to practical completion at no additional cost to the Contract and to the satisfaction of the Supervising Engineer.

4.2.4. Insulation Installation Requirements

- 4.2.4.1. The Contractor shall include for the supply and installation of all materials, plant, equipment, appliances and accessories necessary to form a complete and thorough installation, in accordance with BS 5970 and as detailed in drawings.
- 4.2.4.2. The Contractor shall ensure that the correct thickness, thermal conductivity, fire rating and density of insulation installed complies with the requirements of this Specification and relevant ISO/British Standards. Insulation not complying with these requirements shall be removed and replaced with new insulation to the requirements free of charge.
- 4.2.4.3. The Contractor shall ensure that where insulation is not required at valves, flanges or supports, it is finished 50mm short of any valve, flange, support etc. and be neatly squared off with the end covered with a purpose-made cap to suit the covering used.
- 4.2.4.4. The Contractor shall ensure adequate clearance at supports etc. to allow for expansion/contraction without damage to the insulation.

- 4.2.4.5. The Contractor shall ensure that all manholes, manhole covers, handholds and inspection ports have insulated covers which are easily removed without damage to the insulation.
- 4.2.4.6. The Contractor shall ensure that all nozzles, flanges and valve accessories are insulated to the same extent as the adjoining piping.
- 4.2.4.7. The Contractor shall ensure that instruments are insulated such that there is no interference with their operation/function and allows gauges, dials, sight glasses etc. to remain unobstructed and clearly in view.
- 4.2.4.8. The Contractor shall ensure that all code inspection plates/stamping and nameplates etc. are covered with removable insulation, the covers of which to be easily identifiable.
- 4.2.4.9. The Insulation Contractor shall ensure that all pipework insulation over 75mm thick should be applied in multi-layers with a maximum of 75mm per layer.
- 4.2.4.10. The Contractor shall use only insulating materials of a reputable manufacturer. The thermal insulating properties to relate to the manufacturers' declared value of conductivity (k) based on BS 874 Part 1.
- 4.2.4.11. The Contractor shall ensure that unless stated otherwise, all pipework insulation up to 2 metres above floor level in boiler houses and plantrooms has an aluminium protective sheet covering/finish to avoid impact damage. Note aluminium cladding is not to be used over PLASTIC insulation. All other insulation covering unless stated otherwise to be reinforced "Class O" aluminium foil.
- 4.2.4.12. The Contractor shall provide proof, prior to installation, to the Supervising Officer (Engineer)/ Clerk of Works, that the insulation complies with the requirements of this Specification and, in particular, items mentioned above or in Bill of Quantities/drawings.
- 4.2.4.13. The Contractor shall apply the insulation strictly in accordance with all statutory and British Standard requirements and the insulation manufacturers' recommendations and instructions; work done failing to comply will not be accepted.
- 4.2.4.14. The Contractor shall ensure that all work be left perfectly smooth, clean and properly finished. All unused insulation, finishes and packaging etc. to be removed from the site before the final acceptance of the works. All fibrous particles remaining after cutting and fabrication to be removed by suction cleaning, using 'type H' cleaner at the end of the working day.
- 4.2.4.15. The Contractor shall at the Engineer's request, cut out one section of the insulation on each of the services to verify the thickness and/or density and reinstate the insulation at his own expense.
- 4.2.4.16. The Contractor shall if defects are revealed, cut out two further sections of suspect insulation, for inspection.
- 4.2.4.17. The Contractor shall if further defects are revealed, at his own expense, remove the whole of the insulation and reapply in accordance with this specification.
- 4.2.4.18. The Contractor shall give particular attention to the finished appearance of all thermal insulation to ensure a neat and symmetrical appearance, running true in line with pipe or duct layouts.
- 4.2.4.19. The Contractor shall ensure that insulated pipework/ductwork is painted using paint suitable for the temperature and environment of the service. The colour of the paint to be agreed by the Engineer and to be applied in accordance with the manufacturer's

instructions. These instructions shall be submitted to the Engineer and also affixed on site.

- 4.2.4.20. The Contractor shall strip down any poor quality, irregular or badly finished or installed insulation and/or surfaces and re-insulate, at his own expense, to the satisfaction of the Engineer or his representative.
- 4.2.4.21. The Contractor shall until final acceptance of the installation, (Partial or Full Handover) by the Engineer, accept responsibility for the insulation installed by him, making good any damage, at his expense, so that the installed insulation is handed over in perfect condition.

4.2.5. Building Regulations and Fire Performance

- 4.2.5.1. The Contractor shall, in addition to satisfying the general requirements stated in this Specification, also comply with the following: -

- All insulation material itself shall achieve a minimum of Class 'O' rating (as defined in Appendix A paragraph A12 of the 1991 Building Regulations, Approved Document B of the UK) or an approved equivalent standard where fire and surface spread of flame certificates relate to factory-made products, the Contractor shall ensure that the certificates remain valid when the finish is site applied.
- Facing materials including any/all adhesives, fixing, vapour barrier and finishing material bonded to the insulation shall achieve a minimum of Class 'O' rating. Certification of faced material shall state the nature of the facing material, the type and weight of adhesive, the manufacturer of the substrate, its density and any other factors pertinent to the fire performance of the system.

- 4.2.5.2. Thermal insulation when applied:-

- to internal linings for ventilation ductwork;
- over ductwork in air return plenums;
- insulation for ventilation ductwork or pipes greater than 100mm nominal bore;

- 4.2.5.3. shall itself be of Limited Combustibility (in accordance with BS 476 Part 11 with a weight loss in the test of not more than 50%. The complete assembly of materials shall achieve a Class 'O' rating.

- 4.2.5.4. All insulation including any/all adhesives, fixings, vapour barriers and finishing materials where located in cavities, rooms, circulation spaces and protected shafts shall be of a class at least equal to the class for walls in the Building Regulations 1991 Approved Document B and not less than Class 'O'.

- 4.2.5.5. Insulation shall not be carried through fire compartment walls or floors unless it complies with the Building Regulations of the UK or an approved equivalent standard. Fire stopping is required by the 1991 Building Regulations, Approved Document B, wherever services perforate a compartment wall or floor designated as a fire barrier. The requirements of BS 476 Parts 20, 21, 22 and 23 should also be complied with.

- 4.2.5.6. All insulation situated within a fire-resistant ductwork enclosure shall achieve a Class 'O' rating, unless the space formed between the ductwork and the fire-resistant enclosure is sub-divided at each floor level and wherever the fire resistant ductwork enclosure

penetrates a compartment boundary by fire-resistant construction, in which case it shall have a fire resistance of not less than the ductwork enclosure.

- 4.2.5.7. If there is a potential hazard from contamination by oil or other flammable chemicals, a suitable resistant finish e.g. a metal sheet or appropriate non-absorbent coating shall be applied over the vulnerable areas. The lapped joints of sheet finishes shall be arranged to shed contaminating fluids away from the insulating material.

4.2.6. Electrical Bonding

- 4.2.6.1. Shall where insulation with a sheet metal surface finish is used e.g. aluminium stucco sheeting etc., comply with the IEE Wiring Regulations 16th Edition (BS 7671: 1992) and all subsequent additions and amendments as regards the facility to be electrically bonded to a protective conductor.
- 4.2.6.2. Shall be carried out by the Mechanical Contractor Insulation of pipework, ductwork or plant, finished with aluminium sheeting, or any other metal (but not aluminium foil), also to be bonded. The Mechanical Contractor shall terminate all bonding connections on the nearest earth bar provided by the Electrical Contractor or at the cabling of the fan/AHU as appropriate.

4.3. INSULATION

4.3.1. Selection

- 4.3.1.1. Shall be to the requirements specified in drawings or bill of quantities and be CFC-free, including any blowing agents used in the application.

Table 3: Thermal Insulation Materials

CODE	MATERIAL	BS	TYPICAL TEMP	TYPICAL "K"VALUE	TYPICAL MATERIAL
			RANGE	W/mK at	DENSITY
				mean temp °C	kg/m3
CS	Calcium silicate	3958	Up to	.058@	Not less
	preformed pipe, lags	Pt2	650°C	100°C	than 210.
	and slab sections.				
GF	Bonded preformed man-	3958	Up to	.044@	GF not less than
RF	made glass/rock fibre	Pts3	300°C	100°C	50. RF not less
	mats and	&5			than 65.

CODE	MATERIAL	BS	TYPICAL TEMP	TYPICAL "K"VALUE	TYPICAL MATERIAL
	mattresses.				
GF	Bonded preformed man-	3958	Up to	.043@	GF 80-100
RF	made glass/rock fibre pipe section	Pt4	230°C	100°C	RF 130-150
	pipe sections.			.043@	
				100°C	
GF	Bonded man-made	3958	51°C	.047@	48+
RF	mineral fibre slabs.	Pt5	400°C	100°C	65+
				.047@	
				100°C	
GF	Flexible mattresses.	3958	Up to	.065@	20
RF	Flexible mattresses.		230°C	100°C	90
				.044@	
				100°C	
PF	CFC-free Phenolic		-180°C	0.02	To be
	Resin (Foam)	-	to		not less
	Insulation. Pipe, sheet and slab sections.		+120°C	@ 10°C	than 35.
ENR	Expanded nitrile rubber	-	-40°C to	.036@-10°C	To be
	(Class 'O' only).		+150°C	and	not less
				.041 @	than 65.
				+20°C	

- 4.3.1.2. The Contractor shall obtain from the manufacturer the maximum limiting temperature of the insulation material and the limiting thickness at that temperature. This information along with the name of the manufacturer(s) shall be stated by the Contractor and given to the Engineer prior to the installation of any insulation.

- 4.3.1.3. The Contractor shall ensure that all surfaces to be insulated are fully prepared in strict accordance with the manufacturer's recommended installation instructions and BS 5970.
- 4.3.1.4. The Contractor shall ensure that the insulation material is wholly compatible with the material it is insulating at the design working temperature and environmental conditions.
- 4.3.1.5. The binding agent in "Bonded Mineral Fibre" materials may be lost at temperatures in excess of 230°C. Where bonded mineral fibre is used at very high temperatures the material should be installed in such a way that mechanical stress will not alter its shape when the binder evaporates.
- 4.3.1.6. Expanded Nitrile Rubber materials will not normally be used for internal applications.

4.4. PROTECTION AND PROTECTIVE COVERINGS

4.4.1. Internal Coverings

- 4.4.1.1. Shall be aluminium foil laminate: foil thickness 0.08mm minimum, polyethylene-glass reinforced laminated finish with a factory applied coating to achieve a Class 'O' surface spread of flame fire rating. All joints to have minimum overlaps of 38mm longitudinal and 50mm at ends secured with a self-adhesive tape or adhesive and aluminium foil strip, both tape and strip to be Class 'O', waterproof and a minimum of 75mm wide.
- 4.4.1.2. Shall not be punctured by fixing devices particularly where the finish is a vapour or moisture barrier. Any cladding used over the vapour barrier shall be retained with 19mm wide aluminium metal bands between 300mm centres.
- 4.4.1.3. Plantroom pipework services up to 2m above floor level and externally exposed services liable to impact damage shall be protected with aluminium sheet plain or reeded of minimum thickness as shown in Table 4, secured by aluminium self tapping screws at 50mm pitch. Aluminium bands to be used where screws could penetrate the moisture or vapour barrier. Any quick release fastening shall be either cadmium-plated or aluminium.
- 4.4.1.4. Shall include sealing materials, for sealing joints between sheets. The sealing materials to be suitable for the sheet duty and operating temperature. End joints to be covered with 38mm wide aluminium strip and purpose made caps.
- 4.4.1.5. The contractor shall ensure longitudinal joints on adjacent sheets are arranged slightly offset, with suitable provision made for thermal expansion when fixing the protective aluminium covering. Overlaps should be adequate to cater for the expected expansion movement, plus not less than 40mm.
- 4.4.1.6. Shall have the aluminium covering kept clear of direct contact with dissimilar metals to avoid electrolytic action.
- 4.4.1.7. Shall be electrically continuous and bonded to earth by the Electrical Contractor via connections provided by the Mechanical Contractor.

Table 4: Thickness of Aluminium Sheeting for exposed pipes and pipes subject to mechanical damage

Insulation	Plain	Reeded
OD (mm)	(mm)	(mm)
Up to 150	0.7	0.4
150-450	0.9	0.6
Above 450, flat surfaces and vessels	1.2	0.9
Places where impact damage may occur, on roof for example	1.9	-

4.4.2. Services Exposed to Weather

- 4.4.2.1. Shall be finished with aluminium cladding as specified above. All joints to be secured with 12mm wide butyl tape in accordance with the manufacturer's recommendations. Stop ends to be covered with purpose-made aluminium caps.

4.4.3. Vapour Barriers

- 4.4.3.1. Shall be applied over insulation on plant etc., working at or below ambient temperatures.
- 4.4.3.2. Shall be applied over the insulation and its covering/finish on refrigeration, cold or chilled water and warm/cooled air services.
- 4.4.3.3. Shall be continuous, maintained dry, completed and sealed as a vapour barrier throughout before reducing the service to its working temperature. The water vapour permeance of the finished installation not to exceed 0.0008 (g/Mns) when tested in accordance with BS 3177, or for thicker materials, method 8 of BS 4370 Part 2 be aluminium foil laminate as detailed in 04.02 with a minimum thickness of 0.02mm (foil).
- 4.4.3.4. Where the integrity of the water vapour barrier may be susceptible to "pinhole" penetration, impact or mechanical damage, be protected by aluminium sheeting.

4.4.4. Insulation of Pipework Supports

- 4.4.4.1. Shall at temperatures above ambient insulation, be continued over the pipe supports and shall be sealed at the point where the hanger, clamp or other anchorage protrudes. Insulated pipe supports shall comply with BS 3974 Part 1 and BS 5970.
- 4.4.4.2. Shall at temperatures at or below ambient, have all pipe clips and hangers attached to the outside of the insulation. Metal saddles to be used to prevent crushing of the insulation.

- 4.4.4.3. Shall have supports so arranged to prevent the ingress of moisture to the insulation. The supports to be insulated from the pipeline by lining the supports with insulation of sufficient density and thermal conductivity appropriate for the duty.
- 4.4.4.4. Shall have the vapour barrier and finish carried over the support liners.
- 4.4.4.5. Shall ensure that all protrusions through the insulation are insulated from that surface for a minimum distance of twice the thickness of the insulation and all vapour seals are correctly applied. All insulated pipe supports to comply with BS 3974 Part 1 and BS 5970.

4.4.5. Insulation of Ductwork Supports

- 4.4.5.1. Shall on heat recovery, warm or cooled air systems satisfy the requirements be of DW144

4.4.6. Chilled Water, Refrigeration Cold Water Services

- 4.4.6.1.1. 15mm pipe and above: all valves and all flanges and pump casings.
- 4.4.6.2. Shall not comprise wood, cork or polystyrene blocks etc. or segments as an insulating pad or collar.

4.4.7. Insulated Valve and Flange Cover Boxes

- 4.4.7.1. Insulated valve and flange cover boxes shall be provided
- 4.4.7.2. Shall comprise an aluminium split casing fitted with spring clip fasteners and lined with an insulation material (thickness to be equal to that on pipework) suitable for the particular service.
- 4.4.7.3. Shall be suitable for the size and type of valve or flange and be neatly and properly finished.
- 4.4.7.4. Shall be installed on all flanges and valves including control valves (but not control motors).
- 4.4.7.5. Shall have all joints in the casing suitably sealed. Where available, preformed valve and flange insulation mouldings shall be used.
- 4.4.7.6. Shall on removal, enable full and clear access to the valve body/flange bolts etc.
- 4.4.7.7. The Contractor shall ensure that a complete vapour seal exists between permanent and removable insulation and that the vapour barrier seal returns to the pipework on either side of the flange or valve.
- 4.4.7.8. If the valve/flanged joints are liable to be used/broken frequently, it shall incorporate flexible multi lag covers achieving a Class 'O' rating, and suitable for the temperature range of the service.
- 4.4.7.9. Phenolic insulation shall not be used on steam services.
- 4.4.7.10. The glands on valve spindles shall project beyond the insulation.

4.4.8. Walls and Fire Barriers

- 4.4.8.1. Where insulated services pass through a structure, the Contractor shall ensure that the provision made under Common Services Mechanical accommodates the insulation. At fire barriers the fire integrity of the barrier must be maintained by converting the insulation to non-combustible type; all to be suitably fire stopped.
- 4.4.8.2. At fire barriers and structures the thickness of insulation may be varied, but care must be taken to prevent heat transfer sufficient to cause deterioration of the building fabric.

4.4.9. Expansion Bellows Insulation

- 4.4.9.1. For temperatures above ambient they shall be insulated with the same insulating material and thickness as that used on the adjoining pipework. They shall be provided with shields to avoid the insulating material filling the convolutions. They shall also insulation with mechanical impact and weather protective coverings similar to that of the adjoining pipework and fittings. See BS 5970 Figure 31 "TYPICAL METHOD OF INSULATING EXPANSION BELLOWS".
- 4.4.9.2. For temperatures at or below ambient they shall be insulated as detailed above but have a vapour barrier sealed over the insulation. Ensure that complete vapour seal exists between the pipework and bellows insulation and that the vapour seal returns to the pipework on either side of the expansion bellow unit. The whole to have mechanical impact weather protective coverings similar to the adjoining pipework and fittings.
- 4.4.9.3. Shall not be applied until any "cold draw" has been taken up.

4.4.10. Insulation for Pipework in External Trenches/Ducts

- 4.4.10.1. Shall be in phenolic foam insulation sections, with aluminium foil outer finish. In trenches/ducts liable to flooding, the insulation shall be suitably weatherproofed. The installation of the insulation to comply with the requirements of this Specification and also BS 7572: 1992 as applicable.

4.4.11. Insulation for Ductwork Flanges

- 4.4.11.1. Shall be applied to all ductwork sides using insulation sections the same as the adjacent ductwork.
- 4.4.11.2. Shall be suitably sealed with 100mm wide aluminium foil tape; (and where external weather-proofed in accordance with previous of this Specification) reference should also be made to BS 5970.

4.4.12. Plant Access

- 4.4.12.1. Shall comprise aluminium sheet covering or steel sheet with aluminium and zinc coating, securely fixed to the insulation in an approved manner and neatly joined and shaped to suit the plant/equipment contours. Where removable access or sections are incorporated on the plant, the insulation and covering is to be removable from the relevant area without disturbing the remainder of the insulated surface by means of quick release type fasteners. Reference should be made to the requirements/recommendations of BS 5970.

4.4.13. Sealing of Insulation

- 4.4.13.1. Shall on vapour barrier insulation finishes be effectively sealed and maintained with the materials specified. Where sealing tape is used it must be approved by the insulation manufacturer and securely fixed to the insulation with an approved (or self) adhesive coating.
- 4.4.13.2. Shall not be accepted if the sealing tape is incorrectly applied or fitted. Any puncture or damage to the vapour seal to be carefully and effectively repaired with a suitable sealant.
- 4.4.13.3. At entries into buildings have the weather-proofed insulation extended not less than 100mm beyond the inner face of the wall and correctly fire stopped and sealed.

4.4.14. Pipework Installed in Floor Ducts/Screeds

- 4.4.14.1. Shall be insulated by packing plain finished mineral fibre mattress insulation beneath, between and above the services, thereby filling the duct with insulation.

4.4.15. Adhesives/Sealants

- 4.4.15.1. Shall be suitable for the insulation (and condition of use) they are required for and comply with the Health and Safety Act.
- 4.4.15.2. Shall not cause a fire hazard or emit dense smoke or toxic fumes in the event of a fire or excessive heat.
- 4.4.15.3. Shall meet the requirements of LEED reference guide and LEED credit requirements.

4.5. INSULATION THICKNESS AND COVERINGS

4.5.1. Selection

- 4.5.1.1. Shall be according to ASHRAE 90.1 OR BS EN 5422 or shall be from these Tables below whichever is more stringent. Thicknesses shown in Tables are the minimum for the particular service and conductivity. For intermediate conductivities the minimum thickness to be determined by interpolation.
- 4.5.1.2. Shall permit the use of calcium silicate which does not contain man made mineral fibres, in kitchen/food areas or on/in air conditioned services/spaces.
- 4.5.1.3. Shall ensure compatibility of all materials used.

- 4.5.1.4. Shall not permit the use of man made mineral fibre (MMMF) insulation or calcium silicate containing MMMF in kitchen/food areas or on/in air conditioned services/spaces.

Table 5: Chilled Water Service Pipework

Nominal Diameter – mm			
Steel	Copper	Phenolic Foam (.02 W/mk)	Nitrile Rubber (0.041 w/mk)
15	Up to 22	20	25
20	28	20	25
25	35	25	30
32	42	25	30
40	54	35	30
50	67	35	30
65	76	40	35
80	108	40	35
100		50	35
150		50	40
200		60	40
250		60	

Table 6: Insulation Thickness for Ductwork

Location	Location Thickness-mm			
	Mineral Fibre		Phenolic foam	Nitrile Rubber
	Slab	Wrap		
External duct	65	90	50	75
Plant rooms, ducts, voids an un-conditioned area	50	65	40	50
Suspended ceilings over air-conditioned areas	40	50	30	38

4.5.2. Condensate:

- 4.5.2.1. Internal condensate pipework from cooling coils, etc shall be insulated for their full length unless specifically agreed otherwise with the Engineer.
- 4.5.2.2. Internal condensate pipework from fan coil units shall be insulated for the whole length up including the stack with 15 mm nitrile rubber insulation.

5. MECHANICAL VENTILATION AND AIR CONDITIONING SYSTEMS

5.1. GENERAL

5.1.1. Installations Generally

- 5.1.1.1. Materials incorporated into the works shall not support microbiological growth, this applies particularly to mastics, gaskets, etc. Where available environmentally friendly products should be given preference. All materials used in the construction of cooling coils/chillers batteries and humidifiers should withstand bio-degradation.

5.1.2. Standard References

- 5.1.2.1. The materials components and completed installations shall conform as applicable with the following Standards, including all amendments, current at the time of tendering. Construction products should comply with European Standards and Technical Specifications (ESTS). Wherever reference is made to a British Standard a corresponding ESTS (generally ISO series) shall be equally acceptable. Where available all materials, equipment etc forming part, or whole, of the services specified in the Contract, should be obtained from BS EN ISO 9000 "Quality Assurance" certified manufacturers and preferably "kite marked" or EC equivalent.

BRITISH STANDARDS

General

BS21: 1985	Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).
BS 4504:	Circular flanges for pipes, valves and fittings (PN designated).
Part 3	Steel, cast iron and copper alloy flanges.
Section 3.1: 1989	Specification for steel flanges.
Section 3.3: 1989	Specification for copper alloy and composite flanges.
BS 5720: 1979	Code of Practice for mechanical ventilation and air conditioning in buildings.
BS8313: 1997	Code of Practice for Accommodation of Building Services in ducts.

Ductwork

BS 1449	Steel plate, sheet and strip.
Part 2: 1983	Specification for stainless and heat resisting steel plate, sheet and strip.

BS EN 10051: 1992	Specification for continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels. Tolerances on dimensions and shape.
BS EN 10131: 1991	Cold-rolled uncoated low carbon and high yield strength steel flat products for cold forming. Tolerances on dimensions and shape.
BS EN 485	Aluminium and aluminium alloys - Sheet, strip and plate.
485-1: 1994	Technical conditions for inspection and delivery.
485-2: 1995	Mechanical properties.
485-3: 1994	Tolerances on shape and dimensions for hot-rolled products.
485-4: 1994	Tolerances on shape and dimensions for cold-rolled products.
BSEN515: 1993	Aluminium and aluminium alloys. Wrought products. Temper designations.
BS EN 573	Aluminium and aluminium alloys. Chemical composition and form of wrought products.
573-1: 1995	Numerical designation system.
573-3: 1995	Chemical composition.
573-4: 1995	Forms of products.
BS 1470 : 1987	Specification for wrought aluminium and aluminium alloys for general engineering purposes: plate, sheet and strip.
BS 1474: 1987	Specification for wrought aluminium and aluminium alloys for general engineering purposes - bars, extruded round tubes and sections.
BS EN 10143: 1993	Continuously hot-dip metal coated steel sheet and strip. Tolerances on dimension and shape.
BS 4848	Hot-rolled structural steel sections.
Part 4: 1972 (1986)	Equal and unequal angles.
Fans	
BS 848	Fans for general purposes.
Part 1: 1997	Performance testing using standardized airways.
Part 2: 1985	Methods of noise testing.

BS 4675	Mechanical vibration in rotating machinery.
Part 1: 1976 (1986)	Basis for specifying evaluation standards for rotating machines with operating speeds from 10 to 200 revolutions per second. Withdrawn and replaced by BS 7854 : Part 1 : 1996 -Mechanical vibration - evaluation of machine vibration by measurements on non-rotating parts - general guidelines.
BS 5060: 1987 (1993)	Specification for performance and construction of electric circulating fans and their regulators.
BS 3456	Specification for safety of household and similar electrical appliances.
Part 102	Particular requirements.
Section 102.342 1988	Electric fans and regulators.
BS 5285: 1975 (1988)	Specification for performance of a.c. electric ventilating fans and regulators for non- industrial use.
BS 6861	Balance quality requirements of rigid rotors.
Part 1: 1987	Method for determination of permissible residual unbalance.
Air Heating	
BS 4857	Methods for testing and rating terminal reheat units for air distribution systems.
Part1: 1972(1983)	Thermal and aerodynamic performance.
Part 2: 1978(1983)	Acoustic testing and rating.
BS 4954	Methods for testing and rating induction units for air distribution systems.
Part1: 1973(1987)	Thermal and aerodynamic performance.
Part 2: 1978(1987)	Acoustic testing and rating.
BS5141	Specification for air heating and cooling coils.
Part 2: 1977(1983)	Method of testing for rating of heating coils.
Air Cooling	
BS 4434: 1995	Specification for safety and environmental aspects in the design construction and installation of refrigerating appliances and systems.
BS 5141	Specification for air heating and cooling coils.

Part 1: 1975 (1983)	Method of testing for rating of cooling coils.
Air Terminal Devices	
BS 4773	Methods for testing and rating air terminal devices for air distribution systems.
Part1	Aerodynamic testing.
Section 1.1: 1991	Testing under laboratory conditions.
Part 2: 1989	Acoustic testing.
Air Control Devices	
BS 4979: 1986	Methods of aerodynamic testing of constant and variable dual or single duct boxes, single duct units and induction boxes for air distribution systems.
Attenuation	
BS4196	Sound power levels of noise sources (Parts 0 to 7 as appropriate).
BS4718: 1971	Methods of test for silencers for air distribution systems.
BS3958	Thermal insulating materials.
Part 5: 1986	Specification for bonded man-made mineral fibre slabs.
Filters	
BS 3928: 1969	Method for sodium flame test for air filters. (Other than for air supply to IC combustion engines and compressors.)
BSEN779: 1993	Particular air filters for general ventilation. Requirements, testing, marking.
Fire Tests	
BS 476	Fire tests on building materials and structures.
Part 4: 1970 (1984)	Non-combustibility test for materials.
Part 6: 1989	Method of test for fire propagation for products.
Part 7: 1987(1993)	Method for classification of the surface spread of flame of products.
Part 20: 1987	Method for determination of the fire resistance of elements of construction (general principles).
Part 21: 1987	Methods for determination of the fire resistance of loadbearing elements of construction.

Part 22: 1987	Methods for determination of the fire resistance of elements of construction.
Part 23: 1987	Methods for determination of the contribution of components of the fire resistance of a structure.
Part 24: 1987	Method for determination of the fire resistance of ventilation ducts.
BS 5588	Fire precautions in the design and construction and use of buildings.
Part 9: 1989	Code of practice for ventilation and air conditioning ductwork.
BS 6496: 1984 (1991)	Specification for powder organic coatings for application and stoving to aluminium alloy extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminium alloy extrusions, sheet and preformed sections coated with powder organic coatings.
Miscellaneous	
BS 2871	Specification for copper and copper alloys. Tubes.
Part 2: 1972	Tubes for general purposes.
Part 3: 1972	Tubes for heat exchangers.
BS EN 1057	Replaces Part 1 of BS 2871.
BS3510: 1968	Specification for a basic symbol to denote the actual or potential presence of ionising radiation.
BS 2598	Glass plant, pipeline and fittings.
Part 1: 1991	Specification for properties of borosilicate glass 3.3.
Part 3: 1980 (1989)	Specification for pipeline and fittings of nominal bore 15 to 150mm: compatibility and interchangeability.
Part 4: 1980 (1989)	Specification for glass plant components.
BS 3790: 1995	Specification for endless wedge belt drives and endless V-belt drives.
BS 5304: 1988	Code of practice for safety of machinery.
BS 5378	Safety signs and colours.
Part 1: 1980 (1995)	Specification for colour and design.
Part 3: 1982 (1995)	Specification for additional signs to those given in BS 5378 Part1.

BS 6281	Devices without moving parts for the prevention of contamination of water by backflow.
Part 1: 1992	Specification for type A air gaps.
BS 8233: 1987	Code of practice for sound insulation and noise reduction for buildings.

5.2. AIR DISTRIBUTION DUCTWORK

5.2.1. Ductwork General

- 5.2.1.1. Shall be generally manufactured and installed in compliance with DW/144 with exceptions as specified in subsequent clauses with the standard of design and quality of workmanship such that the service conditions and leakage limitations specified in this document are met.
- 5.2.1.2. Shall be constructed such that all internal surfaces are generally smooth and will not normally retain dust/moisture.
- 5.2.1.3. Shall be run generally parallel with walls and ceilings in order to circumvent building projections or pass through structures where permitted as shown on the drawings.
- 5.2.1.4. Shall be installed where practicable with not less than 100mm space between wall, ceiling or floor and finished face of duct or insulation for cleaning purposes.
- 5.2.1.5. Shall be kept clean during fabrication and as installation proceeds in compliance with the standards defined in the HVCA Guide to Good Practice - Internal Cleanliness of New Ductwork Installations, DW/TM2 .
- 5.2.1.6. Shall be cleaned down outside on completion of each section by brushing, vacuum cleaning, use of grease and oil remover, to remove ALL foreign matter including labels before commissioning of the system. All ductwork shall be disinfected inside.
- 5.2.1.7. Shall be constructed using approved sealants, gaskets, joints, adhesives, etc, which will not support bacterial growth and which produce minimal fire or smoke hazards if involved in a fire, this to include attachments such as grilles, etc.
- 5.2.1.8. Shall be fire stopped around the perimeter of ductwork penetrating fire compartments.
- 5.2.1.9. Shall be provided with weatherproof collars where roofs or external walls are penetrated.
- 5.2.1.10. Shall be installed to avoid any formation of water; should this be a possibility the Design Engineer to be informed. The layout of any drains to be as specified for cooling coils and humidifiers).

5.2.2. Ductwork Supports

- 5.2.2.1. Detailed drawings of the ductwork support not shown in DW/144 Addendum A to be submitted and assessed by the Engineer at the same time as the ductwork drawings are submitted for acceptance in principle.
- 5.2.2.2. Shall comprise supports and hangers generally to DW/144
- 5.2.2.3. Shall be hot dipped galvanised after manufacture where exposed to outside weather conditions.
- 5.2.2.4. Shall comprise fixings for attaching supports or hangers to the building structure or fabric as detailed in DW/144.
- 5.2.2.5. Shall comprise spanning supports on to the floor slab for vertical ductwork passing through floors, with additional intermediate supports as necessary.
- 5.2.2.6. Shall comprise lightweight supports for flexible metal ductwork arranged to avoid crushing the corrugations or causing electrolytic action.

5.2.3. Ductwork Dimensions and Materials

- 5.2.3.1. Shall be to the nominal cross section sizes shown on the drawings. Non-standard sizes may be used where appropriate. Minimum nominal sheet thickness to be not less than 1.2mm. This is acceptable as regards ductwork passing through fire barriers to Building Regulations.
- 5.2.3.2. Ducts shall be flanged throughout in plantrooms. They shall be installed with a minimum of slip joints.
- 5.2.3.3. Ducts shall be of mild steel fabricated from hot dipped galvanised sheet to BS EN 10143. Grade Z.2. G-275 coating.

5.2.4. Ductwork Construction

- 5.2.4.1. Ductwork shall be constructed with sealed seams and cross joints selected from DW/144 and meet the air leakage requirements specified in these documents.
- 5.2.4.2. Ductwork shall be stiffened and braced externally only using galvanised sections/profiles listed in DW/144. Ductwork shall be sealed with an approved sealing compound including longitudinal joints; the sealant used shall permanently retain adhesion and elasticity through a temperature range of 0° to 70°C;

5.2.5. Fittings

- 5.2.5.1. Shall be standard arrangement to DW/144 wherever possible. They shall be arranged with vanes in the bends of rectangular sub branches connecting directly to grilles and diffusers.
- 5.2.5.2. Shall be for square bends fitted with aerofoil section turning vanes mounted in runners and rigidly fixed to the inside of the duct to DW/144
- 5.2.5.3. Shall be where branch connections are not formed as part of the main duct have the branch either welded or rivetted to the main duct. The branch connection to be accordingly formed for either welding direct or rivetting with a flange to the outside of the main duct.

5.2.6. Access Openings, Panels and Covers

- 5.2.6.1. The number and location of all access doors, panels and covers other than those regarded as standard practice (see DW/144) will be marked on the shop drawings for approval prior to installation. These access panels, openings and covers shall be included in the price of the duct linear measurement.
- 5.2.6.2. Shall be fitted in readily accessible locations and suitable for the purpose. They shall be provided to the sizes, requirements and positions recommended in DW/144, utilising suitable proprietary products which meet the relevant pressure classifications.
- 5.2.6.3. Shall be provided adjacent to filters, cooling coils, fans, heating coils, humidifiers, and all dampers to facilitate easy cleaning and maintenance.
- 5.2.6.4. Shall be sealed, to ensure an airtight seal with a soft neoprene full face gasket secured to the ductwork with adhesive.
- 5.2.6.5. Shall be constructed from 1.6mm hot dipped galvanised mild steel sheet secured to the ductwork and 6mm flash welded threaded studs welded to the ductwork at 100mm max equal centres and complete with brass wing nuts and washers.
- 5.2.6.6. Hinged access doors to be as access covers and be complete with heavy gauge brass hinges, secured with heavy gauge mild steel Fitch fasteners up to 600mm high and forged or cast steel wedge tightening refrigerator type door handles over 600mm high. Curved surfaces to be with cadmium plated heavy gauge steel toggle catch and hook fasteners.

5.2.7. Test Holes

- 5.2.7.1. Shall be 13mm diameter and provided before and after each plant component, at all main branches and before all balancing dampers. Each test hole to be sealed (with 'top hat' external type grommet) and in accordance with CIBSE Commissioning Code Series A, positioned as agreed with the Engineer on the ductwork layout drawings and (if necessary) after the installation of the ductwork.

5.2.8. Control Dampers

- 5.2.8.1. Shall be of a proprietary make where specified in Bill of Quantities. They shall be all flanged and generally to the requirements of DW/144. They shall be constructed from corrosion resistant materials.
- 5.2.8.2. They shall be installed where shown on the drawings and/or as detailed in this document. They shall be of the "aerofoil" blade construction (double skin section) of the same material as the associated ductwork and securely fixed to each side of a central (in-blade) operating spindle supported in sintered bronze lined cast aluminium bearings.
- 5.2.8.3. They shall be single blade up to 200mm ducting height. They shall be elsewhere multi-blade, opposed blade type with each blade not exceeding 175mm in width nor longer than 1200mm.
- 5.2.8.4. Shall be arranged so the blade tips overlap each other by 10mm and be covered with soft neoprene edge strip, fixed with adhesive, to form a good seal between the blades.
- 5.2.8.5. Shall be arranged to have the blades linked so they operate from a single lever comprising a cast aluminium operating lever and quadrant (with locking screw) incorporating a self-lubricating bronze bearing and the words "OPEN" and "SHUT" cast on the quadrant.
- 5.2.8.6. After final balancing the quadrant shall have a small 'V' shaped notch, filed in the quadrant, indicating the centre line of the level when in the operating position.
- 5.2.8.7. Each damper shall have an adjacent access or inspection door so that the operation of the blades may be observed.

5.2.9. Fire Dampers

- 5.2.9.1. Shall be installed to meet the requirement of HTM 81 and be installed where shown on the drawings.
- 5.2.9.2. Shall be of the multi-blade curtain type with stainless steel blades completely out of the airstream and certified that they comply with BS 476: Part 20.
- 5.2.9.3. Shall be fitted in all vertical and horizontal ductwork as required by HTM 81.
- 5.2.9.4. Shall be fitted with an access opening on either side; incorporating the largest opening which can be obtained with one dimension 300mm minimum. Consideration should be given to the use of removable duct sections where the efficient use of access openings cannot be achieved.
- 5.2.9.5. Shall be tested in situ with testing and automatic re-set facilities if smoke or heat detector operated types and indication that damper is closed. This shall be in liaison with the Controls Sub-contractor. See also requirements in Part D.
- 5.2.9.6. Shall be retained by a thermally actuated device set at 74°C and designed to ensure rapid closure on release. BS 5588: Part 9 refers. (or shall be motorised control type).
- 5.2.9.7. Intumescent fire dampers are NOT permitted.

- 5.2.9.8. The Contractor shall demonstrate to the Engineer or his representative, the mechanical operation of each fire damper. Replaceable thermally actuated devices shall be included for, if that type of damper is being required.

5.2.10. Sound Attenuation

- 5.2.10.1. Shall be by means of purpose built attenuators type tested to BS EN ISO 7235 at the manufacturers works or an approved testing laboratory with certificates provided. It shall incorporate the attenuator infill of mineral fibre mat to BS 3958 Part 5 faced one side with a bonded white glass cloth, the whole being capable of resistance to mould, vermin, moisture and odours and non-combustible to BS 476 Part 4 with fire propagation index of not more than $I = 12$ and $i = 6$ to BS 476 Part 6. The mat being bonded to the inner surface with all joints sealed and further secured under a perforated non-corrodible metal cover over the glass cloth facing.
- 5.2.10.2. Shall be located so that sound attenuating material is not nearer to a fire damper than one metre and is not fitted anywhere after the final filter unless shown on the drawings.

5.2.11. Flexible Joints

- 5.2.11.1. Shall be provided at fan inlet and outlet connections and any other positions shown on the drawings.
- 5.2.11.2. Shall be equal in cross section to the points of connection and not longer than 250mm or less than 50mm.
- 5.2.11.3. Shall be of "Neoprene" Coated Glass Fibre or other materials excluding asbestos and have fire resistance properties of 30 minutes integrity, Class 1 Surface spread of flame to BS 476: Part 7 and not produce smoke or toxic fume hazards if involved in a fire.
- 5.2.11.4. Shall be complete with galvanised mild steel backing flats drilled to suit flanges or fitted with proprietary flanges.
- 5.2.11.5. Shall be installed without undue deflection or slackness between correctly aligned ductwork and fan flanges or spigoted connections.

5.2.12. Flexible Ductwork

- 5.2.12.1. Shall be used for final connections to grilles and diffusers ONLY if shown on the drawings.
- 5.2.12.2. Shall be to a standard of air tightness equal to that of the ductwork.
- 5.2.12.3. Shall be constructed to meet the fire precautions recommended in BS 5588 which comprise length of flexible ductwork branches not to be longer than 1.0 metre, or pass through fire compartment walls, floors or enclosures of sub-compartment walls or enclosures, or cavity barriers.

- 5.2.12.4. Shall be generally of aluminium material and insulated for air conditioned and fresh air supply system. It shall not be insulated for extraction system unless otherwise specified.

5.2.13. Grilles, Registers, Diffusers, Louvres, Relief Flaps

- 5.2.13.1. Shall be of the sizes, materials, types, noise ratings as specified in Bill of Quantities and/or shown on the drawings.
- 5.2.13.2. Shall be designed/installed for easy removal, in-situ adjustment from within the room. They shall be all installed to insulated plenum boxes.
- 5.2.13.3. Shall be complete with sealing gaskets and free from burrs with all ledges or crevices designed so that dust build up can be kept to a minimum.
- 5.2.13.4. Shall be fitted with two sets of individually adjustable blades and opposed or rhomboidal dampers, lockable in any position, on supply grilles.
- 5.2.13.5. Shall be fitted with one set of adjustable blades and opposed blade dampers, lockable in any position, on extract grilles.
- 5.2.13.6. Shall be fitted with corrosion resistant weatherproof louvres and mesh screens at all external intake or exhaust positions, mesh to be not less than 6mm and not more than 12mm.
- 5.2.13.7. Shall be of the non-vision type for transfer grilles.
- 5.2.13.8. Shall be of the balanced blade type for pressure relief flaps, with fine adjustment of relief pressure settings and give a seal as airtight as practicable when closed.
- 5.2.13.9. Shall be constructed from cast aluminium alloy complete with in-built lugs.
- 5.2.13.10. Shall be fitted with iris and volume control damper and have concealed type fastening for circular ceiling diffusers.
- 5.2.13.11. Shall be constructed to provide distortion free corrosion resistant units free of drumming, having minimal air leakage with regard to the working pressure and giving uniform distribution of air, with equalisation incorporated if necessary.
- 5.2.13.12. Shall be type tested at the manufacturer's works or an approved testing laboratory for flow and noise to BS 4773 Parts 1 and 2 and certificates provided.

5.2.14. Extract Hoods

- 5.2.14.1. Shall be of the sizes and materials specified as detailed on the drawings.
- 5.2.14.2. Shall be adequately braced and supported independently of ductwork with all surfaces smooth and free of sharp edges and crevices.

5.2.14.3. Shall be provided with perimeter drain channel and drain point on kitchen hoods and incorporate corrosion proof grease eliminators of corrugated plate or crimped wire mesh, complete with quick release clips and grease drip tray.

5.2.14.4. Shall be fitted with piping, drain taps and keys to tray and gulley by others.

5.2.15. Service Identification

5.2.15.1. Ductwork should comply with DW/144 shall be carried out by the Contractor

5.2.15.2. All fire, control, regulation dampers shall be identified on their respective ductwork and at a visible position on the building fabric if the ductwork is concealed.

5.2.15.3. Each grille, diffuser and relief flap (and their settings) to be uniquely identified together with their locations. This work will require liaison with the Ductwork and Commissioning Contractors.

5.2.15.4. The Mechanical Contractor shall supply and fix colour coded identification buttons to ceiling tiles where any damper on a duct run is above a suspended ceiling.

5.2.16. Leakage Testing of Ductwork Sections

5.2.16.1. Shall be applied to erected sections of the ductwork complete with access doors, at the test pressure and flow rates before insulation is applied to ductwork.

5.2.16.2. Shall be carried out generally in accordance with DW/144 and DW/143 using portable fan and test equipment.

5.2.16.3. Shall be recorded on test sheets based on DW/144 and DW/143 examples and compared to acceptable leakage rates specified in DW144 or CIBSE Guide.

5.2.16.4. Shall be interpreted as requiring that sections which need unacceptable levels of remedial work on seams or joints are to be replaced by new sections; this requirement to be identified during the preliminary test to DW/143 paragraphs 4.9 and 4.10.

5.2.16.5. Shall be all "in duct" plant to be tested to the same leakage classification by the manufacturer and as installed on site.

5.2.17. Leakage Checks on Completed Systems

5.2.17.1. Shall be carried out when the fan has been first set to work and before thermal insulation is fitted and a visual inspection made of all connections from plant to ductwork including any untested joints between tested sections and all joints and seams not previously subjected to leakage pressure tests, including plant casings, grille joints, dampers, etc.

5.3. FANS

5.3.1. General Requirements

- 5.3.1.1. Shall before items of ventilation plant are ordered, include for a detailed set of calculations to be submitted, for comment, containing the following:-
 - 5.3.1.1.1. Each fan operating point and system characteristics.
 - 5.3.1.1.2. Each fan in duct sound power level.
 - 5.3.1.1.3. Each attenuator insertion loss.
 - 5.3.1.1.4. Resultant room NC levels with all plant running.
- 5.3.1.2. Fans shall be of the types, duties and manufacture, as specified in Schedules.
- 5.3.1.3. Fans shall be provided with protective finishes as necessary for the service conditions specified and free of damage to the protection when installed.
- 5.3.1.4. Fans shall be capable of aerodynamic and acoustic performance specified when related to the required application and the relationship of air inlet, air outlet, ducted or free configuration, as standardised in BS EN ISO 5801 and BS 848
- 5.3.1.5. Fans shall be provided with performance and noise data based on type testing at the Manufacturer's Works or an approved testing laboratory.
- 5.3.1.6. Fans shall be where fitted with impeller and shaft assemblies and pulleys, dynamically balanced at the Manufacturer's Works at the normal maximum speeds using guidelines for balance quality and standard to BS ISO 21940 and as appropriate to the size and safety operation of the fan at its intended maximum operating speed.
- 5.3.1.7. Fans shall be operated at not greater than the maximum design speed and power rating.
- 5.3.1.8. Fans shall be driven by electric motors mounted outside the air stream unless otherwise specified. Fan motors in the air stream to be totally enclosed, forced air cooled, thermistor protected.
- 5.3.1.9. Fans shall be identified by non-ferrous metal plates (or other recognised permanent means) on casings stating:-
 - 5.3.1.9.1. Manufacturer's name
 - 5.3.1.9.2. Fan Model and Serial Number
 - 5.3.1.9.3. Impeller size
 - 5.3.1.9.4. Impeller clearance mm for centrifugal fans
 - 5.3.1.9.5. Speed of impeller Maximum rps

- 5.3.1.9.6. Direction of Rotation
- 5.3.1.9.7. Electrical details (on motor)
- 5.3.1.10. Fans shall be provided with lifting attachments for safe handling of the complete unit, and actual weight painted on the unit if over 25 kilogrammes.

5.3.2. Bearings

- 5.3.2.1. Shall be ring-oiling sleeve, ball, or roller, to fan makers recommendations to suit the installed attitude of the fan, the duty and noise criteria.
- 5.3.2.2. Shall be arranged for ease of lubrication and maintenance without the need to re-align replacement bearings and provided with protection against over-lubrication, loss of lubrication, ingress of dust, etc.
- 5.3.2.3. Shall be independent of involute casings on centrifugal fans.

5.3.3. Centrifugal Fans

- 5.3.3.1. Shall be 2 speed motors capable of full volume at full speed and half volume operation to the requirements given in the schedule, unless they are fitted with variable speed drives.
- 5.3.3.2. Shall comprise a centrifugal fan complete with its motor, rigid welded steel base frame, Vee-belt drive and wire mesh protection guard. The base frame is to be fitted with anti-vibration mountings.
- 5.3.3.3. Shall have base frames of a rigid welded construction designed to carry the fan, motor and slide rails as compact as possible. Each frame is to have compression spring anti-vibration mountings selected by the fan manufacturer, to provide an isolation efficiency of 95% or greater at all points of operation.
- 5.3.3.4. Shall include for provision and installation of any necessary inertia bases to increase the mass of the isolation system to achieve this requirement.
- 5.3.3.5. Impellers shall be of the backward blade type generally to give fan total efficiency of not less than 78%, or alternatively of the forward blade type if specified in the schedule.
- 5.3.3.6. Impellers shall be constructed of mild steel, aluminium alloy, or other materials, suitable for the speed and application
- 5.3.3.7. Volute casings shall be of galvanised mild steel sheet suitably stiffened against vibration and drumming. They shall be constructed with integrally sealed or welded joints to withstand maximum static pressure of the system without air leakage. They shall be designed so that the impeller can be easily withdrawn from the casing and re-assembled after installation.
- 5.3.3.8. Volute casings shall be provided with bolted flanged connections at inlet and outlet. They shall be provided with drain point and brass plug at a position to suit the installed attitude of the fan. This will include bolted access cover and seal in lower half of casing for inspection of impeller.

- 5.3.3.9. Drive shall be multi-Vee belt matched set to BS 3790 through overhung pulley keyed or taper locked on fan shaft for ratings to 30 kW, or keyed on only above this figure, with provision for key removal.
- 5.3.3.10. Drive shall be guarded to BS PD 5304
- 5.3.3.11. Motors shall be supplied in duplicate and of the same duty, as specified in the schedules. The standby motor shall be within the same casing of the fan and provided with a separate VSD if specified in the schedules.
- 5.3.3.12. Motors shall be suitable for 400V, 3ph, 50 Hz supply, 960 or 1440 rpm. They shall be capable of speed control via variable speed drives if specified in the schedules.
- 5.3.3.13. Fans shall be provided within acoustic enclosures by the manufacturer, to achieve the performance specifications listed in schedule or other sections of the specifications.
- 5.3.4. Axial Flow, Mixed Flow and In-Line Centrifugal Fans
 - 5.3.4.1. Impellers shall be capable of giving fan total efficiency of not less than 75% for either guided vane types, mixed flow types, or in-line centrifugal types.
 - 5.3.4.2. Impellers shall be constructed of mild steel, aluminium alloy, or other materials, suitable for the speed and application.
 - 5.3.4.3. Stators shall be constructed with galvanised steel or aluminium alloy vanes.
 - 5.3.4.4. Casings shall be of galvanised mild steel, aluminium alloy, or other materials suitable for the application, and stiffened against vibration and drumming, with supports attached for bolting to frame or structure.
 - 5.3.4.5. Casings shall be designed with bolted flanged ends and of sufficient length to allow complete withdrawal of unit from ductwork.
 - 5.3.4.6. Casings shall be constructed to withstand maximum static pressure of the system without air leakage and provided with airtight cover and seal for inspection of fan.
 - 5.3.4.7. Casings shall be provided with electrical terminal box on outside of casing pre-wired to motors when internally mounted.
 - 5.3.4.8. Drive shall be direct motor drive mounted axially with fan in air stream, or matched set multi-vee belt drive from external motor, or direct drive from motor mounted externally between a bifurcated casing, as specified in the Schedules.
 - 5.3.4.9. Drive shall be assembled so that direct driven fans have the motor positioned correctly relative to upstream or downstream flow in accordance with fan makers recommendations.
 - 5.3.4.10. Anti-Vibration Mounts shall be provided between fan and casing or housing and for external motor drives. The casing shall be acoustically lined by the manufacturer to achieve a noise level of 41dB(A) below the false ceiling, or as otherwise specified in schedules.

5.3.5. Roof Mounted Units

- 5.3.5.1. Shall be complete with weatherproof cowls, bases and casings assembled to provide a water tight seal to the building structure. They shall incorporate a silencer on the suction side or as specified in drawings / schedules. The noise level on the roof shall not exceed 55 dB(A) at 3 meter from the fan and not to exceed 41 dB(A) just below the slab (on the third floor)
- 5.3.5.2. Shall be provided with corrosion proof bird screen not greater than 12mm or less than 6mm mesh.

5.4. AIR HEATER COILS

5.4.1. General Requirements

- 5.4.1.1. Batteries shall be of the types, duties, materials and manufacture, suitable for the heating medium to be used, and the external environmental.
- 5.4.1.2. Batteries shall be supported adjacent so that ductwork does not take the weight.
- 5.4.1.3. Batteries shall be arranged for easy removal without disturbing ductwork or services.
- 5.4.1.4. Batteries shall be provided with the necessary mechanical and electrical service connection points.

5.5. AIR COOLER COILS

5.5.1. General Requirements

- 5.5.1.1. Batteries shall be of the types, duties and manufacture, suitable for the cooling medium to be used.
- 5.5.1.2. Batteries shall be designed for a maximum face velocity of 2.5m/s and also to prevent condensate carryover.
- 5.5.1.3. Batteries shall be installed to meet the safety requirements of BS EN 378 if refrigerant cooled type.
- 5.5.1.4. Batteries shall be tested at the Manufacturer's Works for pressure soundness to 1.5 x working pressure or 20 bar.g. whichever is greater, and certificates provided.
- 5.5.1.5. Batteries shall be complete with casing and drip tray to withstand bio-degradation; stainless steel to BS 1449: Part Grade 316 is advised.
- 5.5.1.6. Batteries shall be supported adjacent so that ductwork does not take the weight.
- 5.5.1.7. Batteries shall be arranged for easy removal without disturbing ductwork or services for inspection and cleaning.
- 5.5.1.8. Batteries shall be provided with the necessary flanged mechanical services connection points.

- 5.5.1.9. Batteries shall be provided with an easily removable drip tray (large enough to capture all water condensed) designed to a fall of 1 in 20 in all directions to the drain outlet to self drain under all working conditions to avoid formation of pools of water. The drain outlet must be suitable for connection to a glass trap and a drainage system to conform to the requirements of HTM 2040 and HTM 2025, a bypass baffle to be fitted under the coil in the tray to prevent air bypassing the coil.
- 5.5.1.10. Batteries shall be provided with access doors upstream and downstream incorporating glazed and sealed viewing windows and designed to afford easy access for inspection and cleaning.
- 5.5.1.11. Batteries shall be manufactured from materials that will not support microbiological growth; this includes surface finish mastics, gaskets, insulation, sealants etc. This applies to both batteries and drip trays. The Water Fittings Directory lists suitable materials.
- NOTE: External cleansing may be with a water solution containing 5 ppm chlorine. Alternatively steam may be used.
- 5.5.1.12. Batteries shall be not greater than 1.00 metres in height, where this is exceeded, each battery shall have its own drip tray.
- 5.5.1.13. Batteries shall be made from tube to BS EN 1057 and BS 2871, Parts 1, 2 or 3 according to duty with refrigerant tube degreased and dehydrated internally. Coils for DX systems to be made from refrigerant grade copper.
- 5.5.1.14. Batteries shall be fitted with copper fins securely bonded on in contact with tubes and copper or gunmetal headers arranged to give uniform flow through tubes, the coil being held in a comparable metal frame and the complete block assembly electro-tinned.
- 5.5.1.15. Batteries shall be fitted with fins extended to form an eliminator on the downstream side. It is essential that downstream eliminator plates are fitted.
- 5.5.1.16. Batteries shall be provided with the coils arranged for total free draining of the coil circuit complete with drain point and plug and air vent connection point and refrigerant coils with suction and liquid connections. In "Packaged" air handling systems, the return bends/header pipework on each battery should be within the air stream and suitably baffled. In "made-up" air handling systems they should be uninsulated but enclosed in insulated (removable) covers.
- 5.5.1.17. Batteries shall be flanged with removable cover plates for withdrawal of coil, for inspection or disinfection.
- 5.5.1.18. Batteries shall be arranged for all service connections to be flanged to BS 4504, and screwed connections to BS 21 for pipes 50mm and below.
- 5.5.1.19. Batteries shall be type tested at the Manufacturer's Works or an approved testing laboratory and rated for thermal performance to BS 5141: Part 1 with airflow resistance not more than 125 Pa at 2.5 m/s face velocity and certificates provided.
- 5.5.1.20. Note: Condensation can occur on the underside of drip trays and adjacent areas. To overcome this potential the plant/ducting arrangement should be designed and installed such that any condensation can discharge from the base of the plant/ducting to a safe position.

5.6. AIR FILTERS

5.6.1. General Requirements

- 5.6.1.1. Filters shall be of the types, duties, efficiencies, resistances, manufacture, as scheduled and specified in the Schedules, drawings and/ or Bill of Quantities.
- 5.6.1.2. Filters shall be where required on extract ductwork etc, provided with galvanised mild steel casings flanged to match ductwork.
- 5.6.1.3. Filters shall be made from filter media for which the Manufacturer is to supply satisfactory type test certificates. They shall be fitted with non-combustible frames to BS 476 Part 4.
- 5.6.1.4. Filters shall be free of asbestos, metal wool, plastic foam type materials, or any materials which may introduce hazards from smoke or toxic fumes if involved in a fire. Filters shall be proof against shedding of fine particles into the air stream.
- 5.6.1.5. Filters shall be tested at the Manufacturer's Works or an approved testing laboratory for performance efficiency to the appropriate British Standard/ EN ISO standards and certificates provided guaranteeing general application filters based on type testing but with HEPA filters individually tested.
- 5.6.1.6. Filters shall be supplied in duplicate initially to provide one spare set for each filter position, with the spares being carefully packed for storage.
- 5.6.1.7. Filters shall be complete with inclined manometer and connecting PVC tubing to clearly indicate initial and final filter resistance in Pascals.
- 5.6.1.8. Filters shall be with the plant running, carefully examined for ingress/egress of unwanted air around seals.

5.6.2. Installation of Filters

- 5.6.2.1. Shall be in corrosion proof holding frames free of distortion, located against durable renewable seals to ensure a positive airtight seal and installed to Manufacturer's recommendations ensuring filter correct way round relative to air flow.
- 5.6.2.2. Shall be arranged to provide easy access to filter media for cleaning, removal, or replacement with side or front withdrawal as required.
- 5.6.2.3. Shall be if located in the main duct, provided with viewing ports and low voltage lighting switched from outside the duct and accessible for maintenance.

5.6.3. Primary/Pre-Filters

- 5.6.3.1. Shall have an ARRESTANCE of at least 80% to , BS EN ISO 16890- Eurovent Grade EU3 or as specified in the schedules particularly for the OT AHU.
- 5.6.3.2. Shall be suitable for a face velocity of up to 2.5m/s.

5.6.4. Secondary/Main Filters

- 5.6.4.1. Shall be of the type specified in the schedules.
- 5.6.4.2. Filters shall have EFFICIENCY to BS EN ISO 16890 and equivalent Eurovent Grade as required and as specified in the schedules. They shall be suitable for a face velocity of up to 2.5m/s.

5.6.5. High Efficiency Particulate Air Filters (HEPA)

- 5.6.5.1. HEPA filters shall be of the replaceable panel type. They shall have a penetration to BS 3928 and equivalent Eurovent Grade as specified in the schedules.
- 5.6.5.2. Shall be extremely well fitted and absolutely airtight at the seals and pass a stringent in-situ test using DOP Dispersed Oil Particle and electronic measuring instrument.
- 5.6.5.3. Shall be provided with housing such that the DIN 1946 leakage test can be performed.
- 5.6.5.4. Shall suit a face velocity of up to 2.5m/s maximum.

5.6.6. Extract Filters

- 5.6.6.1. Shall be of the types, grades and manufacture as specified in the schedules.
- 5.6.6.2. Shall be contained within" safe change" housing and provided with a plastic service bag and heat sealing if specified in the schedules.

5.7. AIR HANDLING UNITS

5.7.1. General Requirements

- 5.7.1.1. Units shall comprise a rigid airtight assembly made from component parts equal in construction, accessibility and performance to parts individually described in previous clauses with component type selected to suit the working medium as specified in the schedules.

- 5.7.1.2. All air handling units shall be fitted with a variable speed drives. Starter units and emergency push button units shall be provided for switching off the unit within the AHU room.
- 5.7.1.3. Units shall comprise casing construction based on the double metal skin insulation panel method with acoustic and thermal insulation materials having fire resistance and other properties as previously described and not harbour dust etc.
- 5.7.1.4. Units shall comprise access doors/panels and viewing windows.
- 5.7.1.5. Units shall comprise inside surfaces to be free from structural projections and have smooth and easily cleaned finishes.
- 5.7.1.6. Units shall comprise internal sloping surfaces, for cooling coil sections drainage to ensure moisture can easily discharge via the drain outlet.
- 5.7.1.7. Units shall comprise gradual change shapes between sections to minimise pressure drop, with not less than minimum spacing of components to Manufacturer's recommendations to ensure satisfactory operation at each stage and allow easy/reasonable access for inspection and cleaning.
- 5.7.1.8. Units shall comprise fan belts, fan motor and filter motors, generally located outside the air stream.
- 5.7.1.9. All AHU should generally be supplied in the following order unless otherwise specified in schedules:
- Fresh air inlet
 - Back-draught damper
 - Frost coil
 - Pre-filter
 - Silencer
 - Fan
 - Cooler Coil
 - Heater Coil
 - Humidifier
 - Alternative position of fan
 - Silencer
 - Control damper
 - Final filter
- 5.7.1.10. Allowance shall be made in the installation height of air handling units for sufficient ground clearance (minimum 600mm) to enable the glass traps to be observed and dismantled and the drainage pipework to be installed as described in later sections.
- 5.7.1.11. All sections which may require removal for maintenance to be easily removed and all coils to have slide tracks for side withdrawal.

Note: if alternative fan positions are considered the cooling coil drain must always be located on the positive pressure side of the fan.

5.7.2. Drainage

- 5.7.2.1. Drainage shall be applied to ALL cooling coils/steam humidifiers/heat recovery/eliminators as required.
- 5.7.2.2. Drainage shall be provided from each drip tray below cooling coils, humidifiers or other nominated positions.
- 5.7.2.3. Drainage shall be fabricated using pipework installed with a gradient of at least 1 in 60 from the trap to discharge, with a class A air break above a floor gully, channel or open tundish provided to BS 6281.
- 5.7.2.4. Individual drainage systems shall not be connected together until after discharge over a tundish ie each individual drain system shall have an air-break, type A to BS 6281 current edition.
- 5.7.2.5. Drainage shall be complete with a trap which need not be directly under the drainage tray provided that the pipework connecting the two has a continuous fall.
- 5.7.2.6. Drainage shall incorporate traps to BS EN 1595 of clear (borosilicate) glass to show (visibly) the integrity of the water seal, and provided with a means for filling. Permanent markers on each trap should be provided to indicate the water seal levels, when the system fan is running at its design duty. It shall incorporate quick release couplings to facilitate removal of the traps. The depth of any trap shall be at least twice the static pressure head generated by the fan irrespective of fan position.
- 5.7.2.7. Drainage shall be supported such that no load can be transmitted through the drainage system to the borosilicate glass trap and under NO circumstances can the dimensions of the air break be reduced to less than that specified in BS 6281.
- 5.7.2.8. Drainage shall be connected to a waste drain only.

5.7.3. Site Requirements

- 5.7.3.1. The contractor shall include for each unit to have lifting lugs or marked lifting positions and be off-loaded and installed using correct tackle and spreader bars if necessary in accordance with the Manufacturer's recommendations, so that distortion and buckling does not occur.

Note: Condensation can occur on the underside of drip trays and adjacent plant/duct areas. To overcome this potential the plant/ducting arrangement should be designed and installed such that any condensation cannot be entrained in the air flow and can be discharged from the base of the plant/ducting to a safe position.

5.8. NOISE CONTROL

5.8.1. Vibration Control

- 5.8.1.1. Shall be provided by means of carefully selected anti-vibration mountings, to suit the mass and speed, supported on adequate plant bases as required, capable of resisting torque reaction on start-up and damping out vibration to within the just perceptible band at maximum operating speeds or conditions.
- 5.8.1.2. Shall be kept to minimum requirements by selecting plant with low vibration generation and with rotating or reciprocating parts suitably dynamically balanced.
- 5.8.1.3. Shall be incorporated in ductwork runs by means of anti-vibration couplings, hangers and supports and flexible connections.
- 5.8.1.4. Shall be incorporated in service pipework runs to the vibrating plant by means of anti-vibration supports close to the plant and in three planes, or by flexible pipework connection.

5.8.2. Plant Noise

- 5.8.2.1. Shall be not greater than 65 dBA within the plant room from the fans, coolers, heaters, etc, when starting up or running.
- 5.8.2.2. Shall be reduced to the noise levels less than 40 dB(A) where the plant is near to departments sensitive to noise.
- 5.8.2.3. Shall be checked using method to BS EN ISO 3741 during commissioning, with single speed plant running at full speed and variable speed plant running at the noisiest intermediate speed.

5.8.3. Attenuation

- 5.8.3.1. Shall be by the use of an acoustic infill that is inorganic, inert, vermin-proof, non-hygroscopic and non-flammable and complies with BS 476 Parts 4 and 24.
- 5.8.3.2. Shall be fitted in the airway surfaces with a covering/sheeting of a fire-proof inert material to prevent particles of acoustic infill becoming airborne.
- 5.8.3.3. Shall be incorporated into the ductwork system or plant arrangement as necessary to reduce noise from fans and plant items in order to achieve the acceptable limits within the rooms at the design air volume flows. The NC level in the rooms shall be not more than NC 35.
- 5.8.3.4. Shall include confirmation of the fan sound power levels and attenuator insertion losses for all systems requiring attenuators with the attenuation manufacturer. This information to be forwarded to the Design Engineer before the items are ordered.
- 5.8.3.5. Shall ensure each attenuator is mounted in accordance with the Manufacturer's instructions and installed prior to the final filter.

5.8.4. Grille, Register and Louvre Noise

- 5.8.4.1. Shall be kept to the minimum by selecting types having low noise producing characteristics without high tonal noise and with acoustically treated external inlet and outlet louvres.
- 5.8.4.2. Shall be checked in-situ during commissioning when the system is fully working.

5.8.5. Overall Noise Level

- 5.8.5.1. Shall be based on levels set down in HTM 2025.
- 5.8.5.2. Shall be checked and recorded during commissioning activities for both internal and external noise levels.

5.9. PROTECTIVE FINISHES

5.9.1. Ductwork and Supports

- 5.9.1.1. Shall be hot dipped galvanized. Finishes damaged by welding shall be suitably cleaned and painted with one coat of zinc-rich or aluminium paint.

5.9.2. Plant

- 5.9.2.1. Shall be painted by the Manufacturer as necessary to protect all parts from corrosion or other reactions under working conditions and include the Manufacturer's standard final finish. All plants to be installed externally shall be tropicalised and treated against corrosion against saline environment.

5.10. DISINFECTION

5.10.1. General Requirements

- 5.10.1.1. Prior to Practical Completion all humidifiers and cooling coils/chiller batteries, eliminators etc shall be disinfected, by the Contractor, to the procedures listed below, who shall certify that the work has been carried out (to this requirement) and the date when it was undertaken.

5.10.2. Disinfection Procedure

- 5.10.2.1. All procedures shall comply with the Health and Safety at Work Act and COSHH Regulations of the UK. All persons working in those areas served by the plant to be disinfected shall be notified.
- 5.10.2.2. Switch off all ventilation plants served by the devices to be disinfected.
- 5.10.2.3. Close the plant isolation dampers or blades.
- 5.10.2.4. Open and remove the inspection covers on both sides of the devices.
- 5.10.2.5. Spray all internal surfaces of the humidifier section or cooling coil/chiller battery with a 5 ppm chlorine solution until all surfaces are thoroughly wetted; also flood drip trays and drainage system with the same solution and allow to stand for a minimum of 2 hours.
- 5.10.2.6. Spray all internal surfaces of the humidifier coil/battery with sufficient clean water to remove all traces of the chlorine solution from the battery and drip tray.
- 5.10.2.7. Restore plant to normal operation.
- 5.10.2.8. Immediately before practical completion the Contractor shall arrange for swab tests from all drain trays and cooling coil/chiller battery tubes/fins. Satisfactory results (ie no presence of Legionellae) must be obtained prior to practical completion.
- 5.10.2.9. As an alternative to steps above, the surfaces may be steam cleaned.
- 5.10.2.10. It is essential that these procedures are detailed in the operating and maintenance manuals produced for the scheme.

5.11. COMMISSIONING AND TESTING

5.11.1. General Requirements

- 5.11.1.1. The work in this Section is a minimum requirement and includes the testing, setting to work, commissioning and handover, all to the Engineer's satisfaction, the whole of the installed Ventilation Services and Associated Equipment.
- 5.11.1.2. To assist the Contractors to appreciate the extent of the works and the necessary sequence of events, a drawing should be prepared, detailing the various stages of the testing and commissioning procedures.
- 5.11.1.3. The Contractor shall ensure that adequate time allowance is made for all the testing and commissioning, Witness Testing, production of commissioning data, instructions to Estates Staff and Handover of Operating and Maintenance Manuals.

5.11.2. Installations

- 5.11.2.1. The requirements for the commissioning and testing of the ventilation installations shall be carried out in conjunction with specifications.
- 5.11.2.2. The whole of the supply, extract and all other ventilation and air-conditioning installations shall be commissioned and tested by the Contractor in accordance with following:-
- CIBSE - Commissioning Code, Series A - "Air Distribution Systems"
 - CIBSE - Commissioning Code, R - "Refrigeration"
 - CIBSE - Technical Memoranda TM8
 - HVCA - DW/142 "Specification for Sheet Metal Ductwork"
 - DW/143 "Ductwork Leakage Testing"
- 5.11.2.3. All checks etc shall be undertaken in the correct chronological order, as specified in the Codes and other related documents.
- 5.11.2.4. The Contractor shall, prior to testing the system(s) ensure that all specialist equipment, fans, filters, washers, heater, coolers etc are (or have been) tested in accordance with the relevant British Standard.
- 5.11.2.5. The Contractor shall, prior to testing the system(s) ensure that all dust etc is removed from inside the ductwork with all grilles and specialist equipment removed from the ducting.
- 5.11.2.6. The Contractor shall, prior to testing the system(s) ensure that all equipment ie air heaters, coolers, grilles, humidifiers etc, be thoroughly cleaned/disinfected.
- 5.11.2.7. Where because of prevailing weather conditions the performance of the plant(s) cannot be fully tested prior to handover, the Contractor shall carry out the required testing after handover, at the time agreed with the Client or his representative.
- 5.11.2.8. All air leakage tests shall be carried out before the application of thermal insulation. Sections of air ductwork in shafts etc or any other inaccessible position shall be individually tested before being concealed.
- 5.11.2.9. Leakage testing of ductwork services shall be applied to erected sections of the ductwork complete with access doors but no insulation, at the test pressure and flow rates, as specified.
- 5.11.2.10. Leakage testing of ductwork services shall be carried out generally in accordance with DW/142 and DW/143 using portable fan and test equipment.
- 5.11.2.11. Leakage testing of ductwork services shall be recorded on test sheets based on DW/142 and DW/143 examples and compared to acceptable leakage rates specified.
- 5.11.2.12. Leakage testing of ductwork services shall be interpreted as requiring that sections which need excessive remedial work on seams or joints are to be replaced by new sections, this requirement to be identified during the preliminary test to DW/143 paragraphs 4.9 and 4.10.

- 5.11.2.13. The Contractor shall test the operation to ensure tightness of all joints, correct rotation of motors, that oiling and greasing has been carried out, secureness of supports, eliminating of vibration and noise and their transfer to structure and room, correct damper operation, correct pulley alignment and belt tightness, operation of controls, operation of grille blades etc.
- 5.11.2.14. The tests shall establish that every item is in working order ready to be started up and this shall be demonstrated to the Client, or his representative, before start up.
- 5.11.2.15. The testing and regulation shall ensure that the design air volumes are achieved in all ducts and at all grilles and diffusers with the whole plant in operation.
- 5.11.2.16. Measurements and records shall be made indicating that specified temperatures are obtainable. Suitable instruments, test gauges etc, as agreed with the Client, or his representative, shall be provided and used for this purpose by the Contractor.
- 5.11.2.17. The Contractor shall record in triplicate the following tests on all plants as applicable.
- All fan and fan motor speeds and duties.
 - All air volumes through grilles, registers etc and all air changes in air-conditioned spaces.
 - All dampers and valves shall be adjusted to obtain the design air flow rates.
 - All water valves shall be adjusted to give proper water circulation.
 - All pump speeds and duties.
 - Temperature and humidity readings shall be taken in individual rooms as specified.
 - Temperature of air inlet and outlet of each air-heater or cooler battery.
 - Water flow rate/pressure drop through each heater/cooler battery.
 - Sound levels in selected areas.
- 5.11.2.18. "Space Test Positions" shall be 1.0 to 1.65 metres above floor level at the centre of rooms, less than 40m² floor area. For rooms greater than 40m², then at the centre of each 40 sq m of floor area.
- 5.11.2.19. The Contractor shall be responsible for ensuring the minimum possible amount of noise interference from other sources during the carrying out of noise tests.
- 5.11.2.20. The Contractor shall forward, in triplicate, a schedule of air quantity and air velocity readings taken for all ventilation plant ductwork and each grille and/or diffuser. This schedule shall also include all test data obtained during the period of this test.
- 5.11.2.21. The Contractor shall ensure that all plant/equipment comprising the Works (in particular fans, condensers and plant installed external of the main building structure) complies with the requirements of BS 4142: Method of Rating Industrial Noise Affecting Residential and Industrial Areas.

6. REFRIGERATION EQUIPMENT

6.1. GENERAL

- 6.1.1. The materials, components and completed installations shall conform as applicable with the following Standards, including all amendments, current at the time of tendering. Construction products should comply with European Standards and Technical Specifications (ESTS). Wherever reference is made to a British Standard a corresponding ESTS (generally ISO series) shall be equally acceptable.
- 6.1.2. Where available all materials, equipment etc forming part, or whole, of the services specified in the Contract, should be obtained from BS EN ISO 9000 - "Quality Assurance" certified manufacturers and preferably "kite marked" or EC equivalent.
- 6.1.3. The latest dates of standard references are given at the time of issue of this Section.

BRITISH STANDARDS

BS 88	Cartridge fuses for voltages up to and including 1000v AC and 1500vDC.
BS EN 1254-1:2021	Copper and copper alloys - plumbing fittings. Capillary Fittings for soldering or brazing to copper tubes:
BS EN 1254-2:2021	Copper and copper alloys - plumbing fittings. Compression fittings for use with copper tubes
BS EN 60269-1	Low-voltage fuses - General requirements.
BS EN 13771-2	Compressors and condensing units for refrigeration — Performance testing and test methods Part 2: Condensing units
BS 1608: 1990	Specification for electrically driven refrigerant condensing units.
BS EN 14324:2004	Brazing. Guidance on the application of brazed joints
BS EN 1044	Brazing - Filler Metals
BS 1872: 1984 (1995)	Specification for electroplated coatings of tin.
BS 2626: 1992	Specification for lubricants for refrigerant compressors.
BS 2640: 1982	Specification for Class II oxy-acetylene welding of carbon steel pipework for carrying fluids.
BS EN 1057:2006	Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications
BS2971: 1991	Specification for Class II Arc welding of carbon steel pipework for carrying fluids
BS EN 60335-1	Household and similar electrical appliances - Safety Part 1: General requirements

BS EN 10217	Welded steel tubes for pressure purposes
BS 4434: 1995	Specification for safety and environmental aspects in the design, construction and installation of refrigerating appliances and systems.
BS 4504:	Circular flanges for pipes, valves and fittings. (PN designated)
Part 3:	Steel, cast iron and copper alloy flanges.
Section 3.1: 1989	Specification for steel flanges.
Section 3.3: 1989	Specification for copper alloy and composite flanges.
BS 4580: 1970 (1987)	Specification for number designation of organic refrigerants.
BS 6231	Specification for PVC insulated cables for switchgear and control gear wiring.
BS 7005: 1988	Specification for design and manufacture of carbon steel unfired pressure vessels for use in vapour compression refrigeration systems.
BS7671	Requirements for Electrical Installations. IEE Wiring Regulations 16th edition.
HVCA - Code of Practice - TR/5 Welding of Carbon Steel Pipework	
HVCA - Code of Practice - TR/3 Jointing of Copper and its Alloys	
Relevant Statutory Instruments and Guidance Documents	
HTM 2023 - Access and Accommodation for Engineering Services	
HTM 2040 - The Control of Legionellae in Healthcare Premises - a Code of Practice	
HTM 2025 - Ventilation in Healthcare Premises HTM 2005 - Building Management Systems	
ANSI/ASHRAE/ASHE STANDARD 170-2021 Ventilation of Health Care Facilities	
Institution of Electrical Engineers	
BS 7671	Requirements for Electrical Installations IEE Wiring Regulations 16th edition

6.2. REFRIGERATION PLANT - GENERAL

6.2.1. Refrigeration Plant

- 6.2.1.1. Shall be mechanical vapour - compression type using non-ozone depletion hydrocarbons.
- 6.2.1.2. Shall have reciprocating, screw or centrifugal compressors as specified in the schedules.
- 6.2.1.3. Shall use refrigerant as specified in schedules which are ozone friendly, include all accessories necessary to ensure continuous and reliable automatic operation, achieve specified cooling rate at designed ambient temperature.
- 6.2.1.4. Shall be capable of running continuously at the lowest step of cooling capacity without any adverse affect.
- 6.2.1.5. Shall include and maintain full charge of refrigerant and lubricating oil until handover of system or putting into use.
- 6.2.1.6. Shall not use CFC compounds such as refrigerants R1 1, R12, R1 13, R1 14 and R502 which have been phased out of production by the Montreal protocol.
- 6.2.1.7. Packaged chillers shall be selected to achieve the cooling duty necessary to satisfy the design requirements when operating under the temperature conditions listed elsewhere in this Specification. They shall comply with BS EN 14511. Rotating and reciprocating components shall be dynamically balanced. All components shall be readily accessible. Each machine shall be provided as a fully packaged, factory assembled and tested unit, constructed on a robust frame and casing.
- 6.2.1.8. The refrigerant shall be as listed elsewhere in this Specification. No refrigerant comprising or containing any CFC or HCFC's shall be used.
- 6.2.1.9. Chillers shall be factory finished with baked-on enamel or electro statically sprayed coating. Internal units shall be to the manufacturer's standard colour. Externally mounted units shall be finished to a BS or RAL colour to be advised by the Architect.
- 6.2.1.10. Chillers shall be capable of performing within the acoustic requirements listed in this Specification. Such performance shall be achieved by either selecting the equipment to ensure that it performs at a noise level below that specified, or by the provision of an acoustic protection package to ensure that the noise level requirements are met.
- 6.2.1.11. Chillers shall be provided with microprocessor control and load management unit central controller for the staging and balanced operation of the chillers to match the load demand of the building. Load machine selection facilities shall be provided. Interlaced control and multiple machine control systems shall be provided by the chiller manufacturer and be capable of maintaining a stable flow temperature without hunting. The chiller control system shall be fully addressable from the building management system. A load management unit shall be fitted with the chillers which shall control the staging and sequential operation of the chillers based on the cooling load demand. The Load Management unit shall be fully microprocessor controlled and interfaced with the BMS. It shall work on an open protocol preferable Ethernet type network

6.2.2. Installation Requirements

- 6.2.2.1. The installation shall comply with BS 4434 and Safety Code for refrigeration systems utilizing chlorofluorocarbons - Part 1 published by The Institute of Refrigeration. The installation, setting to work, testing and commissioning shall be carried out by Engineers from the Manufacturer.
- 6.2.2.2. The installation shall have all major components readily accessible for maintenance and arranged to facilitate removal without disturbing other system components.
- 6.2.2.3. The installation shall have a resiliently mounted control centre on or close to the refrigeration unit to house the control and protection equipment.
- 6.2.2.4. The installation shall be provided with visual indication of operation of all safety protection devices, have provision for remote indication of alarm conditions.
- 6.2.2.5. The installation shall have provision for remote indication of all outputs to a building management system or other control system, as indicated in the schedules.
- 6.2.2.6. The installation shall have a noise level in the room, not exceeding NR65 at 2 metres distance in the plant room when operating at full load.
- 6.2.2.7. The installation shall incorporate hours - run meters for compressors

6.2.3. Refrigeration Plant Data

- 6.2.3.1. The contractor shall provide rating tables, physical data and capacity curves relevant to the selection of equipment and be available for a range of operating conditions based on manufacturer's test results. He shall provide pressure drop values for all circuits; values to be determined from test results and be verifiable fouling factors shall be as well provided.
- 6.2.3.2. The contractor shall provide acoustic data including octave band analysis of the sound power level of the unit under free-field conditions.

6.2.4. Semi-Hermetic and Hermetic Compressors

- 6.2.4.1. Semi-hermetic and hermetic compressors will be accepted on complete factory assembled refrigeration systems, condensing units provided the units are either:-
 - 6.2.4.1.1. fully charged at manufacturer's works; or
 - 6.2.4.1.2. complete with holding charge of refrigerant or inert gas on arrival at site.

6.2.5. Oil Pumps

- 6.2.5.1. Shall if required for semi-hermetic or hermetic compressors, be suitable for 3 phase supply, and operate equally well in either direction of rotation or have special arrangements made to prevent reverse rotation.

6.2.6. Open Type Compressors

- 6.2.6.1. Shall have a replaceable rotary mechanical seal fitted to the driving shaft to prevent leakage of refrigerant and oil.
- 6.2.6.2. Shall be of a type which enables the shaft seal to be removed without moving the compressor or motor, for units exceeding 25kW input power.

6.3. RECIPROCATING COMPRESSORS

6.3.1. General

- 6.3.1.1. Shall have all main rotating and reciprocating components statically and dynamically balanced. They shall include for pistons greater than 50mm diameter to be fitted with either two compression rings and one oil control ring; or a combination of compression rings and a piston specially shaped to act as an oil scraper.

6.3.2. Hot Gas Injection

- 6.3.2.1. Hot gas shall be injected into the refrigerant inlet of the evaporator for capacity control as follows: -
 - 6.3.2.1.1. On compressors below 35kW refrigeration capacity; or
 - 6.3.2.1.2. For compressors above 35kW, equal to the capacity of the final step.

6.3.3. Capacity Control

- 6.3.3.1. For compressors with a refrigeration capacity in excess of 35kW, capacity shall be effected by means of either cylinder unloading or speed change and be arranged so that starting is in the unloaded condition.

6.3.4. All Types of Compressors

- 6.3.4.1. The installation shall incorporate service stop valves on compressor suction and discharge connections.
- 6.3.4.2. The installation shall incorporate resiliently mounted oil-filled refrigerant pressure gauges of minimum 65mm diameter, fitted with means of isolation on suction and discharge with pressure calibrated in bar and saturation temperature for the refrigerant used calibrated in °C for compressors with input power in excess of 6kW.
- 6.3.4.3. The installation shall incorporate capped valved pressure tapings for compressors with input power less than 6kW. It shall incorporate oil pressure gauge of minimum 65mm diameter

with means of isolation for compressors with oil pump. It shall incorporate crankcase oil level sight glass for compressors with input power in excess of 6kW.

- 6.3.4.4. Compressor shall be provided with low oil differential pressure safety cut out with hand reset for compressors with oil pump. It shall be provided with refrigerant suction gas strainer. It shall incorporate internal pressure relief valve for compressors with input power in excess of 35kW.

6.3.5. Open and Semi-Hermetic Compressors

- 6.3.5.1. Shall have crankshafts and eccentric shafts equipped with replaceable bearings for compressors with input power in excess of 2.25kW.
- 6.3.5.2. Shall for compressors with input power in excess of 25kW, be provided with side and/or end covers to enable servicing or repair of the unit to be carried out "in situ" or local to the installation by virtue of ready removal.
- 6.3.5.3. Shall include a crankshaft driven oil pump to force feed lubricant to the main and big end bearings and the shaft seal for compressors with input power in excess of 6kW. It shall be provided with a filter and oil suction strainer within the oil lubrication system.
- 6.3.5.4. Compressors shall have an oil pressure relief valve or bleed device provided between the oil pump discharge and the crank case for compressors with input power in excess of 6kW.
- 6.3.5.5. Compressors shall incorporate provision for draining oil from the suction manifold into the crankcase and for venting refrigerant gas (not oil) in the opposite direction.
- 6.3.5.6. Shall include a crankcase heater, arranged to operate while the compressor is at rest, with protection provided to prevent starting before the oil has reached the minimum operating temperature.

6.4. SCREW COMPRESSORS

6.4.1. General

- 6.4.1.1. The Chiller shall be fitted with screw types compressor and shall be suitable for continuous and automatic operation with minimum vibration.
- 6.4.1.2. Each multi-compressor machine shall be provided with a minimum of two independent refrigeration circuits.
- 6.4.1.3. Each circuit shall be protected by a pressure relief device on the high-pressure pipework complying with BS EN 378 with the outlet discharging into the low-pressure pipework. Where the low-pressure pipework does not have an allowable pressure equal to the high-pressure pipework, a low-pressure relief valve or bursting shall be provided. The discharge shall be located so that refrigerant cannot be drawn back into the building by natural vents or ventilation plant. The high and low-pressure devices shall be capable of safely relieving excess pressure under fire conditions.
- 6.4.1.4. Each machine shall be provided with a liquid receiver to hold the full refrigerant charge. Connections shall be provided to allow abstraction of the refrigerant charge into proper gas

bottles using refrigerant recovery equipment. Venting of refrigerant to atmosphere will not be permitted during installation, commissioning, or maintenance.

- 6.4.1.5. Each system shall be provided with a thermostatic expansion valve or evaporator pressure-regulating valve. Sight glass, strainer and refrigerant drier shall also be provided.
- 6.4.1.6. Pipework and equipment carrying refrigerant shall be insulated. Insulation thickness shall comply with BS 5422. Selection and application of material shall comply with BS 5970.

6.4.2. Connections, Mountings and Fittings

- 6.4.2.1. Each chiller shall be located on a concrete plinth. Anti-vibration mountings shall be supplied and installed to prevent transmission of noise and vibration to the structure.
- 6.4.2.2. Water connections shall be external to the machine or be readily accessible from outside the machine. Connections shall be flanged to BS EN 1092 or arranged for mechanical grooved joints as described in the Pipework Section. Mountings and fittings shall comply with the appropriate Section of this Specification.
- 6.4.2.3. Each water connection to the machine shall be provided with a flexible connection. The connection shall be capable of withstanding the system operating temperatures and pressures without distortion.
- 6.4.2.4. Each chilled water return connection shall be provided with a commissioning set. An isolation valve shall be provided on each flow connection and on each return where the commissioning set does not include a double regulating valve. The valves shall comply with the requirements of the Pipework Section of this Specification.
- 6.4.2.5. Facilities for transmission of plant status, operating temperatures and pressures to the main control panel or building management system, as appropriate, shall be provided for each chiller.

6.4.3. Capacity Control

- 6.4.3.1. The compressor shall be fitted with variable speed drives for capacity control as specified in the schedule.

6.4.4. Lubrication System

- 6.4.4.1. Shall be arranged with an interlock or other means to ensure adequate oil supply at all bearings as the compressor starts. It shall be provided with hand reset pressure or flow switch to stop the compressor on a lubrication system failure.
- 6.4.4.2. Shall incorporate a pressure regulating valve in the pipeline from a positive displacement pump to relieve excess oil.
- 6.4.4.3. Shall be provided with replaceable or cleanable filters in any oil delivery pipeline, external to the compressor.

- 6.4.4.4. Shall incorporate a thermostatically controlled oil cooling system for removing the heat gained by the oil.
- 6.4.4.5. Shall be provided with an electric heater in the oil sump.

6.4.5. Plant Accessories

- 6.4.5.1. Shall be provided and connected as detailed below: -
 - 6.4.5.1.1. Service stop valves or other means of isolation on compressor suction and discharge connection.
 - 6.4.5.1.2. Refrigerant pressure gauges of minimum 65mm diameter fitted with means of isolation on suction and discharge side.
 - 6.4.5.1.3. Oil pressure gauge of minimum 65mm diameter with means of isolation.
 - 6.4.5.1.4. Oil reservoir level sight glass.
 - 6.4.5.1.5. Low oil pressure cut-out or flow switch, both with hand reset facilities. High oil temperature cut-out with hand reset facilities.
 - 6.4.5.1.6. Refrigerant suction gas strainer.
 - 6.4.5.1.7. A suitable device to prevent the pressure differential across the compressor causing backward rotation at a normal or emergency stop.
 - 6.4.5.1.8. A phase reversal protection device to prevent the compressor from operating in the wrong direction of rotation.

6.4.6. Rotor Sealing by Oil Injection

- 6.4.6.1. Shall incorporate arrangements to prevent excessive oil carry-over with refrigerant from the compressor and ensure adequate oil return to the compressor over the full operating range.

6.5. WATER CHILLING EVAPORATORS

6.5.1. General

- 6.5.1.1. Evaporators shall be of the shell and tube type, capable of being retubed "in situ" and be readily removable without affecting other parts of the installation. The coil shall be treated against corrosion and moth.
- 6.5.1.2. Shall have a design fouling factor on the water side not less than 0.00018m² kW.

6.5.2. Materials used for Water Chillers

- 6.5.2.1. Shall comprise steel shell and tube plates and have copper tubes. It shall have cast iron or steel removable type water box/end covers and incorporate tube supports constructed of polypropylene or other suitable and approved materials to prevent tube vibration.
- 6.5.2.2. Shall have water connections flanged or with grooved ends for mechanical joints as detailed Common Services Mechanical section.

6.5.3. Water Chillers Accessories and Provision

- 6.5.3.1. Shall include the following:-
 - 6.5.3.1.1. Water-side drain.
 - 6.5.3.1.2. Air venting provision.
 - 6.5.3.1.3. Refrigerant level controller on flooded evaporators.
 - 6.5.3.1.4. Facility for returning oil to the compressor on flooded evaporators.
 - 6.5.3.1.5. Oil rectification system to ensure that refrigerant in the liquid form is not returned to the compressor, on flooded evaporators.
 - 6.5.3.1.6. Adequate liquid droplets carry over eliminators, on flooded evaporators.

6.6. AIR COOLING EVAPORATORS (DX COOLERS)

6.6.1. General

- 6.6.1.1. Shall include coolers provided with inlet liquid distributors and return suction headers arranged to ensure even distribution of refrigerant to all circuits and to return oil to the compressor.
- 6.6.1.2. Split units shall be from a reputed manufacturer who has been in business for the last fifteen years at least and represented in Mauritius.
- 6.6.1.3. Shall be designed such that the refrigerant passages ensure that any oil present is always carried through at the lowest stage of capacity reduction. They shall comprise tubes staggered in the direction of air flow.
- 6.6.1.4. Shall have return suction headers return bends and liquid distributors located out of the air stream and they shall be thermally insulated.
- 6.6.1.5. Shall have total resistance of air flow through the battery and eliminator sections not exceeding 240Pa under wet coil conditions.
- 6.6.1.6. Shall have face velocity not exceeding 2.5 m/s and shall have point velocity not exceeding 3 m/s.

6.6.2. Cooler Battery Construction

- 6.6.2.1. Shall be from one of the following material combinations and be suitable for the refrigerant used: -
 - 6.6.2.1.1. Tinned copper tubes with aluminium fins and copper headers.
 - 6.6.2.1.2. Copper tubes with copper fins electro tinned in block form after assembly, together with copper headers.
 - 6.6.2.1.3. Comply with BS 2871 Part 3 for copper tubes and BS 1872 for electro-tinning smooth plain fins 0.4mm aluminium or 0.25mm copper with a maximum spacing of 300 per metre.
 - 6.6.2.1.4. Incorporate copper headers with formed sockets for primary tube jointing and BSP male thread or flanged connections.

6.6.3. Refrigerant Circuits

- 6.6.3.1. Shall have an even number of tubes to ensure that liquid and suction connections are on the same side. The units shall utilize non ozone depleting refrigerants.

6.6.4. Drain Trays and Connections

- 6.6.4.1. The bottom casing of the units shall be made in the form of a watertight drain tray, sheet steel galvanised after manufacture.
- 6.6.4.2. Trays shall be sloped on all sides to a flush drain connection to avoid water collection in the tray.
- 6.6.4.3. Trays shall incorporate a pipework drain connection, complete with quick release refillable trap extended from the lowest point on the underside of the tray and discharge into a tundish in close proximity to the air-cooling evaporators.

6.6.5. Dehydration and Charging

- 6.6.5.1. On satisfactory completion of all plant and pipework installation, and remedial work to leaks, the system shall be dehydrated by evacuating to absolute pressure of not more than 1,000 microns (1mm Hg or 0.02 PS1 A).
- 6.6.5.2. The vacuum shall be drawn by the use of auxiliary vacuum pump (not the compressor) capable of drawing 50 microns vacuum.
- 6.6.5.3. Shall the vacuum pump to be isolated and held for two hours without the system pressure rising above 500 microns, before breaking with the refrigerant to be used. The evacuation procedure to be repeated three times before final charging with refrigerant.

6.6.6. Controls

- 6.6.6.1. All split units shall be fitted with wired remote controls fixed on the walls.

6.7. AIR COOLED CONDENSERS

6.7.1. Air Cooled Condensers

- 6.7.1.1. Shall be of refrigerant quality, seamless copper tubes with aluminium fins. It shall have provision for the purging of non-condensable from the condenser.
- 6.7.1.2. The units shall be tropicalised and shall have weatherproof motors when installed outside buildings. The whole outer shell shall be treated against corrosion in a saline environment.
- 6.7.1.3. It shall be designed to ensure equal air distribution over the full coil surface and be provided with automatic control of the condensing pressure. All metal parts shall be bonded to earth.
- 6.7.1.4. Shall discharge air vertically upwards unless they are protected by an integral wind deflector or purpose made baffle.

6.7.2. Frame and Supports

- 6.7.2.1. Frame and supports shall be constructed of material which is corrosion resistant and suitable for use in a saline environment.

6.7.3. Fans

- 6.7.3.1. Shall comply with the fan sections of this specification.
- 6.7.3.2. Shall be within permitted noise level. They shall be weather resistant and shall have the fan outlets suitably protected. The fan motors shall be de-energised on complete closure of the dampers when outlet damper modulation is used.

6.8. REFRIGERATION PLANT ACCESSORIES AND CONTROLS

6.8.1. General Protection

- 6.8.1.1. Each protection circuit shall be provided with a pressure relief device unless it is so constructed that pressure due to fire conditions would be safely relieved. The means of discharge and equipment provided to comply with BS EN 378 and the outlet piped to discharge outside the building in a properly labelled and safe location. High and low refrigeration pressure safety cut-outs with adjustable differential and set point shall be as well provided. The high-pressure cut-out shall be of the manual reset type.

6.8.2. Connections for the Removal of Refrigerant

- 6.8.2.1. Shall be provided in any system with refrigerant content greater than 10Kg for the safe removal of refrigerant charge as outlined in the Montreal protocol.

6.8.3. Liquid Receivers

- 6.8.3.1. Shall be provided on systems which have air cooled condensers, and these liquid receivers shall be of sufficient capacity to hold the complete system refrigerant charge when not more than, 80% full, at maximum plant room ambient temperature.
- 6.8.3.2. Shall be provided with means for checking the liquid refrigerant charge on system, greater than 7.5 kW cooling capacity. It shall be fitted an approved pressure relief safety device.
- 6.8.3.3. Shall be provided with suitable connection to permit the safe transfer of the complete refrigerant charge into service cylinders without loss of refrigerant to atmosphere.

6.8.4. Critically Charged Systems

- 6.8.4.1. Shall be provided with means for the safe transfer of the complete refrigerant charge into service cylinders, without loss of refrigerant to atmosphere (on small self-contained systems, line tap valves may be used if and when required).

6.8.5. System with Thermostatic Expansion Valves

- 6.8.5.1. Shall incorporate the following accessories, located upstream in the refrigerant liquid line: -
- Replaceable element type refrigerant drier.
 - Liquid sight glass.
 - Moisture indicator.
 - Solenoid valve.

6.8.6. Controls and Accessories

- 6.8.6.1. Shall be provided as appropriate and detailed hereunder: -
- Where an evaporator pressure regulating valve is fitted, incorporate a strainer and an evaporator pressure gauge with means of isolation on the upstream side of the regulating valve.
 - Include a compressor motor of sufficient power to restart under high load conditions or be fitted with controls to limit the maximum suction pressure for starting at exceptionally high evaporating temperatures.

- Incorporate controls to override the low-pressure cut-out, which may operate when the compressor starts in cold ambient conditions.
- Provide for the flow of refrigerant to a multiple circuit direct expansion evaporator to be controlled by an externally equalised thermostatic expansion valve which will not "hunt" at any step of compressor unloading.
- Include an oil separator in a system where oil circulation or rectification is difficult.
- Have refrigerant service valves of the capped type complete with spindle glands of the back sealing type so as to facilitate servicing of glands with valves "in situ".
- Have a flow sensing device incorporated in the chilled water pipeline of each shell and tube evaporator to prevent the compressors starting or continuing to run when the water flow is below the minimum stipulated by the manufacturer.
- Incorporate a low temperature thermostat with hand reset to shut down compressors on shell and tube evaporators, when the chilled water flow temperature falls below 3°C.
- Include for the provision of vibration isolation on water chilling equipment, and refrigerant pipework to remote condensers.
- Be arranged for the chilled water pumps to run continuously during pump down on water chilling installations.
- Provide for units having a direct expansion evaporator at a higher level than the compressor to operate on a pump down cycle.
- Controls to prevent over frequent cycling of compressors.

6.9. REFRIGERANT PIPEWORK

6.9.1. General

- 6.9.1.1. Shall be refrigeration quality medium or heavy wall copper pipe to BS EN 1057 or steel to BS EN 10217
- 6.9.1.2. Shall provide for the design, materials, and installation of the refrigerant piping systems to be in accordance with Section 4, Part 1 of the "Safety Code for Refrigerating Systems Utilising Chlorofluorocarbons" published by The Institute of Refrigeration UK.
- 6.9.1.3. Shall be correctly sized to ensure the pipe distribution to evaporators allows the oil returning to compressor with no liquid refrigerant drainage into compressors during shutdown nor liquid entry during operation.
- 6.9.1.4. Shall prevent trapping oil and sludging in the suction line.
- 6.9.1.5. Shall ensure that the oil in the refrigerant leaving the compressor is carried through the system and back to the compressor at the lowest stage of capacity unloading whilst minimising the pressure drop in the pipework.
- 6.9.1.6. Shall have a minimum number of pipework joints.

- 6.9.1.7. Shall be installed using welded or brazed jointing, unless unavoidable.
- 6.9.1.8. Shall prevent refrigerant vapour locks or flash gas formation.

6.9.2. Pipework General

- 6.9.2.1. Shall be firmly supported and secured to prevent vibration. It shall include expansion joints if required to accommodate expansion and contraction. Cold bridging to be prevented.
- 6.9.2.2. Shall incorporate vibration eliminators where necessary to the compressor suction and discharge lines, to minimise transmission of vibration or noise, be insulated in accordance with earlier sections of this specifications.

6.9.3. Copper Pipework Installation

- 6.9.3.1. All refrigeration pipework shall be in copper material. It shall comprise copper suction, discharge and liquid lines up to 105mm outside diameter fabricated as per clause above, except for copper tubes up to 22mm outside diameter which may be fully annealed.
- 6.9.3.2. Shall be delivered to site internally degreased and be stored in clean and dry conditions with ends sealed until required for installation.
- 6.9.3.3. Shall utilize flared joints only when connecting equipment accessories. Pipe ends are to be cut clean and square with the pipe axis, using wheel cutters where possible and deburred, re-rounded and cleaned of cuttings.
- 6.9.3.4. Shall include for the use of the correct pipe expanding tools when utilizing expanded tube joints. The expanded tube joint is only permitted for straight tube joints and on sizes up to and including 28mm. there shall be a maximum of 3 additional joints cut out of a completed installation at the Contractor's expense, before testing has started, and for their reinstatement. If any one of these joints is proved to be unsatisfactory, include for further joints to be cut out and remade until the extent of the defective joints has been established.
- 6.9.3.5. Installation shall be considered unsatisfactory if:-
 - The penetration of brazing alloy is inadequate
 - The internal surface is seen to show oxides and flux

6.9.4. Copper Pipework Brazing

- 6.9.4.1. Shall be carried out in accordance with HVCA Code of Practice TR/3
- 6.9.4.2. It shall be in accordance with the precautions required to avoid hazards during brazing operations. It shall be continuously purged with nitrogen during brazing/soldering to prevent internal oxidization, and all excess solder and flux removed on completion of joints.

6.10. THERMAL INSULATION

6.10.1. General

- 6.10.1.1. Thermal insulation in Refrigerant pipework shall be carried out using materials generally in accordance with Section 4 - Thermal Insulation.
- 6.10.1.2. Pipes shall be protected by a vapour barrier which is unbroken between joints of sectional material or at discontinuities at valves, fittings or supports. The permeance of the barrier to be less than 0.01g/MNs.
- 6.10.1.3. Shall have a thickness based on a thermal conduction not greater than 0.04 W/mK.

6.10.2. Shell and Tube Evaporators

- Shall be insulated with a minimum thickness of 19mm insulation unless otherwise indicated.
- Shall be provided with a sheet metal casing overall to present a smooth surface for painting.
- Shall have insulation and the casing fitted in such a way as to facilitate removal of evaporator end covers without causing damage to either.

6.10.3. Expansion and Suction Pipes

- 6.10.3.1. Shall have the following minimum thickness of insulation applied to refrigerant expansion lines and suction pipes between the evaporator and the compressor:
 - Pipes up to and including 80mm size 19mm
 - Pipes 100mm size and over 25mm

6.10.4. Pipes External to Building

- 6.10.4.1. Pipes shall when subject to solar radiation, either be shielded or have 12mm thickness (minimum) of weather-proofed closed-cell insulation applied, with a reflective or light-coloured finish overall.

7. DRAINAGE SYSTEMS

7.1. GENERAL

- 7.1.1. Sanitary pipework shall be installed in accordance with BS EN 12056-2. Horizontal pipework shall be laid to gradients complying with the above British Standards. Vertical pipework shall be parallel with vertical surfaces. All sanitary pipework shall be uPVC type.
- 7.1.2. Flexible joints in pipework shall not be made within the thickness of the structure or where they would later be built in. Jointing material shall not project into the bore of pipes, fittings or appliances.
- 7.1.3. Access caps or plates shall be fitted at ends of all horizontal pipework, at junctions and changes of direction. Access plates shall be fitted at each floor level immediately above the highest connection, at the foot of each vertical stack and at junctions to horizontal connections to enable the system to be internally cleaned and rodded. Access plates shall be provided on vertical stacks, at every level, above the rim of adjacent sanitary ware.
- 7.1.4. Cleaning eyes shall be provided on the end of horizontal waste floats and rodding eyes at the ends of horizontal soil manifolds, turned up to above the rim of adjacent WC pans. Rodding eyes or access fittings shall be provided at changes of direction on suspended soil or waste pipework. Floor gullies shall be provided with drain access, either internally within the fitting or externally within the pipe run. Soil and waste branches shall be swept type.
- 7.1.5. Main branch ventilating pipes shall be run above spill over level of fitments except where shown, and if connected to main soil, soil waste or waste pipes, the connection shall be at a point above spill over level of the highest sanitary appliance connected to such pipe.
- 7.1.6. At the penetration of all roof levels a suitable water seal and weathering shall be provided. Pipe stacks shall be carried up full bore above eaves or roof levels. Termination of soil, waste or ventilation pipework shall not be closer than 3 metres to any opening window, door or ventilation intake. Should this be unavoidable, the pipework shall be terminated 900mm above any such opening.

7.2. PIPE AND FITTINGS

7.2.1. Plastic Pipe and Fittings

- 7.2.1.1. Shall comprise UPVC and mUPVC pipe and fittings, manufactured by the injection moulding process. It shall for main soil, ventilation pipes and fittings, internal rainwater pipe and fittings, be UPVC plastic to BS 4514.
- 7.2.1.2. Shall for external rainwater pipe and fittings, be UPVC plastic to BS EN 12200-1.
- 7.2.1.3. Shall for branch waste and ventilation pipework and fitting up to and including 50mm diameter, be mUPVC plastic.
- 7.2.1.4. Shall for all branch pipes, be provided with a radius swept in the direction of flow.
- 7.2.1.5. Shall not be fabricated by means of 'the cut and shut', hot air or solvent welded method.

7.3. JOINTING OF PIPEWORK

7.3.1. Plastics Pipe

- 7.3.1.1. Shall have UPVC plastic pipes and fittings, jointed by the solvent weld method.
- 7.3.1.2. Shall have spigot ends, squarely cut, ensuring continuity of the internal pipe bore.
- 7.3.1.3. Shall have excess jointing material removed and not allowed to accumulate on the internal surface of the pipe.
- 7.3.1.4. Shall accommodate thermal movement, by having joints formed using the joint ring system, with the spigot end of the pipe fitting in the direction of flow. All items forming the joint to be cleaned before assembly.
- 7.3.1.5. Shall be jointed using the correct solvent or lubricant and be installed to the Manufacturer's information.

7.4. INSTALLATION OF PIPEWORK

7.4.1. General

- 7.4.1.1. The installation of the above ground sanitation systems shall comply with the requirements of BS EN 12056:2 where applicable to design intent.

7.4.2. Pipework Installation

- 7.4.2.1. Shall be installed to the minimum gradients specified in BS EN 12056 or as indicated on the drawing for all suspended runs.

7.4.3. Pipe Clearances

- 7.4.3.1. Adequate separation from other engineering services and the structure shall be provided to enable maintenance to be carried out in an efficient manner with a minimum of disruption. Plastic pipes shall be distant from heat sources.

7.4.4. Pipe Sleeves

- 7.4.4.1. Where passing through any part of the building fabric not classified as a fire structure, the pipes shall be accommodated in suitably sized sleeves of the same material as the pipe and be of such a diameter as to allow a minimum clearance for the free movement of the pipe.
- 7.4.4.2. The pipes shall, where penetrating a fire resisting structure, shall be accommodated within a fire proof sleeve and which shall be filled with fire proof materials around to comply with Local Fire Services requirement and not less than that prescribed in the Building Regulations of the UK or any other equivalent standard.

7.4.4.3. Shall where passing through sleeves in external walls and ducts, be caulked between pipe and sleeve with lead wool or proprietary sealing compound.

7.4.4.4. Pipe sleeves shall not be used as a means of support to the pipes.

7.4.5. Painting

7.4.5.1. Shall be completed to all ferrous brackets, pipes, supports, nuts, bolts, drop rods and all associated accessories after erection and the witnessing of satisfactory tests, degreasing and washing.

7.4.5.2. Shall be to the recommendations of BS 6150. For cast iron pipes and galvanised items comprise one coat of black bitumen to BS 6949.

7.4.6. Building in of Work

7.4.6.1. No pipes shall be concealed within the building structure until satisfactory completion of the inspection and testing procedures.

7.4.7. Traps

7.4.7.1. Shall conform to BS EN 12056 and all relevant British Standards. They shall be to BS EN 274 or the equivalent French Standard. They shall generally be 'P' traps unless otherwise specified in drawings.

7.4.7.2. Shall for all sanitary fittings and equipment be a two-piece tubular trap, where exposed under basins be chromium plated copper alloy bottle traps.

7.4.8. Sanitary Appliance Connections

7.4.8.1. Shall be by a dry seal push fit joint to the drainage system for all connections from sanitary appliance outlets 89mm diameter and above.

7.4.9. Access Points – GENERAL

7.4.9.1. Shall be provided into the pipe bore to enable testing, inspection and efficient maintenance operations to be carried out. They shall be all fully accessible.

7.4.9.2. They shall have all access plates and caps fitted as the installation work proceeds and remain sealed except for inspection and testing. In the event of an open access point being found at any time during the course of installation, the contractor shall have that section of pipework rodded out and flushed with clean water. Should it be demonstrated that the pipe bore is not satisfactorily finished, the section adjacent to the access point to be stripped out to a location of satisfactory internal finish.

- 7.4.9.3. Access points on vertical main soil, ventilation, and rainwater pipes of 76mm -160mm diameter, shall be provided in the following positions: -
 - 7.4.9.3.1. Above the spill-over level of adjacent sanitary fittings and a minimum of one metre above finished floor level on all floors.
 - 7.4.9.3.2. Above offsets in vertical stacks.
 - 7.4.9.3.3. At all junctions in suspended runs and in other positions as indicated on the drawings.
- 7.4.9.4. Access points shall not be located at high level in clinical areas.

7.4.10. UPVC/Polypropylene Pipe Access Points

- 7.4.10.1. Shall be full width and bolted, integral with a purpose made fitting, or cut and located in positions shown on the drawings where located on the side of UPVC and Polypropylene pipes.
- 7.4.10.2. Shall be solvent welded plugs with screwed caps, where located on the end of UPVC pipes and fixed by compression screwed caps on polypropylene pipes.

7.5. SUPPORTS EXPANSION AND ANCHORS

7.5.1. Expansion Joints and Anchor Points

- 7.5.1.1. Shall be provided to accommodate thermal movement of UPVC and Polypropylene pipes between fixed points at the following minimum positions: -
- 7.5.1.1.1. Be provided on long straight suspended runs at 3m centres.
- 7.5.1.1.2. Be provided between fixed points if the distance exceeds 1m.
- 7.5.1.1.3. Be provided on UPVC branch waste pipes if the straight length exceeds 1.8m.
- 7.5.1.1.4. Be provided on Polypropylene mechanical systems as thermal stress relief units, in both the horizontal and vertical plane to accommodate thermal movement of 4.22mm per 3m length per 10°C.

7.5.2. Anchor Points

- 7.5.2.1. Shall be rigidly fixed brackets with bracing angles and structural fixings to prevent pipe movement in any plane. They shall be provided at expansion joints and branch connections securely fixed on the pipe socket without causing damage or deformation. They shall be positioned to control alignment of the system during expansion.

7.5.3. Pipe Supports

- 7.5.3.1. Shall be provided in accordance with the requirements of BS EN 12056. They shall be provided with supports located at intervals not greater than the following Table for suspended and vertical pipes:-

Support distance for vertical and suspended pipes			
PIPE MATERIAL	NOMINAL BORE (mm)	VERTI VERTICAL RUN (m)	HORIZONTAL RUN(M)
Copper Tube	25	2.4	1.8
	32-40	3	2.4
	50	3	2.7
	65 - 100	3.7	3
Cast Iron	All sizes	3	1.8
UPVC mPVC	32-40	1.2	0.5
	50	1.2	0.6
	75 – 100	1.8	0.9
	150	1.8	1.2
*Polypropylene	38)		0.5

Support distance for vertical and suspended pipes			
PIPE MATERIAL	NOMINAL BORE (mm)	VERTI VERTICAL RUN (m)	HORIZONTAL RUN(M)
Mechanical Joints	51)	1.2	0.5
	76)		1.5
	102)		1.8
Glass	40-80	1.2	1.2
	100	1.5	1.4
	150	1.8	1.8

7.5.3.2. Suspended pipe shall be continuously supported where temperatures in excess of 20°C are maintained. They shall be fixed to the structure at two points and have vertical adjustment facilities for suspended pipes.

7.5.3.3. Anchors and supports be provided on suspended and vertical UPVC pipes between fixed points to maintain stability under temperature change.

7.6. CARE OF PIPES

7.6.1. Sealing Open Ends of Pipes

7.6.1.1. Sealing of pipes shall be carried out as the installation proceeds. It shall comprise purpose made metal or plastic plugs, caps, or blank flanges. In the event of an open-ended pipe being found or a plug removed, the Contractor shall have the section concerned rodded clean and flushed with clean water. If after such clearing operations it can be demonstrated that the pipe bore has not been satisfactorily cleaned, the pipes adjacent to the open end to be stripped out to a location of clean internal finish.

7.6.2. Pipe Condition and Protection

7.6.2.1. All pipes to be used shall be straight, cleanly finished, round in cross section and without defect.

7.6.3. Pipe Cutting

7.6.3.1. Shall include for all pipes to be cut clean and square with axis of the pipe and before installation, the cut ends of the pipe to be made smooth and any burrs removed by filing.

7.6.3.2. Shall include for cast and spun iron pipes to be cut with the correct cutting apparatus or appliance.

7.6.3.3. Shall require care to be taken when cutting cast iron pipe to avoid damage to the internal and external coating.

7.6.4. Storage of Pipe and Fittings

- 7.6.4.1. Shall include for plastic pipe fittings, joints, sealing rings and gaskets to be stored in a ventilated space and not exposed to direct sunlight. The Contractor shall provide purpose made racks for storage of pipes and similar materials to prevent bending and distortion. He shall provide suitable racks and storage for plant, equipment, and materials unable to be stored in huts or buildings.
- 7.6.4.2. Shall allow replacement material, plant, or equipment to be provided where deterioration or damage has occurred prior to handover.

7.7. PRE-HANDOVER AND HANDOVER PROCEDURES AND REQUIREMENTS

7.7.1. General

- 7.7.1.1. The Contractor shall on completion of the pipework installation, and prior to the installation of the sanitary appliances, include for all plugs to be removed and the entire system, including the rainwater system, rodded through, and flushed with clean water.
- 7.7.1.2. The Contractor shall include adequate provision for collection and disposal of the water to ensure that the building fabric or other services are not affected during the operation.
- 7.7.1.3. Shall provide for all access covers and cleaning eyes to be removed, checked, replaced if damaged, greased, refitted, and sealed.

7.7.2. Testing

- 7.7.2.1. All soil and waste pipes shall be subjected to an air pressure test in the following manner: The section of the installation to be tested to be sealed off by the insertion of expanding rubber, or inflatable stopper testing plugs, (one of which to incorporate a tee fitting complete with an air cock), on each of the free ends of the fittings. One of the air cocks to be connected by means of a flexible tube to a manometer (u gauge) and the other connected to a tube for applying the required air pressure to the system. The air pressure to be applied to the whole section of pipework and fittings under test, this to be equal to 38mm water gauge and to remain constant for a minimum of 3 minutes.
- 7.7.2.2. The Contractor shall ensure that the installations are tested at the following stages: -
- Prior to concealment by suspended ceilings, duct covers, partition cladding etc.
 - On completion of the whole installation.
 - On completion of all work, including that of other trades.
- 7.7.2.3. The Contractor shall also be required that all soil and waste pipes to be tested to the satisfaction of the Local Authority as determined by the Building Inspector.
- 7.7.2.4. All final commissioning procedures shall be as defined in BS EN 12056.

8. Pre-commissioning cleansing and Water Treatment

8.1. GENERAL

- 8.1.1. Open and closed-circuit systems shall be flushed through to remove scale and debris collected within the systems. On completion of flushing, they shall be chemically cleaned as necessary.
- 8.1.2. Domestic water systems shall be disinfected and sterilized.
- 8.1.3. Closed circuit systems shall, if necessary, on completion of flushing and chemical cleaning operations be dosed with an agreed chemical treatment.
- 8.1.4. Strainers, test points, drain points, vents and by-passes shall comply with the pipework section of this specification and be provided as required to allow full compliance with the Guide. Temporary flushing tanks pumps and meters shall also be provided as required.
- 8.1.5. The mechanical services installer shall employ a water treatment specialist, who shall provide a method statement covering all aspects pre-commissioning works and subsequent water treatment. The statement shall cover each system and must include details of the chemicals proposed. The method statement shall be submitted to the engineer in sufficient time for comment before the work is carried out.
- 8.1.6. Air duct lines shall be cleaned, disinfected, and sterilized in accordance with the requirements of the HVAC and NHS Model specifications for clean and office applications.
- 8.1.7. The engineer shall be advised at least five working days before in advance of the commencement of the flushing and cleaning programme so that procedures can be witnessed.

8.2. WATER SUPPLY

- 8.2.1. Each closed system shall be provided with a valved connection in the main plant area suitable for flushing and cleaning purposes. A mains cold water connection shall be provided adjacent to the system connection.
- 8.2.2. The connections shall be adequately sized to permit the flushing velocities recommended in BSRIA Application Guides BG BG 29/2021 and BG 2/2010 to be achieved. The supply and connections shall be capable of providing the required flow rate at a minimum pressure of 3 Bar at the top of the building. Where such a pressure is not available the mechanical services installer shall provide sufficient temporary boosting equipment to ensure that this flow rate and pressure is achieved.
- 8.2.3. Connections to the system shall meet the requirements of the local water authority and the model water by-laws.
- 8.2.4. Where the flushing supply is provided from a private source a sample of the intended source shall be analysed via an accredited testing facility. The results of the analysis shall be submitted to the engineer for comment before the commencement of flushing. Before water is taken from a private source or local authority the Contractor shall hold or obtain a licence so to do

8.3. DRAINAGE

- 8.3.1. The mechanical services installer shall ensure sufficient hose is provided to enable the water flushed from the system to be discharged into the foul drainage system if permitted by the local water authority. Where the Mechanical Services Installer is unable to obtain the necessary approval, alternative acceptable arrangements shall be provided.

8.4. ELECTRICAL SUPPLY

- 8.4.1. An electrical supply comprising a fused switch and steel wire armoured cable installed as specified in the "Electrical Services associated with Mechanical Plant" section of the specification shall be provided for connection to the temporary pumping equipment. The switch shall be of sufficient capacity to suit the pump motor rating
- 8.4.2. The connection to the pumping equipment shall be taken from the nearest mechanical services control panel.

8.5. FILLING

- 8.5.1. On completion of the installation the system shall be filled with water and pressure tested as described elsewhere within this specification. On completion of the testing the system shall be allowed to stand for 48 hours to soften the inclusions. The mechanical services installer shall ensure that all flushing by-pass valves are fully open, equipment and terminal units shall be isolated wherever possible.
- 8.5.2. An inhibitor shall be injected into the circuit to the recommended level and thoroughly mixed by circulating for a minimum of four hours. The system shall then be allowed to stand for a minimum of eight hours before circulating for a further four hours. During this time the combined deaerator and dirt separator shall be monitored and cleaned out as necessary.
- 8.5.3. On completion of the above process the system shall be drained. All dirt pockets and strainers shall be inspected and cleaned out. The system shall then be refilled and drained twice more with the dirt pockets and strainers checked each time

8.6. FLUSHING

- 8.6.1. Flushing of closed water systems shall be carried out strictly in accordance with BSRIA Application Guides BG BG 29/2021 and BG 2/2010. Flushing shall commence within 24 hours of the filling described above being completed.
- 8.6.2. Systems shall be flushed through as necessary with clean water to thoroughly clean the system. Flushing shall be carried out by the provision of temporary pumping plant with adequate capacity to permit the flushing velocities required by the above guide to be achieved Use of the permanent system pumps will not permitted except in special circumstances and only with the written approval of the Engineer.
- 8.6.3. The system shall be flushed through in sections in both forward and reverse directions. Sections shall be arranged such that after cleaning they can be isolated to prevent further contamination or to ensure that only clean water passes through the section. Sections shall be selected to permit maintenance of the required flushing

velocities. Flushing shall be continued until visual inspection indicates the water is clear.

- 8.6.4. The mechanical services installer's water treatment specialist shall certify that all flushing has been properly carried out.

8.7. CHEMICAL CLEANING

- 8.7.1. On completion of flushing out all systems other than domestic systems the system water shall be analysed to determine whether chemical cleaning is required. Chemical cleaning shall be applied in accordance with the requirements BSRIA Application Guides BG BG 29/2021 and BG 2/2010. Chemical cleaning shall be carried out immediately after the flushing process is complete.
- 8.7.2. The mechanical services installer shall employ the services of a specialist company to carry out the chemical cleaning and for subsequently draining flushing out and rinsing the out the system. Upon completion of the process the specialist shall issue a certificate for each system confirming that it has been properly cleaned and rinsed out in accordance with the above guide.
- 8.7.3. Chemicals used for cleaning shall be manufactured, controlled, stored and handled in strict accordance with the chemical manufacturers and local regulations. The chemicals used shall be approved by the local authority prior to disposal through the drainage system. Where such approval is not forthcoming an alternative acceptable to the local authority shall be used.
- 8.7.4. Chemicals shall be used in such concentrations as are necessary to ensure the system is properly cleaned and degreased. Inhibitors and neutralising agents shall be provided as necessary to prevent damage to the system due to overreaction.
- 8.7.5. On completion of the chemical cleaning the system shall be thoroughly flushed to remove any remaining chemicals. By-pass valves shall be closed, and equipment isolation valves opened. All dirt pockets and strainers shall be inspected and cleaned out. The system shall then be immediately dosed with a passivating agent in sufficient quantities to neutralise chemical residue.

8.8. CHEMICAL DOSING

- 8.8.1. Each closed circuit system shall be provided with a chemical dosing pot using connections across the primary pumps. Pots shall be as described in the "Plant and Equipment" section of this specification.
- 8.8.2. A sample cock shall be provided on each closed circuit system in a convenient location. On systems operating at temperatures above 90°C a sample cooler complete with isolating valves, connections to the cold water service and drain shall be provided.
- 8.8.3. Chemical dosing shall not be undertaken until receipt of a system water analysis to establish the necessity for chemical dosing.
- 8.8.4. On completion of the chemical cleaning systems shall be filled with clean water of hardness between 80 and 100ppm. Dosing chemicals shall, if the analysis so requires, be added to the system to minimise corrosion foaming sludging and scale formation. The use of alkali based chemicals shall not be permitted except with the written

permission of the Engineer. Details of the water treatment chemicals including confirmation of the ranges of pH and mineral levels that the system is to maintain shall be submitted to the Engineer.

8.9. OPEN CIRCUITS

- 8.9.1. Open circuits other than domestic water systems shall be treated as described above. The treatment shall, in addition to the requirements of the preceding paragraphs comply with the requirements CIBSE Guide TM13 together with Health and Safety Guides EH48 and HS(G)70.

8.10. WATER SAMPLES

- 8.10.1. Duplicate water samples shall be taken as necessary throughout the process to ensure that operations are being carried out at a level sufficient to thoroughly clean the system without using excessive amounts of chemicals and causing damage to the system.
- 8.10.2. One of each sample shall be sent for chemical and microbiological analysis by an independent laboratory, within 24 hours of the sample being taken. Initial results are to be provided within 48 hours, with full results within 10 days.
- 8.10.3. The second sample of each of the system water content shall be handed to the Employer at each stage of the filling flushing chemical cleaning and final dosing processes. Each sample shall be clearly and permanently marked and labelled indicating the stage and date when it was taken.

8.11. DISINFECTION AND STERILISATION

- 8.11.1. All cold hot and mains water service pipework including vessels such as tanks and cylinders shall be sterilised immediately prior to Practical Completion. A certificate of sterilisation shall be provided to the employer.
- 8.11.2. New water pipes shall be sterilised before any system is brought into use. Before sterilisation pipework storage tanks and equipment shall be cleaned out to remove dirt and debris. Such flushing shall be continued until the drain runs clear. The flushing shall be carried out in sections to ensure adequate flushing velocities throughout.
- 8.11.3. Before chlorination begins and as part of the flushing process the inside of the tank lid and the sides of the tank from the water line to the top of the tank shall be scrubbed with a strong solution of chlorinated water. These areas shall then be rinsed with a strong solution of chlorinated water to prevent the build up of algae.
- 8.11.4. No water shall be used for domestic purposes during the flushing operations or until sterilisation has been completed. Mains extensions shall be sterilized first followed by communication and supply pipes, storage tanks and distribution pipes in that order.
- 8.11.5. Mains extensions communication and supply pipes shall be sterilised by a specialist firm appointed by the mechanical services installer and agreed with the Engineer. All such work shall be to the requirements of the local water authority.

- 8.11.6. Storage tanks and distribution pipework shall be filled with water and thoroughly flushed out. With draw off taps closed the tank shall be refilled and sufficient sodium hypochloride having 3.5% available chlorine shall be added during filling to ensure that when full the tank contains water having a concentration of 50mg/litre, 50 ppm of chlorine in the solution. The sterilisation chemical shall be prepared in accordance with the manufacturers instructions.
- 8.11.7. The supply shall then be stopped and draw off taps on the distribution pipework progressively opened working away from the tank. Each tank shall then be topped up with water and sufficient sterilising chemical to give a concentration of 50mg/litre chlorine. The tank and pipes shall then remain charged for three hours. A sample shall be taken at the end of this period and checked for residual chlorine with a comparator. If less than 30mg/litre is indicated the process shall be repeated until this residue is obtained
- 8.11.8. Finally all pipework including vessels shall remain charged with chlorinated water for at least a further 16 hours to ensure total disinfection. The system shall then be flushed out with clean water until all traces of chlorine residue are removed.
- 8.11.9. Draw-off taps on each installation shall be provided with warning labels advising not to use the water whilst sterilisation is in progress.
- 8.11.10. The mechanical services installer shall pay all charges for all water and electricity used for sterilising and flushing out

8.12. CHEMICALS

- 8.12.1. Sufficient of each water treatment and dosage system chemicals shall be provided to the Employer to give specific protection for a minimum period of 12 months.

8.13. TEST CERTIFICATES

- 8.13.1. On completion of flushing cleaning dosing and sterilisation the mechanical services installer shall have water samples from each system analysed to show final water quality. The test certificates shall be incorporated into the Operating and Maintenance manuals.
- 8.13.2. On open circuit domestic water systems samples shall be tested for bacteriological content to ensure the water is of potable quality.
- 8.13.3. Any system failing to comply with the required standards shall be re-treated and re-tested as required by this Section of the specification.

8.14. PSEUDOMONAS BACTERIOLOGICAL INFESTATIONS OF CLOSED PIPEWORK SYSTEMS

- 8.14.1. Water samples shall be taken from the proposed source of water for testing, flushing and final filling before works commence and shall be tested for Pseudomonas bacteria. The test results shall be issued to the Engineer before any filling of the systems for testing commence.

- 8.14.2. A sum shall be identified by the tenderer within the tender for undertaking the necessary treatment to overcome a Pseudomonas Contamination and for providing a temporary water treatment plant from initial filling and hydraulic testing to Practical Completion. If no contamination is found by practical completion this sum shall be removed by instruction and the identified tender cost deducted.
- 8.14.3. On Pseudomonas being detected, a method statement detailing testing, sourcing and treatment regimes shall be agreed with the Engineer in time for the procedures to be incorporated within the construction programme.
- 8.14.4. Before Practical Completion the Mechanical Services Installer shall commission a final water analysis report from water samples taken in the presence of the Engineer. The report shall demonstrate that the systems do not contain any microbiological activity and are chemically closed in accordance with the specialist water treatment companies recommendations. If activity is still present, the systems shall be retreated and tested until clear.

9. INSPECTION, TESTING AND COMMISSIONING

9.1. GENERAL

- 9.1.1. The entire Works shall be inspected, tested and commissioned in accordance with all relevant British Standard Specifications and Codes of Practice together with and the details given in this Specification to the entire satisfaction of the Engineer.
- 9.1.2. Installations shall be inspected and tested in sections as the work proceeds and test certificates issued accordingly. The Engineer or an Insurance Company may require inspecting or testing of any equipment during manufacture.
- 9.1.3. No section of the Works shall be insulated or in any other way concealed prior to testing and inspection. Subsequent concealment, where applicable, shall only take place following written authority from the Engineer.
- 9.1.4. Commissioning shall be undertaken by a specialist commissioning company who shall pre-commission and commission all systems. The specialist shall be advised to the Engineer at the time of Tender for agreement to their suitability. The specialist shall produce a comprehensive report on all systems.
- 9.1.5. A "Conduct of Commissioning Certificate" shall be provided, as published by the "Central Heating Information Council", for commissioning of systems in dwellings as required in the Approved Document Part L1 of the Building Regulations.

9.2. ATTENDANCE

- 9.2.1. Tests shall be arranged in co-operation with the Mechanical Services Installer and Engineer who shall be given five working days notice in writing of the time, location and nature of the test to be performed. No test shall be considered valid unless the Engineer or his appointed representative is present.
- 9.2.2. All necessary skilled and unskilled labour shall be provided for attendance duties during testing and commissioning, including pre- and post-test activities. Test media shall be provided and subsequently disposed of except where specifically stated otherwise. Fuel, water, electricity, gas and other consumables required for testing and commissioning shall be provided by the Electrical Services Installer. All fuel tanks, lubrication systems and the like shall be left fully charged at Practical Completion. Batteries shall be left in a fully charged condition.
- 9.2.3. Representatives present during inspection and testing shall be fully conversant with the system concerned and the method of system and instrument operation. Manufacturers or specialist's representatives shall attend where indicated elsewhere in the Specification or where necessary to ensure that the Works are tested and commissioned in accordance with the requirements of the specification.
- 9.2.4. Equipment with electrical supplies shall be certified ready for use.
- 9.2.5. The commissioning engineer shall attend site regularly during the month prior to commencing work in order to fully familiarise himself with the Works, to monitor the progress of the installation and to ensure that all test points, commissioning valves and other facilities required for commissioning are correctly installed.

9.3. TEST EQUIPMENT

- 9.3.1. All necessary facilities, measuring and recording instruments including test pumps and gauges for inspection or testing purposes shall be provided and shall be checked or calibrated by the Mechanical Services Installer as necessary before use. The Engineer reserves the right to call for a demonstration of the accuracy of any instruments provided.
- 9.3.2. Test points necessary to carry out the specified test and commissioning requirements shall be provided including facilities for temperature, pressure, pressure drop, volume flow, velocity, in duct sound power and pressure, humidity or other relevant conditions to be measured. Such points shall be fitted with removable plugs, flanges or other devices appropriate to the service concerned. Permanent test or reading points shall be provided only where specified elsewhere.

9.4. TEST CERTIFICATES

- 9.4.1. Duplicate signed test certificates shall be provided. Test certificates shall identify the Mechanical Services Installer, the Project name and the date of test. They shall list the apparatus or section under test, makers number (if any), the nature, duration and conditions of test. The certificate shall include details of the test instrument including serial number and the details of its calibration certificate. The result of the test shall be declared and the certificate signed by the person conducting the test.
- 9.4.2. Where a test has been independently verified, the witness shall countersign the certificate. The name of the company represented by the witness shall be added.
- 9.4.3. No test shall be valid until the test certificate is provided.

9.5. FAILURE OF TEST

- 9.5.1. Any defects occurring at any time during the test duration shall be made good and a complete re-test carried out.
- 9.5.2. Where failure during a test, inspection or commissioning process results in damage to the building fabric to any services not provided as part of this Contract, or requires subsequent builders work in connection to be carried out, then the remedial works shall be the responsibility of the Mechanical Services Installer.
- 9.5.3. Leakages shall be repaired by properly remaking or replacing the defective component. Caulking will not be permitted.

9.6. WORKS TESTS

- 9.6.1. The Engineer will be entitled, at all reasonable times during the manufacture, to inspect, examine and test equipment to be provided. The Engineer shall inform the Mechanical Services Installer which equipment is to be inspected or tested at works.
- 9.6.2. The Mechanical Services Installer shall give the Engineer written notice of the date and place at which such equipment will be ready, at least 10 working days before such date.

- 9.6.3. Such inspection, examination or testing shall not release the Mechanical Services Installer from any obligation under the Contract.

9.7. THERMAL TESTS

- 9.7.1. Closed circuit installations shall, after an acceptable hydraulic test, be subjected to a thermal test at design operating conditions. The system shall be operated at the design conditions for a minimum period of four hours. After the above period the system shall be allowed to return to room temperature before inspection for any leaks.
- 9.7.2. For a satisfactory test all expansion and contraction devices, support and guide points shall be examined and function correctly. No leaks shall develop at any point in the system.

9.8. EQUIPMENT OUTPUT TESTS

- 9.8.1. Equipment, which has a specified output or throughput, shall be tested and the recorded output or throughput, method of calculation and relevant test conditions indicated on test certificates.
- 9.8.2. Where a British Standard has been published, tests shall comply with the Standard.

9.9. SPECIALIST PLANT

- 9.9.1. The Mechanical Services Installer shall be responsible for manufacturers attending site to carry out specialist commissioning of plant items, including refrigeration plant, boilers, pressurisation and expansion units, steam humidifiers and automatic controls.
- 9.9.2. Chiller plant shall be demonstrated to be capable of meeting the summer duty. Where particularly required in the Scope of Works a full load test as described by the PSA shall be carried out including the provision of dummy loads to simulate the design conditions. Elsewhere the building heating system shall be run at boost condition until the internal temperature reaches a minimum of 25°C. The air conditioning plant shall then be energised and the time taken to reduce the room temperature recorded.
- 9.9.3. Where described elsewhere in this Specification particular items of plant shall be tested and commissioned in accordance with their relevant clauses.

9.10. COMMISSIONING INSTRUMENTS

- 9.10.1. Instruments for testing shall be provided including the following:
- Tube type velometer (Range 1.5 to 13m/sec)
 - Inclined tube manometer
 - Pitot tubes of various lengths to suit duct sizes
 - Mercury in glass thermometers
 - Weekly recording thermometers

- Weekly recording RH meters
- Specially mounted anemometers fixed in a conical sheet metal box hood for measuring accurately air flow from diffusers
- Ammeter
- Tachometer
- Surface contact dial indicating pyrometer

9.10.2. The above list is not exhaustive

9.11. WATER CIRCUIT BALANCING

- 9.11.1. Systems shall be filled with the working fluid, vented as necessary and brought to a state of complete readiness for the system balancing procedures.
- 9.11.2. Water systems shall be balanced in accordance with the CIBSE Commissioning Codes and BSRIA Commissioning Guide. Balancing shall be achieved by the regulating valves provided and flow rates determined on a pressure drop basis. Where pressure tapings or orifice plates are not provided temperature drop may be used.
- 9.11.3. Flow through pumps shall be measured by relating the pressure drop across the pump to the manufacturers tests curves and by summation of relevant commissioning valve readings. A copy of the test curve indicating the final operating point shall be forwarded to the Engineer.
- 9.11.4. Flow through heaters shall be adjusted to give the design temperature difference and pressure drop across a pressure tapped orifice valve where specified.
- 9.11.5. Upon completion of balancing and testing operations, temperature measurements shall be taken in all rooms and readings tabulated in schedule form together with hourly ambient external temperature readings taken over the measuring period. Two copies of the schedules shall be forwarded to the Engineer.

9.12. AIR FLOW BALANCING

- 9.12.1. Ventilation systems shall be commissioned in accordance with the procedures recommended in the BSRIA Commissioning Guide CIBSE Commissioning code, Series A, Air Distribution with the exception that Note 2 under Clause A0.6 shall not apply.
- 9.12.2. Duplicate schedules of commissioning results shall be forwarded to the Engineer and shall detail the recorded air volume and percentage deviation from design air volume, for each air supply and extract terminal.
- 9.12.3. Wet and dry bulb temperature measurements shall be taken in all rooms served by air supply systems and the results indicated on the schedule of commissioning results, together with external ambient wet and dry bulb temperatures recorded at hourly intervals over the measuring period.
- 9.12.4. Smoke tests shall be conducted on all air distribution systems to DW143 to ensure correct air diffusion from outlet terminals.

9.13. FINAL PLANT TESTING

- 9.13.1. Airflow, air pressure, fan and motor speed and current consumption tests shall be tabulated for each fan set. Pressure differentials across filters, coils, main dampers, louvres, and attenuators shall also be scheduled.

9.14. COMMISSIONING RESULTS

- 9.14.1. On completion of each section of work the results shall be typed in schedule form and submitted to the Engineer for comment. Following comment by the Engineer the tabulated commissioning results shall be incorporated into the Mechanical Services maintenance manuals.

10. DRAWINGS AND DOCUMENTATION

10.1. TENDER DRAWINGS

- 10.1.1. The Tender Drawings are prepared by the Engineer to show the general arrangement of the plant, equipment, and services, which form the intended Contract. The drawings are prepared in sufficient detail to, in conjunction with the Specification, allow competitive Tenders to be submitted.
- 10.1.2. The Mechanical Services Installer shall be responsible for interpreting the drawings, making due allowance for offsets to avoid the building structure or other services, whether indicated or not. The Mechanical Services Installer shall take all necessary steps to fully acquaint him with the nature and extent of the works by visiting the site and inspecting the architectural, structural, and other services drawings.
- 10.1.3. No claim for loss or expense due to the above factors will be considered.

10.2. CONTRACT DRAWINGS

- 10.2.1. The Contract drawings are issued by the Engineer when the Contract is placed. They will comprise the Tender drawings as described, modified to include any variation to the Contract since the issue of the Tender Drawings.
- 10.2.2. Variations to the Contract, requiring the further drawing information will be carried out by the Engineer issuing updated copies of the Contract Drawings or supplementary sketch drawings until such times as the working drawings are available for marking up or in such other manner as the Engineer decides.

10.3. CAD DATA

- 10.3.1. A CAD copy of the Engineers drawings may be made available to the Mechanical Services Installer to assist in the preparation of the Installers working drawings should a request for the information be made to the Engineer in writing. Disks will be prepared in the current version of AutoCAD or in DXF format as required. A charge may be made by the Engineer for the provision of such information, the charge being confirmed to the Mechanical Services Installer as soon as the number and size of the drawing files required is known.
- 10.3.2. The Mechanical Services Installer shall be solely responsible for the modification of the information to provide the working drawings as required by this specification. The modified drawings shall accurately reflect the equipment and installation proposed by the Mechanical Services Installer as if the drawings had been drawn without the benefit of the electronic data. They shall also take account of the most recent Architectural and Structural information. Working drawings prepared from data provided by the Engineer shall be issued with the Engineer's title block replaced by the Installer's own block.
- 10.3.3. The Mechanical Services Installer's particular attention is drawn to the following conditions which apply to the use of any electronic information provided by the Engineer:
-

- 10.3.3.1. Any charge for supplying data for this Project is to be agreed with the Engineer and shall be received prior to release of the data.
- 10.3.3.2. It is an express condition of the contract under which data is supplied that the Mechanical Services Installer is absolutely responsible for verifying its correctness and completeness.
- 10.3.3.3. The Engineer accepts no liability or responsibility whatsoever for any loss or damage suffered by the recipient arising out of or in connection with the use or misuse of this data.
- 10.3.3.4. While all reasonable steps have been taken to ensure that the transfer medium and its contents are free from computer viruses, the Engineer cannot be held responsible for any damage or loss that might from their presence.
- 10.3.3.5. The copyright of the original drawings, of which the data is an electronic copy, belongs to the Engineer. The drawings and data have not been prepared for use by the Mechanical Services Installer and may not fully reflect his needs.
- 10.3.3.6. Measurements taken from information which is not dimensioned on the electronic copy are at the Mechanical Services Installers own risk.
- 10.3.4. All electronic information passed to the Mechanical Services Installer shall be bound by the conditions set out in the above clause.

10.4. MANUFACTURERS DRAWINGS

- 10.4.1. Four copies of manufacturer's drawings and details of all plant and equipment shall be forwarded to the Engineer for comment. Drawings and details shall be certified by the Manufacturer as being applicable to the particular items being supplied.
- 10.4.2. Drawings shall include general layouts and assembly drawings, details of materials and construction, methods of support and fixing and electrical wiring diagrams. The information shall be in sufficient detail to allow the Engineer to comment. Where particular requirements for drawings are listed in the appropriate clauses for equipment or systems then these shall also be provided.

10.5. WORKING DRAWINGS

- 10.5.1. The Mechanical Services Installer shall produce fully detailed and dimensioned working drawings of each service to be installed, including all-purpose made plant and equipment. The location of all plant, equipment and services shall be fully dimensioned from each other, from other work and from the building structure.
- 10.5.2. The Mechanical Services Installer shall ensure that all services, including those provided by others are fully co-ordinated with each other and with the building structure and finishes, including obtaining the necessary information from others and for the indication of the service routes for all trades on composite drawings.
- 10.5.3. The Tenderer shall allow for plant, equipment, pipework, ductwork, or electrical installation to be moved during the preparation of working drawings up to one metre from the position inferred by the Tender Drawings.

- 10.5.4. Working drawings shall include fully dimensioned details and positions of supports and fixings. They shall clearly define the detail and arrangement of installed equipment and systems including access allowances for service and maintenance. Where plant is to be supported on steelwork, the Mechanical Services Installer shall provide setting out dimensions for the steelwork and fixing details of the particular plant to be supported. Weight of plant items with point loads shall be provided.
- 10.5.5. Working drawings shall be produced in accordance with a programme which is to be agreed with the Contractor to suit the overall programme for the Works. Reasonable allowance shall be made for incorporating any comments made by the Engineer.
- 10.5.6. The working drawings shall include the following fully co-ordinated drawings, in addition to any separate trades drawings which may be required: -

Area	Minimum Scale
Floor Layouts	1:50
Ceiling Layouts	1:50
Plant Room Layouts and Sections	1:20
Roof Plant Layouts and Steelwork Layouts	1:25
Toilet Layouts	1:25
Riser Shafts and Service Voids Layout	1:25
Services Layouts in Congested Areas	1:25
Schematic Diagrams of each Mechanical Service	
Metering Strategy Schematics	
Controls Schematics	
Ductwork Fabrication Drawings	1:50
Details	As required

- 10.5.7. Plant and equipment shall be shown in outline with positions of connections and access space clearly shown including space for withdrawal of internal parts. On 1:50 scale drawings pipework, ductwork, or electrical distribution equal to or larger than 100mm shall be shown to scale in double line. Circular distribution shall also have the centre line shown. 1:20 and larger scale drawings shall be similarly detailed, except that distribution equal to or larger than 40mm shall be shown to scale in double line. Where appropriate the thickness of insulation shall also be shown on 1:20 or larger scale drawings.
- 10.5.8. Dimensions shall be clearly shown to locate plant, equipment and distribution from the building structure or fabric and from each other. Inverts or levels above datum shall be shown for all distribution services.
- 10.5.9. Drawings shall be produced to a scale suitable for the application but at least to the scale listed above. Only recognized metric scales shall be used. Drawings shall be produced on A1 or A0 sheets as appropriate. A3 or A4 drawings may be used for specific component details such as typical brackets with the agreement of the Engineer.

10.6. WIRING DIAGRAMS

- 10.6.1. The Mechanical Services Installer shall produce fully detailed wiring diagrams of electrical work in connection with the Mechanical Services. The diagrams shall include the following: -
- 10.6.1.1. Field Control Wiring Layouts
- 10.6.1.2. Field Power Wiring Layouts
- 10.6.1.3. Control Panel Wiring Diagrams

- 10.6.2. Wiring diagrams shall be produced on a minimum of A1 size sheets. Where necessary, to incorporate additional information A0 sheets may be used. Computer generated diagrams on A3 or A4 sheets may alternatively be produced provided the information is clearly legible. Where diagrams have to be produced on more than one sheet then information shall be grouped as far as possible to minimise cross-referencing between sheets. Diagrams which due to non-compliance with the above are difficult to read shall be rejected by the Engineer.
- 10.6.3. Wiring diagrams shall clearly indicate the extent of the wiring system, including numbers and sizes of cables with loadings and relevant cable identification, layouts of cable trays, trunking and conduits and locations of all equipment requiring electrical connection. The drawings shall fully detail the requirements and location of points of connection of electrical services to mechanical services panels and equipment.

10.7. BUILDERS WORK DRAWINGS

- 10.7.1. In addition to the working drawings of the engineering services, the Mechanical Services Installer shall be required to produce drawings indicating builders work requirements in connection with the services. These drawings shall include details of penetrations through the structure, builders work supports and bases. Full details of access requirements for commissioning, servicing and maintenance through suspended ceilings and floors, together with access to riser ducts and the like shall also be provided as well as fire stopping arrangements and continuation of thermal insulation through penetration through building fabric.
- 10.7.2. The drawings shall only be prepared after the working drawings have been finally agreed with the Engineer and shall be based on the detail of these working drawings. The drawing production programme shall take this fully into account.

10.8. ISSUE OF DRAWINGS

- 10.8.1. On completion of working drawings, wiring diagrams and builders work drawings shall be submitted to the Engineer for comment. Four prints of the drawings shall be issued to the Engineer for this purpose. If an electronic document control system is employed for the project this will replace the need for printed copies, if agreed with the Engineer. A period of fifteen working days shall then be allowed for comment on the drawings by the Professional Team.
- 10.8.2. Where drawings are submitted for comment, they will be reviewed by the Engineer and any comments returned, either by marking directly on the drawing, or by correspondence. Drawings will be marked with A, B or C status and the definition of each category is as follows: -
- No comments. The drawing is to be re-issued for Construction.
 - Comments provided by the Engineer. The drawing is to be amended to incorporate all of the Engineers comments and marked for Construction.
 - The drawing is inadequate and is to be redrawn and resubmitted for comment.
 - The giving of an 'A' status does not relieve the Mechanical Services Installer from ensuring that the drawings meet the requirements of the contract documentation.

- The status of working drawings does not relieve the Mechanical Services Installer from his obligations to progress and complete the works in line with the agreed programme. Should the Mechanical Services Installer elect, in order to meet the programme, to proceed with installation work before 'A' status working drawing is achieved, this shall be at his own risk. Should unacceptable work be installed, it will be the responsibility of the Mechanical Services Installer to ensure it is removed and replaced in a manner acceptable to the Engineer. No claims for delay or payment will be entertained in this respect.
- When the drawings have been amended to incorporate any comments four prints and one copy negative shall be issued as the construction issue to the Architect and the Engineer. The same preliminary and construction issue distribution of drawings shall apply to any subsequent revisions of working drawings.

10.9. DIMENSIONS

- 10.9.1. The Mechanical Services Installer shall take site dimensions during the preparation of the drawings and be responsible for their accuracy. Setting out of the works on site shall be carried out by the Mechanical Services.
- 10.9.2. Installer and any errors arising from inaccuracies in setting out shall be the Mechanical Services Installers responsibility.
- 10.9.3. The Mechanical Services Installer shall be solely responsible for the accuracy of the drawings and for any equipment shown being suitable for the purpose for which it is intended and in accordance with the design drawings and specifications.

10.10. SITE COPIES

- 10.10.1. One set of prints of working drawings, manufacturing drawings and installation drawings as necessary to provide a complete record of the Works shall be kept on site. The drawings shall be available at all times for inspection by the Engineer.
- 10.10.2. The drawings shall be kept in good condition and be marked up, at least once a week, to show the progress of work on site and incorporate all alterations, omissions, variations and amendments agreed during the progress of the works.

10.11. SCHEDULE OF RATES

- 10.11.1. Tenderers shall provide, in triplicate, a make-up of the tender price showing quantities, rates and totals in an agreed form and in such detail as required by the Engineer and Quantity Surveyor.
- 10.11.2. Responsibility for the accuracy and completeness of the quantities and descriptions will rest with the Tenderer. No adjustments will be made to the tendered price in respect of any inaccuracies. The exclusion of any items in the Schedule of Rates will not relieve the Mechanical Services Installer of any obligations under the Specifications and Drawings.
- 10.11.3. Schedule of Rates shall be provided within seven days of request from the Engineer or Quantity Surveyor.
- 10.11.4. The Tenderer shall also provide a schedule of makes and types of all equipment included in his Tender, and a list of all Specialists to be employed on the works.

10.12. MANUALS

- 10.12.1. Manuals should consist of one electronic copy and five sets of printed manuals. Both electronic and printed copies shall incorporate all test certificates and acceptances. Six weeks prior to Practical Completion draft copies of the manuals shall be submitted to the Architect and Engineer for comment. One week before Practical Completion final agreed manuals shall be handed over to the Employer. A sum equivalent to 5% of the tender value shall be retained until this occurs.
- 10.12.2. Failure to issue the manuals in time for incorporation into the Health and Safety File will result in failure to achieve Practical Completion.
- 10.12.3. Where a development includes residential units, each individual residential unit shall be provided with its own set of Operating and Maintenance instructions.
- 10.12.4. The manual shall be arranged as follows: -

Section 1	Index
Section 2	Description of the Design Intent
Section 3	Description of the Operation Routine. The description shall include specific instruction for startup, operation and shut down of each system, procedures for emergency shut down, making safe potentially dangerous plant, precautions necessary to overcome known hazards when operating each system, bringing into operation standby equipment, instructions on fault finding and emergency in case of plant malfunction or equipment failure and control sequences for all systems. Health and safety matters identified in the Health and Safety Plan and relevant to the operation, maintenance and replacement of the installation shall be described with precautions envisaged as necessary.
Section 4	Planned Maintenance Instructions. These shall detail the procedures appropriate to the maintenance tasks. Instructions shall include dismantling and reassembly, replacements, adjustment, calibration and testing, reference to parts, identification lists, special tools, test equipment and auxiliary services, hazards which may arise and precautions to be taken, fault finding routines.
Section 5	Maintenance Schedules. These shall detail recommendations for the nature and frequency of inspections, examinations, tests, and maintenance to keep the equipment in a safe and efficient working order. Guidance shall be given on the nature of deterioration and defects to be looked for. Activities shall be listed for daily, weekly, monthly, quarterly, bi-annual, and annual routines.
Section 6	Dismantling. Description of the methods and processes to be used in draining down and emptying of all systems including safe disposal of the contents. Description of the methods envisaged for dismantling of systems to comply with health and safety requirements, including schedules of hazardous substances and methods of disposal.
Section 7	Equipment Schedules and Parts Lists. The schedules shall locate each item with details of the design and actual operating conditions,

including replaceable assemblies. Sufficient information shall be provided to identify each item, with the source of supply, ratings, dimensions, and appropriate standards. Equipment schedules shall include the name and address of the manufacturer, reference number, name and address of supplier, order number, date of purchase and duration of warranty. A separate parts list shall be provided for each item detailed in the equipment schedule. Schedules should be provided electronically in MS Word or MS Excel tabular form.

- Section 8 A set of Record Drawings and Test Certificates. If necessary, due to the number of drawings which have to be included in the manual, each drawing shall be photographically reduced in size to suit the manual. There should also be a Master Record Index provided electronically in MS Word or MS Excel, listing drawing numbers, descriptions, category and all related drawings.
- Section 9 Emergency Measures. This shall include telephone numbers of Mechanical Services Installer's emergency staff and name, address, and telephone number of all manufacturers.
- Section 10 Copies of all test certificates and commissioning data for each service and item of plant and equipment. They shall be final copies of the data produced as required by the Inspection, Testing and Commissioning Section of this Specification. Where such data is not available for inclusion in the draft copy of the manual required by paragraph b of this Clause, the draft shall be forwarded without them. Inability to include these items will not be accepted as a reason for non-production of the rest of the draft manual.

- 10.12.5. Covers shall be substantial, of adequate size, distinctive and of sufficient strength to protect the contents for the life of the installation. The binding shall give a permanent anchorage along the left-hand side whilst allowing the text to be flat without damage to the spine.
- 10.12.6. The contents shall be prepared with an agreed typeface on top quality A4 paper suitable for direct insertion into the manuals.
- 10.12.7. The front cover and where appropriate the spine shall have the name or logotype of the Employer, the name of the building and details of the services included in the manual clearly displayed in permanent lettering. Where the manual is contained in more than one volume, a volume number shall be added.
- 10.12.8. The title page shall identify the building, describe the Services referred to in the manual and give the full name and address of the Employer. It shall also contain, date of completion and date of handover of the services to the Employer. The date of issue of the manual with the name and address of the manual author and the Author's reference number
- 10.12.9. The preliminary pages shall contain the full name, address and telephone number of the Engineer, the Mechanical Services Installer, and specialists. A description of how to use the manual with any limitations on its use shall be included. The preliminary pages shall include a contents list, list of supplementary documents and a record of amendments to the manual.

- 10.12.10. Each section of the manual shall be divided by a stiff divider of the same size as the holder. The divider shall be labelled to identify the section of the manual which is following.
- 10.12.11. All pages comprising the manual shall be sequentially numbered within each Section.

10.13. BUILDING LOG BOOK

- 10.13.1. The Mechanical Services Installer shall produce all required information for the Building Log book to meet the requirements of the Building Regulations Approved Document in accordance with CIBSE TM31: Building Log Books and Standard Templates.
- 10.13.2. The Mechanical Services Installer shall issue the required information to the Contractor in good time for onward transmission to the Log book Author to allow the completed log book to be issued one week prior to Practical Completion. Failure to issue the required information may prejudice the issue of the Practical Completion certificate.

10.14. RECORD DRAWINGS

- 10.14.1. Two sets of paper prints of the Record Drawings shall be provided to the Architect by the Mechanical Services Installer for comment 28 days prior to Practical Completion. If an electronic document control system is employed for the project this will replace the need for printed copies, if agreed with the Engineer.
- 10.14.2. When agreement with the contents of the Drawings is received from the Architect five sets of paper prints and electronic copies to the current version of AutoCAD or in DXF format shall be issued to the Architect. The Drawings shall comply with the requirements of the Construction (Design and Management) Regulations for incorporation into the Health and Safety File for the Contract.
- 10.14.3. Record Drawings shall show the work as completed and shall record the following:-
- The location, including levels if buried, of public service connections provided within the Contract, whether installed as part of the Contract or the appropriate authority, together with the points of origin and termination, size and materials of pipes, line pressure, flow and other relevant information.
 - The layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes, drain cocks, test pockets, gauges, flow or pressure switches and other instruments.
 - Location, identification size and details of all apparatus and controls equipment served by, or associated with, each of the various services.
 - The layout, location, extent of air ducts, including those formed in builders work or otherwise, plant, equipment, dampers, acoustic silencers, grilles, diffusers, other air terminals, balancing dampers, access panels, fire dampers, turning vanes, hand holes, test holes, gauges and instruments. Each duct and terminal shall be marked with its size and air quantity flowing. Each terminal unit or grille shall have its duty clearly shown.
 - The location and identity of each room including spaces housing plant, machinery or apparatus.

- Detailed general arrangements of boiler houses, machinery spaces, air handling plant rooms, tank rooms, electrical switch rooms and other plant or apparatus, including the location, identity, manufacturer, size and rating of each apparatus.
- Sections, elevations, isometrics and schematics of the plant spaces required to clearly indicate the plant arrangements.
- Control and wiring diagrams, incorporating details of each instrument and equipment item with a written description of the sequence of operation of each system. Diagrams shall include full details of internal panel wiring and connections to field mounted items.
- Layout, location and extent of electrical switchgear distribution boards, cables and termination points.
- The Record Drawings, as described, shall be drawn using the current version of AutoCAD and shall be printed on quality paper using international A series sizes. Lettering shall be not less than 5mm in height.
- Each Record Drawing shall show the name of the Contract and, where appropriate, the zone or floor designation. They shall include a description of the drawing, drawing number and scale. The name and address of the Mechanical Services Installer and the Engineer shall be included. Each Drawing shall include the words 'Record Drawing' in 18mm upper case lettering in the bottom right hand corner adjacent to the title block.
- A sum equivalent to 5% of the Contract value to cover the production of these Drawings shall be withheld until they are completed to the Engineer's satisfaction and handed to the Employer. Failure to issue the Record Drawings in time to form part of the Health and Safety File will result in failure to achieve Practical Completion.

10.15. INSTRUCTION OF EMPLOYER

- 10.15.1. The Employer's Representatives shall be fully instructed by experienced personnel in the operation, servicing and maintenance of the Works. Instruction shall include the provision of such specialist instruction as is required from any suppliers or specialists.
- 10.15.2. Such instruction shall be given for a minimum period of one week unless otherwise specified elsewhere in this document. On completion a signed receipt shall be obtained from the Employer stating that such instruction has been received.
- 10.15.3. A weeks refresher course shall be provided three months after Practical Completion. On completion a signed receipt shall be obtained from the Employer stating that such instruction has been received.

10.16. WORK IN EXISTING BUILDINGS

- 10.16.1. Where works are to be undertaken in an existing building, it shall be the Mechanical Services Installer's responsibility to locate the existing Health & Safety File, (or Operating and Maintenance Manuals and Record Drawings where no Health and Safety File exists), at an early stage during the contract. The existing documentation shall be updated by cross referencing it to the new record documentation provided as part of the new contract works.

- 10.16.2. Where the final installations incorporate elements retained from the original installation, they shall be clearly identified within the record manuals and on the record drawings so as to clarify the demarcation between the existing and new contract works.
- 10.16.3. Where no Health and Safety File or original record documentation exists, or is incomplete, the Mechanical Services Installer shall allow to provide the record documentation for the new contract works and take further instruction from the Engineer with regard to the new works.

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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

ELECTRICAL SPECIFICATIONS

1 GENERAL

1.1 Introduction

- 1.1.1 The project is the refurbishment of an existing office building located at Pope Hennessy Street Port Louis. The building, of approximately 4,400m², comprises a basement, ground floor, 1st to 6th floors, and spaces (technical office and room) at roof level. There is a technical block at ground floor at the back of the building forming part of the main building.
- 1.1.2 The building is being designed to comply with all local regulations and by laws. Where specified, the building shall comply with some sections of the British Standards.
- 1.1.3 Building services equipment shall be tested at manufacturer's premises as far as possible before erection on site. The consulting Engineers shall be witnessing all these tests at the contractor's costs. A full schedule of factory tests is described in the Inspection and Testing Sections of this specification.
- 1.1.4 Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances and the responsibility to provide a complete installation fit for the building.
- 1.1.5 This specification sets out the standards of materials and workmanship for the project. All materials shall comply with the latest issue of the European Standards, or the Standards specified elsewhere in the Sections / Drawings or Bills of Quantities. All electrical equipment used within the contract shall primarily comply with the Requirements of BS 7671 and MS 63.
- 1.1.6 The installation shall include for all aspects of Health and Safety for those who are going to operate and maintain the installation.

1.2 Services description

1.2.1 Engineering Systems

1.2.1.1 This section details the main design principles and design criteria of the electrical installation.

1.2.1.2 It also gives preliminary sizing of the installation. It is the Contractor's responsibility to re-calculate and check the system sizing based on the actual product/equipment chosen.

1.2.1.3 The works to be provided include the Supply, Installation, Testing and Commissioning of the entire system as described in this Specification, and the Drawings

1.2.1.4 The drawings indicate major cable routes only. The Contractor shall provide all supporting steelwork, cleats, cable tray, ducts, cable ladder, trunking, conduits, and fixings necessary to complete the installation regardless of whether they are specifically indicated on the drawings or not.

1.2.1.5 The Contractor is responsible for the design of cable management and support structures.

1.2.1.6 Fixings shall be made to the structure of the building only in a manner approved by the Structural Engineer & Architect.

1.2.2 Power supply

1.2.2.1 The public utility electrical supply shall be from 1Nos. 250 kVA transformer located in the transformer room on ground floor.

1.2.2.2 Essential power will be supplied from the 105 kVA prime rated generator located in the technical room on ground floor.

1.2.2.3 All medium voltage and transformer installations shall be carried out by the CEB and contributory fees shall be borne by the client as required by the CEB.

1.2.2.4 The contractor shall be required to liaise with the Utility Company for the scheduling of the works as well as the site co-ordination.

1.2.3 LV switchgear

1.1.1.1. The Contractor shall supply and install low voltage switchboards. Switchgear shall comprise moulded case circuit breakers (MCCBs). The design has been based upon Schneider electric switchgear. If a listed alternative is chosen, the Contractor shall include for any necessary changes to the scheme, for example cable sizes, discrimination studies etc.

- 1.2.3.1 Where MCCB's are not required to be motor operated to achieve the design, they shall be arranged, and space shall be provided to enable the fitting of motor operators and auxiliary contacts in the future.
- 1.2.3.2 Hardwired safety interlocks shall be provided as follows:
- To prevent paralleling of mains supplies.
 - To prevent back feeding into a failed mains feeder.
 - To prevent connection of any supplies which are not proven to be in synchronism with each other.
 - All LV switchboards shall be extensively tested at the manufacturers' works for construction, workmanship, electrical integrity and functionality. This will require all sections of the main LV panel to be available simultaneously in the works with temporary connections made to enable all operational scenarios to be simulated. This is an extensive operation and time must be allowed for the setting up as well as the testing itself.
- 1.2.4 LV sub-main distribution
- 1.2.4.1 Provide sub main cabling using XLPE/SWA/Cu cables installed on cable tray, cable ladder or cleated to steelwork along riser ducts. All power cables shall be spaced apart by one clear cable diameter and shall be cleated to the ladder using purpose made metal or LSF cleats. Cable ties etc will not be permitted.
- 1.2.4.2 Provide cableways for all cables whether or not they are specifically shown on the drawings.
- 1.2.4.3 Where LV sub main distribution cables pass through walls or floor slabs, a purpose made cable transit device shall be used. This shall comprise a steel frame built into the wall or slab with a clamping mechanism and infill blocks to fit around the cables. The entire system shall maintain the fire rating of the wall or slab in which it is installed, and the Contractor shall provide certification to this effect.
- 1.2.5 Standby generation
- 1.2.5.1 The standby generator installation shall be under the scope of work of the generator contractor. Cabling works from the generator to the MLVP/E will be done by the generator contractor. The electrical contractor shall be required to carry out the neutral earthing of the generator and ensure that the resistance does not exceed 5 ohms.
- 1.2.5.2 An existing low voltage standby diesel generator, rated 105kVA is located in the technical room on the ground floor.
- 1.2.5.3 Engine cooling shall be done via a skid-mounted radiator.
- 1.2.5.4 Equipment for mains failure control, indication and detection shall be located within the main LV panels and the Automatic Transfer switches.

- 1.2.5.5 Electrical contractor to provide all automatic transfer switches.
- 1.2.5.6 Facilities shall be provided to enable manually initiate starting and connection of the generator and to simulate a full mains failure for generator list purposes.
- 1.2.6 Small power
 - 1.2.6.1 Provide small power installation throughout the common and services areas. Installation shall generally be concealed.
 - 1.2.6.2 Sockets shall be British and French types as per client requirements. Socket outlets shall be of Ampere and Voltage ratings and type according to the power use. All sockets shall be labelled, and distinction shall clearly be made from Main or UPS source. All sockets shall be equivalent to Make Legrand as specified by the client.
- 1.2.7 General lighting
 - 1.2.7.1 Provide lighting installation throughout the building.
 - 1.2.7.2 Installation shall generally be recessed mounted on all floor areas, surface mounted in service areas and where there is no false ceiling. Wiring shall be drawn in concealed conduits.
 - 1.2.7.3 Where surface mounted, the installation shall be in concealed conduit, using three-core LSF cables. Where concealed, prefabricated and prewired flexible plastic conduits may be used within ceiling voids, risers and walls. The Contractor shall be responsible for the design of wireways and distribution.
 - 1.2.7.4 Lighting shall be manually controlled via local switches in offices, technical rooms and timer with PIR detectors for circulation areas. External lighting shall be controlled by twilight sensor from ground floor to sixth floor and manual switch on rooftop.
- 1.2.8 Emergency lighting
 - 1.2.8.1 Provide emergency lighting throughout all areas using self-contained or local battery/inverter units to provide 1-hour standby. These shall be direct from the luminaire manufacturers. Third party conversions will not be permitted.
- 1.2.9 Telecommunications installations
 - 1.2.9.1 A main telecom cubicle shall be provided in the pump room, located in the basement of the building. This room shall be used for the termination of telecom fibre optic cables and to the main telecom equipment.
 - 1.2.9.2 Telecommunications services shall be supplied to the building premises via optical fibre cabling, that is, Fibre To The Premises (FTTP) from the main distribution frame, located in the telecom room to the sub-fibre distribution boxes located on each floor (ground floor to sixth).

- 1.2.9.3 Contractor shall provide and install a complete generic cabling (structured cabling) system. The incoming fibre optic cables shall terminate in the sub-fibre distribution boxes.
- 1.2.9.4 Cabling to Telecommunications Outlets (TOs) shall be made via concealed conduits/cable tray.
- 1.2.10 Earthing and bonding installation
 - 1.2.10.1 The main earthing arrangements for the distribution shall be as shown on the drawings and cable schedule with all incoming services being provided with main equipotential bonds.
 - 1.2.10.2 Any ceiling grid systems and metallic false floor shall be periodically bonded throughout to ensure they remain electrically connected to earth even when runs of tiles are opened up for working above and below. Supplementary bonding shall be provided by the Contractor to ensure an equipotential zone as required by BS.7671 regulations is achieved throughout the building.
 - 1.2.10.3 The Contractor shall provide and install a grid of earth electrodes and cabling and earth bars to provide the main earth for the electrical services as shown on the drawings.
 - 1.2.10.4 One main earth bar, MEB, shall provide a connection point for cables run out to earth electrodes installed in earth pits which shall be bonded into the foundations by the Contractor. The Earth test point for lightning protection shall be connected to the main earth bar via a transient earth conductor (TEC). The earth pits shall be complete with seals as W J Furse single flange type ES210 and pit PT205 or equal and approved.
 - 1.2.10.5 Each individual rod shall be driven to provide a resistance of not greater than 10 ohms and the combined resistance of the earth rods connected to the main earth bar shall not exceed 5 ohms. The contractor shall use artificial earth enhancement materials if required to achieve the above.
 - 1.2.10.6 A clean earth system shall be provided consisting of a clear earth bar located adjacent to the main earth bar.
 - 1.2.10.7 On completion of the contract, duplicate copies of an inspection and test certificate shall be handed to the Engineer and copies incorporated in the O&M manuals.
- 1.2.11 Lightning Protection Installation
 - 1.2.11.1 The Contractor shall employ a specialist for the supply and installation of a complete lightning protection system. A programme of works shall be agreed with the Specialist to suit the Contractors programme and the Contractor shall liaise with the specialist thereafter to ensure that the lightning protection system is installed according to the requirements of BS 6651, this specification, and the Contractors programme. The air termination system shall comprise an Early Streamer Emission (ESE) terminal and 50 x 6mm copper tape down conductor. The down conductor

tape shall be PVC covered in a colour appropriate to the surface on which it is laid to the Architect's choice.

- 1.2.11.2 The earthing arrangement shown on the drawings is indicative only. The Contractor shall test the resistivity of the ground to determine the most appropriate method of obtaining an earth less than 10 ohms as required by BS 6651.
- 1.2.11.3 An inter-link shall be made between the building electrical system earth and the lightning protection system.
- 1.2.11.4 The Contractor shall supply and install electronic surge protection equipment within the main switchboards to meet BS 6651. Fused protection or circuit breaker for the selected devices shall be provided to manufacturers recommendations. Status indications for the devices shall be visible on the front of the switch boards. The unit will provide protection L-E, L-N, L-L and N-E (L=line, N=neutral, E=earth).
- 1.2.11.5 On completion of the contract, duplicate copies of an inspection and test certificate shall be handed to the Engineer and copies incorporated in the O&M manuals.
- 1.2.12 Fire Detection and Alarm Systems
 - 1.2.12.1 The fire alarm system shall be a two stage one.
 - 1.2.12.2 The fire alarm system complying with BS 5839 shall be provided for the building. Generally, smoke and heat detectors shall be provided throughout the building to detect any fire.
 - 1.2.12.3 Loop connection boxes shall be required to extend the fire alarm system during fit-out works.
 - 1.2.12.4 The addressable fire alarm system shall consist of 2-Loop addressable panels located in basement. All detectors and manual call points shall be of the addressable type. Sounders have been selected to provide a minimum sound level of 95 dB (A).
 - 1.2.12.5 Upon receipt of a signal from any fire alarm device, the panel will go in stage 1 as indicated in Table 1.
 - 1.2.12.6 A time lapse of three (3) minutes will be given for the staff to investigate whether the signal received is a false signal or a real fire.
 - 1.2.12.7 During the three (3) minutes, if a second fire alarm has been activated, the panel will go in the second stage.
 - 1.2.12.8 In case this is a false signal, the staff may cancel the signal by pressing the reset button.
 - 1.2.12.9 Should the signal not be cleared within the three (3) minutes, the panel will go in the second stage automatically. Consequently, all the zones will go in second stage as shown in Table 2 and the whole building will be required to be evacuated.

Table 1: First Stage Alarm

1 st Stage					
CAUSE	EFFECT				
		LG	G	L1	L2
	LG	1			
	G		1		
	L1			1	
	L2				1
Annotations: '1' denotes first stage					
'2' denotes second stage					

Table 2: Second Stage Alarm

2 nd Stage					
CAUSE	EFFECT				
		LG	G	L1	L2
	LG	2	2	2	2
	G	2	2	2	2
	L1	2	2	2	2
	L2	2	2	2	2
Annotations: '1' denotes first stage					
'2' denotes second stage					

The fire alarm system shall operate on a two-stage alarm principle to facilitate progressive horizontal evacuation to minimise the disruption to the operation of the building in the event of a false alarm or in the event of a real fire condition. The fire alarm system shall integrate with all other systems that shall be required to either send a signal to the fire alarm system or receive a signal from the fire alarm system.

2 BASIS OF DESIGN

2.1 General

2.1.1 This Section of the Specification set out the principal design parameters applicable to the Electrical Services Installation.

2.2 LV Power supply

The power supplies and distribution equipment shall be sized to cater for the under noted loads. Allowance for diversity complies with the requirements described elsewhere in this specification. The LV distribution has been designed for a 400/230 Volts, 50 Hz AC supply with a variation of $\pm 10\%$ in voltage and $\pm 1\%$ in frequency. Equipment shall be selected to operate with the above supply unless otherwise specified. Main low voltage switchgear shall incorporate spaces to enable the addition of future circuit breakers if required to serve dedicated equipment loads.

2.2.1 General power density

• Lighting	7 W/m ²
• Small power	25 W/m ²
• External lighting	4 W/m ²

2.2.2 Power factor

- Targeted value = minimum 0.95 lagging

2.2.3 Diversity

The following diversity factors shall be applied:

- 0.8 for all small power.
- 0.5 for miscellaneous items such as cleaning equipment.
- An overall diversity of 0.8 shall be applied at all switchboards.
- An overall diversity of 0.7 will be applied at the point of supply.

2.3 Lighting

2.3.1 Internal lighting

The internal lighting Installation has been designed to provide the light level as per the society of light and lighting (SLL) requirement.

The undernoted reflection factors have been used for lighting level calculations.

- Ceiling – 70%, Wall – 50%, Floor – 30%
- Minimum/Average illuminance ratio: - 0.5
- Lamp lumen maintenance factor: Re-lamping frequency of 10,000-40,000 hours
- Lamp survival factor: Spot replacement/Group lamp replacement of 10,000 hours
- Luminaire maintenance factor: Luminaires cleaned every year.
- Room surface maintenance factor: Room surface cleaned every year.

The Internal Lighting Installation has been designed to provide the following levels of maintained illuminance based on a revamping frequency of 6000 hours with luminaire and room surfaces cleaned every two years.

2.3.1.1 General lighting level of 100-150 lux for circulation areas shall be achieved at floor level. The lighting shall meet the requirements of CIBSE Lighting Guide LG7.

Lobby	150 - 200 lux
Office	300-500 lux
Corridors	150 lux
Basement car park	75 lux
Stairways	150 lux
Toilet	200 lux

2.3.2 Emergency lighting

2.3.2.1 Emergency lighting installations shall comply with the requirements of BSEN 1833 and BS 5266. They have been designed to maintain the following levels of illumination for a minimum period of three hours:

- Open plan areas: 0.5 lux minimum
- Escape routes: 0.2 lux minimum

2.3.2.2 The requirements of the Building Regulations (UK) approved document B regarding escape lighting shall be met.

2.4 Ancillary services

2.4.1 Earthing & bonding

2.4.1.1 Earthing and bonding shall comply with BS 7430

2.4.1.2 Only earth rods are being used for earthing and bonding.

2.4.1.3 The earth loop resistance at any point of the installation shall not exceed 5 ohms.

2.5 Acoustic criteria

2.5.1 The systems shall be designed, and equipment selected to achieve the following noise levels within the building:

2.5.1.1 Structural Vibration: The services installation shall be isolated from the structure to ensure that the frequency and acceleration of structural borne vibration falls within the 1.4 curve for continuous vibration and the 20 curve for intermittent vibration with up to 3 occurrences per day as shown in fig A1.22 of the CIBSE guide. DESIGN CONDITIONS.

3 COMMON ELECTRICAL SERVICES

3.1 Plastic conduit and trunking

3.1.1 General

3.1.1.1 All plastic conduits shall be LSF to BS 4607 and BS EN 50086 as applicable. They shall be heavy gauge, high impact, smooth inside and outside, free from imperfection, of minimum diameter 20mm. They shall be protected from weather and all mechanical damage during installation or whilst stored at site. They shall be reamed to remove all sharp edges and burrs and shall be cleaned of all debris.

3.1.2 Plastics conduit installation

3.1.2.1 This shall generally be in accordance with the requirements specified for steel conduits.

3.1.2.2 They shall have bends and sets formed with the aid of helical spring fitted internally, with the conduit warmed sufficiently for it to move without deformation of the bore, and with minimum wall thinning on the outside of the bend.

3.1.2.3 Conduits shall have lengths coupled together by means of plastics sockets jointed by adhesive solution, or by compression fittings. They shall have a separate insulated circuit protective conductor run in the conduit to ensure earth continuity between exposed metal items.

3.1.2.4 Conduits shall be coupled to equipment not having shaped or smooth conduit entries, by means of plastics bushes fitted inside the equipment, with external locking rings.

3.1.2.5 Conduits shall have expansion couplers at intervals not exceeding 6.0m on straight lengths. Secured to one conduit and a sliding fit to the other using a flexible adhesive to prevent ingress of moisture.

3.1.2.6 Conduits shall be to BS 4607 as applicable where they are to be cast in concrete. They shall be installed in accordance with the manufacturer's recommendations.

3.1.2.7 Conduits shall be supported by means of a plastics spacer bar or distance saddle at centres not exceeding the following: -

Conduit Size	Vertical and Horizontal Spacing
20mm - 25mm	1.2m
32mm - 40mm	1.5m
50mm	1.8m

- 3.1.2.8 Shall have saddles fixed within 150mm each side of all bends or sets.
- 3.1.2.9 Plastics conduits shall not be installed where ambient temperature is below -5°C or working temperature is above 60°C.
- 3.1.2.10 Plastics conduit boxes shall not have self-tapping screws or push-in threaded inserts for the suspension of luminaires.
- 3.1.3 Plastic trunking
 - 3.1.3.1 Plastic trunking shall be LSF in accordance with BS 4678 Part IV extruded unplasticised PVC compound. They shall be smooth inside and outside and free from imperfections. They shall be of the high impact resisting heavy gauge type fitted with drip proof lids.
 - 3.1.3.2 Trunking shall be fitted with cable retaining straps where trunking is installed with cover on the underside. Alternatively manufactured with one edge turned to form a retaining trough; this method to be used only where the lid of the trunking is not fitted on the top side.
 - 3.1.3.3 Trunking shall be fitted with insulated cable support pins at intervals of 1.2m in vertical runs of trunking that exceed 1.8m in length. The first pin in cases where junctions occur shall not be more than 300mm from such junctions. They shall be fitted with overlapping covers where installed flush with the building fabric. The edge of the trunking being flush with the finished surface of the building fabric.
 - 3.1.3.4 Trunking shall be provided with separate insulated circuit protective conductor run within the trunking to ensure earth continuity between exposed metal items. They shall be fitted with manufacturer's standard radiused angle bends, connector tees, off-sets, end plates or flares and other accessories to accommodate expansion of the trunking.
 - 3.1.3.5 Separate fixed section of trunking shall be used where accessories are fitted on to it. They shall be fixed to the building structure 50mm each side of all joints and elsewhere in accordance with the IEE Wiring Regulations.
 - 3.1.3.6 Trunking shall be cut to allow conduit access directly to the appropriate section where conduits are connected to multi-compartment trunking. They shall not pass through fire compartment walls. They shall be installed where ambient temperature is below -5°C or working temperature is above 60°C.

3.2 Cables in conduit and trunking

- 3.2.1 Cables
 - 3.2.1.1 Cables shall be minimum cross-section 1.5mm². Wiring cables shall be provided with copper conductors, with PVC insulation 450/750 volt grade, to BS 6004.

- 3.2.1.2 Insulation shall be of butyl rubber (to BS 6007), silicon rubber (to BS 6007) or other heat resistant cables to the appropriate BS to be used in the positions and areas as indicated.
- 1.1.1.2. All cables shall be of stranded conductors for 1.5mm² and above. Cables shall be coloured throughout the whole length in accordance with the IEE Regulations. Specifically, live conductors shall be Brown, Neutral Blue and Earth Yellow and Green stripes for 230V circuits and Brown, Black, Grey and Blue from three phase circuits.
- 3.2.1.3 All cables supplied shall meet the approval of the Mauritius Standards Bureau and shall also comply with the relevant British Standards. Cables shall be of European or South African origin.
- 3.2.1.4 Cables shall be delivered to site with each coil having its seal intact and bearing the name of the manufacturer, classification, and size, description of cable, length and grade.
- 3.2.1.5 Cables shall be installed without kinks or joints. There shall be no intermediate connections other than at luminaires, switches, or other outlets. They shall be laid into trunking after removal of all lids and loomed into separate groups by means of purpose made bands at 2m intervals. They shall not be drawn into trunking except where it passes through the structure.
- 3.2.1.6 Cables shall be connected directly to any lamp holder or other appliance where temperatures are likely to exceed the maximum operating temperature for the insulation specified in the appropriate British Standard without the use of high temperature sleeves or beads.
- 3.2.1.7 Flexible Cables and Cords shall not have conductors smaller than 0.75mm² (24/0.20mm) unless otherwise specified. They shall be 300/500 volt grade and of circular construction, with colour coded cores in accordance with the IEE Wiring Regulations.
- 3.2.2 Termination of cable conductors
- 3.2.2.1 Terminations of cables shall be either sweated lugs of the appropriate size for the cable used or compression type lugs (using manufacturer's recommended equipment) or pinch screw or tunnel type terminals designed to prevent damage and spreading of the conductors
- 3.2.2.2 They shall be fitted with locking nuts or other effective locking devices on all bolted connections. They shall be so arranged that the tunnel or clamp connector is effectively filled and shall be terminated in an enclosure or within the appliance using fixed connectors.

3.3 Cables sheathed and/or armoured

3.3.1 General

3.3.1.1 All cables shall be new and complete with all manufacturers' labels and test documents where appropriate. They shall be delivered to site in one continuous length on a drum ready for laying with ends sealed. They shall be installed without damage to either cable or building fabric.

3.3.1.2 Each run of cable shall be marked at each end and at access points by a securely fixed non-corrosive metallic or substantial plastic label, engraved to indicate the cable size and circuit. All cables shall be in one continuous length without joints.

3.3.1.3 Cables shall be as indicated on drawings and schedules with the routes measured on site. Any length found to be measured too short shall be replaced with cable of the correct length. No cables shall be cut from measurement taken from the bill of quantities. All measurements shall be checked on site prior to ordering and cutting. Any cables falling short of the quantities provided in the BoQ shall be notified to the Engineer prior to ordering.

3.3.1.4 Cables shall be protected from mechanical damage to a height of 1.5m above floor level where run vertically on the surface of walls or in any other location where it may be vulnerable.

3.3.1.5 Cables shall be with fire resisting infill where passing through floors or walls, to the IEE Wiring Regulations. The sealing agent shall have fire resistance equal to that of the structure.

3.3.1.6 Cables shall be such that all glands and boxes provide an effectively maintained earth continuity path.

3.3.1.7 Cables shall be with the same construction and cross-sectional-area and route length where installed in parallel unless otherwise specified in the bills or drawings.

3.3.2 PVC/SWA/PVC cables and cross-linked polyethylene cables general

3.3.2.1 These cables shall be installed generally in accordance with clauses listed above.

3.3.2.2 Shall be to BS 6346. 600/1000 V grade for PVC/SWA/PVC cables having copper or aluminium conductors and shall be to BS 5467 for XLPE/WA/PVC cables.

3.3.2.3 Cables shall be terminated in suitable bright dipped or plated brass compression glands to BS 6121 to provide an anchorage and a cross-joint bonding of the armouring. Glands shall be totally enclosed within PVC shrouds. They shall not be installed in direct contact with any form of polystyrene.

3.3.3 Cable joints in PVC/SWA/PVC cables

3.3.3.1 Cable joints, if instructed by the Engineer, shall be made in standard underground junction boxes purpose made for PVC/SWA/PVC sheathed cables and shall be filled with a cold pouring sealing compound. They shall have soldered joints made using a resin type flux for copper conductors, and either organic or inorganic flux in the case of aluminium conductors.

3.3.3.2 All joints shall be wrapped with PVC tape to BS 3924 giving a degree of insulation at least equal to that of the original insulation. Joints shall be made in strict accordance with the Manufacturer's recommendations.

3.4 Cable trenches

3.4.1 Cable trenches general

3.4.1.1 Trenches shall be excavated for minimum cable depths, spacing between services and trench widths as indicated below, unless otherwise stated in drawings or dictated by Public Utilities.

TYPE OF CABLE	GENERAL CONDITIONS	TRAFFIC ROADS	CULTIVATED AREAS	AREAS BENEATH DRAINAGE
Road Lighting	500mm	750mm to top of ducts	600mm	1.0m
Communication	"	"	"	"
Alarm	"	"	"	"
LV	"	"	"	"
HV	800mm	1.0m to top of ducts	1.0m	"

Minimum Spacing Between Services Laid Direct in the Ground (General Conditions)				
CABLE	HV	LV	COMMUNICATION AND ALARM	GAS AND WATER
HV	150mm	300mm	600mm	600mm
LV	300mm	75mm	300mm	"
Communication and alarm	600mm	300mm	50mm	"

Minimum Width of Cable Trenches for Required Depths	
NOMINAL DEPTH	NOMINAL WIDTH
Down to 500mm	300mm
Down to 800mm	500mm
Down to 1.0 m	500mm
Down to 1.5 m	700mm
Below 1.5m	800mm

- 3.4.1.2 Trenches shall be provided with 100mm earthenware or pitch fibre ducts at roadway crossings, the ducts to extend 1.0m on either side of the roadway and be covered with a haunch of concrete.
- 3.4.1.3 Trenches shall be filled with a layer of 75mm of sifted soil or rocksand to support the cable, and 75mm of rocksand covering the cable after laying, with interlocking cable covers for high voltage cable to BS 2484 laid on the sand directly over the cable, of such width as to provide a minimum overlap of 50mm on each side OR for low voltage and communications cables one or more continuous strips of plastic marking tape clearly and indelibly marked DANGER ELECTRIC CABLES run at nominal 300mm above cables.
- 3.4.1.4 Trenches shall be back-filled with the excavated earth well rammed down. Not more than 150mm depth of soil shall be rammed down at any one time. The work shall be inspected before back filling is commenced.
- 3.4.2 Cable route markers and identification labels
- 3.4.2.1 All cables laid externally shall be provided with cable route markers and identification labels. They shall be laid level with the finished surface and spaced at intervals of 50m on straight runs. These labels shall be installed at all "T" and "through" joints, at changes of direction, and at each side of every road crossing.
- 3.4.2.2 Cable route markers shall be 200mm x 200mm x 50mm, formed of reinforced concrete, and with inserts brass inserts indicating the voltage/service, direction and depth of cable as agreed with the Engineer. In unmade ground, they shall be concrete posts 600mm long, sunk into the ground to a depth of 300mm.
- 3.4.2.3 Where cables enter buildings, they shall comprise brass or plastic plates fitted to the wall, engraved with the size and voltage of the cable.

3.4.2.4 Shall comprise 75mm x 50mm labels attached to each end of every cable indicating the following information: -

- Reference number of cable
- Points of termination
- Size and number of conductors
- Type of cable and date installed
- Operating voltage/service type

3.5 All insulated cable systems

3.5.1 Generally

3.5.1.1 Shall be PVC insulated and sheathed to BS 6004 and BS 6746 or LSF insulated and sheathed.

3.5.1.2 Shall incorporate a circuit protective conductor.

3.5.1.3 Shall terminate in a box with fixed connectors in locations where luminaires are to be fitted directly on to conduit boxes. Grommets to be provided at all terminate boxes.

3.5.1.4 Shall terminate in incombustible enclosures securely fixed to the building fabric and earthed where of metal construction.

3.5.1.5 Shall run along or at right angles to any timber joists and vertically or horizontally to the building lines.

3.5.1.6 Shall be installed at 50mm minimum distance from the top/bottom of floor or ceiling finishes.

3.5.1.7 Shall be where run within plaster finish; be protected by means of plastic or galvanised metal channel.

3.5.1.8 Shall be installed in such a manner that the cables are not in direct contact with any form of polystyrene.

3.5.1.9 Shall be where run in intermediate floors; be threaded through holes not exceeding 25mm drilled at half joist depth.

3.5.1.10 Shall be unless adequately supported by the building fabric, in accessible positions, be clipped at distances not exceeding 225mm.

3.6 Cable trays

3.6.1 Cable trays

- 3.6.1.1 Cable trays shall be return flanged type, rust proofed perforated sheet steel hot dipped galvanised finish complying with BS 1449 Classification CR4/GP of dimensions as detailed in the following table:-

Nominal Width	Minimum Height of Uprand	Nominal Thickness of Steel Sheet	Finish	Application
100mm	12mm	1mm	Hot dip galvanised	Internal Installation
150mm	12mm	1mm	Hot dip galvanised	Internal Installation
225mm	12mm	1.5mm	Hot dip galvanised	Internal Installation
300mm	20mm	1.5mm	Hot dip galvanised	Internal Installation
450mm	20mm	1.5mm	Hot dip galvanised	Internal Installation
600mm	20mm	1.5mm	Hot dip galvanised	Internal Installation
100mm	12mm	1mm	Hot-dip Galvanised	External Installation
150mm	12mm	1mm	Hot-dip Galvanised	External Installation
300mm	12mm	1.5mm	BS 729 Part 1	External Installation

- 3.6.1.2 Cable trays shall be supported by suitable brackets at intervals necessary to provide rigid fixing. They shall be capable of carrying cables in single layer formation with a maximum deflection of 12.0mm at any point and with a maximum deflection of 12.0mm over any 2500mm span between supports. Trays shall be fixed to the fabric of the building as detailed in drawings or as instructed by the structural Engineer. Threaded rods used for all tray supports shall be minimum 16 mm in diameter for up to 400 mm wide and 18 mm diameter for wider trays.

- 3.6.1.3 All trays shall be installed with minimum spacing 50mm between the structure or any other building component and trays. This shall be carried on purpose made MS supports to BS EN 10113, BS EN 10155 or a proprietary form of steel channel which will permit easy adjustment or modification.

- 3.6.1.4 Trays shall be installed using factory formed bends of the same material thickness and finish. With cut sections used for sets being free from sharp edges and joined by means of fish plates bolted to each section with mushroom head galvanised steel roofing bolts.
- 3.6.1.5 Trays shall be bonded in its entirety by 12mm x 1.5mm copper links bolted across each joint by means of M6 brass nuts and bolts complete with flat and spring washers. Alternatively, 10 sq mm PVC insulated earth conductor shall be used.
- 3.6.1.6 Trays shall be covered through and extending to 300mm either side of fire barriers. They shall be externally wrapped with crushed rock or blast furnace slag mineral wool with wire mesh reinforcing over the whole length within the fire barrier and extending to 300mm either side. (Alternatively a proprietary fire protected cable may be installed with a suitably sized protective conductor linking the lengths of cable tray).
- 3.6.1.7 Trays shall be internally packed over the same distance, with crushed rock or blast furnace slag mineral wool and shall be painted to BS 5493 where cuts have been made. It shall be suitably bushed where holes have been cut to allow cables to pass through.

3.6.2 Cable fixings

- 3.6.2.1 Cable fixings shall be by means of proprietary forms of heavy duty plastic, clips or straps, or PVC covered copper or brass cable clips, brass saddles or straps. Refer to the appropriate section of the specification on the type of cable to be installed for the fixing method to be adopted.
- 3.6.2.2 The Contractor shall utilize brass screws or bolts and nuts for fixing saddles, clips and straps to the tray. Cable fixing shall not take the form of nylon ties.

3.7 Low voltage switchboard panels and distribution fuse boards

3.7.1 General

Low Voltage switchboards shall be to BS EN 60439 and shall be adequate for the voltage, load current, prospective fault levels, and type of supply, all as indicated the schematic.

3.7.2 Enclosures

- 3.7.2.1 Enclosures shall be reinforced polyester construction, with all electrical conductors, contacts etc., totally enclosed. They shall be unit or cubicle type construction from the same manufacturer as the switchgear. They shall be protected to not less than IP31 for indoor use and shall be weatherproofed IP65 for exterior use.

- 3.7.2.2 Enclosures shall be provided with facilities for padlocking or locking to prevent unauthorised interference. The locks to be operable by a key common to all enclosures, switchgear, and distribution gear locks.
- 3.7.2.3 Enclosures shall be provided with adequate local means of isolation, earthing and insulation to ensure safety of operatives during maintenance works. Such isolation to be lockable in the OPEN position.
- 3.7.2.4 Enclosures shall be adequately ventilated or cooled.
- 3.7.2.5 Floor mounted panels shall be mounted on a plinth in wet plant areas. Wall mounted panels shall be fixed to the structural wall with bolts.
- 3.7.2.6 Enclosures shall be finished in manufacturers' standard stoved enamel finish. Plain steelwork to be painted to BS 6150 with red lead primer and two coats of enamel to match the switchgear, Beige colour.
- 3.7.2.7 Enclosures shall be arranged with operating handles, control knobs, push buttons etc., within the range of 450mm and 1800mm above floor level. They shall be so designed and constructed as to provide effective segregation between incoming circuits/busbars/outgoing circuits/control circuits and equipment. Where equipment is fitted above busbar chambers it shall not be possible for objects to fall into the chamber. The segregation provided shall prevent the passage of ionised gas, resulting from the making or breaking of any circuit under normal or fault conditions, to any busbar, adjacent switch etc.
- 3.7.2.8 Enclosures shall be provided with cable entry locations (top, bottom etc.) to suit the detail of the scheme and be of adequate size to accommodate all incoming cables.
- 3.7.2.9 Enclosures shall be so designed and constructed as to protect all live parts to IP2X including live parts behind locked doors, removable panels, and particularly on the back of opening doors. So designed and constructed as to provide test facilities via 3mm holes in protection to IP2X as necessary for fault finding purposes.
- 3.7.2.10 Enclosures shall be so designed and constructed that all user adjustments are accessible without opening doors or removing panels; i.e. from the outside.
- 3.7.2.11 Enclosures shall not be located such that it can be affected by the normal operation, maintenance, or failure of mechanical services installations, including drainage.
- 3.7.3 Fuse switches and switch fuses
 - 3.7.3.1 All fuses and switch fuses shall be to BS EN 60947-3. They shall be fitted with HBC fuses to all line conductors for a.c. and to all poles of d.c. systems. They shall be fitted as required with a neutral terminal. For units exceeding 100 A this terminal shall have a removable bolted link.
- 3.7.4 Air circuit breakers (ACB's) and moulded case circuit breakers (MCCB's)

- 3.7.4.1 ACB's and MCCB's shall be of the four-pole type and shall be to BS EN 60947-2. They shall be of same make and preferably either from Schneider electric, Legrand, ABB or Siemens. They shall be provided with positive means for preventing any one pole of a multi-pole MCCB being operated or tripped, independently of the other poles.
- 3.7.4.2 Shall be provided with facilities for padlocking to prevent unauthorised interference if instructed by the Engineer.
- 3.7.5 Miniature circuit breakers (MCB's)
 - 3.7.5.1 MCB's shall be to BS EN 60898 and shall be of the one pole and Neutral or three pole and Neutral type. The Neutral connection shall be open in event of tripping of the circuit breaker. The make shall be from Schneider.
 - 3.7.5.2 MCB shall be provided with single phase or three phase instantaneous magnetic tripping. They shall be of Type C for general loads and Type D for motor loads or loads with high starting currents.
 - 3.7.5.3 MCB shall be provided with positive means for preventing any one pole of a multi-pole MCB being operated or tripped independently of the other poles. Tripping of the circuit breaker shall cause opening of the neutral pole as well.
 - 3.7.5.4 MCB shall be provided with facilities for locking to prevent unauthorised interference, where located other than in an enclosure. Where located within an enclosure, have facilities for locking that enclosure to prevent unauthorised interference.
- 3.7.6 Residual current devices (RCD's) and RCBO
 - 3.7.6.1 RCD's and RCBO shall be provided to BS EN 61008 and shall be rated as per the schematic or shall be 30 mA for all outlets. Unless otherwise specified, RCD/RCBO shall be of the one pole and Neutral or three pole and Neutral type. The Neutral shall open in event of tripping of the device.
- 3.7.7 Distribution boards
 - 3.7.7.1 Distribution Boards shall be to BS 5486 and generally of metal enclosure, from a European Manufacturer and shall be same make as the protective devices.
 - 3.7.7.2 All cables feeding switchgears shall be from a busbar inside the distribution board. Boards shall be provided with a separate earth bar for the connection of circuit protective conductors.

- 3.7.7.3 Boards shall be flushed or surface mounted over suitably sized adaptable boxes where surface distribution boards are used on recessed installations. Access apertures cut in the back of the fuseboard to be adequately bushed, and the box provided with spare conduits, all effectively bonded to the board.
- 3.7.7.4 Boards shall be provided with barrel type locks, where located other than in switchrooms. The locks to be operable by a common key OR fitted with other means of locking to prevent unauthorised interference.
- 3.7.7.5 All boards shall be fitted with Indicators, digital power meter which may be used to record energy use in the various departments.
- 3.7.8 Fuses
- 3.7.8.1 Fuses shall be to BS 88 HBC cartridge type for general power applications, fitted inside fuse spurs. They shall be fitted to all-insulated carriers incorporating means of identifying failed fuses.
- 3.7.9 Busbars and connections
- 3.7.9.1 Busbars shall be of constant cross section copper throughout. The copper conductors shall be tinned. Busbars shall be air insulated except where solid insulation is a design feature. They shall be connected to outgoing switches with solid copper connections. The connections to be as short and direct as possible.
- 3.7.9.2 Busbars shall be rigidly clamped and secured to prevent undue movement under fault conditions or displacement as a result of the installation of cabling and provided, where necessary, with insulated phase or circuit barriers. All clamping and supporting bolts, nuts and screws to be plated brass or steel.
- 3.7.9.3 Busbars shall be separate for individual supply systems. Two systems shall not occupy the same busbar chamber unless they are segregated and separated by earthed metal and warning notices fixed.
- 3.7.10 Unit switchboards
- 3.7.10.1 Unit switchboards shall be to BS EN 60439-1. They shall have separate items of switchgear assembled and connected to provide a switchboard secured by built in fixings or masonry bolts. They shall be suitable for top or bottom entry to suit the application.
- 3.7.10.2 Unit switchboards shall have a suitable busbar chamber housing the appropriate bars for the system, such chambers to be capable of ready extension. They shall have busbars of such length within the chamber that outgoing connections are taken from the bars at right angles, undue deviation will not be accepted other than the necessary sets to provide electrical clearance.

- 3.7.10.3 Unit switchboards shall be supplied with removable gland plates, drilled for conduit entry, or suitable cable glands, clamps, spreader boxes, and reverse entry chambers as required.
- 3.7.11 Cubicle switchboards
 - 3.7.11.1 Shall be to BS EN 60439-1.
 - 3.7.11.2 Shall be manufactured from sheet steel, suitably rust proofed and stove enamelled or equal finish to an approved colour.
 - 3.7.11.3 Shall be of modular construction with interchangeable units where applicable.
 - 3.7.11.4 Shall be suitable for top or bottom entry to suit the application.
 - 3.7.11.5 Shall be not exceeding 2250mm in height excluding cable boxes.
 - 3.7.11.6 Shall be constructed in sections to facilitate delivery and installation.
 - 3.7.11.7 Shall be arranged for the storage of spare fuses within the cubicle.
 - 3.7.11.8 Shall be supplied with removable gland plates, drilled for conduit entry, or suitable cable glands, clamps and spreader boxes.
- 3.7.12 Switchgear earthing
 - 3.7.12.1 Switchboards shall be provided with an earthing terminal consisting of a brass threaded stud or copper earth bar 25mm x 5mm minimum dimensions, running the length of the switchboard and bolted to the supporting framework to provide good electrical contact to all sections of the switchboard.
 - 3.7.12.2 Switchboards shall have all incoming and outgoing cable armouring and earth conductors connected to the earthing terminal by copper circuit protective conductors. Similar connections to be provided to the conduit entry plates and to metal trunking.
 - 3.7.12.3 Switchgears shall have solid copper earthing conductors connected between the earth bar, the main earth electrode system where installed in a substation or for a generator installation and each incoming and outgoing cable armour clamp and gland plate.
 - 3.7.12.4 Switchboards shall have circuit protective conductors of flat soft copper strip or PVC cables sheathed Green and Yellow.

3.7.13 Labels and identification

3.7.13.1 Labels and identifications shall be provided to all items of equipment; this shall be on the front face of all equipment and face for free standing equipment. Labels shall be mounted on the fixed portion of equipment not on withdrawable or interchangeable sections.

3.7.13.2 Labels shall be “Traffolyte” of white background with suitably sized letters and figures coloured red for warning labels and black where informative. Labels shall be screwed fixed to the fixed part of the equipment.

3.7.13.3 Labels shall be provided at the main earth terminal bar and labelled ‘SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE’. They shall also be provided at each outgoing switch for each separate installation with the following headings and completed information :

Voltage & phases utilised	.....
Cable size & type	.....
Function	.....
Reference No.	.....
Current rating/fuse fitted	.....

3.7.13.4 Labels shall be provided at each incoming switch fused as a main isolator for electrical services to with the following headings and completed information:

Voltage & phases utilised	.....
Cable size & type	.....
Function	.....
Reference No.	.....
Current rating/fuse orlink fitted	.....

3.7.13.5 Labels shall be at `installation' locations with two supplies, Essential and Non-Essential, a label shall be fitted stating the procedure for isolation.

“SHALL THIS INSTALLATION HAS TWO SOURCES OF SUPPLY AND BOTH SWITCHES MUST BE IN THE OFF POSITION TO ISOLATE ELECTRICAL SUPPLY TO THIS INSTALLATION’

3.7.13.6 Switches, isolators, control gas, and all electrical equipment be clearly labelled or engraved, stating function and supply source reference. Earth tags shall be stamped on non-corrosive metal and fitted at all bonding and connection points.

- 3.7.13.7 At each main distribution point a schematic diagram system shall be fitted giving details of all conductor sizes, L-E impedance at all points the diagram shall be on transparent plastic with white plastic sheet backing with wood frame protected with clear rigid PVC sheet.
- 3.7.13.8 An Electrical Accident Instruction sheet as the 'Electrical Times' metal copy, shall also be on all the distribution points.
- 3.7.13.9 A chart shall be provided at each final distribution board giving details of the circuit designation, protection, conductor sizes, L-N Impedance, Earth Loop Impedance, etc., the chart shall be in a rigid, clear PVC envelope secured to the inside of the lid of the distribution board or adjacent to it.

3.8 Accessories

3.8.1 Luminaire switches

- 3.8.1.1 Switches shall be manufactured to comply with BS 3676. They shall be flush pattern when used with concealed systems, surface pattern elsewhere. They shall be cord operated where ceiling mounted, cords to be terminated 1.5m above FFL. Switches shall be fitted in boxes with adjustable grids and fixings flanges to allow for variations in the internal cladding thickness.
- 3.8.1.2 Switches shall be mounted in multi-gang assemblies where grouped. They shall be identified where fitted to the essential circuit of a dual non-essential / essential system. They shall be provided with phase barriers and labels where applicable to IP44 where weatherproof pattern.

3.8.2 Socket outlets and connection units

- 3.8.2.1 Socket outlets shall be to BS 1363. They shall be flush pattern where used with concealed systems, surface pattern elsewhere. They shall be switched or unswitched and mounted in single or multi-assemblies as specified in drawings. They shall be capable of switching full rated inductive or resistive load.
- 3.8.2.2 All sockets shall have Neon Indicators. They shall be weatherproof pattern with push-on cap and retaining ring or screw-on cap, for external locations.
- 3.8.2.3 All sockets shall be supplied with 13 amp plugs complete with appropriate fuse to BS 1362 for equipment connected to socket outlets as specified in drawings.
- 3.8.2.4 Sockets shall be identified where fitted to the essential circuit of an essential / non-essential supply served by standby supplies by engraving or other appropriate measures. They shall be fitted in deep pattern boxes to allow edge of the box to finish flush with the wall surface.
- 3.8.2.5 Sockets shall be supplied with fixing flanges where fitted into plasterboard partitioning.

3.8.3 Connections to Motors

- 3.8.3.1 Connection to Motors shall be so arranged as to provide an efficient means of switching-off, readily accessible, easily operated, and so placed as to prevent danger. Each motor shall be provided with starter units fitted with thermal and overload protection and a local isolator switch.

4 LIGHTING SYSTEMS

4.1 General

4.1.1 This section of the Specification describes the general requirements for luminaires and accessories, including switching. Particular requirements are described elsewhere in this Specification.

4.1.2 The contractor shall allow in his prices for the production of a sample of all equipment & accessories for approval.

4.2 LUMINAIRES

4.2.1 Luminaires and components shall comply with the requirements of all appropriate European Standards and Regulations as listed in the Scope of Works Section of this Specification. Luminaires from China may be accepted provided they are from reputed European manufacturers. In the event these luminaires are being proposed, the Contractor shall arrange for the Engineer to inspect these light fittings at the manufacturer's premises. Samples provided on site shall not be considered sufficient for the approval of these fittings.

4.2.2 Metallic louvres shall be provided with an equipotential protective conductor with a minimum size of 1mm² between the main body of the fitting and the louver.

4.2.3 Any modifications required to the manufacturer's standard luminaires to comply with the requirements regarding mounting height shall be provided. Should extra-long suspensions be required, they shall be ordered concurrent with the luminaires.

4.2.4 Luminaires for internal use shall be provided with protection to a minimum of IP44 classification, as defined in BSEN 60529. Fluorescent batten type luminaires shall be fully enclosed with an IP rating to suit their location.

4.2.5 Luminaires shall carry an identification label giving manufacturer name and luminaire model reference. Labels shall be positioned such that they are easily visible within the ceiling voids but are not visible from below.

4.2.6 Lamp lumens shall be as per the schedule provided in the drawings or bills of quantities. A certificate shall be produced from the manufacturer confirming the lamp lumens output of all lamps furnished to site.

4.3 Luminaire installation

- 4.3.1 Luminaires shall be installed complete with control gear, lamps, louvers or diffusers where specified, including any necessary fixings and steel supports. The Contractor shall connect all control gear and install lamps, louvers or diffusers as specified in schedules.
- 4.3.2 Luminaires shall be suspended from, or fitted to, a small conduit box, unless otherwise agreed. Luminaires mounted in suspended ceilings shall be provided to suit the ceiling and with brackets suitable for mounting the luminaire from the top of the ceiling grid. White break joint rings shall be provided wherever necessary.
- 4.3.3 Conduit or chain suspensions shall be provided for all pendant luminaires. The stems of conduit suspension shall be screwed to ball and socket type dome lids with positive earth connection.
- 4.3.4 Luminaires shall be cleaned prior to final handover, if necessary, with an anti-static cleaning agent, to provide clean, dust free lighting. All lamps shall be replaced by new at handing over.

4.4 Luminaire wiring

- 4.4.1 Wiring installations shall comply with the Wiring Systems Section of this Specification.
- 4.4.2 Luminaires, except continuous type, recessed into suspended ceilings shall be connected using flexible cables from plug-in type ceiling roses. Flexible cables shall be of a minimum length to facilitate disconnection of the luminaire. It shall be between 2m and 4m long with a minimum conductor size of 1.5mm².
- 4.4.3 Circuit cables shall not be routed through bulkhead or other fittings where the cables would be liable to undue temperature rise. They shall terminate in a fixed base connector in a conduit box mounted behind or adjacent to the fitting. Final connection to each fitting shall be carried out with silicone rubber insulated cable.
- 4.4.4 Luminaire internal wiring shall be arranged such that it is not visible when lamps/reflectors/louvres are in place.

4.5 LED luminaires

- 4.5.1 LED luminaires shall be provided complete with LED driver, LED controller, connectors and lamps as per schedules. LED drivers and controllers shall be from European origins. The metal work of all luminaires and equipment shall be effectively earthed to the installation.

4.5.2 Luminaires shall be selected to provide the lighting levels required by the Design and Performance Parameters Section of this Specification with the limits and restrictions described in that Section. Samples of all luminaires listed in the luminaires schedules shall be provided for the Engineer and Architect to comment. These samples shall be retained on site until completion of the delivery of the rest of the fittings.

4.5.3 Control gear shall be of European origin and from a reputed manufacturer like Philips, Mazda, GE or Thorn. A separate set of control gear shall be provided for each pair of lamps within a fitting.

4.6 Lamps

4.6.1 Lamps shall be made by a reputed European manufacturer, like Cree, Osram, Philips, Mazda or GE. Lamps from China shall not be accepted.

4.6.2 Each luminaire shall be complete with a lamp for each way. Fluorescent lamps shall be of the appropriate size and rating, with bi-pin ends and complying with BS 1853: Part 2 and BS EN 60081. Vapour lamps shall comply with BS 3677. All lamps of each type shall be supplied by the same manufacturer.

4.6.3 Prior to purchase of the lamps, a sample area shall be provided to permit the Architect to inspect the colour rendition of the lamps against actual building finishes. The Architect shall confirm the colour temperature of the required lamps.

4.6.4 All lamps shall be new and unused at Taking Over. Any lamps used prior to Taking Over shall be replaced.

4.7 Local switches

4.7.1 General

4.7.1.1 Local switches shall be installed in positions agreed with the Architect and the Engineer. They shall comply with BS 3676 and BSEN 60669, with the type and finish specified elsewhere. Lateral positions of the switched with respect to door jambs and corner walls shall be discussed and agreed with the Architect. Drawings showing the proposed positions and dimensions shall be produced by the contractor for the Architect to approve.

4.7.1.2 Switches shall be of the slow break, AC only pattern in which the successful operation of the switch does not wholly depend upon the action of a spring. The operating mechanism shall be insulated from all live parts. Switches shall have a minimum rating of 10amps and be suitable for inductive operation at their rated capacity.

4.7.1.3 Where more than one phase occurs in switch box barriers shall be provided to segregate the circuits on different phases. A label engraved "Danger 415 Volts" shall be attached to or engraved upon the front cover plate.

- 4.7.1.4 All boxes used for fixing switches shall be supplied with an earth terminal or screw in the base of the box.
- 4.7.1.5 Where DC lighting circuits are to be switched, double pole, quick make, quick break switches with pillar type terminals and earthing straps shall be provided.
- 4.7.1.6 Any switch controlling equipment not visible from the switch point shall be engraved with a label identifying the final circuit it controls. Unless otherwise indicated, it shall be fitted with a 0.5 Watt neon indicating lamp.
- 4.7.2 All insulated plate switches
 - 4.7.2.1 Switches shall be rocker type mounted on an all-insulated front plate. The front plate shall overlap the box on all sides.
 - 4.7.2.2 The switches shall be mounted on boxes not less than 25mm deep of metal or white PVC depending on the type of construction. They shall have cable or conduit entries. PVC boxes shall have accessory fixing lugs or columns with brass fixing screw inserts.
- 4.7.3 Weatherproof switches
 - 4.7.3.1 Weatherproof switches shall be mounted in heavy galvanized cast iron boxes having dome covers with waterproof machined joints, neoprene seals and external fixing lugs. They shall have a minimum protection of IP.54. They shall be provided in all wet areas and plant rooms.
 - 4.7.3.2 Switches shall be overridden by a rotating knurled knob, the stem of which shall pass through a packed gland.
- 4.7.4 Grid Switches
 - 4.7.4.1 Grid switches shall be provided with adjustable fixings and shall be complete with earth terminal.
 - 4.7.4.2 The switch and grid shall be mounted in a sheet steel box not less than 40mm deep. For surface units they shall be complete with a steel cover plate fitting flush with the edge of the box and of matching colour. For flush units they shall be provided with metal or PVC covers finished as required. Boxes for surface installations shall not have knockouts but shall be drilled on site as necessary.

4.8 Emergency lighting

4.8.1 General

4.8.1.1 Emergency lighting systems shall comply with local Fire Regulations. They shall be designed to meet the requirement of BS 5266 and BS 5588. Emergency luminaires shall comply with the requirements of BS 4533, BSEN 60598 and BS 5225. Emergency signs shall comply with BS 5499.

4.8.2 Self-contained systems

4.8.2.1 Self-contained emergency lighting unit shall incorporate solid state switching, static inverter, nickel cadmium cells and automatic trickle recharge facilities. They shall be provided as individual units or as conversion packs connected to selected fittings as appropriate.

4.8.2.2 Where conversion packs are provided, they shall be incorporated into the spine of the luminaire they serve. Where this is not practical, they shall be enclosed within a compact metal box and installed within 1 metre of the luminaire in a concealed but accessible position. The remote conversion packs shall be independently supported of the ceiling installation and shall be fitted with safety chains to prevent injury.

4.8.2.3 Emergency luminaires shall be connected direct to the mains supply. In the event of mains failure, the unit shall automatically connect to the battery. On restoration of the permanent supply the unit shall revert to mains operation. Internal wiring and connections shall be carried out in silicone rubber covered cable. A green LED indicator shall be visible through the diffuser or louvre of the fitting to indicate when the batteries are on charge.

4.8.2.4 Each battery unit shall be capable of maintaining the luminaire for a minimum of 3 hours. The recharge facility shall be capable of fully recharging a totally discharged battery in a maximum of 14 hours. Facilities shall be provided to prevent reverse polarity at low battery voltage.

4.8.3 Ceiling Roses

4.8.3.1 Ceiling roses shall be manufactured of white plastic, complying with BS 67. They shall be overlapping or fitted with break joint ring when used on recessed BS conduit boxes.

4.8.3.2 They shall be two plate types with additional loop-in earthing and strainer terminals where necessary. They shall be plugged in type where mounted in ceiling voids or as specified in drawings.

- 4.8.4 Lampholders
- 4.8.4.1 Shall be manufactured in accordance with BS EN 61184 as applicable. They shall be effectively earthed when made of metal. They shall be small bayonet cap type for ELV lamps, bayonet cap type, up to and including 150 watt lamps, Edison screw type for 200 watt lamps, Goliath Edison screw type for 300 watt lamps and above.
- 4.8.4.2 Lampholders shall be fitted with porcelain interiors where the ES and GES screw type. They shall be heat-resistant quality white plastic with compression cord grips where used with flexible pendants. They shall be in heat resistant quality white plastic where of the batten type. They shall be H.O. skirted or shrouded where exposed in damp situations.
- 4.8.5 Luminaires
- 4.8.5.1 Luminaires shall be supplied and installed as specified in drawings and schedules. Luminaires shall be fixed with raw bolts. All luminaires shall comply with BS 4533 & BS 60598. They shall be all be of European origin and certificate of origin shall be produced for all luminaires.
- 4.8.5.2 Luminaires shall in the case of loop-in or surface conduit installations, have the fixed wiring terminated in a BESA conduit box fitted with a heat resisting insulated connector. Where provided elsewhere have the fixed wiring terminated in a BESA box fitted with a plug in 3 plate ceiling rose. The cord from the ceiling rose to the luminaire to enter the luminaire via a nylon compression gland of appropriate size to securely grip the cable.
- 4.8.5.3 Luminaires shall be fitted with non-rigid ball and socket joints, in the case of tube suspended units. The earth connection to be independent of the ball joint. They shall utilise the manufacturer's fixing and cable entry positions with a minimum of 2 fixings for linear fluorescent luminaires.
- 4.8.5.4 Luminaires shall be provided with 16/0.2mm high temperature PVC insulated internal wiring and fused terminal blocks. They shall have all metalwork (other than specular surfaces) and finished with acrylic enamel to approved colour. They shall incorporate simple means of dismantling diffusers for cleaning.
- 4.8.5.5 In the case of fluorescent units, they shall be supplied with high frequency low-loss ballast units to BS EN 60920 AND BS EN 60921 and high frequency lamps.
- 4.8.5.6 Incandescent lamps shall be General Lighting Service (GLS) BC coiled coil, Pearl, for up to and including 150 watt.
- 4.8.5.7 Incandescent lamps shall be GLS, ES, single coil, clear for 200/250 volt 200 watt.
- 4.8.5.8 Incandescent lamps shall be GLS, GES single coil, clear for 200/250 volt above 200 watt.
- 4.8.5.9 Incandescent lamps shall be SBC or SES, where required to be non-interchangeable with GLS lamps.

4.8.5.10 Incandescent lamps shall be Rough Service, BC, pearl, for use with handlamps, or portable equipment or in situations subject to mechanical shock.

4.8.5.11 Fluorescent tubes shall comply with BS 1853 of the colour indicated in the Bill of Quantities.

4.9 External lighting

4.9.1 General

4.9.1.1 Standard references

- The materials, components and completed installations shall conform as applicable with the following Standards, including all amendments, current at the time of tendering. Construction products should comply with European Standards and Technical Specifications (ESTS). Wherever reference is made to a British Standard a corresponding ESTS (generally ISO series) shall be equally acceptable.
- Where available all materials, equipment etc forming part, or whole, of the services specified in the Contract, should be obtained from BS EN ISO 9000 - "Quality Assurance" certified manufacturers and preferably "kite marked" or EC equivalent.
- All luminaires must carry the CE mark.

4.9.1.2 Protection

- All luminaires, columns, control gear, fittings etc shall be protected to prevent damage from physical, damp, or other cause, as necessary during the execution of the works.

4.9.1.3 Cleaning

- Cleaning shall be carried out to all luminaires, columns etc on completion of installation.

4.9.1.4 Luminaires and equipment

- Shall be of the manufacture and/or design and/or types as specified in the Bill of Quantities and as amplified by the requirements of this Section.

4.10 Luminaires

4.10.1 General

4.10.1.1 Shall comply with BS 873 and BS 4533, as applicable. They shall be provided with cable entry and/or fixing provision appropriate to method of mounting. They shall be fitted with hinged or captive diffusers in the case of column mounted units, otherwise be fitted with protective enclosures capable of removal only by use of a special tool.

4.10.1.2 Luminaires shall have all internal wiring carried out in high temperature cable, either PVC or butyl rubber to BS 6007 and BS 6500 to suit the appropriate temperature conditions. They shall have all internal wiring clipped or restrained. They shall be fitted with heat resisting sleeving to BS 2848 where required.

4.10.1.3 Luminaires shall incorporate a fused weatherproof terminal block, shrouded so as to prevent contact with live parts. They shall be all corrosion proofed and vandal resistant.

4.10.1.4 Luminaires shall be protected as follows: -

- Index of protection minimum of IP65 unless otherwise specified in drawings or schedules.
- Luminaire bodies shall be manufactured in Aluminium, Epoxy Powder coated, moulded Polyester, any clips shall be Stainless steel or suitable plastic. Steel only to be used if galvanised.
- Diffusers shall be vandal resistant, and UV stabilised.
- Shall not have the external case penetrated by the fixing screws of any internal component.

4.10.2 Lamps

4.10.2.1 Shall comply with BS 161, BS 1853 (replaced by BS EN 60081), BS 3677, BS 5971, BS 6179 as applicable. They shall be handled with care in accordance with the manufacturer's recommendations.

4.10.2.2 Lamps shall be mounted in the plane giving maximum efficiency and life for the type of lamp. They shall be of the types and ratings specified in the bill of quantities with particular attention to the lumens output. Only lamps with the highest lumen to watt ratio shall be selected. This selection shall be proved and demonstrated to the Engineer prior to ordering.

4.10.3 Lamp holders

4.10.3.1 Shall comply with BS 5101, BS EN 60061, BS EN 61184, BS EN 61195, BS 61199 & BS 60238, as applicable. They shall be securely mounted in the luminaire, particularly when used as the sole support for the lamp or tube. They shall be effectively earthed when of metal construction.

- 4.10.3.2 Lamp holders shall be all ceramic construction or metal cased with ceramic interiors or of high temperature plastic to above standards.
- 4.10.4 Ballast/control gear
- 4.10.4.1 Gears shall be supplied and installed for all discharge lamps. They shall be of rating, type and composition compatible with the lamp type and rating which it controls.
- 4.10.4.2 Gears shall comply with:-
- All CE marking and standards
 - BS EN 60920, BS 60921, BS 60922, BS EN 60923, BS EN 60926,
 - BS EN 60928, BS EN 61048 & BS EN 61048.
- 4.10.4.3 They shall include radio interference suppression appropriate to type of lamp circuit employed. They shall be "switch start" pattern for fluorescent lamp circuits and shall incorporate fused terminal block, shrouded so as to prevent contact with live parts.
- 4.10.5 Ballast/control gear for wall mounted luminaires
- 4.10.5.1 They shall be of rating, type and composition compatible with the lamp type and rating to be controlled. They shall comply with:-
- All CE marking and standards
 - BS EN 60920, BS EN 60921, BS 60922, BS EN 60923, BS EN 60926
 - BS EN 60928, BS EN 61048 & BS EN 61049.
 - They shall include radio interference suppression appropriate to type of lamp circuit employed. They shall be "switch-start" pattern for fluorescent lamp circuits and be mounted within the luminaire.
- 4.10.6 Mounting brackets
- 4.10.6.1 Brackets shall be supplied and fitted for all wall mounted luminaires, which do not incorporate wall mounting provisions within their basic construction. They shall be securely fixed to the building structure, as detailed in drawings.
- 4.10.7 Direct mounting equipment
- 4.10.7.1 Shall be securely fixed to the building structure with the use of stainless steel bolts. Wall plugs and screws shall not be accepted.

4.10.8 Mounting columns

4.10.8.1 General

Columns shall comply with BS EN 40-1 as applicable.

4.10.8.2 Service compartments

Service compartments shall be provided at the base of all mounting columns. They shall be of adequate size to allow access for maintenance, to accommodate the lamp Ballast/Control Gear, together with the distribution cable termination unit and, if specified the controlling time switch or other switching devices. They shall be fitted with a lockable door protected to IP54.

4.10.8.3 Installation

Columns shall be vertical from all angles of view.

4.10.8.4 Mounting brackets

Shall be supplied and fitted to all columns supporting luminaires which are other than 'post top' mounting. They shall be of the types and lengths specified in drawings and are of a design and section to match the column. All columns must be able to withstand wind gusts of 270 km/h. All supporting calculations shall be submitted to the Structural Engineer for approval. The columns shall be securely fixed to the columns so as to maintain their set positions under all conditions.

4.10.8.5 Internal wiring

All internal wiring shall be carried out using PVC insulated and sheathed cables to BS 6004 and BS 6500 to suit the appropriate temperature conditions. They shall be fitted with heat resisting sleeving to BS 2848 where required.

4.11 Distribution

4.11.1 General

4.11.1.1 Shall not be carried out by means of uninsulated overhead cable.

4.11.2 Terminations (column)

4.11.2.1 Terminations shall be made at fused termination chambers shrouded so as to prevent contact with live parts, compatible with the distribution scale. They shall be made within the service compartment. Clip on terminals shall be provided for connection to the distribution cable. It shall include an earth terminal and test point.

4.11.2.2 Where the distribution cable supplies centrally controlled multiple external lighting circuits (e.g. all night and part night), it shall include provision for the termination of all circuits with facility for readily connecting the served luminaire to any circuit.

4.11.3 Terminations (wall mounted luminaires)

4.11.3.1 Terminations shall be made at a fused termination block forming part of the Ballast/Control Gear, the whole to be shrouded so as to prevent contact with live parts.

4.12 Control

4.12.1 All external lighting shall be controlled by timer switches synchronized from the master clock system. Dry contacts shall be provided from the master clock to control the external lighting contactors. A minimum of three dry contacts shall be providing at the master clock for the control of external lighting at various times. Manual override switches shall be provided in the common distribution boards located in the electrical room on ground floor itself.

4.13 Earthing

4.13.1 General

4.13.1.1 Shall comply fully with the requirements of the "Common Services Electrical (low and extra low voltage)" Section C41 Specification.

4.13.2 Columns and brackets

- Shall be provided with circuit protective conductors between the main earth terminal and all components requiring to be earthed, including the luminaire.
- Shall be bonded to earth where they are of metal construction.
- Shall not be relied upon as the sole means of earth continuity.
- Shall not be bonded to adjacent metal structures.

4.14 Pre-testing and commissioning

4.14.1 General

4.14.1.1 Shall comply fully with the requirements of the "Common Services Electrical (low and extra low voltage)" Section C41 Specification as far as applicable to these works.

4.14.2 Column

4.14.2.1 Shall be inspected and agreed correctly located and executed before the columns are set in position.

4.14.3 Illuminance

4.14.3.1 Shall be measured and recorded as appropriate.

5 GENERAL PURPOSE POWER

5.1 Small power installations

5.1.1 General

5.1.1.1 This Section of the Specification describes the general requirements for equipment connected with the small power installation. Particular requirements are described elsewhere in the Specification. Electrical wiring shall comply with the requirements of the Wiring Systems Section of this Specification as defined in the Scope of Works Section.

5.1.2 Residual current devices

5.1.2.1 Unless specified otherwise, RCD's shall be rated at 30mA and shall incorporate protection features to ensure that pulsating DC fault currents do not affect the operation of the unit.

5.1.2.2 RCD's shall comply with BSEN. 61008. Where provided with integral over current protection they shall comply with BSEN. 61009. Unless otherwise specified RCD's shall function independent of line voltage. All RCD's shall be of European origin and shall be of single pole and Neutral type or 3 poles and neutral type, as indicated on drawings.

5.1.3 Socket outlets

5.1.3.1 Switched 13 ampere socket outlets complying with BS.1363 shall be provided. They shall be wired as radial circuits having conductors of 2.5mm² minimum.

5.1.3.2 The socket outlets shall generally be of the flush pattern with all insulated or metal front plate of the finish and colour specified. They shall be mounted in metal or PVC boxes, according to the system of installation, not less than 35mm deep with cable or conduit entries. Where socket outlets are mounted on PVC boxes, they shall have accessory fixing lugs or columns with brass screw inserts.

5.1.3.3 For surface installations metal boxes shall not have knockouts but shall be drilled on site.

5.1.4 Miscellaneous

5.1.4.1 Socket outlets mounted externally shall be protected to IP56. All enclosure components shall be made from high impact resistant material. All component joints shall have synthetic gaskets. Outlets shall incorporate weatherproof flaps which are spring-loaded and automatically shut fully when a plug is withdrawn.

- 5.1.4.2 Socket outlets which may reasonably be expected to supply portable equipment for use outdoors, shall be provided with supplementary protection by means of a residual current device as specified in regulation 412-06-02 (ii) of BS7671.
- 5.1.4.3 Socket outlets that are not supplied with fused plug tops shall be wired from an appropriately current rated circuit breaker.
- 5.1.4.4 Three phase socket outlets shall be four poles with earth connection and interlocked switch.
- 5.1.4.5 Socket outlets shall not be interchangeable for different voltages and each unit shall be effectively earthed and provided with a suitable plug.
- 5.1.5 Fused connection units
 - 5.1.5.1 The requirements for fused connection units shall be generally as specified for 13 Ampere socket outlets finishes and fixings etc. Connection units shall comply with BS.5733.
 - 5.1.5.2 Units shall be switched, and each shall contain a fuse of the appropriate rating for the appliance served. Where required the fused connection unit shall incorporate an integral neon pilot light and flex outlet hole with efficient cord grip in the front plate. Fused connection units shall be so designed that withdrawal of the fuse holder does not expose any live parts or permit any extraneous connections to the contacts.
 - 5.1.5.3 Connection units shall be engraved with the name of the appliance served and shall be connected into ring circuits wherever possible.

5.2 Electrical work associated with mechanical services.

- 5.2.1 Electrical work associated with Mechanical services is described within the Mechanical services Specification and will be provided as part of those Works.
- 5.2.2 The work to be provided as part of this Specification shall comprise the installation to and termination of all incoming power supplies to control panels, including power supplies to control panels on packaged equipment where such supplies are not from a Mechanical Control Panel.
- 5.2.3 The Contractor shall be responsible for ensuring that the correct size and type of cable terminations are provided.

6 FIRE DETECTION AND ALARM SYSTEMS

6.1 General

- 6.1.1 This Section of the Specification describes the general requirements for the fire detection and alarm systems. Particular requirements shall be as described elsewhere in this Specification.
- 6.1.2 The Fire Alarm manufacturer/supplier shall be approved to ISO 9002 Quality System standards for the design and manufacture of the fire alarm systems equipment.
- 6.1.3 Wiring shall be carried out using Fire retardant cables, light grade with red coloured LSF sheathing. The wiring installation shall comply with the Wiring Systems Section of the Specification. Call points shall have conductors with a minimum size of 1.5mm². All wiring shall be of adequate section to prevent excessive volt drop in accordance with the requirements of BS.7671.
- 6.1.4 The fire alarm system shall be installed, completed, commissioned and witnessed by the Engineer at least one week before Taking Over. Taking Over will not be granted until the system has been operating faultlessly for at least one week. A system logbook shall also be handed to the Client suitably completed.
- 6.1.5 When a zone goes in first stage the ancillary devices as detailed in Table 3 shall be activated:

Table 3: 1st Stage (1)

1st Stage (1)	
1	Buzzer sound in panel.
2	Zone/address displayed on panel.
4	Lift return to ground floor. If fire signal originates from ground floor, lift shall be stopped on first floor.
5	Sounder to be activated (pulse mode).

- When a zone goes in second stage, the ancillary devices as detailed in Table 4 shall be activated:

Table 4: 2nd Stage (2)

2nd Stage (2)	
1	Sounder to go on second stage mode (continuous).
2	Lift shall remain in the position as in stage 1.
3	Motorised fire dampers are closed (If any).
4	Shut down of Fresh air supply fans
5	Smoke extractor fan goes into fire mode (speed of fan increases).

- Once the signal has been cleared, all the system shall return to normal operation automatically as detailed in table 5:

Table 5: Normal Stage (0)

Normal Stage (0)	
1	Sounders are silenced.
2	Fire dampers are opened.
3	Lift return to normal operation.
4	Switch on of fresh air supply fans
5	Smoke extractor fan return to normal (speed of fan decreases)

6.2 Control and Indication Equipment

6.2.1 Addressable Control Panels

- 6.2.1.1 Control panel shall comply with the requirements of BS.5839: Part. 1. Panel shall be suitable for surface wall mounting with a one piece hinged lockable fascia. Panel shall be complete with all controls, indicators, batteries, charger, and test equipment.

- 6.2.1.2 The panel shall be provided with indication facilities for alarm and fault indication together with the following facilities: -
- Full system monitoring of detector and sounder circuits.
 - Dual alarm sounder outlets, for integral sounder and area sounder.
 - Connection of manual call points.
 - Mains and battery failure indicators.
 - Alarm mute, alarm resound and system-reset facilities, key controlled.
 - Lamp test push button.
 - Key switch operated system isolation facilities.
- 6.2.1.3 Programmable input and output modules shall be provided to control and monitor the ancillary equipment interfaced with the fire alarm system as required in the event of fire, or to enable indication of alarms: -
- 6.2.1.4 The power supply unit for the control panel shall be complete with an integral charger and sealed lead acid batteries. The unit shall be designed to meet FOC requirements and BS.5839: Part 1. The charger shall be capable of automatically recharging the cells fully within 8 hours.
- 6.2.1.5 When a fire alarm is manually or automatically raised, the zone shall be identified on the panel. For multi-stage systems the evacuate signal shall be sent to the appropriate zones as programmed. All other areas of the building shall receive a first stage warning.
- 6.2.1.6 All 230-volt supplies shall be adequately protected, shrouded, and labelled.
- 6.2.1.7 The control and indicating equipment shall form the central processing unit of the system, receiving and analysing signals from fire sensors, providing audible and visual information to the user, initiating automatic alarm response sequences, and providing the means by which the user interacts with the system.
- 6.2.1.8 The control and indicating equipment shall be modular in construction to allow for future extension of the system.
- 6.2.1.9 The control and indicating equipment shall be easily configurable to meet the exact detection zone and output mapping requirements of the building.
- 6.2.1.10 The control and indicating equipment shall be microprocessor based and operate under a multitasking software program. Operating programs and configuration data must be contained in easily up-datable non-volatile memory (EEPROM).
- 6.2.1.11 The control and indicating equipment shall incorporate a real-time clock to enable events to be referenced against time and date. This clock shall be accurate to within 1 minute per year under normal operating conditions.

- 6.2.1.12 It shall be possible for an Engineer to perform configuration updates on site by plugging a portable personal computer into the control and indicating equipment. Configuration data shall be retained on a floppy disk.
- 6.2.1.13 The company responsible for the installation shall operate an approved document control system for the retention of configuration data.
- 6.2.1.14 The control and indicating equipment shall meet the requirements of EN 54 Part 2.
- 6.2.1.15 The control and indicating equipment shall comprise separate processors, cross monitoring each other's correct operation, for the major functions of the systems. In particular, different processors must be used for the main control function, the detection input and alarm output functions, and the display and control function.
- 6.2.1.16 To facilitate re-configuration and system extension, the allocation of addresses to devices shall be independent of their physical location on the loops.
- 6.2.1.17 The control and indicating equipment shall have provision for the connection of an 80-character line printer.
- 6.2.1.18 The enclosures shall be capable of being surface mounted or semi- recessed and shall come complete with cable entries, fixings, knockouts and covers.
- 6.2.1.19 The enclosures shall afford a minimum ingress protection to IP40. It shall not be possible to open the control and indicating equipment without the use of a special tool.
- 6.2.1.20 The number of zones and areas covered shall be determined in accordance with the geographical logic and the requirements of BS.5839: Part. 1. A spare capacity of at least 10% shall be provided to allow for expansion of the system.
- 6.2.2 Basic System Functions
 - 6.2.2.1 The control and indicating equipment shall monitor the status of all devices on the addressable loops for fire, short-circuit fault, open-circuit fault, incorrect addressing, unauthorised device removal or exchange, pre-alarm condition and contaminated detector condition.
 - 6.2.2.2 The control and indicating equipment shall monitor the status of internal connections and interfaces, including charger, battery, and remote signalling functions.

- 6.2.2.3 The control and indicating equipment shall provide the following discrete visual indications:

POWER ON	Green LED indicator
FIRE ALARM	Dual red LED indicator
FAULT	Yellow LED indicator
DISABLED/ISOLATED	Yellow LED indicator
FIRE ZONES	Red LED indicator per Zone.

- 6.2.2.4 The equipment shall also have an integral 80-character LCD alphanumeric display and the following controls for the authorised operator:

- Evacuate
- Silence
- Reset
- Lamp Test

- 6.2.2.5 The control and indicating equipment shall provide a simple to operate keypad to enable a user to access the various built-in functions and interact with the information displayed on the LCD. For security reasons, the control and indicating equipment shall provide a customer configurable password code facility.

- 6.2.2.6 The control and indicating equipment shall provide facilities for signalling the following system conditions to a repeater panel at the reception desk:

- Alarm
- Pre-alarm
- Fault
- Zone Isolated

- 6.2.2.7 The control and indicating equipment shall be capable of monitoring and controlling remote site devices, such as door release units and relays for the control of plants and dampers, directly from the addressable loops.

- 6.2.2.8 The control and indicating equipment shall be capable of providing a two-stage alarm sounder facility that can be programmed, either on a zonal basis or common system basis, to meet the requirements of the fire authority. Three possible sound output signals shall be available as follows:

- Alert pulsed tone (1 second ON, 1 second OFF)
- Evacuate continuous tone
- User definable tone for specialised events, for example bomb alert.

6.2.2.9 The control and indicating equipment shall monitor all critical system components and interconnections (internal and external). In the event of a failure, which prevents correct operation of the alarm functions, a FAULT indicator will light, and a message shall be given on the alphanumeric display. These shall be as follows:

- Loop Short/Open Circuit
- Device Failure
- Device Not Responding
- Incorrectly Configured Device
- PSU Fault
- Charger Fault
- Battery Fault
- Battery Critical
- Mains Failure
- Auxiliary PSU Failure
- Signalling Fault
- Sounder Wiring Short/Open Circuit

6.2.2.10 The control and indicating equipment shall incorporate the following system management facilities:

- Isolate/re-connect a particular device
- Isolate/reconnect a particular detector zone
- Isolate/re-connect a particular sounder zone
- Walk-test of a selected zone to verify detectors and sounders
- View the number of alarms since power up
- View the number of software initializations since power up
- View common alarm/fault/disabled status
- View zonal alarm/fault/isolated status
- View point address status
- Print event log
- Print points isolated
- Print point status

6.2.2.11 The control and indicating equipment shall have an event log capable of storing up to the last 500 events that have occurred. It shall be possible to view the content of the log via the alphanumeric display.

6.2.2.12 The control and indicating equipment shall be capable of providing audible and visual warning when a weekly system test, as defined in BS5839: Pt. 1: 1988, is required.

6.2.2.13 Contractor to ensure that the control and indicating panel to have the following specifications:

Description	Fire alarm panel
Type	Addressable
No of Loop	2
Loop Capacity	128 devices
Fixation	Flush mounted
Batteries	2 x 12V@12Ah
Battery Standby	24 hours standby + 30 minutes alarm
Accessories	Flush mounting kit
Manufacturers And Model	Gent, Morley & Zitton

6.3 Repeater panel

6.3.1 Non-operational repeater panel shall be provided in the building. The non-operational repeater panels will be capable of indicating fire conditions only and their use will be for notification and location of a registered fire alarm. The repeater panel shall have the following specification:

Description	Fire Alarm repeater panel
Type	LCD repeat panel
Ingress Protection	IP 30
Communication Ports	1x RS485 to communicate with the main control panel
Fixation	Flush mounted
Accessories	Flush mounting kit
Manufacturers And Model	Gent, Morley & Zitton

6.4 DETECTORS

6.4.1 Automatic fire detectors shall be addressable type and comply with the requirements of BS 5445: Pt.7: 1984 (EN54: Pt.7). Detectors shall be selected to suit the type of system described in the Scope of Works Section. Detectors shall be compatible with the environmental conditions appropriate to their location without resulting in false operation.

- 6.4.2 Detectors shall provide separate fire and fault signals. They shall also be capable of transmitting information regarding their condition and the environment. Each detector shall be provided with an integral LED which shall illuminate when the unit is in the alarm state.
- 6.4.3 Detectors shall be fixed to the installation by means of plug-in detector bases, suitable for direct mounting onto conduit boxes. The bases shall incorporate the optional feature of being able to lock the detector into position once plugged in.
- 6.4.4 The addressable base must incorporate all the circuitry required for communicating detector status to the control and indicating equipment, including the means of addressing.
- 6.4.5 Addressable detectors and modules must be able to transmit to the control and indicating equipment a pre-set and unique identifier to detect unauthorised changes in the system configuration.
- 6.4.6 It shall be possible to connect and mix automatic detectors, manual call points and addressable modules within the same zone sub-division of an addressable loop.
- 6.4.7 The automatic detectors shall be designed to have high resistance to contamination and corrosion.
- 6.4.8 The automatic detectors shall include RFI screening and feed-through connecting components to minimise the effect of radiated and conducted electrical interference.

6.5 ASSOCIATED ANCILLARY EQUIPMENT

- 6.5.1 Manual Call Points
- 6.5.1.1 Manual call points shall be addressable type and comply with BS.5839: Part.2. They shall be square or rectangular, break glass type and shall be suitable for semi-recessed mounting using a standard single outlet box.
- 6.5.1.2 Units shall be moulded red plastic type and shall be activated by breaking the front element. Front elements shall be labelled "BREAK GLASS". Call points shall be provided with testing facilities utilising a special key.
- 6.5.1.3 The addressable manual call points shall monitor and signal to the 02control and indicating equipment the status of a switch operated by a 'break glass' assembly.
- 6.5.1.4 The addressable call points shall be capable of operating by means of thumb pressure and not require a hammer.
- 6.5.1.5 The addressable call points shall be capable of being mounted in a weatherproof enclosure affording protection to IP65.

- 6.5.1.6 The addressable call points shall incorporate a mechanism to interrupt the normal addressable loop scan to provide an alarm response within less than 1 second.
- 6.5.1.7 The addressable call points shall be capable of being tested using a special 'key' without the need for shattering the glass.
- 6.5.1.8 The addressable call points shall provide an integral red LED to indicate activation.
- 6.5.2 Short Circuit Isolators
 - 6.5.2.1 Short circuit isolators shall be provided wherever wiring passes from one fire compartment to another or from one zone to another. Short circuit isolators shall be labelled to indicate which devices they are connected between.
 - 6.5.2.2 The line isolator module shall provide protection on the addressable loop by automatically disconnecting the section of wiring between two zones where a short circuit has occurred.
 - 6.5.2.3 The line isolator module shall derive power directly from the addressable loop.
 - 6.5.2.4 The line isolator module shall provide an LED indication that the module has tripped.
- 6.5.3 Addressable Relay Output Module
 - 6.5.3.1 The addressable relay output module shall provide a volt free changeover relay contact operated by command from the control and indicating equipment.
 - 6.5.3.2 The contacts of the addressable relay output module shall be rated at a minimum of 5Amp at 230 volts.
 - 6.5.3.3 The addressable relay output module shall monitor the relay coil for open-circuit and transmit the fault signal to the control and indicating equipment.
 - 6.5.3.4 The addressable relay output module shall be capable of deriving its operating power from the addressable loop.
 - 6.5.3.5 The addressable relay output module shall provide a red LED indication that the relay has operated.
- 6.5.4 Alarm Sounders
 - 6.5.4.1 Alarm sounders shall be of the electronic sounder type. They shall be designed to operate on a 12- or 24-volt DC supply and shall comply with BS.5839. They shall be finished in a colour to be agreed with the Architect and shall be labelled "FIRE ALARM". They shall be rated IP 54.
 - 6.5.4.2 Sounder selection and location shall be capable of producing a minimum sound level of 65dB(A), or 5db(A) above any other noise likely to persist for a period longer than 30 seconds, whichever is the greater.

6.5.4.3 In areas, such as plant spaces and where described, elsewhere within the Works, xenon flash tubes shall be provided in addition to the sounder. The flash tubes shall be clearly differentiated from the visual signals and shall have a flash rate in the range 30 to 120 cycles/minutes. The alarm shall comply with BS.5839: Part.1.

6.5.5 Power Supplies

6.5.5.1 Power supplies for the control and indicating equipment shall be in accordance with the requirements of clause 16 of BS 5839: Part 1:1988.

6.5.5.2 The standby battery supply shall have a minimum capacity capable of maintaining the system in normal operation for a period of not less than 24 hours, after which sufficient capacity should remain to provide an evacuation alarm in all zones for at least 30 minutes. This requirement shall also cover remote powered fire alarm equipment such as flashing beacons and aspirating smoke detectors that are not powered from the detection loop.

6.5.5.3 Every isolator or protective device that can isolate the supply to the fire alarm system, other than the main isolator of the building shall be labelled either: -

- FIRE ALARM in the case of a protective device that serves only the fire alarm circuit but incorporates no switch.
- FIRE ALARM DO NOT SWITCH OFF in the case of a switch (whether incorporating a protective device or not) that serves only the fire alarm circuit.
- WARNING THIS SWITCH ALSO CONTROLS THE SUPPLY TO THE FIRE ALARM SYSTEM in the case of any switch that disconnects the mains supply to both the fire alarm system and to other circuits.

6.5.5.4 Labels shall be clear and in durable red fade resistant material.

6.5.5.5 To maintain the integrity of the mains supply to the fire alarm system under fire conditions, the supply cables shall be suitably fire rated, even though the equipment is provided with a standby power supply.

6.6 Drawings and technical information

6.6.1 The drawings produced by the Engineer are for Tender purposes only and are essentially schematic in nature. The Contractor shall be responsible for the provision of all fire alarm equipment required to comply with this Specification in compliance with the requirements, of the appropriate British Standards.

6.6.2 During construction, the Contractor shall fully and accurately describe the proposed fire detection and alarm system and its design concepts, providing a complete set of layout drawings and a specification describing all aspects of the system, including:

6.6.2.1 Detailed component and equipment lists with model and manufacturers part numbers.

6.6.2.2 Product sheets for each item of equipment.

- 6.6.2.3 Theory of Operations with description of system functions.
- 6.6.2.4 Written confirmation that a manufacturer trained representative will provide on-site supervision during system installation, perform all final testing and commissioning of the installed system and instruct operating personnel on all system operations.
- 6.6.3 The Contractor shall provide a complete set of contract documents describing the system and its design concepts, installation, final testing, commissioning, and required operating and maintenance procedures. These shall include the following documentation:
- System description.
 - Checklist of equipment and components.
 - Installation instructions.
 - Equipment connection diagrams showing wiring detail of Addressable Device positions with addresses.
 - Standby battery calculations showing system power requirements and formulas used to calculate specified power.
 - Final testing instructions.
 - Commissioning instructions.
 - Certification documents.
 - Logbook.
 - System operating instructions.
 - Routine maintenance instructions and schedules.
 - Remote monitoring link description and operating instructions (if this option is being provided).
- 6.6.4 As a minimum, the following drawings shall be provided for the system:
- System schematic diagram.
 - Cabling and wiring diagram.
 - Detailed equipment connection diagrams.
 - Building plan showing zoning and location of fire controller, detectors, call points, sounders and ancillary devices.
- 6.6.5 Prior to Taking Over, Record Drawings with operating and maintenance instructions for the installation shall be provided along with the system logbook suitably completed for issue to the operator. A full address chart indicating each device type, address, location and text programmed shall be provided.

6.6.6 Drawings and technical information shall comply with the Drawings and Documentation Section including numbers of copies, preliminary and final issues. Two additional sets of all issues shall be provided to the Engineer for issue to the Client's Insurers.

6.7 Installation

6.7.1 The installation shall be in accordance with the recommendations of BS5839: Pt 1: 1988 and BS 7671.

6.7.2 The Contractor shall be responsible for the correct sitting of all equipment and components of the system in accordance with previously agreed plans and drawings.

6.7.3 All cabling and wiring shall be tested before they are connected to the fire controller and its associated devices.

6.8 Testing and commissioning

6.8.1 The fire controller and associated devices and modules shall be tested in accordance with the guidelines set out in BS 5839: Pt 1: 1988 and the testing instructions provided by the manufacturer. These tests shall include the following: -

- Witness tests on the Fire Alarm Cables for insulation resistance and electrical continuity.
- Test the functional operation of the break glass units, smoke/heat detectors and sprinkler monitoring devices.
- Battery discharge test with a full 30-minute operation at the end of the specified battery autonomy period with the system in its quiescent state.

6.8.2 The Contractor shall test all functions of the system, including the software, to ensure that it operates in accordance with the requirements of the design specification and relevant standards.

6.8.3 The Contractor shall carry out audibility tests in order to demonstrate the suitability of the system installed. This shall involve an element of out-of-hours working, which shall be included for in the tender submission.

6.8.4 Following the satisfactory completion of installation, testing and start up, the Contractor shall demonstrate to the customer that the system successfully performs all of the functions set out in the design specification.

6.8.5 The Contractor shall provide the customer with an agreed quantity of spare parts testing equipment and consumables, which are to be used during routine maintenance, and testing of the system.

6.8.6 The Contractor shall provide a customer appointed fire system supervisor with on-site training in the use, operation and maintenance of the system and explain the procedures to be followed in the event of fire and false alarms. The system supervisor shall also be shown how to carry out routine maintenance and testing procedures, and how to keep the logbook. (Also see Section 9).

6.8.7 The Contractor shall prepare a report detailing all tests performed during installation and commissioning of the system. The report shall include the results of the tests and details of any specific settings or adjustments made. Any outstanding tasks or activities, which are to be completed at another time, shall also be included in the report.

6.9 Maintenance

6.9.1 The Contractor shall include for any normal service and maintenance required during the Defects Liability Period.

6.9.2 The scope shall include a comprehensive maintenance and emergency call out service for the whole of the fire alarm installation for a period of 12 months from the certified completion date.

6.9.3 Regular examination and any adjustment of parts etc. as necessary to suit the type of equipment installed and keep it in a satisfactory operation shall be provided.

6.9.4 The Contractor shall as a minimum include for periodic examination of the panel during the defect's liability period.

7 EXTRA LOW VOLTAGE SYSTEMS

7.1 Telecommunications Distribution System

7.1.1 General

This element of the Specification covers the standards of design, materials, installation and testing of each element and aspect of the Tele-communications Distribution System (TDS) as specified in the Drawings. All the specified requirements shall comply generally with BS 6701.

7.1.2 Cabling and Extension Wiring Within One Building

7.1.2.1 Shall comply with BS 6701 and concealed wherever possible. It shall be marked at terminating and through-access boxes in duct or conduit and at all points where cables enter or emerge from concealment. Conduit and duct to be marked at entry and exit points to the distribution system.

7.1.2.2 Where cables and conduits are installed in plaster or concrete liable to damp conditions, precautions shall be taken against corrosive effects. Cables shall be run in trunking where a number of cables need to be run on the surface on a common route.

7.1.2.3 All cable shall be installed in accordance with the cable manufacturer's recommendations. They shall be run on external surfaces of buildings only after obtaining the agreement of the Engineer.

7.1.2.4 All cables shall be protected against over-voltage surges where necessary under such circumstances. There shall be in addition to types of internal wiring specified in BS 4808, include any types of internal wiring not at present included in any British Standard, but known to give reliable service.

7.1.2.5 Cables shall include distribution cables of sufficient capacity to allow for expected additions or modifications and for maintenance purposes.

7.1.2.6 Cables shall be installed in such a way as to minimise cross-talk. For example, a two-wire extension circuit should be routed over the two wires of a twisted pair. The use of a twisted pair should continue through joints and terminations. **NOTE:** The needs of digital and analogue systems with respect to cross-talk will differ from one another.

7.1.2.7 Cables shall be securely fixed at 300mm intervals on unsupported horizontal runs and 400mm on vertical runs. Supported runs to be fixed at 1m **intervals**. These spacings to be reduced on uneven surfaces.

7.1.2.8 Cables shall be provided to be bent to a radius not less than four times their diameter or six times in the case of metal sheathed. They shall be independently suspended where passing through suspended ceilings or floors to ensure segregation of services, where no trunking is provided.

- 7.1.2.9 Cables shall be of the types, capacities and conductor sizes specified in schedules or bill of quantities and installed according to the drawings.
- 7.1.3 External Cabling, Wiring and Installation
- 7.1.3.1 External cabling shall comply with BS 6701 and be of the types, capacities and conductor sizes specified in BoQ or drawings. Underground cabling shall be installed and drawn-in and be executed with extreme care at all times.
- 7.1.3.2 Cables shall be installed, at all times utilising the appropriate guide rollers or such other equipment as may be necessary and ensure that the cable end be attached to the draw rope by means of a suitable attachment such as a compression "sock" so that no damage is sustained by the cable during the drawing-in operation.
- 7.1.3.3 The contractor shall provide for overhead lines to comply with BS 6701 and be of the types, capacities and conductor sizes specified in Part D and the drawings.
- 7.1.4 Cable Connections and Terminations
- 7.1.4.1 All cable connections and terminations shall comply with BS 6701 and shall be readily identifiable at the connection point. They shall be designed for fault free performance e.g., insulation displacement connection type for copper conductors. They shall comprise joints as an alternative to junction boxes only when specified in writing by the Engineer.
- 7.1.4.2 The contractor shall avoid the necessity of two conductors being placed in the same termination unless it is specifically designed for multiple terminations. It shall include spare conductors of sufficient length for future use, labelled and neatly terminated or stowed clear of other wiring.
- 7.1.5 Junction, Distribution and Termination Boxes
- 7.1.5.1 All junction, termination and distribution boxes shall be of the latest approved type complying with the provisions of BS 6701 Part 1 and of the types and capacities specified in drawings and bill of quantities. It shall be suitable for the environment in which they are installed. It shall provide adequate space for wiring and connections.
- 7.1.5.2 All boxes shall bear identification on their lids, with this identification and the associated connection sequence recorded. They shall be located at positions which afford ready access.
- 7.1.5.3 Boxes shall include extension sockets which are interchangeable with the current MT line jack units, flush or surface mounting and fitted with jack plug retainers which require the use of a tool to remove the plug.
- 7.1.6 Internal Ducting, Conduits, Trunking and Tray

7.1.6.1 Shall comply with the requirements of BS 6701 and be installed in accordance with the relevant clauses of this Model Specification.

7.1.7 Segregation

7.1.7.1 Cable segregation shall follow provisions of BS 6701 and precautions observed where necessary, to protect the TDS from itself and from any site interference sources, such as paging transmitters, computer installations and similar interference generating equipment.

7.1.8 Marking of Apparatus

7.1.8.1 Marking apparatus shall be in accordance with BS 6701 and apply to apparatus which is connected to: -

7.1.8.2 Power supply systems operating at voltages exceeding: -

50V	ac	to earth.
120V	dc	but not exceeding 650V to earth.
100V	ac	rms measured under no-load conditions.
175V	ac	peak value when the load is at the highest impedance setting.

7.1.8.3 Marking apparatus shall be marked in accordance with safety sign number A2.8 BS 5378, together with indication of the voltage.

7.1.9 Safety Precautions for TDS

7.1.9.1 Safety systems shall be in accordance with BS 6701. It shall include special protection on lines subject to induced voltage. It shall provide for a careful survey of cable and wiring routes to ensure that the most suitable are selected, that items associated with the installation are located in positions creating no hazard to occupants, installation, or maintenance staff.

7.1.9.2 The contractor shall provide for draw lines to be left in conduits to facilitate pulling-in of future cables. It shall be ensured that any plugs and sockets used for telecommunication circuit connections are not interchangeable with general power sockets.

7.1.9.3 The contractor shall provide fire barriers with 3 hr fire resistance to all penetrations in wall and through fire compartment.

7.1.10 Earth Connections

7.1.10.1 Earth connections shall be in accordance with BS 6701 and comprise a functional earth (FE) for system safeguards, which should be connected to the general protective earth at the building main earthing terminal or an earth electrode system which is bonded to the building main earthing terminal. This shall include for the functional earth conductor to be connected to the earth terminals of all apparatus protective devices.

7.1.10.2 The Earth connector shall include for the functional earth conductor to earth terminals of floor distribution points, except in the case of earth continuity conductors of less than 1.5mm² from floor distribution points to terminating stations. The earthing system shall include for the functional earth conductor to earth terminal of the central apparatus, any ancillary apparatus and the framework, if this is not connected to the general protective earthing system.

7.1.11 Site Conditions, Hazards and General Safety Precautions

7.1.11.1 The Contractor shall take into account any other services, apparatus or conditions which may adversely affect telecommunications apparatus, typical examples are listed in BS 6701. These shall additionally comply with the requirements of BS 6701 with regard to hazards arising from general site conditions, explosive products and processes and fire extinguishing systems.

7.1.12 Inspection and Testing

7.1.12.1 All inspection and testing shall be carried out according to BS 6701. This shall include for copies of the test results to be clearly typewritten in a presentable format and handed over prior to the end of the Contract, together with maintenance manuals and any other relevant documentation.

8 EARTHING SYSTEM

8.1 Earthing arrangements and protective conductors

8.1.1 General

8.1.1.1 The Earthing system shall be TT type except in specialised locations and shall be in accordance with the IEE Wiring Regulations. This shall comprise separate neutral and protective conductors throughout.

8.1.1.2 The earthing shall provide for the main equipotential bonding conductors to connect to the main earthing terminal, all incoming main metallic piped services, and the Lightning Protection system. The metallic sheath of telecommunication systems to be similarly bonded only with the permission of the operator. The extraneous conductive parts of all other separate metallic services particular to the building also to be connected to the main earthing terminal, including central air conditioning, and exposed metallic parts of the building fabric including metallic ceiling grids.

8.1.1.3 Where necessary, include for the extraneous conductive parts of exposed metalwork to be connected to circuit protective earth conductors by local supplementary bonding conductors to maintain an equipotential zone.

8.1.2 Earth system

8.1.2.1 The Earthing system shall be TT type and the external main earth shall comprise of a network of buried rods and plates which are bonded to the building foundations reinforcement.

8.1.2.2 Where the earthing shall be liable to corrosion (buried in ground, floors, walls, fixed externally, etc.) it shall be PVC sheathed or wrapped with corrosion resistant tape.

8.1.2.3 The earthing system shall have brass bolts, nuts and washers for all fixings. (Bronze where liable to corrosion.)

8.1.3 Earth electrode system

8.1.3.1 The earthing system shall comprise solid drawn high conductivity copper and earth electrode rods of 15mm dia, 1.8m long sections with internal screw and socket joints. They shall be fitted with hardened steel tip and driving cap. They shall be driven into the ground to a minimum depth of 2.4m.

8.1.3.2 The conductors shall be connected by means of a purpose made clamp below ground level in a proprietary brand of concrete inspection pit with a removable cover.

- 8.1.3.3 The earthing electrode system shall include earthing conductors which together with the electrode system provide the required value of impedance. The earthing conductors to be insulated between Main Earth Bar and Earth Electrode and fitted with copper disconnecting links to provide a testing facility at the point of connection to the earth electrode. Links to be of equivalent cross-sectional area to the earthing conductor.
- 8.1.3.4 Shall consist of a minimum of two nests, to enable the integrity of the safety Earth path to be preserved whilst Earth tests are carried out.
- 8.1.4 Earthing tape
- 8.1.4.1 Shall be high conductivity, untinned except where otherwise specified. They shall be PVC sheathed or PVC wrapped where run externally, or in the ground, through walls and floors or in situations where it may be liable to corrosion. Sheaths and wrappings shall be green and yellow.
- 8.1.4.2 Tapes shall be fixed by means of purpose made brass or bronze saddles.
- 8.1.4.3 They should be joined by tinning both pieces before assembly, riveting with at least 2 rivets and sweating solid. They shall be connected to equipment by tinning the contact area and clamping or by drilling the tape, tinning the contact area and bolting with high tensile plated steel bolts, flat washers, nuts and locknuts.
- 8.2 Lightning Protection System**
- 8.2.1 General
- 8.2.1.1 This section covers the manufacture, supply, installation, testing and site inspection of a lightning protection system, comprising an early streamer air termination network, down conductors, test joints, earth terminations and earth electrodes.
- 8.3 Installation**
- 8.3.1 General
- 8.3.1.1 The lightning conductor system shall be in accordance with the installation drawings and shall comply with the requirements of BS 6651.
- 8.3.1.2 The system shall be carried out using copper down conductors and in addition, conductors shall be PVC (3mm minimum thickness) covered on vertical surfaces and be of suitable colour to blend with the building surface.

8.3.2 Air Termination Network

8.3.2.1 The air termination network shall consist of an ESE terminal with clamps for down conductors and complete with bonding to all major exposed metallic projections including television and radio aerial, metallic supporting structures, hand railing, metallic roof, coping, metallic guttering and structure reinforcing bars.

8.3.2.2 The entire system shall be fixed, to allow for movement of the horizontal conductor, at intervals as detailed in Table 1 of BS 6651 using approved colour outdoor grade polypropylene clips with single non-ferrous screw plug fixing suitable for surface material, PVC/heat bonded felt pads 100mm x 100 solvent welded to the roof finish, where screw fixing would damage the weatherproof membrane of the building, or manufacturers standard fittings for special surface applications.

8.3.3 Down Conductors

8.3.3.1 Shall be copper conductor tapes 50mm x 3mm running where possible vertically on the surface of the building structure, following the most direct route between air and earth terminations, with the minimum of joints, and the avoidance of deep re-entrant loops. (See fig 22 BS 6651).

8.3.3.2 It shall be fixed to allow movement of the vertical conductor, at intervals not exceeding 1.0m (750mm over 20m), using approved colour outdoor grade polypropylene clips with single non-ferrous screw plug fixing suitable for surface material, or manufacturers standard fittings for special surface applications. It shall be bonded at top and bottom conductor positions to any other metalwork lying within a common duct.

8.3.4 Conductor Joints and Connections

8.3.4.1 This shall comprise bolted clamps, rigidly securing the conductor tape ends, with recommended mating surfaces cleaned, anti-corrosion protected and the whole joint wrapped in waterproof tape or shroud, extended beyond the joint ends and colour matched to any PVC covered copper conductors. It shall have both metal contact surfaces of the joint, of similar or dissimilar metal tapes, wire wool cleaned and tinned (copper only) before a liberal coating of water repellent paste and thixotropic tape (Denso) is applied.

8.3.5 Test Joints

8.3.5.1 Shall be provided in positions, inaccessible to unauthorised persons, not greater than 1.8m above ground level, on each down conductor, unless otherwise specified in drawings. It shall comprise a gunmetal or copper bolted clamp housing the down conductor and earth termination copper tapes. Clamping screws to be arranged not to bear directly on the conductors. There shall be no connection, other than that direct to earth electrodes, at any point below the test joints.

8.3.6 Earth Terminations

- 8.3.6.1 Shall be applied separately to each down conductor and be made via a test joint to the earth electrode system. Access to the earth electrode is to be provided where the steel structure is concealed. Copper tapes 25mm x 3mm or 8mm rods shall be utilised.
- 8.3.6.2 They shall be fixed firmly between test joint and ground level and protected, en route to earth electrodes. Any buried ring conductor earth tape is to be buried a minimum of 600mm below ground level.
- 8.3.6.3 Earth terminations shall be bonded as directly as possible, preferably below ground, to all adjacent buried services having exposed metal in the form of sheathing, armouring or piping and to the incoming electricity supply protective conductor.

8.3.7 Earth electrodes

- 8.3.7.1 Shall be located as close as practicable to down conductors.
- 8.3.7.2 Shall be steel cored or steel tipped copper earth rods minimum 16mm diameter, plain round section, 1.2m long coupled as necessary with bonded screwed connections and complete with triangular type gunmetal head clamps, unless otherwise specified in drawings. The minimum length of any electrode shall be 2.4m at each position.
- 8.3.7.3 Shall be arranged in formation as specified in drawings, with provision for a minimum number of four electrodes, the number to be adjusted as earth resistance readings are taken to confirm ground conditions. Electrode spacing shall be a minimum of 1.25 times the driven length of the 1st rod.
- 8.3.7.4 Earth electrodes shall be provided with inspection pits with lockable covers where earth termination connection is below ground. Inspection pits to be finished flush with ground level and the hinged covers permanently labelled "Lightning Protection System Earth". Inspection pits to be concrete or lightweight heavy-duty polymer.

8.4 Testing, completion, and handover

8.4.1 Testing and commissioning

- 8.4.1.1 Testing and commissioning shall be carried out in accordance with the requirements of BS 6651 and include the provision of the necessary test equipment for the measurements required. The installation to be complete and all electrical continuity and mechanical efficiency tests carried out before handover.

8.4.2 Final acceptance tests

- 8.4.2.1 The contractor shall ensure that the combined resistance to earth of the whole lightning protection system is not exceeding 10 ohms. The resistance to earth of each termination is not to exceed the product given by 10 ohms times the number of earth terminations provided.
- 8.4.2.2 Shall include for the tests and accuracy of such tests to be demonstrated to the satisfaction of the Engineer and copies of recorded test results and as installed drawings made available for inclusion in the O & M Manuals.

9 INSPECTION AND TESTING

9.1 General

- 9.1.1 The whole of the installation shall be inspected and tested in an orderly sequence to ensure that the requirements of this specification, the IEE Wiring Regulations the Electricity at Work Regulations and British Standards are met. The tests will be carried out using instruments of the type and standard specified.

9.2 Inspection and tests

- 9.2.1 The procedure shall include a visual inspection of the installation including equipment, subways, walkways, crawl ways, and false ceilings where accessible, together with the items as described in the IEE Wiring Regulations.
- 9.2.2 The procedure shall include operation of accessories and all items of fixed equipment. These tests to be made under normal operation conditions and the results noted.

9.3 Method of test

- 9.3.1 The procedure shall include the testing of all equipment in accordance with the IEE Wiring Regulations.
- 9.3.2 The procedure shall include operation of equipment by properly trained and competent persons.
- 9.3.3 The procedure shall include for witnessing by the Engineer.
- 9.3.4 The procedure shall include for disconnection or similar operations as are required to fully satisfy the test requirements and reconnection to restore the installation.
- 9.3.5 The procedure shall include for simulation of fault conditions in the installation to ensure that all alarms, controls, indicators, and safety devices operate correctly and subsequent re-setting to the correct operating conditions.
- 9.3.6 The procedure shall include for the simulation of fault conditions in the "normal" electricity supply system to ensure that the emergency supply changeover contactors, sensing circuits, phase failure relays, timers etc. operate correctly and the subsequent re-setting of the network to the correct operating conditions.
- 9.3.7 The procedure shall include for insulation tests on all armoured cables of 25mm² and above with lengths exceeding 5 metres. The tests to be made with isolators and switches in the open position and under competent supervision to ensure the safety of persons and prevention of damage.
- 9.3.8 The procedure shall include for the rectification of faults or the renewal of any part of the installation which fails or breaks down a result of the insulation tests.

9.3.9 The procedure shall include for tests on the wiring/cabling for such services as Fire Alarms, Intercommunication Systems, General Alarms, TV and Radio Systems to be made prior to the terminal equipment being connected but with the cable terminations completed, in order to preclude damage to the terminal equipment and to obviate any adverse effects on the test results.

9.3.10 The procedure shall include the recording and completion of all schedules, test, inspection and completion certificates with copies.

9.3.11 The procedure shall include, in the event of unsatisfactory tests, for a witnessed repeat test after rectification of the fault(s).

9.4 Test equipment

9.4.1 Shall be correctly calibrated and certified for the limits of accuracy necessary and identified by serial number on each test sheet. If an instrument used is considered suspect, it shall be tested by an authorised standard testing laboratory. All equipment shall meet the requirements of BS EN 61557 Equipment for testing up to 1000V.a.c to ensure safety of the operator. Calibration certificate which has been issued maximum one month prior to the testing sessions shall be produced to the Engineer before any test is carried out.

9.4.2 Tests instruments shall be provided with insulated and shrouded probe.

9.4.3 Tests instruments shall be of the following types for the associated function: -

9.4.3.1 Ring final circuit continuity:

- Low reading ohmmeter capable of reading fractions of an ohm to a high degree of accuracy

9.4.3.2 Protective conductors' continuity:

- Heavy current low reading ohmmeter capable of reading fractions of an ohm.

9.4.3.3 Earth electrode resistance:

- Hand driven alternating current generator with a minimum voltage of 240 volts and maximum current low of 25 Amps.

9.4.3.4 Insulation resistance:

- Hand driven generator 500v d.c.

9.4.3.5 Polarity:

- "Avometer" or other approved commercial instrument.

9.4.3.6 Earth fault loop impedance:

- Phase-earth fault loop tester neutral-earth fault loop tester.

- 9.4.3.7 Residual current devices:
- Test set comprising transformer with two separate windings at 240v primary and 45v secondary, with core earthed to primary circuit protective conductor.
- 9.4.4 They shall not be of the "stop go" type but must indicate the impedance value directly in ohms with means of measuring and correcting for voltage variations.
- 9.5 Final acceptance tests**
- 9.5.1 Final acceptance tests shall be carried out at the completion of the works prior to witness testing. These tests shall be carried out for a period of 15 days with all the equipment / load connected to the supply and the full system set to work.
- 9.5.2 These tests shall be recorded upon the final acceptance record sheets with copies. Included within the operating and maintenance manual and be signed and dated by the test engineer.
- 9.6 Additional miscellaneous requirements to be verified during the installation**
- 9.6.1 The whole of the work shall be continuously checked throughout the installation period to ensure complete safety and compliance with the specification.
- 9.6.2 Switchgear shall be checked for correct labelling, complete circuit schedules and satisfactory operation by hand. Interlocking facilities shall also be checked for correct operation. Isolation locking facilities shall be checked.
- 9.6.3 Clearances around switchgear for operation and maintenance shall be checked for adequacy.
- 9.6.4 Distribution boards' labels shall be checked for correctness and completion. Fuse ratings to be verified against circuit schedules and specification. MCB boards to be checked for satisfactory operation by hand.
- 9.6.5 Protection of live parts to IP2X, test facilities, and positioning of user adjustments shall be checked.
- 9.6.6 The radius of all cable bends shall be checked as shall the provision of mechanical protection and cable shrouds.
- 9.6.7 Cable trenches shall be checked for dimensions and spacing between services, the provision of earthenware ducts, cable tiles, identification tapes and route markers.
- 9.6.8 All switching and control arrangements to be checked against drawings and for operation.
- 9.6.9 Labelling and engraving to be checked for compliance with drawings and specification.
- 9.6.10 Luminaires to be inspected for operation and correct colour and rating of lamps.

9.6.11 Sockets and fused spur units shall be checked to ensure:-

- Compatibility with specification and drawings.
- Labelling and engraving are in accordance with the specification and drawings.
- Three phase power outlets shall be checked to ensure:-
- Provision is in accordance with specification and drawings.

10 IDENTIFICATION OF SERVICES

10.1 General

- 10.1.1 All services shall be identified in accordance with this specification.
- 10.1.2 All services shall comply with BS 1710 and comprise two parts (I). The basic colour (II) The Code or safety colour.

10.2 Colour coding

- 10.2.1 All services shall have the basic colour identifying the general contents.
- 10.2.2 They shall have safety colour identifying the exact contents, temperature, quality or presence of additional substances to the basic content (i.e. water temperature, medical oxygen, natural gas etc).

10.3 Basic colour

- 10.3.1 Shall be applied to the whole system or confined to basic colour bands at all valves, junctions, service appliances, structural penetrations, access openings to ducts and voids, and at intervals not greater than 3 metres throughout the pipework installation. Where basic colour bands are used, be placed on each side of the code colour. They shall have a minimum band width of 75mm for diameters up to 50mm and 150mm width for diameters above 50mm.

10.4 Code for safety colours

- 10.4.1 Code for safety colours shall have a minimum band width of 100mm.
- 10.4.2 They shall have symbols, words and letters indicating the contents, function, pipe diameter and direction of flow (->) printed in black on or adjacent to the colour code as shown in the Colour Identification Charts.
- 10.4.3 They shall have lettering not less than 10mm in height when applied to diameters less than 50mm and not less than 38mm when applied to diameters greater than 50mm.

10.5 Key for basic and colour codes

10.5.1 Each colour is represented by a letter or letters in accordance with the following tables:-

Basic Colours			
Colour	Key	BS 5252: Colour Ref	Basic Contents
Green	G	12 D 45	Water
Silver Grey	SGy	10 A 03	Steam
Brown	B	06 C 39	Oil
Yellow Ochre	YO	08 C 35	Gases
Black	BK	Black	Drainage
Light Blue	LBe	20 E 51	Air also Vacuum
Violet	V	22 C 37	Acids & Alkalis
Orange	O	06 E 51	Electrical Conduits

Code Colours			
Colour	Key	BS 5252: Colour Ref	
Auxiliary Blue	Abe	18 E 53	
Crimson	C	04 D 45	
Emerald Green	EG	14 E 53	
Salmon Pink	SPk	04 C 33	
Safety Ref	SR	04 E.53	
French Blue	FBe	20 D 45	
Grey	Gy	00 A 09 Exhaust/recirculated air	
Primrose	P	12 E 51	
Terracotta/Brown	T	06 C 39	
Yellow	Yw	10 E 53	
White	W	White	
Black	BK	Black	
Maroon		M	02 C 39

10.6 Colour identification charts

10.6.1 General services

PIPE CONTENTS	Basic colour approximately 150mm	Colour code indication 100mm			Basic colour approximately 150mm
WATER					
Drinking	G	Abe			G
Cooling	G	W			G
Boiling feed	G	C	W	C	G
Condensate	G	C	EG	C	G
Chilled	G	W	EG	W	G
Central Heating - 100°C	G	Abe	C	Abe	G
Central Heating + 100°C	G	C	Abe	C	G
Cold, down service	G	W	Abe	W	G
Hot water supply	G	W	C	W	G
Hydraulic power	G				G
Sea, river untreated					
Fire extinguishing	G	SR			G
Laundry softened	G (SOFTENED)				
Laundry raw	G (RAW)				
WATER					
Laundry recovered	G (RECOVERED)				
Steam	Sgy				
Drainage					
Electrical conduit ducts					
TOWN GAS					
Natural gas	YO	Yw			YO

10.6.2 Industrial gases

PIPE CONTENTS	Basic colour approximately 150mm	Colour code indication 100mm	Basic colour approximately 150mm
INDUSTRIAL GASES			
Vacuum	LBe	W	LBe
Acetylene * (See note)	YO	M (ACETYLENE)	YO
Argon	YO (ARGON)		
Butane	YO (BUTANE)		
Hydrogen	YO (HYDROGEN)		
Nitrogen	YO (NITROGEN)		
Oxygen	YO (IND.O ₂)		
Propane	YO (PROPANE)		
Refrigerant	YO (REFRIGERANT)		

***Note: Acetylene pipelines shall have identification (as shown) at intervals not greater than 3 metres.**

11 Drawings and documentation

11.1 Tender drawings

11.1.1 The Tender Drawings are prepared by the Engineer to show the general arrangement of the plant, equipment and services which form the intended Contract. The drawings are prepared in sufficient detail to allow competitive tenders to be submitted, in conjunction with the Specification.

The Contractor shall be responsible for interpreting the drawings, making due allowance for offsets to avoid the building structure or other services, whether indicated or not. The Contractor shall take all necessary steps to fully acquaint himself with the nature and extent of the Works by visiting the site and by inspecting the architectural, structural and other services drawings.

11.1.2 No claim for loss or expense due to the above factors will be considered.

11.1.3 The Contractor shall also be responsible for the completion of the design, preparation of fully coordinated drawings after liaising with other suppliers and contractors.

11.2 Contract drawings

11.2.1 The Contract drawings are issued by the Engineer when the Contract is placed. They will comprise the Tender drawings as described, modified to include any variation since the issue of the Tender Drawings.

11.2.2 Variations to the Contract, requiring further drawing information will be carried out by the Engineer issuing updated copies of the Contract Drawings or supplementary sketch drawings, until such times as the working drawings are available for marking up or by such other method as the Engineer may determine.

11.3 Cad data

11.3.1 A CAD copy of the drawings may be made available to the Contractor to assist in the preparation of the Contractor's working drawings should a request for the information be made to the Engineer in writing. Disks will be prepared for the latest version of AutoCAD or in DXF format as required. The CAD drawing will not be in a layered format nor will contain blocks or attributes for the various elements. All CAD information shall be on a single layer.

11.3.2 The Contractor shall be solely responsible for the modification of the information to provide the working drawings as required by this specification. The modified drawings shall accurately reflect the equipment and installation proposed by the Contractor as if the drawings had been drawn without the benefit of the electronic data. They shall also take account of the most recent Architectural and Structural information. Working drawings prepared from data provided shall be issued with the title block replaced by the Contractor's own block.

11.3.3 Particular attention is drawn to the following conditions which apply to the use of any electronic information provided:-

- It is an express condition of the contract under which data is supplied that the Contractor is absolutely responsible for verifying its correctness and completeness.
- No liability or responsibility whatsoever is accepted for any loss or damage suffered by the recipient arising out of or in connection with the use or misuse of this data.
- While all reasonable steps have been taken to ensure that the transfer medium and its contents are free from computer viruses, the originator cannot be held responsible for any damage or loss that might result from their presence.
- The copyright of the original drawings, of which the data is an electronic copy, belongs to the originator. The drawings and data have not been prepared for use by the Contractor and may not fully reflect his needs.

- Measurements taken from information which is not dimensioned on the electronic copy are at the contractor's own risk.

11.3.4 All electronic information passed to the Contractor shall be bound by the conditions set out in the above clause.

11.4 Manufacturers drawings

11.4.1 The Contractor shall be responsible for the provision of manufacturer's drawings and details of all plant and equipment required. The drawings and details shall be certified by the manufacturer as being applicable to the particular items being supplied.

11.4.2 Where the manufacturer has to develop control/interlocking wiring systems, to meet the requirements of the specification it shall be the responsibility of the Contractor to ensure that the manufacturers proposals are satisfactory and meet fully the requirements of the specification.

11.4.3 The drawings shall include general layouts and assembly drawings, details of materials and construction, methods of support and fixing and electrical wiring diagrams. The information shall be in sufficient detail to allow the Engineer to comment on the equipment. Where particular requirements for drawings are listed in the appropriate clauses for equipment or systems then these shall also be provided.

11.5 Working drawings (shop drawings)

11.5.1 The Contractor shall be responsible for the production of fully detailed and dimensioned working drawings of each service to be installed, including all purpose made plant and equipment. The location of all plant, equipment and services shall be fully dimensioned from each other, from other work and from the building structure.

11.5.2 All services shall be fully co-ordinated with each other and with the building structure and finishes, including obtaining the necessary information from others and for the indication of the service routes for all trades on composite drawings.

11.5.3 The tenderer shall allow for any plant, equipment or electrical installations to be moved during the preparation of working drawings. However, approval shall be sought or the Engineer be consulted prior to moving services during the preparation of working drawings.

11.5.4 Working drawings shall include fully dimensioned details and positions of all supports and fixings. They shall clearly define the detail and arrangement of all installed equipment and systems including access allowances for service and maintenance. Where plant is to be supported on steelwork, the Contractor shall provide setting out dimensions for the steelwork and fixing details of the particular plant to be supported. Weights of plant items with point loads shall be provided.

11.5.5 Working drawings shall be produced in accordance with a programme which is to be agreed with the Contractor to suit the overall programme for the Works. Reasonable allowance, minimum seven working days, shall be made for comments by the Engineer.

11.5.6 The Working Drawings shall include the following fully co-ordinated drawings, in addition to any separate trades' drawings which the Contractor may require.

11.5.7 Drawings shall be produced to a scale suitable for the application, but not less than listed above. Only recognized metric scales shall be used. Drawings shall be produced on A1 or A0 size sheets as appropriate. A3 or A4 drawings may be used for specific component details such as typical brackets with the agreement of the Engineer.

11.6 Wiring diagrams

11.6.1 The Contractor shall produce fully detailed wiring diagrams of all electrical work. The diagrams shall include the following: -

- Control Wiring Layouts
- Power Wiring Layouts
- Switchgear and Panel Wiring Diagrams
- Wiring Diagrams for Fire Alarm Systems, Specialist and Ancillary Services

11.6.2 Wiring diagrams shall be produced on a minimum of A1 size sheets. Where necessary, to incorporate additional information A0 size sheets may be used. Computer generated diagrams on A3 or A4 sheets may alternatively be produced, provided the information is clearly legible. Where diagrams have to be produced on more than one sheet information shall be grouped as far as possible to minimise cross-referencing between sheets. Diagrams which, due to non-compliance with the above are difficult to read shall be rejected by the Engineer.

11.6.3 Wiring diagrams shall clearly indicate the extent of the wiring system, including numbers and sizes of cables with loadings, layouts of cable trays, trunking and conduits and locations of all equipment requiring electrical connection. Drawings shall fully detail the requirements and location of points of connection.

11.7 Builders work drawings

11.7.1 In addition to the working drawings of the engineering services, the Contractor shall also produce drawings indicating builders work requirements in connection with the services. The drawings shall include details of penetrations through the structure, builders work supports and bases.

11.7.2 Full details of access requirements for commissioning, servicing and maintenance through suspended ceilings and floors, together with access to riser ducts and the like shall be provided.

- 11.7.3 The drawings shall only be prepared after the working drawings have been finally agreed with the Engineer and shall be based on the detail of the working drawings. The drawing production programme shall take this fully into account.

11.8 Issue of drawings

- 11.8.1 On completion of working drawings, wiring diagrams and builders work drawings they shall be submitted for comment in 3 copies, in accordance with the relevant clauses of the Preliminaries Bill.
- 11.8.2 When the drawings have been amended to incorporate any comments, they shall be issued as the construction issue to the Engineer. The same preliminary and construction issue distribution of drawings shall apply to any subsequent revisions of working drawings.

11.9 Dimensions

- 11.9.1 The Contractor shall take site dimensions during the preparation of the drawings and shall be responsible for their accuracy. Setting out of the works on site shall be carried out by the Contractor and any errors arising from inaccuracies in setting out shall be their responsibility.
- 11.9.2 The Contractor shall be solely responsible for the accuracy of the drawings and for any equipment shown being suitable for the purpose for which it is intended and in accordance with the tender drawings and specifications.

11.10 Site copies

- 11.10.1 One set of prints of working drawings, manufacturing drawings and installation drawings as necessary to provide a complete record of the Works shall be kept on site. They shall be available at all times for inspection by the Engineer. These drawings shall be maintained on site and not in the Contractor's office. Reasonable place shall be provided for keeping of these drawings on site.
- 11.10.2 These drawings shall be kept in good condition and shall be marked up, at least once a week, to show the progress of work on site and incorporate alterations, omissions, variations and amendments agreed during the progress of the works. Should the Engineer determine this requirement is not being complied with, they shall reserve the right to appoint an independent company to survey the installation and prepare drawings to indicate the actual positions of the installations at the cost of the Contractor.

11.11 Manuals

11.11.1 Manuals shall consist of copies as set out in the Preliminaries. Both electronic and printed copies shall incorporate all test certificates and acceptances. Six weeks prior to Taking Over draft copies of the manuals shall be submitted to the Engineer for comment. The manuals shall comply with the requirements of the Construction (Design and Management) Regulations for incorporation into the Health and Safety file for the Contract. Four weeks before Practical Completion final agreed manuals shall be handed over to the Client. Retention will be held as set out in the Conditions of Contract, until this occurs.

11.11.2 Failure to issue the manuals in time will result in failure to achieve Practical Completion.

11.11.3 The manual shall be arranged as follows:-

Section 1 Index

Section 2 Non-Technical User Guide. This section shall include a brief "Non-Technical User" friendly description of each of the Building's Building Services Installations and specific point of contact in case of failure of the respective installations.

Section 3 Description of the Design Intent

Section 4 Description of the Operation Routine. The description shall include full and specific instruction for start up, operation and shut down of each system, procedures for emergency shut down, means of making safe potentially dangerous plant, precautions necessary to overcome known hazards when operating each system, bringing into operation standby equipment, instructions on fault finding and emergency in case of plant malfunction or equipment failure, control sequences for all systems installed. Health and safety matters identified in the Health and Safety Plan and relevant to the operation, maintenance and replacement of the installation shall be described with precautions envisaged as necessary. This section shall also include a simplified user guide for the non-technical user.

Section 5 Planned Maintenance Instructions. These shall detail the methods and procedures appropriate to the maintenance tasks. Instructions shall include dismantling and reassembly, replacements, adjustment, calibration and testing, reference to parts, identification lists, special tools, test equipment and auxiliary services, hazards which may arise and precautions to be taken, fault finding routines.

Section 6 Maintenance Schedules. These shall detail recommendations for the nature and frequency of inspections, examinations, tests and maintenance to keep the equipment in a safe and efficient working order. Guidance shall be given on the nature of deterioration and defects to be looked for. Activities shall be listed for daily, weekly, monthly, quarterly, bi-annual, and annual routines.

- Section 7 De-commissioning, Removal and Re-instatement. Description of the methods and processes to be used in de-commissioning, removal and re-instatement of all systems including safe disposal. Description of the methods envisaged for de-commissioning of systems to comply with health and safety and CDM requirements, including schedules of hazardous substances and methods of disposal. A dedicated plant replacement procedure for all major plant shall be provided.
- Section 8 Equipment Schedules and Parts Lists. Schedules shall detail the design and actual operating conditions and detail replaceable assemblies. Sufficient information shall be provided to identify each item, together with the source of supply, ratings, dimensions, and appropriate standards. Equipment schedules shall include the name and address of the manufacturer, reference number, name and address of supplier, order number, date of purchase. A separate parts list shall be provided for each item detailed in the equipment schedule.
- Section 9 A set of Record Drawings. If necessary due to the number of drawings, which must be included in the manual, each drawing shall be photographically reduced in size to suit the manual. Drawings shall be as detailed in the Record Drawings clause.
- Section 10 Emergency Measures. This shall include telephone numbers of the Contractor's emergency staff and the names, addresses and telephone numbers of all manufacturers.
- Section 11 Copies of test certificates and commissioning data for each service and item of plant and equipment. They shall be final copies of the data produced as required by the Inspection, Testing and Commissioning Section of this Specification. Where such data is not available for inclusion in the draft copy of the manual required by this Clause, the draft shall be forwarded without them. Inability to include these items will not be accepted as a reason for non-production of the rest of the draft manual.
- 11.11.4 Covers shall be substantial, of adequate size, distinctive and of sufficient strength to protect the contents for the life of the installation. The binding shall give a permanent anchorage along the left-hand side whilst allowing the text to be flat without damage to the spine.
- 11.11.5 The contents shall be prepared with a suitable type face on top quality A4 paper suitable for direct insertion into the manuals.
- 11.11.6 The front cover and where appropriate the spine, shall have the name or logotype of the Client, the name of the buildings and details of the services included in the manual clearly displayed in permanent lettering. Where the manual is contained in more than one volume, a volume number shall be added.

- 11.11.7 The title page shall identify the building, describe the Services referred to in the manual and give the full name and address of the client. It shall also contain, date of the completion and date of handover of the services to the Client. The date of issue of the manual with the name and address of the manual author and the Author's reference number.
- 11.11.8 The preliminary pages shall contain the full name, address and telephone number of the Engineer, the Contractor and all other specialists employed by him. A description of how to use the manual with any limitations on its use shall be included. The preliminary pages shall include a contents list, lists of all supplementary documents and a record of amendments to the manual.
- 11.11.9 Each section of the manual shall be divided by a stiff divider of the same size as the holder. The divider shall be labelled to identify the section of the manual which is following.
- 11.11.10 Pages shall be sequentially numbered according to each section (i.e. Section 1:1/1, 2, etc., Section 2:2/1, 2/2, etc.)
- 11.12 Building log book**
- 11.12.1 The Contractor shall produce all required information for the Building Logbook, to meet the requirements of the Building Regulations Approved Documents, in accordance with CIBSE TM31: Building Log books and Standard Templates.
- 11.12.2 The Contractor shall issue the required information to the Contractor in good time for onward transmission to the logbook Author to allow the completed log book to be issued one week prior to Practical Completion. Failure to issue the required information may prejudice the issue of the Practical Completion certificate.
- 11.13 Record drawings**
- 11.13.1 Record drawings shall be provided for comments 28 days prior to Taking over.
- 11.13.2 When agreement with the contents of the Drawings is received from the Engineer, paper prints and electronic copies in the current version of AutoCAD or DXF format shall be issued.
- 11.13.3 Record drawings shall show the work as completed and shall record the following: -
- 11.13.3.1 The location, including levels if buried, of public service connections provided within the contract, whether installed as part of the contract or the appropriate authority, together with the origin and termination, size and materials of services.
- 11.13.3.2 The layout, location and extent of all services showing sizes.
- 11.13.3.3 Location, identification size and details of all apparatus and controls equipment served by, or associated with, each of the various services.

- 11.13.3.4 Fully indicate with accurate dimensions, the sizes and positions of all plant, equipment, conduits, trunking, under floor ducting, cable tray and cable joints together with all inspection points and cable joints. Each service shall be clearly identified.
- 11.13.3.5 The location and identity of each room including spaces housing plant, machinery or apparatus.
- 11.13.3.6 The number, size and services supplied by every cable. Circuit lists and fuse sizes for each distribution board shall be entered into relevant drawings and shall agree with lists fixed within distribution boards. They shall show the position and nature of all earth electrodes installed and the route of the connecting tapes.
- 11.13.3.7 The position of all luminaires with type identification and average levels of illumination in each area.
- 11.13.3.8 Sections, elevations, isometrics and schematics of the plant spaces.
- 11.13.3.9 Control and wiring diagrams incorporating details of each instrument and equipment item with a written description of the sequence of operation of each system. Diagrams shall include full details of internal panel wiring and connections to field mounted items.
- 11.13.3.10 Layout, location and extent of electrical switchgear distribution boards, cables and termination points.
- 11.13.3.11 The complete symbol notation used for all Record Drawings shall be shown on a separate drawing. The symbols used for individual Record Drawings shall be identified on each drawing.
- 11.13.4 The Record Drawings, as described, shall be drawn using the current version of AutoCAD and shall be printed on quality paper using the international A series sizes. Lettering shall be not less than 5mm in height.
- 11.13.5 Each Record Drawing shall show the name of the Contract and, where appropriate, the zone or floor designation. They shall include a description of the drawing, drawing number and scale. The name and address of the Contractor and the Engineer shall be included.
- 11.13.6 Retention will be held, as set out in the Conditions of Contract, until they are completed to the Engineer's satisfaction and handed to the Client. Failure to issue the Record Drawings in time will result in failure to achieve Taking Over.
- 11.14 Instruction of client**
 - 11.14.1 The Clients Representatives shall be fully instructed by experienced personnel in the operation, servicing, and maintenance of the Works. Instruction shall include the provision of such specialist instruction as is required from any suppliers or specialists.

PUBLIC HEALTH SPECIFICATIONS

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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

PUBLIC HEALTH SPECIFICATIONS

1 General

1.1 Introduction

- 1.1.1 The project is the refurbishment of an existing office building located at Pope Hennessy Street Port Louis. The building, of approximately 4,400m², comprises of a basement, ground floor, 1st to 6th floors, and space (technical office and room) at roof level. There is a technical block at ground floor at the back of the building forming part of the main building.
- 1.1.2 Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances and the responsibility to provide a complete installation fit for its purpose-the purpose being an office building.
- 1.1.3 This specification sets out the standards of materials and workmanship for the project. All materials shall comply to the latest issue of the European Standards, or the Standards specified elsewhere in the Sections / Drawings or Bills of Quantities. All electrical equipment used within the contract shall primarily comply to the Requirements of BS 7671 and MS 63.
- 1.1.4 The installation shall include for all aspect of Health and Safety for those who are going to operate and maintain the installation.

1.2 Services description

- 1.2.1 Cold water mains
- 1.2.1.1 The incoming (potable) water to the building shall be connected to the existing plot connection, recessed in a valve box, and containing a smart water meter and pressure reducing valve.
- 1.2.2 Cold water services.
- 1.2.2.1 Distribution pipework on site to the building shall be in pressure rated HDPE PN10 pipe and uPVC PN10 for surface mounted pipes. Connection to sanitary ware shall be in PEX-A pipe cast in slabs running through protection sleeves. The Contractor shall terminate all cold-water services to sanitary wares as required.

- 1.2.2.2 All draw off points to sanitary appliances shall be fitted with flow restrictors to limit flow to 0.15 l/sec to WHB.
- 1.2.3 Drainage – general
 - 1.2.3.1 The building foul drainage system shall be connected to the onsite manholes which shall be connected to the main external wastewater reticulation services.
 - 1.2.3.2 All underground gravity sewer pipes shall be of uPVC SN8 material.
- 1.2.4 Drainage - soil, waste and vent installations
 - 1.2.4.1 A separate soil and waste system shall be installed within the building to serve all sanitary ware. The above ground drainage system shall be installed concealed with rodding eyes provided at strategic location so that potential blockages can be removed and easily accessible for maintenance.
 - 1.2.4.2 All waste pipes from the building shall discharge to the soil network via gully traps on site. All soil, waste and ventilation pipework shall be in uPVC. The in-slab/ concealed pipework shall be in pressure rated uPVC PN10.
 - 1.2.4.3 The sanitary ware shall be provided as per the Architect's schedule. The Contractor shall provide the soil and waste system, as necessary, to serve the sanitary ware provided, including terminating services to the sanitary ware.
 - 1.2.4.4 All waste and soil pipes protruding roof shall terminate with a vent cowl at 900mm AFFL.
 - 1.2.4.5 Jetting and pressure testing of the installation shall be included within this contract, including 'in-slab' drainage.

2 Common Public Health services

2.1 General

2.1.1 Scope

2.1.1.1 This specification covers the standard of materials and workmanship for the Public Health Services installations for the project. Particular specifications shall be described further in the specifications and in the schedules. This specification has to be read in conjunction with the Schedules attached.

2.1.2 Standard references

2.1.2.1 The materials, components and completed installations shall conform as applicable with the following Standards, including all amendments, current at the time of tendering. Construction products should comply with European Standards and Technical Specifications (ESTS). Wherever reference is made to a British Standard a corresponding ESTS (generally ISO series) shall be equally acceptable.

2.1.2.2 Where available all materials, equipment etc forming part, or whole, of the services specified in the Contract, should be obtained from BS EN ISO 9000 "Quality Assurance" certified manufacturers and preferably "kite marked" or EC equivalent.

2.1.2.3 The latest dates and amendments of standard references are given at the time of issue of this Section.

British standards

Pipes

BS 21: 1985	Specification for pipe threads for tubes and fittings where pressure tight joints are made on the threads (metric dimensions).

BS 534: 1990	Specification for steel pipes, joints and specials for water, gas and sewage.

BS 1387 1985	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or screwing to BS 21 pipe threads.

BS 2871	Specification for Copper and Copper Alloys. Tubes.

Part 2: 1972	Tubes for general purposes.

Part 3: 1972	Tubes for heat exchangers.

BS EN 1057: 1996	Copper & Copper Alloys - seamless, round Copper tubes for water and Gas in sanitary and heating installations.
BS 3505: 1986	Specification for unplasticised polyvinyl chloride (PVC-U) pressure pipes for cold potable water.
BS 3600: 1997	Specifications for dimensions and masses per unit length of welded and seamless steel pipes and tubes for pressure purposes.
BS 3601: 1987 (1993)	Specification for carbon steel pipes and tubes with specified room temperature properties for pressure purposes.
BS 4127: 1994	Specification for light gauge stainless steel tubes, primarily for water application.
BS EN 545: 1995	Ductile iron pipes, fittings, accessories and their joints for water pipelines – requirements and test methods.
BS EN 598: 1995	Ductile iron pipes, fittings, accessories and their joints for sewerage applications – requirements and test methods.
BS EN 969	Ductile iron pipes, fittings, accessories and their joints for gas pipelines – requirements and test methods.
BS 5391:	Specification for acrylonitrile-butadiene-styrene (ABS) pressure pipe.
Part 1: 1976	Pipe for industrial uses.
BS 5556: 1978 (1986)	Specification for general requirements for dimensions and pressure ratings for pipe of thermoplastics materials (metric series).
BS 6572: 1985	Specification for blue polyethylene pipes up to nominal size 63 for below ground use for potable water.
Flanges	
BS 1560:	Circular flanges for pipes, valves and fittings (class designated).
Part 3	Steel, Cast Iron and Copper Alloy flanges.
Section 3.1: 1989	Specification for Steel flanges.

Section 3.3: 1989	Specification for Copper Alloy and composite flanges.
BS 4190: 1967	Specification for ISO metric black OBSOLESCE hexagon bolts, screws and nuts.
BS 4320: 1968	Specification for metal washers for general engineering purposes. Metric series.
BS 4504	Circular flanges for pipes, valves and fittings. (PN designated.)
Part 3:	Steel, Cast Iron and Copper Alloy flanges.
Section 3.1: 1989	Specification for Steel flanges.
Section 3.3: 1989	Specification for Copper Alloy and composite flanges.
Fittings	
BS 143 & BS 1256:1986	Specification for malleable Cast Iron and Cast Copper Alloy threaded pipe fittings. Partially replaced by BS EN 10242: 1995 but remains current.
BS 864:	Capillary and compression tube fittings of Copper and Copper Alloy.
Part 2: 1983	Specification for capillary and compression fittings for Copper tubes.
BS 1042:	Measurement of fluid flow in closed conduits.
Part 1:	Pressure differential devices.
BS EN ISO 5167-1: 1997	Specification for square-edged orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full.
BS 1740:	Specification for wrought steel pipe fittings (screwed BS 21 R-series thread).
Part 1: 1971	Metric units.
BS 1965:	Specification for butt-welding pipe fittings for pressure purposes.
Part 1: 1963	Carbon Steel.

BS 4346:	Joints and fittings for use with unplasticised PVC pressure pipes.
Part 1: 1969	Injection moulded plasticised PVC fittings for solvent welding, for use with pressure pipes, including potable water supply.
Part 2: 1970	Mechanical joints and fittings principally of unplasticised PVC.
BS 4368:	Compression couplings for tubes.
Part 3: (1984)	Specifications for light series couplings (metric).
Part 4: 1984	Specification for type test requirements.
BS 5114: 1975	Specification for performance requirements for joints and compression fittings for use with polyethylene pipes.
BS 5245: 1975	Specification for phosphoric acid based flux for soft soldered joints in Stainless Steel.
BS 5392:	Specification for acrylonitrile-butadiene-styrene (ABS) fittings for use with ABS pressure pipe.
Part 1: 1976	Fittings for use with pipe for industrial uses.
Jointing	
BS EN 29453: 1994	Soft solder alloys. Chemical compositions and forms.
BS 1723:	Brazing.
Part 1: 1986	Specification for brazing.
Part 2: 1986	Guide to brazing.
Part 3: 1988	Methods for non-destructive and destructive testing.
Part 4: 1988	Methods for specifying brazing procedure and operator approval testing.
BS 1845: 1984	Specification for filler metals for brazing.
BS 2494: 1990	Specification for elastomeric seals for joints in pipework and pipelines.
BS 2789: 1985	Specification for spheroidal graphite or nodular graphite cast iron.

BS 4346:	Joints and fittings for use with unplasticised PVC pressure pipes.
Part 3: 1982	Specification for solvent cement.
BS 7668: 1994	Specification for weldable structural steel. hot finished structural hollow sections in weather resistant Steels.
BS EN 10029: 1991	Specification for tolerances on dimensions, shape and mass for hot rolled Steel plates 3mm thick or above.
BS EN 10113: 1993	Hot-rolled products in weldable fine grain structural Steels.
10113-1	General delivery conditions.
10113-2	General delivery conditions for normalized rolled Steels.
10113-3	Delivery conditions for thermomechanical rolled Steels.
BS EN 10137:1996	Plates and wide flats made of high yield strength structural Steels in the quenched and tempered or precipitation hardened conditions.
EN 10137-1	General delivery conditions.
EN 10137-2	Delivery conditions for quenched and tempered Steel.
EN 10137-3	Delivery conditions for precipitation hardened Steels.
BS EN 10155: 1993	Structural Steels with improved atmospheric corrosion resistance. Technical delivery conditions.
BS EN 10210: 1994	Hot finished structural hollowsections of non-alloy and fine grain structural Steels.
BS EN 10210-1	Technical delivery requirements.
BS EN 1514	Flanges and their joints – Dimensions of gaskets for PN designated flanges.
EN 1514-1:1997	Non metallic flat gaskets with or without inserts.
EN 1514-2:1997	Spiral wound gaskets for use with Steel flanges.

BS 5245: 1975 (1990)	Specification for phosphoric acid based flux for soft soldered joints in Stainless Steel.
BS 5292: 1980	Specification for jointing materials and compounds OBSOLESCE for Installations using water, low pressure steam or 1st, 2nd and 3rd family gases. (partially superseded by BS 6956 Parts 1, 5, 6 and 7)
BS EN ISO 9000:	Quality systems
BS 6681: 1986	Specification for malleable Cast Iron.
BS EN 10025: 1993	Hot rolled products of non-alloy structural Steels. Technical delivery conditions.
BS 7786: 1995	Unsintered PTFE tape. General requirements.
Safety Valves	
BS 6759	Safety Valves.
Part 1: 1984	Specification for safety valves for steam and hot water.
Part 2: 1984	Specifications for safety valves for compressed air or Inert gases.
Part 3: 1984	Specification for safety valves for process fluids.
Valves and Gauges	
BS 1010	Specification for draw-off taps and stop valves for water services (screw down pattern).
Part 2: 1973	Draw-off taps and above ground stop-valves.
BS 1552: 1995	Specification for open bottomed taper plug valves for 1st, 2nd and 3rd family gases up to 200 mbar.
BS 1780: 1985	Specification for bourdon tube pressure and vacuum gauges.
BS 2879: 1980	Specification for draining taps (screwdown pattern).
BS 5150: 1990	Specification for Cast Iron gate valves.

BS 5151: 1974	Specification for Cast Iron Gate (Parallel Slide) valves for general purposes.
BS 5152: 1974	Specification for Cast Iron globe and globe stop and check valves for general purposes.
BS 5153: 1974	Specification for Cast Iron check valves for general purposes.
BS 5154: 1991	Specification for Copper Alloy globe, globe stop and check, check and gate valves.
BS 5155: 1984	Specification for butterfly valves.
BS 5156: 1985	Specification for diaphragm valves.
BS 5157: 1989	Specification for Steel Gate (parallel slide) valves.
BS 5158: 1989	Specification for Cast Iron plug valves.
BS 5159: 1974	Specification for Cast Iron and Carbon Steel ball valves for general purposes.
BS 5163: 1986	Specification for predominantly key-operated cast iron gate valves for water work purposes.
BS 5235: 1975	Specification for dial-type expansion thermometers.
BS 5433: 1976	Specification for underground stop-valves for water services.
BS 7350: 1990	Specification for double regulating globe valves and flow measurement devices for heating and chilled water systems.
Pipe Supports	
BS 1494	Specification for fixing accessories for building purposes.
Part 1: 1964	Fixings for sheet, roof and wall coverings.
BS 3974	Specification for pipe supports.
Part 1:	Pipe hangers, slider and roller type supports.
Part 2:	Pipe clamps, cages, cantilevers and attachments to beams.

Miscellaneous

BS 12: 1996	Specification for Portland cement.
BS 729: 1971	Specification for hot dip galvanised coatings on Iron and steel articles.
BS 1710: 1984	Specification for identification of pipelines and services.
BS 3059	Steel boiler and superheater tubes.
Part 2: 1990	Specification for carbon, alloy and austenitic Stainless Steel tubes with specified elevated temperature properties.
BS 3382	Specification for electroplated coatings on threaded components.
Parts 1 & 2: 1961	Cadmium on Steel components. Zinc on Steel components.
BS 3416: 1991	Specification for bitumen based coatings for cold application, suitable for use in contact with potable water.
BS 4027: 1996	Specification for sulphate-resisting Portland cement.
BS 4147: 1980	Specification for bitumen based hot-applied coating materials for protecting Iron and Steel, including suitable primers where required.
BS 4800: 1989	Schedule of paint colours for building purposes.
BS 5493: 1977	Code of practice for protective coating of Iron and Steel structures against corrosion.
BS 5834	Surface boxes, guards and underground chambers for gas and water works purposes.
Part 1: 1985	Specification for guards, including foundation units.
Part 2: 1983	Specification for small surface boxes.
Part 3: 1985	Specification for large surface boxes.
Part 4: 1989	Specification for preformed chambers.

BS 6129	Code of practice for the selection and application of bellows expansion joints for use in pressure systems.
Part 1: 1981	Metallic bellows expansion joints.
BS 6281	Devices without moving parts for the prevention of contamination of water by backflow.
Part 1: 1992	Specification for Type A air gaps.
Part 2: 1982	Specification for Type B air gaps.
Part 3: 1982	Specification for pipe inter-rupters of nominal size up to and including DN42.
BS 6282	Devices with moving parts for the prevention of contamination of water by backflow.
Part 1: 1982	Specification for check valves of nominal size up to and including DN54.
Part 2: 1982	Specification for terminal anti-vacuum valves of nominal size up to and including DN54.
Part 3: 1982	Specification for in-line anti-vacuum valves of nominal size up to and including DN42.
Part 4: 1982	Specification for combined check and anti-vacuum valves of nominal size up to and including DN42.
BS 6700: 1997	Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their cartilages.
BS 7671: 1992	Requirements for electrical installations IEE Wiring Regulations. Sixteenth Edition.
Code of Practice	
BS 1306: 1975	Specification for copper and copper alloy pressure piping systems.
BS 806: 1993	Specification for design and construction of ferrous piping installations for and in connection with land boilers.
BS 5410	Code of practice for oil firing.

Part 2: 1978	Installations of 44 kW and above output capacity for space heating, water and steam supply purposes.
CP 312	Code of practice for plastics pipework (thermoplastics material).
Part 1: 1973	General principles and choice of material.
Part 2: 1973	Unplasticised PVC pipework for the conveyance of liquids under pressure.
Part 3: 1973	Polyethylene pipes for conveyance of liquids under pressure.
BS 6880	Code of practice for low temperature hot water heating systems of output greater than \45kW.
Part 1: 1988	Fundamental and design considerations.
Part 2: 1988	Selection of equipment.
Part 3: 1988	Installation, commissioning and maintenance.
CP 342	Code of practice for centralised hot water supply.
Part 2: 1974	Buildings other than individual dwellings.
BS 8313: 1997	Code of practice for accommodation of building services in ducts.
BS 8010	Code of practice for pipelines.
Part 2:	Pipelines on land: design, construction and installation.
Section 2.1: 1987	Ductile iron.
Welding	
BS 639: 1986	Withdrawn and replaced by:
BS EN 499: 1995	Welding consumables. Covered electrodes for manual metal arc welding for non-alloy and fine grain.

Steels. Classification.

BS 1453: 1972	Specification for filler materials for gas welding.
BS 2640: 1982	Specification for Class II oxy acetylene welding of carbon steel pipework for carrying fluids.
BS 2910: 1986	Methods for radiographic examination of fusion welded circumferential butt-joints in steel pipes. Replaced by BS EN 1435: 1997.
BS 2971: 1991	Specification for Class II arc welding of carbon steel pipework for carrying fluids.
BS 3923	Methods for ultrasonic examination of welds.
Part 1: 1986	Methods for manual examination of fusion welds in ferritic steels.
Part 2: 1972	Automatic examination of fusion welded butt joints in ferritic steels.
BS 4872	Specification for approval testing of welders when welding procedure approval is not required.
Part 1: 1982	Fusion welding of steel.
BS EN 970: 1997	No-destructive examination of fusion welds – visual examination.
HVCA – Code of Practice – TR/5 Welding of Carbon Steel Pipework (1990)	
HVCA – Code of Practice – TR/3 Jointing of Copper and its Alloys (1990)	

STATUTORY REQUIREMENTS

Electricity Act
Health and Safety Act
Building Regulations

OTHER EUROPEAN STANDARDS

BS EN ISO 9002: 1994	Quality Systems – Model for Quality Assurance in Design/Development, Production, Installation and Servicing (for designers of systems)
DIN 2391	Seamless steel precision tube cold drawn or cold rolled

DIN 2393	Welded steel precision tubes
DIN 2394	Welded and sized precision tubes

2.2 Pipework installation

2.2.1 Quality of installation

- 2.2.1.1 Installations shall be to specification and comprise new materials assembled to a high standard of workmanship under the supervision of qualified personnel. Sub-standard work will not be accepted and the following clauses list examples of materials and work that will be rejected:-
- 2.2.1.2 The use of damaged parts, incorrect types, standard, sizes, materials, markings, etc.
- 2.2.1.3 Carbonaceous residues left in the bores of copper pipes by the manufacturer.
- 2.2.1.4 Damage to parts by tools, soldering, brazing, welding, etc.
- 2.2.1.5 The use of long screws, back-nuts or reducing bushes.
- 2.2.1.6 Pipes not cut clean and square with the axis or removed of burrs, or pipes cut with bevel wheel cutters.
- 2.2.1.7 Pipes or fittings with broken or damaged threads and more than 3 threads extending beyond fittings when screwed up.
- 2.2.1.8 Joints misaligned or distorted and not true with pipe axis.
- 2.2.1.9 Pipework runs without the required gradient.
- 2.2.1.10 Pipes supported from other pipes or not capable of individual removal without disturbing other pipes.
- 2.2.1.11 Misaligned or distorted supports, fixings and pipework.
- 2.2.1.12 Insecure supports or restrictive of proper expansion, contraction, or lateral movement as required for the pipeline, or branch pipes used as supports for risers.
- 2.2.1.13 Pipes supported on the sleeve of fire stopping, or the fire stopping not fitted correctly or to the required Fire Authority standard.
- 2.2.1.14 Bores of pipes and fittings which are blocked or contaminated by foreign matter.
- 2.2.1.15 Eccentric fittings assembled the wrong way up-the taper should rise in the direction of flow.
- 2.2.1.16 Valves difficult for access for operation or maintenance.
- 2.2.1.17 Any items not installed to manufacturers recommendations.

- 2.2.1.18 Disregard of requirements for preservation of water quality including use of pastes, compounds, greases or lubricants, on joint faces of hot and cold water services.
- 2.2.1.19 Inadequate protection against electrolytic action.
- 2.2.1.20 Other faults may also apply including any disclosed by weld inspections, testing and commissioning.
- 2.2.2 Pipe ends and cutting
 - 2.2.2.1 Pipes shall be cut clean and square with the axis by machine, pipe cutter or saw as appropriate to materials, but not by flame cutting or bevel wheel cutter.
 - 2.2.2.2 Pipes shall be prepared for capillary fittings on copper and stainless steel pipes by deburring and re-rounding.
 - 2.2.2.3 Pipes shall be prepared for threading of steel pipes by removing burrs.
 - 2.2.2.4 Pipes shall be prepared for butt welded steel pipelines by machining bevels and removing burrs.
 - 2.2.2.5 Pipes shall be prepared on plastic pipelines in accordance with the manufacturer's instructions, to suit solvent or heat fusion techniques for jointing.
- 2.2.3 Screwed threads
 - 2.2.3.1 Screw threads shall be to BS 21 taper on pipes and adaptors. They shall be cut clean, concentric and unbroken with all oil, swarf, etc removed.
 - 2.2.3.2 Shall be provided by means of capillary screwed adaptors on copper or stainless steel pipes with a limit of 2" BSP maximum.
 - 2.2.3.3 Shall be painted on the exposed threads of mild steel pipes immediately the fitting has been screwed on.
 - 2.2.3.4 Shall be on hot and cold water services, made pressure tight by means of ptfе tape only and without the use of pastes, hemp or similar materials.
- 2.2.4 Thread sealants
 - 2.2.4.1 For Hot and Cold Water Services:-
 - Shall be approved to Water Research Centre tests UK as suitable for potable water and proof against bacterial growth, i.e. ptfе unsintered tape applied with 50% overlap to BS 7786 for threads 2" BSP and below, or jointing materials to BS 5292 (Obsolescent) and BS 6956 parts 1,5,6 & 7.

- 2.2.4.2 For Other Services:-
- Shall comprise PTFE tape as CWS for steam 1½" BSP and below, or 2"BSP and below for other services.
 - Shall consist of proprietary brands of sealants or compounds for threads 2½" BSP and above such as galvanised flanges if PTFE is not suitable.
- 2.2.5 Pipe unions, flanges and gaskets
- 2.2.5.1 Unions shall be limited to 2" BSP maximum size, or less if otherwise specified by the Engineer.
- 2.2.5.2 Unions shall be assembled without the use of pastes or lubricants on the joint faces when used on hot and cold water services.
- 2.2.5.3 Flanges shall be provided on pipes 65mm diameter and above and on smaller pipes where specified in drawings, to suit particular requirements.
- 2.2.5.4 Flanges shall be metric sizes to details given on the pipework materials tables.
- 2.2.5.5 Flanges shall be screwed or welded true and square with pipe axis on steel and ductile iron pipes and have raised joint faces with continuous spiral grooved finish.
- 2.2.5.6 Flanges shall be composite type on copper or stainless steel pipes with manufacturer's standard finish on joint face.
- 2.2.5.7 Flanges shall be composite type on plastic pipework, solvent or heat welded on as appropriate.
- 2.2.5.8 Gaskets shall be free of asbestos materials.
- 2.2.5.9 Gaskets shall be metric sizes to suit the flanges.
- 2.2.5.10 Gaskets shall be as recommended by the manufacturer to suit the service conditions and flange finish, to provide an effective seal without the use of jointing compounds.
- 2.2.5.11 Gaskets shall be provided with non-stick surfaces where flanged joints are required to be easily opened.
- 2.2.5.12 Gaskets shall be ethylene propylene synthetic rubber, approved by the Water Research Centre (UK) as suitable for potable water and proof against bacterial growth, where used on hot and cold water services.
- 2.2.5.13 Gaskets shall be assembled without the use of pastes and compounds particularly on hot and cold water services.

- 2.2.6 Pipe runs, gradients, break points
- 2.2.6.1 Pipes shall be generally parallel with walls on horizontal runs and set neatly round piers and projections where a good appearance is required.
- 2.2.6.2 Pipes shall be set plumb and without offsets on vertical runs.
- 2.2.6.3 Pipes shall be arranged without joints where pipes pass through the thickness of walls, floors and structures.
- 2.2.6.4 Pipes shall be arranged with adequate clearance of walls and ceilings to allow easy access to valves.
- 2.2.7 Gradients
- 2.2.7.1 Provided with the following break points :-
- Unions on pipes 50mm diameter and below (except refrigeration)
 - Break points shall be provided at each branch from headers, mains and risers, at connections to plant and equipment, at 18m intervals for unions and 10m for flanges.
- 2.2.8 Open ends of pipework
- 2.2.8.1 Shall be temporarily sealed by the use of purpose made plugs, blanking caps, or blank flanges during pipework erection including valves at the end of pipework runs which shall be closed and sealed.
- 2.2.9 Pipework clearances and segregation

Pipework clearances and segregation	
Ceilings	100mm
Finished Floors	150mm
Adjacent pipes, both insulated	25mm
Adjacent pipes, both uninsulated	25mm
Adjacent pipes, one only insulated	75mm
Insulated pipes adjacent to conduit or trunking	100mm
Uninsulated pipes adjacent to conduit or trunking	150mm
Uninsulated pipes adjacent to electrical cables not in conduit or trunking	150mm
Insulated pipes adjacent to electrical cables not in conduit or trunking	100mm

- 2.2.9.1 Minimum clearance between uninsulated pipes, finished face of insulation on pipes and adjacent surfaces shall be as follows:
- 2.2.9.2 The spacing of services shall provide for:
- The application of thermal insulation and valve and flange boxes.
 - Increased spacings to accommodate pipeline fittings.
 - To pipes and electrical services for ease of installation, maintenance and inspection.
 - Layout and segregation of services to be in accordance with BS 8313.
 - Cold water pipes to be spaced from hot pipes to minimise heat gain.
- 2.2.10 Sleeves and cover plates
- 2.2.10.1 Sleeves shall be provided for pipes passing through walls, floors and partitions of similar material to pipe and copper or steel, for plastic pipes.
- 2.2.10.2 Sleeves shall be generally one or two sizes larger than pipe as necessary and positioned true with pipe to provide adequate clearance and allow for lateral movements of pipeline if required.
- 2.2.10.3 Sleeves shall be built in by others after correct positioning around the pipe.
- 2.2.10.4 Sleeves shall be finished flush with finished face of wall, floor and ceilings.
- 2.2.10.5 Sleeves shall be project 75mm above floors in wet areas with the gap sealed with waterproof mastic.
- 2.2.10.6 Sleeves shall be supplied with lugs to locate in floors and ceilings.
- 2.2.10.7 Sleeves shall be fire-stopped in gap between pipe and sleeve in all fire rated structures to Building Regulations Approved Document B - Fire Spread, using asbestos-free material approved by the Fire Authority, without restricting pipework movement.
- 2.2.10.8 Sleeves shall have thermal insulation sections stopped short each side.
- 2.2.10.9 Sleeves shall have caulked in gap between pipe and sleeve in external walls using asbestos-free, weather and vermin proof material.
- 2.2.10.10 Sleeves shall be oversize if insulation is to be carried through non-fire rated wall or partition as shown on the drawings.
- 2.2.10.11 Cover plates shall be according to installation materials.

- 2.2.11 Pipe fittings
- 2.2.11.1 Shall be low resistance type bends, sweep tees, etc. Fittings shall be square type only on final draw off pipe runs and if necessary, to facilitate venting and draining, or at steam trap sets for venting, draining or relaying.
- 2.2.11.2 Shall be eccentric pattern on horizontal pipes at changes of diameter to facilitate venting and draining, with the taper of the fitting to rise in the direction of flow.
- 2.2.12 Draining and venting
- 2.2.12.1 Draining taps shall be provided at all low points in water systems to facilitate complete and rapid emptying down and at branch valves immediately downstream to facilitate maintenance on the branch.
- 2.2.12.2 Draining taps shall be Drain cocks on systems containing glycol shall have warning notices affixed prohibiting drainage direct to mains drains loose key operated to BS 2879 lock shield pattern of chromium plated finish, where fitted, to chromium plated tube.
- 2.2.12.3 Draining taps shall be supplied with three loose keys for each size of drain cock fitted.
- 2.2.12.4 Air vents shall be provided at all high points in water systems to facilitate complete removal of air.
- 2.2.12.5 Air vents shall be automatically operated unless specified.
- 2.2.12.6 Air vents shall be as indicated on the drawings.
- 2.2.12.7 Air vents shall be run and discharge to a convenient position as indicated on the drawings or to the nearest drain system.
- 2.2.12.8 Automatic air eliminators shall be fitted to an equal square tee on the main, together with the necessary reducers.
- 2.2.12.9 Automatic air eliminators shall be of non-ferrous metal with non-corrodible ball valve and seat.
- 2.2.12.10 Automatic air eliminators shall from the outlet have a male or female iron to copper union adaptor with an 8mm copper bleed pipe to BS EN 1057, R250/R220, arranged to discharge in a convenient position as indicated on the drawings.

- 2.2.13 Inaccessible or concealed pipe joints within buildings
- 2.2.13.1 Pipe joints which will unavoidably be built-over or otherwise be difficult for access to be of the welded or capillary type only and satisfactorily tested before concealment.
- 2.2.14 Flange bolts, nuts and washers
- 2.2.14.1 Shall be of forged steel 400N/mm² tensile minimum to BS 4504: BS 4320: and be cadmium plated to BS 3382, Part 1 & Part 2.
- 2.2.14.2 Shall be faced under the head, machined on the shank and screwed ISO metric coarse in the case of bolts.
- 2.2.14.3 Shall be faced on one side in the case of nuts.
- 2.2.14.4 Shall be faced on both sides in the case of washers and fitted under both bolt head and nut.
- 2.2.15 Pipe supports
- 2.2.15.1 Shall be generally to the following standards with fixings to Part B.01 Appendix II as appropriate:-
- Shall be BS 1494 Part 1, for pipe clips, brackets etc.
 - Shall be BS 3974, Part 1 for hangers, sliders and rollers.
 - Shall be BS 3974, Part 2 for clamps, cages, cantilevers and beam attachments.
 - Shall be as detailed on the drawings and fastened only to the building structure at the specified positions. They shall be proprietary support systems hot dipped galvanised and from a reputed manufacturer like Mupro or Caddy.
 - Shall be arranged to support each pipe run independently of others, to permit differential expansion and maintenance without disturbing adjacent pipes.
 - Shall be installed so that pipes may expand and contract freely within the design figure and in the intended direction without overstressing pipes, joints or connections to equipment.
 - Shall be provided at base of vertical pipes, bends, tees, flanges, unions, and changes of direction, each side of valves, in conjunction with the normally spaced supports on horizontal and vertical runs.
 - Shall be fabricated from standard hot dipped galvanised mild steel rolled sections, or alternatively proprietary sections if specified in drawings, where built into walls or floors of ducts and subways.
 - Shall be provided oversize with load bearing insulation incorporated as specified in drawings for installation as the pipework is erected on the following services:-
 - o Steam, condensate, M & HTHW pipes, of all sizes.
 - o Chilled water pipes and refrigeration pipes of all sizes.

- o Cold water pipes if the thermal insulation is vapour sealed.

2.2.16 Spacing of supports

TABLE OF MAXIMUM SPACINGS FOR PIPEWORK SUPPORTS

Horizontal Spacings - Metres				Vertical Spacings - Metres		
Nominal Pipe Size mm	Steel or Iron Pipes	PVC or ABS Pipes	Copper or Stainless Steel Pipes	Steel or Iron Pipes	PVC or ABS Pipes	Copper or Stainless Steel Pipes
15	1.8	0.8	1.2	2.4	1.2	1.8
20	2.4	0.8	1.2	3.0	1.2	1.8
25	2.4	0.9	1.5	3.0	1.3	2.4
32	2.4	1.0	1.8	3.0	1.5	3
40	2.4	1.1	1.8	3.7	1.6	3
50	2.4		1.8	3.7		3
65	3		2.4	4.6		3.7
80	3		2.4	4.6		3.7
100	3		2.4	4.6		3.7
125	3.7		3.0	5.5		3.7
150	4.5		3.7	5.5		3.7
200	6		-	8.5		-

2.2.17 Electrolytic action

- 2.2.17.1 Shall be prevented by ensuring that dissimilar metals are not in contact where the presence of water or moisture could promote electrolytic action.
- 2.2.17.2 Shall be prevented where copper pipes connect to ferrous cisterns or equipment, whether galvanised or not, by means of approved fibre washers or gaskets, as specified in C07: Heating, hot and cold water systems equipment.
- 2.2.17.3 Shall be prevented by avoiding the need to join copper pipes to steel pipes.
- 2.2.17.4 Shall be prevented by using pipe supports as under:-
- Galvanised malleable iron or steel for steel or iron pipes.
 - Brass or gunmetal for copper, stainless steel or plastic pipes.

2.2.18 Compression unions

- 2.2.18.1 Shall be of the single ferrule type and permit a butt flat face to face connection between the body of the union and ferrule.

- 2.2.18.2 Shall be such that the seal between the union and the ferrule is metal to metal, no washers, gaskets, jointing compound or similar material will be accepted.
- 2.2.18.3 Shall be installed such that the pipework does not protrude through the ferrule into the body of the union.
- 2.2.18.4 Shall provide for the attachment of the ferrule to the pipe to be such that the pipe is "necked" rather than being cut or notched by the ferrule.
- 2.2.18.5 Shall be generally complying with the performance requirements of BS 4368.

- 2.2.19 Pipework miscellaneous
- 2.2.20 Expansion devices
- 2.2.21 Shall be fitted where expansion cannot be accommodated by natural offsets and changes of direction.
 - 2.2.21.1 Shall in the case of expansion bellows, comply with BS 6129 Part 1, be installed strictly to the manufacturer's instructions including the provision of associated guides and anchors, which are approved by the bellows manufacturer.
 - 2.2.21.2 Shall in the case of expansion loops, be manufactured from the same material as the pipe with additional thickness to allow for bending without undue thinning and formed in one length with ends flanged.
 - 2.2.21.3 Shall be marked with a suitable plate giving manufacturers name and detail, maximum working pressure, direction of flow, maximum and minimum working lengths and amount of cold draw.

- 2.2.22 Cold draw
 - 2.2.22.1 Shall be applied by means of flanges secured to the ends to be pulled together and long high tensile steel bolts and nuts.
 - 2.2.22.2 Shall be checked to the design figure for correct gap plus allowance for gasket thickness before final pull is made.
 - 2.2.22.3 Shall be changed to standard bolting when gap is closed.

- 2.2.23 Anchors
 - 2.2.23.1 Shall be generally to BS 3974 Part 1 and BS 3974 Part 2 with steel brackets rigidly attached to the building structure or concrete blocks as shown on the drawings.
 - 2.2.23.2 Shall be suitable for test pressure loading.

- 2.2.23.3 Shall be positioned not nearer than 600mm to welded joints on steel pipes and secured so that the pipe is not deformed or overstressed by clamps, or where welded or brazed attachments are made, which shall be inspected and passed.
- 2.2.23.4 Shall be provided at stop ends, bends, junctions, valves and gradients steeper than 1 in 6. For buried mains of the non self anchoring type.
- 2.2.23.5 Shall be provided on polyethylene buried mains as above and at mechanical joints where these are not designed to take end loads.
- 2.2.24 Guides
- 2.2.24.1 Shall be incorporated at all roller and slider supports.
- 2.2.24.2 Shall be provided at expansion joints as recommended and be capable of adjustment to give correct alignment of the pipework and device before being rigidly fixed.
- 2.2.25 Buried pipework
- 2.2.25.1 Shall in the case of cold water pipes be copper, polyethylene, buried at a depth of between 1000mm to 1350mm to top of pipe to suit local conditions and requirements of Central Water Authority.
- 2.2.25.2 Shall in the case of gas services, be in accordance with the recommendations of Local Gas Suppliers, and not less than 600mm, depth.
- 2.2.25.3 Shall throughout the length of either service, be laid on a bed of well rammed clean sand at least 100mm thick to underside and sides the trench sides to be clear of rocks or any other protruding debris.
- 2.2.25.4 Shall alternatively for ductile iron pipes, be laid on a bed of similar thickness of graded granular material to DOE Guidance Sheet No 4.08, or on a bed of weak cement sand mix, particularly on steep gradients.
- 2.2.25.5 Shall be finally backfilled with not less than 100mm thickness of the bedding material well rammed down on pipe before levelling off with soil free of rocks or other harmful debris. The work to be inspected before backfilling is commenced.
- 2.2.25.6 Shall be protected against possible damage by any future excavation work by the use of proprietary plastic warning marker tapes or 150mm wide mesh laid along the pipe run during backfilling and positioned between 150mm to 225mm below ground level, the tape or mesh to have a stainless steel wire for pipe detection on plastic systems.
- 2.2.25.7 Shall in the case of mains associated with fire fighting services, be governed also by any particular requirements of the Government Fire services.

- 2.2.26 Markers for buried pipework
- 2.2.26.1 Shall be provided at 50m intervals along the pipe run on straight sections and at all changes of direction and each side of roadways.
- 2.2.26.2 Shall consist of 200mm x 200mm x 50mm formed of reinforced concrete, bearing non-corrodible and durable plates having permanent letters and numbers stamped or cast on stating:-
- pipe size in mm - e.g. 200 -and include direction
 - service - e.g. CWS - arrows where this is necessary
 - depth of service in mm - e.g. 900 - to indicate pipe run direction
- 2.2.26.3 Shall be secured to raise concrete marker posts in unmade ground and to flush concrete blocks in lawns, verges or pavements.
- 2.2.26.4 Shall be attached to buildings at the point of entry.
- 2.2.26.5 Shall state distance from plate to service in the case of services running parallel to buildings.
- 2.2.26.6 Shall be located at valve positions and comprise of raised letters cast on the exterior surface of the box cover to indicate type of service, with separate marker plate to indicate the valve function.
- 2.2.27 Testing
- 2.2.28 General
- All individual parts forming the pipework circuit shall have been pressure tested by the manufacturers to British Standard or other recognised standards and certificates of soundness provided.
 - The installation shall then be pressure tested to prove soundness of joints and of the parts as installed.
 - When air pressure tests are conducted or gas pipework is purged with gas the area shall be cleared of personnel.
- 2.2.29 Flushing out and draining
- 2.2.29.1 Shall be undertaken before pressure tests are conducted and carried out using water or air as appropriate, with parts that will restrict flow or sustain damage removed.
- 2.2.29.2 Shall be witnessed to demonstrate that there are no blockages and that no foreign matter remains.

- 2.2.29.3 Shall be undertaken again when water is drained off or air released after pressure testing to establish that the systems are still clean. On completion, all strainer cages shall be removed and cleaned and all dirt pockets opened up and cleaned.
- 2.2.29.4 Shall be arranged so that water systems are left dry after testing until setting-to-work and air systems left charged with reduced pressure air, monitored by a gauge to show any damage by other trades up to handover.
- 2.2.30 Filling
- 2.2.30.1 Shall be carefully controlled in the case of hydraulically tested systems, to ensure that water hammer does not occur and demonstrated to show that all air has been vented off and the system is full and ready for testing.
- 2.2.30.2 Shall be similarly controlled when systems are re-filled for regulating, balancing, setting-to-work etc.
- 2.2.31 Pressure tests
- 2.2.31.1 Shall be to the pressures as detailed in the appropriate pipework service elements of this specification.
- 2.2.31.2 Shall be carried out in stages if advantageous and finally on the whole of each completed circuit or system.
- 2.2.31.3 Shall be undertaken before pipework is concealed by structures, covers, partitions, ceilings, insulation, backfilling over joints, final painting etc and when there is no danger of the water tested systems freezing.
- 2.2.31.4 Shall be carried out with all parts not designed to withstand the test pressure, removed or blanked off and the pipeline suitably anchored to withstand test pressure load.
- 2.2.31.5 Shall be witnessed and test certificates signed when the test is satisfactory.
- 2.2.32 Provision for testing, commissioning, instruments and controls
- 2.2.32.1 Shall require all necessary connection points to be included as the pipework is erected.
- 2.2.32.2 Shall require the positions to be shown on the drawings and details agreed with the commissioning engineer or adviser, including positions of regulating valves and metering station.
- 2.2.32.3 Shall require test plugs to be of the self-sealing type with brass bodies having captive blank closing caps screwed on.

- 2.2.32.4 Shall require thermometer pockets to be to BS 2765, Part 1, Part 2 and of brass (non-dezincifiable material on hot and cold water services) screwed BSP thread and filled with heat conducting grease.
- 2.2.32.5 Shall require connection points for chemical dosing to be included where shown.
- 2.2.32.6 Shall require suitable bosses welded or brazed on to the pipes and screwed to suit pockets, gauges, sensors, etc to details shown on the drawings.
- 2.2.32.7 Shall require to fit all such controls or test equipment to the pockets/bosses.
- 2.2.32.8 Shall require all work involved in attaching the bosses and drilling and screwing to be done before the pipework length is installed, so that all oil, swarf, etc can be completely removed.
- 2.2.32.9 Shall require orifice plates to be to BS EN ISO 5167-1 and made of copper alloy or stainless steel as appropriate.
- 2.2.32.10 Shall require test and purge points on Natural Gas pipework to be provided in accordance with BGC standards IM/2 and IM/5.
- 2.2.33 Painting
 - 2.2.33.1 Shall require protection of iron and steel structures in accordance with BS 5493.
 - 2.2.33.2 Shall require all pipework, valves, and fittings, to be supplied with manufacturer's standard finish or protective coating.
 - 2.2.33.3 Shall require all fabricated steelwork and steel pipework other than galvanised to be thoroughly cleaned of all scale, corrosion, grease, etc, after erection and painted with corrosion resistant lead, copper, zinc, tin or aluminium free paint or coating suitable for service conditions.
- 2.2.34 Service identification
 - 2.2.34.1 Shall require all services to be identified and labelled according to BS 1710.
 - 2.2.34.2 Shall require all valves for the reclaimed water pipes to have labels attached as per WRAS requirements.
 - 2.2.34.3 Shall require the approval of the Engineer before notices and labels are manufactured and attached.
- 2.2.35 Protection of services
 - 2.2.35.1 Shall be ensured by internal pipework services not being installed until the building envelope is reasonably watertight / weatherproof in order to protect the services from corrosion.

2.3 Welding of low carbon steel pipework

2.3.1 General

2.3.1.1 The inspection, testing and approval of the welders and the welding of low carbon steel pipework must be carried out by an independent inspecting authority. The contractor shall ensure that all welders possess a competency certificate for welding issued by a reputed institution and welders must have at least 5 years of experience. These certificates shall be issued to the Engineer for verifications prior to appointment of welders on site.

2.3.1.2 Oxy-acetylene welding will not be accepted for pipework above 100mm diameter or pipe flanges of any size.

2.3.1.3 Welding shall be in accordance with the recommendations in HVCA Code of Practice TR/5 for pipe not exceeding 200mm size and 20mm wall thickness.

2.3.1.4 Welding shall be to Class II by electric arc process to BS 2971 using welding materials to BS EN 499 for pipe exceeding 200mm size and 20mm wall thickness. BS 2460, (withdrawn and replaced by BS 1709).

OR

2.3.1.5 Welding shall to class II by oxy-acetylene process using welding materials to BS 1453.

2.3.1.6 Welding shall be utilised for all joints on steam, condensate, steel chilled water, and LPHW services located in boiler houses, plantrooms, tank rooms, ducts and concealed spaces together with services run externally or in ceiling voids.

2.3.2 Competency of welders and test welds

2.3.2.1 Welders shall be supervised by the Contractor's qualified welding supervisor.

2.3.2.2 Welders shall have their names and certificate numbers submitted on a list by the Contractor and produce their certificates for inspection by the Engineer before welding commences.

2.3.2.3 Welders shall only be employed on the work on or off site provided that they hold a currently valid Certificate of Competency for Oxy-Acetylene welding Grade 'A' or Metal Arc welding as appropriate to the work in hand or alternatively a currently valid welder's performance certificate issued by a competent body.

2.3.2.4 Welders shall if holding a currently valid provisional certificate of either of the above, only carry out welding covered by the certificate subject to being under the constant supervision of a person currently competent for the work in hand.

2.3.2.5 Welders shall be required in either case before the work to carry out a specimen butt (without backing) and branch pipe connection fusion test at site in accordance with

BS 4872 Part 1 procedures and acceptance levels for which a welder approval test record to Appendix B of the standard shall be kept for each test.

2.3.2.6 Welders shall be replaced, if unable to meet the requirements of BS 4872: Part 1, by a competent welder who will also be subjected to the same test requirements.

2.3.2.7 Welders shall not be allowed to continue welding on the work on or off site if their standards of workmanship prove to be unsatisfactory.

2.3.3 General welding requirements

2.3.3.1 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have standard fittings to BS 1965 Part 1, without the use of segmental or cut-and-shut bends.

2.3.3.2 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have continuous welding of each weld run of a welded joint, with cleaning and inspection by the welder before further run applied.

2.3.3.3 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have no welding done in extremely severe weather conditions which would affect weld quality.

2.3.3.4 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have faulty weld sections removed and made good by welding-in lengths of pipe not less than 300mm long subject to supervisor/inspector's instructions.

2.3.3.5 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have all branch welds made by the set-on method, with the centres of adjacent branch welds at a distance not less than twice the diameter of the largest pipe as a minimum, in conjunction with a suitable gap between flanges.

2.3.3.6 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have welded joints located not less than 600mm from an anchor point or pipeline guide.

2.3.3.7 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have end faces of pipes and fittings machined and bevelled (not flame cut) at right angles to axis of bore.

2.3.3.8 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have welded-on flanges at intervals of not more than 10 metres to provide break points.

2.3.3.9 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have joint faces of the pipe within 25mm of the face completely cleaned to remove all foreign matter before welding and on completion of the weld, cleaned around the joint for the visual inspection procedure. Finally cleaned and primed within four hours of the inspection, or after satisfactory testing.

- 2.3.3.10 In addition to the requirements of BS 2971 and HVCA Code of Practice TR/5 the work shall have adjacent to each weld the welders certificate of competency number stamped on the pipe by the welder. Provisional Certificates will not be accepted.
- 2.3.4 Inspection, testing and rectification of faulty welds
- 2.3.4.1 Shall require all joints to have a visual inspection of completed weld to BS 2971 and BS EN 970 requirements, this may be carried out by the independent inspection authority to be appointed by the Contractor. Apave or Socotec shall be considered as appropriate independent authority.
- 2.3.4.2 Shall require where non-destructive testing is specified, a percentage of joints tested in addition to the visual inspection, carried out by the independent inspecting authority.
- 2.3.4.3 Shall require any weld found not to be stamped with the welder's Certificate of Competence number to be non-destructively tested at the Contractor's expense.
- 2.3.4.4 Shall require depending upon the method of NDT specified the following standards to apply:-
- BS 2910 for radiographic examination
 - BS 3923 Part 1 for ultrasonic examination
- 2.3.5 Records of inspection and testing
- 2.3.5.1 Shall require accurate records of inspections, welding procedures, tests and dates to be kept and submitted by the welding inspector and the results made available for inspection within ten days of the test.
- 2.3.5.2 Shall require each result to have the welders certificate number appropriate to the weld recorded on it and a description of the exact location of the joint by reference to the drawing.
- 2.3.5.3 Shall require the AOTC welding inspector to advise which welds are satisfactory and which have failed and the extent of rectification work required which he may mark on the actual joint.
- 2.3.5.4 Shall require the Contractor to satisfactorily carry out the rectification work in accordance with the conditions stated in Part D which may call for an increase in the number of NDT tests until a satisfactory standard is achieved. Rectification work to be carried out at no cost to the client.
- 2.3.6 Protection of persons and material from weld damage
- 2.3.6.1 Shall be generally in accordance with Health and Safety Executive (UK) Booklet No 38 (Electric arc welding).

- 2.3.6.2 Shall comprise opaque screens to be used and positioned around fusion operations to prevent weld flash being visible to persons other than the welder.
- 2.3.6.3 Shall include for heat-resistant mats to be used to prevent fire and damage to other materials during the welding procedures.
- 2.3.6.4 Shall include for the provision of two portable fire extinguishers located in the immediate vicinity for emergency use and suitable for type of hazard present.
- 2.3.6.5 Shall require employment of mechanical extract ventilation where an unacceptable concentration of fumes may occur.
- 2.3.6.6 Carry out a risk assessment for welding processes in each location.
- 2.3.7 Failure of welded joints during pressure test
 - 2.3.7.1 Shall be notified immediately to the Engineer and the joint rectified in accordance with his instructions.
 - 2.3.7.2 Shall require a further pressure test to be applied.
 - 2.3.7.3 Shall be entered on the welding and pressure test record sheets with details of repair work carried out.
 - 2.3.7.4 Shall include for all the above work to be carried out by the Contractor at no additional cost to the Client.

2.4 Capillary jointing of copper or stainless steel pipework

- 2.4.1 Capillary soldered joints
- 2.4.2 Shall be to BS 864 Part 2 using integral ring fittings with lead-free solder and marked accordingly, for hot and cold water services and for all other services to standardise on site inspection requirements.
- 2.4.3 Shall be made using the correct grade of flux to suit the service requirements as detailed on the pipework materials tables.
- 2.4.4 Capillary brazed joints
 - 2.4.4.1 All brazed joints shall be to BS 1723 Part 1 and BS 1306. They shall be in accordance with the recommendations in HVCA Code of Practice TR/3.
 - 2.4.4.2 Shall be made and inspected generally in accordance with procedures as specified for capillary soldered joints. This shall exclude bronze weld.

- 2.4.4.3 Shall be made using the correct grade of silver brazing alloy and flux to BS 1845 to suit the service conditions as indicated on the pipework materials tables and to meet the requirements for potable water quality in the case of hot and cold water services.
- 2.4.4.4 Shall have brazing of copper water pipework carried out using a filler rod complying with BS 1845 Type CP1, CP2 or CP4 to suit the circumstances involved. Where copper is to be joined these rods may be considered to be self-fluxing, but where copper alloy fittings are to be joined to copper the manufacturer's recommended flux to be used.
- 2.4.4.5 Shall include for silver brazing on condensate mains assembled from copper tube and heavy duty fittings where a brazing alloy to BS 1845 Type AG14 or AG20 or similar approved filler should be used (the pipe end only being fluxed). The flux to be as recommended by the manufacturer.
- 2.4.4.6 Where brazing of copper to gunmetal/bronze is required, these shall have joints made using a copper-silver-zinc brazing alloy to BS 1845 Type AG14 or AG20 or similar approved filler together with an appropriate flux as recommended by the manufacturer, the process to be carried out under controlled conditions and in a clean condition suitable for use as appropriate for the service intended, with no traces of flux, grease or other matter on the completed items. Each person producing brazed joints shall be provided with a steel marker die with which to mark all completed joints with his identification symbol.
- 2.4.4.7 Shall where applicable be tested in accordance with BS 1723 Part 1, and HVCA Code of Practice TR/3 and BS 6443.
- 2.4.4.8 Shall include the cost for any additional testing of joints required by the Engineer or his representative during the Contract.
- 2.4.5 Precautions/hazards during brazing
- 2.4.5.1 Attention is drawn to the Health and Safety at Work etc Act, as the above processes present health hazards, comprising not only the explosion risks from oxygen and fuel gases but also from the vapours from cleaning solvents, fluxes and over-heating filler metals etc.
- 2.4.5.2 The Contractor shall ensure that the area of operation is safe for carrying out the work involved and free from combustible waste materials etc.
- 2.4.5.3 The Contractor shall provide adequate heat shielding and where necessary heat sinks.
- 2.4.5.4 The Contractor shall report to the Safety/Fire Officer on completion of hot work each day where work has been carried out in any void, duct, unoccupied space or any other concealed location.
- 2.4.5.5 The Contractor shall acquaint himself with the fire drill procedure, be responsible for adequate ventilation of the work area, confirm that all operatives are aware of the

dangers of the misuse of oxygen for ventilation purposes and ensure that there is adequate means of escape from confined spaces.

2.4.5.6 The Contractor shall carry out a risk assessment for each process/location.

2.5 Preservation of water quality

2.5.1 General

2.5.1.1 The Contractor shall provide for all parts of hot and cold water circuits in contact with the water to have clean and disinfected surfaces before being installed.

2.5.1.2 The Contractor shall comply with the local water Authority's by-laws that are based on BS 6700 or any local prevailing standards and guidance.

2.5.1.3 The Contractor shall comply with the Guidance for the General Design and Operation of Water Systems in offices contained in plumbing engineering guide.

2.5.1.4 It shall be required that all materials specified and used to be proof against the following hazards:-

- Dezincification or galvanic action;
- Chlorine treatments;
- Imparting taste or odour to the water;
- Contamination of water by lead, copper or other elements in excess of standards laid down by the WHO.
- Bacterial growth due to nutrients in pipework materials, jointing materials, pastes and compounds, fluxes, solders, thread sealant tapes, gaskets, grommets, tap washers, O Rings, gland packings, valve seats, filters, hoses, greases, lubricants, protective coatings or linings.

2.5.1.5 The Contractor shall include for all materials and fittings to be of an approved type as tested and listed by the Central Water Authority or the Water Research Centre (UK) as suitable for potable water and not capable of promoting bacterial growth.

2.5.1.6 Pipework circuits for cold water shall run below or away from hot pipes to minimise heat gain and keep water temperature below 20°C to prevent the multiplication of Legionella bacteria.

2.5.1.7 The installation shall incorporate backflow prevention devices or air gaps based on BS 6700: 1997 and to BS 6281: 1992 Part 1 and BS 6282: 1982 Parts 2 and 3 and 4 as appropriate.

- 2.5.2 Desinfecting of hot and cold water systems
 - 2.5.2.1 Shall be carried out following satisfactory flushing as detailed in 03.08 and pressure testing and setting-to-work prior to handover.
 - 2.5.2.2 Shall provide for the whole of each system including cisterns, vessels and pipework to be disinfected with chlorine either by a specialist organisation certified for this type of work.
 - 2.5.2.3 Shall include for the procedures to follow code of practice and BS 6700 as outlined in the following clauses for new installations and for extended or modified systems.
- 2.5.3 External mains chlorination
 - 2.5.3.1 Shall include for chlorination of pipework under pressure from the mains, to be carried out in accordance with the requirements of the local water undertaking.
 - 2.5.3.2 Shall be through suitable valved filling points located at one end of the system, for the introduction of the chlorine solution.
 - 2.5.3.3 Shall include for chlorine introduced by means of chemical dosing apparatus connected upstream until a concentration of not less than 20 ppm can be measured along the pipe run of new mains.
 - 2.5.3.4 Shall have the main left static for not less than 24 hours before flushing through with fresh water until chlorine cannot be detected above that in the Water Authority and mains.
 - 2.5.3.5 Shall be provided with wash-out valves and valved filling points included in the installation.
 - 2.5.3.6 Shall include for existing mains supplying new distribution systems to be chlorinated. Any insertions or repairs at junctions into an existing pipeline to be disinfected by immersion in a solution of sodium hypochlorite containing 1,000 mg/L of free available chlorine.
- 2.5.4 Distribution pipework chlorination
 - 2.5.4.1 Shall include for the mains supply to storage cisterns to be chlorinated as necessary, and cisterns cleared of all visible contaminants before services within buildings are treated.
 - 2.5.4.2 The Contractor shall determine the capacities of the systems to be calculated to determine the amounts of chlorine to be added. All water shall be drained off; all draw off points closed and all isolating valves opened except on cistern outflow.
 - 2.5.4.3 After flushing, include for the system to be filled with water and the servicing valve on the supply to the cistern to be closed. Following which the capacity of the system

to be assessed and a calculated quantity of sodium hypochlorite of known strength to be added to the cistern to give a free residual chlorine concentration of 50 ppm to the cistern water content. The chlorinated water to be drawn around the system by successively opening each draw-off fitting, working away from the cistern, and closing it when chlorinated water at 40-50ppm is discharged, the concentration being determined by colorimetric methods. The cistern to be refilled and chlorinated as above during these operations, to maintain a residual chlorine level of 50 ppm in the cistern at all times. The contact time commences when the entire system is filled with chlorinated water, together with the cistern to overflow level.

2.5.4.4 The above procedures to be applied to all cold water services and secondary circuits of hot water systems before heat is applied and with the water cold. Care shall be taken not to use excessive amounts of chlorine which may affect pipework or other materials. Records must be kept of all procedures, checks, tests and witnessing.

2.5.5 Prevention of water stagnation

2.5.5.1 The Contractor shall provide for draining down and re-filling each system on a routine basis twice weekly until handover.

2.5.6 Water quality tests

2.5.6.1 The Contractor shall provide for all systems to have been satisfactorily set to work and disinfected before water samples are taken. The Contractor shall make analysis of each hot and cold water supply system taken from representative sampling points at draw off and storage positions with the systems at working temperatures.

2.5.6.2 The Contractor shall provide for all samples to be tested in accordance with the DOH/DOE Report No 71 - The Bacteriological Examination of Water Supplies Published in the UK, or any method approved and employed by the Public Health Department of the Ministry of Health or any relevant approved Government Body.

2.5.6.3 The Contractor shall have all water samples tested for E.Coli and chemical analysis including copper and lead content. The quality of potable water at outlets, (as sampled) and as supplied by the Water Authority, to be generally to EC Directive, 15 July 1980, 80/778/EEC "Quality of Water intended for Human Consumption".

2.5.6.4 The Contractor shall include for the tests to be carried out by any Government approved Laboratory, preferably from the Ministry of Health.

2.5.6.5 The Contractor shall include for two sets of tests, the first after setting to work and disinfecting and the second in conjunction with the handover date and the date for occupation of the premises.

- 2.5.7 Legionnaires disease precautions
 - 2.5.7.1 The Contractor shall take all necessary precautions while erecting the installations in accordance with the requirements of HTM 04-01.
 - 2.5.7.2 Shall include for taking water samples for Legionellae bacteria from all hot and cold water systems.
 - 2.5.7.3 Shall provide for the tests to be carried out by the Public Health Laboratories Service on samples taken from representative sampling points when the systems are at working temperature and conditions.
 - 2.5.7.4 Shall include for the temperature of the water (hot or cold) at the sampling point to be recorded at the time of taking each sample.
 - 2.5.7.5 Shall have water samples for analysis taken from three hot and three cold water outlets, the location of the outlets to be determined by the Client.
 - 2.5.7.6 Shall provide for the samples and their analysis to be carried out prior to Practical Completion and the Client notified of the results.
- 2.5.8 Analysis reports
 - 2.5.8.1 Shall if the results are found to be unsatisfactory due to poor workmanship and/or use of unacceptable components, include for all remedial work to be carried out at the Contractor's expense.
 - 2.5.8.2 Discharge of Waste Water used During Disinfection/Chemical Cleaning Procedures within Buildings
 - 2.5.8.3 The Contractor shall inform authorities responsible for sewers before chlorinated/treated water used for disinfecting/cleaning an installation is discharged. He shall establish an agreed procedure beforehand; this may involve simply dilution of the discharge or de-chlorination / neutralisation.
 - 2.5.8.4 De-chlorination shall be achieved using either sulphur dioxide or sodium thiosulphate (20g of sodium thiosulphate crystals are required to dechlorinate 500 litres of water containing 20mg/l free chlorine).
- 2.6 Thermometers, altitude/pressure gauges etc**
 - 2.6.1 General
 - 2.6.1.1 Similar make and style of thermometers and altitude/pressure gauges are to be fitted, where suitable, to items of plant (e.g. calorifiers/boiler etc.) and/or pipework connections on each side of plant items such as calorifiers/heater batteries/pumps/mixing valves etc. and in positions indicated on the drawing or as specified in Bill of Quantities. All such devices shall be of UK origin.

- 2.6.2 Thermometers
- 2.6.2.1 Shall be to BS 5235: mercury in steel dial type with 100mm minimum diameter dial, white faced with black figured scale, complete with integral vertical or centre stem and separate pocket (brass or steel) to suit the immersion position and matt paint finish to casing and bezel.
- 2.6.2.2 Shall be installed using heat conducting grease.
- 2.6.2.3 Shall be calibrated in Celsius with divisions at 1°C intervals and numbered at 10°C intervals, the scale ranges being:-
- 0 - 50°C Cold Water Service
 - 0 - 100°C Hot Water Service
- 2.6.2.4 Where a fixed working temperature is being measured, have a loose red pointer set to that point.
- 2.6.3 Altitude and pressure gauges
- 2.6.3.1 Shall be generally to BS 1780, with 100mm minimum diameter dial, white faced with black figures scale calibrated in bar or metre head to approximately 1.5 times the working pressure specified in Part D, complete with lever handle (pressure gauges to have a ring or "U" pattern siphon) and adjustable red pointer set at normal working pressure/head of the system.
- 2.6.3.2 Shall be finished matt paint for both casing and bezel.
- 2.6.3.3 Shall be calibrated in metres head of water for altitude gauges, bar or millibar for pressure gauges (0.10 bar) and millimetre Hg or kilo Pascals (kPa) for vacuum.
- 2.6.3.4 Shall be steel tube to BS 3059, Part 2 filled with water prior to being put into service in the case of siphons.

2.7 Pumps

- 2.7.1 General
- 2.7.1.1 Pump(s) shall be factory assembled, packaged and tested to meet the required working conditions and test pressure of the system concerned and shall be supplied by one brand name manufacturer.
- 2.7.1.2 The pumps shall be capable of delivering the required discharge volumes at the duty-point without cavitation, run out, or over-heating.
- 2.7.1.3 The minimum overall efficiency shall be 60% at the duty point.
- 2.7.1.4 The pumps shall be minimum 1P55.

- 2.7.1.5 Pump capacities shall be not less than those specified in the schedules. The Contractor shall submit characteristic curves of the pump performance and such drawings and literature as may be necessary to illustrate and defined the type and details of the equipment offered.
- 2.7.1.6 Shut-off valves shall be gear type, provided on suction and discharge connections of each pump or on common connection of twin or duplex pumps. Non-return valves and test cock shall be provided on discharge side.
- 2.7.1.7 All valves shall be suited for opening or closing under maximum working pressures by hand by one person. Non return valves shall be of the ball type suited for horizontal or vertical mounting.
- 2.7.1.8 Pressure gauges shall be provided in the suction and discharge connections of each pump or in the common suction and discharge connections of duplicate pumps.
- 2.7.1.9 The pump package and controls shall fully comply with the requirements of BS.767 both during installation and upon completion.
- 2.7.1.10 Pumps and their drives shall be segregated such that failure of the pump seals shall not result in damage to the drive motor.
- 2.7.1.11 Pumps shall be quiet, smooth running and effectively isolated from the building fabric. The complete unit shall effectively be balanced to eliminate nuisance noise and vibration.
- 2.7.1.12 Base plate assembly/ supporting frame shall be in Mild steel, galvanised to BS.719 (coating thickness 610 g/sq.m)/ Hot dipped galvanised complete with height-adjustable rubber-in-shear vibration dampeners
- 2.7.1.13 Pumps shall be provided complete with a drain plug and, except where the pump is inherently self venting.
- 2.7.2 Control Panel
- 2.7.2.1 The control panel(s) and distribution board for the pump shall be constructed from factory made standard size steel plate (minimum 1.5 mm thick) cubicles, which together with a steel framework shall form a robust enclosure structure for cables and equipment. The surface treatment shall be epoxy powder painting giving a design life of minimum often (10) years.
- 2.7.2.2 In addition to the electrical protection specified elsewhere herein, safety cut-outs for the LV control panels and switchgear shall be provided to protect equipment against any operating conditions which could arise which would be liable to cause damage to the equipment.
- 2.7.2.3 The internal wiring shall be identified with markers having the same information as the point to be connected to. All equipment shall be clearly marked.

- 2.7.2.4 Doors shall be provided with a rubber gasket, fixed Jocks with handles and hinges to enable doors to be opened to a minimum of 120°.
- 2.7.2.5 Enclosure protection shall be a minimum of IP 55.
- 2.7.2.6 The construction shall ensure high operational reliability and personnel safety.
- 2.7.2.7 Distribution Boards shall be identified by an engraved non-corrosive metallic name plate. Degree of protection shall be a minimum IP 55.
- 2.7.3 Motor Protection
 - 2.7.3.1 Motor protection relay units shall be provided for the protection of the motors. The relay units shall incorporate wide range adjustable over-current protection, earth fault units; single phasing, under and over voltage protection etc.
- 2.7.4 Identification
 - 2.7.4.1 All pumps shall bear the manufacturer's designation plate which shall indicate the type of services and serial number of the unit.
- 2.7.5 Booster pump set
 - 2.7.5.1 Booster pump(s) shall be factory assembled, packaged and tested to meet the required working conditions and test pressure of the system concerned and shall be supplied by one brand name manufacturer.
 - 2.7.5.2 Each set shall be fixed on a common bedplate and supported with suitable anti-vibration mountings.
 - 2.7.5.3 Each pump shall have isolating valves on suction and delivery, non-return valves on delivery and a test cock.
 - 2.7.5.4 Appropriate flexible connections to suction and discharge pipework shall be provided to the booster set.
 - 2.7.5.5 Suitable pressure gauges shall be provided on the discharge main from the booster set.
 - 2.7.5.6 Integral control panel to IP55, complete with HRC fuses for motor/control circuits, motor starters and overloads, appropriate control interfacing, terminal strips and labeling shall be provided.
- 2.7.6 Sump pump
 - 2.7.6.1 Sump pump materials shall comply with the schedules.
 - 2.7.6.2 Each pump shall be protected by a non-ferrous strainer on the suction side which can be removed for cleaning.

- 2.7.6.3 Sump pumps shall operate automatically under level control with provision for an alarm to indicate when normal high water level is exceeded.
- 2.7.6.4 Bolts, nuts and fastenings shall generally be of stainless steel, and ensure electrical cable entry is of watertight construction.
- 2.7.6.5 All materials used shall be compatible with the fluid in which they are immersed.
- 2.7.6.6 Isolating valves, non-return valves and strainers (where shown) of pipeline size not pump connection size shall be provided on the discharge side of the sump pump.
- 2.7.6.7 Bearings shall either be of sleeve type with oiling ring and reservoir, or ball or roller type with grease lubricator.
- 2.7.6.8 Preference shall be given to pumps which exhibit design features that allow for ease of maintenance and inexpensive replacement of components liable to wear, such as shaft sleeves, wearing rings etc.

2.8 Cold water service

2.8.1 Scope

- 2.8.1.1 This section covers pipes, valves and fittings connecting to the outlet of a Water Authority meter to provide mains for fire services and for supplies to storage cisterns with distribution pipework from these to user points, etc. It does not include pumps, cisterns, ball float valves etc which will be as specified in later sections.
- 2.8.1.2 Pipes, valves and fittings shall be selected from the appropriate tables to suit the different requirements of the service as shown on the drawings and comply with both the Local Water Undertaking Byelaws and lists of approved materials as tested by the Water Research Centre (WRc UK) and listed in the current water fittings and materials directory.
- 2.8.1.3 No materials used in the construction or assembly of the services shall support microbial growth within the water circuits.
- 2.8.1.4 All cold water services shall be classed as potable. The installation of potable services should comply with the WHO recommendations.

2.8.2 Pressure testing

- 2.8.2.1 Shall be generally to BS 6700 and shall be carried out after a preliminary inspection for leakage with the pipework full of water at normal pressure.

2.8.2.2 Shall be applied to completed sections of pipework and finally to the whole installation and comprise the following hydraulic pressures which must be held for not less than four hours after the rectification of any leakages:-

Service pipework (mains pressure)

Test Pressure = Twice maximum mains pressure for ductile iron or copper pipes or 10 bar.g whichever is greater and 1.5 x maximum mains pressure for polyethylene pipes or 10 bar.g whichever is greater.

Distribution pipework (cistern supplies)

Test Pressure = Twice maximum static head or 4 bar.g whichever is greater.

3 Fire extinguishing installations (if applicable)

3.1 General

3.1.1 Standard references

3.1.1.1 The materials, components and completed installations shall conform as applicable with the following Standards, including all amendments, current at the time of tendering. Construction products should comply with European Standards and Technical Specifications (ESTS). Wherever reference is made to a British Standard a corresponding ESTS (generally ISO series) shall be equally acceptable.

3.1.1.2 Where available all materials, equipment etc forming part, or whole, of the services specified in the Contract, should be obtained from BS EN ISO 9000 - "Quality Assurance" certified manufacturers and preferably "kite marked" or EC equivalent.

3.1.2 Scope

3.1.2.1 This section covers the manufacture, works testing, supply, installation and site testing of the components of fire extinguishing installations, from dedicated pressurised water mains/tanked supply, hose reels and dry rising mains.

3.2 Installation

3.2.1 Temporary notices

3.2.1.1 Shall be displayed, as recommended by the fire authority, with black letters on yellow background and remain until the installation becomes fully operational.

3.2.1.2 Read '**FIRE MAIN OUT OF ORDER**' where an installation is not available for use.

3.2.2 Identification of fire mains

3.2.2.1 Shall be identified in accordance with BS 1710.

3.2.3 Earthing (extraneous conductive requirements)

3.2.3.1 Shall be effected between the main earthing terminal of the electrical installation and to the pipework and other conductive metal work of the Fire Extinguishing Installation by an equipotential bonding conductor in accordance with the IEE Wiring Regulations 17th Edition. Provided by local supplementary bonding connections to pipes and metal work in the absence of permanent metal to metal joints of negligible impedance, to maintain the equipotential zone.

3.2.4 Pipework installation

3.2.4.1 Shall be to the standards of pipework installation specified in this document.

3.3 First aid fire hose reels

3.3.1 Supply pipework

3.3.1.1 Shall be fed from combined fire fighting/domestic pump set.

3.3.1.2 Shall be suitable for working pressure 16 bar.g max - temperature nominal 10°C.

ITEM	NOM SIZE BORE mm	DESCRIPTION	BS NO
Pipe	28 to 100	Half Hard Copper.	BS EN 10
Fittings	28 to 67	Copper or non-dezincifiable Copper Alloy. Capillary Type 97/3 Tin/Lead Soft Solder.	864 Part 2 BS EN 29453
Fittings	76 and above	Non-dezincifiable Copper Alloy. Capillary Type 2% Silver/Copper/Phosphorous Brazing Metal.	Makers std 1845:1984
Unions	28 to 54	Non-dezincifiable Copper Alloy. Capillary Type 40/60 Tin/Lead Soft Solder. Brass Union Nuts.	864 Part 2 BS EN 29453
Flanges	65 and above	MS Flange/Copper Alloy Centre Piece. Capillary Type 2% Silver/Copper Phosphorous Brazing Metal.	Makers std 1845:1984
Gaskets	All size Metric	Ethylene propylene synthetic rubber.	BS EN 1514-1
Isolating Valve (as specified)	1" to 2" 25 to 54	Non-dezincifiable Copper Alloy. Wedge Gate Type. NR Stem. Hand wheel or Lockshield PN 16 Bar.	5154
Isolating Valve	65 and above	Cast Iron. Wedge Gate Type. Inside Screws GM Trim, NR Stem. PN 16 Bar. Flanged.	151
Draining Tap	0.5" & 0.75	Copper Alloy. Bush Pattern. Screwdown with loose handle and hose connection.	2879

3.3.2 Hose reels

3.3.2.1 Shall be connected to a minimum 25mm branch pipe, through a union fitting and inlet valve easily accessible local to the unit, generally to BS 5306: Part 1 and as shown on drawings.

3.3.2.2 Shall be finally connected to the hose reel supply branch only after the pipework system has been pressure tested and flushed through satisfactorily.

3.3.2.3 To have the following specification:

Description	FIRE HOSE REEL
Location	Inside fire fighting cabinet provided by the Arch
Type	Swinging
Drum Size	600mm diameter x 200mm deep
Hose Diameter X Length	25mm x 30m
Accessories	Wall bracket
Manufacturers and Model	SRI/Combat
Notes	Fire hose reel to comply to EN 371

3.3.3 Hose reel nozzle

3.3.3.1 Hose reel nozzle to have the following specifications:

Description	Nozzle
Location	Inside fire fighting cabinet
Type	Brass finished jet & spray nozzle
Material	Brass
Finishing	Chrome
Inlet Size	25mm
Flowrate @ 2 Bar	32 L/min
Throw range @ 2 Bar	11m
Manufacturers And Model	SRI/Combat
Notes	Nozzle to comply to EN 371

3.4 Testing

3.4.1 Pressure testing

3.4.1.1 Shall be generally to BS 5306: Part 1, BS 6700/ It shall be carried out on the completed pipework installation or sections of pipework, which shall be subjected to the following hydraulic pressure and the pressure maintained for not less than one hour, or as long as is necessary for satisfactory inspection of the whole of the installation.

3.4.1.2 Shall be one and a half times the system static head or working pressure or a pressure of 10 bar g whichever is the greater - for Internal Rising Mains.

3.4.1.3 Shall be one and a half times the system working pressure or a pressure of 10 barg, whichever is the greater - for Fire Hose Reel Mains.

3.4.1.4 Shall be followed by flushing out of the installation with clean water when pressure testing results are satisfactory.

4 Drainage systems

4.1 General

- 4.1.1 Sanitary pipework shall be installed in accordance with BS EN 12056-2. Horizontal pipework shall be laid to gradients complying with the above British Standards. Vertical pipework shall be parallel with vertical surfaces. All sanitary pipework shall be uPVC type except for laboratory drainage and drainage from hot water discharge points like sterilisers and disinfectors.
- 4.1.2 Flexible joints in pipework shall not be made within the thickness of the structure or where they would later be built in. Jointing material shall not project into the bore of pipes, fittings or appliances.
- 4.1.3 Access caps or plates shall be fitted at ends of all horizontal pipework, at junctions and changes of direction. Access plates shall be fitted at each floor level immediately above the highest connection, at the foot of each vertical stack and at junctions to horizontal connections to enable the system to be internally cleaned and rodded. Access plates shall be provided on vertical stacks, at every level, above the rim of adjacent sanitary ware.
- 4.1.4 Cleaning eyes shall be provided on the end of horizontal waste floats and rodding eyes at the ends of horizontal soil manifolds, turned up to above the rim of adjacent WC pans. Rodding eyes or access fittings shall be provided at changes of direction on suspended soil or waste pipework. Floor gullies shall be provided with drain access, either internally within the fitting or externally within the pipe run. Soil and waste branches shall be swept type.
- 4.1.5 Main branch ventilating pipes shall be run above spill over level of fittings except where shown, and if connected to main soil, soil waste or waste pipes, the connection shall be at a point above spill over level of the highest sanitary appliance connected to such pipe.
- 4.1.6 At the penetration of all roof levels a suitable water seal and weathering shall be provided. Pipe stacks shall be carried up full bore above eaves or roof levels. Termination of soil, waste or ventilation pipework shall not be closer than 3 metres to any opening window, door or ventilation intake. Should this be unavoidable, the pipework shall be terminated 900mm above any such opening.

4.2 Grease trap

- 4.2.1 The grease trap shall retain solids, grease and oil contained in waste water coming from the kitchen.
- 4.2.2 Larger solids shall be retained in a stainless steel perforated basket and smaller solids to settle at the bottom to form the sludge.
- 4.2.3 Grease trap shall be of fibreglass material.

4.2.4 Inlet and outlet dimension of grease trap to be Ø110mm.

4.2.5 The working capacity of the grease trap shall vary from 200Lts to 1000Lts .

4.3 Pipe and fittings

4.3.1 Plastic pipe and fittings

4.3.1.1 Shall comprise UPVC pipes and fittings, manufactured by the injection moulding process. It shall for main soil, ventilation pipes and fittings, internal rainwater pipe and fittings, be UPVC plastic to BS 4514.

4.3.1.2 Shall for branch waste and ventilation pipework and fitting up to and including 50mm diameter, be uPVC plastic.

4.3.1.3 Shall for all branch pipes, be provided with a radius swept in the direction of flow.

4.3.1.4 Shall not be fabricated by means of 'the cut and shut', hot air or solvent welded method.

4.4 Jointing of pipework

4.4.1 Plastics pipe

4.4.1.1 Shall have UPVC plastic pipes and fittings, jointed by the solvent weld method.

4.4.1.2 Shall have spigot ends, squarely cut, ensuring continuity of the internal pipe bore.

4.4.1.3 Shall have excess jointing material removed and not allowed to accumulate on the internal surface of the pipe.

4.4.1.4 Shall accommodate thermal movement, by having joints formed using the joint ring system, with the spigot end of the pipe fitting in the direction of flow. All items forming the joint to be cleaned before assembly.

4.4.1.5 Shall be jointed using the correct solvent or lubricant and be installed to the Manufacturer's information.

4.5 Installation of pipework

4.5.1 General

4.5.1.1 The installation of the above ground sanitation systems shall comply with the requirements of BS 5572 where applicable to design intent.

- 4.5.2 Pipework installation
 - 4.5.2.1 Shall be installed to the minimum gradients specified in BS 5572 or as indicated on the drawing for all suspended runs.
- 4.5.3 Pipe clearances
 - 4.5.3.1 Adequate separation from other engineering services and the structure shall be provided to enable maintenance to be carried out in an efficient manner with a minimum of disruption. Plastic pipes shall be distant from heat sources.
- 4.5.4 Pipe sleeves
 - 4.5.4.1 Where passing through any part of the building fabric not classified as a fire structure, the pipes shall be accommodated in suitably sized sleeves of the same material as the pipe and be of such a diameter as to allow a minimum clearance for the free movement of the pipe.
 - 4.5.4.2 The pipes shall where penetrating a fire resisting structure, shall be accommodated within a fire proof sleeve and which shall be filled with fire proof materials around to comply with Local Fire Services requirement and not less than that prescribed in the Building Regulations of the UK or any other equivalent standard.
 - 4.5.4.3 Shall where passing through sleeves in external walls and ducts, be caulked between pipe and sleeve with lead wool or proprietary sealing compound.
 - 4.5.4.4 Pipe sleeves shall not be used as a means of support to the pipes.
- 4.5.5 Painting
 - 4.5.5.1 Shall be completed to all ferrous brackets, pipes, supports, nuts, bolts, drop rods and all associated accessories after erection and the witnessing of satisfactory tests, degreasing and washing.
 - 4.5.5.2 Shall be to the recommendations of BS 6150. For cast iron pipes and galvanised items comprise one coat of black bitumen to BS 6949.
- 4.5.6 Building in of work
 - 4.5.6.1 No pipes shall be concealed within the building structure until satisfactory completion of the inspection and testing procedures.

- 4.5.7 Traps
- 4.5.7.1 Shall conform to BS 5572 and all relevant British Standards. They shall be to BS 3943 or the equivalent French Standard. They shall generally be 'P' traps unless otherwise specified in drawings.
- 4.5.7.2 Shall for all sanitary fittings and equipment be a two piece tubular trap, where exposed under basins be chromium plated copper alloy bottle traps.
- 4.5.8 Sanitary appliance connections
- 4.5.8.1 Shall be by a dry seal push fit joint to the drainage system for all connections from sanitary appliance outlets 89mm diameter and above.
- 4.5.9 Access points – general
- 4.5.9.1 Shall be provided into the pipe bore to enable testing, inspection and efficient maintenance operations to be carried out. They shall be all fully accessible.
- 4.5.9.2 They shall have all access plates and caps fitted as the installation work proceeds and remain sealed except for inspection and testing. In the event of an open access point being found at any time during the course of installation, the contractor shall have that section of pipework rodded out and flushed with clean water. Should it be demonstrated that the pipe bore is not satisfactorily finished, the section adjacent to the access point to be stripped out to a location of satisfactory internal finish.
- 4.5.9.3 Access points on vertical main soil and ventilation pipes of 75mm -160mm diameter, shall be provided in the following positions:-
- Above the spill-over level of adjacent sanitary fittings and a minimum of one metre above finished floor level on all floors.
 - Above offsets in vertical stacks.
 - At all junctions in suspended runs and in other positions as indicated on the drawings.
- 4.5.10 Upvc/polypropylene pipe access points
- 4.5.10.1 Shall be full width and bolted, integral with a purpose made fitting, or cut and located in positions shown on the drawings where located on the side of UPVC and Polypropylene pipes.
- 4.5.10.2 Shall be solvent welded plugs with screwed caps, where located on the end of UPVC pipes and fixed by compression screwed caps on polypropylene pipes.

- 4.5.11 Sanitary appliances
- 4.5.11.1 All sanitary appliances shall be fixed in accordance with BS 8000: Part 13. They shall have all outlets and overflows bedded into the sanitary appliances together with all washers, wedges and other sundries necessary to complete an efficient fixing.
- 4.5.11.2 All debris shall be removed and the appliance cleaned and protected from damage and abuse on completion of fixing.
- 4.5.11.3 Sanitary appliances shall be tested by operation of taps to ensure overflow waterways are clear of mastic sealant.
- 4.5.11.4 Shall be subjected to discharge tests to determine the integrity of trap seal under normal operating conditions as defined in BS 5572: Performance Tests.

4.6 Supports expansion and anchors

- 4.6.1 Expansion joints and anchor points
- 4.6.1.1 Shall be provided to accommodate thermal movement of UPVC and Polypropylene pipes between fixed points at the following minimum positions:-
- Be provided on long straight suspended runs at 3m centres.
 - Be provided between fixed points if the distance exceeds 1m.
 - Be provided on UPVC branch waste pipes if the straight length exceeds 1.8m.
 - Be provided on Polypropylene mechanical systems as thermal stress relief units, in both the horizontal and vertical plane to accommodate thermal movement of 4.22mm per 3m length per 10°C.
- 4.6.2 Anchor points
- 4.6.2.1 Shall be rigidly fixed brackets with bracing angles and structural fixings to prevent pipe movement in any plane. They shall be provided at expansion joints and branch connections securely fixed on the pipe socket without causing damage or deformation. They shall be positioned to control alignment of the system during expansion.

4.6.3 Pipe supports

- 4.6.3.1 Shall be provided in accordance with the requirements of BS 5572. They shall be provided with supports located at intervals not greater than the following Table for suspended and vertical pipes :-

Support distance for vertical and suspended pipes			
PIPE MATERIAL	NOMINAL BORE (mm)	VERTICAL RUN (m)	HORIZONTAL RUN (m)
Copper Tube	25	2.4	1.8
	32-40	3	2.4
	50	3	2.7
	65 - 100	3.7	3
Cast Iron	All sizes	3	1.8
UPVC	32-40	1.2	0.5
	50	1.2	0.6
	75 – 100	1.8	0.9
	150	1.8	1.2
*Polypropylene Mechanical Joints	38		0.5
	51	1.2	0.5
	76		1.5
	102		1.8
Glass	40-80	1.2	1.2
	100	1.5	1.4
	150	1.8	1.8

- 4.6.3.2 Suspended pipe shall be continuously supported where temperatures in excess of 20°C are maintained. They shall be fixed to the structure at two points and have vertical adjustment facilities for suspended pipes.
- 4.6.3.3 Anchors and supports are provided on suspended and vertical UPVC pipes between fixed points to maintain stability under temperature change.

4.7 Care of pipes

4.7.1 Sealing open ends of pipes

4.7.1.1 Sealing of pipes shall be carried out as the installation proceeds. It shall comprise purpose made metal or plastic plugs, caps or blank flanges. In the event of an open ended pipe being found or a plug removed, the Contractor shall have the section concerned rodded clean and flushed with clean water. If after such clearing operations it can be demonstrated that the pipe bore has not been satisfactorily cleaned, the pipes adjacent to the open end to be stripped out to a location of clean internal finish.

4.7.2 Pipe condition and protection

4.7.2.1 All pipes to be used shall be straight, cleanly finished, round in cross section and without defect.

4.7.3 Pipe cutting

4.7.3.1 Shall include for all pipes to be cut clean and square with axis of the pipe and before installation, the cut ends of the pipe to be made smooth and any burrs removed by filing.

4.7.3.2 Shall include for cast and spun iron pipes to be cut with the correct cutting apparatus or appliance.

4.7.3.3 Shall require care to be taken when cutting cast iron pipe to avoid damage to the internal and external coating.

4.7.4 Storage of pipe and fittings

4.7.4.1 Shall include for plastic pipe fittings, joints, sealing rings and gaskets to be stored in a ventilated space and not exposed to direct sunlight. The Contractor shall provide purpose made racks for storage of pipes and similar materials to prevent bending and distortion. He shall provide suitable racks and storage for plant, equipment and materials unable to be stored in huts or buildings.

4.7.4.2 Shall allow replacement material, plant or equipment to be provided where deterioration or damage has occurred prior to handover.

4.8 Pre-handover and handover procedures and requirements

4.8.1 General

4.8.1.1 The Contractor shall on completion of the pipework installation, and prior to the installation of the sanitary appliances, include for all plugs to be removed and the entire system, including the rainwater system, rodded through and flushed with clean water.

4.8.1.2 The Contractor shall include adequate provision for collection and disposal of the water to ensure that the building fabric or other services are not affected during the operation.

4.8.1.3 Shall provide for all access covers and cleaning eyes to be removed, checked, replaced if damaged, greased, refitted and sealed.

4.8.2 Testing

4.8.2.1 All soil and waste pipes shall be subjected to an air pressure test in the following manner: The section of the installation to be tested to be sealed off by the insertion of expanding rubber, or inflatable stopper testing plugs, (one of which to incorporate a tee fitting complete with an air cock), on each of the free ends of the fittings. One of the air cocks to be connected by means of a flexible tube to a manometer (u gauge) and the other connected to a tube for applying the required air pressure to the system. The air pressure to be applied to the whole section of pipework and fittings under test, this to be equal to 38mm water gauge and to remain constant for a minimum of 3 minutes.

4.8.2.2 The Contractor shall ensure that the installations are tested at the following stages:-

- Prior to concealment by suspended ceilings, duct covers, partition cladding etc.
- On completion of the whole installation.
- On completion of all work, including that of other trades.

4.8.2.3 The Contractor shall also be required that all soil and waste pipes to be tested to the satisfaction of the Local Authority as determined by the Building Inspector.

4.8.2.4 All final commissioning procedures shall be as defined in BS 5572.

5 Pre-commissioning cleansing and water treatment

5.1 General

- 5.1.1 Open and closed circuit systems shall be flushed through to remove scale and debris collected within the systems. On completion of flushing they shall with the exception of domestic water systems be chemically as necessary.
- 5.1.2 Domestic water systems shall be disinfected and sterilized.
- 5.1.3 Closed circuit systems shall if necessary on completion of flushing and chemical cleaning operations be dosed with an agreed chemical treatment.
- 5.1.4 Strainers, test points, drain points, vents and by-passes shall comply with the pipework section of this specification and be provided as required to allow full compliance with the Guide. Temporary flushing tanks pumps and meters shall also be provided as required
- 5.1.5 The public health services installer shall employ a water treatment specialist, who shall provide a method statement covering all aspects pre-commissioning works and subsequent water treatment. The statement shall cover each system and must include details of the chemicals proposed. The method statement shall be submitted to the engineer in sufficient time for comment before the work is carried out.
- 5.1.6 The engineer shall be advised at least five working days before in advance of the commencement of the flushing and cleaning programme so that procedures can be witnessed.

5.2 Water supply

- 5.2.1 Each closed system shall be provided with a valved connection in the main plant area suitable for flushing and cleaning purposes. A mains cold water connection shall be provided adjacent to the system connection.
- 5.2.2 The connections shall be adequately sized to permit the flushing velocities recommended in BSRIA Application Guides AG1/2001 and AG2/89.3 to be achieved. The supply and connections shall be capable of providing the required flow rate at a minimum pressure of 3 Bar at the top of the building. Where such a pressure is not available the mechanical services installer shall provide sufficient temporary boosting equipment to ensure that this flow rate and pressure is achieved.
- 5.2.3 Connections to the system shall meet the requirements of the local water authority and the model water by-laws.
- 5.2.4 Where the flushing supply is provided from a private source a sample of the intended source shall be analysed via an accredited testing facility. The results of the analysis shall be submitted to the engineer for comment before the commencement of flushing. Before water is taken from a private source or local authority the Contractor shall hold or obtain a licence so to do.

5.3 Drainage

- 5.3.1 The public health services installer shall ensure sufficient hose is provided to enable the water flushed from the system to be discharged into the foul drainage system if permitted by the local water authority. Where the Mechanical Services Installer is unable to obtain the necessary approval, alternative acceptable arrangements shall be provided.

5.4 Electrical supply

- 5.4.1 An electrical supply comprising a fused switch and steel wire armoured cable installed as specified in the "Electrical Services associated with Mechanical Plant" section of the specification shall be provided for connection to the temporary pumping equipment. The switch shall be of sufficient capacity to suit the pump motor rating.
- 5.4.2 The connection to the pumping equipment shall be taken from the nearest mechanical services control panel.

5.5 Filling

- 5.5.1 On completion of the installation the system shall be filled with water and pressure tested as described elsewhere within this specification. On completion of the testing the system shall be allowed to stand for 48 hours to soften the inclusions. The mechanical services installer shall ensure that all flushing by-pass valves are fully open, equipment and terminal units shall be isolated wherever possible.
- 5.5.2 On completion of the above process the system shall be drained. All dirt pockets and strainers shall be inspected and cleaned out. The system shall then be refilled and drained twice more with the dirt pockets and strainers checked each time.

5.6 Flushing

- 5.6.1 Flushing of closed water systems shall be carried out strictly in accordance with BSRIA application Guides AG1/2001 and AG2/89.3. Flushing shall commence within 24 hours of the filling described above being completed.
- 5.6.2 Systems shall be flushed through as necessary with clean water to thoroughly clean the system. Flushing shall be carried out by the provision of temporary pumping plant with adequate capacity to permit the flushing velocities required by the above guide to be achieved. Use of the permanent system pumps will not be permitted except in special circumstances and only with the written approval of the Engineer.

- 5.6.3 The system shall be flushed through in sections in both forward and reverse directions. Sections shall be arranged such that after cleaning they can be isolated to prevent further contamination or to ensure that only clean water passes through the section. Sections shall be selected to permit maintenance of the required flushing velocities. Flushing shall be continued until visual inspection indicates the water is clear.
- 5.6.4 The mechanical services installer's water treatment specialist shall certify that all flushing has been properly carried out.

5.7 Chemical cleaning

- 5.7.1 On completion of flushing out all systems other than domestic systems the system water shall be analysed to determine whether chemical cleaning is required. Chemical cleaning shall be applied in accordance with the requirements of BSRIA Application guides AG1/2001 and AG2/89.3. Chemical cleaning shall be carried out immediately after the flushing process is complete.
- 5.7.2 The mechanical services installer shall employ the services of a specialist company to carry out the chemical cleaning and for subsequently draining flushing out and rinsing the out the system. Upon completion of the process the specialist shall issue a certificate for each system confirming that it has been properly cleaned and rinsed out in accordance with the above guide.
- 5.7.3 Chemicals used for cleaning shall be manufactured, controlled, stored and handled in strict accordance with the chemical manufacturers and local regulations. The chemicals used shall be approved by the local authority prior to disposal through the drainage system. Where such approval is not forthcoming an alternative acceptable to the local authority shall be used.
- 5.7.4 Chemicals shall be used in such concentrations as are necessary to ensure the system is properly cleaned and degreased. Inhibitors and neutralising agents shall be provided as necessary to prevent damage to the system due to overreaction.
- 5.7.5 On completion of the chemical cleaning the system shall be thoroughly flushed to remove any remaining chemicals. By-pass valves shall be closed and equipment isolation valves opened. All dirt pockets and strainers shall be inspected and cleaned out. The system shall then be immediately dosed with a passivating agent in sufficient quantities to neutralise chemical residue.

5.8 Open circuits

- 5.8.1 Open circuits other than domestic water systems shall be treated as described above. The treatment shall, in addition to the requirements of the preceding paragraphs comply with the requirements CIBSE Guide TM13 together with Health and Safety Guides EH48 and HS(G)70.

5.9 Water samples

- 5.9.1 Duplicate water samples shall be taken as necessary throughout the process to ensure that operations are being carried out at a level sufficient to thoroughly clean the system without using excessive amounts of chemicals and causing damage to the system.
- 5.9.2 One of each sample shall be sent for chemical and microbiological analysis by an independent laboratory, within 24 hours of the sample being taken. Initial results are to be provided within 48 hours, with full results within 10 days.
- 5.9.3 The second sample of each of the system water content shall be handed to the Employer at each stage of the filling flushing chemical cleaning and final dosing processes. Each sample shall be clearly and permanently marked and labelled indicating the stage and date when it was taken.

5.10 Disinfection and sterilisation

- 5.10.1 All cold hot and mains water service pipework including vessels such as tanks and cylinders shall be sterilised immediately prior to Practical Completion. A certificate of sterilisation shall be provided to the employer. Disinfection work shall be carried out in accordance with BS 6700 Section 13 as a minimum standard.
- 5.10.2 New water pipes shall be sterilised before any system is brought into use. Before sterilisation pipework storage tanks and equipment shall be cleaned out to remove dirt and debris. Such flushing shall be continued until the drain runs clear. The flushing shall be carried out in sections to ensure adequate flushing velocities throughout.
- 5.10.3 Before chlorination begins and as part of the flushing process the inside of the tank lid and the sides of the tank from the water line to the top of the tank shall be scrubbed with a strong solution of chlorinated water. These areas shall then be rinsed with a strong solution of chlorinated water to prevent the build up of algae.
- 5.10.4 No water shall be used for domestic purposes during the flushing operations or until sterilisation has been completed. Mains extensions shall be sterilized first followed by communication and supply pipes, storage tanks and distribution pipes in that order.
- 5.10.5 Mains extensions communication and supply pipes shall be sterilised by a specialist firm appointed by the mechanical services installer and agreed with the Engineer. All such work shall be to the requirements of the local water authority.
- 5.10.6 Storage tanks and distribution pipework shall be filled with water and thoroughly flushed out. With draw off taps closed the tank shall be refilled and sufficient sodium hypochloride having 3.5% available chlorine shall be added during filling to ensure that when full the tank contains water having a concentration of 50mg/litre, 50 ppm of chlorine in the solution. The sterilisation chemical shall be prepared in accordance with the manufacturer's instructions.

- 5.10.7 The supply shall then be stopped and draw off taps on the distribution pipework progressively opened working away from the tank. Each tank shall then be topped up with water and sufficient sterilising chemical to give a concentration of 50mg/litre chlorine. The tank and pipes shall then remain charged for three hours. A sample shall be taken at the end of this period and checked for residual chlorine with a comparator. If less than 30mg/litre is indicated the process shall be repeated until this residue is obtained
- 5.10.8 Finally all pipework including vessels shall remain charged with chlorinated water for at least a further 16 hours to ensure total disinfection. The system shall then be flushed out with clean water until all traces of chlorine residue are removed.
- 5.10.9 Draw-off taps on each installation shall be provided with warning labels advising not to use the water whilst sterilisation is in progress.
- 5.10.10 The mechanical services installer shall pay all charges for all water and electricity used for sterilising and flushing out.

5.11 Chemicals

- 5.11.1 Sufficient of each water treatment and dosage system chemicals shall be provided to the Employer to give specific protection for a minimum period of 12 months.

5.12 Test certificates

- 5.12.1 On completion of flushing cleaning dosing and sterilisation the mechanical services installer shall have water samples from each system analysed to show final water quality. The test certificates shall be incorporated into the Operating and Maintenance manuals.
- 5.12.2 On open circuit domestic water systems samples shall be tested for bacteriological content to ensure the water is of potable quality.
- 5.12.3 Any system failing to comply with the required standards shall be re-treated and re-tested as required by this Section of the specification.

5.13 Pseudomonas bacteriological infestations of closed pipework systems

- 5.13.1 Water samples shall be taken from the proposed source of water for testing, flushing and final filling before works commence and shall be tested for Pseudomonas bacteria. The test results shall be issued to the Engineer before any filling of the systems for testing commence.

- 5.13.2 A sum shall be identified by the tenderer within the tender for undertaking the necessary treatment to overcome a Pseudomonas Contamination and for providing a temporary water treatment plant from initial filling and hydraulic testing to Practical Completion. If no contamination is found by practical completion this sum shall be removed by instruction and the identified tender cost deducted.
- 5.13.3 On Pseudomonas being detected, a method statement detailing testing, sourcing and treatment regimes shall be agreed with the Engineer in time for the procedures to be incorporated within the construction programme.
- 5.13.4 Before Practical Completion the Mechanical Services Installer shall commission a final water analysis report from water samples taken in the presence of the Engineer. The report shall demonstrate that the systems do not contain any microbiological activity and are chemically closed in accordance with the specialist water treatment companies' recommendations. If activity is still present, the systems shall be retreated and tested until clear.

6 Inspection, testing and commissioning

6.1 General

- 6.1.1 The entire Works shall be inspected, tested and commissioned in accordance with all relevant British Standard Specifications and Codes of Practice together with and the details given in this Specification to the entire satisfaction of the Engineer.
- 6.1.2 Installations shall be inspected and tested in sections as the work proceeds and test certificates issued accordingly. The Engineer or Insurance Company may require inspecting or testing of any equipment during manufacture.
- 6.1.3 No section of the Works shall be insulated or in any other way concealed prior to testing and inspection. Subsequent concealment, where applicable, shall only take place following written authority from the Engineer.
- 6.1.4 Commissioning shall be undertaken by a specialist commissioning company who shall pre-commission and commission all systems. The specialist shall be advised to the Engineer at the time of Tender for agreement to their suitability. The specialist shall produce a comprehensive report on all systems.
- 6.1.5 A "Conduct of Commissioning Certificate" shall be provided, as published by the "Central Heating Information Council", for commissioning of systems in dwellings as required in the Approved Document Part L1 of the Building Regulations.

6.2 Attendance

- 6.2.1 Tests shall be arranged in co-operation with the Public Health Services Installer and Engineer who shall be given five working days' notice in writing of the time, location and nature of the test to be performed. No test shall be considered valid unless the Engineer or his appointed representative is present.
- 6.2.2 All necessary skilled and unskilled labour shall be provided for attendance duties during testing and commissioning, including pre- and post-test activities. Test media shall be provided and subsequently disposed of except where specifically stated otherwise. Fuel, water, electricity, gas and other consumables required for testing and commissioning shall be provided by the Electrical Services Installer. All fuel tanks, lubrication systems and the like shall be left fully charged at Practical Completion. Batteries shall be left in a fully charged condition.
- 6.2.3 Representatives present during inspection and testing shall be fully conversant with the system concerned and the method of system and instrument operation. Manufacturers or specialist's representatives shall attend where indicated elsewhere in the Specification or where necessary to ensure that the Works are tested and commissioned in accordance with the requirements of the specification.
- 6.2.4 Equipment with electrical supplies shall be certified ready for use.

- 6.2.5 The commissioning engineer shall attend site regularly during the month prior to commencing work in order to fully familiarise himself with the Works, to monitor the progress of the installation and to ensure that all test points, commissioning valves and other facilities required for commissioning are correctly installed.

6.3 Test equipment

- 6.3.1 All necessary facilities, measuring and recording instruments including test pumps and gauges for inspection or testing purposes shall be provided and shall be checked or calibrated by the Mechanical Services Installer as necessary before use. The Engineer reserves the right to call for a demonstration of the accuracy of any instruments provided.
- 6.3.2 Test points necessary to carry out the specified test and commissioning requirements shall be provided including facilities for temperature, pressure, pressure drop, volume flow, velocity, in duct sound power and pressure, humidity or other relevant conditions to be measured. Such points shall be fitted with removable plugs, flanges or other devices appropriate to the service concerned. Permanent test or reading points shall be provided only where specified elsewhere.

6.4 Test certificates

- 6.4.1 Duplicate signed test certificates shall be provided. Test certificates shall identify the Mechanical Services Installer, the Project name and the date of test. They shall list the apparatus or section under test, maker's number (if any), the nature, duration and conditions of test. The certificate shall include details of the test instrument including serial number and the details of its calibration certificate. The result of the test shall be declared and the certificate signed by the person conducting the test.
- 6.4.2 Where a test has been independently verified, the witness shall countersign the certificate. The name of the company represented by the witness shall be added.
- 6.4.3 No test shall be valid until the test certificate is provided.

6.5 Failure of test

- 6.5.1 Any defects occurring at any time during the test duration shall be made good and a complete re-test carried out.
- 6.5.2 Where failure during a test, inspection or commissioning process results in damage to the building fabric to any services not provided as part of this Contract, or requires subsequent builders work in connection to be carried out, then the remedial works shall be the responsibility of the Public Health Services Installer.

- 6.5.3 Leakages shall be repaired by properly remaking or replacing the defective component. Caulking will not be permitted.

6.6 Works tests

- 6.6.1 The Engineer will be entitled, at all reasonable times during the manufacture, to inspect, examine and test equipment to be provided. The Engineer shall inform the Public Health Services Installer which equipment is to be inspected or tested at works.
- 6.6.2 The Public Health Services Installer shall give the Engineer written notice of the date and place at which such equipment will be ready, at least 10 working days before such date.
- 6.6.3 Such inspection, examination or testing shall not release the Public Health Services Installer from any obligation under the Contract.

6.7 Equipment output tests

- 6.7.1 Equipment, which has a specified output or throughput, shall be tested and the recorded output or throughput, method of calculation and relevant test conditions indicated on test certificates.
- 6.7.2 Where a British Standard has been published, tests shall comply with the Standard.

6.8 Specialist plant

- 6.8.1 The Public Health Services Installer shall be responsible for manufacturers attending site to carry out specialist commissioning of all plant items.
- 6.8.2 Where described elsewhere in this Specification particular items of plant shall be tested and commissioned in accordance with their relevant clauses.

6.9 Commissioning Instruments

- 6.9.1 Instruments for testing shall be provided including the following:
- Water Flow meter.
 - Pressure gauge

6.10 Water circuit balancing

- 6.10.1 Systems shall be filled with the working fluid, vented as necessary and brought to a state of complete readiness for the system balancing procedures.
- 6.10.2 Water systems shall be balanced in accordance with the CIBSE Commissioning Codes and BSRIA Commissioning Guide. Balancing shall be achieved by the regulating valves provided and flow rates determined on a pressure drop basis. Where pressure tapings or orifice plates are not provided temperature drop may be used.
- 6.10.3 Flow through pumps shall be measured by relating the pressure drop across the pump to the manufacturer's tests curves and by summation of relevant commissioning valve readings. A copy of the test curve indicating the final operating point shall be forwarded to the Engineer.

6.11 Commissioning results

- 6.11.1 On completion of each section of work the results shall be typed in schedule form and submitted to the Engineer for comment. Following comment by the Engineer the tabulated commissioning results shall be incorporated into the Mechanical Services maintenance manuals.

7 Drawings and documentation

7.1 Tender drawings

- 7.1.1 The Tender Drawings are prepared by the Engineer to show the general arrangement of the plant, equipment and services, which form the intended Contract. The drawings are prepared in sufficient detail to, in conjunction with the Specification, allow competitive Tenders to be submitted.
- 7.1.2 The Mechanical Services Installer shall be responsible for interpreting the drawings, making due allowance for offsets to avoid the building structure or other services, whether indicated or not. The Mechanical Services Installer shall take all necessary steps to fully acquaint him with the nature and extent of the works by visiting the site and inspecting the architectural, structural and other services drawings.
- 7.1.3 No claim for loss or expense due to the above factors will be considered.

7.2 Contract drawings

- 7.2.1 The Contract drawings are issued by the Engineer when the Contract is placed. They will comprise the Tender drawings as described, modified to include any variation to the Contract since the issue of the Tender Drawings.
- 7.2.2 Variations to the Contract, requiring the further drawing information will be carried out by the Engineer issuing updated copies of the Contract Drawings or supplementary sketch drawings until such times as the working drawings are available for marking up or in such other manner as the Engineer decides.

7.3 Cad data

- 7.3.1 A CAD copy of the Engineers drawings may be made available to the Mechanical Services Installer to assist in the preparation of the Installers working drawings should a request for the information be made to the Engineer in writing. Disks will be prepared in the current version of Autocad or in DXF format as required. A charge may be made by the Engineer for the provision of such information, the charge being confirmed to the Mechanical Services Installer as soon as the number and size of the drawing files required is known.
- 7.3.2 The Mechanical Services Installer shall be solely responsible for the modification of the information to provide the working drawings as required by this specification. The modified drawings shall accurately reflect the equipment and installation proposed by the Mechanical Services Installer as if the drawings had been drawn without the benefit of the electronic data. They shall also take account of the most recent Architectural and Structural information. Working drawings prepared from data provided by the Engineer shall be issued with the Engineer's title block replaced by the Installer's own block.

7.3.3 The Mechanical Services Installer's particular attention is drawn to the following conditions which apply to the use of any electronic information provided by the Engineer:-

- Any charge for supplying data for this Project is to be agreed with the Engineer and shall be received prior to release of the data.
- It is an express condition of the contract under which data is supplied that the Mechanical Services Installer is absolutely responsible for verifying its correctness and completeness.
- The Engineer accepts no liability or responsibility whatsoever for any loss or damage suffered by the recipient arising out of or in connection with the use or misuse of this data.
- While all reasonable steps have been taken to ensure that the transfer medium and its contents are free from computer viruses, the Engineer cannot be held responsible for any damage or loss that might from their presence.
- The copyright of the original drawings, of which the data is an electronic copy, belongs to the Engineer. The drawings and data have not been prepared for use by the Mechanical Services Installer and may not fully reflect his needs.
- Measurements taken from information which is not dimensioned on the electronic copy are at the Mechanical Services Installers own risk.

7.3.4 All electronic information passed to the Mechanical Services Installer shall be bound by the conditions set out in the above clause.

7.4 Manufacturers drawings

7.4.1 Four copies of manufacturer's drawings and details of all plant and equipment shall be forwarded to the Engineer for comment. Drawings and details shall be certified by the Manufacturer as being applicable to the particular items being supplied.

7.4.2 Drawings shall include general layouts and assembly drawings, details of materials and construction, methods of support and fixing and electrical wiring diagrams. The information shall be in sufficient detail to allow the Engineer to comment. Where particular requirements for drawings are listed in the appropriate clauses for equipment or systems then these shall also be provided.

7.5 Working drawings

- 7.5.1 The Mechanical Services Installer shall produce fully detailed and dimensioned working drawings of each service to be installed, including all purpose made plant and equipment. The location of all plant, equipment and services shall be fully dimensioned from each other, from other work and from the building structure.
- 7.5.2 The Mechanical Services Installer shall ensure that all services, including those provided by others are fully co-ordinated with each other and with the building structure and finishes, including obtaining the necessary information from others and for the indication of the service routes for all trades on composite drawings.
- 7.5.3 The Tenderer shall allow for plant, equipment, pipework, ductwork or electrical installation to be moved during the preparation of working drawings up to one metre from the position inferred by the Tender Drawings.
- 7.5.4 Working drawings shall include fully dimensioned details and positions of supports and fixings. They shall clearly define the detail and arrangement of installed equipment and systems including access allowances for service and maintenance. Where plant is to be supported on steelwork, the Mechanical Services Installer shall provide setting out dimensions for the steelwork and fixing details of the particular plant to be supported. Weight of plant items with point loads shall be provided.
- 7.5.5 Working drawings shall be produced in accordance with a programme which is to be agreed with the Contractor to suit the overall programme for the Works. Reasonable allowance shall be made for incorporating any comments made by the Engineer.
- 7.5.6 Plant and equipment shall be shown in outline with positions of connections and access space clearly shown including space for withdrawal of internal parts. On 1:50 scale drawings pipework, ductwork or electrical distribution equal to or larger than 100mm shall be shown to scale in double line. Circular distribution shall also have the centre line shown. 1:20 and larger scale drawings shall be similarly detailed, except that distribution equal to or larger than 40mm shall be shown to scale in double line. Where appropriate the thickness of insulation shall also be shown on 1:20 or larger scale drawings.
- 7.5.7 Dimensions shall be clearly shown to locate plant, equipment and distribution from the building structure or fabric and from each other. Inverts or levels above datum shall be shown for all distribution services.
- 7.5.8 Drawings shall be produced to a scale suitable for the application but at least to the scale listed above. Only recognized metric scales shall be used. Drawings shall be produced on A1 or A0 sheets as appropriate. A3 or A4 drawings may be used for specific component details such as typical brackets with the agreement of the Engineer.

7.6 Wiring diagrams

- 7.6.1 The Mechanical Services Installer shall produce fully detailed wiring diagrams of electrical work in connection with the Mechanical Services. The diagrams shall include the following:-
- Field Control Wiring Layouts
 - Field Power Wiring Layouts
 - Control Panel Wiring Diagrams
- 7.6.2 Wiring diagrams shall be produced on a minimum of A1 size sheets. Where necessary, to incorporate additional information A0 sheets may be used. Computer generated diagrams on A3 or A4 sheets may alternatively be produced provided the information is clearly legible. Where diagrams have to be produced on more than one sheet then information shall be grouped as far as possible to minimise cross-referencing between sheets. Diagrams which due to non-compliance with the above are difficult to read shall be rejected by the Engineer.
- 7.6.3 Wiring diagrams shall clearly indicate the extent of the wiring system, including numbers and sizes of cables with loadings and relevant cable identification, layouts of cable trays, trunking and conduits and locations of all equipment requiring electrical connection. The drawings shall fully detail the requirements and location of points of connection of electrical services to mechanical services panels and equipment.

7.7 Builders work drawings

- 7.7.1 In addition to the working drawings of the engineering services, the Mechanical Services Installer shall be required to produce drawings indicating builders work requirements in connection with the services. These drawings shall include details of penetrations through the structure, builders work supports and bases. Full details of access requirements for commissioning, servicing and maintenance through suspended ceilings and floors, together with access to riser ducts and the like shall also be provided as well as fire stopping arrangements and continuation of thermal insulation through penetration through building fabric.
- 7.7.2 The drawings shall only be prepared after the working drawings have been finally agreed with the Engineer and shall be based on the detail of these working drawings. The drawing production programme shall take this fully into account.

7.8 Issue of drawings

- 7.8.1 On completion of working drawings, wiring diagrams and builders work drawings shall be submitted to the Engineer for comment. Four prints of the drawings shall be issued to the Engineer for this purpose. If an electronic document control system is employed for the project this will replace the need for printed copies, if agreed with the Engineer. A period of fifteen working days shall then be allowed for comment on the drawings by the Professional Team.
- 7.8.2 Where drawings are submitted for comment they will be reviewed by the Engineer and any comments returned, either by marking directly on the drawing, or by correspondence. Drawings will be marked with A, B or C status and the definition of each category is as follows:-
- No comments. The drawing is to be re-issued for Construction.
 - Comments provided by the Engineer. The drawing is to amend to incorporate all of the Engineers comments and marked for Construction.
 - The drawing is inadequate and is to be redrawn and resubmitted for comment.
 - The giving of an 'A' status does not relieve the Mechanical Services Installer from ensuring that the drawings meet the requirements of the contract documentation.
- 7.8.3 The status of working drawings does not relieve the Mechanical Services Installer from his obligations to progress and complete the works in line with the agreed programme. Should the Mechanical Services Installer elect, in order to meet the programme, to proceed with installation work before 'A' status working drawing is achieved, this shall be at his own risk. Should unacceptable work be installed, it will be the responsibility of the Mechanical Services Installer to ensure it is removed and replaced in a manner acceptable to the Engineer. No claims for delay or payment will be entertained in this respect.
- 7.8.4 When the drawings have been amended to incorporate any comments four prints and one copy negative shall be issued as the construction issue to the Architect and the Engineer. The same preliminary and construction issue distribution of drawings shall apply to any subsequent revisions of working drawings.

7.9 Dimensions

- 7.9.1 The Mechanical Services Installer shall take site dimensions during the preparation of the drawings and be responsible for their accuracy. Setting out of the works on site shall be carried out by the Mechanical Services.
- 7.9.2 Installer and any errors arising from inaccuracies in setting out shall be the Mechanical Services Installers responsibility.
- 7.9.3 The Mechanical Services Installer shall be solely responsible for the accuracy of the drawings and for any equipment shown being suitable for the purpose for which it is intended and in accordance with the design drawings and specifications.

7.10 Site copies

- 7.10.1 One set of prints of working drawings, manufacturing drawings and installation drawings as necessary to provide a complete record of the Works shall be kept on site. The drawings shall be available at all times for inspection by the Engineer.
- 7.10.2 The drawings shall be kept in good condition and be marked up, at least once a week, to show the progress of work on site and incorporate all alterations, omissions, variations and amendments agreed during the progress of the works.

7.11 Schedule of rates

- 7.11.1 Tenderers shall provide, in triplicate, a make-up of the tender price showing quantities, rates and totals in an agreed form and in such detail as required by the Engineer and Quantity Surveyor.
- 7.11.2 Responsibility for the accuracy and completeness of the quantities and descriptions will rest with the Tenderer. No adjustments will be made to the tendered price in respect of any inaccuracies. The exclusion of any items in the Schedule of Rates will not relieve the Mechanical Services Installer of any obligations under the Specifications and Drawings.
- 7.11.3 Schedule of Rates shall be provided within seven days of request from the Engineer or Quantity Surveyor.
- 7.11.4 The Tenderer shall also provide a schedule of makes and types of all equipment included in his Tender, and a list of all Specialists to be employed on the works.

7.12 Manuals

- 7.12.1 Manuals should consist of one electronic copy and five sets of printed manuals. Both electronic and printed copies shall incorporate all test certificates and acceptances. Six weeks prior to Practical Completion draft copies of the manuals shall be submitted to the Architect and Engineer for comment. One week before Practical Completion final agreed manuals shall be handed over to the Employer. A sum equivalent to 5% of the tender value shall be retained until this occurs.
- 7.12.2 Failure to issue the manuals in time for incorporation into the Health and Safety File will result in failure to achieve Practical Completion.
- 7.12.3 Where a development includes residential units, each individual residential unit shall be provided with its own set of Operating and Maintenance instructions.
 - 7.12.3.1 The manual shall be arranged as follows:-
 - Section 1 Index
 - Section 2 Description of the Design Intent

- Section 3 Description of the Operation Routine. The description shall include specific instruction for start up, operation and shut down of each system, procedures for emergency shutdown, making safe potentially dangerous plant, precautions necessary to overcome known hazards when operating each system, bringing into operation standby equipment, instructions on fault finding and emergency in case of plant malfunction or equipment failure and control sequences for all systems. Health and safety matters identified in the Health and Safety Plan and relevant to the operation, maintenance and replacement of the installation shall be described with precautions envisaged as necessary.
- Section 4 Planned Maintenance Instructions. These shall detail the procedures appropriate to the maintenance tasks. Instructions shall include dismantling and reassembly, replacements, adjustment, calibration and testing, reference to parts, identification lists, special tools, test equipment and auxiliary services, hazards which may arise and precautions to be taken, fault finding routines.
- Section 5 Maintenance Schedules. These shall detail recommendations for the nature and frequency of inspections, examinations, tests and maintenance to keep the equipment in a safe and efficient working order. Guidance shall be given on the nature of deterioration and defects to be looked for. Activities shall be listed for daily, weekly, monthly, quarterly, bi-annual and annual routines.
- Section 6 Dismantling. Description of the methods and processes to be used in draining down and emptying of all systems including safe disposal of the contents. Description of the methods envisaged for dismantling of systems to comply with health and safety requirements, including schedules of hazardous substances and methods of disposal.
- Section 7 Equipment Schedules and Parts Lists. The schedules shall locate each item with details of the design and actual operating conditions, including replaceable assemblies. Sufficient information shall be provided to identify each item, with the source of supply, ratings, dimensions and appropriate standards. Equipment schedules shall include the name and address of the manufacturer, reference number, name and address of supplier, order number, date of purchase and duration of warranty. A separate parts list shall be provided for each item detailed in the equipment schedule. Schedules should be provided electronically in MS Word or MS Excel tabular form.
- Section 8 A set of Record Drawings and Test Certificates. If necessary, due to the number of drawings which have to be included in the manual, each drawing shall be photographically reduced in size to suit the manual. There should also be a Master Record Index provided electronically in MS Word or MS Excel, listing drawing numbers, descriptions, category and all related drawings.

Section 9 Emergency Measures. This shall include telephone numbers of Mechanical Services Installer's emergency staff and name, address and telephone number of all manufacturers.

Section 10 Copies of all test certificates and commissioning data for each service and item of plant and equipment. They shall be final copies of the data produced as required by the Inspection, Testing and Commissioning Section of this Specification. Where such data is not available for inclusion in the draft copy of the manual required by paragraph b of this Clause, the draft shall be forwarded without them. Inability to include these items will not be accepted as a reason for non-production of the rest of the draft manual.

7.12.4 Covers shall be substantial, of adequate size, distinctive and of sufficient strength to protect the contents for the life of the installation. The binding shall give a permanent anchorage along the left hand side whilst allowing the text to be flat without damage to the spine.

7.12.5 The contents shall be prepared with an agreed typeface on top quality A4 paper suitable for direct insertion into the manuals.

7.12.6 The front cover and where appropriate the spine shall have the name or logotype of the Employer, the name of the building and details of the services included in the manual clearly displayed in permanent lettering. Where the manual is contained in more than one volume, a volume number shall be added.

7.12.7 The title page shall identify the building, describe the Services referred to in the manual and give the full name and address of the Employer. It shall also contain, date of completion and date of handover of the services to the Employer. The date of issue of the manual with the name and address of the manual author and the Author's reference number

7.12.8 The preliminary pages shall contain the full name, address and telephone number of the Engineer, the Mechanical Services Installer and specialists. A description of how to use the manual with any limitations on its use shall be included. The preliminary pages shall include a contents list, list of supplementary documents and a record of amendments to the manual.

7.12.9 Each section of the manual shall be divided by a stiff divider of the same size as the holder. The divider shall be labelled to identify the section of the manual which is following.

7.12.10 All pages comprising the manual shall be sequentially numbered within each Section.

7.13 Building log book

7.13.1 The Mechanical Services Installer shall produce all required information for the Building Log book to meet the requirements of the Building Regulations Approved

Document in accordance with CIBSE TM31: Building Log Books and Standard Templates.

- 7.13.2 The Mechanical Services Installer shall issue the required information to the Contractor in good time for onward transmission to the Log book Author to allow the completed log book to be issued one week prior to Practical Completion. Failure to issue the required information may prejudice the issue of the Practical Completion certificate.

7.14 Record drawings

- 7.14.1 Two sets of paper prints of the Record Drawings shall be provided to the Architect by the Mechanical Services Installer for comment 28 days prior to Practical Completion. If an electronic document control system is employed for the project this will replace the need for printed copies, if agreed with the Engineer.

- 7.14.2 When agreement with the contents of the Drawings is received from the Architect five sets of paper prints and electronic copies to the current version of AutoCAD or in DXF format shall be issued to the Architect. The Drawings shall comply with the requirements of the Construction (Design and Management) Regulations for incorporation into the Health and Safety File for the Contract.

- 7.14.3 Record Drawings shall show the work as completed and shall record the following:-

- The location, including levels if buried, of public service connections provided within the Contract, whether installed as part of the Contract or the appropriate authority, together with the points of origin and termination, size and materials of pipes, line pressure, flow and other relevant information.
- The layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes, drain cocks, test pockets, gauges, flow or pressure switches and other instruments.
- Location, identification size and details of all apparatus and controls equipment served by, or associated with, each of the various services.
- The layout, location, extent of air ducts, including those formed in builders work or otherwise, plant, equipment, dampers, acoustic silencers, grilles, diffusers, other air terminals, balancing dampers, access panels, fire dampers, turning vanes, hand holes, test holes, gauges and instruments. Each duct and terminal shall be marked with its size and air quantity flowing. Each terminal unit or grille shall have its duty clearly shown.
- The location and identity of each room including spaces housing plant, machinery or apparatus.

- Detailed general arrangements of boiler houses, machinery spaces, air handling plant rooms, tank rooms, electrical switch rooms and other plant or apparatus, including the location, identity, manufacturer, size and rating of each apparatus.
- Sections, elevations, isometrics and schematics of the plant spaces required to clearly indicate the plant arrangements.
- Control and wiring diagrams, incorporating details of each instrument and equipment item with a written description of the sequence of operation of each system. Diagrams shall include full details of internal panel wiring and connections to field mounted items.
- Layout, location and extent of electrical switchgear distribution boards, cables and termination points.
- The Record Drawings, as described, shall be drawn using the current version of Autocad and shall be printed on quality paper using international A series sizes. Lettering shall be not less than 5mm in height.
- Each Record Drawing shall show the name of the Contract and, where appropriate, the zone or floor designation. They shall include a description of the drawing, drawing number and scale. The name and address of the Mechanical Services Installer and the Engineer shall be included. Each Drawing shall include the words 'Record Drawing' in 18mm upper case lettering in the bottom right hand corner adjacent to the title block.
- A sum equivalent to 5% of the Contract value to cover the production of these Drawings shall be withheld until they are completed to the Engineer's satisfaction and handed to the Employer. Failure to issue the Record Drawings in time to form part of the Health and Safety File will result in failure to achieve Practical Completion.

7.15 Instruction of employer

- 7.15.1 The Employer's Representatives shall be fully instructed by experienced personnel in the operation, servicing and maintenance of the Works. Instruction shall include the provision of such specialist instruction as is required from any suppliers or specialists.
- 7.15.2 Such instruction shall be given for a minimum period of one week unless otherwise specified elsewhere in this document. On completion a signed receipt shall be obtained from the Employer stating that such instruction has been received.
- 7.15.3 A week's refresher course shall be provided three months after Practical Completion. On completion a signed receipt shall be obtained from the Employer stating that such instruction has been received.

MECHANICAL SCHEDULES

Air Handling Unit

REFERENCE	DOAS-01
LOCATION	On roof slab
SYSTEM SERVED	General ventilation of whole Building
LEAKAGE CLASS	B
INSULATION	Rockwool with 135 kg/m ³ density or equivalent. Thickness of insulation to be as per manufacturer's recommendation
CONSTRUCTION	As per specifications
PANEL THICKNESS	As per manufacturer's recommendation
ACCESS HANDLE TYPES	As per manufacturer's recommendation
UNIT SIZE	To fit in space provided on roof
SUPPLY AIR FILTER RATING	MERV 14, front withdrawal c/w inclined manometer, front withdrawal c/w inclined manometer. 2-stage filtration required F5/F9.
RETURN AIR FILTER RATING	MERV 14, front withdrawal c/w inclined manometer
DESIGN OUTDOOR CONDITIONS (SUMMER)	35 degC @ 90% RH
DESIGN INDOOR CONDITIONS (SUMMER)	21 – 24 degC @ 50 % RH
DX COOLING COIL TOTAL COOLING CAPACITY	427.09 kW
DX COOLING COIL SENSIBLE CAPACITY	144.92 kW
HEATING BATTERY CAPACITY	99.68 kW
HEATING BATTERY TYPE	Heating of the air to control its dry bulb temperature and relative humidity shall be done exclusively by using waste heat from the refrigerant hot gas by-pass circuit. <u>Any other heating method shall NOT be accepted.</u>
HEATING CONTROL TYPE	Stepless continuously adjustable heat input by full modulating 2-way or 3-way refrigerant control valve varying flow of hot refrigerant gas from the refrigerant circuit.
AIR FLOW RATE (l/s)	Supply air = 4500 l/s
EXTERNAL STATIC PRESSURE (UPSTREAM FAN) INCLUDING FILTERS, COILS AND DAMPERS RESISTANCE BEFORE FAN	As per manufacturer's recommendation
EXTERNAL STATIC PRESSURE (DOWNSTREAM FAN) INCLUDING FILTERS, COILS AND DAMPERS RESISTANCE BEFORE FAN	450 Pa
FAN TYPE	Direct drive, electronically commutated plug fan with variable speed capability
ELECTRICAL SUPPLY	400/3Ph/50 Hz

Air Handling Unit

REFERENCE	DOAS-01
ENERGY RECOVERY DEVICE TYPE	Variable speed, through EC motor direct drive, energy recovery wheel, with both sensible and latent heat recovery with minimum 70% efficiency.
POWER RATING	< 10 kW
ACCESSORIES	Flexible connections to ducting. Anti-vibration mountings Attenuator on inlet and outlet Weatherproof protection for motor casing Time controlled start/stop. Control interface for duty/standby operation and demand control ventilation VSD LCD Display for AHU parameters Control panel Easily removable (MERV 14) filter. Thermal protection of motor Insect guards Access door to be provided on same side as coil connection and to access filters
FINISH	Doubled skin galvanised steel. Fully treated against corrosion and against weather conditions – IP65
NOTES	Air Handling Units to be provided with the following accessories / devices and controls: 1. Starter control Unit with Variable Speed Drive (VSD) for the plug EC fans. VSD drive to be fixed to AHU casing. 2. Push Emergency shutdown switch located on the unit 3. All AHU to be supplied complete with control panel. 4. AHU shall have acoustic treatment if required such that the sound level just outside the AHU rooms does not exceed 55 dB(A) at 1m 5. Fresh air filter refers to Panel filter, return air filter refers to Bag filter and Supply outlet air filter refers to Absolute filter 6. Remote operation of AHU from Fireman switch via motorised breaker. 7. The AHU interface control panel at the reception shall enable the personnel to set the desired ventilation air supply temperature and relative humidity and switch on and off the AHU by overriding the default timer control of the AHU.
NOISE RATING	NR30 within the building.
FAN MOTOR EFFICIENCY CLASS	Minimum IE5
PROPOSED MAKES	Unitair, Vividair, Toussaint Nysenne, FranceAir, Trox, System Air, Daikin, Trane

Toilet Extract Fan

REFERENCE	Toilet Extract Fan -TEF 01
LOCATION	Roof
FAN TYPE	2 Nos. Cabinet fans with direct drive EC plug fan working in duty, standby, auto-change over mode
FAN SPEED CONTROL	Fixed speed
FAN FLOW RATE (l/s)	1000 L/s for each fan
PRESSURE RATING (Pa)	250 Pa for each fan
FINISH	Aluminium/Hot dipped galvanised steel. Fully treated against corrosion and against weather conditions – IP65
ELECTRICAL SUPPLY	230/1Ph/50 Hz
START	DOL starting c/w programmable digital timer control module and control wiring.
ACCESSORIES	Flexible connections to ducting Rain Cowl Anti-vibration mountings Noise attenuator (silencer) on inlet and outlet Weatherproof protection for motor casing Time controlled start/stop and auto-changeover of fan after elapsed running time. Control interface for duty/standby operation and demand control ventilation VSD Thermal protection of motor Insect guards MERV 8 Filter to be fitted on exhaust air duct from clinic building
NOISE RATING	NR30 within the building.
EXPECTED LIFETIME OF FAN	Fan: 20 years
EFFICIENCY CLASS	Minimum IE5
PROPOSED MAKES	FranceAir, Aldes, Novovent, Trox, System Air

Insulation & Duct Schedules

INSULATION SCHEDULES		
SERVICE	LOCATION	INSULATION MATERIAL
Condensate pipes	Throughout	Nitrile Rubber insulation. Thickness to be ASHRAE Standard 90.1-2010 or to BS 5422. Minimum thickness 19 mm.
Refrigerant pipes	Internal	Nitrile Rubber insulation. Thickness to be ASHRAE Standard 90.1-2010 or to BS 5422. Minimum thickness 19mm.
	External	Nitrile Rubber insulation. Thickness to be ASHRAE Standard 90.1-2010 or to BS 5422 WITH aluminium cladding Minimum thickness 19mm.
Conditioned Air Supply/ Return	Inside Ceiling Void/ Internal	Nitrile Rubber insulation . Thickness to BS 5422. Minimum thickness 25 mm.
	External	Nitrile Rubber insulation . Thickness to BS 5422 Minimum thickness 25 mm.
Chilled Water Pipes	Internal	Phenolic foam insulation. Thickness to be ASHRAE Standard 90.1-2010 or to BS 5422 Minimum thickness 25 mm.
	External	Phenolic foam insulation . Thickness to be ASHRAE Standard 90.1-2010 or to BS 5422 WITH aluminium cladding. Minimum thickness 25 mm.
Toilet Extract System Fresh Air System General exhaust	External	Uninsulated.
	Risers	Uninsulated.
	Ceiling voids	Uninsulated.

DUCT SCHEDULE		
	LOCATION	
Flexible Duct	Throughout	Material and installation compliant to Section 30 of DW144

DUCT SYSTEM	DW144 CLASSIFICATION	LEAKAGE TESTING
Fresh Air Supply	A	Y
Air Extract	A	Y
Conditioned Air Supply/ Return	A	Y

Grilles and Damper Schedules

REFERENCE	Extract Diffuser
DESCRIPTION	600x600 mm Toilet extract diffuser
LOCATION	Fixed to toilet false ceiling
TYPE	Diffuser c/w damper
DUTY	As detailed on drawings
RESISTANCE	Not exceeding 20 Pa
FINISH	Aluminium material,
ACCESSORIES	Plenum box Volume Control Damper Mounting accessories
NOTES	Ensure that noise level due to the extract diffusers does not exceed NR30.

REFERENCE	Return air diffuser
DESCRIPTION	600x600mm egg crate return air diffuser
LOCATION	Fixed to false ceiling
TYPE	Diffuser c/w damper
DUTY	As detailed on drawings
RESISTANCE	Not exceeding 20 Pa
FINISH	Aluminium material,
ACCESSORIES	Plenum box Volume Control Damper Mounting accessories
NOTES	Ensure that noise level due to the extract diffusers does not exceed NR30.
REFERENCE	Supply air diffuser
DESCRIPTION	4-way diffuser for supply air
LOCATION	Fixed to false ceiling
TYPE	Diffuser c/w damper
DUTY	As detailed on drawings
RESISTANCE	Not exceeding 20 Pa
FINISH	Aluminium material,
ACCESSORIES	Plenum box Volume Control Damper Mounting accessories
NOTES	Ensure that noise level due to the extract diffusers does not exceed NR30.

Grilles and Damper Schedules

Reference	Description	Type	Material	Manufacturer
VCD	Manual Volume control dampers	Rectangular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
		Circular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
BDS	Backdraft shutter	Rectangular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
		Circular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
FD	Fire dampers	Rectangular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
		Circular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
MSFD	Motorised Smoke and Fire damper	Rectangular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
		Circular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
CVR	Constant volume regulator	Rectangular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair
		Circular	Galvanised steel	France Air, Fluxmeca Aldes, Systemair

ELECTRICAL SCHEDULES

LV DISTRIBUTION

General Notes for power cabling:

1. Low voltage power cables, voltage range: 0.6/1.0 kV
2. Applicable standards:
 - BS 5467 for XLPE insulated Armoured cables
 - BS 7889 for XLPE insulated single core unarmoured cables
3. Insulated core colour codes to BS 5467 (A:2008)
3 cores single phase: Brown (L1), Blue (N), Green/Yellow (E)
3 cores three phase : Brown (L1), Black (L2), Grey (L3)
4 cores three phase and neutral: Brown (L1), Black (L2), Grey (L3) and Blue (N)
5 cores, three phase, neutral and protective conductor: Brown (L1), Black (L2), Grey (L3), Blue (N) and Green/Yellow
4. Installation:
Low voltage cables with both PVC and XLPE insulation are suitable for indoor and outdoor applications. Armoured cables are suitable for covered cable ducts, cable tray, buried PVC sleeves or trenches.
5. All cables in cable trays or cable ducts are to be laid flat vertically or horizontally (Method E or F as described in BS 7671 IEE wiring regulation 17th edition).

General Notes:

- 1 Standard electrical accessories mounting heights:
 - a. General Socket Outlet to be fixed at 300 mm above floor finish.
 - b. Lighting switch to be fixed at 1200 mm above floor finish.
- 2 Single and double switched outlets shall conform to BS 1363 and enclosure box to BS 4662.
- 3 All accessories shall be aligned vertically and horizontally, where accessories are grouped, they shall be mount horizontally in line and parallel to each other and equidistant. Space between any two accessories shall be 10 mm.
- 4 Cover plates to boxes with brass fixing screws.
- 5 Provide masking covers for surface mounted accessories to protect surface from paint, where accessories are flush mounted install front plate after painting is finished.

MAUBANK PORT-LOUIS - GENERAL, EMERGENCY AND EXTERNAL LIGHTING SCHEDULE

ITEM	TYPE	LOCATION	DESCRIPTION	PICTURE	Unit	Quantity	RATE (MUR EXCL. VAT)	AMOUNT (MUR EXCL. VAT)	SUPPLIER TO STATE WARRANTY/ GUARANTEE ON DRIVERS AND LED COMPONENTS (for e.g. 3 years)	REMARKS	APPROVAL BY ID
1	A	Offices	LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE		nr						
2	A/E	Offices	LED Panel Light 30W c/w emergency battery pack, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE		nr						
3	B	Technical rooms, Toilet corridors, Kitchen and Technical offices on roof	LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN		nr						
4	B/E	Technical rooms, Toilet corridors, Kitchen and Technical offices on roof	LED Batten 40W c/w emergency battery pack , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN		nr						
5	C	Corridors/Lobbies	LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN		nr						

MAUBANK PORT-LOUIS - GENERAL, EMERGENCY AND EXTERNAL LIGHTING SCHEDULE

ITEM	TYPE	LOCATION	DESCRIPTION	PICTURE	Unit	Quantity	RATE (MUR EXCL. VAT)	AMOUNT (MUR EXCL. VAT)	SUPPLIER TO STATE WARRANTY/ GUARANTEE ON DRIVERS AND LED COMPONENTS (for e.g. 3 years)	REMARKS	APPROVAL BY ID
6	C/E	Corridors/Lobbies	LED circular panel c/w emergency battery pack, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN		nr						
7	D	Meeting rooms	LED Batten, 48W 1.5M IP20, 4000K similar or equivalent to ROBUS CAESAR		nr						
8	D/E	Meeting rooms	LED Batten, 48W 1.5M IP20, 4000K c/w emergency battery pack similar or equivalent to ROBUS CAESAR		nr						
9	E1	Exit doors	Illuminated Emergency Escape sign - Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS		nr						
10	E2	Exit doors at staircase	Illuminated Emergency Escape sign - Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS		nr						

MAUBANK PORT-LOUIS - GENERAL, EMERGENCY AND EXTERNAL LIGHTING SCHEDULE

ITEM	TYPE	LOCATION	DESCRIPTION	PICTURE	Unit	Quantity	RATE (MUR EXCL. VAT)	AMOUNT (MUR EXCL. VAT)	SUPPLIER TO STATE WARRANTY/ GUARANTEE ON DRIVERS AND LED COMPONENTS (for e.g. 3 years)	REMARKS	APPROVAL BY ID
11	E3	In corridors/circulation area	Illuminated Emergency Escape sign - Arrow Right, 1.5W, Maintained, similar or equivalent to ROBUS SWISS		nr						
12	E4	In corridors/circulation area	Illuminated Emergency Escape sign - Arrow Left, 1.5W, Maintained, similar or equivalent to ROBUS SWISS		nr						
13	F	External area	Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO		nr						
14	G	Rooftop (Outdoor)	Weatherproof LED Floodlights IP65 - Warm White (3000K) 20W - 2000 lm(178x165mm) similar or equivalent to Legrand		nr						
15	H	Void above	Pendant light, White with LED, 7.5W, 800 lm, 2500K, similar or equivalent to SLV, FITU E27, Product No 132691 with LED Prod. No 1005265		nr						

MAUBANK PORT-LOUIS - GENERAL, EMERGENCY AND EXTERNAL LIGHTING SCHEDULE

ITEM	TYPE	LOCATION	DESCRIPTION	PICTURE	Unit	Quantity	RATE (MUR EXCL. VAT)	AMOUNT (MUR EXCL. VAT)	SUPPLIER TO STATE WARRANTY/ GUARANTEE ON DRIVERS AND LED COMPONENTS (for e.g. 3 years)	REMARKS	APPROVAL BY ID
16	I1	Entrance lobby	Recessed downlight with Opal cover, 19W, 2250 lm, 118 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus II S PRE with Opal cover		nr						
17	I1/E	Entrance lobby	Recessed downlight, 19W, 2250 lm, 118 lm/W, CCT 4000K c/w emergency battery pack, similar or equivalent to OMS, Prettus II S PRE with Opal cover		nr						
18	I2	Lift lobby and Entrance on ground floor	Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover		nr						
19	J	Electrical room, Misc Room	LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON		nr						
20	K	Entrance on ground floor	Downlight, 20W, White Colour, 2120 lm, UGR 16 similar or equivalent to SLV Numinos M, Ø 8.5, Dali, 4000K, Prod No 1004527								

MAUBANK PORT-LOUIS - GENERAL, EMERGENCY AND EXTERNAL LIGHTING SCHEDULE

ITEM	TYPE	LOCATION	DESCRIPTION	PICTURE	Unit	Quantity	RATE (MUR EXCL. VAT)	AMOUNT (MUR EXCL. VAT)	SUPPLIER TO STATE WARRANTY/ GUARANTEE ON DRIVERS AND LED COMPONENTS (for e.g. 3 years)	REMARKS	APPROVAL BY ID
21	L	Entrance lobby	Pendant Light, 31W, Black Colour, 2700 lm, 4000k, similar or equivalent to SLV Supros PD, Prod No 1003278								
22	S	Toilet, Staircase, Store rooms	LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE		nr						
23	S/E	Toilet, Staircase, Store rooms	LED Surface Mount 20W c/w emergency battery pack, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE		nr						
TOTAL											

ELECTRICAL ACCESSORIES

Accessory	Finish Colour	Installation Method	Location	Similar or Equivalent Type Range
Light switch 1 gang 1 way	White	Flush	As indicated on drawings	Legrand Synergy, c/w flush mounting backbox.
Light switch 1 gang 2 way	White	Flush	As indicated on drawings	Legrand Synergy, c/w flush mounting backbox.
Light switch 2 gang 1 way	White	Flush	As indicated on drawings	Legrand Synergy, c/w flush mounting backbox.
Light switch 2 gang 2 way	White	Flush	As indicated on drawings	Legrand Synergy, c/w flush mounting backbox.
4P 20A Double Pole Switch with red LED indicator	White	Flush	Inside false ceiling for Indoor Units	Legrand Synergy, c/w flush mounting backbox.
4P 50A Proximity Switching Isolating Switch (Rotary Isolator), IP 65, with auxiliary contact	White	Flush	For Outdoor units on Rooftop	Legrand Synergy, c/w flush mounting backbox.
1x13A switched socket outlet	White	Flush	(In technical areas & in locations wherever there are defective and damaged sockets)	Legrand Arteor British standard socket outlet

ELECTRICAL ACCESSORIES

Presence detectors with light level sensor

Reference	Description
PD	Type PD is dual technology ceiling-mounted motion detector for indoor use 360° detection area, Coverage: 10mx10m, with adjustable 30sec-30minutes OFF time delay, In-built light level sensor similar to DT-355 from LEGRAND.

General Notes:

- 1 Standard electrical accessories mounting heights:
 - Lighting switch centre to be fixed at 1200 mm above floor finish and 200mm from door jamb.
- 2 All accessories shall be aligned vertically and horizontally, where accessories are grouped, they shall be mounted horizontally in line and parallel to each other and equidistant. Space between any two accessories shall be 10 mm.
- 3 Cover plates to boxes with brass fixing screws.
- 4 Provide masking covers for surface mounted accessories to protect surface from paint, where accessories are flush mounted install front plate after painting is finished.

UPS SCHEDULE



UPS Schedule	
Reference	UPS Power Backup for Security Camera Systems
Power	1000 VA 600 Watt
Quantity	1
Location	Floor mounted in CCTV room
Load Serve	Lighting and Small Power
Display	Intelligent multi-function LCD panel
Battery/Surge Protected Outlets	5 x 5-15R
Surge Protected Outlets	4 x 5-15R
Connectivity	1 x Serial DB9; 1 x USB 4-pin
Battery	User replaceable 12V 9Ah battery included inside
Origin	European
Warranty	Three-Year Manufacturer's Limited Warranty

Notes:

1. Supplier to include all accessories and components to complete the UPS configuration.
2. UPS's batteries must be hot swappable without ever having to shut down connected equipment.
3. Low battery signally with audible sounder.
4. UPS to include electronically overcurrent and short-circuit protection.
5. The UPS shall incorporate 100% galvanic isolation between the incoming supply and the UPS supply.

Wiring & Cable Management

System	Location	Conforms To	Cable Type/Description	Installation	Features
Fire Alarm	All floors	—	FP200 Fire retardant, LSF sheath	Rigid PVC conduit inside false ceiling (Cabling shall run on cable tray provided by others and via rigid PVC conduit) Cable drops via uPVC conduits (Orange) in block works.	—
Backbone Networking Optical Cabling	In riser	IEC 60794-1, ISO 11801, EN 50173-1	Multi-Mode 8 core OM3 50/125 Micron	Cable Tray	—
Other Systems	—	—	To Specialists Requirements	PVC conduit (concealed) or laid on cable/wire trays	—

Type	Location	Conforms To	Installation
Rigid PVC conduit (White)	All floors	All plastic conduits shall be LSF to BS 4607 and BS EN 50086 as applicable.	Inside false ceiling from cable tray to the room/ area concerned
Flexible Corrugated Conduit (Polyflex) Low friction internal layer for easy cable pulling. Non-flame propagating, UV resistant	All floors	BS EN 61386-1 & BS EN 61386-22	Vertical drops (False ceiling and partitions)
Other Systems	All floors	—	PVC conduit inside ceiling/ flexible corrugated conduit in partitions/ isorange conduit in block work

Fire Detection and Alarm System

Description	Fire Alarm panel
Location	Inside building as shown in W50 drawing series.
Type	Addressable Fire Alarm panel
Colour	White/RAL 7035
No of Loop	2, at least 200 devices per loop
Battery Standby	48 hours
Weight	5.2 Kg (without batteries)
User controls	Jog dials and soft buttons
Cable Entry	Top and Rear
Operating Temperature	-5°C to 40 °C
Email notifications for events directly from panel	Yes, 4 user accounts emails.
Send SMS to GSM phone	Yes, two telephone numbers
Automatic dialling	Yes, two telephone numbers
Ethernet port with TCP/IP for remote diagnostic, maintenance and programming	Yes
I/O interface	24 port input/output interface module.
Ports	3 USB ports with memory stick support, RS232 for printer support.
Manufacturers And Model	UTC Fire & security (United Technologies Company), Gent, Ziton

Description	Smoke detector complete with strobelight	
Location	Inside building where there is false ceiling as shown in W50 drawing series.	Inside building where there is no false ceiling and inside ceiling void as shown in W50 drawing series.
Type	Addressable optical smoke detector, complete with strobelight	Addressable optical smoke detector, complete with strobelight
Rating	-	-
Colour	White	White
Fixation	Flush mounted	Surface mounted
Ingress Protection	IP 30	IP 30
Operating Temperature	-10°C to +50°C	-10°C to +50°C
Manufacturers And Model	UTC Fire & security (United Technologies Company), Gent, Ziton	UTC Fire & security (United Technologies Company), Gent, Ziton

Fire Detection and Alarm System

Description	Heat detector		
Location	Inside building where there is false ceiling as shown in W50 drawing series.		Inside building where there is no false ceiling as shown in W50 drawing series.
Type	Addressable	optical	smoke detector
Rating	-		-
Colour	White		White
Fixation	Flush mounted		Surface mounted
Ingress Protection	IP 30		IP 30
Operating Temperature	-10°C to +50°C		-10°C to +50°C
Manufacturers And Model	UTC Fire & security (United Technologies Company), Gent, Ziton		UTC Fire & security (United Technologies Company), Gent, Ziton

Description	Electronic sounder with strobe light	
Location	Indoor	Outdoor
Type	Addressable	Addressable
Ingress Protection	IP55	IP 65
Operating Temperature	10°C to+55°C	-10°C to+55°C
Sound Output At 1m (adjustable range). Multi tone for multiple stage evacuation.	50 dB(A) to 90 dB(A)	50 dB(A) to 90 dB(A)
Fixation	Wall mounted	Wall mounted
Finish	Red	Red
Power	Loop powered	Loop powered
Manufacturers And Model	UTC Fire & security (United Technologies Company), Gent, Ziton	UTC Fire & security (United Technologies Company), Gent, Ziton

Description	Manual call point	
Location	Indoor	Outdoor
Type	Addressable	Addressable
Operating Temperature	-25°C to 70°C	-25°C to 70°C
Ingress Protection	IP54	IP 67
Fixation	Wall mounted	Wall mounted
Finish	Red	Red
Accessories	Gasket	-
Manufacturers And Model	UTC Fire & security (United Technologies Company), Gent, Ziton	UTC Fire & security (United Technologies Company), Gent, Ziton

Description	Interface unit
INTERFACE UNIT	IU
Type	Addressable
I/O	2 Input 2 output
Power	Loop powered
Fixation	Wall mounted
Manufacturers And Model	UTC Fire & security (United Technologies Company), Gent, Ziton

Reference	Description	Size (mm)	Viewing distance (m)	Geometric shape	Safety colour	Contrast colour	Graphical symbol colour
Type S28	Signage for Manual call point	300 x 300	22	Square	Red	White	White
Type ER	Key plan indicating escape route	400 x 300	22	Rectangular	Green	White	White
Material	Photoluminescent rigid PVC fire signs on Perspex background screwed to background concrete to BS 5499. (Laminated PVC sheet incorporating a photoluminescent layer backed by a rigid white reflective substrate and protected by a tough, clear gloss PVC film, Thickness: 1Amm)						
Flammability	Inherently fire retardant. Luminance performance: in excess of 23mcd/m' @ 10 minutes and 3mcd/m' @ 60 minutes.						

PUBLIC HEALTH SCHEDULES

PUMP SCHEDULE

1.0 COMBINED BOOSTED, COLD-WATER & FHR PUMP

REFERENCE	TP1
Description	Combined Boosted, FHR and Cold-water Pump
Location	Ground Floor Technical Room
System	Cold-water system
No. of pumps	3 no. vertical multistage centrifugal pump on common base plate, to be fixed on new concrete structure. All pumps are to be manifolded in situ to a common manifold.
Control Sequence of Pumps	Duty/ Assist/ Standby (auto-changeover of pump) 2 pump will be working on Duty/ Assist mode and the 3rd pump will be on standby mode. Auto changeover of pump shall be possible. Control panel for pump management to be included.
Total Flow rate per pump	1.6 L/s clw VSD
Total Head	76 m
Pipe Material	cPVC PN16
Existing Connection size (Suction/ discharge manifold) mm	Ø 75mm suction and 2x Ø 50mm discharge
Valves	Flexible connection, flanged butterfly isolating valves, non-return valves, drain valves, pressure gauge etc...
Shaft	Stainless steel
Mechanical seal	Tungsten carbide
O-ring	EPDM
Minimum Operating efficiency	65%
Method of control	1. If the water level is less than critical level in water tank 2 then the pump shuts down 2. The water pump is operated based on timer. During office hours, the pump is turned on, and the system operates on boosted water. 3. Outside office hours, or with input from operator, the pump turns off and is operated on gravity. 4. During a power failure, the system works on gravity with the pump being off. 5. If the water level in the roof water tank is below critical level then the pump is automatically turned on.
Fitted on cabinet	Mains Isolator, MCB's, Runs/trip lights, Hours run meter, Emergency stop push button.
Electrical Rating per pump per Set (kW)	As per supplier
Power Supply (ph/V/Hz)	3 phase/ 400V/ 50 Hz
Method of Starting	Soft start or DOL (Star/Delta)
Pressure vessel	80 L
BMS Interfaces	N/A

REFERENCE	TP1
NOTES	• Control panel to be of the same make as pump set. • Low water level cut-out by control impulse, pressure switch, adjustable stop-time delay on low water. • European origin, similar or equivalent to Grundfos, Ebara, Calpeda, Davey, Pedrollo, Wilo, Samson, Homa, DP pumps.

Pipe Schedules

SERVICE	LOCATION	PIPEWORK MATERIAL	PRESSURE RATING	JOINTING	INSULATION	PROTECTION
Cold Water Pipes	In Riser duct	uPVC	PN16	• Solvent welding	No	No
	Rising to appliances	uPVC	PN16	• Solvent welding	No	No
	On Roof	uPVC	PN16	• Solvent welding	No	Two layers of weatherproof paint
	Underground (On Site)	HDPE	PN10	• Electrofusion joint.	No	Concrete surround where crossroads.

SERVICE	LOCATION	PIPEWORK MATERIAL	PRESSURE RATING	JOINTING	INSULATION	PROTECTION
Soil, waste and vent pipes	In Riser duct	PVC	PN 6	• Solvent welding	No	No
	Underground	PVC	SN8	• Rubber ring joints	No	Concrete surround for road crossing.
	Cast in Slab	PVC	PN10 for pipes	• Solvent welding	No	No
	Inside false ceiling	PVC	PN6	• Solvent welding	Yes (for waste pipes running at HL in ground floor)	No
	In boxing	PVC	PN6	• Solvent welding	No	No

SERVICE	LOCATION	PIPEWORK MATERIAL	PRESSURE RATING	JOINTING	INSULATION	PROTECTION
Condensate Drain Pipe	In Riser duct, floor slab and concealed in blockwork	uPVC	PN 10	• Solvent welding	N/A	N/A

Pipe Schedules

SERVICES	LOCATION	PIPEWORK MATERIAL	JOINTING	SUPPORT
Fire hose reel	Inside Riser duct	Heavy weight galvanised mild steel pipe	- Screwed malleable iron fittings to BS 143 for pipe sizes up to 50 mm diameter. For pipe sizes 65 mm diameter to above the following type of jointing may be used: - Galvanised mechanical grooved end fittings or - Galvanised steel flanges to BS 10 jointed with inside-bolt-circle flat ring composition gaskets, with metric hexagonal headed bolts and nuts with washers.	Pipe ring with extension rod.
	Connection to puddle flange in water tanks.	Heavy weight galvanised steel	Galvanised steel flanges to BS 10 jointed with inside-bolt-circle flat ring composition gaskets, with metric hexagonal headed bolts and nuts with washers.	Pipe ring with extension rod.
	Surface mounted Horizontal run inside fixed to ceiling slab.	Heavy weight galvanised mild steel pipe	- Screwed malleable iron fittings to BS 143 for pipe sizes up to 50 mm diameter. For pipe sizes 65 mm diameter to above the following type of jointing to be used: - Galvanised mechanical grooved end fittings with earth continuity clip or - Galvanised steel flanges to BS 10 jointed with inside-bolt-circle flat ring composition gaskets, with metric hexagonal headed bolts and nuts with washers.	- Clevis hangers similar or equivalent to make Sikla Praktica with minimum M12 threaded rod connections and bolt anchors at specified intervals. - Pipe ring with extension rod.

Valve Schedules

VALVES TYPE	SERVICE	LOCATION	MATERIAL	TYPE OF JOINT	ACCESSORIES
Isolating valve	Cold water supply	Throughout	Brass body, stainless steel lever	Compression/ threaded	-
Isolating valve	Fire hose reel	Throughout	Bronze or brass body, stainless steel lever	Threaded	Leatherstraps and padlock
Stop valve	Fire hose reel	Fire fighting cabinet	Bronze or brass body, stainless steel lever	Threaded	Nozzle interlocking device
Globe regulating valve	Cold water supply	Wash hand basins/ sinks/ washing machines	Chromium plated brass	Compression/ screwed	-
Angle valve	Cold water supply	Hand spray taps	Chromium plated	Compression/ screwed	-
Double Angle valve	Cold water supply	Water closets	Chromium plated	Compression/ screwed	-
Non-return valve	Cold water supply	Throughout	Bronze stainless steel	Flanged	-
Strainer	Cold water supply	Throughout	Bronze	Flanged	-
Float valves		Water tank	Brass		-
Automatic air vent (air release valve)	Cold water supply	Throughout	Brass	Screwed	-
Drain valves	Cold water supply	Throughout	Bronze or brass	Compression	-
Notes:	1. All valves shall be to BS standards and bear the BS kitemark. 2. Valves to be properly labelled with tags. 3. Refer to the public health specifications.				

Fire fighting equipment Schedules

DESCRIPTION	PORTABLE FIRE EXTINGUISHER
Location	Below FHR (as per drawings)
Type	ABC/CO2
Capacity	4.5 kg
Working Pressure	14 Bar
Discharge Time	11.7 s
Body Material	Cold rolled steel
Paint Finish	Signal red
Fire Rating	13A 55B
Type of Fire	A, B, C, E
Manufacturers And Model	SRI/Combat
Note	Fire extinguisher to comply to BS EN 3

DESCRIPTION	FIRE HOSE REEL
Location	Inside building. Located in FHR enclosure provided by Architect
Cabinet	Material: mild steel Colour: Epoxy powder red Thickness: 1.2 mm
Type	Swinging type
Length of hose	30
Diameter of hose	25 mm
Nozzle type	Chrome finish jet nozzle
Body Material	Steel
Maximum drum size	600 mm
Body	Plate powder finish red
Manufacturers And Model	SRI/Combat
Mode of operation	Manual
Accessories to be provided	Pressure gauge
	Stop valve with nozzle interlocking device
Note	Fire hose reel to comply to EN 671

Fire fighting equipment Schedules

REFERENCE	DESCRIPTION	SIZE (MM)	VIEWING DISTANCE	GEOMETRIC SHAPE	SAFETY COLOUR	CONTRAST COLOUR	GRAPHICAL SYMBOL COLOUR
Signage Type	Fire extinguisher identification and location signs incorporating graphical symbols for classes of fire from BS EN3.5: 1996: FIRE HOSE REEL.	200x80	10	Rectangular	Red	White	White
	Fire extinguisher identification and location signs incorporating graphical symbols: FIRE FIGHTING EQUIPMENT STORED INSIDE - TO BE USED ONLY IN THE CASE OF FIRE	200x200	10	Rectangular	Red	White	White
	Fire extinguisher identification and location signs incorporating graphical symbols for classes of fire from BS EN3.5: 1996: BRECHING INLET.	200x80	10	Rectangular	Red	White	White
	FIRE ACTION NOTICE to give instructions to building occupants of what to do in the event of fire.	200X150	10	Rectangular	Green	White	White
	Safe area signs: SAFE AREA	150 x 450	22	Rectangular	Green	White	White
	Assembly point signs: ASSEMBLY POINT	300 x 300	22	Rectangular	Green	White	White
Material	Photoluminescent rigid PVC fire signs on Perspex background screwed to background concrete to BS 5499. (Laminated PVC sheet incorporating a photoluminescent layer backed by a rigid white reflective substrate and protected by a tough, clear gloss PVC film, Thickness: 1Amm)						
Flammability	Inherently fire retardant. Luminance performance: in excess of 23mcd/m' @ 10 minutes and 3mcd/m' @ 60 minutes.						

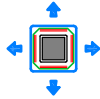
LIST OF TENDER DRAWINGS

Mechanical & Allied Works

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	Revision
22026-PDE-MBPH-T62-U60-00	P00
Architect Drawing Number:	REV:
-	-

Legend



Cassette type AC unit.



Refrigerant tray for VRF refrigerant pipes.



Wired wall mounted thermostat for VRF indoor unit.



Insulated refrigerant pipes.



Insulated condensate drain pipe.



Pipe drop/rise.



P-trap.



Y-Branch kit.



Direction of flow.



Rodding eye c/w air vent.

General Notes

- Contractor shall be responsible to ensure that all services are coordinated with other trades.
- All supply and return refrigerant pipes to be of copper material & supplied complete with insulation.
- Refrigerant pipes to run inside false ceiling or to be fixed inside uPVC trunking as shown on drawings.
- Condensate drain pipes to be supplied complete with rubber insulation and to connect to nearest waste pipe via condensate U-trap as indicated on drawings.
- Electrical cabling to air conditioning units to be carried out by electrical contractor. However, control and electrical cabling between indoor and outdoor units to be supplied by AC Contractor.

Drawing Notes

- All condensate drain pipes to have 13mm thick insulation.
- All drain pipes to be 2% minimum slope towards condensate drain stack in riser.
- Condensate drain to be fixed directly to soffit of slab.
- Insulated P-trap to be provided before connecting to stack, c/w provision for rodding and cleaning point.
- All AC indoor units to have condensate drain pump.

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MEP Engineer



Architect

-

Client

MAUBANK LTD

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
LEGEND AND GENERAL NOTES
MECHANICAL SERVICES

-

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-T62-U60-00

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

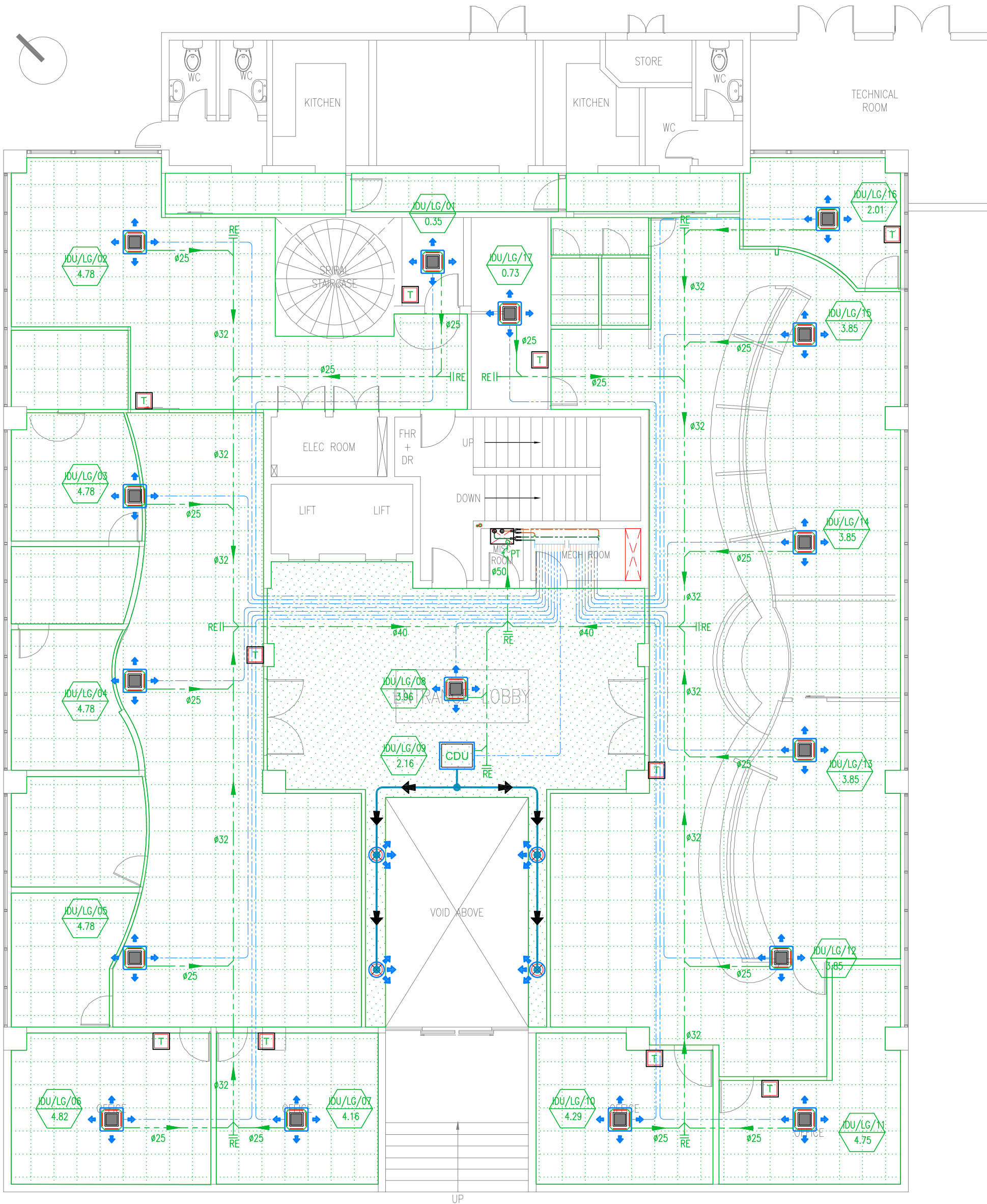
Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L0-T62-U60-01

Revision
P00

Architect Drawing Number:

REV: -



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Architect

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
GROUND FLOOR PLAN
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L0-T62-U60-01

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

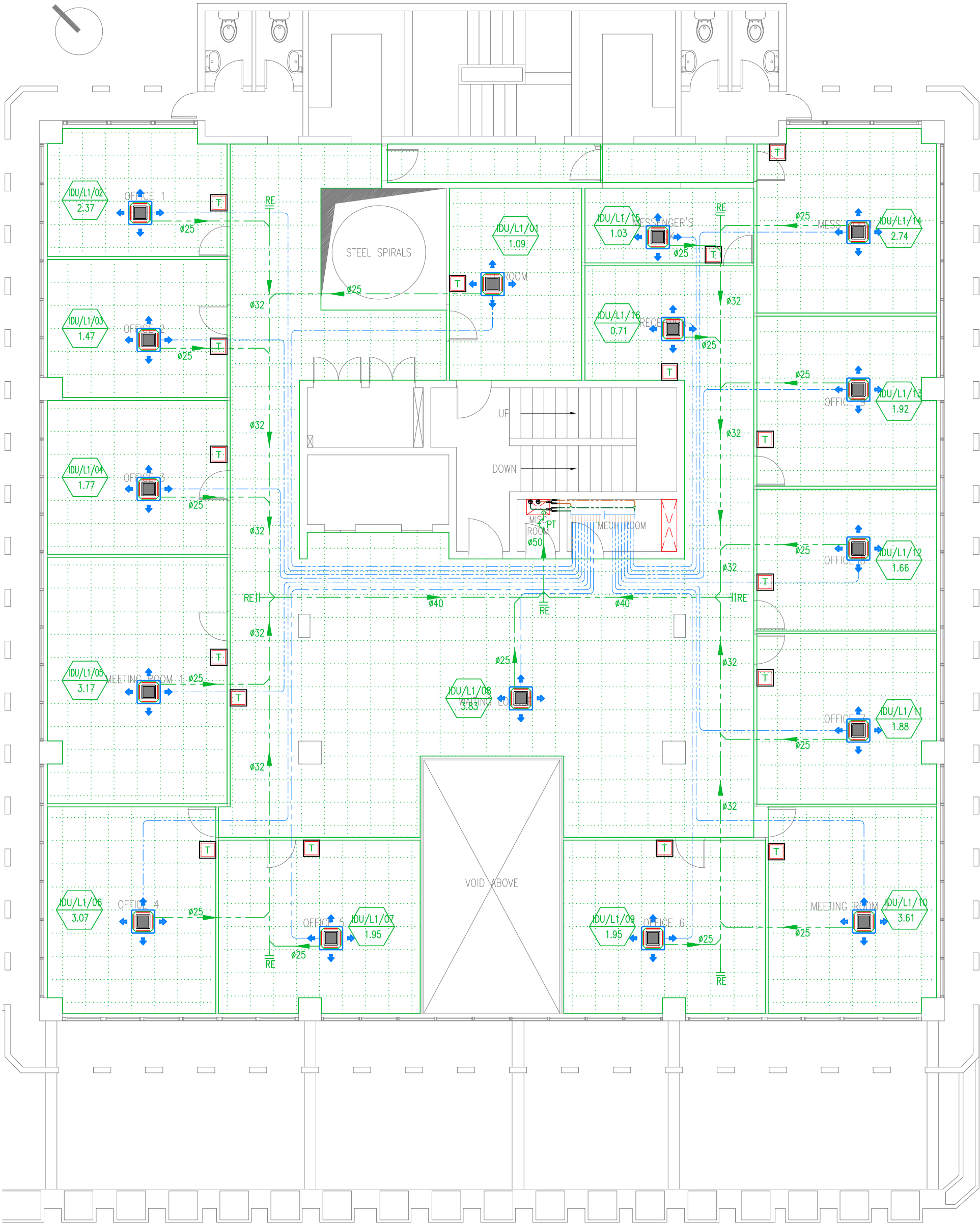
Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L1-T62-U60-02

Revision
P00

Architect Drawing Number:

REV: -



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MEP Engineer

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Architect

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title

FIRST FLOOR PLAN
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

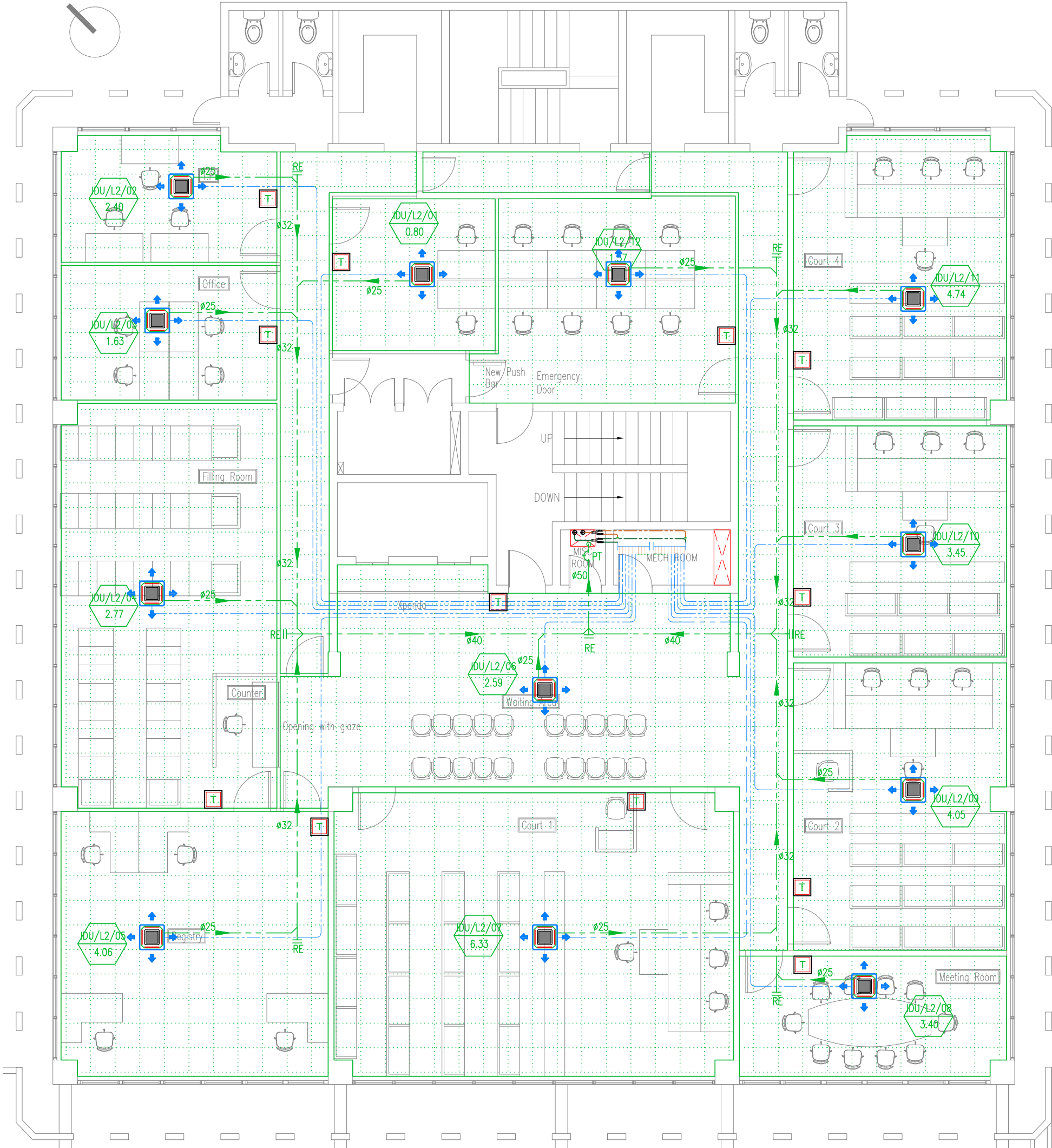
Drawing Number
22026-PDE-MBPH-L1-T62-U60-02

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Drawing Number	22026-PDE-MBPH-L2-T62-U60-03	Revision	P00
Architect Drawing Number:	-	REV:	-



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Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SECOND FLOOR PLAN
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

Drawn BB Checked AVP Approved

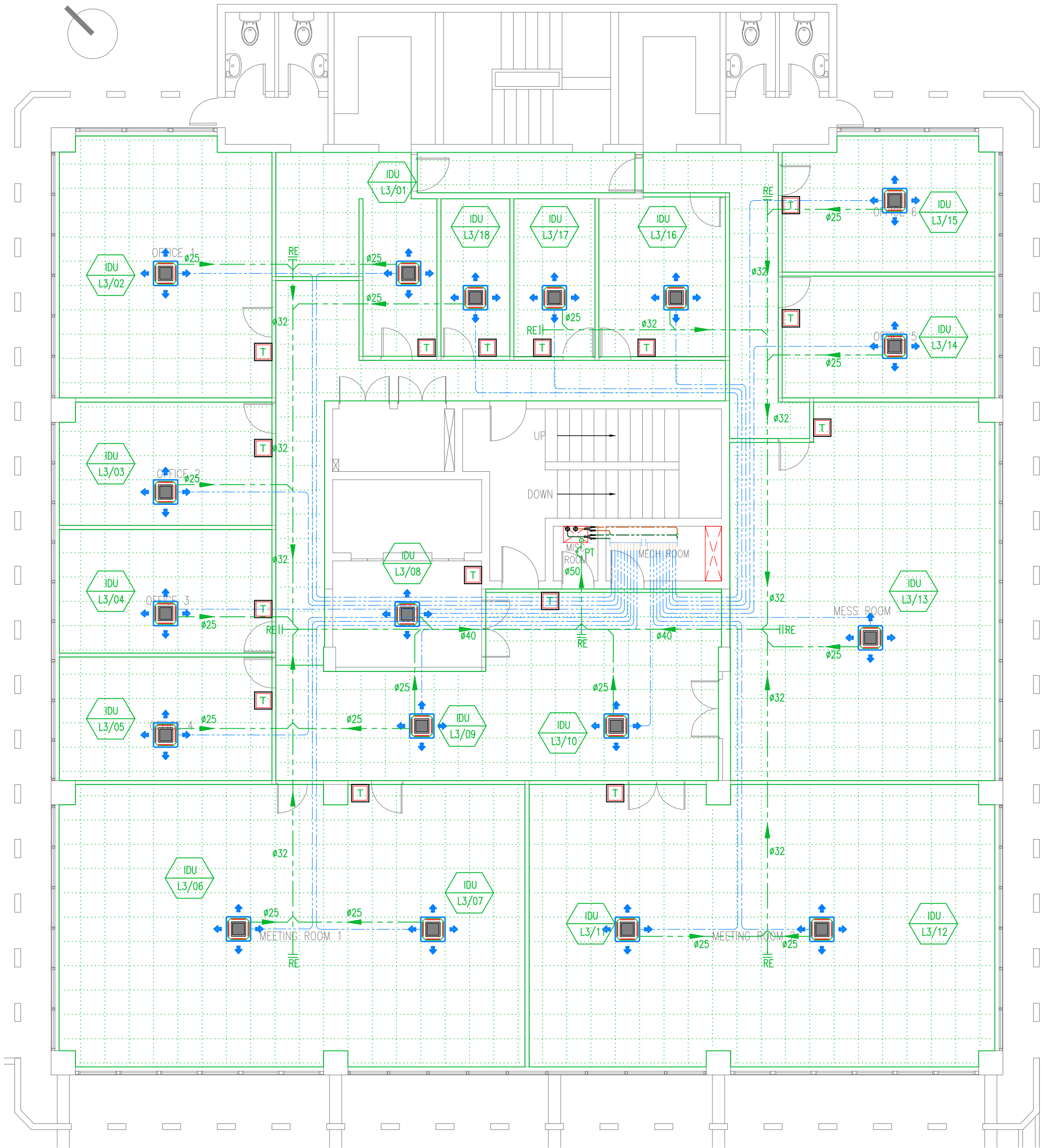
Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L2-T62-U60-03
Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Drawing Number	22026-PDE-MBPH-L3-T62-U60-04	Revision	P00
Architect Drawing Number:	-	REV:	-



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MEP Engineer



Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
THIRD FLOOR PLAN
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

Drawn BB Checked AVP Approved

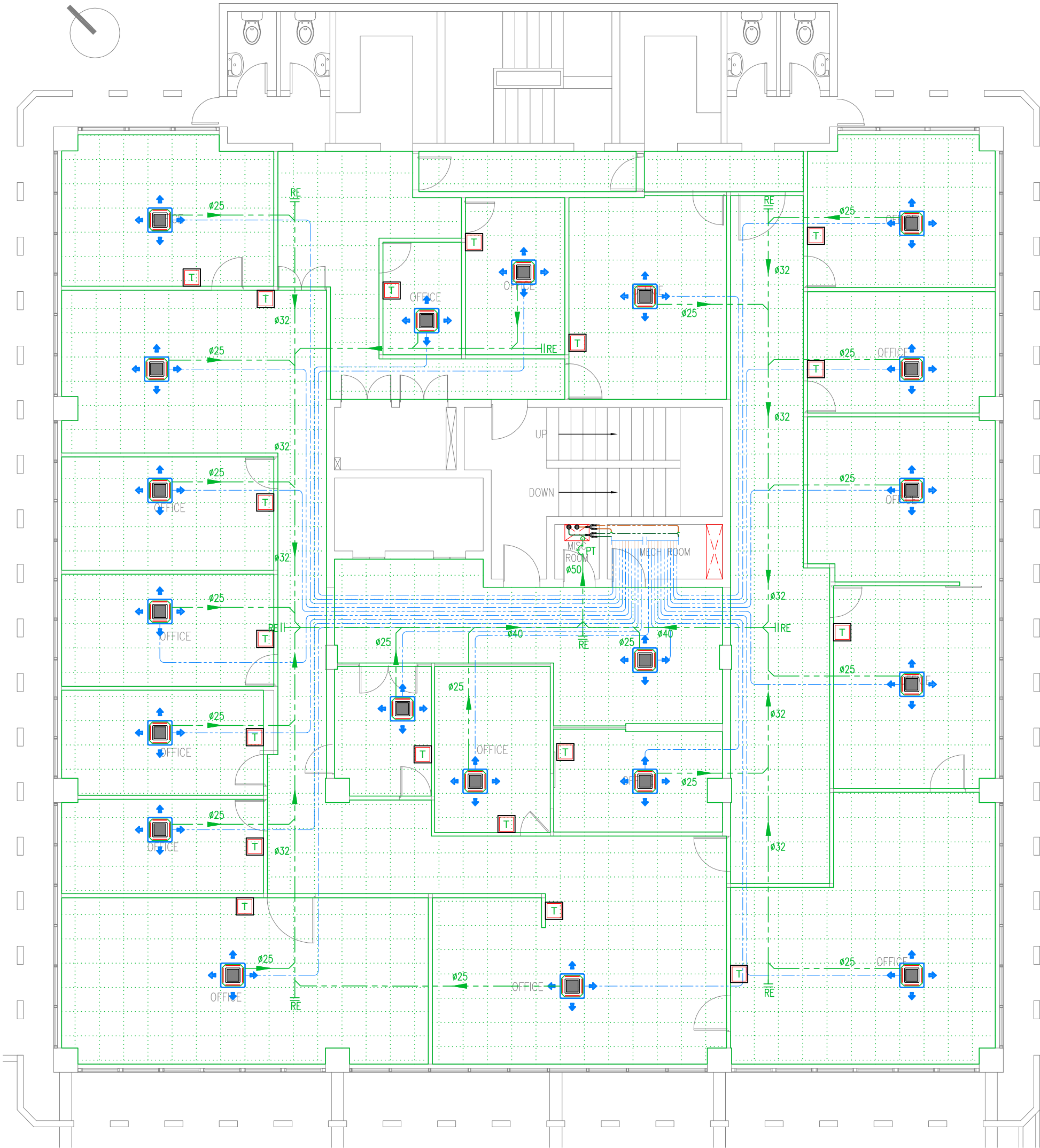
Date 06.04.2023 Size A3 Scale 1:100

Drawing Number 22026-PDE-MBPH-L3-T62-U60-04 Revision P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Drawing Number	22026-PDE-MBPH-L4-T62-U60-05	Revision	P00
Architect Drawing Number:	-	REV:	-



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MEP Engineer



Architect

Client

MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FOURTH FLOOR PLAN
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

Drawn BB Checked AVP Approved

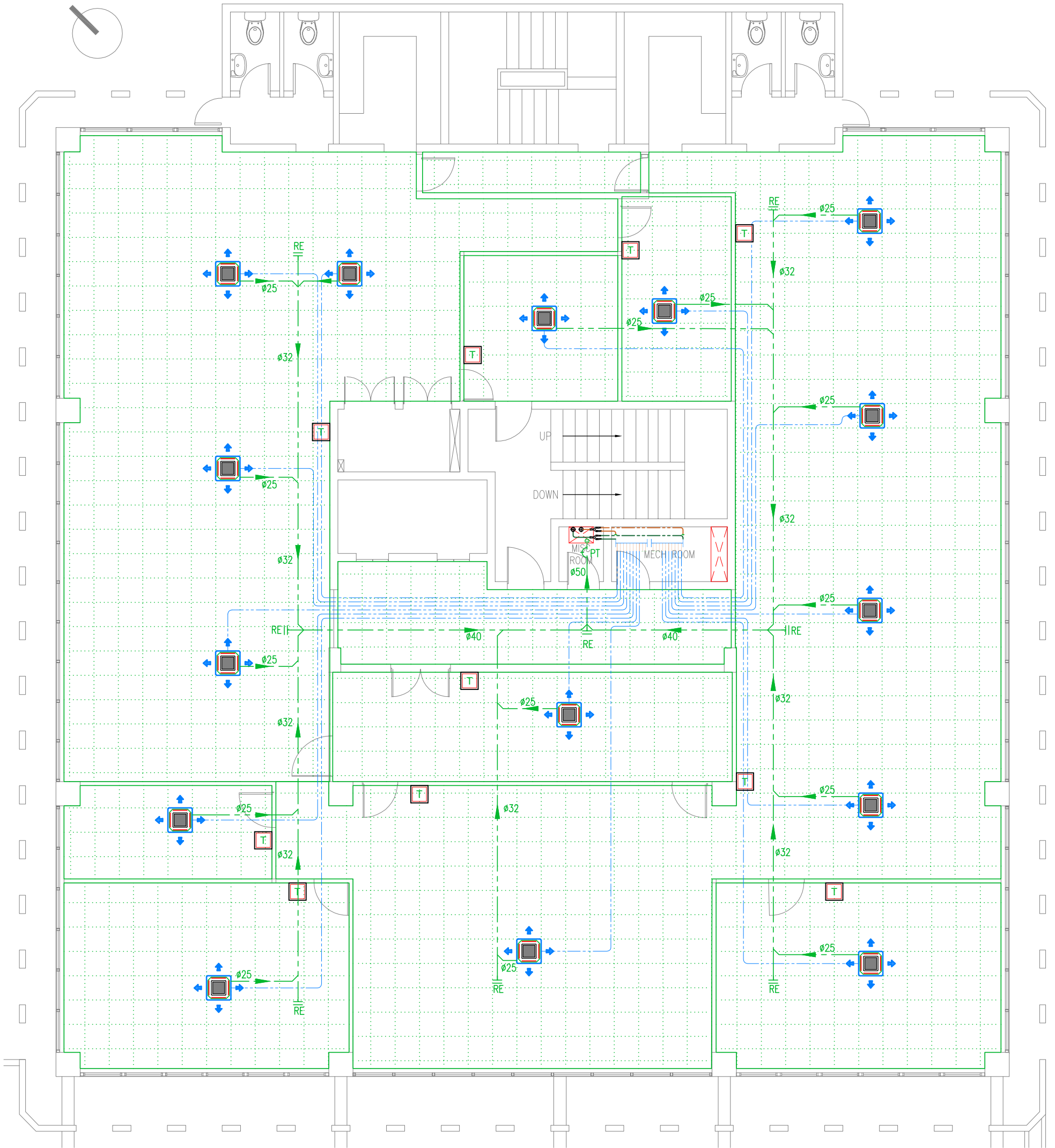
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Drawing Number 22026-PDE-MBPH-L4-T62-U60-05 Revision P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Drawing Number	22026-PDE-MBPH-L5-T62-U60-06	Revision	P00
Architect Drawing Number:	-	REV:	-



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Client
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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FIFTH FLOOR PLAN
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

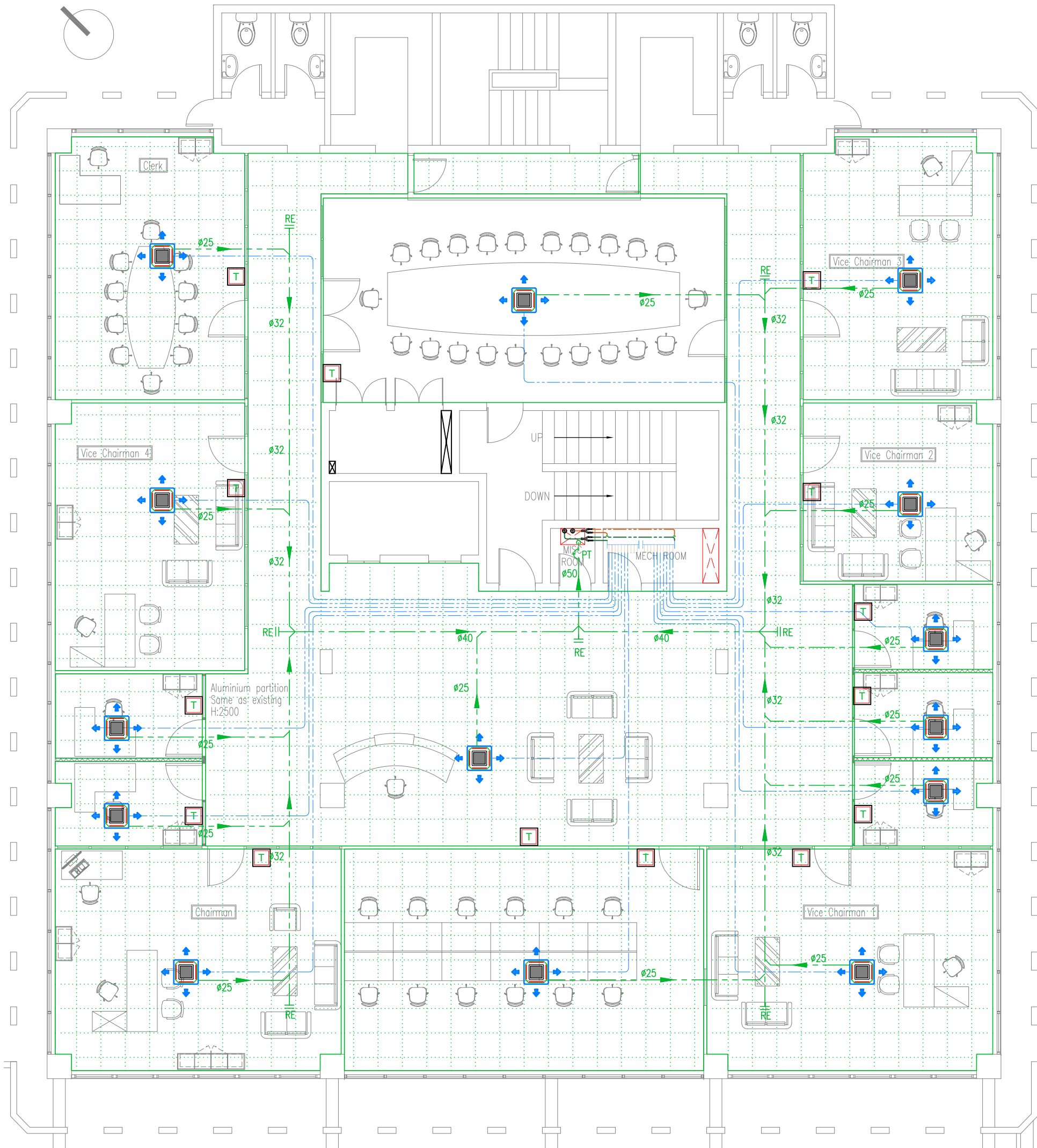
Drawing Number
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Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Drawing Number	22026-PDE-MBPH-L6-T62-U60-07	Revision	P00
Architect Drawing Number:	-	REV:	-



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Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SIXTH FLOOR PLAN
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

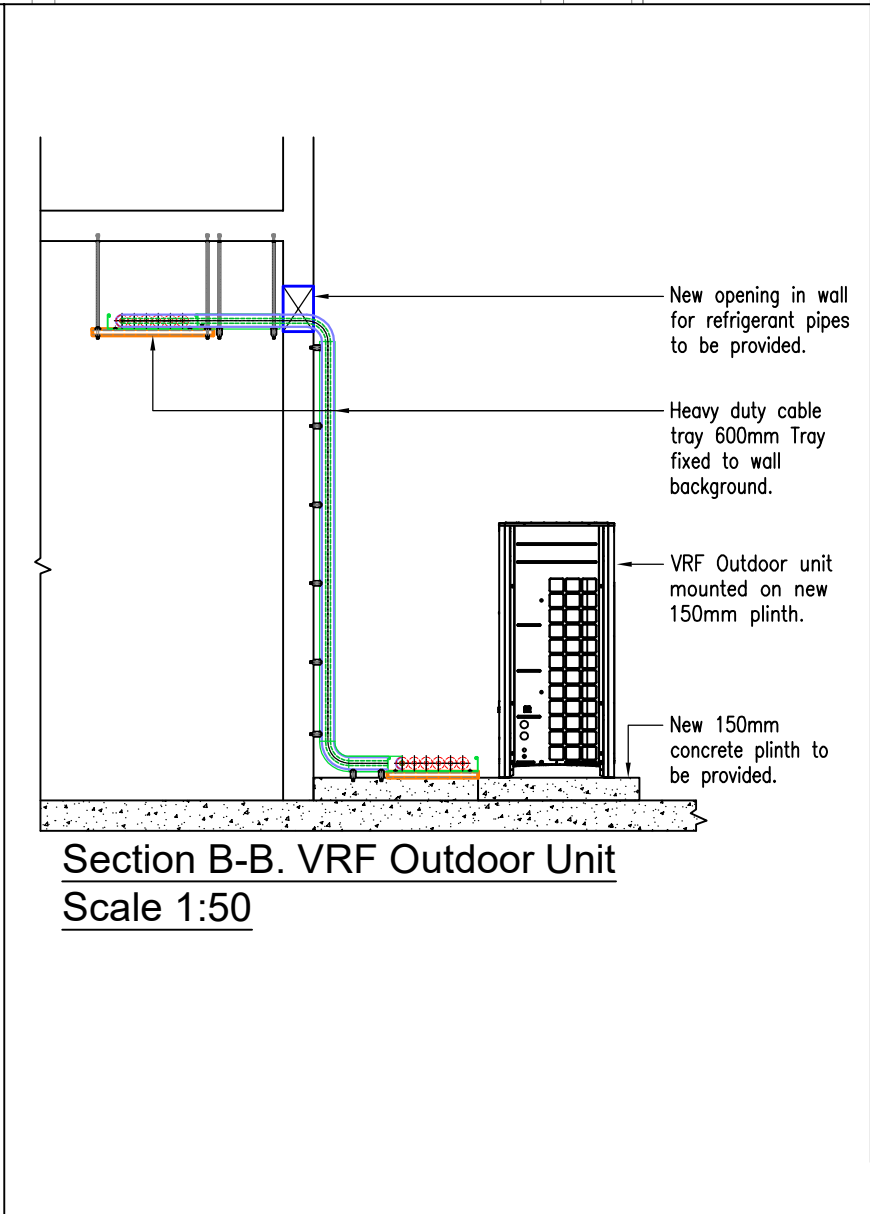
Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L6-T62-U60-07
Revision
P00

Refer to sheet
22026-PDE-MBPH-T62-U60-00
for Legend & General Notes.

Architect Drawing Number: - REV: -



Title						
ROOF PLAN						
MECHANICAL SERVICES						
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS						
Drawn	JC	Checked	AVP	Approved		
Date	06.04.2023	Size	A3	Scale	1:100	
Drawing Number						Revision
22026-PDE-MBPH-RF-T62-U60-08						P00

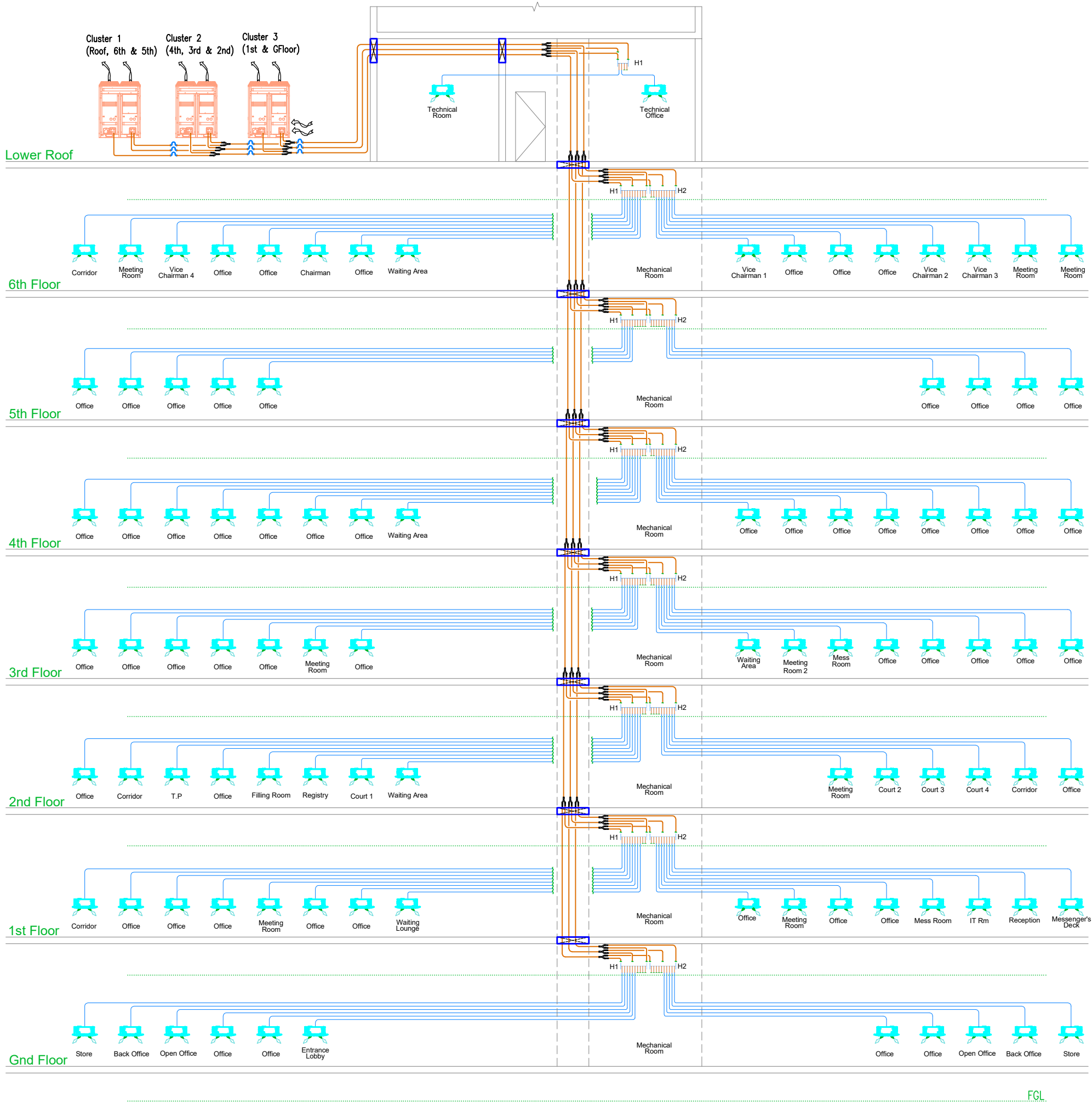
REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number
22026-PDE-MBPH-SCH-T62-U60-09

Revision
P00

Architect Drawing Number: -

REV: -



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Architect

Client
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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SCHEMATIC DIAGRAM
MECHANICAL SERVICES
VRF COOLING DISTRIBUTION & AIR CONDITIONING UNITS

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale NTS

Drawing Number
22026-PDE-MBPH-SCH-T62-U60-09

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Legend

- Supply duct.
- Extract duct.
- Supply diffuser.
- Extract valve.
- Volume control damper.
- Motorised damper.



- Presence detector.
- Back draught shutter.
- Motorised fire damper.
- Direction of flow.
- Attenuator.
- Flexible connection.
- Extractor fan.

General Notes

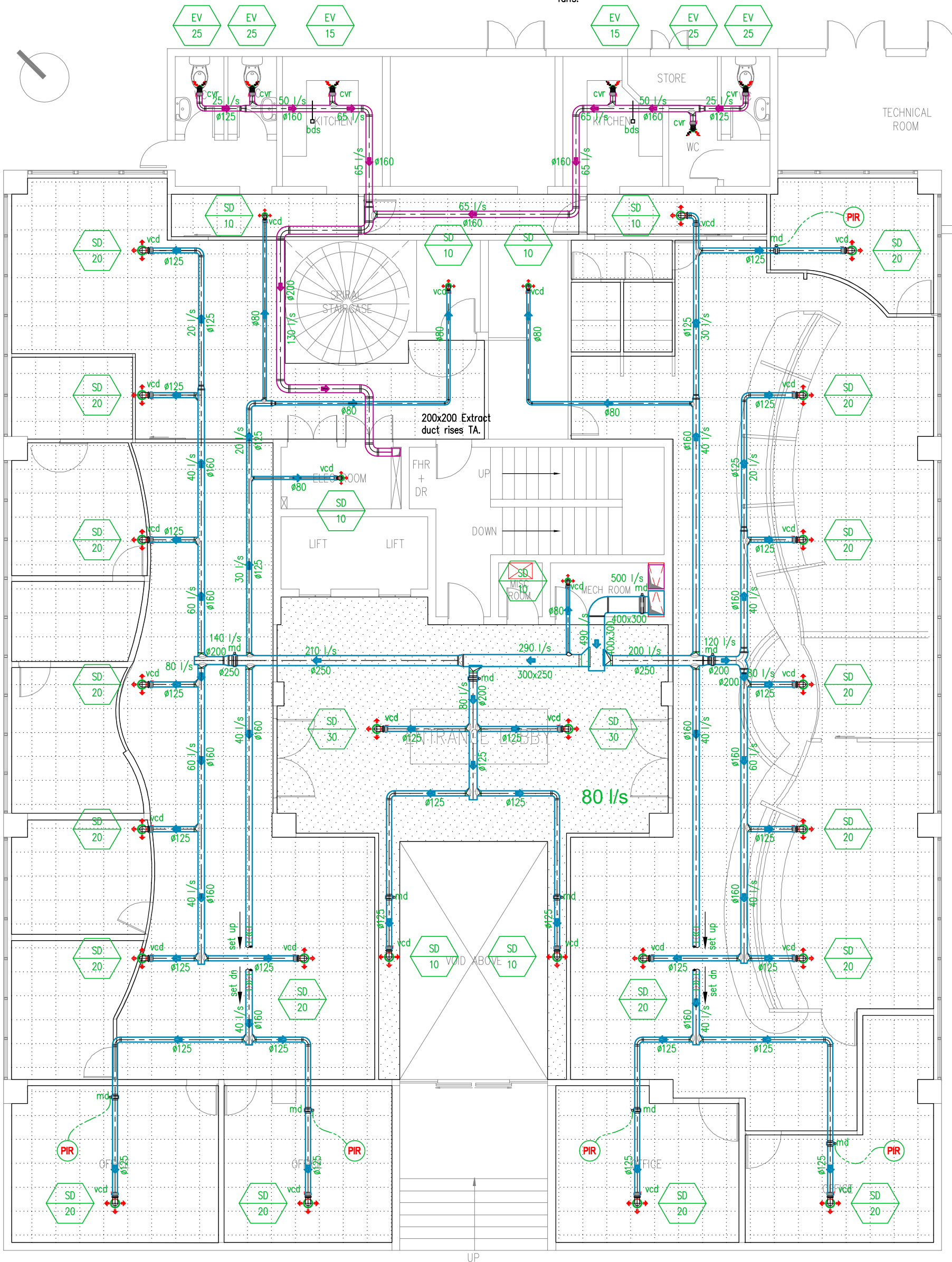
- Contractor shall be responsible to ensure that all services are coordinated with other trades.
- Contractor shall produce their own coordinated shop drawings and provide same to the Consulting Engineer in a timely manner for verification and validation before any procurement is done.
- All extractor fans shall be provided with an external weather proof grille with gravity shutter corresponding to the flow rates of the fans.

Drawing Number: 22026-PDE-MBPH-L0-U10-U11-U12-00P00

Revision

Architect Drawing Number:

REV: -



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Architect

Client

MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title

GROUND FLOOR PLAN
MECHANICAL SERVICES
GENERAL, TOILET & KITCHEN VENTILATION

Drawn JC

Checked AVP

Approved

Date 06.04.2023

Size A3

Scale 1:100

Drawing Number

22026-PDE-MBPH-L0-U10-U11-U12-00 P00

Revision

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

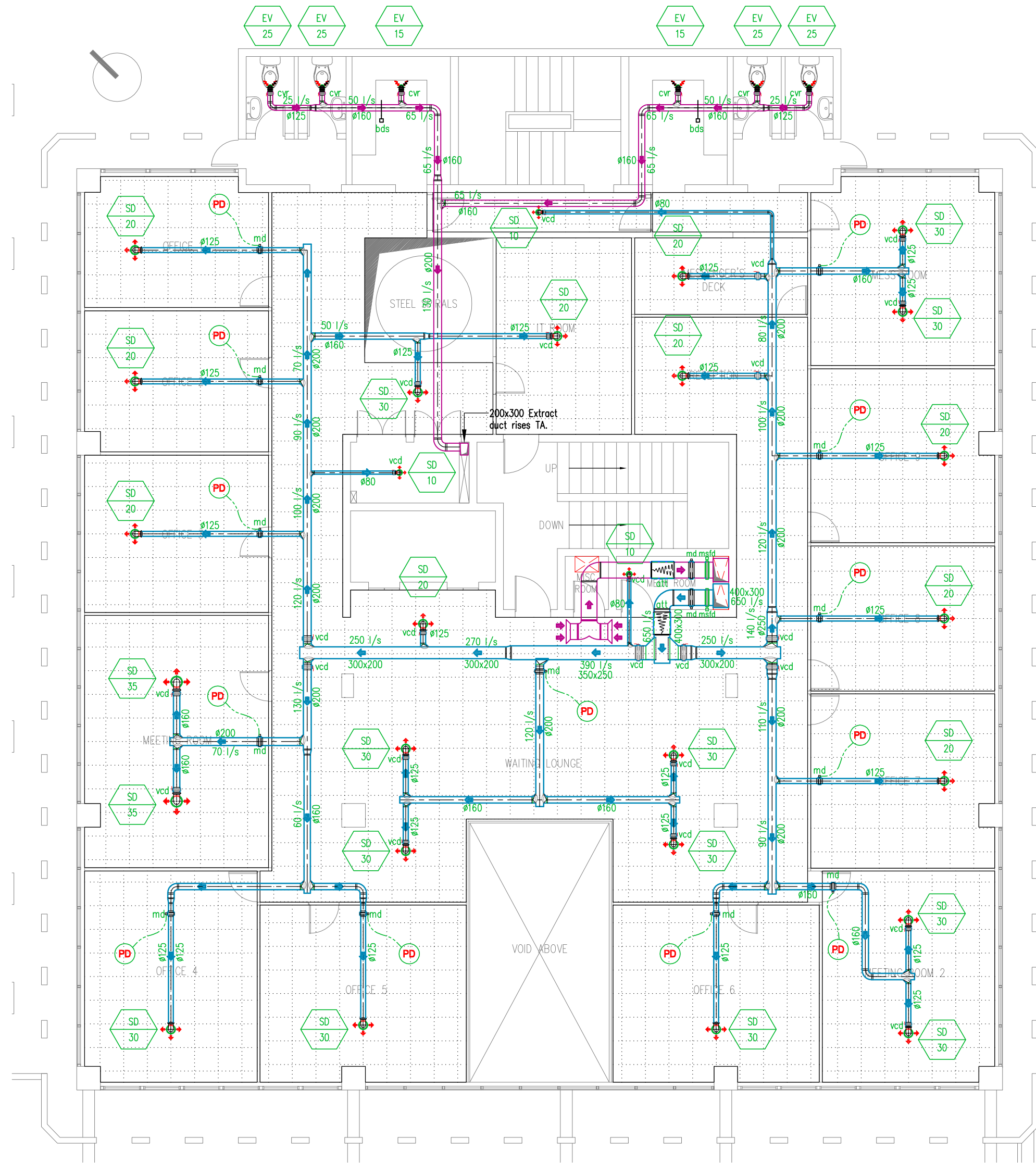
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Revision

Architect Drawing Number:

REV: -

Refer to sheet
22026-PDE-MBPH-L0-U10-00
for Legend & General Notes.



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Client

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STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title

FIRST FLOOR PLAN
MECHANICAL SERVICES
GENERAL, TOILET & KITCHEN VENTILATION

Drawn JC

Checked AVP

Approved

Date 06.04.2023

Size A3

Scale 1:100

Drawing Number

22026-PDE-MBPH-L1-U10-U11-U12-01 P00

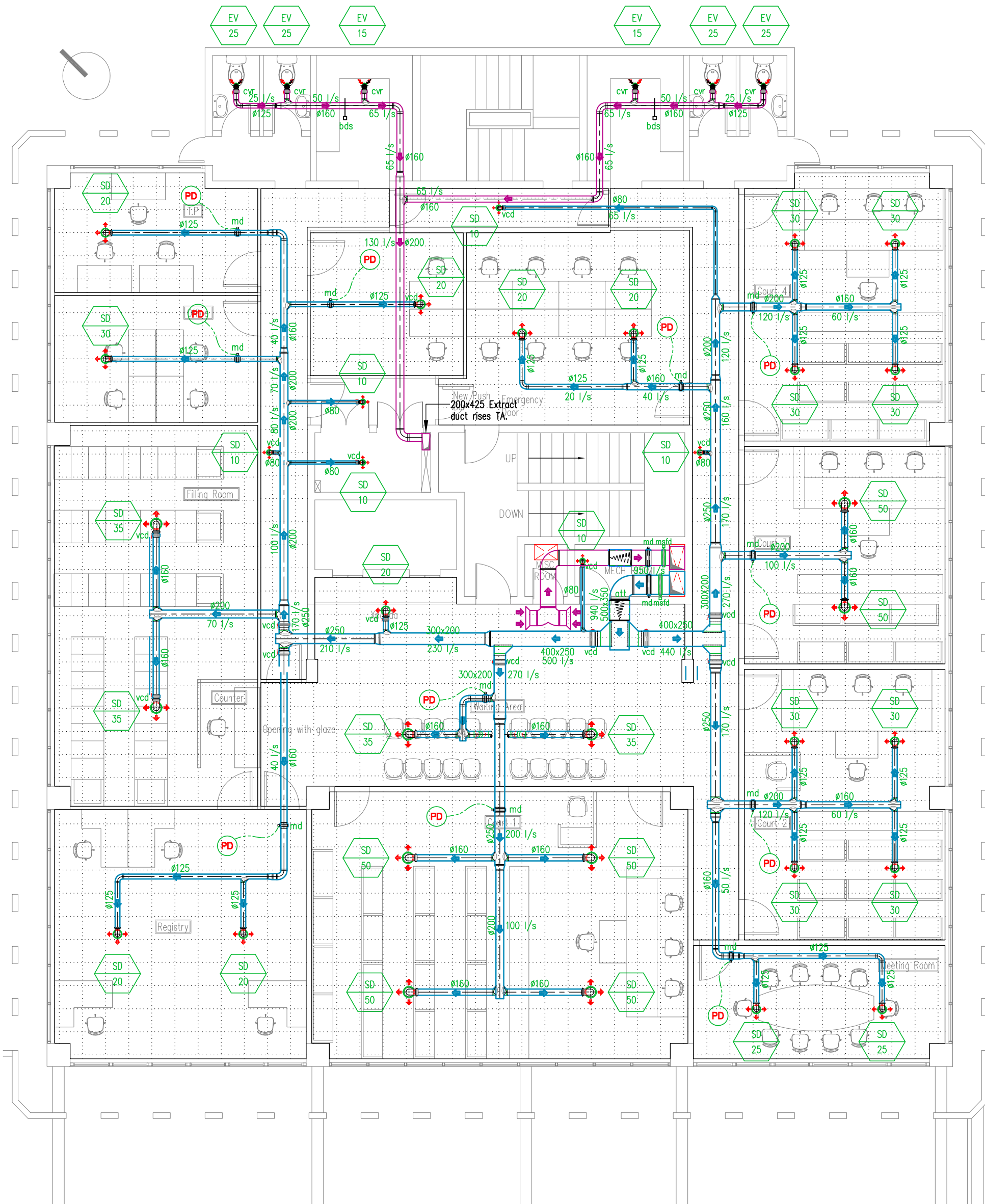
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REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-L0-U10-00
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L2-U10-U11-U12-02P00

Architect Drawing Number: - REV: -



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Architect

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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SECOND FLOOR PLAN
MECHANICAL SERVICES
GENERAL, TOILET & KITCHEN VENTILATION

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L2-U10-U11-U12-02 P00

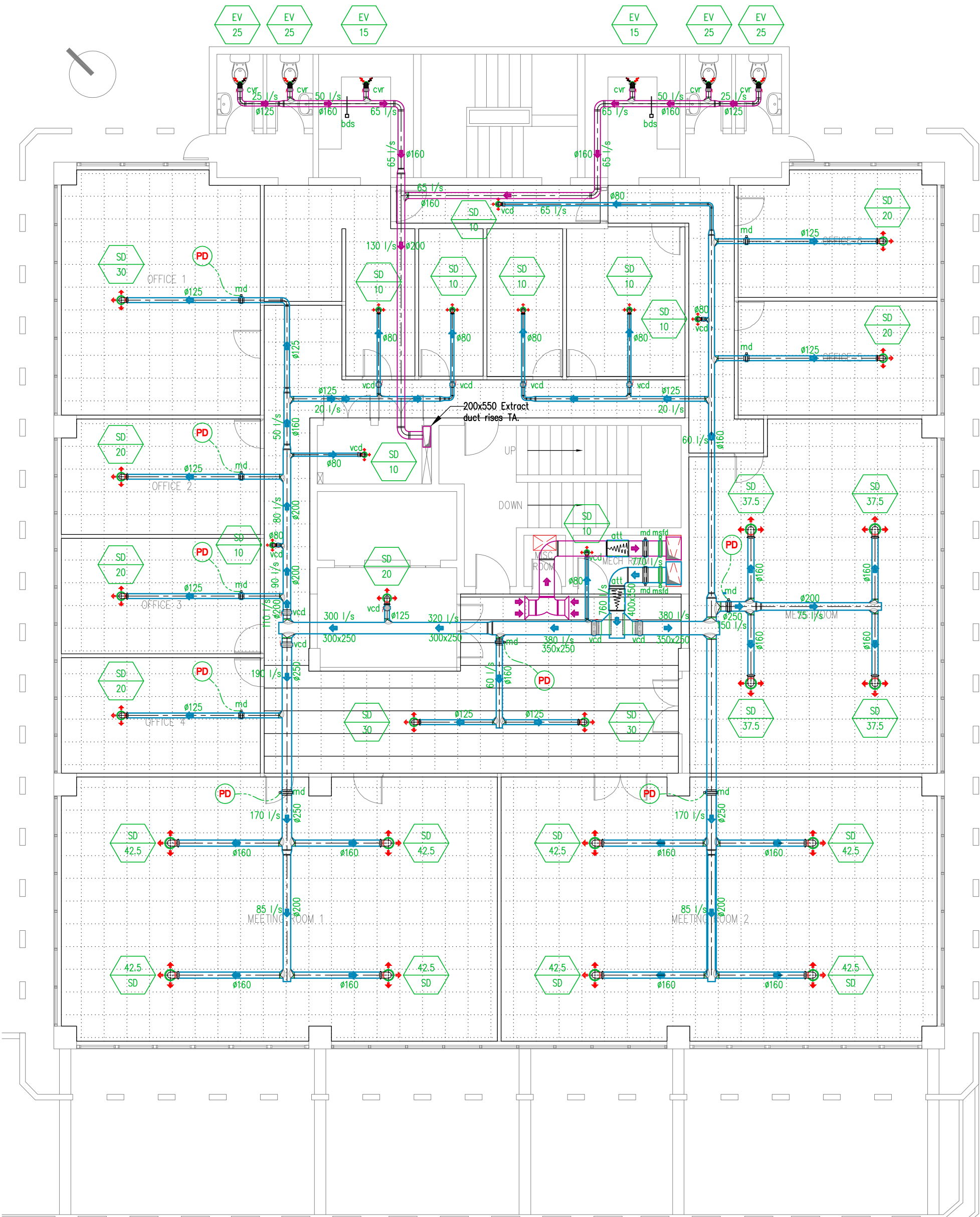
Revision

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-L0-U10-00
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L3-U10-U11-U12-03P00

Architect Drawing Number: - REV: -



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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
THIRD FLOOR PLAN
MECHANICAL SERVICES
GENERAL, TOILET & KITCHEN VENTILATION

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L3-U10-U11-U12-03 P00

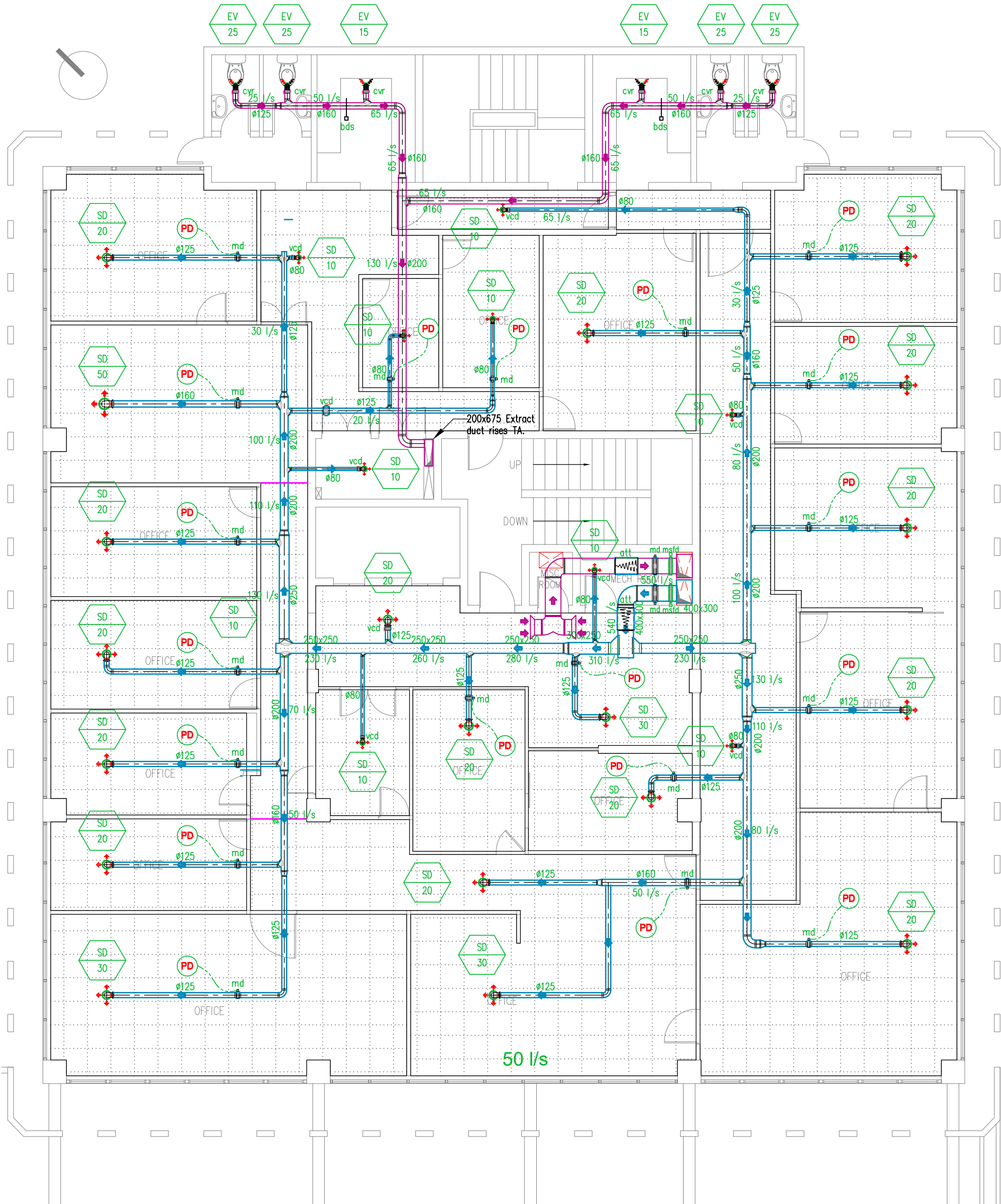
Revision

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-L0-U10-00
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L4-U10-U11-U12-04P00

Architect Drawing Number: - REV: -



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MEP Engineer



Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FOURTH FLOOR PLAN
MECHANICAL SERVICES
GENERAL, TOILET & KITCHEN VENTILATION

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L4-U10-U11-U12-04 P00

Revision

Refer to sheet
22026-PDE-MBPH-L0-U10-00
for Legend & General Notes.

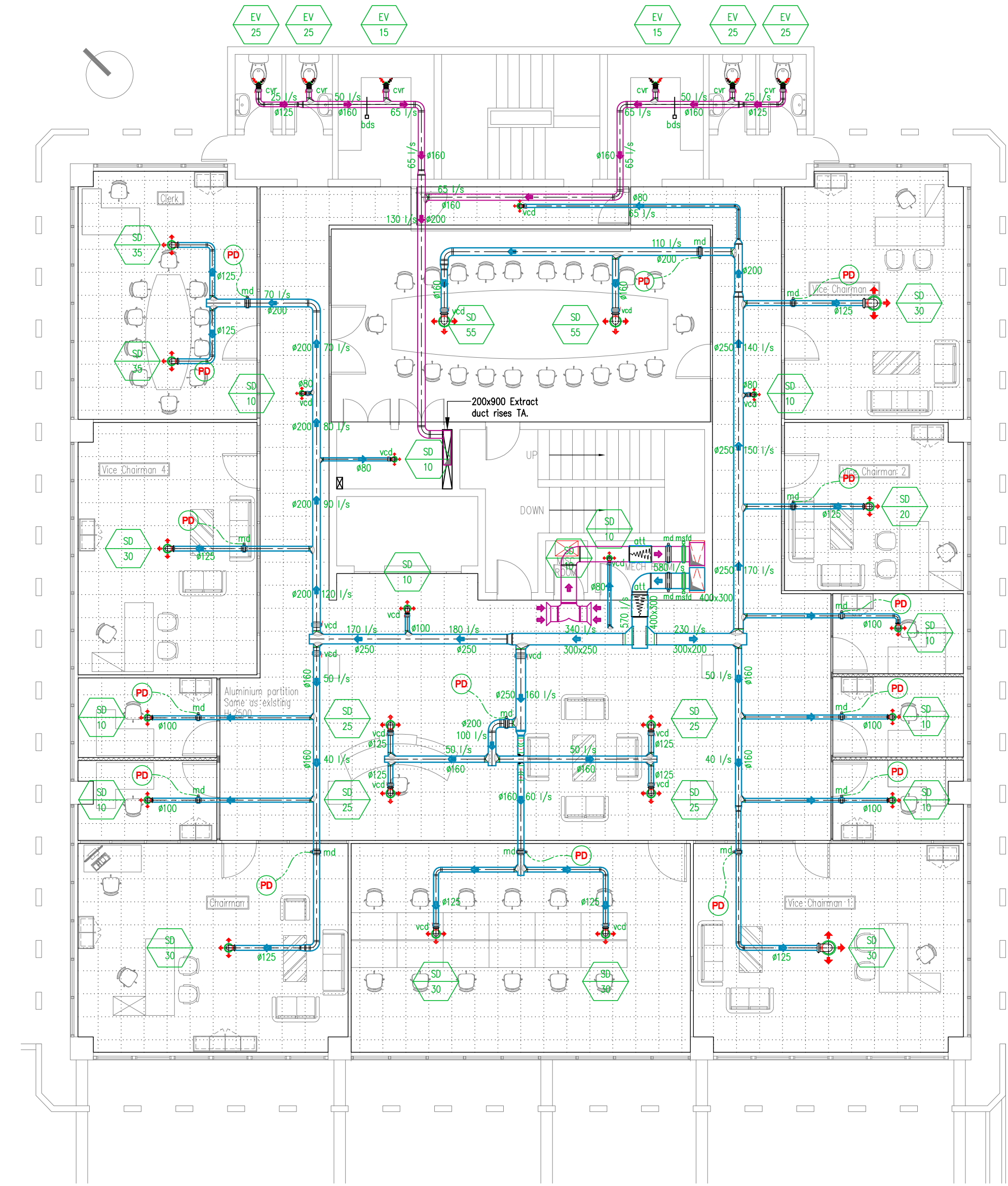
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22026-PDE-MBPH-L5-U10-U11-U12-05 P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-L0-U10-00
for Legend & General Notes.

Drawing Number	22026-PDE-MBPH-L6-U10-U11-U12-06P00	Revision	
Architect Drawing Number:	-	REV:	-



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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SIXTH FLOOR PLAN
MECHANICAL SERVICES
GENERAL, TOILET & KITCHEN VENTILATION

Drawn JC Checked AVP Approved

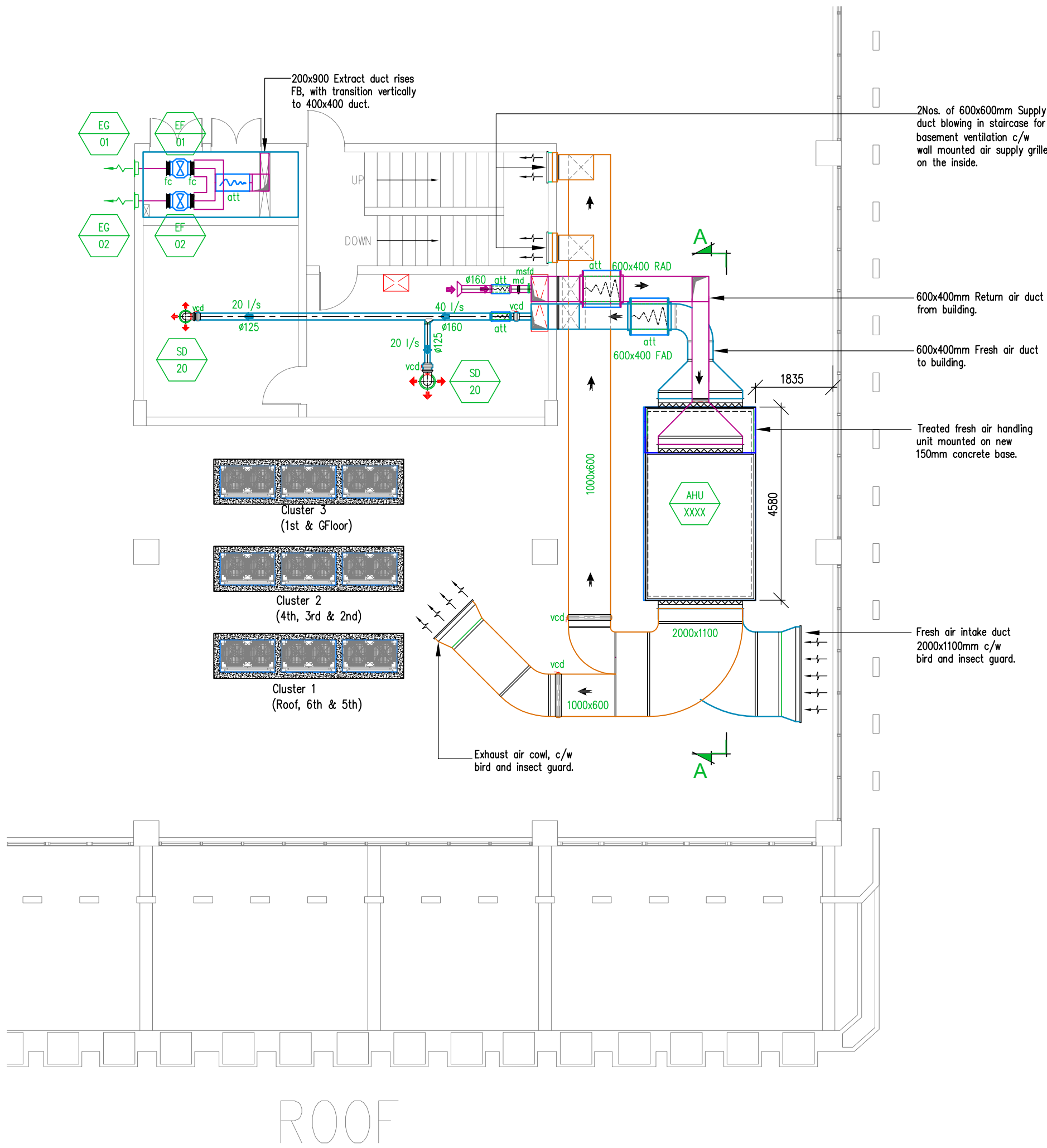
Date 06.04.2023 Size A3 Scale 1:100

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REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-L0-U10-00
for Legend & General Notes.

Drawing Number 22026-PDE-MBPH-RF-U10-U11-U12-0P00	Revision
Architect Drawing Number: -	REV: -



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MEP Engineer



Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

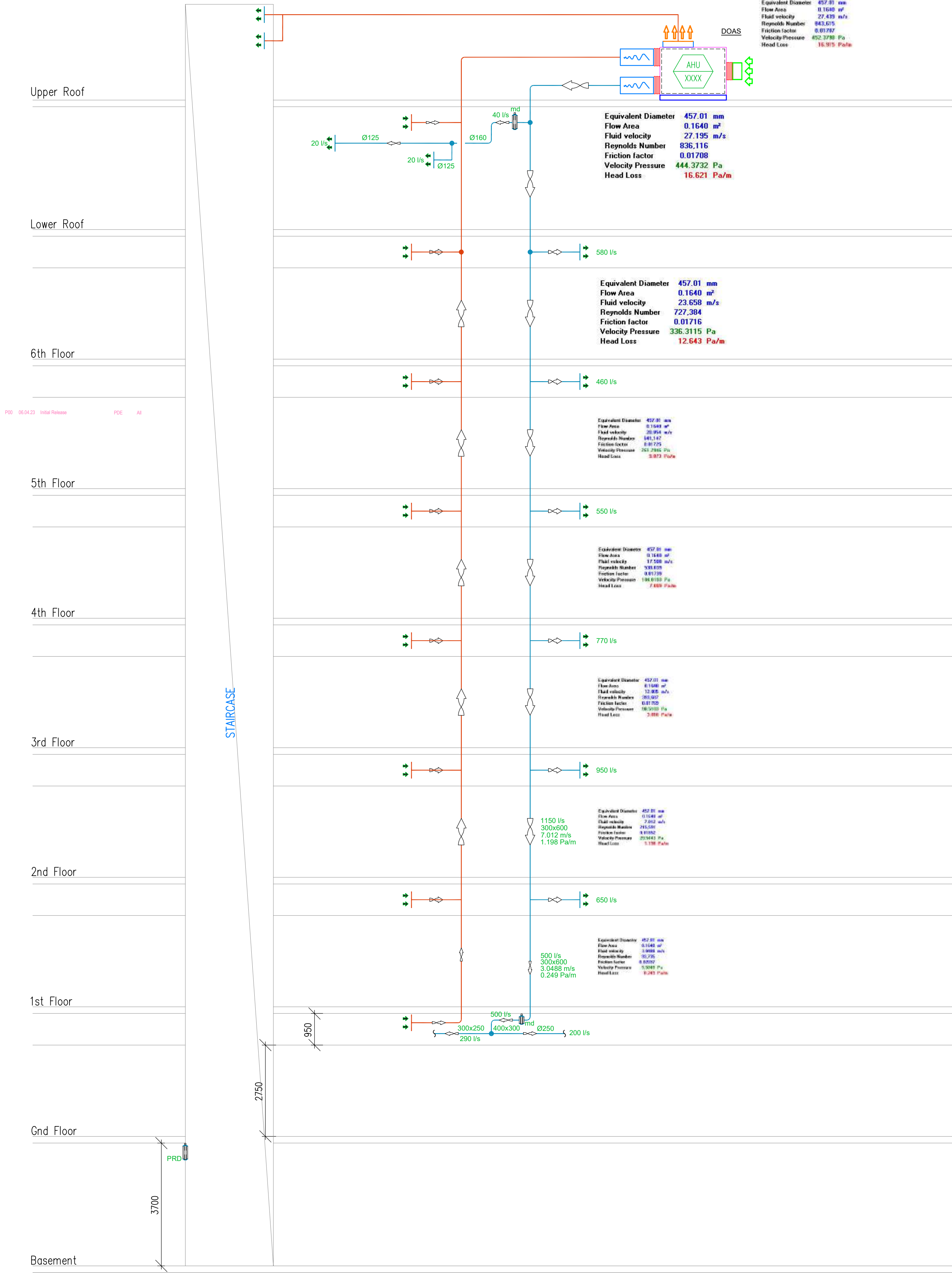
Title
ROOF PLAN
MECHANICAL SERVICES
GENERAL, TOILET & KITCHEN VENTILATION

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-RF-U10-U11-U12-07 P00

Revision



Electrical & Allied Works

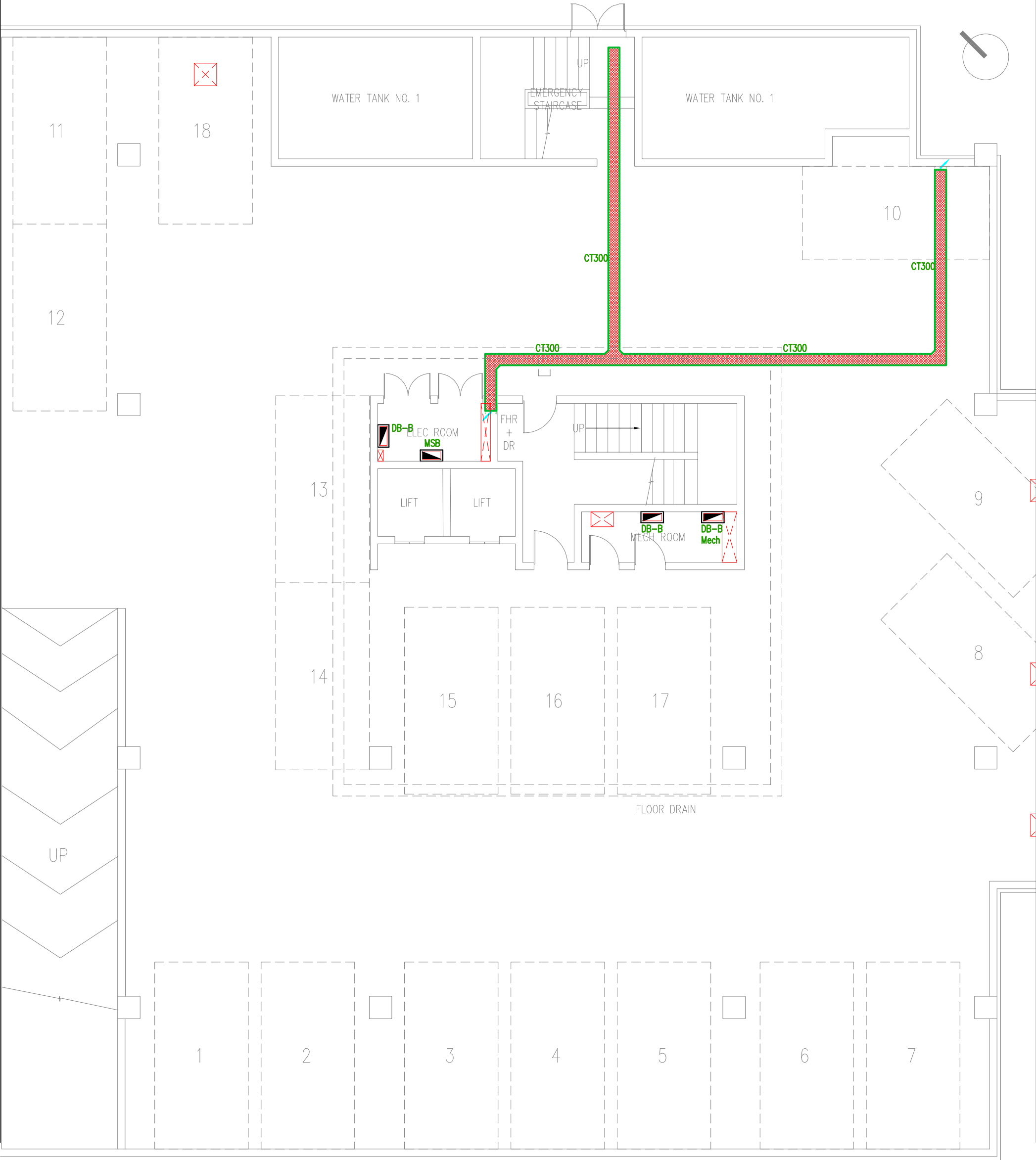
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M&E DRAWING REGISTER				STAGE 4 - TECHNICAL DESIGN	
PROJECT TITLE : REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD				DAY	02
PROJECT CODE : 22026				MONTH	06
SERVICE PACKAGE : ELECTRICAL SERVICES				YEAR	23
Dwg No.:	Drawing Title:	Size:	Scale:		
V12/W30	LV Supply/Public Supply / Data Transmission				
22026-PDE-MBPH-LB-V12-W30-01	Basement - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L0-V12-W30-02	Ground Floor - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L1-V12-W30-03	First Floor - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L2-V12-W30-04	Second Floor - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L3-V12-W30-05	Third Floor - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L4-V12-W30-06	Fourth Floor - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L5-V12-W30-07	Fifth Floor - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L6-V12-W30-08	Sixth Floor - Electrical Services Containment Plan	A3	1:100	P00	P00
22026-PDE-MBPH-RF-V12-W30-09	Roof - Electrical Services Containment Plan	A3	1:100	P00	P00
V20	LV distribution				
22026-PDE-MBPH-XX-V20-01	Schematic Diagram (MSB) Electrical Services LV Distribution	A2	NTS	P00	P00
22026-PDE-MBPH-XX-V20-02	Schematic Diagram Electrical Services LV Distribution	A3	NTS	P00	P00
22026-PDE-MBPH-XX-V20-03	Schematic Diagram Electrical Services LV Distribution	A3	NTS	P00	P00
22026-PDE-MBPH-XX-V20-04	Schematic Diagram Electrical Services LV Distribution	A3	NTS	P00	P00
V21/V40/V41	General, Emergency and External Lighting				
22026-PDE-MBPH-LX-V21-V40-V41-01	Legend and General Notes	A3	1:100	P00	P00
22026-PDE-MBPH-LB-V21-V40-V41-02	Basement	A3	1:100	P00	P00
22026-PDE-MBPH-L0-V21-V40-V41-03	Ground Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L1-V21-V40-V41-04	First Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L2-V21-V40-V41-05	Second Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L3-V21-V40-V41-06	Third Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L4-V21-V40-V41-07	Fourth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L5-V21-V40-V41-08	Fifth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L6-V21-V40-V41-09	Sixth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-RF-V21-V40-V41-10	Roof Plan	A3	1:100	P00	P00
V22	General LV Power				
22026-PDE-MBPH-LB-V22-01	Basement	A3	1:100	P00	P00
22026-PDE-MBPH-L0-V22-02	Ground Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L1-V22-03	First Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L2-V22-04	Second Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L3-V22-05	Third Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L4-V22-06	Fourth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L5-V22-07	Fifth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L6-V22-08	Sixth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-RF-V22-09	Roof Plan	A3	1:100	P00	P00
W50	Fire detection and Alarm system				
22026-PDE-MBPH-LB-W50-01	Basement	A3	1:100	P00	P00
22026-PDE-MBPH-L0-W50-02	Ground Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L1-W50-03	First Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L2-W50-04	Second Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L3-W50-05	Third Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L4-W50-06	Fourth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L5-W50-07	Fifth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-L6-W50-08	Sixth Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-RF-W50-09	Roof Plan	A3	1:100	P00	P00
W51/W52	Earthing and bonding system / Lightning Protection				
22026-PDE-MBPH-LB-W51-52-01	Basement	A3	1:100	P00	P00
22026-PDE-MBPH-L0-W51-52-02	Ground Floor Plan	A3	1:100	P00	P00
22026-PDE-MBPH-RF-W51-52-03	Roof Plan	A3	1:100	P00	P00
W60	Building Management System				
22026-PDE-MBPH-XX-W60-01	Schematic diagram	A2	NTS	P00	P00
			Total	45	
DISTRIBUTION		SIGNATURE		Number of Copies and Format of Distribution: H = Hard copy, X = Issue sheet only, D = Drive/Dropbox, E = Electronic transfer/Email	
I- INFORMATION	C- CONSTRUCTION	T-TENDER		T	T
ISSUED FOR					
Client					
Main Contractor					
Architect					
Project Manager					
Quantity Surveyor					
Structural & Civil Engineer					
Mechanical & Electrical Sub-Contractor					

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number	Revision
22026-PDE-MBPH-LB-V12-W30-01	P00
Architect Drawing Number:	REV:
-	-

Legend

- Cable tray for LV cables.
- Cable tray for ELV cables.
- DB-XX Distribution Board.
- MDB Main Switch Board.



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MEP Engineer



Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
BASEMENT
ELECTRICAL SERVICES
CONTAINMENT LAYOUT

Drawn BB Checked JN Approved

Date 22.05.2023 Size A3 Scale 1:100

Drawing Number 22026-PDE-MBPH-LB-V12-W30-01 Revision P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number
22026-PDE-MBPH-L0-V12-W30-02

Revision
P00

Architect Drawing Number: -

REV: -

Legend

 Cable tray for LV cables.

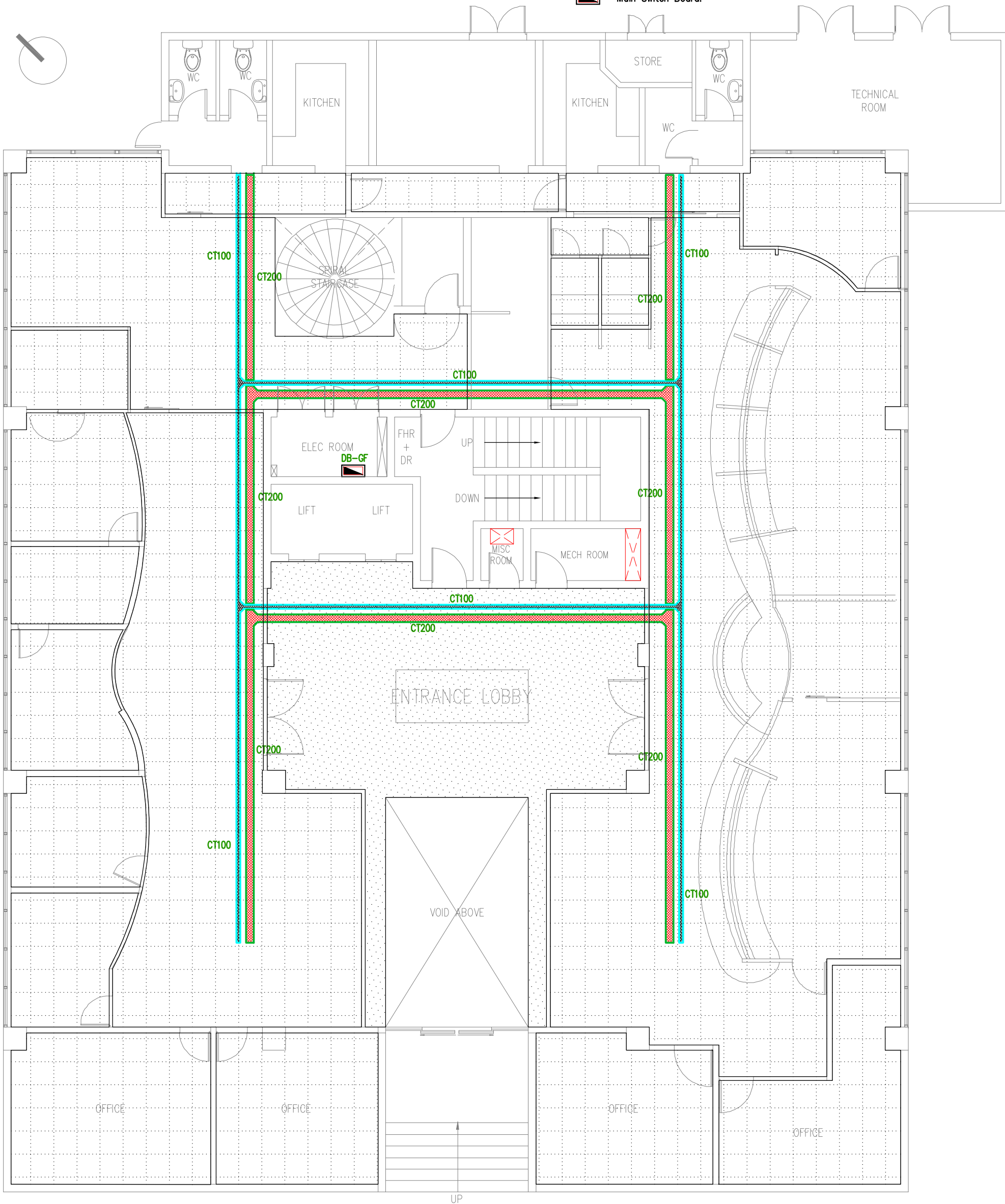
 Cable tray for ELV cables.

 DB-XX

Distribution Board.

 MDB

Main Switch Board.



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Architect

Client

MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
GROUND FLOOR PLAN
ELECTRICAL SERVICES
CONTAINMENT LAYOUT

Drawn BB Checked JN Approved

Date 22.05.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L0-V12-W30-02

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number
22026-PDE-MBPH-L1-V12-W30-03

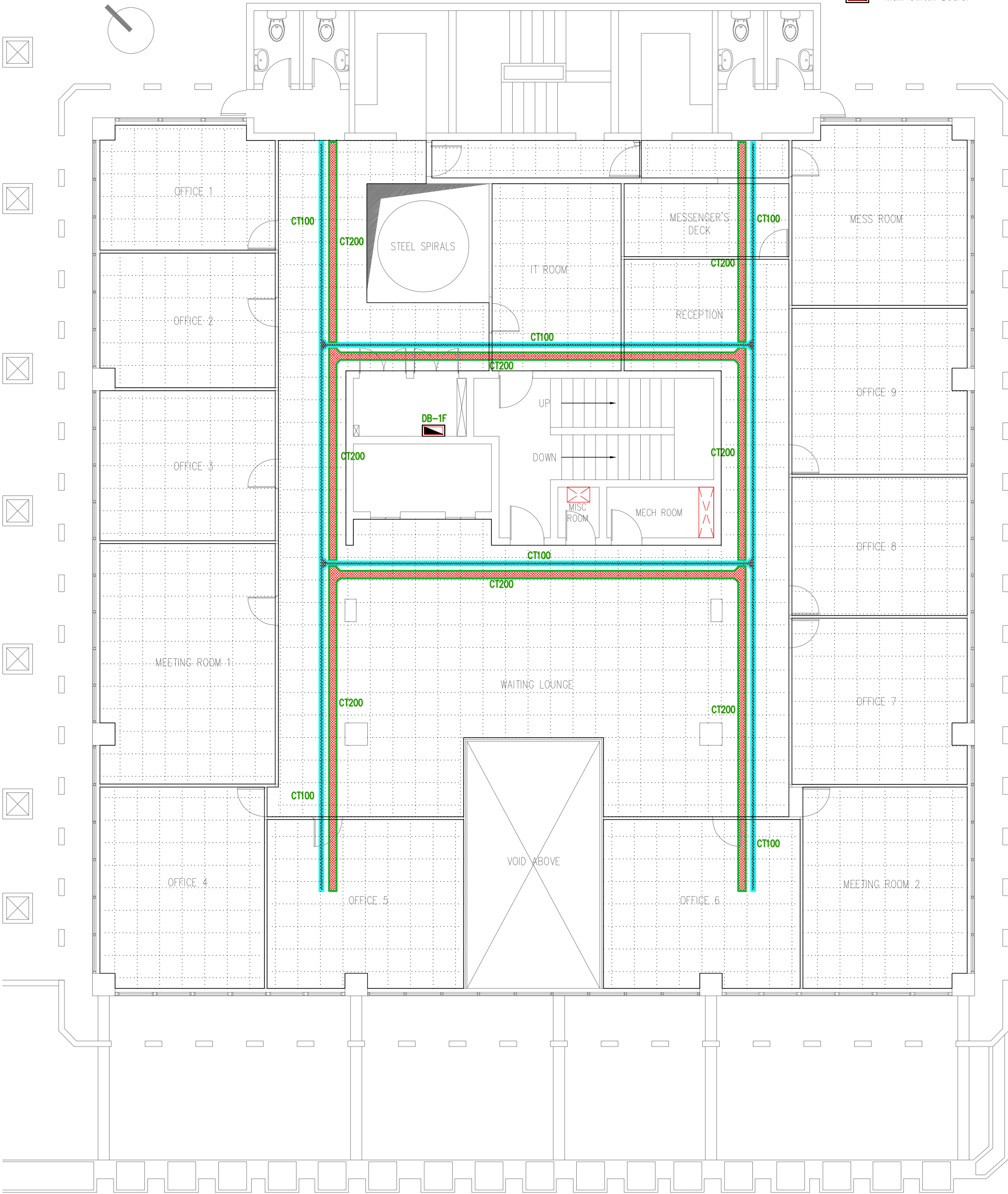
Revision
P00

Architect Drawing Number: -

REV: -

Legend

-  Cable tray for LV cables.
-  Cable tray for ELV cables.
-  DB-XX
-  Distribution Board.
-  MDB
-  Main Switch Board.



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MEP Engineer



Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FIRST FLOOR PLAN
ELECTRICAL SERVICES
CONTAINMENT LAYOUT

Drawn BB Checked JN Approved

Date 22.05.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L1-V12-W30-03

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L2-V12-W30-04	Revision	P00
Architect Drawing Number:	-	REV:	-

Legend

- Cable tray for LV cables.
- Cable tray for ELV cables.
- DB-XX Distribution Board.
- MDB Main Switch Board.



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Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

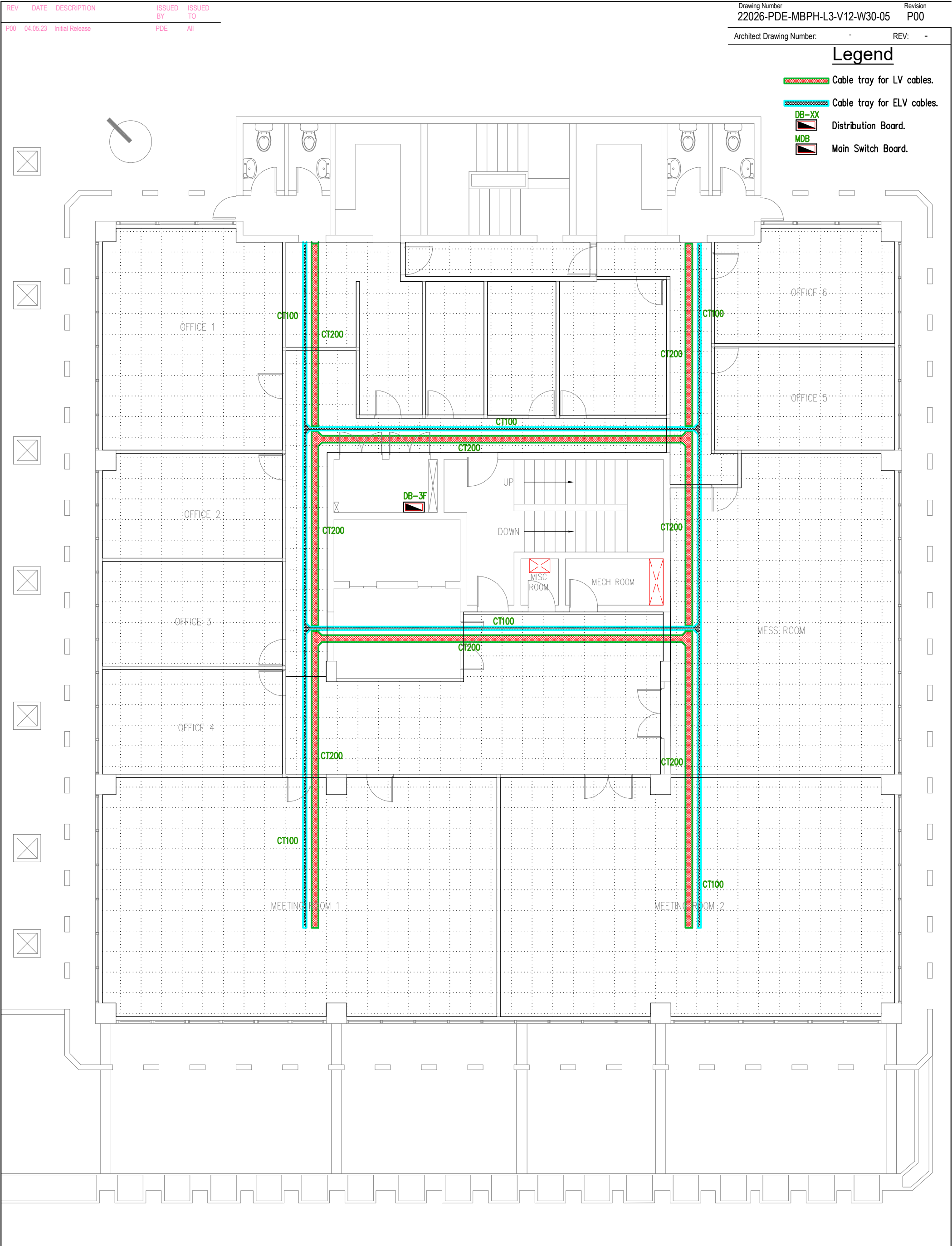
Title
SECOND FLOOR PLAN
ELECTRICAL SERVICES
CONTAINMENT LAYOUT

Drawn BB Checked JN Approved

Date 22.05.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L2-V12-W30-04

Revision
P00



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Architect

-

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title

THIRD FLOOR PLAN ELECTRICAL SERVICES CONTAINMENT LAYOUT

Drawn BB

Checked JN

Approved

Date 22.05.2023

Size A3

Scale 1:100

Drawing Number

22026-PDE-MBPH-L3-V12-W30-05

Revision

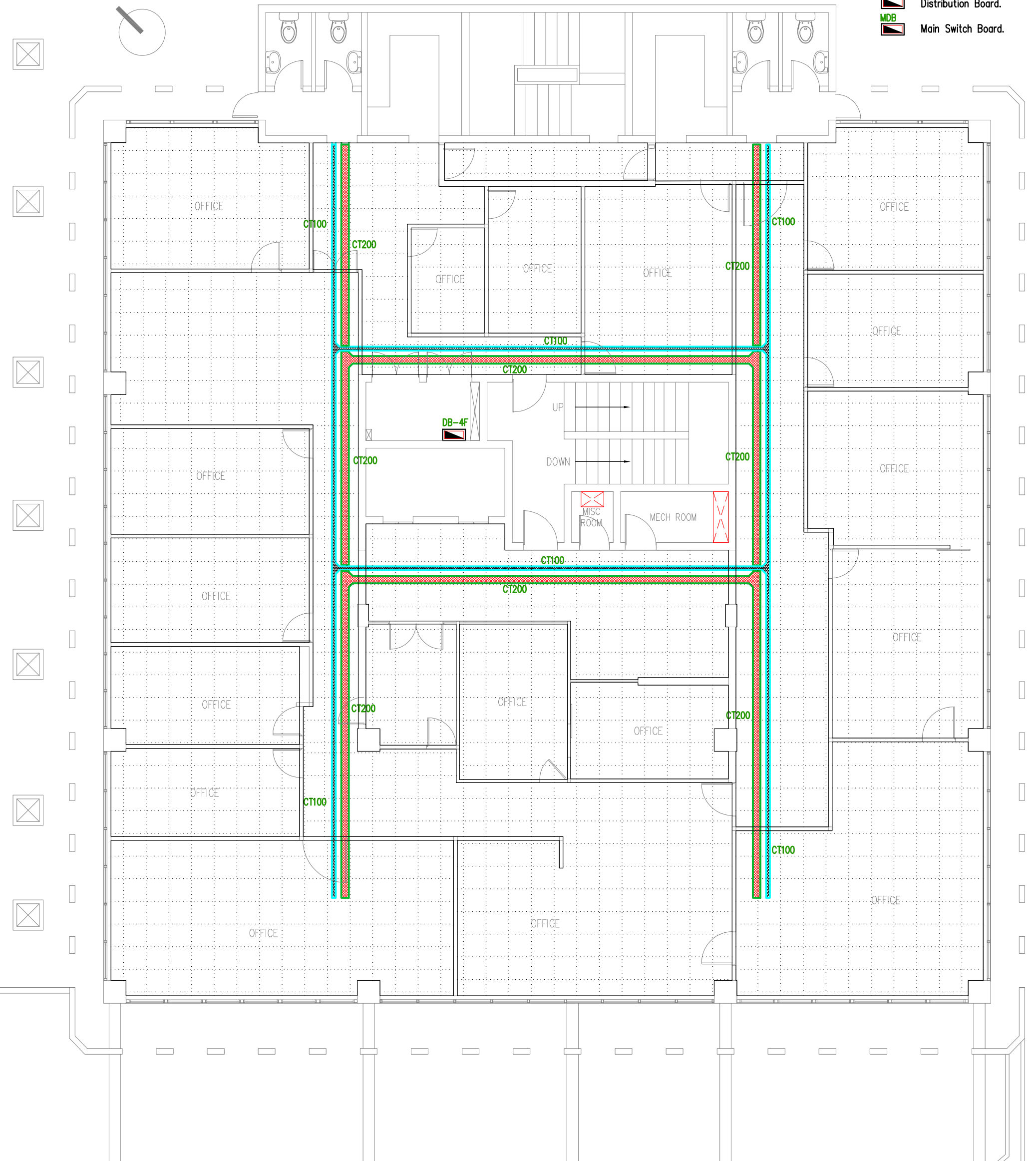
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L4-V12-W30-06	Revision	P00
Architect Drawing Number:	-	REV:	-

Legend

-  Cable tray for LV cables.
-  Cable tray for ELV cables.
-  Distribution Board.
-  Main Switch Board.



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MEP Engineer



Architect

Client

MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FOURTH FLOOR PLAN
ELECTRICAL SERVICES
CONTAINMENT LAYOUT

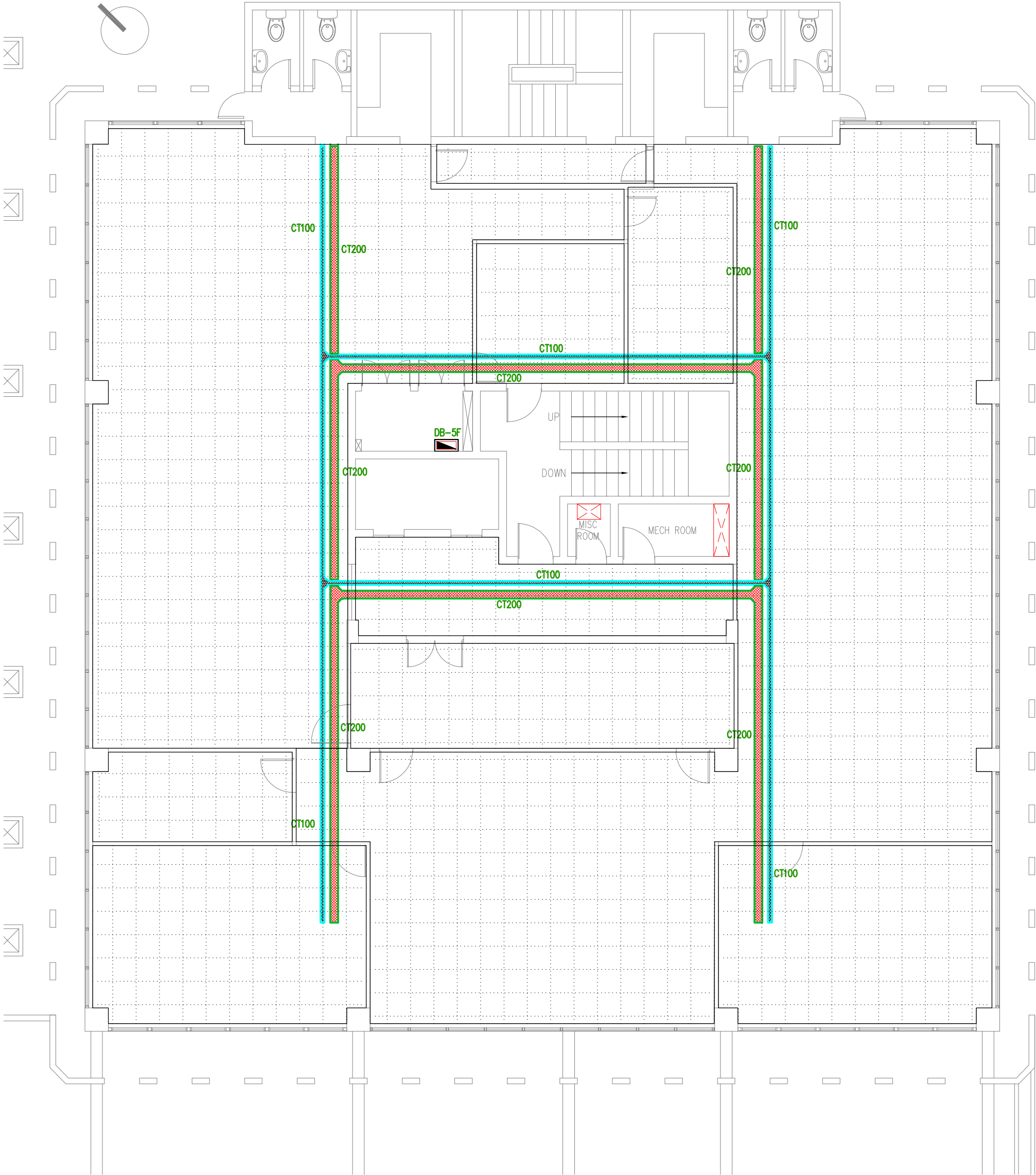
Drawn	BB	Checked	JN	Approved
Date	22.05.2023	Size	A3	Scale 1:100
Drawing Number	22026-PDE-MBPH-L4-V12-W30-06	Revision	P00	

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L5-V12-W30-07	Revision	P00
Architect Drawing Number:	-	REV:	-

Legend

-  Cable tray for LV cables.
-  Cable tray for ELV cables.
-  DB-XX Distribution Board.
-  MDB Main Switch Board.



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Architect

Client

MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FIFTH FLOOR PLAN
ELECTRICAL SERVICES
CONTAINMENT LAYOUT

Drawn BB Checked JN Approved

Date 22.05.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L5-V12-W30-07

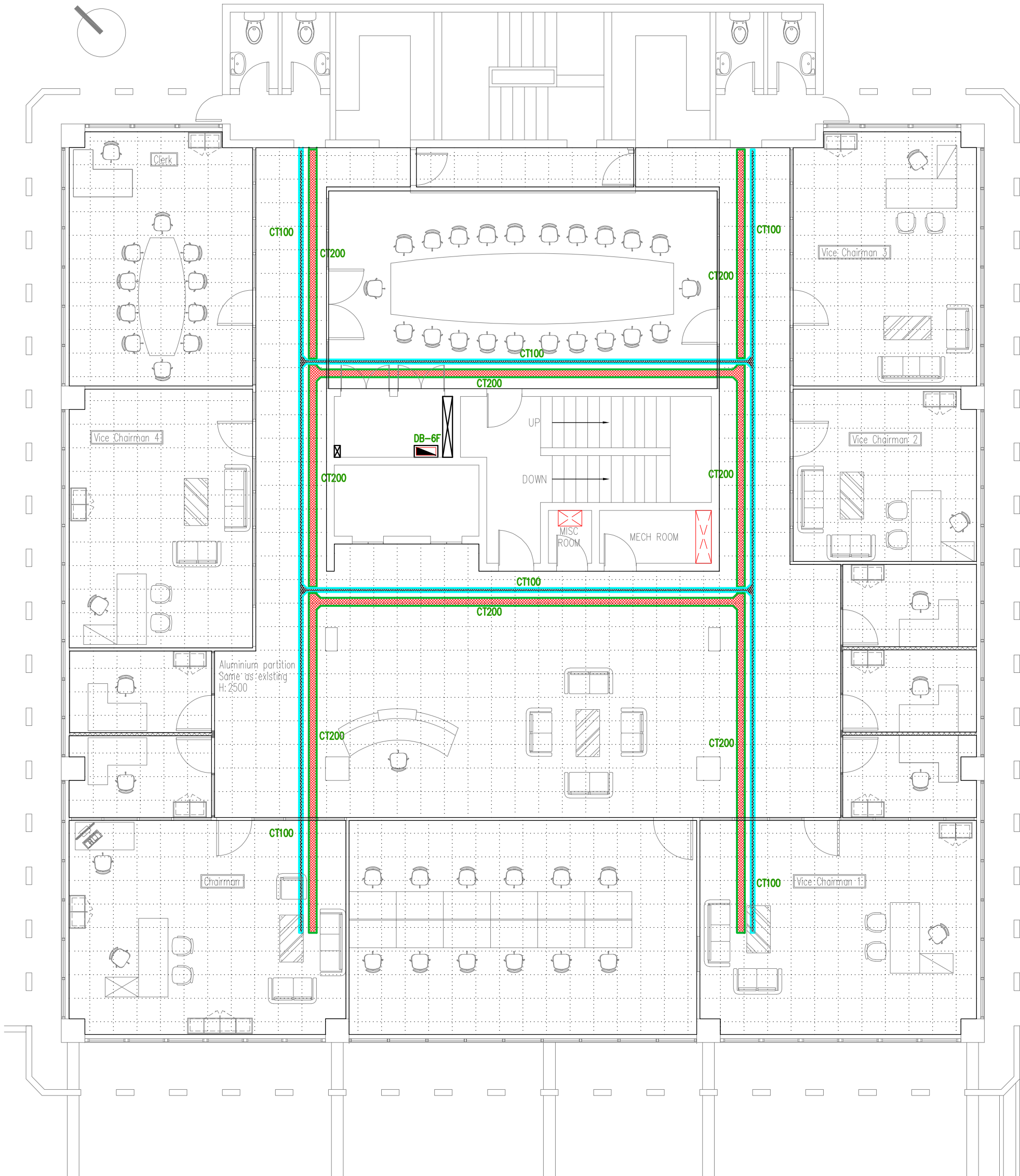
Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number	Revision
22026-PDE-MBPH-L6-V12-W30-08	P00
Architect Drawing Number:	REV:

Legend

- Cable tray for LV cables.
- Cable tray for ELV cables.
- DB-XX Distribution Board.
- MDB Main Switch Board.



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MEP Engineer



Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SIXTH FLOOR PLAN
ELECTRICAL SERVICES
CONTAINMENT LAYOUT

Drawn BB Checked JN Approved

Date 22.05.2023 Size A3 Scale 1:100

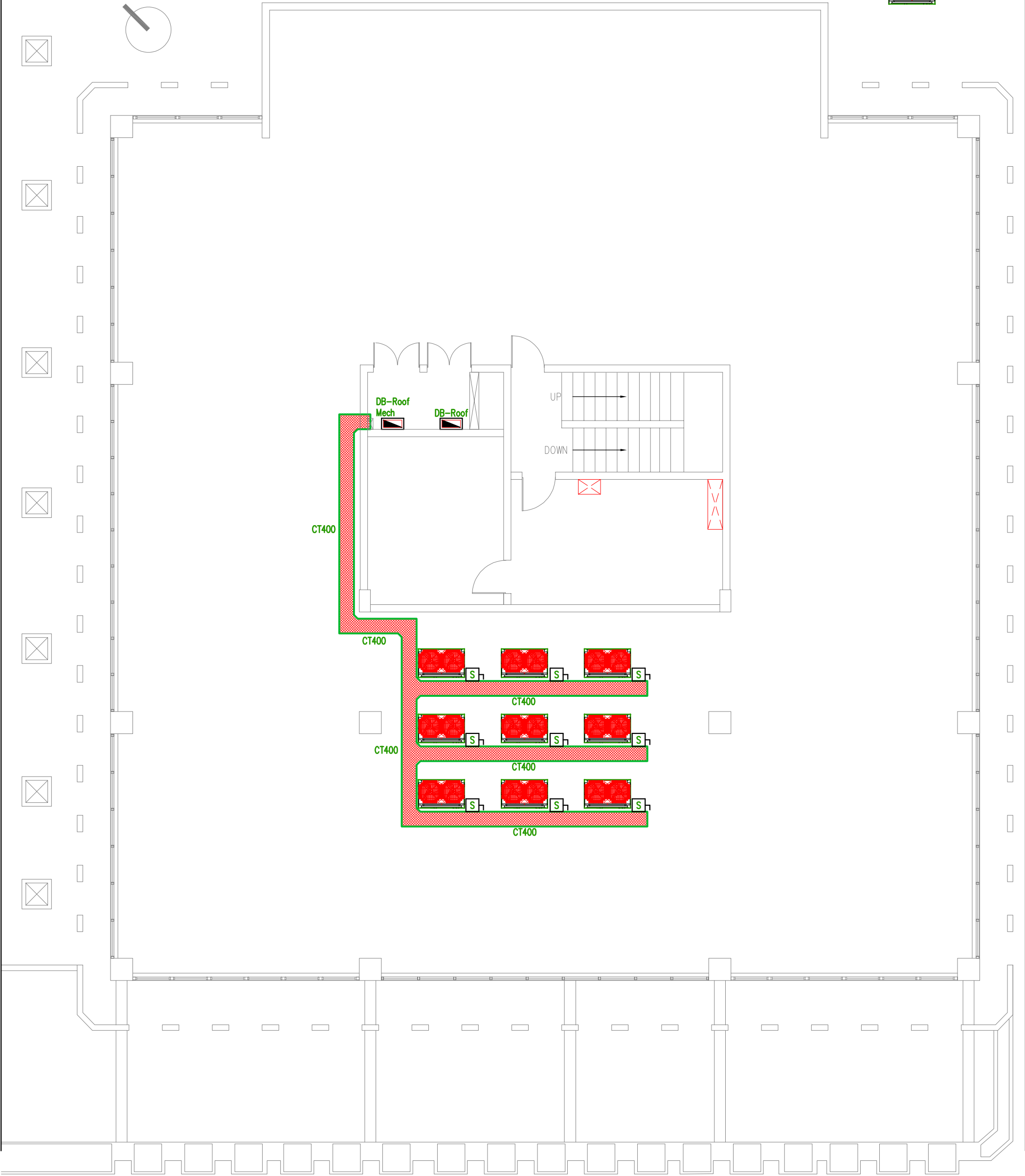
Drawing Number 22026-PDE-MBPH-L6-V12-W30-08 Revision P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	22.05.23	Initial Release	PDE	All

Drawing Number	Revision
22026-PDE-MBPH-RF-V12-W30-09	P00
Architect Drawing Number:	REV:
-	-

Legend

-  Isolator.
-  Distribution board.
-  Cable tray.
-  VRF outdoor unit.



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MEP Engineer



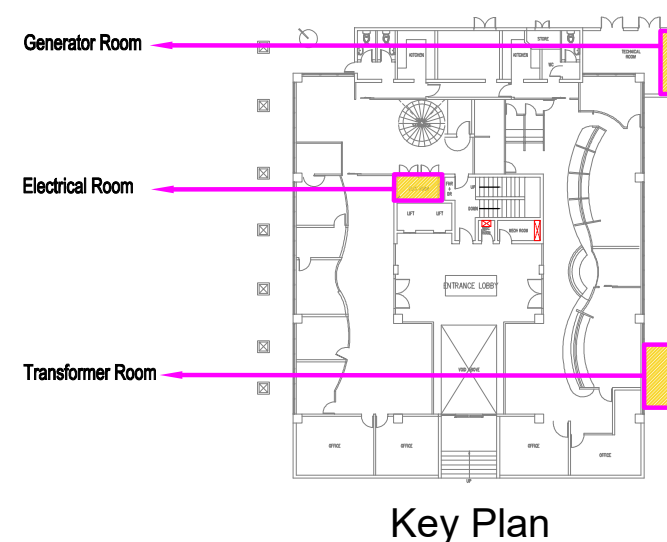
Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD
Structural Engineer

Title		ROOF PLAN	
		ELECTRICAL SERVICES	
		CONTAINMENT LAYOUT	
Drawn	BB	Checked	JN
		Approved	
Date	22.05.2023	Size	A3
		Scale	1:100
Drawing Number		Revision	
22026-PDE-MBPH-RF-V12-W30-09		P00	



REV

DATE

DESCRIPTION

ISSUED BY

ISSUED TO

P00

02.06.23

Initial Release

PDE

All

Drawing Number

22026-PDE-MBPH-XX-V20-02

Revision

P00

Architect Drawing Number: -

REV: -

Refer to sheet
22026-PDE-MBPH-XX-V20-04 for
Legend.

1x1x5C 6mm² + CPC 6mm²
CU/XLPE/ARMOURED

FROM MSB
PANEL

4P 40A

2P 10A
30mA

2P 10A
30mA

Signal from TS
on Roof

Signal from TS
on Roof

Isc= 8kA

DB-B (Basement)

CKT NO.	DESCRIPTION	MCB RATING	RCD RATING	CABLE SIZE (mm ²)
L1	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L2	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L3	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L4	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L5	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L6	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
EL1	EXTERNAL LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 2.5 Cu/PVC
EL2	EXTERNAL LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 2.5 Cu/PVC
S1	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S2	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S3	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
SPARE	SPARE	1P+N 16 A	30 mA	-
SPARE	SPARE	1P+N 16 A	30mA	-
SPARE	SPARE	1P+N 16 A	30mA	-

1x1x5C 16mm²
CU/XLPE/ARMOURED

FROM MSB
PANEL

4P 63A

RCD 30-100MA ADJUSTABLE
+ MCB TYPE D

Isc= 8kA

DB-B (Mech)

CKT NO.	DESCRIPTION	MCB RATING	RCD RATING	CABLE SIZE (mm ²)
SPRINKLER PUMP	TO SPRINKLER PUMP CONTROL PANEL	3P+N 32 A	30 mA	5C 6.0 Cu/PVC
BCW PUMP	TO BCWS PUMP CONTROL PANEL	3P+N 32 A	30 mA	5C 6.0 Cu/PVC
SUMP PUMP	TO SPRINKLER PUMP CONTROL PANEL	3P+N 32 A	30 mA	5C 6.0 Cu/PVC
CAR PARK EXTRACT FAN	TO CARK PARK EXTRACT FAN	3P+N 16 A	30 mA	5C 2.5 Cu/PVC
CAR PARK EXTRACT FAN	TO CARK PARK EXTRACT FAN	3P+N 16 A	30 mA	5C 2.5 Cu/PVC
CAR PARK EXTRACT FAN	TO CARK PARK EXTRACT FAN	3P+N 16 A	30 mA	5C 2.5 Cu/PVC
CAR PARK EXTRACT FAN	TO CARK PARK EXTRACT FAN	3P+N 16 A	30 mA	5C 2.5 Cu/PVC

1x1x5C 6mm²
CU/XLPE/ARMOURED

FROM MSB
PANEL

4P 40A

2P 10A
30mA

2P 10A
30mA

Signal from TS
on Roof

Signal from TS
on Roof

Isc= 4.9kA

DB-GF (Ground Floor)

CKT NO.	DESCRIPTION	MCB RATING	RCD RATING	CABLE SIZE (mm ²)
L1	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L2	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L3	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L4	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L5	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L6	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
EL1	EXTERNAL LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 2.5 Cu/PVC
EL2	EXTERNAL LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 2.5 Cu/PVC
S1	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S2	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S3	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S4	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S5	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S6	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
SPARE	SPARE	1P+N 16 A	30 mA	-
SPARE	SPARE	1P+N 16 A	30mA	-
SPARE	SPARE	1P+N 16 A	30mA	-

Disclaimer

MEP Engineer

Architect

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title

SCHEMATIC DIAGRAM
ELECTRICAL SERVICES
LV DISTRIBUTION

Drawn

BB

Checked

JN

Approved

Date

22.05.23

Size

A3

Scale

NTS

Drawing Number

22026-PDE-MBPH-XX-V20-02

Revision

P00

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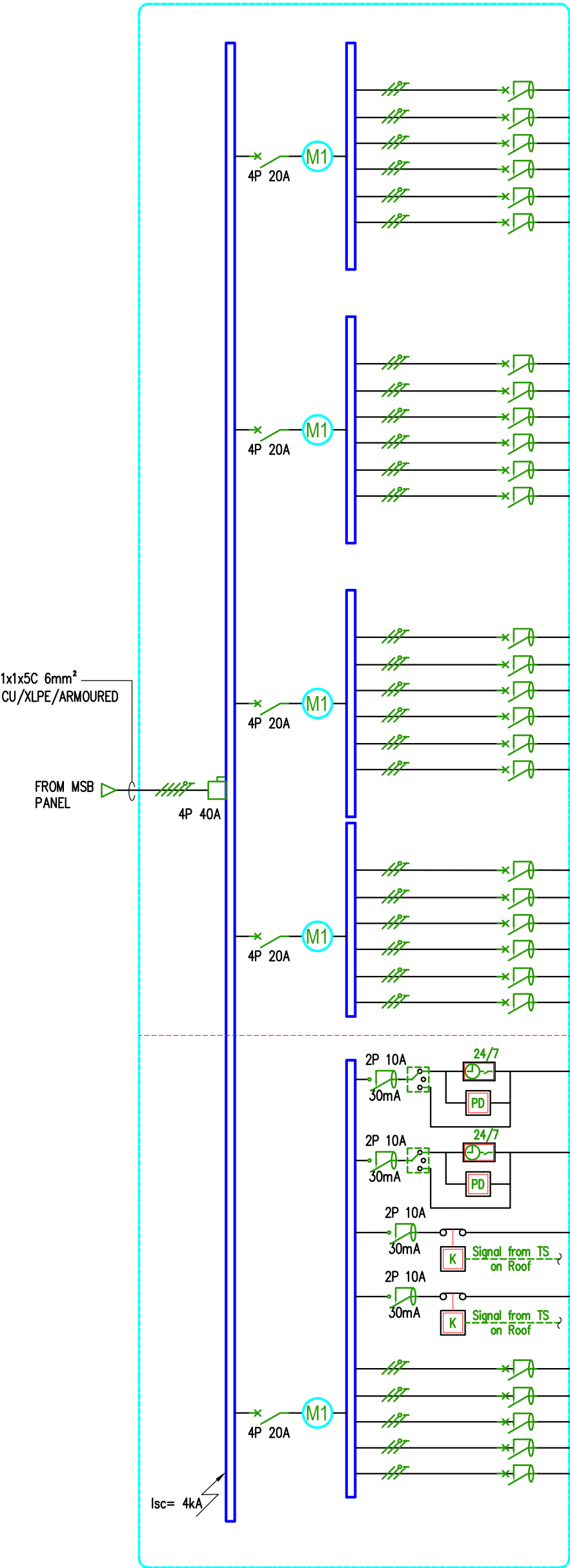
97

98

99

100

CKT NO.	DESCRIPTION	MCB RATING	RCD RATING	CABLE SIZE (mm ²)
TENANT 1				
L1	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L2	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
S1	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 1.5 Cu/PVC
S2	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 1.5 Cu/PVC
IDU	VRF INDOOR UNITS CIRCUIT	1P+N 16 A	30 mA	3C 1.5 Cu/PVC
SPARE	SPARE	1P+N 16 A	30 mA	-
TENANT 2				
L1	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L2	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
S1	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S2	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
IDU	VRF INDOOR UNITS CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
SPARE	SPARE	1P+N 16 A	30 mA	-
TENANT 3				
L1	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L2	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
S1	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S2	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
IDU	VRF INDOOR UNITS CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
SPARE	SPARE	1P+N 16 A	30 mA	-
TENANT 4				
L1	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L2	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
S1	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
S2	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
IDU	VRF INDOOR UNITS CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
SPARE	SPARE	1P+N 16 A	30 mA	-
COMMON				
L1	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
L2	LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 1.5 Cu/PVC
EL1	EXTERNAL LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 2.5Cu/PVC
EL2	EXTERNAL LIGHTING CIRCUIT	1P+N 10 A	30 mA	3C 2.5Cu/PVC
S1	SOCKET CIRCUIT	1P+N 16 A	30 mA	3C 2.5 Cu/PVC
SPARE	SPARE	1P+N 16 A	30 mA	-
SPARE	SPARE	1P+N 16 A	30 mA	-
SPARE	SPARE	1P+N 16 A	30 mA	-
SPARE	SPARE	1P+N 16 A	30 mA	-

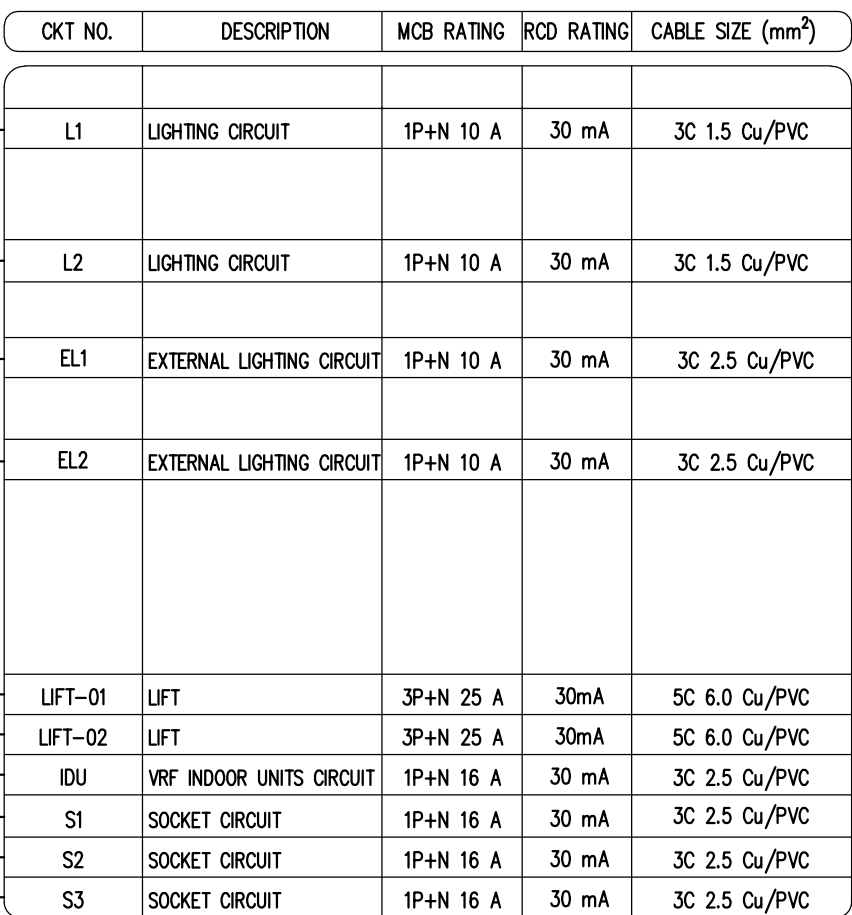


DB-1F to DB-6F

Refer to sheet
22026-PDE-MBPH-XX-V20-04 for
Legend.

Distribution Board	I _t / kA
Distribution Board Ground floor	4.9
Distribution Board 1st floor	4.0
Distribution Board 2nd floor	4.0
Distribution Board 3rd floor	3.0
Distribution Board 4th floor	2.8
Distribution Board 5th floor	2.5
Distribution Board 6th floor	2.2

Drawing Number	Revision
22026-PDE-MBPH-XX-V20-04	P00
Architect Drawing Number: -	REV: -



TEF	DUTY/STANDBY EXTRACTOR FAN	3P+N 16 A	30-100 mA	5C 2.5 Cu/PVC
AHU	AIR HANDLING UNIT (AHU)	3P+N 63 A	30-100 mA	4C 25 Cu/PVC + CPC 16
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC
VRF	VRF CIRCUIT	3P+N 50 A	30-100mA	5C 16 Cu/PVC

	Residual current circuit breaker with overload protection (RCBO).
	Earth leakage circuit breaker (RCD).
	Digital 24hrs, 7day timer.
	Presence detector.
	Contactor.
	Manual override switch.
	Switch disconnecter.
	Meter.
	Twilight switch.

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Architect
-
Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title SCHEMATIC DIAGRAM ELECTRICAL SERVICES LV DISTRIBUTION					
Drawn	BB	Checked	JN	Approved	
Date	22.05.23	Size	A3	Scale	NTS
Drawing Number				Revision	
22026-PDE-MBPH-XX-V20-04				P00	

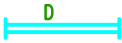
Legend



LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE



LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN



Suspended LED Batten, 48W 1.5M IP20 , 4000K similar or equivalent to ROBUS CAESAR



LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE



LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN



LED Batten, 20W, IP20, 0.6m, CCT 4500K similar or equivalent to Robus BARON



Surface mounted LED Die Cast with Full Diffuser, 18W, 4000K, Black, 350mm diameter similar or equivalent to Robus ROCCO



Weatherproof LED Floodlights IP65 – Warm White (3000K) 20W – 2000 lm(178x165mm) similar or equivalent to Legrand



Pendant light, White with LED, 7.5W, 800 lm, 2500K, similar or equivalent to SLV, FITU E27, Product No 132691 with LED Prod. No 1005265



Pendant Light, 31W, Black Colour, 2700 lm, 4000k, similar or equivalent to SLV Supros PD, Prod No 1003278



Recessed downlight, 19W, 2250 lm, 118 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus II S PRE



Recessed downlight, 10W, 1250 lm, 125 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus XS PRE with Opal Cover



Downlight, 20W, White Colour, 2120 lm, UGR 16 similar or equivalent to SLV Numinos M, Ø 8.5, Dali, 4000K, Prod No 1004527



LED Panel Light 30W, UGR<19 , 600*600mm, with white finish, 4000K similar or equivalent to ROBUS SPACE, c/w emergency battery pack.



LED circular panel, 18W , IP20, 225mm, White, 4000K, similar or equivalent to ROBUS SUN, c/w emergency battery pack.



Suspended LED Batten, 48W 1.5M IP20 , 4000K similar or equivalent to ROBUS CAESAR, c/w emergency battery pack.



LED Surface Mount 20W, CCT 4000K, IP20 with white finish similar or equivalent to Robus LUNATE, c/w emergency battery pack.



LED Batten 40W , IP20, 1.2m, wide 160mm base, CCT 4000K similar or equivalent to ROBUS BRAZEN, c/w emergency battery pack.



Recessed downlight, 19W, 2250 lm, 118 lm/W, CCT 4000K, similar or equivalent to OMS, Prettus II S PRE, c/w emergency battery pack.



Illuminated Emergency Escape sign – Arrow Up, 1.5W, Maintained, similar or equivalent to ROBUS SWISS



Illuminated Emergency Escape sign – Arrow Down, 1.5W, Maintained, similar or equivalent to ROBUS SWISS



Illuminated Emergency Escape sign – Arrow Right, 1.5W, Maintained, similar or equivalent to ROBUS SWISS



Illuminated Emergency Escape sign – Arrow Left 1.5W, Maintained, similar or equivalent to ROBUS SWISS



Presence detector.



Distribution board.



Switch 1 gang 1 way flush mounted .



Switch 2 gang 1 way flush mounted .



Switch 1 gang 2 way flush mounted .



Switch 2 gang 2 way flush mounted .



Push button.

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

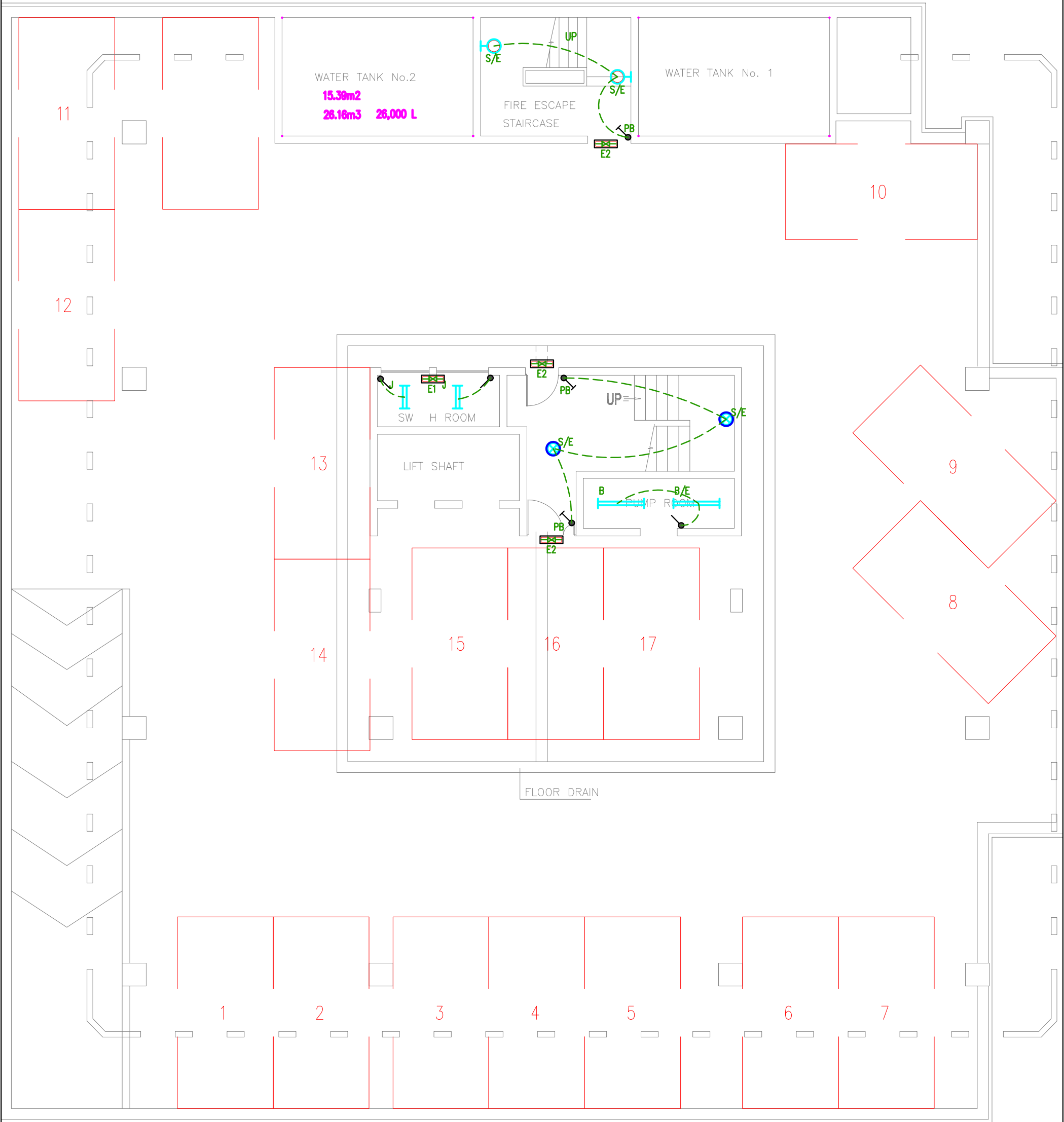
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22026-PDE-MBPH-LX-V21-V40-V41-01
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-LB-V21-V40-V41-02 P00

Revision

Architect Drawing Number:

REV:



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MEP Engineer



Architect

Client

MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
BASEMENT
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-LB-V21-V40-V41-02 P00

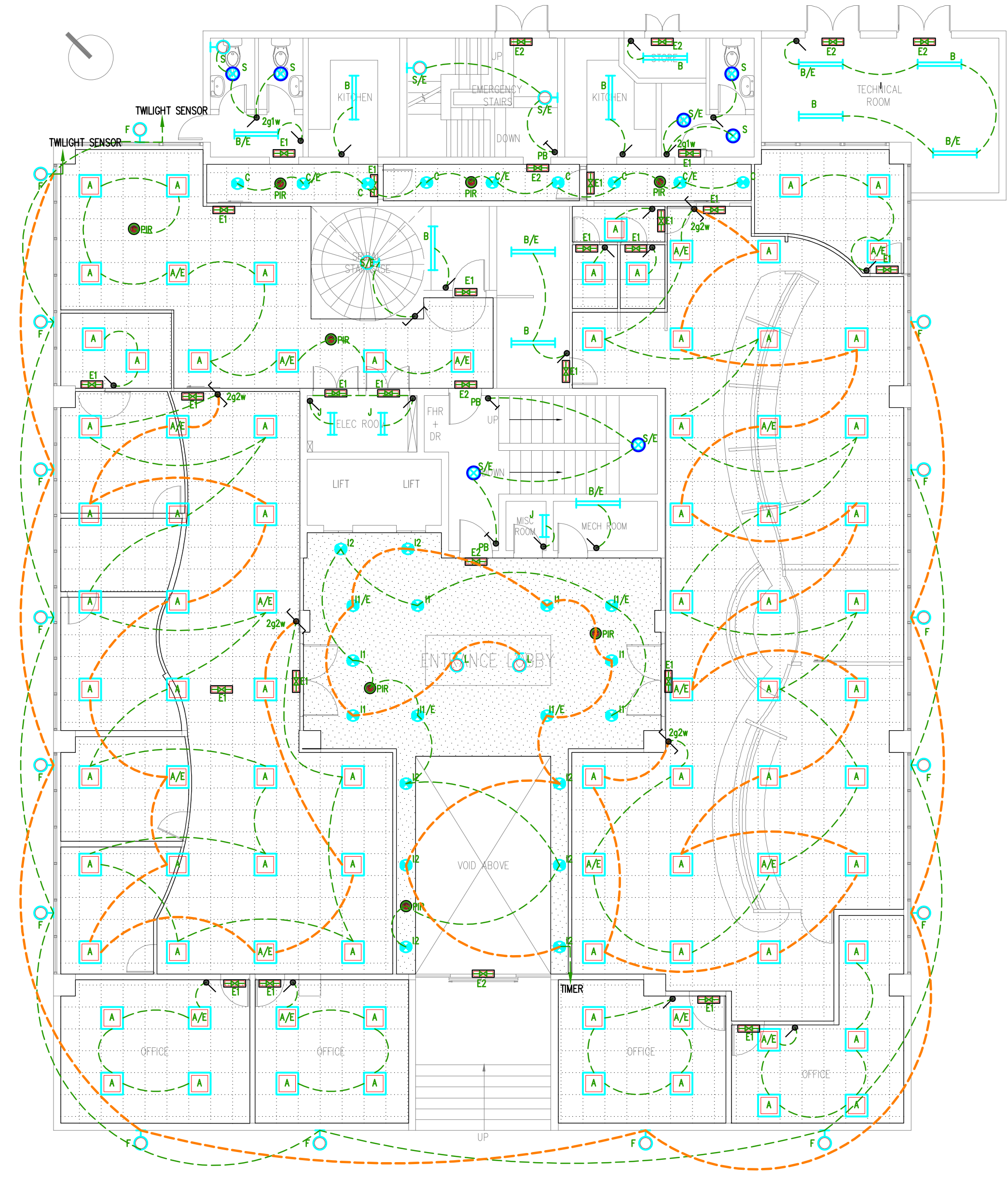
Revision

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-LX-V21-V40-V41-01
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L0-V21-V40-V41-03 P00

Architect Drawing Number: - REV: -



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Architect

Client

MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
GROUND FLOOR PLAN
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L0-V21-V40-V41-03 P00

Revision

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

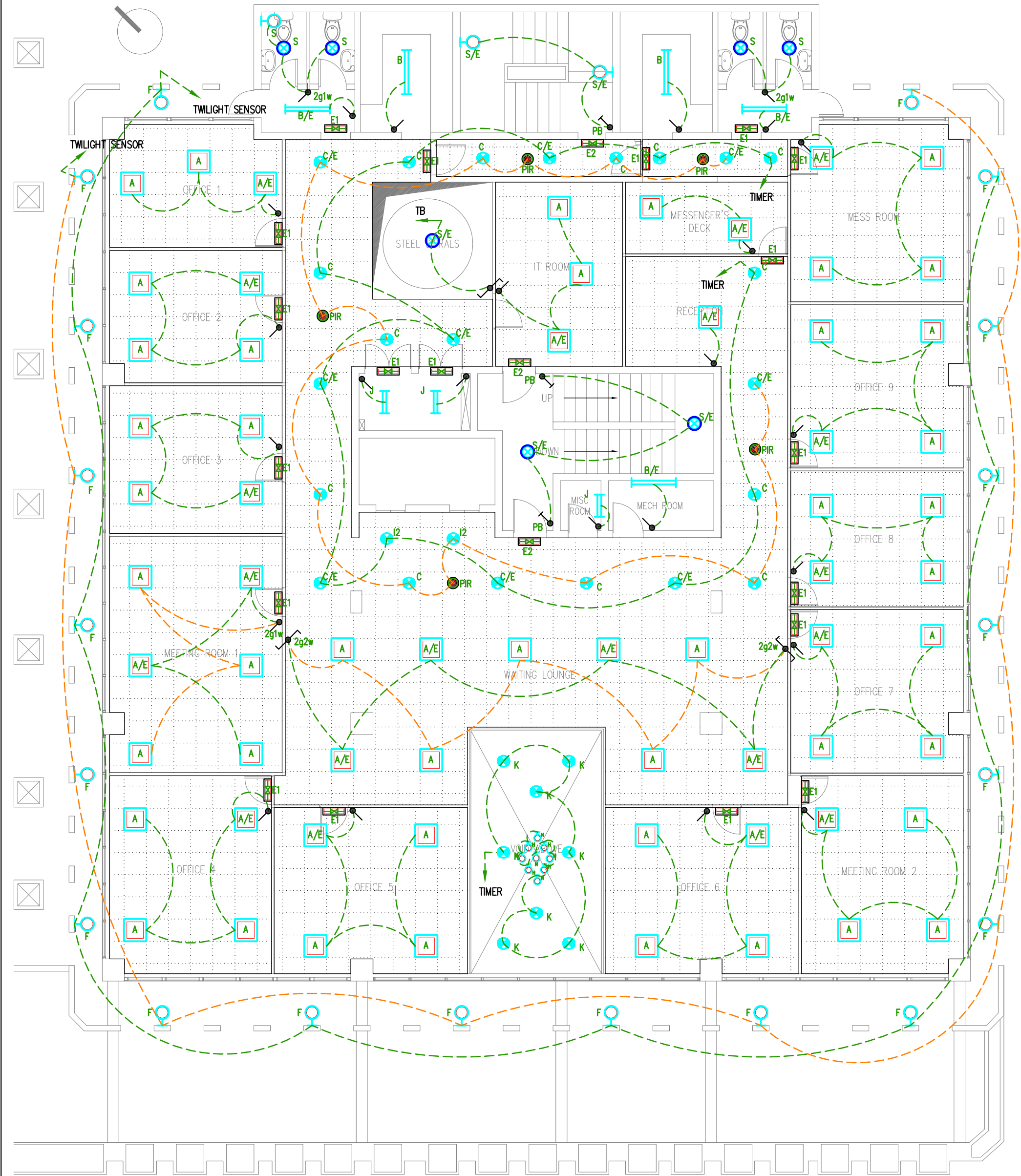
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for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L1-V21-V40-V41-04P00

Revision

Architect Drawing Number:

REV:



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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FIRST FLOOR PLAN
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn BB Checked AVP Approved

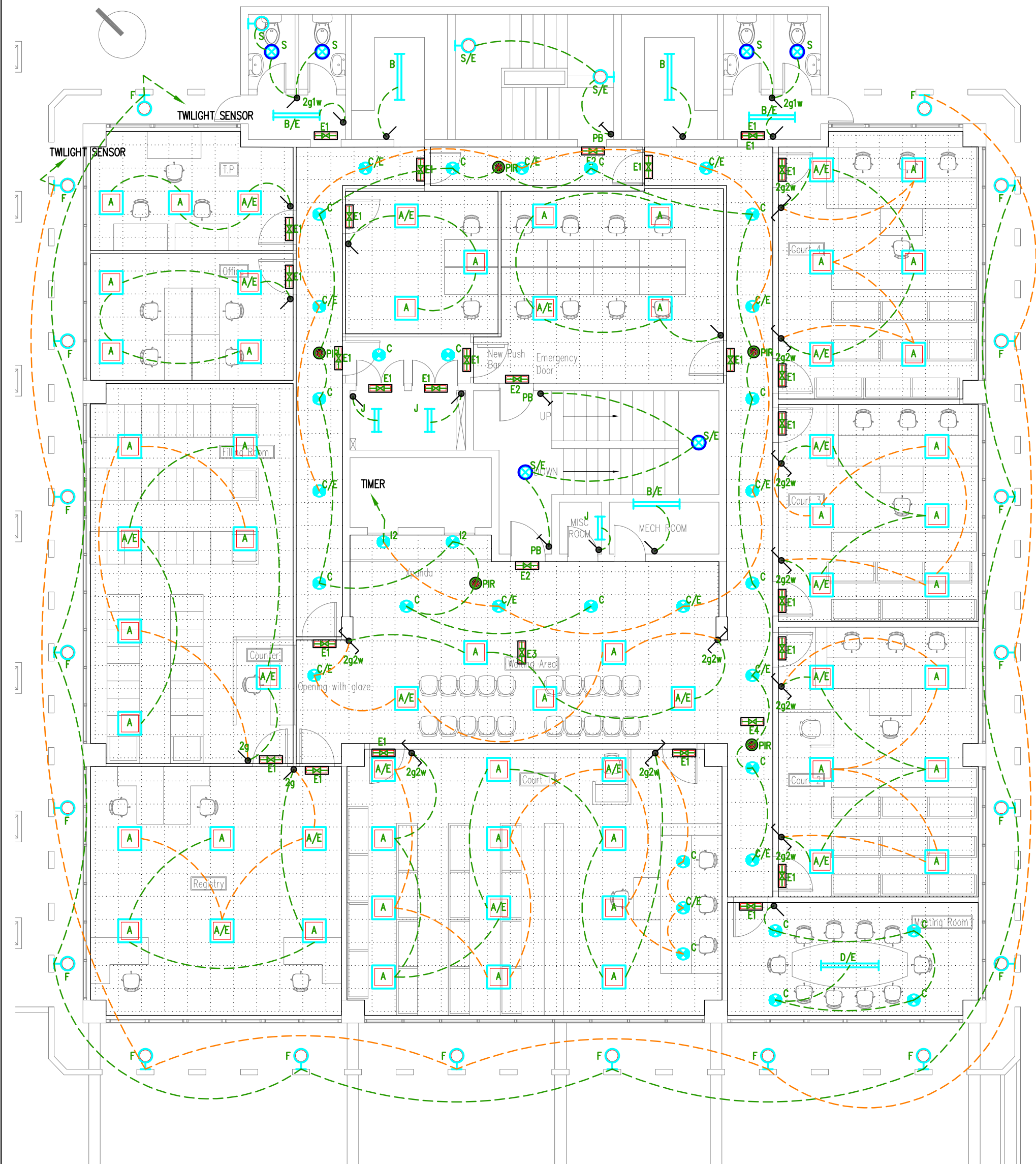
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Drawing Number
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Revision

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
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Drawing Number	Revision
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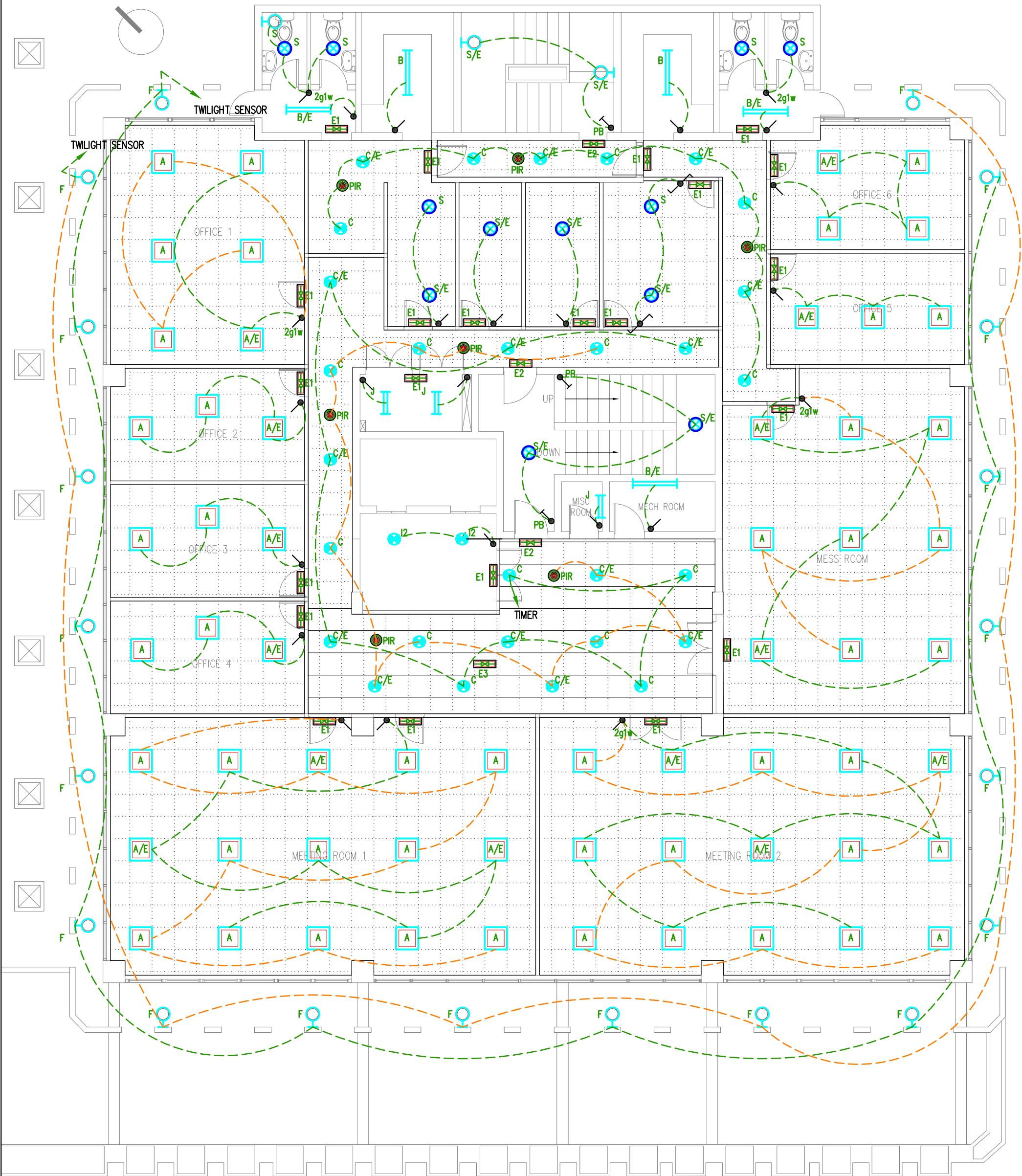


Drawing Number	Revision
22026-PDE-MBPH-L2-V21-V40-V41-05	P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-LX-V21-V40-V41-01
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Drawing Number	22026-PDE-MBPH-L3-V21-V40-V41-06	Revision	P00
Architect Drawing Number:	-	REV:	-



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MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
THIRD FLOOR PLAN
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number 22026-PDE-MBPH-L3-V21-V40-V41-06 Revision P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
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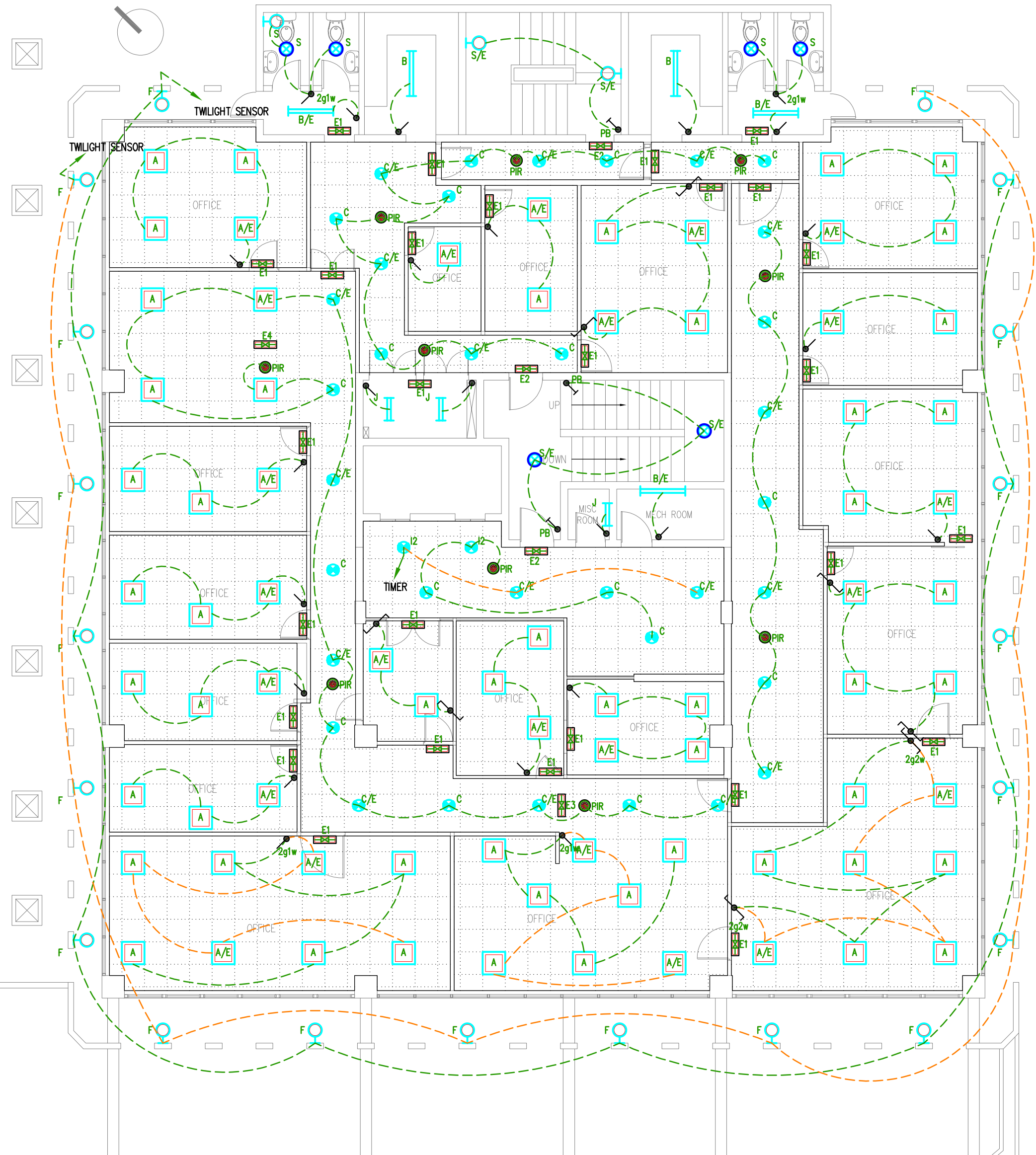
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for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L4-V21-V40-V41-07 P00

Revision

Architect Drawing Number:

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STAGE 4: TECHNICAL DESIGN

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FOURTH FLOOR PLAN
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn BB Checked AVP Approved

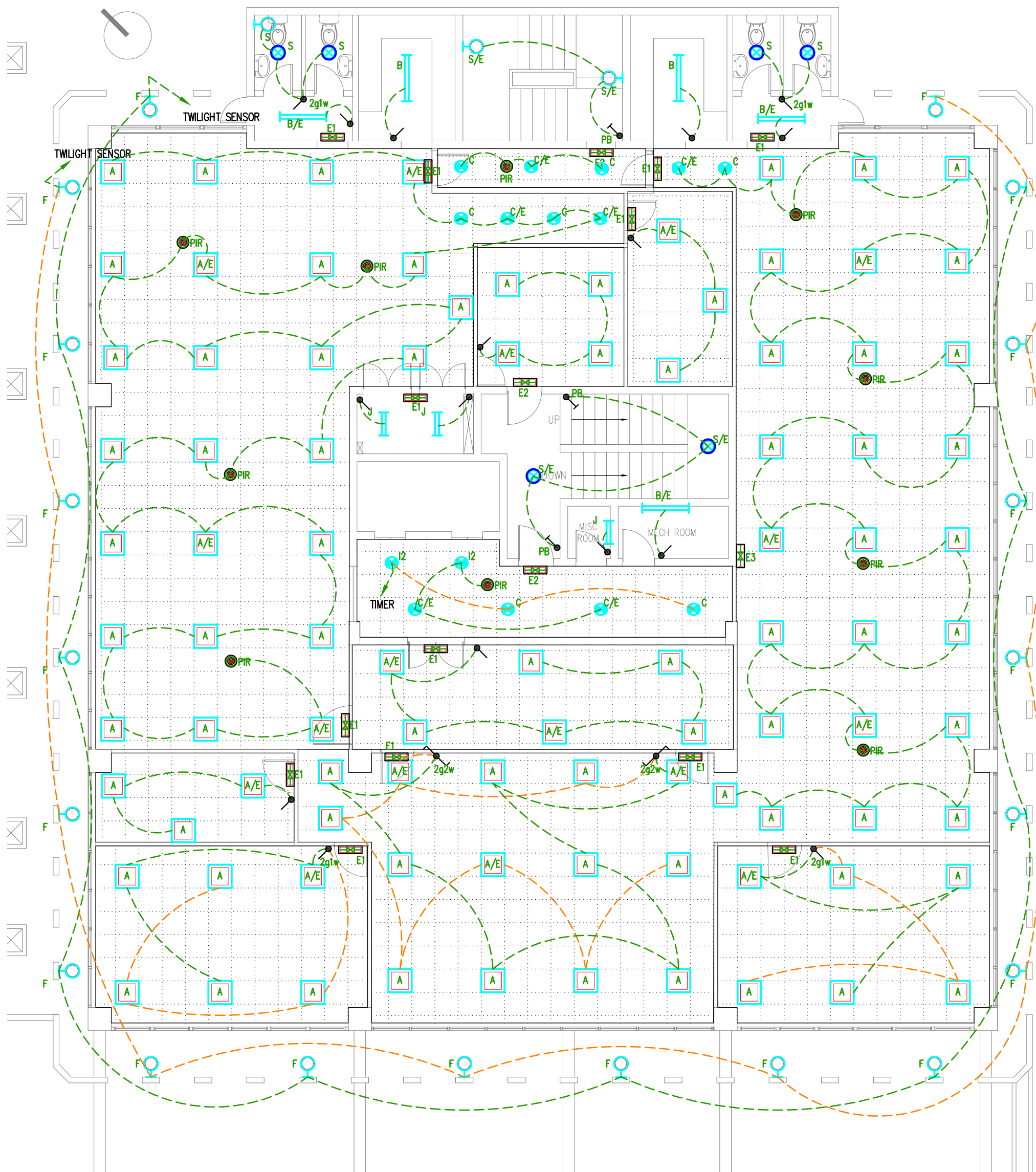
Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L4-V21-V40-V41-07 P00

Revision

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22026-PDE-MBPH-LX-V21-V40-V41-01
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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FIFTH FLOOR PLAN
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

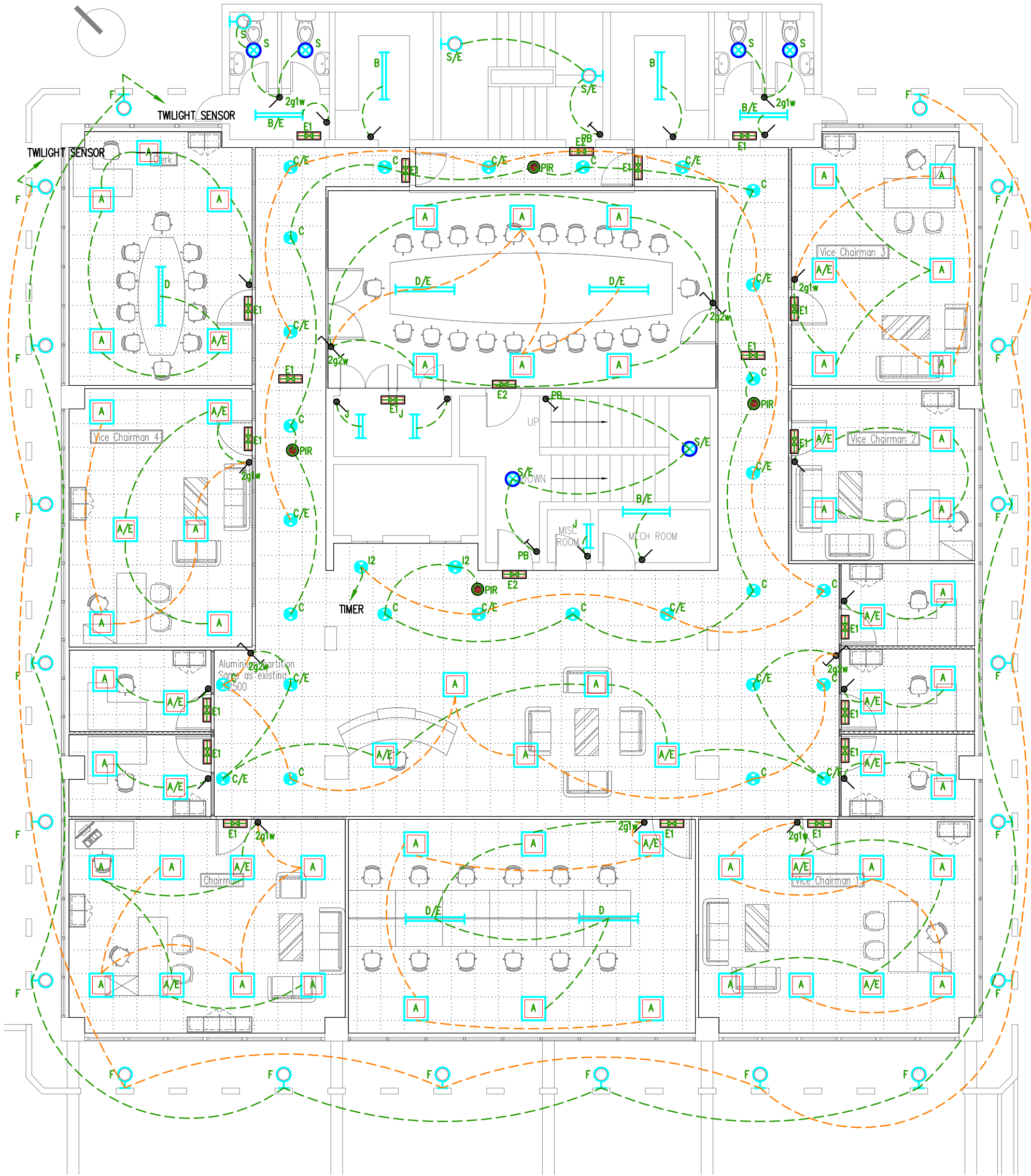
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REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-LX-V21-V40-V41-01
for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-L6-V21-V40-V41-09 P00

Architect Drawing Number: - REV: -



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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SIXTH FLOOR PLAN
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L6-V21-V40-V41-09 P00

Revision

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

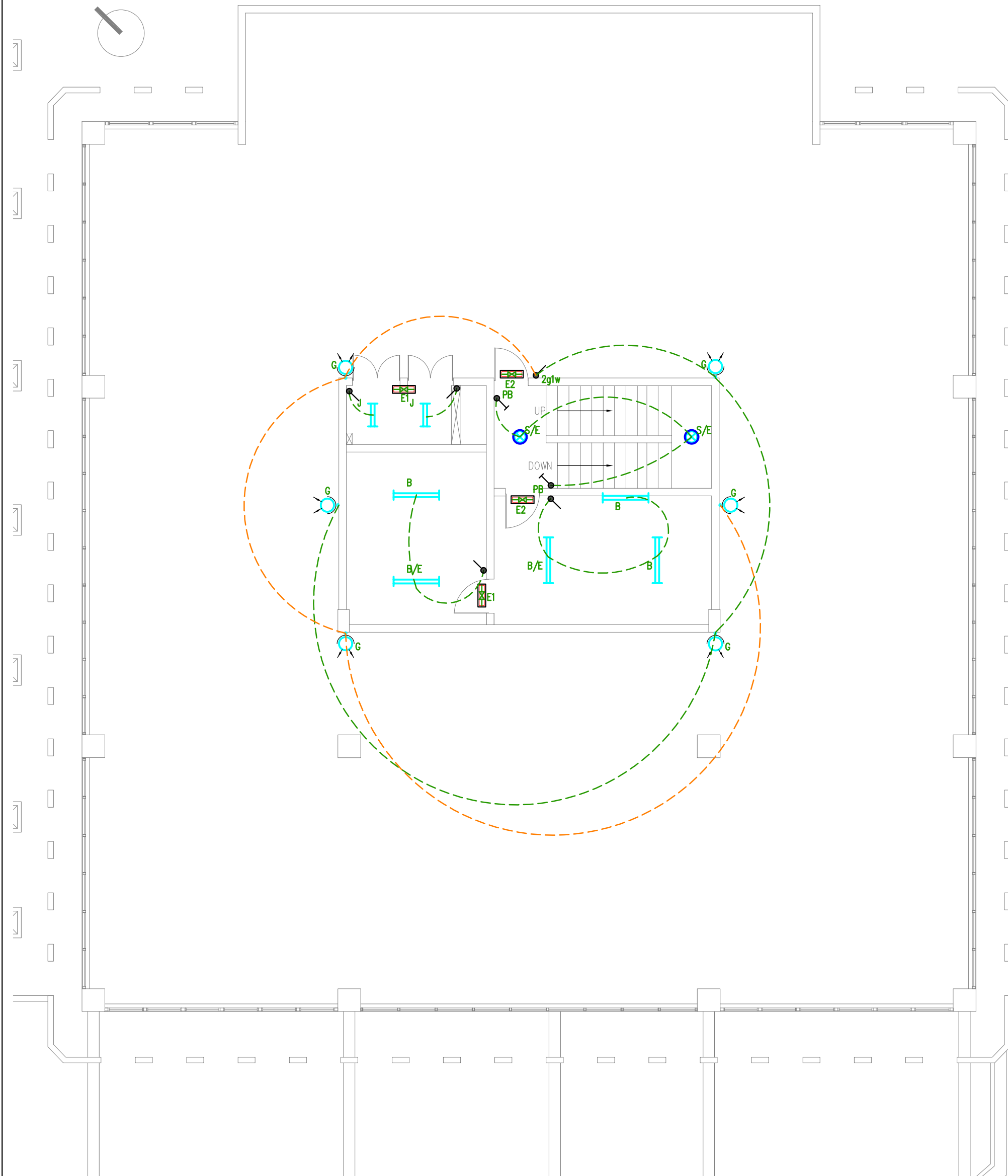
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for Legend & General Notes.

Drawing Number
22026-PDE-MBPH-RF-V21-V40-V41-10 P00

Revision

Architect Drawing Number:

REV:



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Architect

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

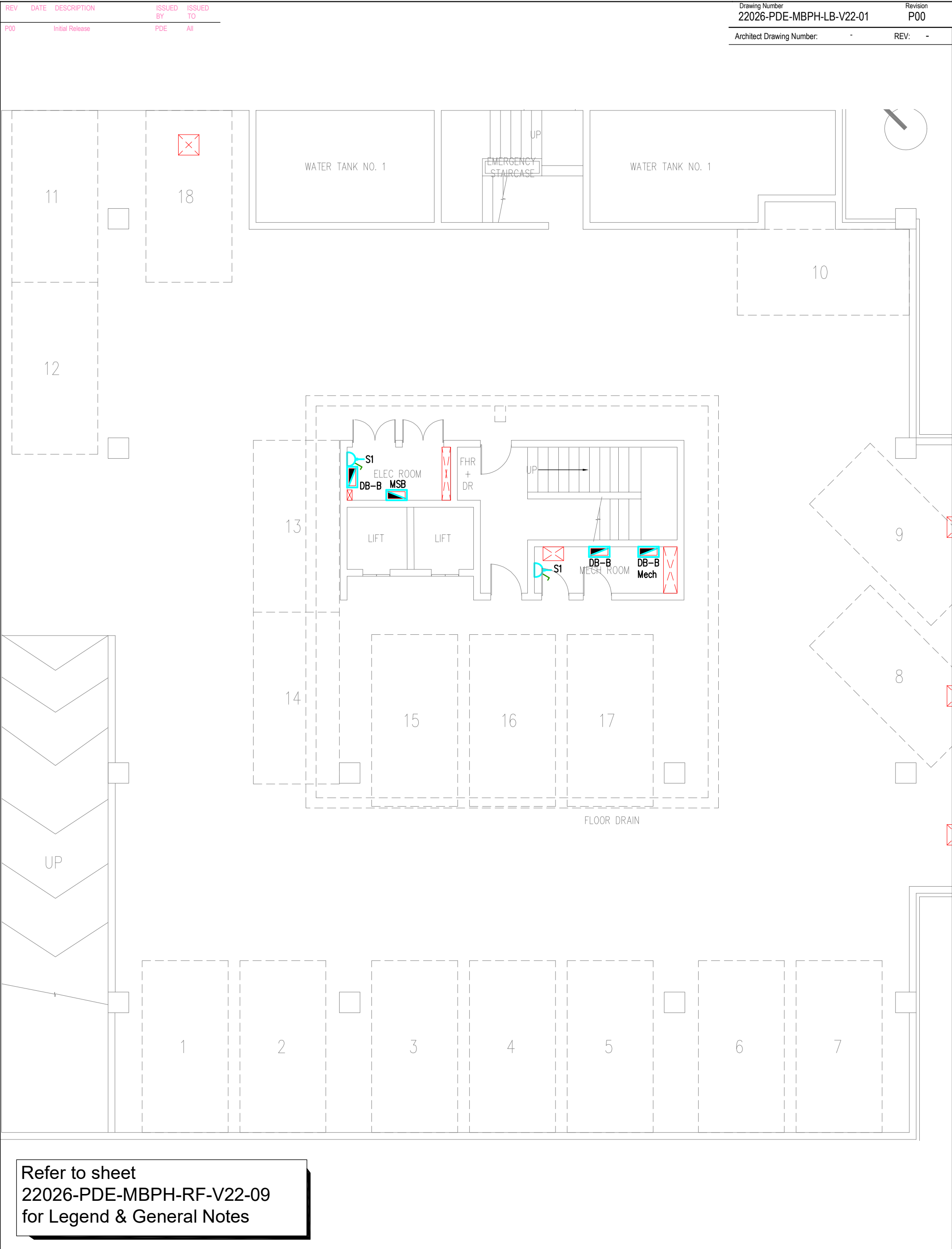
Title
ROOF PLAN
ELECTRICAL SERVICES
GENERAL, EMERGENCY & EXTERNAL LIGHTING

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-RF-V21-V40-V41-10 P00

Revision



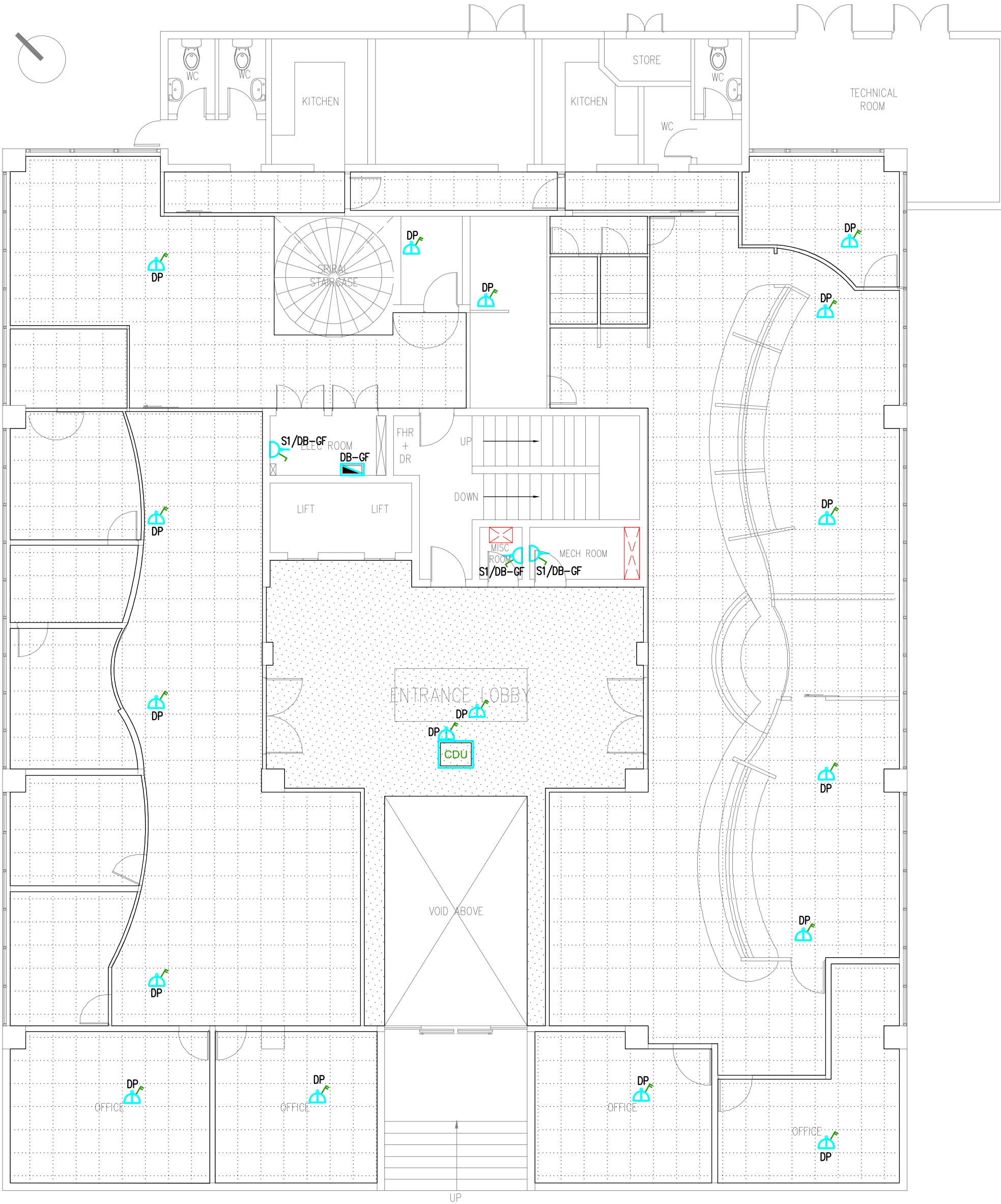
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P00	02.06.23	Initial Release	PDE	All

Drawing Number
22026-PDE-MBPH-L0-V22-02

Revision
P00

Architect Drawing Number: -

REV: -



Refer to sheet
22026-PDE-MBPH-RF-V22-09
for Legend & General Notes

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Architect

Client
MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
GROUND FLOOR PLAN
ELECTRICAL SERVICES
GENERAL LV POWER

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L0-V22-02

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number
22026-PDE-MBPH-L1-V22-03

Revision
P00

Architect Drawing Number: -

REV: -



Refer to sheet
22026-PDE-MBPH-RF-V22-09
for Legend & General Notes

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MEP Engineer



Architect

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
FIRST FLOOR PLAN
ELECTRICAL SERVICES
GENERAL LV POWER

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L1-V22-03

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L2-V22-04	Revision	P00
Architect Drawing Number:	-	REV:	-



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for Legend & General Notes

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MEP Engineer



Architect

-

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
SECOND FLOOR PLAN
ELECTRICAL SERVICES
GENERAL LV POWER

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L2-V22-04

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L3-V22-05	Revision	P00
Architect Drawing Number:	-	REV:	-



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Architect
-
Client
MAUBANK LTD

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD
Structural Engineer

Title		THIRD FLOOR PLAN ELECTRICAL SERVICES GENERAL LV POWER		
Drawn	BB	Checked	AVP	Approved
Date	06.04.2023	Size	A3	Scale 1:100
Drawing Number		Revision		
22026-PDE-MBPH-L3-V22-05		P00		

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L4-V22-06	Revision	P00
Architect Drawing Number:	-	REV:	-



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Architect

Client

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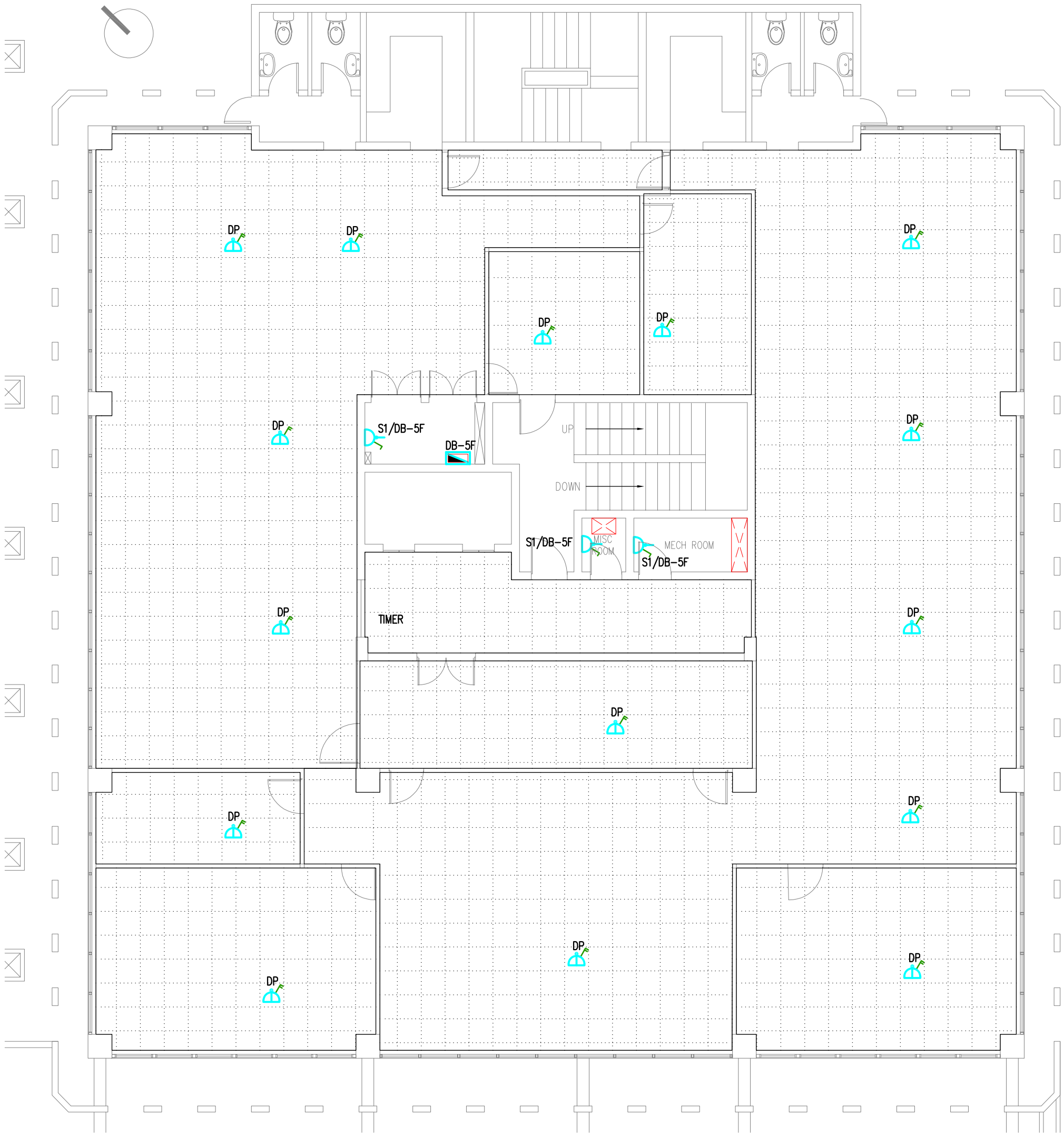
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title				
FOURTH FLOOR PLAN ELECTRICAL SERVICES GENERAL LV POWER				
Drawn	BB	Checked	AVP	Approved
Date	06.04.2023	Size	A3	Scale 1:100
Drawing Number				Revision
22026-PDE-MBPH-L4-V22-06				P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L5-V22-07	Revision	P00
Architect Drawing Number:	-	REV:	-



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22026-PDE-MBPH-RF-V22-09
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Architect

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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
FIFTH FLOOR PLAN
ELECTRICAL SERVICES
GENERAL LV POWER

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L5-V22-07

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00		Initial Release	PDE	All

Drawing Number	Revision
22026-PDE-MBPH-L6-V22-08	P00
Architect Drawing Number:	REV:
-	-



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Architect

Client
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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
SIXTH FLOOR PLAN
ELECTRICAL SERVICES
GENERAL LV POWER

Drawn JC Checked AVP Approved

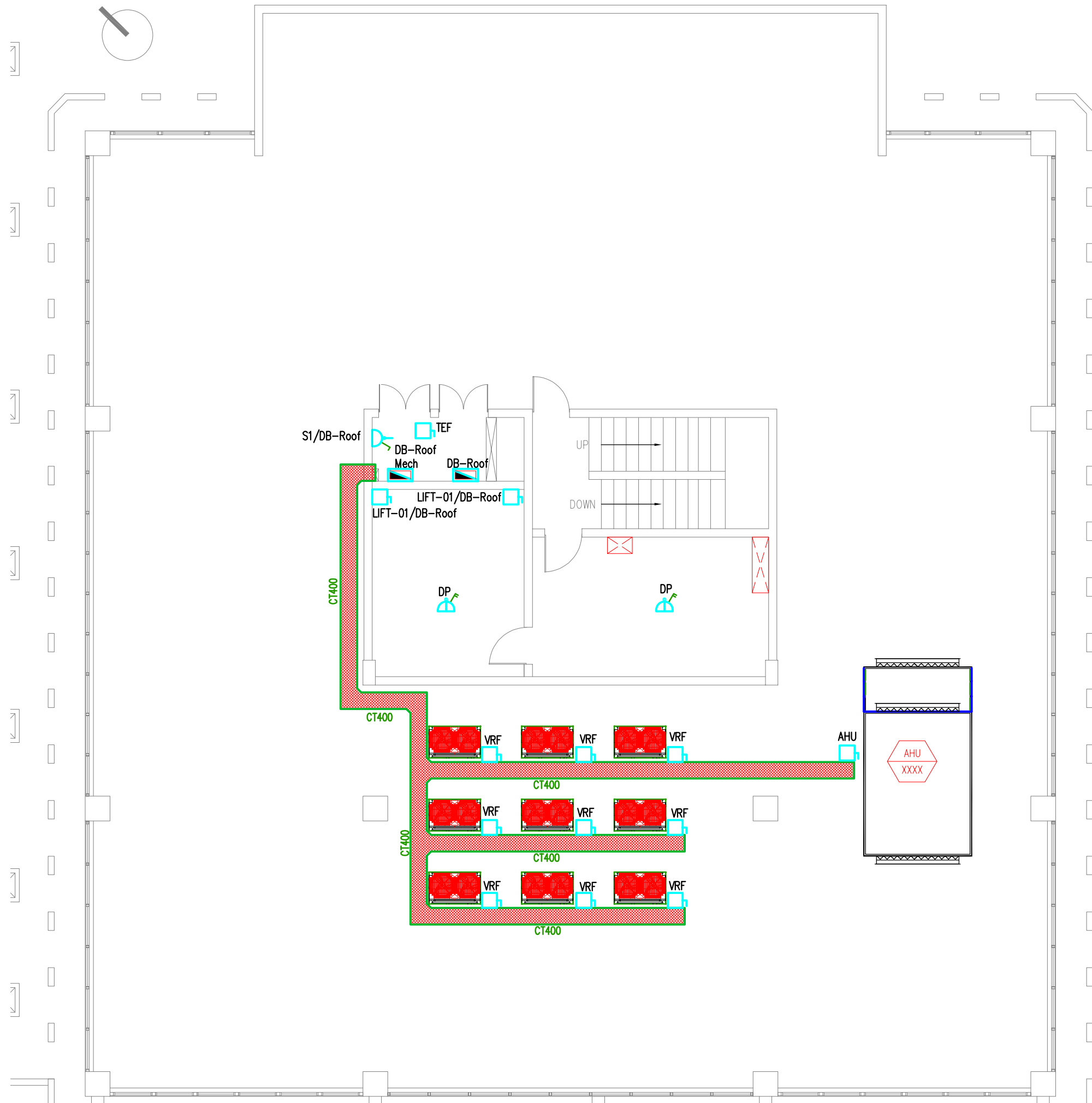
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Drawing Number
22026-PDE-MBPH-L6-V22-08

Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-RF-V22-09	Revision	P00
Architect Drawing Number:	-	REV:	-



Legend

- 20A Double Pole Switch with red LED indicator similar to Legrand Synergy in false ceiling under soffit
- 4P 50A Rotary Isolator Switch with auxiliary contact similar to Legrand
- 1x13A switched socket outlet similar to Legrand Synergy c/w cover plate.
- Cable tray.
- Distribution board.

General Notes

- This drawing shall be read jointly with LV distribution schematics.
- All sockets and power points shall be labelled after installation.
- 1X13A switched socket outlet shall be fixed at 300mm AFFL.
- In areas with false ceiling, 20A DP Switch shall be in false ceiling, under soffit.
- In areas with no false ceiling, 20A DP Switch shall be fixed under soffit of slab.

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Architect

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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

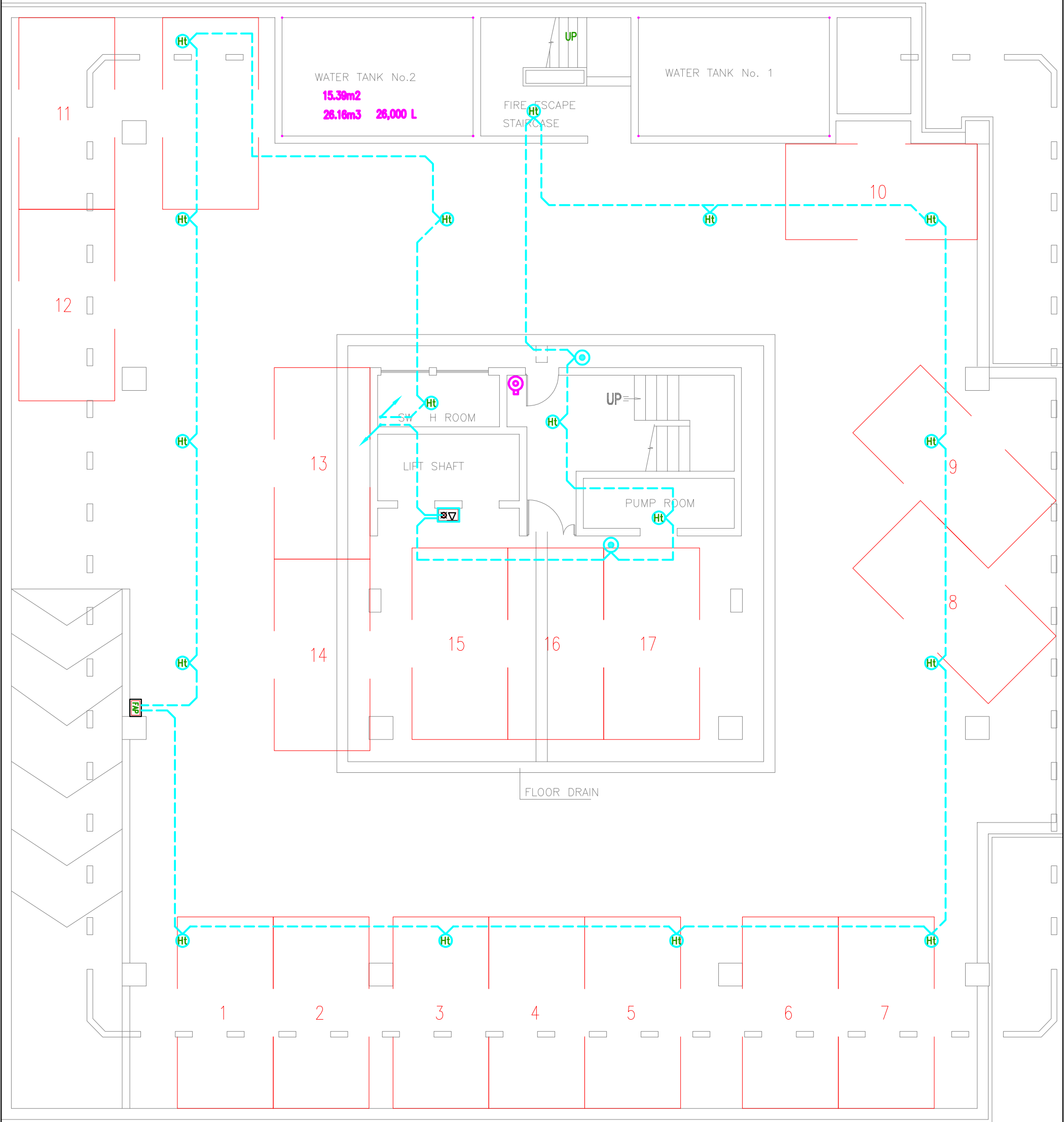
Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title		ROOF PLAN ELECTRICAL SERVICES GENERAL LV POWER			
Drawn	JC	Checked	AVP	Approved	
Date	06.04.2023	Size	A3	Scale	1:100
Drawing Number		22026-PDE-MBPH-RF-V22-09		Revision	
				P00	

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-LB-W50-01	Revision	P00
Architect Drawing Number:	-	REV:	-



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BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
BASEMENT
ELECTRICAL SERVICES
FIRE DETECTION & ALARM

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

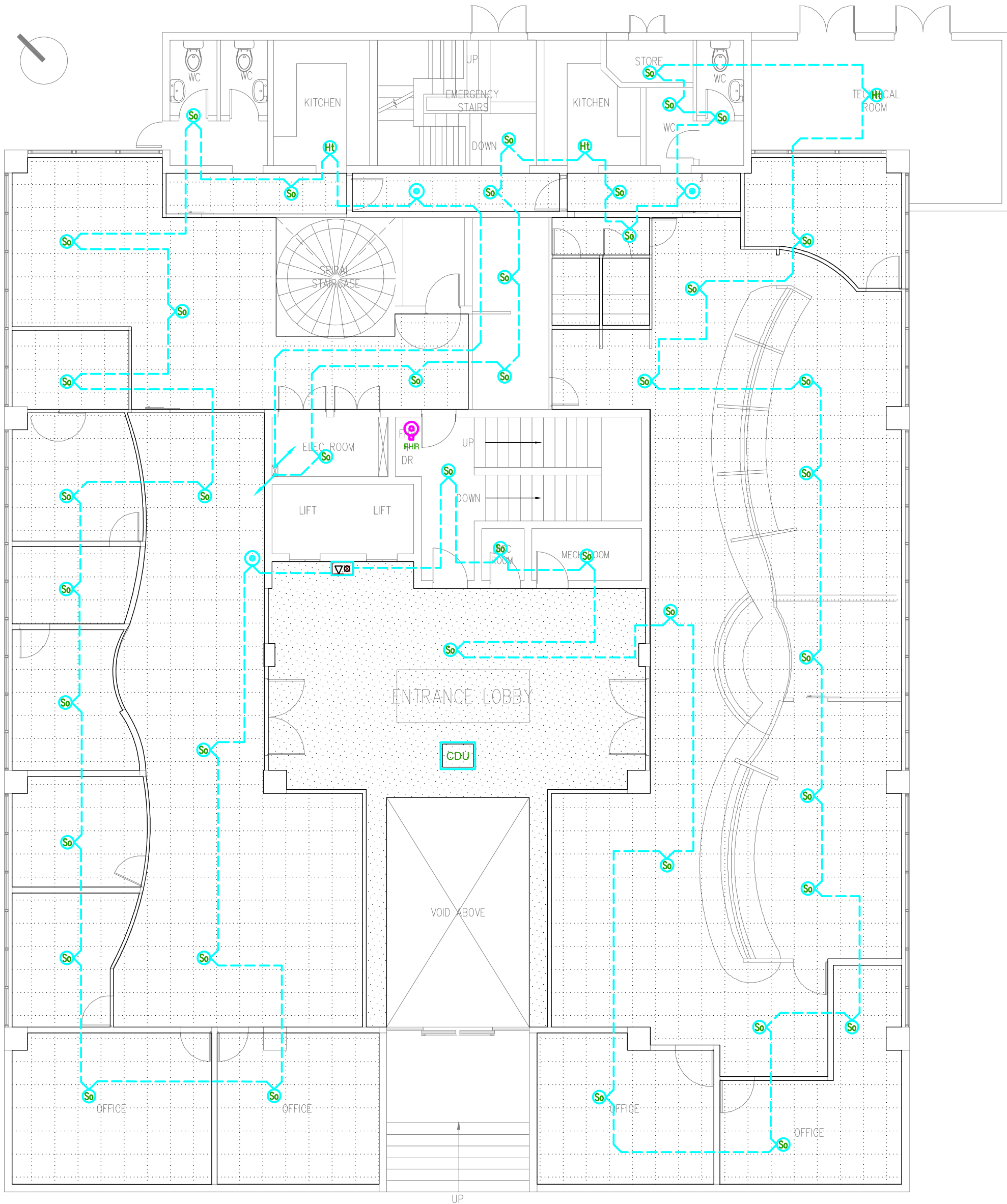
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Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

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Drawing Number	22026-PDE-MBPH-L0-W50-02	Revision	P00
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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

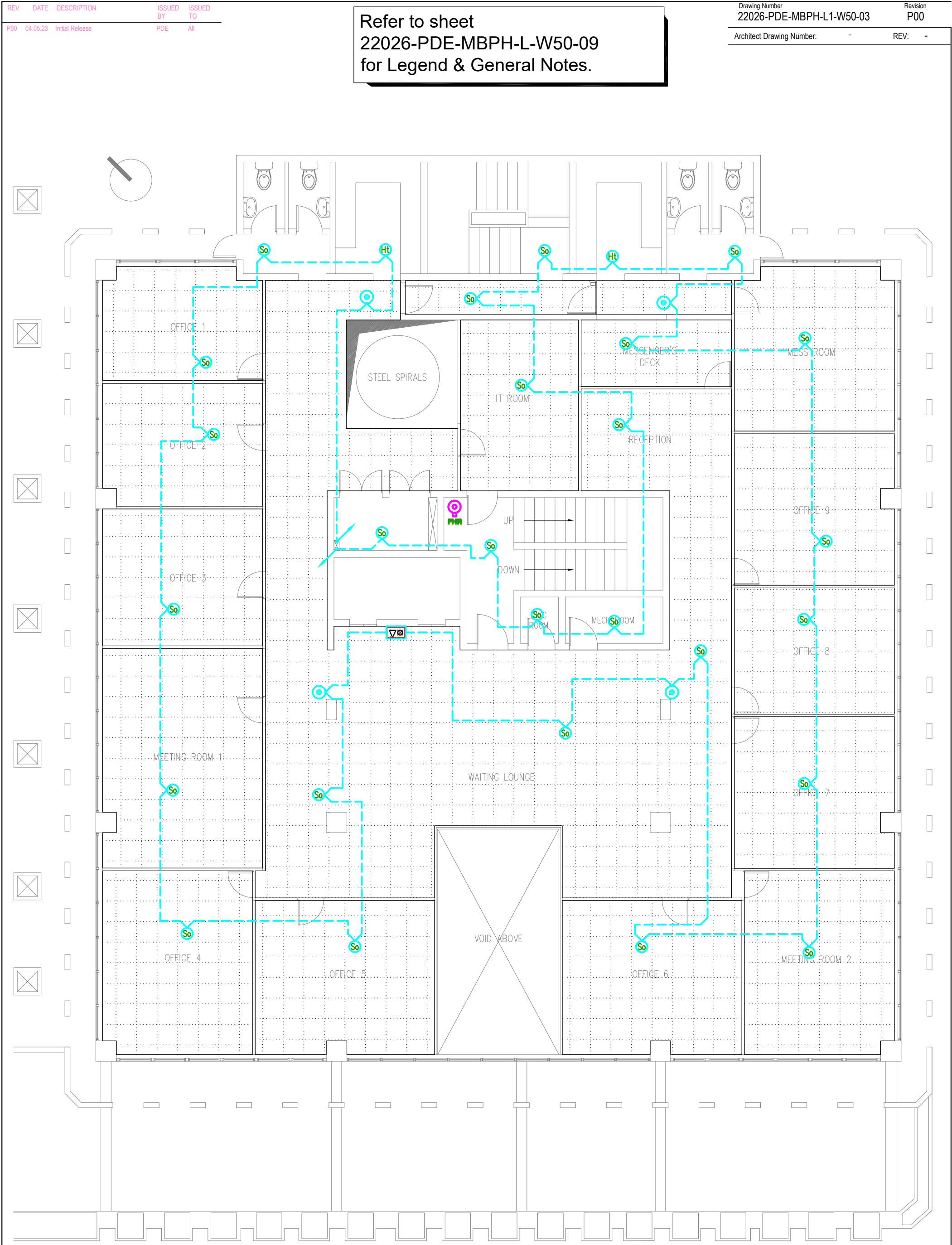
Title
GROUND FLOOR PLAN
ELECTRICAL SERVICES
FIRE DETECTION & ALARM

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L0-W50-02

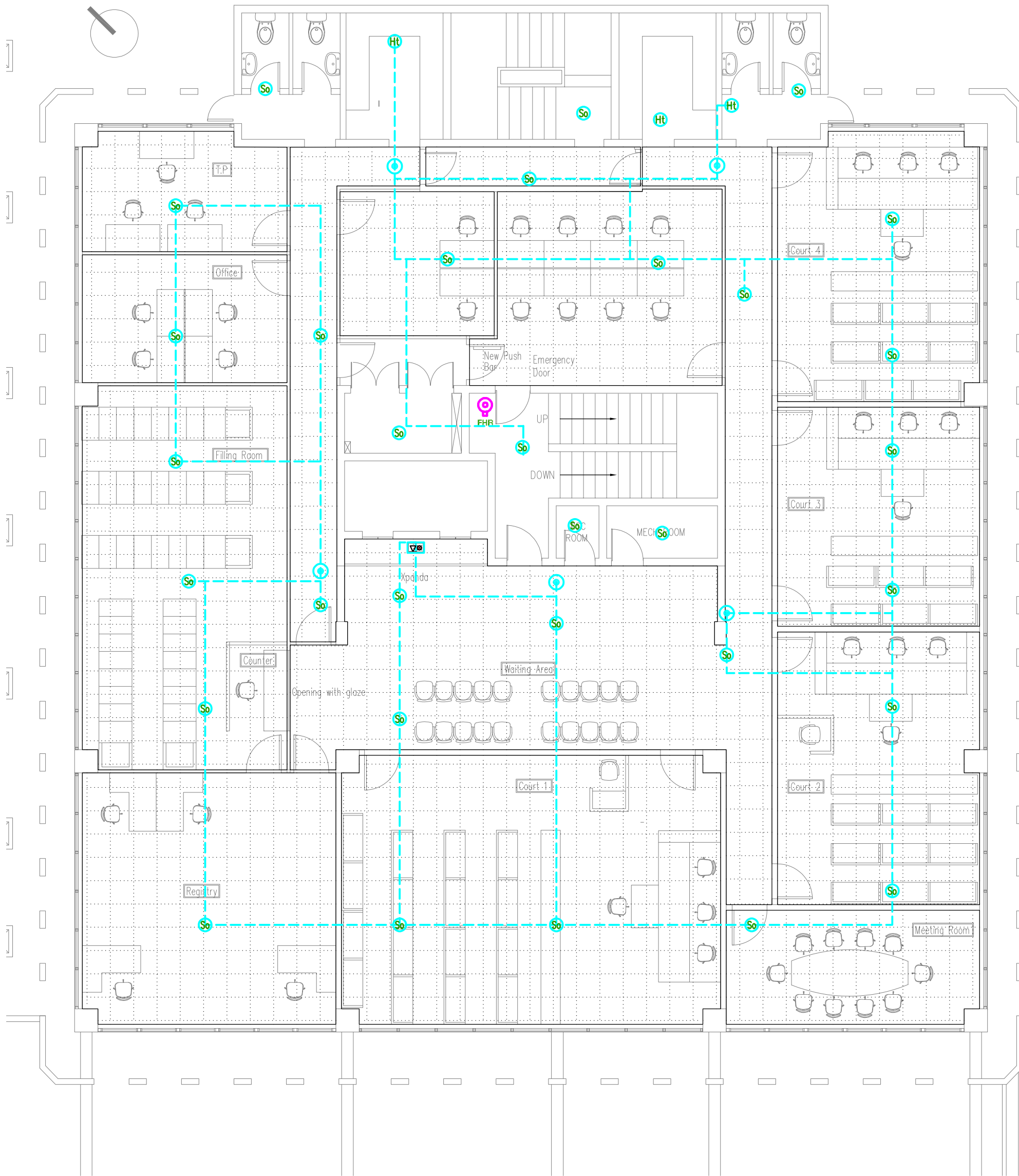
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Drawing Number	22026-PDE-MBPH-L2-W50-04	Revision	P00
Architect Drawing Number:	-	REV:	-



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Architect

Client

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Project

REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

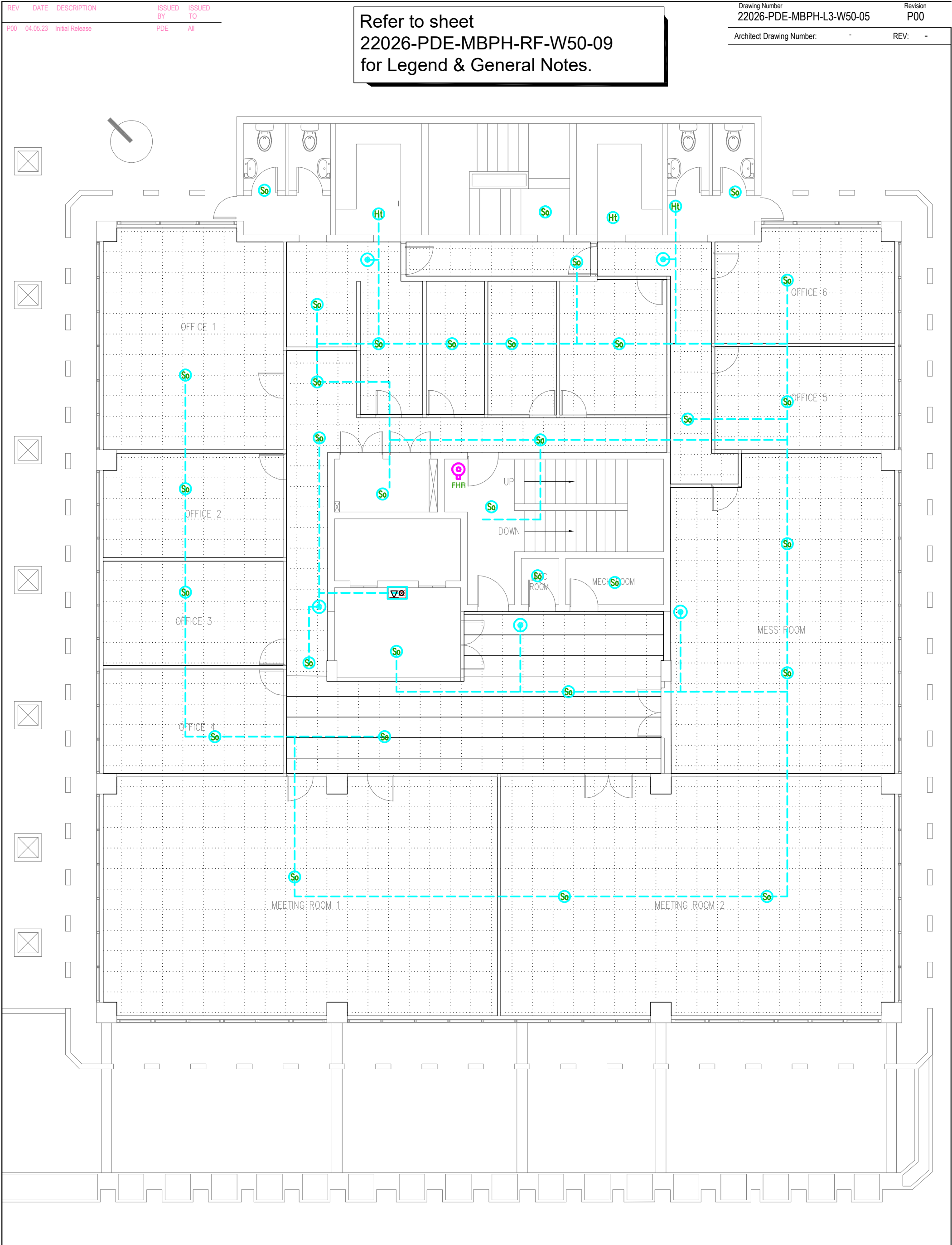
Title
SECOND FLOOR PLAN
ELECTRICAL SERVICES
FIRE DETECTION & ALARM

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L2-W50-04

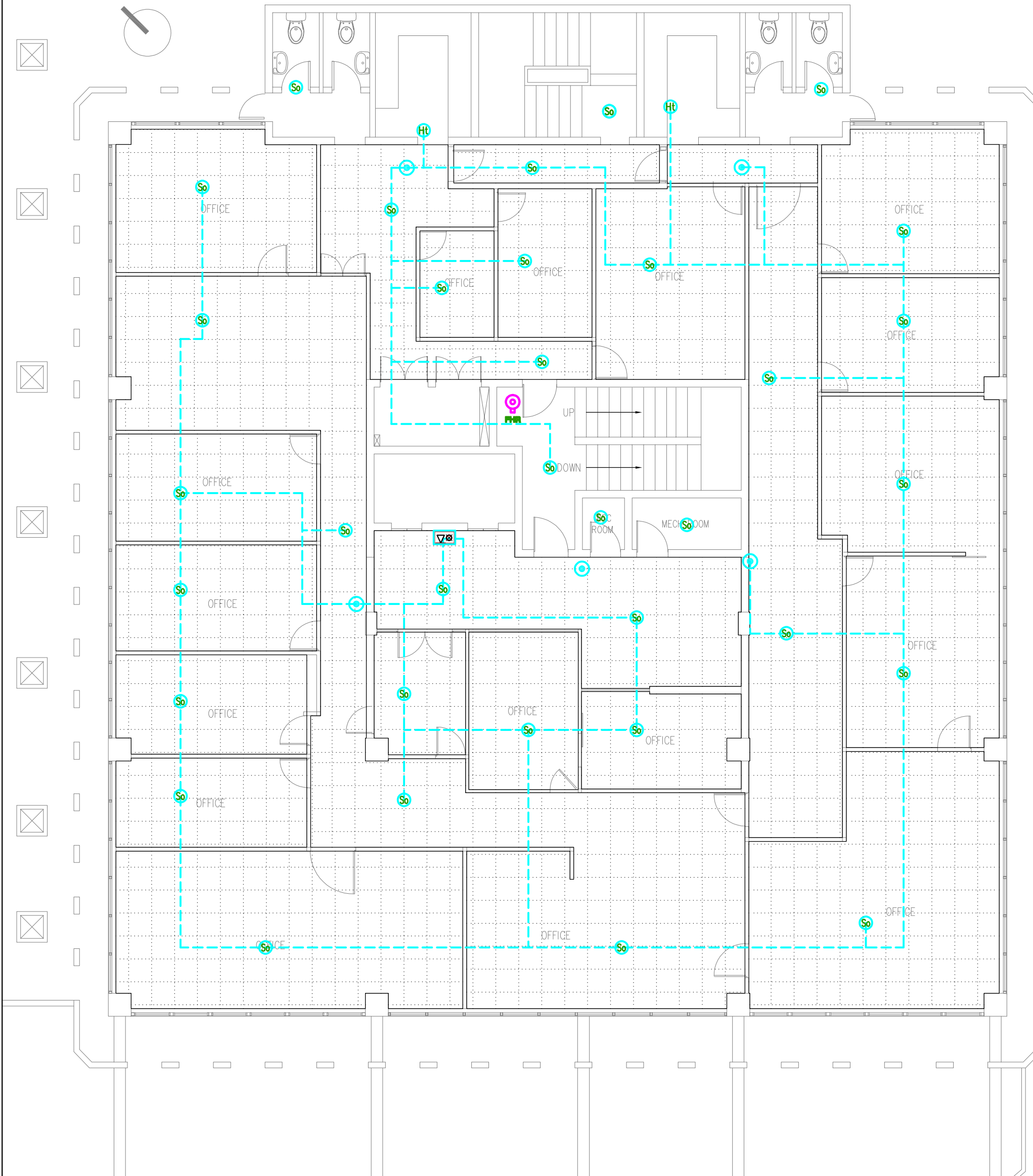
Revision
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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title
FOURTH FLOOR PLAN
ELECTRICAL SERVICES
FIRE DETECTION & ALARM

Drawn BB Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

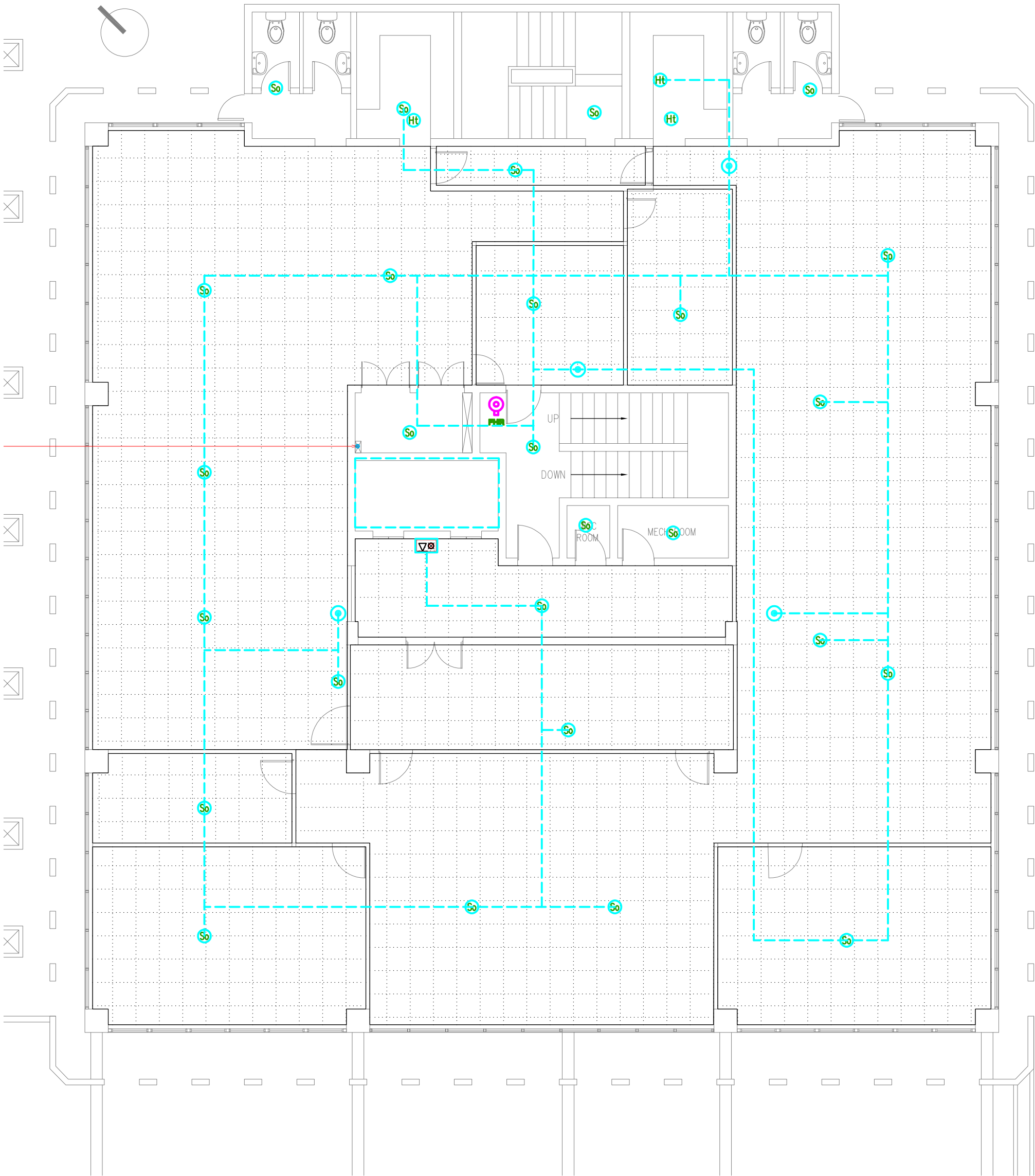
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Revision
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REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
FIFTH FLOOR PLAN
ELECTRICAL SERVICES
FIRE DETECTION & ALARM

Drawn JC Checked AVP Approved

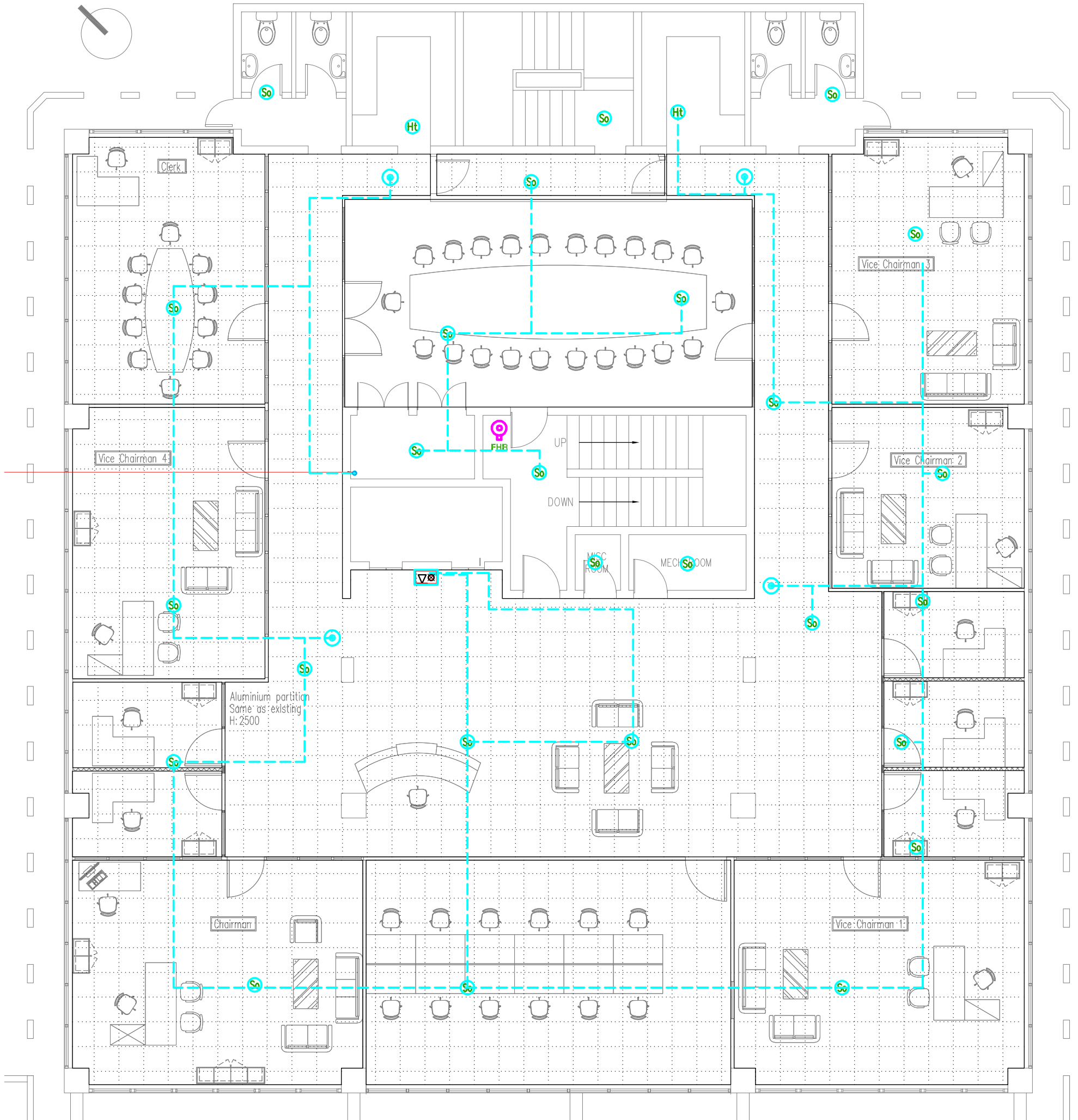
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Drawing Number
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Revision
P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	04.05.23	Initial Release	PDE	All

Drawing Number	22026-PDE-MBPH-L6-W50-08	Revision	P00
Architect Drawing Number:	-	REV:	-



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STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

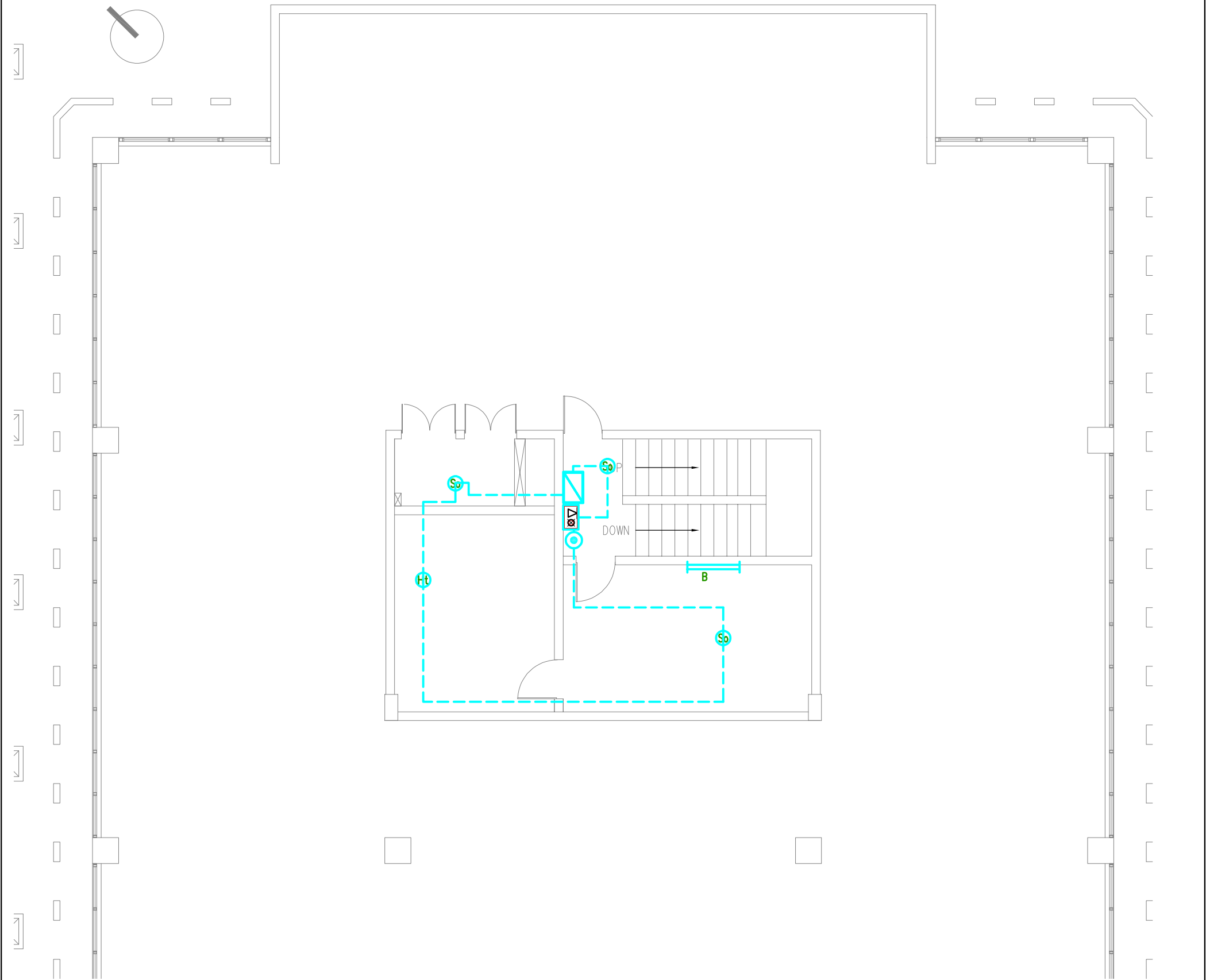
Title
SIXTH FLOOR PLAN
ELECTRICAL SERVICES
FIRE DETECTION & ALARM

Drawn JC Checked AVP Approved

Date 06.04.2023 Size A3 Scale 1:100

Drawing Number
22026-PDE-MBPH-L6-W50-08

Revision
P00



Legend

-  Smoke detector optical.
-  Heat detector.
-  Manual Call Point – Surface Mounted.
-  Electronic Sounder Surface Mounted c/w strobe.
-  Fire alarm conduit/cable.
-  Fire alarm cables running in conduit drop/rise inside wall.
-  Interface unit.
-  Fire hose reel.

General Notes

- All detectors and manual call points shall connect to existing system. Contractor shall be required to carry a survey prior to start of works.
- The detectors shall be positioned as follows:
 - (i) 400 mm from wall.
 - (ii) 500 mm from light fittings.
 - (iii) 500 mm from beam downstand.
- Manual call points shall be recessed mounted at 1.4m AFFL. and be coordinated with position of switches.
- Signage for manual call point is to be placed above the manual call point.
- Sound intensity level of sounders shall be as indicated on drawing and the sounders shall be surface mounted at 2.5m AFFL.
- Wiring to the detectors, manual call points and sounder shall be done in concealed conduits using continuous run of wire.
- The contractor is to determine the exact number of runs of rigid concealed conduit required for the installation.
- The contractor is to be responsible for the coordination of the services with other trades.
- Loop connection boxes have been provided in tenants areas for future connection of smoke detector/sounder/manual call point by tenants during fit out work.
- Sounders placed in common area is to be used mainly to alert occupants in the common area. Additional sounders shall be placed by tenants during fit out work to alert occupants

Copper earth cable.

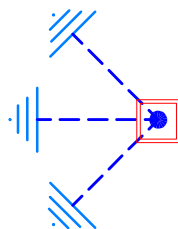
Main earth bar.

Earth rod.

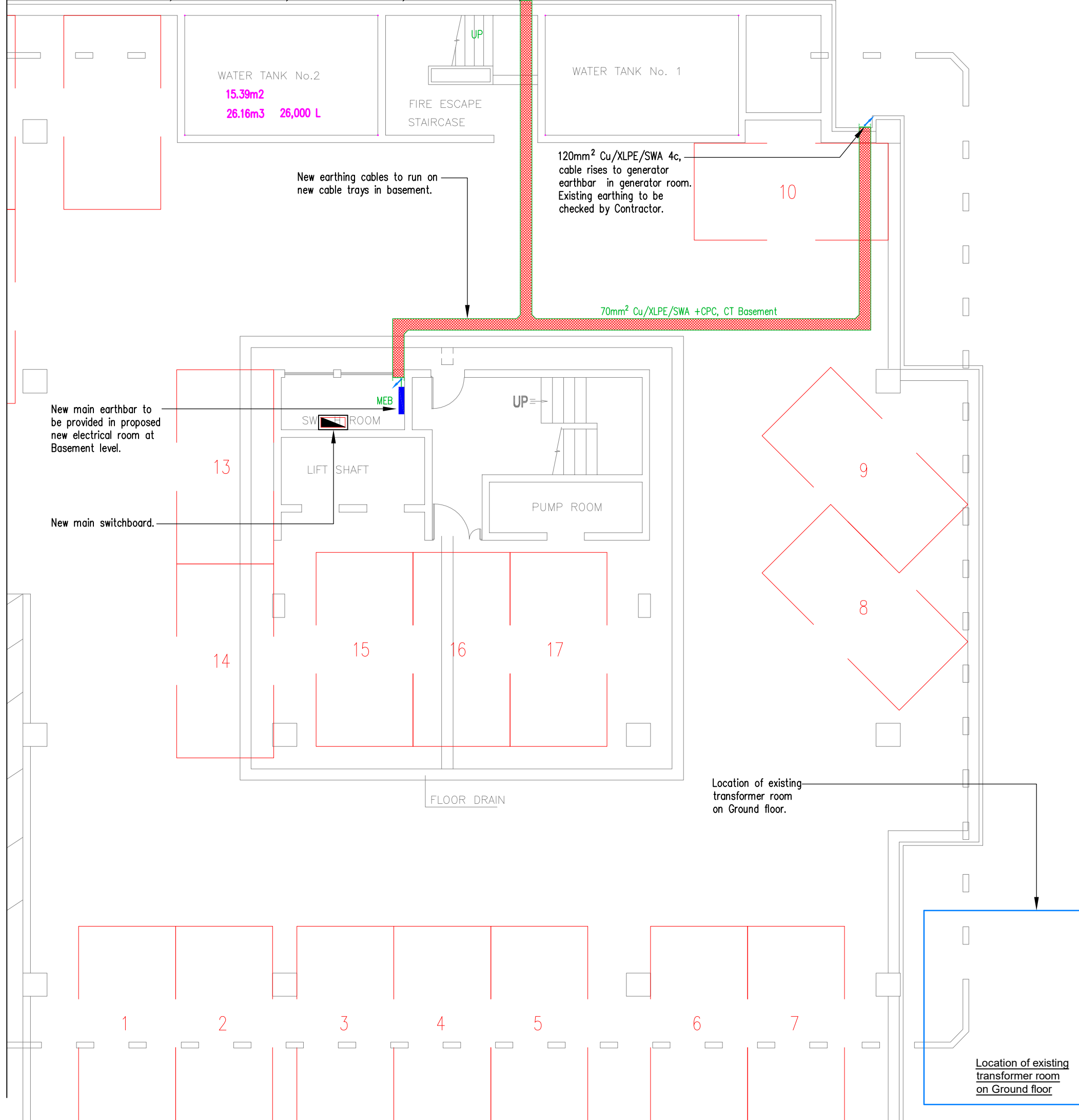
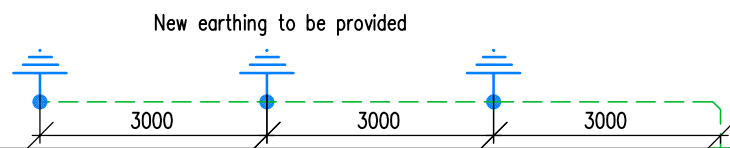
Lightning down conductor.

Lightning counter.

Architect Drawing Number: - REV: -



Lightning protection earth
farm in crow foot
arrangement.



Architect

STAGE 4: TECHNICAL DESIGN

Structural Engineer

Drawn	BB	Checked	JN	Approved	
Date	22.05.2023	Size	A3	Scale	1:100
Drawing Number				Revision	

22026-PDE-MBPH-LB-W51-W52-01 P00

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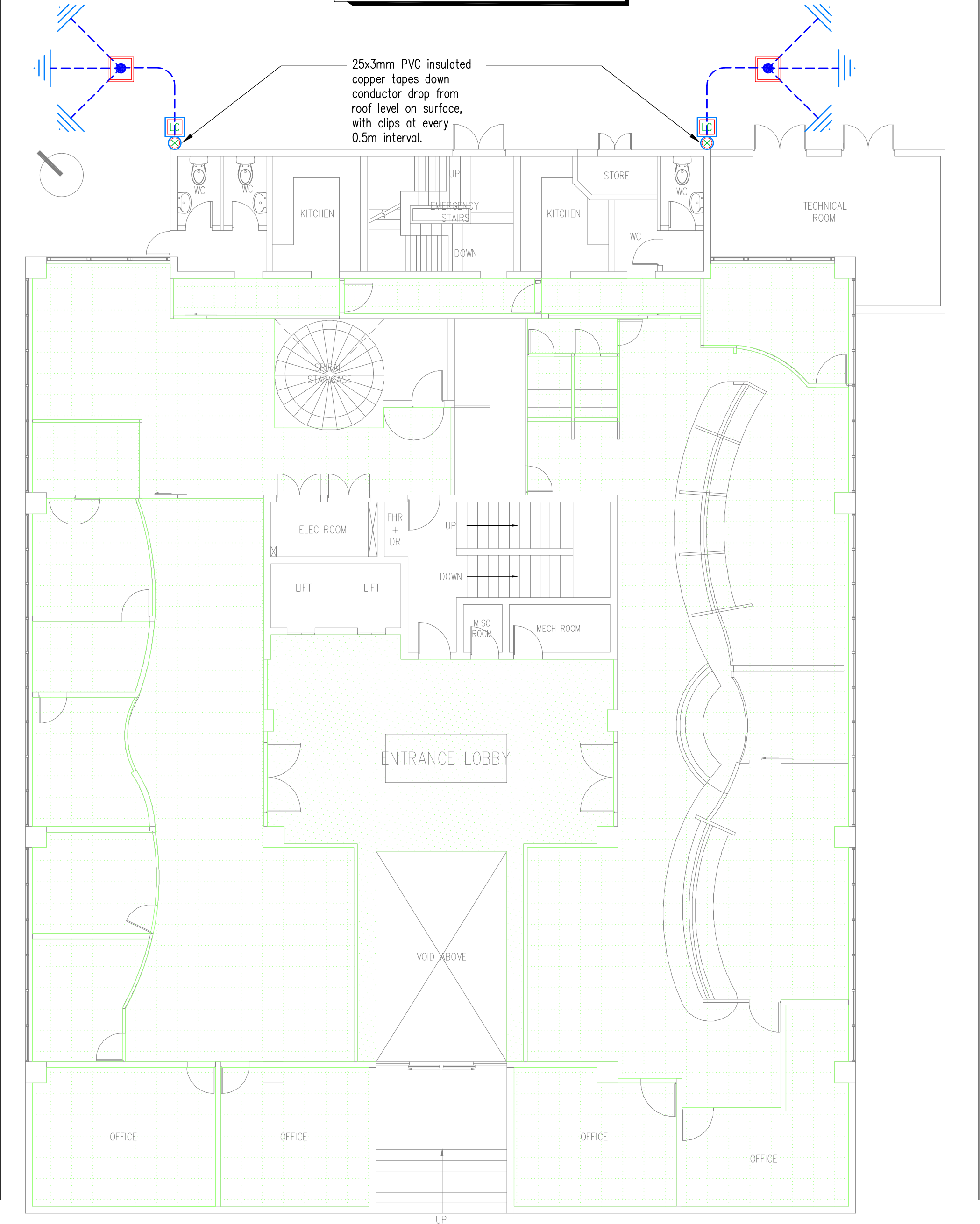
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for Legend .

Drawing Number
22026-PDE-MBPH-L0-W51-W52-02

Revision
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Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
GROUND FLOOR PLAN
ELECTRICAL SERVICES
EARTHING & BONDING AND LIGHTNING PROTECTION

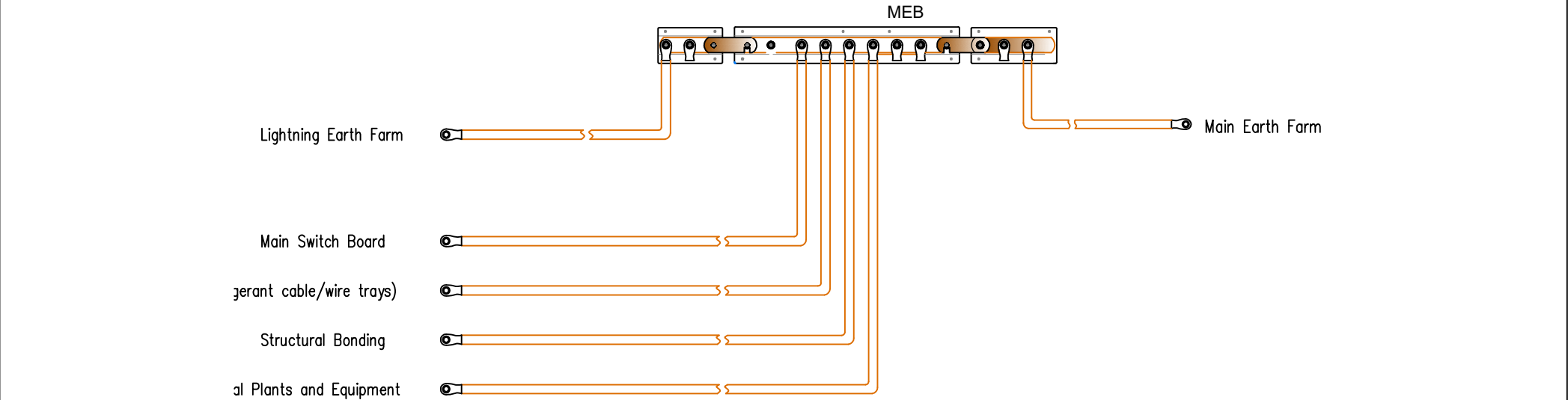
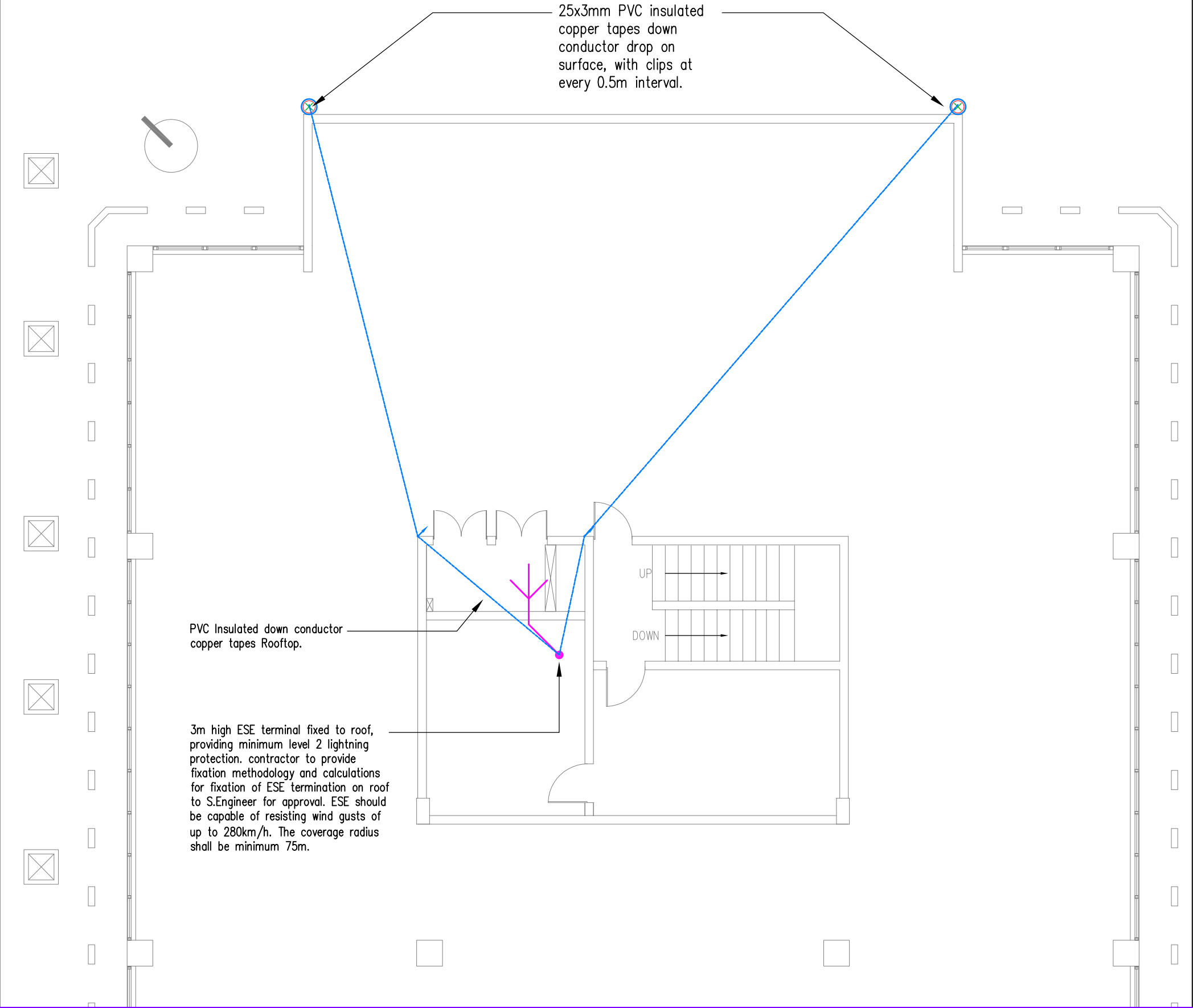
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Date	22.05.2023	Size	A3	Scale	1:100
Drawing Number			Revision		

22026-PDE-MBPH-L0-W51-W52-02 P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	2.06.23	Initial Release	PDE	All

Refer to sheet
22026-PDE-MBPH-LB-W51-W52-01
for Legend .

Drawing Number	22026-PDE-MBPH-RF-W51-W52	Revision	P00
Architect Drawing Number:	-	REV:	-

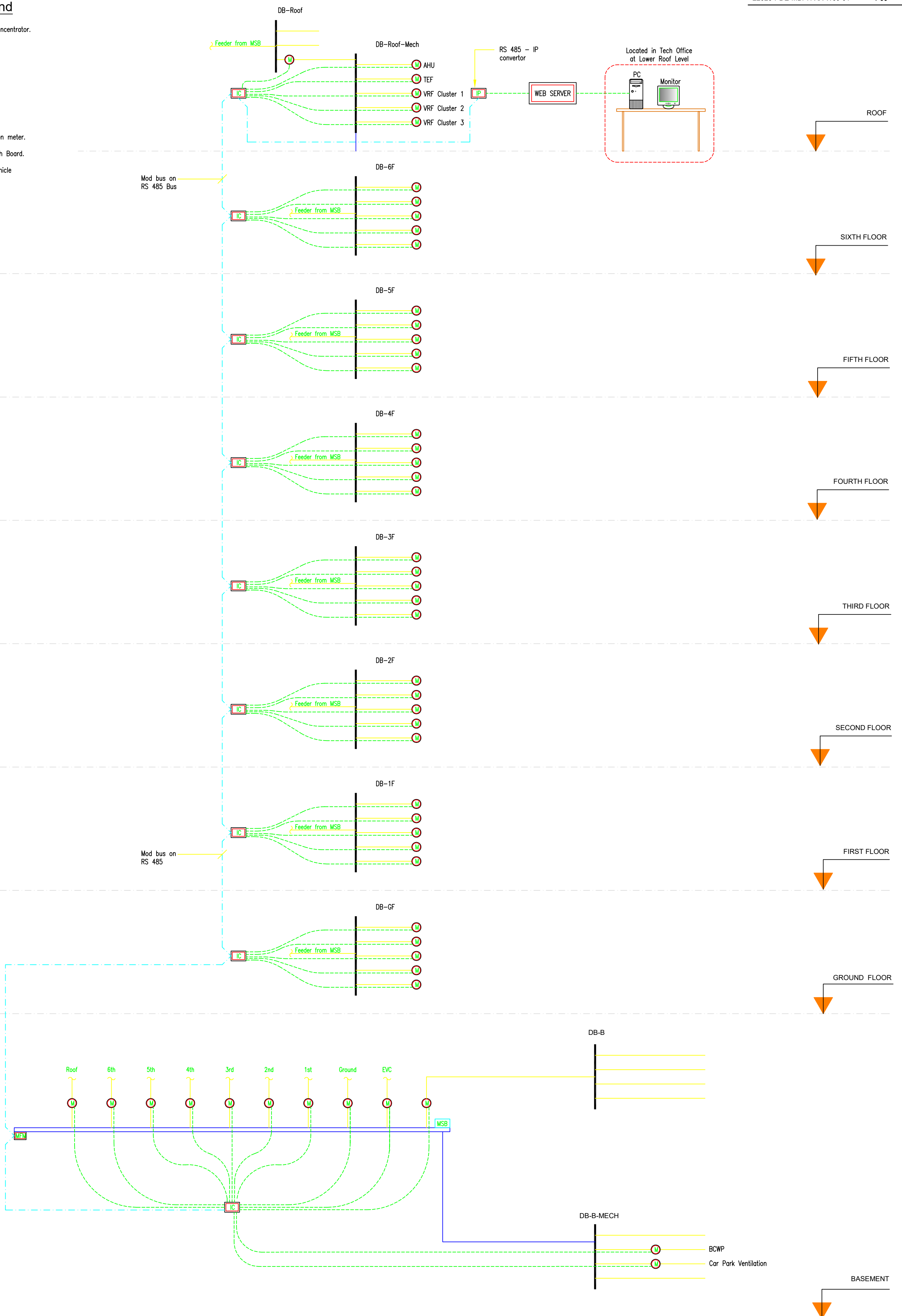


Schematics
scale NTS

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PRODESIGN SUSTAINABILITY & MEP ENGINEERS 1st Floor Building No2 Industrial Building, Valentina Industrial Estate Phoenix Tel: (230) 660 4545 Fax: (230) 606 7070 Email: admin@prodesign.mu www.prodesign.mu		Client MAUBANK LTD		Project REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD		Structural Engineer		Drawn BB Checked JN Approved	
								Date 22.05.2023 Size A3 Scale 1:100	
								Drawing Number 22026-PDE-MBPH-RF-W51-W52 Revision P00	

Legend

	Impulse concentrator.
	CPU
	Monitor
	Meter.
	Multifunction meter.
	Main Switch Board.
	Electric vehicle charging.



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Architect

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MAUBANK LTD

STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD
Structural Engineer

Title
SCHEMATIC DIAGRAM
ELECTRICAL SERVICES
CENTRAL CONTROL/ ENERGY MANAGEMENT

Drawn	BB	Checked	AVP	Approved	
Date	06.04.2023	Size	A2	Scale	NTS
Drawing Number					Revision
22026-PDF-MRPH-XX-W60-01					P00

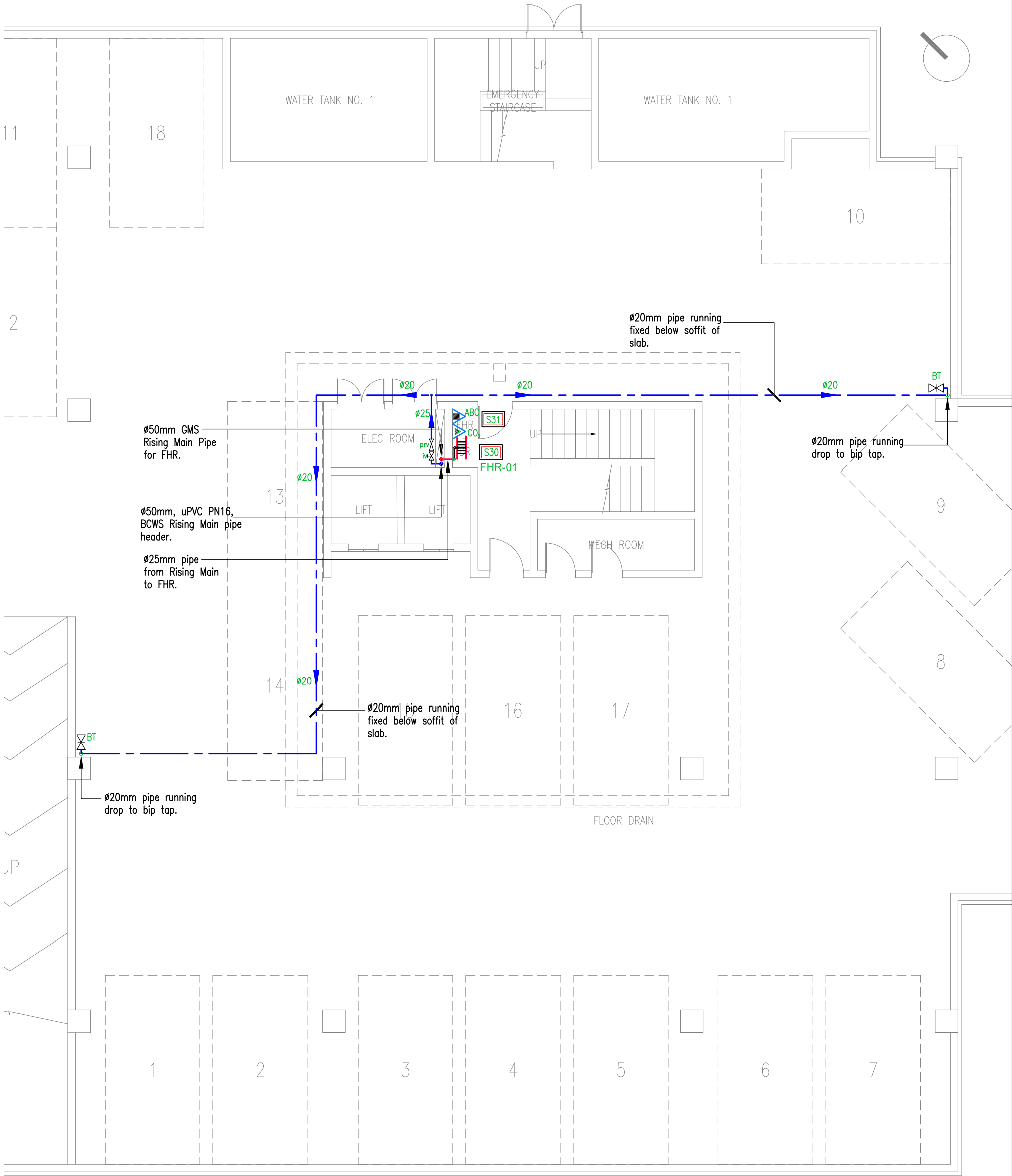
Architect Drawing Number: - REV:

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	2.06.23	Initial Release	PDE	All

Public Health & Allied Works

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	Revision
22026-PDE-MBPH-LB-S10-S60-S72-01	P00
Architect Drawing Number:	REV:



Refer to sheet
22026-PDE-MBPH-L0-S10-S60-S72-02
for Legend & General Notes.

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MEP Engineer



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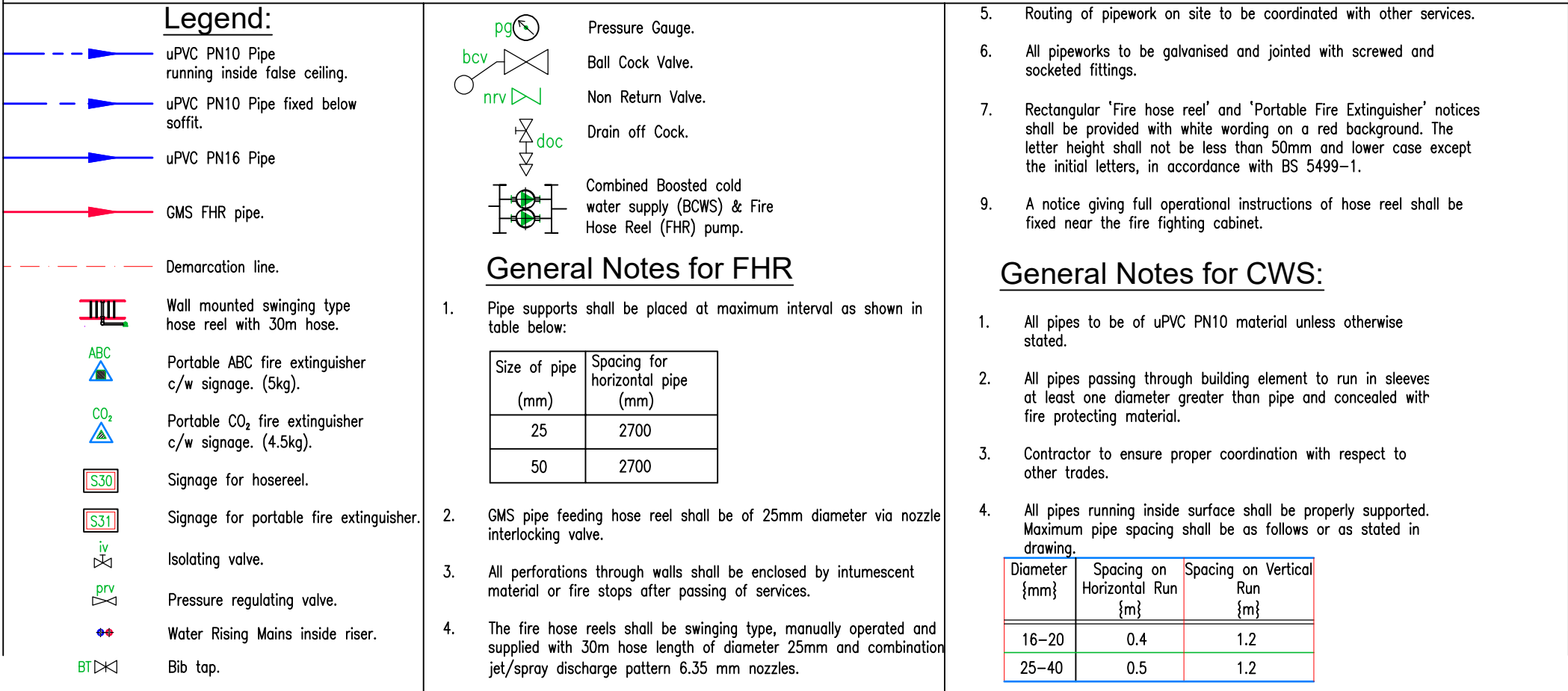
STAGE 4: TECHNICAL DESIGN

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title BASEMENT FLOOR PLAN PUBLIC HEALTH SERVICES COLD WATER, FIRE HOSE REEL & PORTABLE FIRE EXTINGUISHER				
Drawn	JC	Checked	AVP	Approved
Date	02.06.2023	Size	A3	Scale 1:100
Drawing Number		Revision		
22026-PDE-MBPH-LB-S10-S60-S72-01		P00		

Drawing Number	Revision
22026-PDE-MBPH-L0-S10-S60-S72-02	P00
Architect Drawing Number:	REV:
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Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT JOLIIS FOR MAIBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

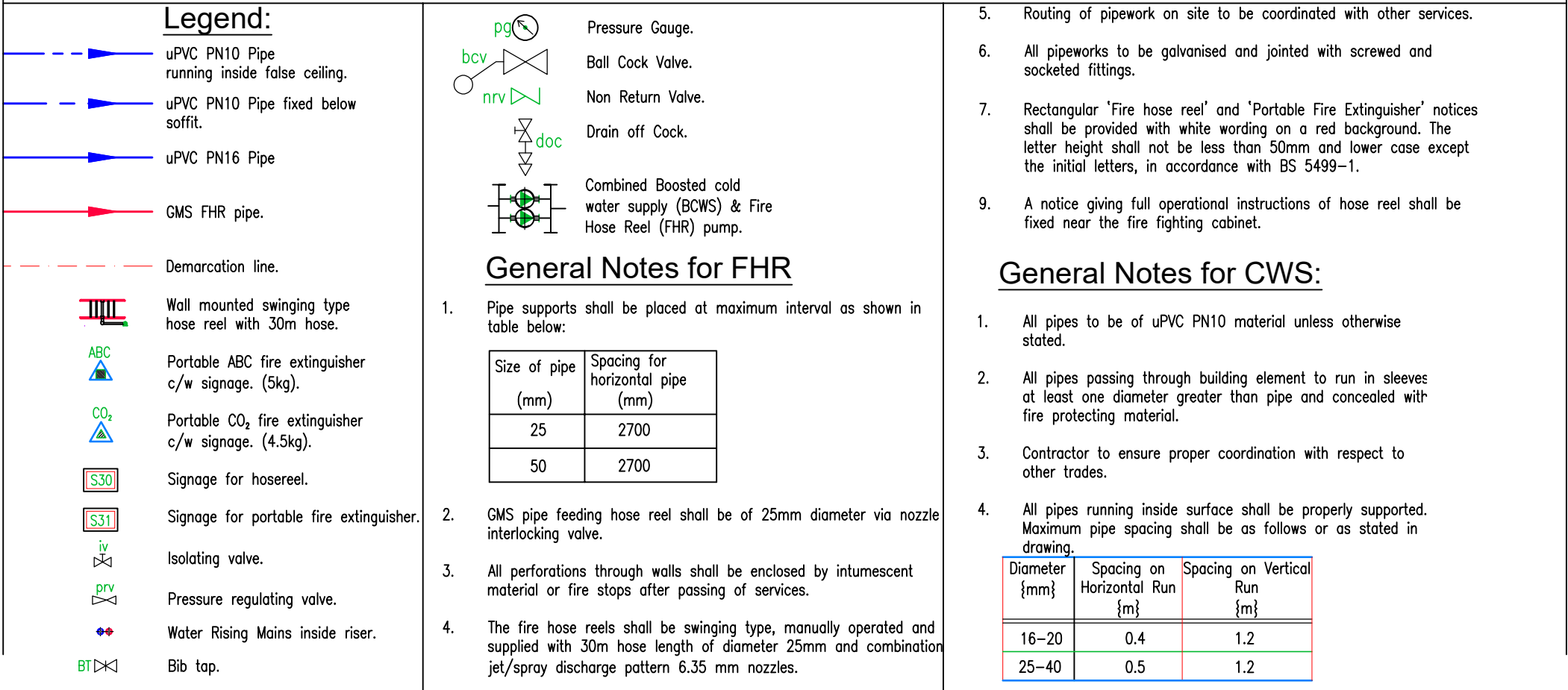
Title
GROUND FLOOR PLAN
PUBLIC HEALTH SERVICES
COLD WATER, FIRE HOSE REEL & PORTABLE FIRE EXTINGUISHER

Drawn: _____ IC: _____ Checked: _____ AVP: _____ Approved: _____

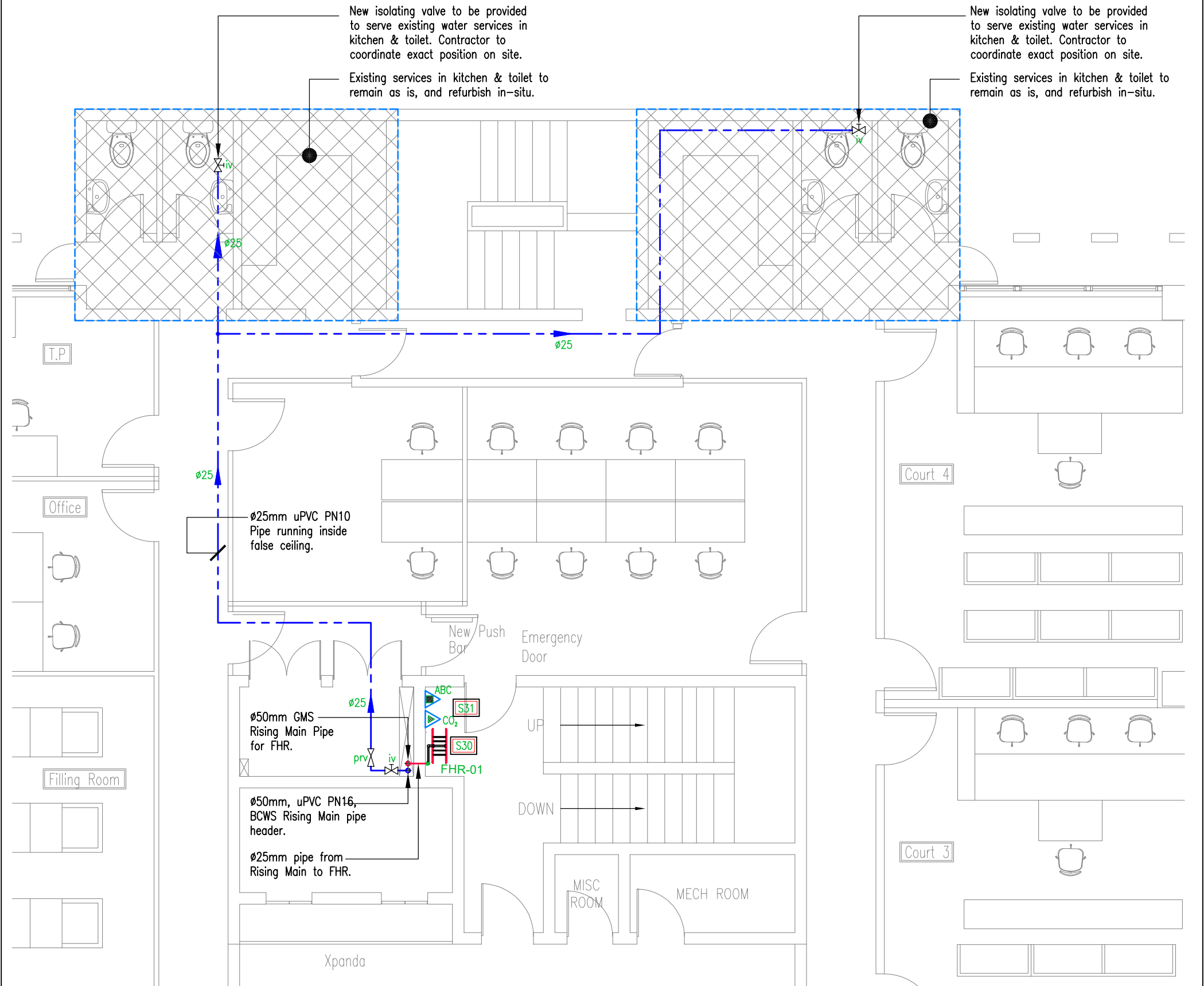
Date 02.06.2023 Size A3 Scale 1:75

Drawing Number 22026-PDE-MBPH-L0-S10-S60-S72-02 P00 Revision

Drawing Number	Revision
22026-PDE-MBPH-L1-S10-S60-S72-03	P00
Architect Drawing Number:	REV:
-	-



Title					
FIRST FLOOR PLAN					
PUBLIC HEALTH SERVICES					
COLD WATER, FIRE HOSE REEL & PORTABLE FIRE EXTINGUISHER					
Drawn	JC	Checked	AVP	Approved	
Date	02.06.2023	Size	A3	Scale	1:75
Drawing Number				Revision	
22026-PDE-MBPB-L1-S10-S60-S72-03				P00	



Legend:

uPVC PN10 Pipe running inside false ceiling.

uPVC PN10 Pipe fixed below soffit.

uPVC PN16 Pipe

GMS FHR pipe.

Demarcation line.

Wall mounted swinging type hose reel with 30m hose.

ABC

Portable ABC fire extinguisher c/w signage. (5kg).

CO₂

Portable CO₂ fire extinguisher c/w signage. (4.5kg).

S30

Signage for hose reel.

S31

Signage for portable fire extinguisher.

iv

Isolating valve.

prv

Pressure regulating valve.

BT

Water Rising Mains inside riser.

Bib tap.

pg

Pressure Gauge.

bcv

Ball Cock Valve.

nrv

Non Return Valve.

doc

Drain off Cock.

Combined Boosted cold water supply (BCWS) & Fire Hose Reel (FHR) pump.

General Notes for FHR

1.

Pipe supports shall be placed at maximum interval as shown in table below:

Size of pipe (mm)	Spacing for horizontal pipe (mm)
25	2700
50	2700

2.

GMS pipe feeding hose reel shall be of 25mm diameter via nozzle interlocking valve.

3.

All perforations through walls shall be enclosed by intumescent material or fire stops after passing of services.

4.

The fire hose reels shall be swinging type, manually operated and supplied with 30m hose length of diameter 25mm and combination jet/spray discharge pattern 6.35 mm nozzles.

5.

Routing of pipework on site to be coordinated with other services.

6.

All pipeworks to be galvanised and jointed with screwed and socketed fittings.

7.

Rectangular 'Fire hose reel' and 'Portable Fire Extinguisher' notices shall be provided with white wording on a red background. The letter height shall not be less than 50mm and lower case except the initial letters, in accordance with BS 5499-1.

9.

A notice giving full operational instructions of hose reel shall be fixed near the fire fighting cabinet.

General Notes for CWS:

1.

All pipes to be of uPVC PN10 material unless otherwise stated.

2.

All pipes passing through building element to run in sleeves at least one diameter greater than pipe and concealed with fire protecting material.

3.

Contractor to ensure proper coordination with respect to other trades.

4.

All pipes running inside surface shall be properly supported. Maximum pipe spacing shall be as follows or as stated in drawing.

Diameter {mm}	Spacing on Horizontal Run {m}	Spacing on Vertical Run {m}
16-20	0.4	1.2
25-40	0.5	1.2

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Architect

-

Client

MAUBANK LTD

Project

REFURBISHMENT OF POPE HENNESSY BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title

SECOND FLOOR PLAN
PUBLIC HEALTH SERVICES
COLD WATER, FIRE HOSE REEL & PORTABLE FIRE EXTINGUISHER

Drawn

JC

Checked

AVP

Approved

Date

02.06.2023

Size

A3

Scale

1:75

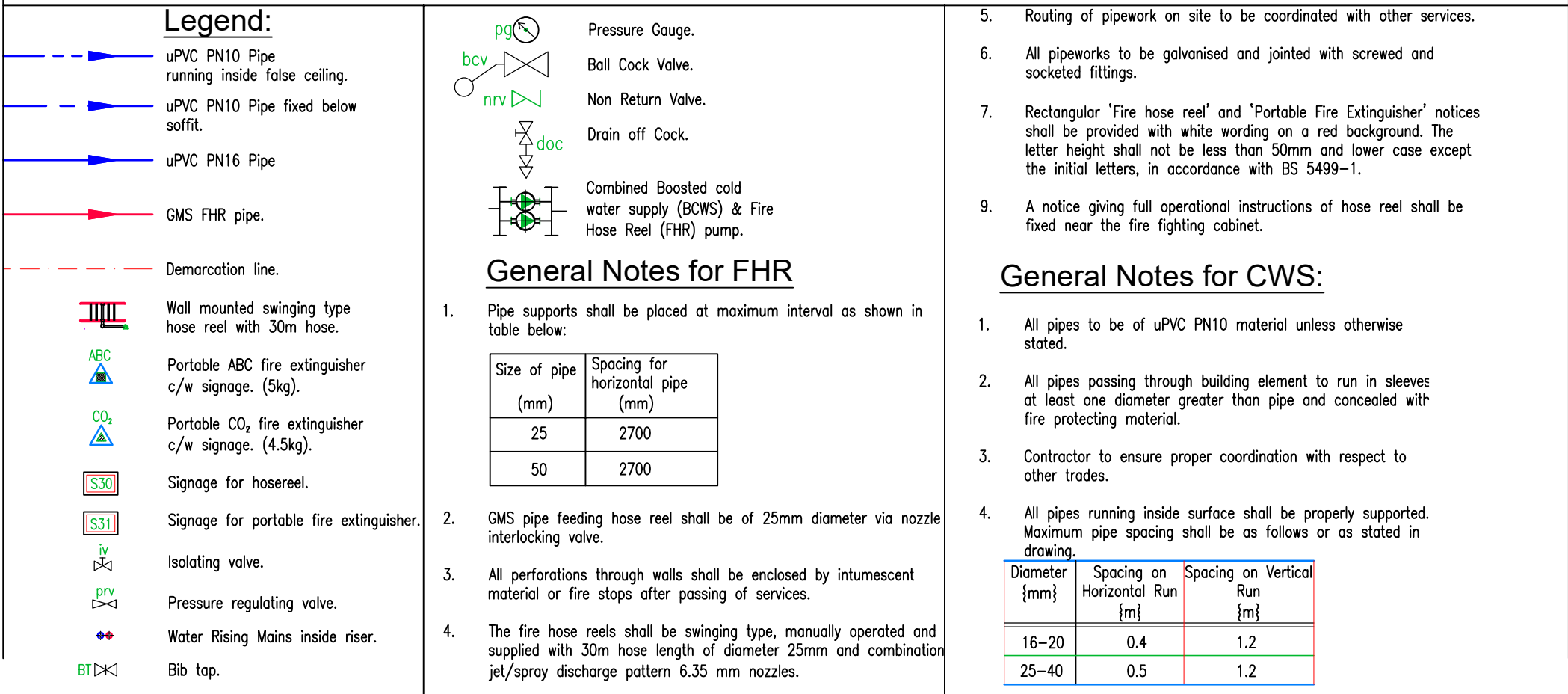
Drawing Number

22026-PDE-MBPH-L2-S10-S60-S72-04

Revision

P00

Drawing Number	Revision
22026-PDE-MBPH-L3-S10-S60-S72-05	P00
Architect Drawing Number:	REV:
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Architect

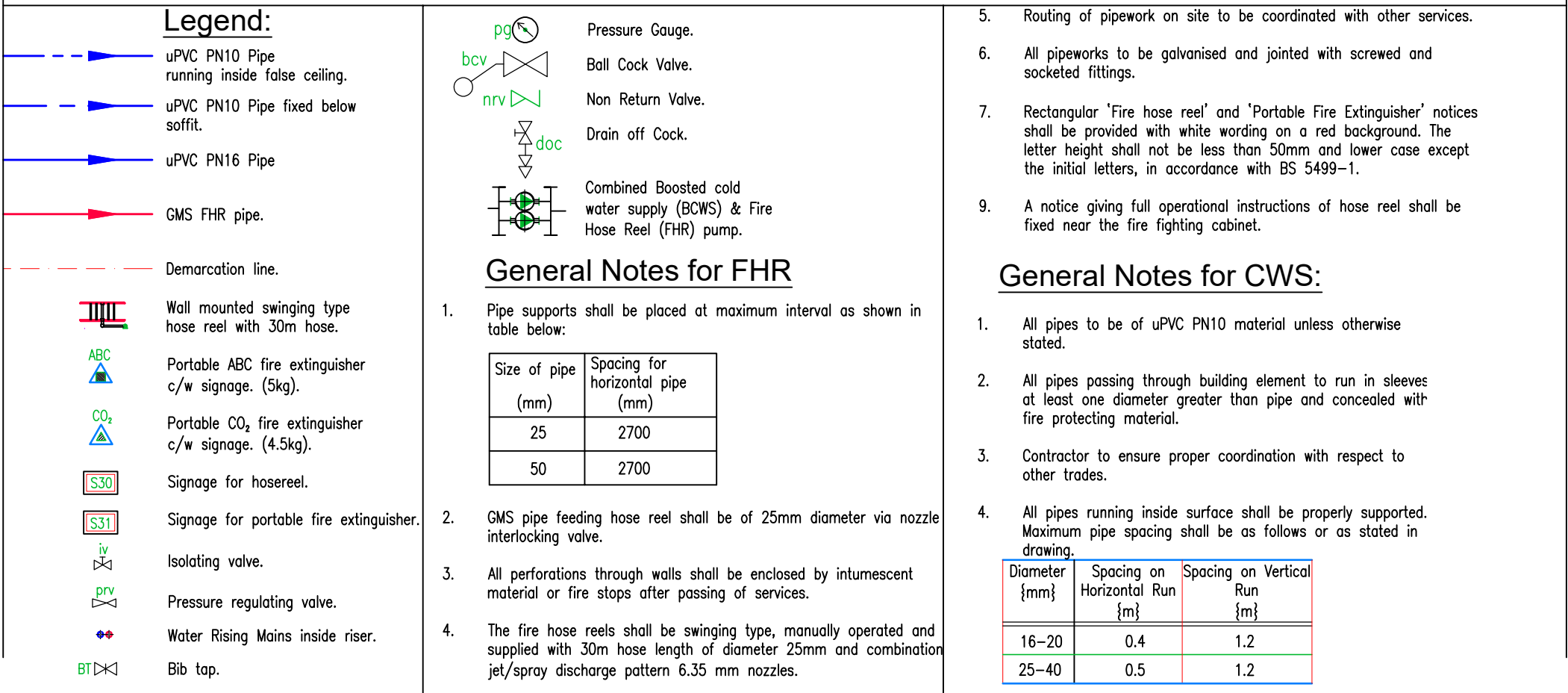
Client
MAUBANK LTD

Project
REFURBISHMENT OF POPE HENNESSY
BUILDING AT PORT LOUIS FOR MAUBANK LTD

Structural Engineer

Title				
THIRD FLOOR PLAN				
PUBLIC HEALTH SERVICES				
COLD WATER, FIRE HOSE REEL & PORTABLE FIRE EXTINGUISHER				
Drawn	JC	Checked	AVP	Approved
Date	02.06.2023	Size	A3	Scale 1:75
Drawing Number				Revision
22026-PDE-MBPH-L3-S10-S60-S72-05				P00

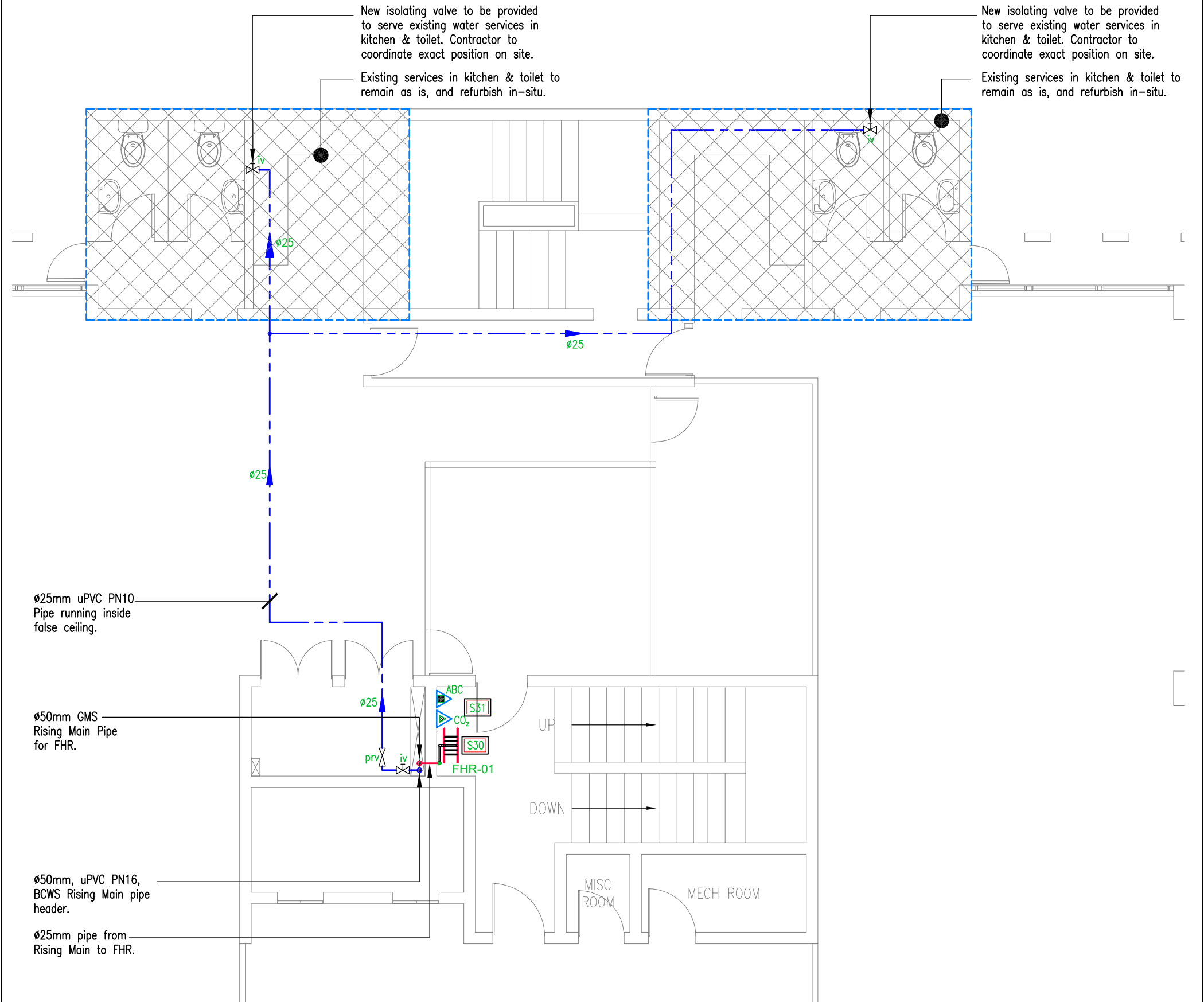
Drawing Number	Revision
22026-PDE-MBPH-L4-S10-S60-S72-06	P00
Architect Drawing Number:	REV:
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Title				
FOURTH FLOOR PLAN PUBLIC HEALTH SERVICES COLD WATER, FIRE HOSE REEL & PORTABLE FIRE EXTINGUISHER				
Drawn	JC	Checked	AVP	Approved
Date	02.06.2023	Size	A3	Scale 1:75
Drawing Number				Revision
22026-PDE-MBPH-L4-S10-S60-S72-06				P00

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number	Revision
22026-PDE-MBPH-L5-S10-S60-S72-07	P00
Architect Drawing Number:	REV:
-	-



Legend:

- uPVC PN10 Pipe running inside false ceiling.
- uPVC PN10 Pipe fixed below soffit.
- uPVC PN16 Pipe
- GMS FHR pipe.
- Demarcation line.
- Wall mounted swinging type hose reel with 30m hose.
- Portable ABC fire extinguisher c/w signage. (5kg).
- Portable CO₂ fire extinguisher c/w signage. (4.5kg).
- Signage for hosereel.
- Signage for portable fire extinguisher.
- Isolating valve.
- Pressure regulating valve.
- Water Rising Mains inside riser.
- Bib tap.

Pressure Gauge.

Ball Cock Valve.

Non Return Valve.

Drain off Cock.

Combined Boosted cold water supply (BCWS) & Fire Hose Reel (FHR) pump.

General Notes for FHR

- Pipe supports shall be placed at maximum interval as shown in table below:

Size of pipe (mm)	Spacing for horizontal pipe (mm)
25	2700
50	2700

- GMS pipe feeding hose reel shall be of 25mm diameter via nozzle interlocking valve.
- All perforations through walls shall be enclosed by intumescent material or fire stops after passing of services.
- The fire hose reels shall be swinging type, manually operated and supplied with 30m hose length of diameter 25mm and combination jet/spray discharge pattern 6.35 mm nozzles.

- Routing of pipework on site to be coordinated with other services.
- All pipeworks to be galvanised and jointed with screwed and socketed fittings.
- Rectangular 'Fire hose reel' and 'Portable Fire Extinguisher' notices shall be provided with white wording on a red background. The letter height shall not be less than 50mm and lower case except the initial letters, in accordance with BS 5499-1.
- A notice giving full operational instructions of hose reel shall be fixed near the fire fighting cabinet.

General Notes for CWS:

- All pipes to be of uPVC PN10 material unless otherwise stated.
- All pipes passing through building element to run in sleeves at least one diameter greater than pipe and concealed with fire protecting material.
- Contractor to ensure proper coordination with respect to other trades.
- All pipes running inside surface shall be properly supported. Maximum pipe spacing shall be as follows or as stated in drawing.

Diameter {mm}	Spacing on Horizontal Run {m}	Spacing on Vertical Run {m}
16-20	0.4	1.2
25-40	0.5	1.2

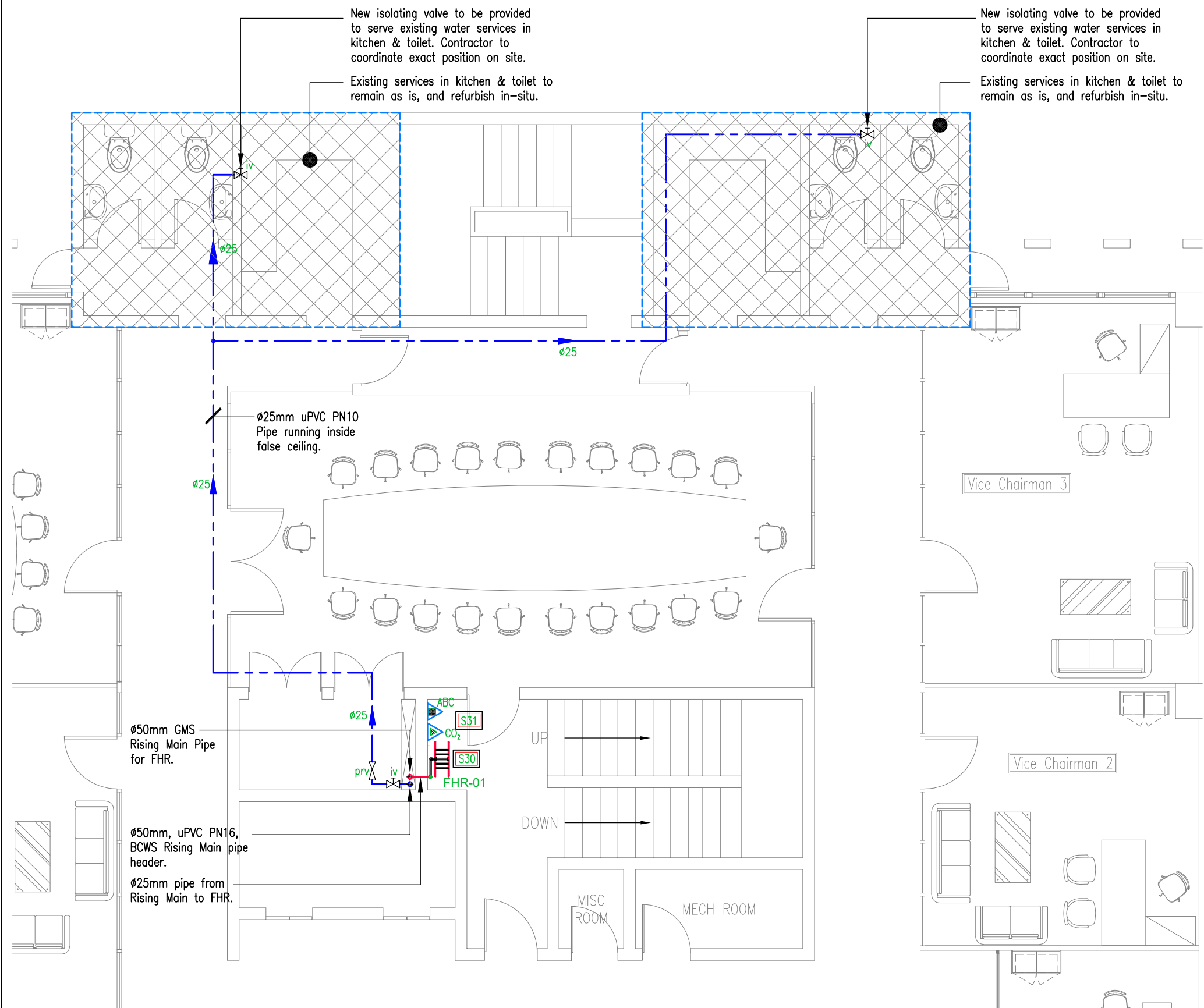
REV	DATE	DESCRIPTION	ISSUED BY	ISSUED TO
P00	02.06.23	Initial Release	PDE	All

Drawing Number
22026-PDE-MBPH-L6-S10-S60-S72-08

Revision
P00

Architect Drawing Number: -

REV: -



Legend:

- uPVC PN10 Pipe running inside false ceiling.
- uPVC PN10 Pipe fixed below soffit.
- uPVC PN16 Pipe
- GMS FHR pipe.
- Demarcation line.
- Wall mounted swinging type hose reel with 30m hose.
- Portable ABC fire extinguisher c/w signage. (5kg).
- Portable CO₂ fire extinguisher c/w signage. (4.5kg).
- Signage for hosereel.
- Signage for portable fire extinguisher.
- Isolating valve.
- Pressure regulating valve.
- Water Rising Mains inside riser.
- Bib tap.

- Pressure Gauge.
- Ball Cock Valve.
- Non Return Valve.
- Drain off Cock.
- Combined Boosted cold water supply (BCWS) & Fire Hose Reel (FHR) pump.

General Notes for FHR

- Pipe supports shall be placed at maximum interval as shown in table below:

Size of pipe (mm)	Spacing for horizontal pipe (mm)
25	2700
50	2700
- GMS pipe feeding hose reel shall be of 25mm diameter via nozzle interlocking valve.
- All perforations through walls shall be enclosed by intumescent material or fire stops after passing of services.
- The fire hose reels shall be swinging type, manually operated and supplied with 30m hose length of diameter 25mm and combination jet/spray discharge pattern 6.35 mm nozzles.

- Routing of pipework on site to be coordinated with other services.
- All pipeworks to be galvanised and jointed with screwed and socketed fittings.
- Rectangular 'Fire hose reel' and 'Portable Fire Extinguisher' notices shall be provided with white wording on a red background. The letter height shall not be less than 50mm and lower case except the initial letters, in accordance with BS 5499-1.
- A notice giving full operational instructions of hose reel shall be fixed near the fire fighting cabinet.

General Notes for CWS:

- All pipes to be of uPVC PN10 material unless otherwise stated.
- All pipes passing through building element to run in sleeves at least one diameter greater than pipe and concealed with fire protecting material.
- Contractor to ensure proper coordination with respect to other trades.
- All pipes running inside surface shall be properly supported. Maximum pipe spacing shall be as follows or as stated in drawing.

Diameter {mm}	Spacing on Horizontal Run {m}	Spacing on Vertical Run {m}
16-20	0.4	1.2
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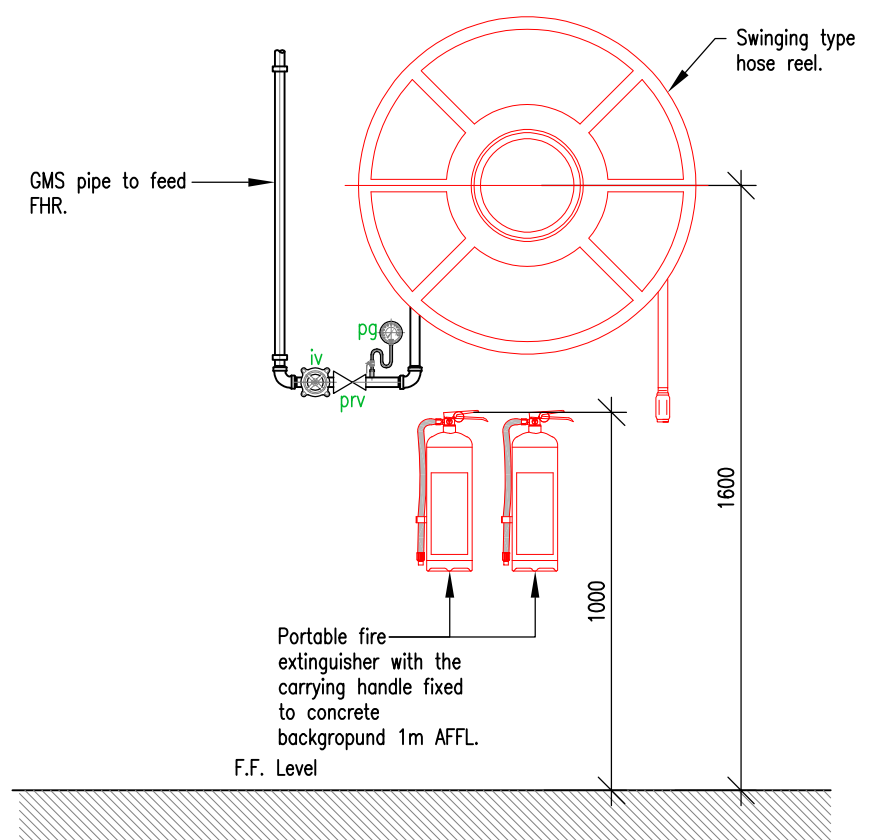
Structural Engineer

STAGE 4: TECHNICAL DESIGN

Title
SIXTH FLOOR PLAN
PUBLIC HEALTH SERVICES
COLD WATER, FIRE HOSE REEL & PORTABLE FIRE EXTINGUISHER

Drawn	JC	Checked	AVP	Approved
Date	02.06.2023	Size	A3	Scale 1:75
Drawing Number	Revision			
22026-PDE-MBPH-L6-S10-S60-S72-08	P00			

Drawing Number	Revision
22026-PDE-MBPH-RF-S10-S60-S72-09	P00
Architect Drawing Number:	REV:
-	-



Detail - Typical Fixation Detail of FHR &
Portable Fire Extinguisher.
Scale 1:20

Drawing Number	Revision
22026-PDE-MBPH-SCH-S10-S60-S72-10	P00
Architect Drawing Number: -	REV: -

