LEHDING SERVICES DESIGN LTD

**RETAIL UNITS 01 AND 02**
**CENTRE POINT, LINK BUILDING W1**
**101-103 NEW OXFORD STREET**
**LONDON**
**WC1A 1DD**

**SUPPLY, ERECTION, INSTALLATION, COMMISSIONING AND SET TO WORK**

**OF**

**MECHANICAL SERVICES INSTALLATION**

**MECHANICAL**
**INSTALLATION PACKAGE**

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## 1. INTRODUCTION

This project covers the installation of the mechanical services to Streat Markets Restaurant, Retail Units 01 and 02, Centre Point, 101-103 New Oxford Street, London for Streat Markets.

**The building has numerous heritage features which must be preserved.**

The building is a multi-storey / multi tenancy building. Main restaurant is located on ground and mezzanine floor, with bar and FOH toilets at basement -1 level. Back of house facilities are located on basement -1 and basement -2 levels.

This project covers the installation of new mechanical services as detailed on the drawings and described later. The new mechanical services installation shall be complete in all aspects with distribution pipework throughout the building. The installation shall comprise of fresh air plant, condense water, LTHW heating, CHW water, plumbing, sanitary ware, soils & waste, gas, sprinklers and ventilation installations.

### 1.1. CDM Regulations

In the context of CDM Regulations the Contractor appointed for the works described in these documents is not considered Principal Contractor.

### 1.2. Contract

The Mechanical contractor shall be a sub-contractor to the main contractor employed under the conditions set-out in the Prelims.

### 1.3. Dress Code

All contract staff shall be suitably trained prior to visiting the site and conduct of all personnel shall be to the highest standard with respect to all occupants of the development. Site personnel shall be provided with new overalls, new high visibility vests and new hard hats which should be kept clean in appearance. Smoking and foul language of site operatives shall not be permitted in any area of the premises. Failure to comply with this may result in site operatives being asked to leave the site. All personnel working on the site are required to be fluent in the English Language.

### 1.4. Fabrication Drawings

The contractor shall provide fabrication drawings indicating all routes of pipework, ductwork and pipe lengths throughout the building. These shall be approved prior to manufacture of any spools etc. The contractor shall allow one week after delivery of drawings to the Consultant Engineers office for drawing approval. This shall be allowed within the program of works for the contract. The contractor shall provide a drawing in 3D ensuring the installation of all equipment can take place. This shall be provided a minimum of 2 weeks after awarding of contract.

### 1.5. Landlord Interface

The contractor shall note the onerous requirements of the building landlord and shall make due allowance within their tender sums for complying fully with the requirements stipulated within the various landlords guidance documents as included within this tender package.

### 1.6. Co-ordination

The Contractor shall liaise with the other subcontractors on site (i.e. Kitchen supplier/installer, Bar supplier/installer, Electrical) regarding final routes of all services. Zones shall be agreed with all parties prior to work commencing on site. Final agreement shall be issued to the consulting engineer prior to the commencement.
To facilitate this, section drawings are provided for the intended concept of services installations.
Each contractor shall employ a common CAD technician for the site to prepare fully coordinated drawings, both in plan and section for issue to the Consulting Engineer for approval 2 weeks prior to work commencing. All fully coordinated drawings should be issued to the Consulting Engineer a minimum of three weeks before works commence in each zone.

**The Mechanical Contractor shall take lead on the completion of these drawings.**

Drawings shall be required for the reflected ceiling plan, ceiling void coordination, floor void coordination and kitchen services coordination.
All drawings are to be produced in .dwg format.

The contractor shall note that the front of house areas incorporate a large amount of finished services within floors, specialist joinery/furniture items, wall panelling, ceilings etc. The Contractor shall note that the services indicated are for tender purposes and finite setting out must be coordinated on site with the main contractor and the other specialists. Relevant costs associated with co-ordination shall be included within the tender price.

### 1.7. Operation and Maintenance Manuals

The Contractor shall supply at the end of the contract, operation and maintenance manuals as noted elsewhere within the documentation.
Additional to this the Contractor shall include the following within the manual.

- Assets register
- Separate building user guide on the operation of plant etc without technical content providing operation and environmental performance of the building.

### 1.8. Maintenance

The Contractor shall include within the tender price for the full maintenance of all mechanical services during the 12 months Defects and Liability period.
On completion of the maintenance, full servicing documentation shall be forwarded along with a new maintenance agreement for our Client.

### 1.9. Other Works

In addition to the works specified in this specification and the Civil Contractor a Mechanical Contractor will be engaged to carry out the mechanical installation.

### 1.10. Other Consultants

This specification is to be read in conjunction with drawings and specifications from the following consultants:

- Architect - Macaulay Sinclair
- Structural - Thomasons
- Kitchen designer - Hallmark Kitchens
- Lighting Designer - Into Lighting
- Audio Visual - TBC

These drawings and documents shall be referred to for set out location and final quantities.

### 1.11. Existing Premises

The contractor shall take due care and diligence with respect to all works required. No deliveries will be permitted outside the allocated time periods.

## 2. BREEAM

The installation shall be in accordance with the requirements outlined in "BREEAM 2011NC - Green Lease & Green Building Guide Agreement Centre Point Retail106610/DH/05082015: Revision 07BREEAM 2011" document included within the tender package. The contactor shall note that the development has to target VERY GOOD BREEAM rating, and that installation, commissioning etc. shall strictly follow outlined guidelines.

**Listed below are a number of elements that the Mechanical Contractor must include within the tender for BREEAM Assessment requirements.**

### 2.1. Man 01 Sustainable Procurement: Building Services Commissioning

The mechanical contractor shall ensure that their fit-out equipment will be commissioned in accordance with BREEAM requirements:

An appropriate project team member(s) is appointed to monitor and programme pre- commissioning, commissioning and, where necessary, re-commissioning on behalf of the client.

All building services are included in the commissioning schedule and commissioning is to be carried out in line with current Building Regulations, BSRIA and CIBSE guidelines and/or other appropriate standard, where applicable (where a BMS is specified relevant BMS commissioning procedures should be undertaken).

1. The principal contractor accounts for the commissioning programme, responsibilities and criteria within the main programme of works.
2. A specialist commissioning manager is appointed during the design stage (by either client or contractor) for complex systems and the scope of their responsibility includes:
 a. Design input: commissionability design reviews;
 b. Commissioning management input to construction programming;
 c. Commissioning management input during installation stages;
 d. Management of commissioning, performance testing and handover/post handover stages.

3. The following seasonal commissioning responsibilities will be completed over a minimum 12 month period, once the building becomes occupied:
Complex systems - Specialist commissioning manager
 a. Testing of all building services under full load conditions, i.e. heating equipment in mid-winter, cooling/ventilation equipment in mid-summer, and under part load conditions (spring/autumn);
 b. Where applicable, testing should also be carried out during periods of extreme (high or low) occupancy;
 c. Interviews with building occupants (where they are affected by the complex services) to identify problems or concerns regarding the effectiveness of the systems;
d. Re-commissioning of systems (following any work needed to serve revised loads), and incorporating any revisions in operating procedures into the O&M manuals.

### 2.2. Man 04 Stakeholder Participation: Building User Information

The Tenant shall update the Building User Guides after their fit-out works and ensure that Building User Guides are provided and are appropriate to all users of the building (general users including staff and if applicable residents, as well as the non technical facilities management team/building manager).

The Guides must cover all functions and uses of the building, ensuring building users are able to use the building effectively. Where relevant, the documents must describe the facilities to be shared and how access to them will be arranged for potential users.

Building and site related information shall be made readily available to all future building users, enabling them to access and use the building, site and local transport infrastructure/amenities effectively.

Building user guide needs to cover the following items:

1. The building's staff (or where relevant residents);
2. The non technical facilities management team/building manager;
3. Other building users e.g. visitors/community users.

The content of the guide will be specific to the building type, but should broadly include information on the following:
1. Overview of the building and its environmental strategy e.g. energy/water/waste efficiency policy/strategy and how users should engage with/deliver the policy/strategy;
2. Building services overview and access to controls (where to find them, what they control, how to operate effectively and efficiently etc.);
3. Pre-arrival information for visitors e.g. access and security procedures/provisions;
4. Provision of and access to shared facilities;
5. Safety and emergency information/instructions;
6. Building related operational procedures specific to building type/operation e.g. labs;
7. Building related incident reporting/feedback arrangements;
8. Building related training information/links;
9. Provision of and access to transport facilities e.g. public transport, cyclist facilities, pedestrian routes etc;
10. Provision of and access to local amenities;
11. Re-fit, refurbishment and maintenance arrangements/considerations;
12. Links, references and relevant contact details.

### 2.3. Hea 03 Thermal comfort

The Tenant shall ensure that appropriate thermal comfort levels are achieved, and that the controls selected to maintain a thermally comfortable environment for occupants are appropriately selected. With regards to thermal zoning, it is imperative to consider the amount of occupant control required for these zones, based on discussions with the end user; the specific items that must be considered include (but are not limited to):

Modelling analysis will be required to demonstrate the for temperature control strategy for the building and its users. Meets the following criteria:

1. Thermal modelling has been carried out using software in accordance with CIBSE AM11 Building Energy and Environmental Modelling. Eg using Dynamic thermal modelling software's IES, TAS etc
2. The modelling demonstrates that the building design and services strategy can deliver thermal comfort levels in occupied spaces in accordance with the criteria set out in CIBSE Guide A Environmental Design; or other appropriate industry standard (where this sets a higher or more appropriate requirement/level for the building type).
3. The software used to carry out the simulation at the detailed design stage provides full dynamic thermal analysis. For smaller and more basic building designs with less complex heating / cooling systems, an alternative less complex means of analysis may be appropriate (such methodologies must still be in accordance with CIBSE AM11).
4. The building complies with any requirement, in terms of "time out of range" (TOR) metric, from the appropriate industry standard (as above) OR where there is no appropriate industry standard available or TOR recommendation made, the building services engineer confirms that the TOR is acceptable for the purpose and function of the building.
5. The TOR metric (%) is reported, via the BREEAM scoring and reporting tool, based on the modelling above (and therefore specified building servicing strategy) and includes maximum and minimum temperatures for both summer and winter settings

### 2.4. Hea 04 Water quality:

The Tenant shall ensure that for any future fit-out works the following will have complied with the following:

All water systems in the building are designed in compliance with the measures outlined in the Health and Safety Executive's "Legionnaires' disease - The control of legionella bacteria in water systems". Approved Code of Practice and Guidance, 2000 and, where relevant, other Industry/sector best practice guidance.

Humidification has not been specified / installed for the base built design, in case humidification is installed as part of the fit-out works, only failsafe humidification system should be installed.

Note: A failsafe humidification system is one where failure of the system that sterilises the water vapour results in the entire humidification system initiating a shut down. This shut down therefore avoids any risk of building users being exposed to untreated and potentially contaminated water until the systems failure is corrected. Steam humidification is an example of a failsafe system.

## 2.5. Ene 01: Reduction of Emissions

The Tenant shall ensure that all Fit-out plant installed meets or exceeds the efficiencies stated in the base build Building Regulations Part L2a assessment. All new installations or modifications shall be submitted to the Landlord for approval. The limiting efficiencies of these items are detailed in the table below

| Plant Items | Limiting Efficiencies |
|---|---|
| LTHW Heating | LTHW boilers with a seasonal efficiency to be ≥ 92% and system distribution efficiency ≥ 95%. OR No lesser than that base built plant. Use Value whichever is greater or efficient. |
| Chilled Water Cooling | Chillers with a SEER of ≥ 6 and system distribution efficiency ≥ 95%. OR No lesser than that base built plant. Use Value whichever is greater or efficient. |
| Central Air Handling Units (AHUs) | Specific Fan Power (SFP) ≤ 1.7 W/l/sec & Heat Recovery of ≥ 75 % |
| Zonal supply system where the fan is remote from the zone (Ceiling void or roof mounted unit) | Specific Fan Power (SFP) ≤ 0.60 W/l/sec<br>(For units with Heat Recovery ≥ 75 % additional 0.3 W/l/sec) |
| Local Extract Fans | Specific Fan Power (SFP) ≤ 0.40 W/l/sec |
| Fan Coil Units | Specific Fan Power (SFP) ≤ 0.25 W/l/sec |
| Pumps | Variable speed with multiple pressure sensors across the system |
| Duct Work Leakage Testing to CEN Standards | CEN Classification Class B |
| AHU Leakage Testing Meet CEN Standards | CEN Class L2 |
| **Areas** | **Limiting Lighting Efficacies & Controls** |
| Retail – Sales Areas | 2.0 W/m²/100 Lux (Day light Dimming with Automatic On/off) |
| Meeting Rooms | 1.6 W/m²/100 Lux (Day light Dimming with Automatic On/off) |
| Cellular Office Areas | 1.6 W/m²/100 Lux (Day light Dimming with Automatic On/off) |
| Toilet Areas | 85 lm (Automatic On/Off) |
| Circulation Areas | 85 lm (Automatic On/off) |
| Storage Areas | 85 lm (Automatic On/Off) |

## 2.6. Wat 01 Water Consumption

The Tenant shall ensure that where catering and sanitary fittings are installed as part of the fit-out, that they are water efficient and that their performance mimic the fittings installed for the Landlord area. The base building sanitary specification has been assessed to meet the existing level of portable water, any new sanitary appliance installed as part of the fit out works needs to be limited to meet the Level 5 requirement of BREEAM 20011 Guide (Version 3.4) Table 18, as listed below

| Component | Unit |
|---|---|
| WC | 3 Effective flush volume (litres) |
| Wash hand basin taps | 3 litres/min |
| Showers | 3.5 litres/min |
| Baths | 100 litres |
| Urinal (s) | 0 |
| Greywater / rainwater system | N/A |
| Kitchen tap (Kitchenette) | 5 litres/min |
| Kitchen tap restaurant (pre-rinse nozzles only | 6 litres/min |
| Domestic sized dishwashers | 10 litres/cycle |
| Domestic sized washing machines | 30 litres/cycle |
| Waste disposal unit | 0 |
| Commercial sized dishwashers | 3 litres/rack |
| Commercial Industrial sized washing machine | 4.5 litres/kg |
| All sanitary ware shall be WRAS-approved. | |

## 2.7. Wat 02 Water Monitoring

The tenant shall ensure that any new water connection from the water mains supply or from the base built central supply made (Sub metering to base built supply will be required if this supply is to result in water consumption of 10 % or more of the buildings total water demand) as part of fit-out is to be metered. In addition to this, any new water meters (main or sub) installed are to be of the pulsed variety and shall be connected to the BMS

## 2.8. Wat 03 Water Leak detection & prevention

Tenant shall ensure if new WC areas/facilities are installed as part of the fit-out works, they are to incorporate one of the following flow control device to ensure water is supplied only when needed therefore prevent minor water leaks:

a) A time controller i.e. an automatic time switch device to switch off the water supply after a predetermined interval
b) A programmed time controller i.e. an automatic time switch device to switch water on and/or off at predetermined times.
c) A volume controller i.e. an automatic control device to turn off the water supply once the maximum preset volume is reached.
**d) A presence detector and controller i.e. an automatic device detecting occupancy or movement in an area to switch water on and turn it off when the presence is removed.**
e) A central control unit i.e. a dedicated computer-based control unit for an overall managed water control system, utilising some or all of the types of control elements listed above.

Note that option d) has been selected for the toilets and should be allowed for in the mechanical tender cost.

## 2.9. Mat 04 Insulation

The Tenant shall ensure that all insulation products used in the external walls, ground floor, roof or building services as a result of the fit-out are rated as A or A+ by the BRE Green Guide to Specification. The Tenant shall obtain technical data sheets for each insulation product used and a detailed summary of the area or length, thickness and thermal conductivity of all products installed.
The Tenant shall only use insulation products produced by manufacturers holding a current, valid ISO 14001, EMAS or BES6001 certificate that covers the production of polymers/mineral fibres and manufacture of insulation products, or who can verifiably demonstrate that the products contain at least 80% recycled content. The Tenant shall submit details of all insulation products to be used to the Landlord for approval

## 2.10. Pol 05 Noise attenuation

The Tenant shall ensure that all new plant installed as part of the fit-out works is suitably acoustically insulated so as not to cause an increase in background noise levels within 800m radius of the building. The Tenant shall commission a noise survey in accordance with BS 7445 to determine new plant noise limits, and to generate appropriate acoustic performance criteria for any new plant. The Tenant shall provide a copy of the noise assessment and plant acoustic performance specification to the Landlord and Local Planning Authority for approval. The Tenant shall undertake post completion noise testing to ensure that the installed plant has not increased background noise levels by more than +5dB during the day (7.00-23.00) and more than +3dB at night (23.00-07.00), and where it has increased background noise levels by more than these levels, the Tenant shall undertake the required remedial actions to ensure that noise levels are reduced to background levels

## 2.11. EPC rating

Design and installation shall be in accordance with the requirements outlined in “BRUKL” document to target the EPC rating suitable for targeted BREEAM VERY GOOD building.

## 3. DEVIATIONS FROM SPECIFICATION

Any discrepancies in or proposed deviations from the 'Scope of Work' are to be clarified with the Engineer before commencement.

## 4. DRAWING LIST

### 4.1. Project Drawings

| | | |
|---|---|---|
| L2171M001 | Ventilation - Mezzanine | D |
| L2171M002 | Ventilation - Ground | E |
| L2171M003 | Ventilation - Basement -1 | D |
| L2171M004 | Ventilation - Basement -2 | E |
| L2171M005 | Drainage - Mezzanine | E |
| L2171M006 | Drainage - Ground | E |
| L2171M007 | Drainage - Basement -1 | E |
| L2171M008 | Drainage - Basement -2 | E |
| L2171M009 | Plumbing - Mezzanine | A |
| L2171M010 | Plumbing - Ground | A |
| L2171M011 | Plumbing - Basement -1 | A |
| L2171M012 | Plumbing - Basement -2 | A |
| L2171M013 | Heating, Cooling & Gas - Mezzanine | A |
| L2171M014 | Heating, Cooling & Gas - Ground | A |
| L2171M015 | Heating, Cooling & Gas - Basement -1 | A |
| L2171M016 | Heating, Cooling & Gas - Basement -2 | A |
| L2171M017 | LTHW Schematic | A |
| L2171M018 | CHW Schematic | A |
| L2171M019 | Cond. Water Schematic | A |
| L2171M020 | Mechanical Details | A |
| L2171M021 | Ventilation Schematic | A |
| L2171M022 | Heating and Cooling Schematic | A |
| | | |
| L2171S001 | Primary Sprinkler Protection - Mezzanine | E |
| L2171S002 | Primary Sprinkler Protection - Ground | E |
| L2171S003 | Primary Sprinkler Protection - Basement -1 | E |
| L2171S004 | Primary Sprinkler Protection - Basement -2 | E |
| L2171S005 | Secondary Sprinkler Protection - Basement -1 | E |

## 5. MECHANICAL SPECIFICATION

### 5.1. Introduction

This section provides an outline scope of works for the mechanical services installation. This document has been prepared to identify the principal components of the installation and is to be read in conjunction with the drawings listed previously.

The Contractor shall be responsible for full supply, installation, testing and commissioning of the mechanical installation described in this document and or indicated on the drawings.

All equipment requiring maintenance shall be installed to be easily accessible and replaceable without major disruption.

**The contractor shall allow for all items/equipment not specifically noted or mentioned that are required to make a complete and functioning installation of the items/equipment indicated on the drawings and or specified within this document.**

For tendering as well as installation this specification and associated drawings must be read by a qualified and competent person who shall be capable of identifying engineering details necessary to provide a complete installation.

The contractor shall note that the finish and quality of this installation shall be off the highest order and shall allow for this in their tender.

## 5.2. Installation Standards

The Contractor shall ensure that the installation of the mechanical services fully complies with all the requirements and recommendations of the following:

a) All British Standard Specifications

b) All British Standard Codes of Practice

c) The Health and Safety at Work Act

d) Recommendations of the Health and Safety at Work Executive

e) Factories Act

f) Office, Shops and Railway Premises Act

g) Electricity Acts

h) Electricity at Work Regulations

i) Building Research Station Digest Recommendations

j) Local Bylaws and Regulations

k) Requirements of the Building Control Officer, Fire Officer and Environmental Health Officer

l) The Employers Insurers

m) Requirements of the Local Water Supply Company Electricity Supply Company and Local Authority

n) The Institution of Electrical Engineers Regulations for Electrical Installations 17th Edition including all amendments and Appendices (BS7671)

o) COSHH

p) Requirements of British Telecom and other telecommunications companies whose services may be taken into the building

q) Local Authority Regulations and Approvals

r) Local Water Supply Company Byelaws

s) All documentation, recommendations, guides, etc., produced by the Chartered Institute of Building Services Engineers including:-

- Guides (Volumes A. B. C and D)
- Commissioning Codes
- Technical Memoranda
- Practice Notes
- Energy Notes
- Code for Interior Lighting Design
- Code for Exterior Lighting Design

t) BSRIA Commissioning Codes

u) Institute of Plumbing Design Guide

v) Manufacturers stipulations and recommendations for installation, testing, commissioning and maintenance

w) All other bodies and Authorities having jurisdiction

x) CDM Regulations

y) Gas Safe Register

z) Cabling colours to meet European Colour Codes – Brown/Black/Grey

Where published documents are referred to in the above list, the Contractor shall ensure that the installation of the works comply with the edition current at the date of tender issue.

## 6. MECHANICAL INSTALLATION

### 6.1. Scope of Works

The following is a description of the mechanical services that shall be installed by the Mechanical Contractor within Streat Markets Restaurant.

This project covers the installation of mechanical services to the Bar / Restaurant and back of house areas. The services shall include the installation of new mechanical services installation as detailed on the drawings. The new mechanical services installation shall be complete in all aspects with distribution pipework throughout the building. The installation shall comprise of fresh air plant, condense water, heating, chilled water, plumbing, sanitary ware, soils & waste, gas and ventilation installations.

**Condense water**

2No valved and blanked condenser water loop (flow & return) connections via a plateheat exchanger, with a pressure drop of 15kPa and volume flow rate of 8.6l/s combined, will be provided by the landlord within the demise of the Unit.

The mechanical contractor shall supply, install and commission the necessary watercooled condensing units to satisfy the heating and cooling requirements within the demise. Space has been allocated within the demise equipment as indicated on the drawings. The mechanical contractor shall provide a circulating pump and pressurisation unit with expansion vessel on the secondary condenser water circuit from the Landlord plate heat exchanger to the tenant's water cooled condensers. The connection to the condenser water loop will enable the Retail Tenant to generate the required heating and cooling to suit their requirements. For cooling mode, maximum flow and return temperatures of 42/48°C provides a possible total heat rejection of 180kW.

For heating mode, minimum flow and return temperatures of 21/18°C provides heat input of 180kW, excluding additional heating capacity due to compressor heat rejection.

**Heating**

A complete new LPHW heating installation shall be provided by the mechanical contractor. This installation shall comprise of water cooled and air cooled heat pumps, for generation of LTHW, pumps, pressurisation unit and expansion vessel, all serving the heating requirements of the unit. The installation as indicated on the drawings will serve AHU heating coils, fan coil units and a water cylinder.

In addition, mechanical contractor shall supply and install electrical overdoor curtain as well as electrical perimeter heaters in the main dining area as indicated on the relevant drawings.

**Chilled Water cooling**

A complete new CHW installation shall be provided by the mechanical contractor. This installation shall comprise of a water cooled chiller and air cool heat pump, for generation of CHW, pumps, pressurisation unit and expansion vessel, all serving the cooling requirements of the unit. The installation as indicated on the drawings will serve AHU cooling coils and fan coil units.

**Ventilation**

A new ventilation installation shall be provided under this contract. The Landlord has provided ductwork connection at basement levels level dedicated for the kitchen extract facility. Louvres have been provided by the Landlord for general extract and fresh air provision for the unit.

The landlord will provide 2no dedicated Air Purification AHUs (Ecology Units)(extract only), together with associated extract ductwork. The Ecology Unit serving the Unit will be located within the landlord plant area at basement -2 level. The extract duct shall terminate (blanked off) within the demise of the Retail Unit for future connection by the Tenant.

Supply air handling units shall provide fresh air, heating and cooling to the restaurant area and kitchens.

The toilet extract facilities shall be provided with ductwork, twin fan and grilles, with the installation terminating in the general louvre provision provided by the Landlord.

**Gas**
The landlord will provide gas supply left blanked and capped within the demise of the Retail Unit for future connection by the Retail Tenant. Gas meters for each Retail Unit will be located within the main Gas Meter room at basement level. The mechanical contractor shall provide pipework, a gas solenoid valves arrangement as indicated on relevant drawings. This shall be interlocked with the supply AHUs and kitchen extract installation with signal to the fire alarm.

**Plumbing**
A builder's work sleeve will be installed by the landlord at the building perimeter, Earnshaw Street (Basement Level) to facilitate the installation of a future water main from the Thames Water main to the Retail Unit by the Retail Tenant.
This contract shall include for installation of a complete MWS system. The contractor shall liaise with Thames Water in respect of new water connection.
A new plumbing installation shall be provided serving all kitchen equipment, bar equipment and sanitary ware facilities incorporating hot water generation

**Soils & Waste**
A new above ground drainage facility shall be provided for all areas. A limited number of drainage points have been provided by the Landlord and the sanitary ware facilities shall connect to these facilities. The kitchen area will also be provided with a grease interceptor which will integrate into the kitchen equipment provided under catering contract.
The mechanical contractor shall install complete above ground drainage system to include drainage pumps, pipework, manholes and floor void pipework, kitchen floor gullies, etc. as indicated on relevant drawings.

### 6.2. Temporary services

The mechanical contractor will be responsible for connection of temporary water supply to the landlords metered supply. Such connection will only be permitted once they have submit certification to confirm that all internal plumbing services have been pressure tested, chlorinated and flushed out before 'the Main Contractor' opens the stop valve. Thus, the contactor shall allow for pressure test, chlorination and flushing of temporary water services for fit out purpose.

### 6.3. Fire Stopping/Acoustic Suppression

The contractor shall allow for fire stopping and acoustic suppression where services penetrate walls and floors. A certificate of completion by an authorised contractor must be provided prior to handover.

The contractor shall note that all fire stopping required around services shall be included under this contract. The fire stopping shall be ASTRO flame product meeting BS 476 pt 20, PR EN1366-4 achieving minimum 2 hours fire rating.

Large hole - ASTRO FM COMPOUND Fire Resistant Mortar to be used
Small holes – ASTRO INTU MASTIC Intumescent Acoustic Mastic

This includes fire stopping of all builders openings through walls / floors and voids

## 7. CONDENSE WATER INSTALLATION

### 7.1. General

This Contract shall include for the supply, installation, testing and commissioning of the condense water Installation all as indicated on the relevant drawings and as detailed hereafter.

A Landlord Heating plate heat exchanger has been installed by others in a dedicated area. The contractor shall connect to the secondary side of the plate heat exchanger (which shall be deemed the point of demarcation). All secondary install shall be by the contractor and include pumped circulators to serve water cooled chillers, heat pumps and VRV units throughout the premises as indicated on the drawings. The entire installation shall be provided and installed in accordance with the Specification and Drawings shall be to the complete satisfaction of the Consulting Engineers. The contractor shall allow in the tender for the liaison with the Landlord Team for the final connections, setting to work and commissioning of the plate heat exchanger.

### 7.2. Accessories

The Contractor shall provide and install within the plant room the following accessories:-

(i) 10 Metre length of 28mm dia. non-kink canvas reinforced rubber hose for boiler drain down purposes together with a suitable wall mounting hose coiling bracket.

(ii) Thermometers and altitude gauges shall be of the type as manufactured by British Steam Specialities or other equal and approved. These shall be fitted on the suction and discharge side of each pump and where indicated on the drawings and as detailed herebefore.

### 7.3. Air Purger

The Contractor shall supply and install within the plantroom where indicated on the drawings Armstrong Air Purgers.

### 7.4. System Pressurisation/Expansion Unit

The Contractor shall provide and install within the plantroom where shown on the relevant drawing, a System Pressurisation Expansion Vessel packaged assembly of the type as manufactured by Messrs Microfill. The pressurisation unit shall serve the boiler to maintain a pressure of 4 bar.
The pressurisation Unit shall be a wall mounted unit.
The pressurisation unit consists of a control cabinet containing break tank, twin make up pumps, microprocessor control plus high pressure/low pressure alarm and volt free contacts.
One expansion vessel sized for a heat output of 256kW and accessories for the packaged equipment shall be supplied and installed under this contract.
All necessary interconnecting pipework and accessories for the packaged equipment shall be supplied and installed under this contract.
The system Pressurisation Unit/Expansion Vessel assembly shall be fully commissioned and set to work by the manufacturer's local agents, the cost for all such commissioning shall be included in the Tender price returned.

### 7.5. Circulating Pumps

The Contractor shall provide and install in the positions shown on the relevant drawing circulating pumps of the type as manufactured by Messrs Wilo, Grundfos or Holden & Brooke.
The respective pumps shall be capable of the minimum duties as shown on the drawings

Each pump shall be complete with the following:-

(a) Cast iron body with flanged connections.
(b) Reinforced Gunmetal Impeller and s.s. shaft.
(c) Motor suitable for operation on 415 volts, 50 Hz a.c. supply of electricity.
(d) A suitable starter as detailed under Plant Controls and Cabling Section later.
(e) All pumps to have on-board inverters

The pumps shall be fitted with a suitable traffolyte label detailing type of pump, manufacturers name, duty, head, H.P. voltage and pump reference. Maximum pump speed shall be 1450 RPM.
Provide altitude gauges on pump suction and delivery. Pumps shall be arranged for Duty/Standby.
The pumps shall be arranged as shown on the relevant drawing with isolating valves fitted on pump suction and discharge connections, non return valves shall be fitted on pump discharge connections and strainers fitted on pump inlet connections.

One complete set of installation and maintenance instructions, together with a parts list shall be provided and handed over to the Employers Representative on completion of the Contract and a signed receipt obtained.
Pumps to operate on system pressure and shall be c\w onboard inverter controlled.

**7.6. Chemical Flushing of condense water system**

The Contractor shall allow for the drain down of the full condense water installation, flush a number of times until clean and undertake a full chemical flush of the installation in line with the specialist requirements.

On completion, the Contractor shall refill the system and provide additives to the required standard and provide test results to the Landlord prior to final connections.

**7.7. Pipework and Fittings**

Provide and install all necessary pipework and fittings for the complete condense water installation. Condense water pipework shall be installed in black mild steel where shown on the drawings and be in accordance with the requirements of Appendix C.
Where pipework is installed within suspended ceiling voids, or roof voids of the premises, pipework shall be supported in an approved manner to the satisfaction of the Consulting Engineers prior to installation work commencing. (Electrical Services within corridor ceiling voids shall also be considered prior to works commencing.)
It is imperative that the Contractor be aware of the fact that only swept/or pitcher tees must be installed at all circuit take-off and return locations. Straight or welded connections will under no circumstances be accepted.

**7.8. Welding**

All welding shall be applied in strict accordance with the requirements of Appendix 'C'. Only welders holding the Certificate of Competency shall be employed on the installation of the system pipework.

**7.9. Pipe Supports**

The whole of the heating pipework assembly shall be adequately supported in accordance with the requirements of Appendix 'C' and as shown. The Contractor shall note that all heating pipework supporting clips must be fitted above skirting levels. Notching of skirting for clips shall be avoided generally throughout and permitted only with prior approval of the Architect/Consulting Engineers.

**7.10. Pipework Jointing**

All pipework in the plantroom, above false ceilings and where concealed shall be an all welded assembly.

**7.11. Air Eliminators**

Automatic Air Eliminators shall be provided and fitted where noted and at all high points in the system, in accordance with requirements of Appendix 'C' with copper drain pipe to outside.

**7.12. Anchor and Guides**

Pipe anchors and guides shall be fitted where required and shall comply with the requirements of Appendix 'C' where necessary, to suit the installation pipework.

**7.13. Drain Cocks**

Drain cocks shall be installed at all low points, at suitable locations to be agreed with the Consulting Engineers, and in accordance with the requirements of Appendix 'C'.

**7.14. Expansion**

Expansion bellows of type as powerflex RXA shall be fitted where indicated on the relevant drawings and shall comply with the requirements of Appendix 'C'. Guides at expansion locations shall be in accordance with the manufacturers recommendations.

**7.15. Sleeves and Plates**

Where pipework passes through walls, floors, partitions or ceilings a M.S. sleeve shall be provided and installed. Sleeves shall be one size larger than the circuit pipe and shall terminate neatly and

flush with the finished wall surface in such manner to permit the secure fixing of c.p. wall collars where exposed pipework exists.

**7.16. Testing of Pipework**

The Contractor shall include for testing of all pipework throughout the installation in accordance with the requirements of Appendix 'C' as applicable.
Testing shall be carried out if necessary in sections to suit the programme of works, and shall be witnessed by a representative of the Consulting Engineers and the Contractor shall keep a systematic record of all such tests in a triplicate record book. Two copies of each test record with the signature of the Consulting Engineers representative shall be forwarded to the Consulting Engineers, one copy remaining the property of the Contractor.
After the installation or section of the installation has been completed, a hydraulic test shall be applied to a pressure of twice the working pressure for a period of twenty four hours and witnessed. Hydraulic tests shall be successfully completed, prior to cleansing operations and the application of thermal insulation.
Should the pressure fall during any of the tests, the section must be removed or repaired, as required by the Engineers and further tests applied until a satisfactory result is obtained.

**7.17. Identification Labels**

Identification labels shall be provided in accordance with the requirements of Appendix 'C'.

**7.18. Painting**

In addition to the requirements of Appendix 'E' this Contract shall include for the protection by painting of all exposed ironwork, brackets, etc. This shall be done by the application before erection and after wire brushing of one coat of rust inhibiting paint on all surfaces followed by one undercoat and on top coat of gloss enamel of an approved colour after erection. The Contractor shall adequately protect the Boiler casing and all other items of plant during painting.

**7.19. Balancing and Commissioning of the System**

Balancing of the system shall be carried out strictly in accordance with the requirements of Appendix 'C' as applicable.
The Contractor shall employ a Specialist Commissioning Company to balance the installations and certification of all aspects provided within the Operation and Maintenance Manuals. The Contractor shall also allow for Seasonal commissioning to be provided within the contract.

**7.20. Electrical Motors**

All units having a motor output power in excess of 0.37 kW shall be supplied complete with starter.

**7.21. Wall Charts**

The Contractor shall provide and fix within the plantroom two detailed diagrammatic wall charts; one of the plantroom plant indicating all circuits, all pipe sizes and all valves and one showing the heating pipework areas and routes. Valves shall be numbered against the diagrammatic layout. Charts shall also include the Mechanical Services Contractors trade title, the Consulting Engineers title and shall be mounted within a hardwood frame suitably covered by glazing panel of similar covering and installed within the plantroom in a readable location.

**7.22. Thermal Insulation**

During the application of thermal insulation within the premises all plant shall be carefully protected. Pipework and vessels shall be insulated all in accordance with the requirements of Appendix 'E' and as detailed hereafter:-

.01 All Flow and Return pipework within the plantroom, shall be insulated with fibreglass sections applied in accordance with Appendix 'E'.

.02 All pipework where concealed and within ceiling voids shall be insulated with 'Rigid Glass Fibre' foil-backed class 'O' sections in accordance with Appendix 'E' where applicable.

.03 Valves and flanges shall be painted after installation to an approved colour in consultation with the Consulting Engineers.

.04 All insulated pipework shall be identified as required in accordance with the requirements of Appendix 'E'

.05 It shall be noted that the requirements of Appendix 'E' incorporate the pipework colour coding chart.

.06 All valves, strainers and flanges within the plantroom shall be fitted with insulated Topo valve boxes.

**The contractor must ensure that all insulation provided is obtained from Saint-Gobain Isover as per the Green Guide for Insulation in compliance with the BREEAM assessment. Insulation to be A+ rated.**

**7.23. Maintenance Requirements**

The Contractor shall include within his Tender Price for the following attendances during the Defects Liability Period:-

(a) Immediate attention to breakdown calls at any time by a competent Service Engineer.

(b) Replacement of all defective equipment.

(c) Carrying out a comprehensive examination of the installation including checks on balancing, air venting, combustion efficiency in conjunction with the Employers representative in 6 months and at the end of the defects liability period.

(d) Seasonal Commissioning

## 8. L P H W SPACE HEATING INSTALLATION

### 8.1. General

This Contract shall include for the supply, installation, testing and commissioning of the complete L.P.H.W. Space Heating Installation all as indicated on the relevant drawings and as detailed hereafter.
This installation shall comprise of water cooled heat pumps and air cooled heat pump, for generation of LTHW, pumps, pressurisation unit and expansion vessel, all serving the heating requirements of the unit. The installation as indicated on the drawings will serve AHU heating coils, FCU's and a water cylinder.

In addition, mechanical contractor shall supply and install electrical overdoor curtain as well as electrical perimeter heaters in the main dining area as indicated on the relevant drawings.

The entire installation shall be provided and installed in accordance with the Specification and Drawings shall be to the complete satisfaction of the Consulting Engineers.

### 8.2. Accessories

The Contractor shall provide and install within the plant room the following accessories:-

(i) 10 Metre length of 28mm dia. non-kink canvas reinforced rubber hose for boiler drain down purposes together with a suitable wall mounting hose coiling bracket.

(ii) Thermometers and altitude gauges shall be of the type as manufactured by British Steam Specialities or other equal and approved. These shall be fitted on the suction and discharge side of each pump and where indicated on the drawings and as detailed herebefore.

### 8.3. Heat Pump Boilers

The Contractor shall supply and install within the plantroom where indicated on the drawings water source Heat pump boilers for generation of LTHW. The heat pump boilers shall be Carrier or similar and approved.

### 8.4. System Pressurisation/Expansion Unit

The Contractor shall provide and install within the plantroom where shown on the relevant drawing, a System Pressurisation Expansion Vessel packaged assembly of the type as manufactured by Messrs Microfill. The pressurisation unit shall serve the boiler to maintain a pressure of 4 bar.
The pressurisation Unit shall be a wall mounted unit.
The pressurisation unit consists of a control cabinet containing break tank, twin make up pumps, microprocessor control plus high pressure/low pressure alarm and volt free contacts.
All necessary interconnecting pipework and accessories for the packaged equipment shall be supplied and installed under this contract.
The system Pressurisation Unit/Expansion Vessel assembly shall be fully commissioned and set to work by the manufacturer's local agents, the cost for all such commissioning shall be included in the Tender price returned.

### 8.5. Circulating Pumps

The Contractor shall provide and install in the positions shown on the relevant drawing circulating pumps of the type as manufactured by Messrs Wilo, Grundfos or Holden & Brooke.
The respective pumps shall be capable of the minimum duties as shown on the drawings

Each pump shall be complete with the following:-

(a) Cast iron body with flanged connections.
(b) Reinforced Gunmetal Impeller and s.s. shaft.
(c) Motor suitable for operation on 415 volts, 50 Hz a.c. supply of electricity.
(d) A suitable starter as detailed under Plant Controls and Cabling Section later.
(e) All pumps to have on-board inverters

The pumps shall be fitted with a suitable traffolyte label detailing type of pump, manufacturers name, duty, head, H.P. voltage and pump reference. Maximum pump speed shall be 1450 RPM.
Provide altitude gauges on pump suction and delivery. Pumps shall be arranged for Duty/Standby.

The pumps shall be arranged as shown on the relevant drawing with isolating valves fitted on pump suction and discharge connections, non return valves shall be fitted on pump discharge connections and strainers fitted on pump inlet connections.
One complete set of installation and maintenance instructions, together with a parts list shall be provided and handed over to the Employers Representative on completion of the Contract and a signed receipt obtained.
Pumps to operate on system pressure and shall be c\w onboard inverter controlled.

**8.6. Overdoor Air Curtains**

This Contract shall include for the supply and installation of Electrical overdoor air curtain as manufactured by JS Air Curtains.
The unit shall be complete high temperature cut-out and a remote control box allowing 3 stage heat control supplied and installed under this contract located at door as per Standard Manual Controller finished in black.
Unit shall be supplied complete with thermal safety cut out.
A controller shall be positioned remotely from the door curtain as indicated on the electrical drawings.

**8.7. Electrical tranch heaters**

This Contract shall include for the supply and installation of perimeter electrical trench heaters as shown on the relevant drawing

It shall be the responsibility of the Contractor to check space available for heater to ensure that there is adequate room to install the specified size.

**8.8. Pipework and Fittings**

Provide and install all necessary pipework and fittings for the complete L.P.H.W. space heating installation.
L.P.H.W space heating pipework shall be installed in black mild steel where shown on the drawings and be in accordance with the requirements of Appendix C.
Where pipework is installed within suspended ceiling voids, or roof voids of the premises, pipework shall be supported in an approved manner to the satisfaction of the Consulting Engineers prior to installation work commencing. (Electrical Services within corridor ceiling voids shall also be considered prior to works commencing.)
It is imperative that the Contractor be aware of the fact that only swept/or pitcher tees must be installed at all circuit take-off and return locations. Straight or welded connections will under no circumstances be accepted.

**8.9. Welding**

All welding shall be applied in strict accordance with the requirements of Appendix 'C'. Only welders holding the Certificate of Competency shall be employed on the installation of the system pipework.

**8.10. Pipe Supports**

The whole of the heating pipework assembly shall be adequately supported in accordance with the requirements of Appendix 'C' and as shown. The Contractor shall note that all heating pipework supporting clips must be fitted above skirting levels. Notching of skirting for clips shall be avoided generally throughout and permitted only with prior approval of the Architect/Consulting Engineers.

**8.11. Pipework Jointing**

All pipework in the plantroom, above false ceilings and where concealed shall be an all welded assembly.

**8.12. Air Eliminators**

Automatic Air Eliminators shall be provided and fitted where noted and at all high points in the system, in accordance with requirements of Appendix 'C' with copper drain pipe to outside.

**8.13. Anchor and Guides**

Pipe anchors and guides shall be fitted where required and shall comply with the requirements of Appendix 'C' where necessary, to suit the installation pipework.

**8.14. Drain Cocks**

Drain cocks shall be installed at all low points, at suitable locations to be agreed with the Consulting Engineers, and in accordance with the requirements of Appendix 'C'.

**8.15. Expansion**

Expansion bellows of type as powerflex RXA shall be fitted where indicated on the relevant drawings and shall comply with the requirements of Appendix 'C'. Guides at expansion locations shall be in accordance with the manufacturers recommendations.

**8.16. Sleeves and Plates**

Where pipework passes through walls, floors, partitions or ceilings a M.S. sleeve shall be provided and installed. Sleeves shall be one size larger than the circuit pipe and shall terminate neatly and flush with the finished wall surface in such manner to permit the secure fixing of c.p. wall collars where exposed pipework exists.

**8.17. Testing of Pipework**

The Contractor shall include for testing of all pipework throughout the installation in accordance with the requirements of Appendix 'C' as applicable.
Testing shall be carried out if necessary in sections to suit the programme of works, and shall be witnessed by a representative of the Consulting Engineers and the Contractor shall keep a systematic record of all such tests in a triplicate record book. Two copies of each test record with the signature of the Consulting Engineers representative shall be forwarded to the Consulting Engineers, one copy remaining the property of the Contractor.
After the installation or section of the installation has been completed, a hydraulic test shall be applied to a pressure of twice the working pressure for a period of twenty four hours and witnessed. Hydraulic tests shall be successfully completed, prior to cleansing operations and the application of thermal insulation.
Should the pressure fall during any of the tests, the section must be removed or repaired, as required by the Engineers and further tests applied until a satisfactory result is obtained.

**8.18. Identification Labels**

Identification labels shall be provided in accordance with the requirements of Appendix 'C'.

**8.19. Painting**

In addition to the requirements of Appendix 'E' this Contract shall include for the protection by painting of all exposed ironwork, brackets, etc. This shall be done by the application before erection and after wire brushing of one coat of rust inhibiting paint on all surfaces followed by one undercoat and on top coat of gloss enamel of an approved colour after erection. The Contractor shall adequately protect the Boiler casing and all other items of plant during painting.

**8.20. Flushing of System**

On completion of the systems but prior to final tests and balancing, all valves and control valves shall be fully opened and the system flushed to drain to remove dirt and debris.
All flushing shall be witnessed by the Consulting Engineers.

**8.21. Balancing and Commissioning of the System**

Balancing of the system shall be carried out strictly in accordance with the requirements of Appendix 'C' as applicable.
The Contractor shall employ a Specialist Commissioning Company to balance the installations and certification of all aspects provided within the Operation and Maintenance Manuals. The Contractor shall also allow for Seasonal commissioning to be provided within the contract.

**8.22. Electrical Motors**

All units having a motor output power in excess of 0.37 kW shall be supplied complete with starter.

**8.23. Wall Charts**

The Contractor shall provide and fix within the plantroom two detailed diagrammatic wall charts; one of the plantroom plant indicating all circuits, all pipe sizes and all valves and one showing the heating pipework areas and routes. Valves shall be numbered against the diagrammatic layout. Charts shall also include the Mechanical Services Contractors trade title, the Consulting Engineers title and shall be mounted within a hardwood frame suitably covered by glazing panel of similar covering and installed within the plantroom in a readable location.

**8.24. Thermal Insulation**

During the application of thermal insulation within the premises all plant shall be carefully protected. Pipework and vessels shall be insulated all in accordance with the requirements of Appendix 'E' and as detailed hereafter:-

.01 All Heating Flow and Return pipework within the plantroom, shall be insulated with fibreglass sections applied in accordance with Appendix 'E'.

.02 All Heating pipework where concealed and within ceiling voids shall be insulated with 'Rigid Glass Fibre' foil-backed class ‘O’ sections in accordance with Appendix 'E' where applicable.

.03 Valves and flanges shall be painted after installation to an approved colour in consultation with the Consulting Engineers.

.04 All insulated pipework shall be identified as required in accordance with the requirements of Appendix 'E'

.05 It shall be noted that the requirements of Appendix 'E' incorporate the pipework colour coding chart.

.06 All valves, strainers and flanges within the plantroom shall be fitted with insulated Topo valve boxes.

**The contractor must ensure that all insulation provided is obtained from Saint-Gobain Isover as per the Green Guide for Insulation in compliance with the BREEAM assessment. Insulation to be A+ rated.**

**8.25. Maintenance Requirements**

The Contractor shall include within his Tender Price for the following attendances during the Defects Liability Period:-

(a) Immediate attention to breakdown calls at any time by a competent Service Engineer.

(b) Replacement of all defective equipment.

(c) Carrying out a comprehensive examination of the installation including checks on balancing, air venting, combustion efficiency in conjunction with the Employers representative in 6 months and at the end of the defects liability period.

(d) Seasonal Commissioning

## 9. CHILLED WATER INSTALLATION

### 9.1. General

This Section of the Specification shall include for the supply, installation, testing and commissioning of the complete Chilled Water Installation all as indicated on the relevant drawings and as specified hereafter.

This installation shall comprise of a water cooled chiller and air cooled heat pump, for generation of CHW, pumps, pressurisation unit and expansion vessel, all serving the cooling requirements of the unit. The installation as indicated on the drawings will serve AHU cooling coils and FCU's.

The entire installation shall be provided and installed in strict accordance with the Specification and Drawings and shall be to the complete satisfaction of the Consulting Engineers.

### 9.2. Temperature Controls Chilled Water Installation

The Chilled Water Installation shall be fitted with temperature control equipment.

### 9.3. Chiller

Water cooled chiller shall be complete packaged units, including compressors, condensers, evaporators and refrigeration circuits, with evaporator fans and integral control and starter panel, all contained within a robust casing suitable for the application.
The condenser units shall be suitably sized to dissipate the building heat loads and the load of the compressors. They shall be attached to the evaporator to ensure that the refrigeration machines have optimum performance. Head pressure control shall be provided and control of the condenser fans to maintain acceptable condensing temperatures.
The refrigeration plant provided shall be suitable in every respect for the intended application and operate as defined by this Specification and in accordance with the equipment manufacturers recommendations.

Compressor Assembly
Compressors shall be of the screw type with step less capacity control. The starting method shall limit the starting current such that it does not exceed that specified by the Electricity Board.
The lubrication system shall be force fed by a positive displacement oil pump and the lubrication system shall include an oil filter.
The motor shall be cooled by the suction gases and shall be protected by temperature sensors in the windings.
Each compressor shall be provided with an electrical heater to prevent the oil and refrigerant mixing during periods when the compressor is not running. This shall be wired and controlled by the manufacturer.
Acoustic equipment shall be provided to ensure the installation meets with acoustic requirements of the Specification.

Condensers
Each chiller machine shall have water-cooled condensers with coils of seamless copper tubes expanded into continuous aluminium fins. The condensers shall be circuited to provide sub-cooling of the refrigerant.
Casings shall be manufactured from heavy gauge pre-galvanised sheet steel.
Motors shall be squirrel cage type and fully weatherproofed.
Allowance shall be made for the supply and installation of any acoustic equipment to ensure the installation meets the acoustic requirements of the Specification.

Evaporator
The evaporators shall be of the shell and tube type with separate refrigeration circuits and cast steel headers. The evaporator shall be insulated and suitable for a chilled water operating pressure of 10 bar.

Controls

The control panel of each machine shall contain all necessary operating and safety controls, including lead/lag selector switches for the compressors, chilled water temperature control, high

and low oil pressure, freeze protection condenser fan controls, starters, overload protection, phase failure protection and control circuit fuses.
If specified, special starting facilities shall be provided to ensure that the starting current of the chillers does not exceed that required by the Electricity Board. If specified, automatic power factor correction equipment shall be provided to maintain a minimum power factor of 0.95 lag between no load to full load conditions.

Refrigeration Circuits
The refrigeration circuits within each machine shall include compressor suction and shutoff discharge valves, liquid line shut-off valves, solenoid valves, high pressure relief device, filter driers, sight glasses and thermostatic expansion valves. The suction lines shall be insulated.

General Construction of Chillers
The chiller machines shall have welded steel frames and galvanised steel panels finished with a bake-on enamel to a BS colour to be approved by the Engineer. The units shall be fully weatherproof and totally suitable for external application.
The control and starter panels are to have fully removable access panels.
The water connections shall be external to the machine and shall be flanged with suitable flexible connections provided. Pipe work immediately adjacent to the flexible connections shall be rigidly supported.

Anti-Vibration Mountings
The chillers shall be provided with a steel base frame.
Anti-vibration mountings shall be provided to prevent transmission of noise and vibration to the structure.

Connections
Each machine shall have installed in the adjacent pipe work the following:-
a) Chilled water flow and return temperature gauges.
b) Chilled water pressure gauges positioned before and after the evaporator.
c) Binder test points for commissioning purposes in the chilled water flow and return pipe work connections.
d) A differential pressure switch or flow switch interlocked with the chiller to protect the evaporator from freezing.
e) Isolating valves in the chilled water flow and return pipe work connections.

**9.4. System Pressurisation/Expansion Unit**

The Contractor shall provide and install within the plantroom where shown on the relevant drawing, a System Pressurisation Expansion Vessel packaged assembly of the type as manufactured by Messrs Microfill. The pressurisation unit shall serve the chiller to maintain a pressure of 4 bar.
The pressurisation Unit shall be a wall mounted unit.
The pressurisation unit consists of a control cabinet containing break tank, twin make up pumps, microprocessor control plus high pressure/low pressure alarm and volt free contacts.
All necessary interconnecting pipework and accessories for the packaged equipment shall be supplied and installed under this contract.
The system Pressurisation Unit/Expansion Vessel assembly shall be fully commissioned and set to work by the manufacturer's local agents, the cost for all such commissioning shall be included in the Tender price returned.

**9.5. Circulating Pumps**

The Contractor shall provide and install in the positions shown on the relevant drawing circulating pumps of the type as manufactured by Messrs Wilo, Grundfos or Holden & Brooke.
The respective pumps shall be capable of the minimum duties as shown on the drawings

Each pump shall be complete with the following:-
(a) Cast iron body with flanged connections.
(b) Reinforced Gunmetal Impeller and s.s. shaft.
(c) Motor suitable for operation on 415 volts, 50 Hz a.c. supply of electricity.
(d) A suitable starter as detailed under Plant Controls and Cabling Section later.

(e) All pumps to have on-board inverters

The pumps shall be fitted with a suitable traffolyte label detailing type of pump, manufacturers name, duty, head, H.P. voltage and pump reference. Maximum pump speed shall be 1450 RPM. Provide altitude gauges on pump suction and delivery. Pumps shall be arranged for Duty/Standby. The pumps shall be arranged as shown on the relevant drawing with isolating valves fitted on pump suction and discharge connections, non return valves shall be fitted on pump discharge connections and strainers fitted on pump inlet connections.

One complete set of installation and maintenance instructions, together with a parts list shall be provided and handed over to the Employers Representative on completion of the Contract and a signed receipt obtained.

Pumps to operate on system pressure and shall be c\w onboard inverter controlled.

**9.6. Valves**

The Contractor shall provide and install isolating valves and drain cocks where indicated on the drawings in accordance with the requirements of Appendix 'C' as applicable.

Double regulating valves as Hattersley Cat No. 1432 up to and including 50mm diameter and Cat No. M733DR over 50mm diameter shall be installed in the locations shown on the drawings. Flow measurement stations as Hattersley Cat No. 2432 up to and including 50mm diameter and Cat No. M2733 over 50mm diameter shall be installed in the locations shown on the drawings. The respective systems shall be fully balanced to give the desired flow rates and these shall be demonstrated to the Consulting Engineers. Measurement equipment shall be supplied by the Mechanical Services Contractor.

**9.7. Pipework and Fittings**

Provide and install all necessary pipework and fittings for the complete Chilled Water Installation. Chilled Water pipework shall be installed in black mild steel where shown on the drawings and be in accordance with the requirements of Appendix D.

Where pipework is installed within suspended ceiling voids of the premises, it shall be supported in an approved manner to the satisfaction of the Consulting Engineers, agreed prior to installation work commencing. (Electrical and other services within ceiling voids shall also be considered prior to works commencing.)

**9.8. Sleeves and Plates**

Where pipework passes through walls, floors, partitions or ceilings a mild steel sleeve shall be provided and installed. Sleeves shall be one size larger than the circuit pipe and shall terminate neatly and flush with the finished wall surface in such manner to permit the secure fixing of C.P. wall plates where pipework is exposed in accepted areas.

Fire stopping around and within sleeves shall be carried out by the Main Contractor.

**9.9. Testing of Pipework**

The Contractor shall include for testing of all pipework throughout the installation in accordance with the requirements of Appendix 'C' as applicable.

Testing shall be carried out if necessary in sections to suit the programme of works, and shall be witnessed by a representative of the Consulting Engineers. The Contractor shall keep a systematic record of all such tests in a triplicate record book. Two copies of each test record with the signature of the Consulting Engineers' representative shall be forwarded to the Consulting Engineers, one copy remaining the property of the Contractor.

After the installation or section of the installation has been completed, a hydraulic test shall be applied to a pressure of twice the working pressure for a period of twenty-four hours and witnessed. Hydraulic tests shall be successfully completed prior to cleansing operations and the application of thermal insulation.

Should the pressure fall during any of the tests, the section must be removed or repaired, as required by the Engineers, and further tests applied until a satisfactory result is obtained.

**9.10. Identification Labels**

Identification labels shall be provided in accordance with the requirements of Appendix 'C'.

**9.11. Painting**

In addition to the requirements of Appendix 'E' this Contract shall include for the protection by painting of all ironwork, brackets, etc. This shall be done by the application before erection and

after wire brushing of one coat of rust inhibiting paint on all surfaces followed by one undercoat and one top coat of gloss enamel of an approved colour after erection. Omit the top coat on insulated or concealed items. The Contractor shall adequately protect the Building Fabric and all other services during painting.

**9.12. Flushing of System**

On completion of the installation but prior to final tests and balancing, all valves and control valves shall be fully opened and the system flushed to drain to remove dirt and debris. Strainers shall be thoroughly cleaned.
All flushing shall be witnessed by the Consulting Engineers.

**9.13. Balancing and Commissioning of the System**

Balancing and commissioning of the system shall be carried out strictly in accordance with the requirements of Appendix 'C' as applicable.
Initial commissioning shall be carried out with water. Glycol shall then be added to give a 20% concentration. Sufficient Glycol to provide two further doses shall be stored in sealed and labelled containers within the plantroom.
Glycol dosing shall be followed by the addition of Fernox AF10 Biocide to give a 0.1% concentration. Sufficient Biocide to provide two further doses shall be stored in sealed and labelled containers within the Plantroom.
The Glycol and Biocide dosing shall be recorded in a triplicate record book. Two copies of each dosing record with the signature of the Consulting Engineers' representative shall be forwarded to the Consulting Engineers, one copy remaining the property of the Contractor.
The Contractor shall check the concentration of the Glycol and Biocide six months after handover and one week before the end of the Defects Liability Period.
Test results shall be obtained from the samples and provided to the Landlord.

**9.14. Electrical Motors**

All units having a motor output power in excess of 0.37 kW shall be supplied complete with starter.

**9.15. Wall Charts**

The Contractor shall provide and fix within the plantroom detailed diagrammatic wall charts indicating the plant and all circuits, all pipe sizes and all valves. Valves shall be numbered against the diagrammatic layout.
Charts shall also include the Mechanical Services Contractors trade title, the Consulting Engineers title and shall be mounted within a hardwood frame suitably covered by glazing panel or similar covering and installed within the plantroom in a readable location.

**9.16. Thermal Insulation**

During the application of thermal insulation within the premises the Building Fabric and all services shall be carefully protected.
Pipework shall be insulated all in accordance with the requirements of Appendix 'E' where applicable and as detailed hereafter:-

.01 All Chilled Water Flow and Return pipework located internally and externally to the building shall be insulated with Class 'O' foil backed fibreglass sections applied in accordance with Appendix 'E', using 'hot surface' thicknesses.

.02 Valves and joints shall be insulated using removable insulating covers with Velcro fastenings, as manufactured by Bridela Ltd, or other equal and approved.

.03 All insulated pipework shall be identified in accordance with the requirements of Appendix 'E' as applicable.

.04 Load bearing blocks as manufactured by Koolphen Ltd, or other equal and approved, shall be fitted at all support locations, with Class 'O' foil carried over the blocks to give an unbroken appearance.

.05 Extreme care shall be taken to ensure that the foil backing is properly sealed to provide a 100% vapour seal, without breakage, using adhesive foil tape to the manufacturer's recommendations at all joints and section ends.

.06 All external insulation including valves and joints shall be waterproofed using 'Opanol' thermoplastic sheeting in accordance with the requirements of Appendix 'E' as applicable.

**The contractor must ensure that all insulation provided is obtained from Saint-Gobain Isover as per the Green Guide for Insulation in compliance with the BREEAM assessment. Insulation to be A+ rated.**

### 9.17. Maintenance Requirements

The Contractor shall include within his Tender Price for the following attendances during the Defects Liability Period:-

(a) Immediate attention to breakdown calls at any time by a competent Service Engineer.
(b) Replacement of all defective equipment.
(c) Carrying out a comprehensive examination of the installation including checks on balancing and air venting, in conjunction with the Employers representative 6 months after handover and at the end of the defects liability period.
(d) Carrying out all maintenance items listed in the Maintenance Manuals.

### 9.18. Fuel for Testing and Commissioning

The Employer shall provide sufficient fuel and electricity to the Contractor for testing and commissioning purposes, free of charge to the Contractor.

## 10. MECHANICAL VENTILATION

### 10.1. General

This Section of the Specification shall cover the supply, installation, testing, and commissioning of the complete Mechanical Ventilation Installation, including all fans, ductwork, grilles, louvres, dampers, fire sleeves etc.
The entire Mechanical Ventilation Installation as shown on the drawings and as specified hereafter shall be provided and installed to the complete satisfaction of the Consulting Engineers and strictly in accordance with the regulations of the H.V.C.A. publication DW/144 and Appendix F of this Specification.

### 10.2. Acoustic Supports

This Contract shall include for the supply and installation of anti-vibration mounts on all equipment and services installations.
Suitable hangers will be provided for all services.
Anti-vib mounts shall be provided for all equipment and plant internally.
Anti-vib mounts shall be provided for all AHU plant.

### 10.3. Supply Air Handling Unit

This Sub Contract shall include for the supply, installation and commissioning of air handling unit as follows. Include TICO pads under all AHU base. Provide two spare sets of filters and one change of belts and pulleys for all A.H.U.s. All units shall be as supplied by Messrs. Envirotec, VES ANDOVER, AirCraft Air Handling Units or other equal and approved.

Air Handling Unit Specification

- In all cases the fan power performance requirements of the Building Regulations Part L2 must be met.
- SFP: All AHUs shall be designed to the SFP figures as stated in the schedules. SFP figures must be proven and Eurovent certified, including the method of SFP calculation. Simple statements of SFP conformity will not be acceptable.
- Fan pressures quoted are external to air handling unit. The Contractor shall be responsible for adjusting the fan duties as necessary if these figures increase or decrease.
- Integral AHU attenuators shall be designed and selected to achieve noise levels as per the schedule at the supply, return, intake, and exhaust connections, as well as the break-out to the plant room (plant room max 50 dB(A). The contractor shall be responsible for the addition of external attenuators to ensure the relevant NR figures for each area are met.
- The contractor shall note that no provision has been made for additional attenuators in the pressure drop calculation.
- The AHU schedules must be read in conjunction with the relevant part of the specification.

The AHUs shall generally be as follows:

1) Casing: The Air handling unit standard modules and the casing of the functional sections shall be constructed of extruded, naturally anodised aluminium profiled frame members. The frame members are, where appropriate, jointed together by means of surface treated corner pieces. The panels shall be of a double skin design and consist of two sheets of aluminium-zinc plated sheet steel, protected by an ALC corrosion resistive coating that conforms to the provisions of corrosion resistance Class C4 to SS-EN ISO 12944-2 standard. The intervening panels shall be in filled with a minimum of 50mm thick thermal insulation with a volumetric weight of 40 Kg/m3. The casing shall meet the demands of Air tightness class B (L2) for subatmospheric pressure and Class A (L3) for excess pressure and total heat transfer coefficient T4 to CEN EN 1886:2007. The casings shall be suitable for biocide decontamination (formaldehyde).

2) The AHU panels shall be of the same construction and finish on both the inner and outer surfaces. All panels shall be suitable for coastal application. Plastisol or similar material covered outer panels will not be acceptable.

3) Dampers: All dampers shall be manufactured of aluminium profiles and meet the provisions of corrosion resistance class 4. The Tip seals shall be manufactured from silicone rubber enabling a tight seal to achieve an air tightness of 98%.

4) Light Fittings:Light fittings shall be supplied mounted and pre wired to an external isolator, in all access, fan and filter sections. The fitting shall be constructed from a polycarbonate base with an aluminium reflector and a ribbed glass globe, protected by a steel wire guard to minimum IP44 rating.

5) Access Panels: All access panels shall me manufactured in the same constructional manner as the standard panels. These panels shall incorporate as required fully integrated inspection windows consisting of an inner and outer panel manufactured from plexiglass. All access panels shall also be equipped with adjustable hinges and be fully lockable. All access sections that require inspection windows and light fittings shall be a minimum of 450mm long.

6) Filters: All filters shall be mounted on slide rails, to enable easy withdraw and replacement. These filter slide rails shall be fitted with effective sealing strips to minimize leakage. All filter sections must incorporate into the housing a locking mechanism, to securely secure them into place. In addition the housings shall be equipped with factory fitted pressure tappings for connection to gauges.
Filters shall be selected to suit the application but generally pre filters shall be of the throw away deep-bag type construction, shall be of a minimum grade class G3, and be of synthetic fibre type. Final filters shall be of a deep pocketed variety to a minimum grade of class F7 and shall be of glass-fibre type. Return air filters shall be of a deep pocketed variety to a minimum grade of class F6 and shall be of glass-fibre type. Filter frames shall be of a fully combustible type for easy incineration, not steel.

7) Fans: All Fans shall be of the direct driven type and shall consist of a centrifugal fan with built-in rotating diffuser. Impellers shall be made of aluminium. Fan diffuser shall have baked, powder coated paint finish, and shall be equipped with factory fitted energy spoilers to ensure high fan efficiency. All fans shall either be suitable for inverter drive or be of EC type as specifically designated within the schedules. All fans must be individually factory tested, prior to despatch. It is not acceptable to batch test fans and motors. No belt-driven fans will be accepted. Fans shall be suitable for operation with an electrical supply 415V/3ph/50Hz.

8) Motors: Fan motors shall be of the types specifically designated on the AHU schedule, but generally shall be either:
a. EC Motor pre-balanced to fan
b. IE2 (Eff1) fan motor with integral inverter

***IE2(Eff2) motors are not acceptable under EU regulations

9) Where specified, areas that require a duty standby motor, with a spare motor being supplied for on-site storage, this must be part of the original scope of supply and delivered to site with the respective AHU and supplied to the client at handover.

10) Coils: All coils shall be manufactured from copper with aluminium fins (see schedule). All coils shall have integral air purging valves and drain cocks fitted. Velocity across the coils must not exceed 2.0 m/s unless specifically detailed within the AHU schedule. The coils shall be mounted onto rails which allow for the easy removal for cleaning and maintenance of the coil. Due consideration shall be given by the contractor to allow sufficient access around the unit for coil withdrawal.

11) All cooling coils shall be supplied with drip trays manufactured from stainless steel. All drip trays to be removable type for maintenance access & cleaning.

12) The AHUs must not contain any material or substance that could cause or support combustion.

13) All Air handling units shall be Eurovent tested and accredited. AHU suppliers that are not currently Eurovent accredited will not be considered.

14) Life Cycle Cost & Energy Usage: Prior to supply, the AHU supplier shall supply to the consultant engineer figures for both annual energy usage & life cycle cost based upon running time figures applicable to the application. These run time figures shall be supplied by the consultant engineer. This shall form part of the technical submittal.

15) The technical submittal for each AHU must include a Eurovent Energy Certification Class Certificate. Certification for every AHU must be as per the certification grade within the original design.

**10.4. Kitchen Extract Ductwork**

Kitchen extract ductwork outside kitchen fire compartment shall be fire resistant ductwork, as manufactured by Fire Protection Limited or Cape Calsil, to comply with BS476 Part 24 (1987) and ISO 6944 (1985) for 2 hours stability, 2 hours integrity and 2 hours insulation, within the unit to the connection location of the Landlord extraction point on Ground Floor.
The duct type shall be Type A (Fire outside and fire inside) and once erected shall be pressure tested to DW 143.
All ductwork supports, sealants, gaskets and flexible joints shall be non-flammable and as tested and certified in accordance with BS476 Part 2 and ISO 6944 and comply fully with the manufacturers recommendations.
The Kitchen extract ductwork shall have a smooth internal finish to assist with cleaning and fire rated access doors shall be fitted at 2m intervals along the whole of the duct length with raised collars to accommodate insulation.
A certificate of conformity shall be issued by the Contractor confirming that the Kitchen Extract system has been manufactured and installed correctly.

**10.5. Extract Fans**

The Contractor shall provide and install extract fans all as detailed on the drawings.
Extract fans shall be as manufactured by Halton or Vent Axia Ltd. All extract fans to be supplied complete with backdraught shutters. All run on timers, PIR's and speed controllers shall be supplied under this Contract but installed under a separate contact.
Kitchen Speed Controller is installed under this Contract. The kitchen extract fan and supply AHUs shall be linked within kitchen and gas proving systems via the BEMs.

**10.6. Supply and Extract Grilles**

This Contract shall include for the supply and install grilles as detailed on the drawings.
All grilles shall be complete with opposed blade damper and concealed fixings. Grilles to be finished in a RAL colour to be specified by the architect prior to ordering. All grilles shall be sized to provide a maximum noise level of NC25. All grilles as manufactured by GDL/Gilberts.
The contractor shall ensure that each grille is provided with a plenum box.

**10.7. Access Doors**

Access doors shall be Actionair Access/Shield type or equivalent.

**10.8. Fire Dampers**

Where shown on the drawings the Sub Contractor shall supply and fit for all fire dampers an interlocking curtain type Fire Damper as Actionair Smoke Shield with 72°C fusible link.
Where ventilation ductwork passes through a fire compartment into a means of escape, a fire/smoke automatically controlled and thermally controlled damper must be provided.

**10.9. Electric Motors**

All units having a motor output power in excess of 0.37kW shall be supplied complete with starter.

**10.10. Earthing**

The ductwork installation shall be provided with all Earthing and Earth Bonding facilities required to comply with the 17th Edition of the Regulations for the Electrical Equipment of Buildings as published by the Institution of Electrical Engineers.

**10.11. Supply and Extract Ductwork**

Galvanised sheet metal ductwork shall be supplied and installed in strict accordance with Appendix F attached and with H.V.C.A. Specification DW.144 and as shown on the relevant drawings.
Ductwork pressurisation classification shall be low.
Ductwork shall have a minimum wall thickness of 0.8 mm; Duct tape shall not be used.
Balancing dampers shall be installed in all main branch ducts and where shown on the drawings.
Access doors local to the balancing dampers shall be installed in accordance with DW.144.
Extended arms shall be fitted where required to enable ease of operation from point of accessibility.
All dampers shall be fitted with open/shut indicators.
Ductwork supports shall be provided and installed to support all ductwork in accordance with the requirements stated in the relevant clause of Appendix F where applicable and DW/144.
Attenuation tape shall be fitted between ductwork and supports to prevent noise transmission. All support steelwork shall be given two coats of aluminium paint or similar (galvafroid).
All ductwork including grilles and fans shall be supported from structural steel or concrete so that it does not distort or sag under its own weight or where applicable exert undue loading on the ceiling structure. Sharp edges on corners of ductwork or supports shall not be permitted. All joints shall be sealed against leaks by using a soft non-setting compound. All ductwork shall be free from vibration and drumming when in service.
Duct bends shall have a centre line radius of 1.5 times the width of the duct.
Branch ducts shall not be taken off the main ducts at an angle greater than 45 degrees and all transition pieces shall not have an angle on any one side exceeding 7.5 degrees.
Detailed manufacturers drawings for each respective ductwork system shall be submitted in triplicate to the Consulting Engineers for approval prior to ductwork construction commencing:-
The Contractor shall note that the Contract Price shall include for the adjustment of grille layouts from that shown on the drawings to suit the installed ceiling and tile layout where applicable and at no extra cost to the Sub-Contract.
This Contract shall include for all co-ordination with the electrical contractor and other trades.

.01 Test Holes

Test holes of 25mm diameter, fitted with rubber, sealing grommets, shall be provided in the ductwork systems to enable air flow to be taken at the following positions:-

(a) Downstream of each balancing damper.
(b) All other ducts and branches to enable a complete pattern of all airflows in the system to be recorded.

Each test point shall have sufficient test holes to enable readings to be taken in any part of the duct cross section.

**Anti-vib mounts shall be installed on all equipment.**

**10.12. Flexible Duct Connections**

Flexible ductwork connections shall be permitted at the inlets and outlets to each grille, Extractor Fan Unit in ductwork assemblies to eliminate noise transmission to the systems ductwork as applicable to suit the Systems Installation shown.
Connections to spigots shall be by means of a worm drive clip arrangement and ends taped.
Flexible ductwork shall be provided where shown on the relevant drawings. Flexible ducting shall be adequately supported over its entire length to prevent sagging. Connections to spigots etc. shall be by means of a worm drive clip arrangement to provide an air tight installation.
Ductwork shall be of the type as Thermaflex suitable for Ventilation Systems.
Maximum permissible length of flexible ductwork shall be 0.5m.

**10.13. Terminal Plenum Boxes**

The Contractor shall provide and install all necessary plenum boxes with suitable spigots to permit ductwork connections to the respective grilles, registers etc.

**10.14. Painting**

All support steelwork for items of plant and ductwork shall be given two coats of rust inhibiting paint, followed by one undercoat and one finish coat of paint, followed by one undercoat and one finish coat of paint to approved colour scheme advised by the Architect / Interior Designer.

**10.15. Working Drawings**

The Contractor shall prepare detailed working drawings for all major installation works clearly indicating service routes, locations method of support, connections to all items of plant etc., and submit in triplicate to the Consulting Engineers for approval purposes prior to construction/installation commencing. It is imperative that the Contractor visits the premises at the time of preparation of these layout drawings to familiarise himself as to all structural conditions.

**10.16. Testing and Commissioning and Balancing**

The Contractor shall, on completion of the Mechanical Ventilation Systems Installation, fully balance, test and commission each of the respective systems, undertaking to carry out all necessary adjustments to main plant items, balancing of all extract diffusers registers and grilles etc., setting of all dampers and production of a composite schedule of all recorded air quantities, in triplicate, for all diffusers, registers and grilles etc., at each respective area.

The Contractor shall be required to verify all air quantities to the Consulting Engineers on completion of the balancing and commissioning of the System Installation and at a suitable time and date to be agreed. All necessary test equipment shall be provided by the Contractor for all such test purposes.

The local service agents for each respective item of plant, equipment and controls shall be present for the commissioning of the installation on occasions as necessary in the sole opinion of the Consulting Engineers to achieve installation performance results.

The System Installation shall be fully commissioned in accordance with the Chartered Institute of Building Services Engineers Code A.

**The Contractor shall employ a Specialist Commissioning Company to balance the installations and certification of all aspects provided within the Operation and Maintenance Manuals. The Contractor shall also allow for Seasonal commissioning to be provided within the contract.**

**10.17. Attendances**

It shall be the responsibility of the Contractor to provide and mark on site where necessary all attendances in respect to openings for fan units, grille locations at ceiling level and openings for ductwork where such ductwork passes through the structure. All such information shall be fully co-ordinated with the Main Contractor on site.

**10.18. Thermal Insulation**

Insulate all supply, fresh air inlet and roof level extract ductwork with flexible glass fibre mat with foil backing. Joints to be fully taped and PVC clamping bands fitted at 500mm centres.

Provide 25mm flexible mat foil backed Class 'O' insulation on all supply and extract ducts, 50mm on fresh air inlets. External ductworks shall be finally covered with oponal to ensure a waterproof finish.

**The contractor must ensure that all insulation provided is obtained from Saint-Gobain Isover as per the Green Guide for Insulation in compliance with the BREEAM assessment. Insulation to be A+ rated.**

**10.19. Duct Control Dampers**

Duct control dampers shall be as manufactured by Advanced Air Ltd., Model 1040 opposed blade type.

**10.20. Attenuators**

Provide and fit as shown on the relevant drawings attenuators as follows:-

All Extract Ductwork: Vent Axia - 600mm long to suit duct size. (On Vent Axia fans only).

Air Handling Units: Refer to AHU Clause in this Specification.

All attenuators shall ensure a noise rating of NR35 at the nearest room and a pressure drop of no more than 40Pa.

**10.21. Cross-Talk Attenuators**

The Contractors shall supply and install cross-talk attenuators where shown on the relevant drawing. Attenutators shall be as manufactured by Attenumate Ltd on other equivalent or approved

and shall have a length of 750mm with dimensions corresponding to the cross-talk duct area. Maximum pressure drop 25Pa

**10.22. Cleaning**

The Contractor shall employ a specialist duct cleaning company on completion of the ductwork installation and prior to handover, to thoroughly clean the ductwork of dust, dirt and debris. A certificate of duct cleaning shall be provided on completion of works.
The ventilation installations shall be left compliant to HVCA TR19.

## 11. PLUMBING SERVICES INSTALLATION

### 11.1. General

This Section of the Specification shall include for the supply, installation, testing and commissioning of the complete Plumbing Services Installation.
The unvented plumbing installation shall be carried out by a person holding a current Registered Operative Identity Card for the installation of unvented hot water storage systems issued by – the Association of Installers of Unvented Hot Water Storage Systems (England, Scotland and Northern Ireland), the Institute of Plumbing, the Construction Industry Training Board or an equivalent body.
The Plumbing Installation shall comprise the following:-

(a) Hot, Cold and Mains Water distribution pipework throughout the building.
(b) Sanitary Ware and Brassware Installation.
(c) Soils, Wastes and Overflows Installation.
(d) Thermal Insulation.

The entire plumbing installation shall be provided and installed to the satisfaction of the Consulting Engineers and be in accordance with the Specification and associated Drawings.

### 11.2. Domestic Hot Water Storage

The Contractor shall provide and install in the locations indicated on the relevant drawing, unvented calorifiers, as manufactured by Heatrea Sadia. The calorifiers shall be installed in accordance with the manufacturers recommendations and shall be to the complete satisfaction of the Consulting Engineers, all as detailed on the drawings.

### 11.3. Temperature Control Domestic Hot Water

The Domestic Hot Water System shall be fitted with temperature control equipment, all in accordance with that detailed under Plant Controls and Cabling arrangements specified later.

### 11.4. Domestic Hot Water Secondary Circulation Pumps

This Contract shall include for the supply and installation of Domestic Hot Water Circulating Pumps located in the return pipework as shown on the relevant drawings.
The pump shall be of the type as manufactured by Myson, or other equal and approved, listed as pipeline model

Pumps shall be complete with the following:-

(a) Screwed B.S.P. inlet and outlet connections.
(b) Totally enclosed motor suitable for operation on a 230V/50 Hz. supply of electricity.
(c) G.M. Impeller and G.M. body.
(d) Suitable starter as described under Plant Controls and Cabling later.
(e) Brass rectangular label giving manufacturers name, pump type, duty, head, H.P. voltage and pump reference, and fitted in a readable position.

Isolating valves shall be fitted on suction and discharge sides of the pump as shown on the drawings. Maximum pump shall be 1450 RPM.
Provide and hand over to the Employer for retention within the plantroom one pump of similar size and duty for each secondary pump.

### 11.5. Pipework and Fittings

All Hot, Cold, Internal Mains Water and Cold Feed Pipework shall be installed in light gauge copper tube to BS 2871, Part I, Table X. Pipework installed within the floor screed/voids shall be installed using a pipe-in-pipe system such as the Wirsbo Radipex System. Capillary fittings to BS 864, Part 2 shall be used throughout. Exposed pipework and fittings in the Kitchen shall be chrome plated.

### 11.6. Pipe Sleeves and Plates

Pipe sleeves, wall and floor plates shall be fitted in accordance with Appendix 'D'.
Where pipework passes through walls or floors, pipe sleeves and collars shall be provided and sealed with intumescent putty.

### 11.7. Pipe Supports

All pipe supports and brackets shall be installed in accordance with Appendix 'D'.

**11.8. Valves and Stopcocks**

All valves and stopcocks shall be fitted and installed where shown on the drawings and be in accordance with the relevant paragraphs of Appendix 'D' as and where applicable.
All stopcocks shall be installed in positions which are readily accessible and be grouped together in the same relative positions where possible.
Each supply to all items of sanitary ware shall be fitted with a 'Ball-o-fix' valve to provide local isolation of supplies.

**11.9. Automatic Air Eliminators**

Automatic Air Eliminators shall be provided and fitted where shown and at all high points in the system in accordance with Appendix D to suit pipe gradients.

**11.10. Drain Cocks**

Drain cocks shall be installed at all low points in accordance with the requirements of Appendix D.

**11.11. Labels**

Identification labels shall be provided as required in Appendix D.

**11.12. Testing and Commissioning**

The Contractor shall carry out all Testing and Commissioning as described in Appendix D.
The Contractor shall employ a Specialist Commissioning Company to balance the installations and certification of all aspects provided within the Operation and Maintenance Manuals. The Contractor shall also include for Seasonal commissioning to be provided within the contract.

**11.13. Balancing**

This Contract shall include for the Balancing of all pipework circuits included under this Section of this Specification.

**11.14. Attendances**

It shall be the responsibility of the Contractor to provide and mark on site where necessary all attendances in connection with the Plumbing Services Installation. All such information shall be fully co-ordinated with the Builder.

**11.15. Thermal Insulation**

Pipework shall be insulated generally in accordance with the relevant clause of Appendix 'E' where applicable and as follows:-

.01 All domestic hot, cold and mains water pipework within the plantroom shall be insulated with glass fibre sections in accordance with the requirements of Appendix 'E'. Insulation shall be cut back and neatly edge trimmed at all flanges and valves etc.

.02 Valves, unions and flanges shall be painted to an approved colour.

.03 All necessary painting shall be carried out in accordance with the relevant clauses of Appendix 'E' where applicable. All flanges and valves shall be painted colours consistent with colour code for respective circuits as detailed in relevant clauses of Appendices.

.04 The Contractor shall adequately protect all items of plant during application of insulation when painting is being carried out.

.05 All plumbing pipework where concealed and within ceiling voids shall be insulated with Rigid Glass Fibre Foil-Backed Class ‘O’ sections in accordance with Appendix E where applicable

.06 All valves, strainers and flanges within the plantroom shall be fitted with insulated Topo valve boxes.

**The contractor must ensure that all insulation provided is obtained from Saint-Gobain Isover as per the Green Guide for Insulation in compliance with the BREEAM assessment. Insulation to be A+ rated.**

**11.16. Balancing**

This Contract shall include for the balancing of all pipework circuits installed under this Section of the Specification.

**11.17. Water Conditioner**

The Contractor shall supply and install a water conditioner as Hydromag electromagnetic water conditioning unit as indicated on the schematic drawings.

The unit shall be a DN42, as obtained from Hydrotec UK tel – 01494796040

**11.18. Kitchen Installation**

The Contractor shall supply and install on all kitchen appliances double regulating valves to avoid cross flow between cold and hot water outlets.

**11.19. Water Isolation**

The Contractor shall supply and install a water isolation facilities to both toilet areas as per BREEAM requirements. The installation shall consist of panel, plumbing motorised isolation valves and proximity detection as per AquaPIR Automatic Water Supply Shut-off by Aqualeak Detection Ltd.

**11.20. Disinfection**

All Hot, Cold and Mains water pipework from the point of connection on the local water authority mains shall, before regular use, be disinfected in accordance with the procedure detailed in clause 13.9 of British Standard 6700: 1987 ' Design Installation, Testing and Maintenance of Services supplying water for domestic use within buildings and their curtilages' or as required by the Local Authority. Disinfection shall be carried out and a certificate of disinfection issued by an approved specialist.

**11.21. Sanitary Ware**

The Contractor shall include for the supply, erection, connection and setting to work of all items of Sanitary Ware. All protecting paper etc. shall be removed and each item left in a clean condition to the satisfaction of the Consulting Engineers.
All brackets etc. shall be fixed by means of suitably sized brass wood screws and plugs. All chromium plate brackets shall be fixed by means of chromium plated brass screws and plugs. Plugs shall be made from either plastic or aluminium. Plugs made from wood or fibre will not be accepted.
All sanitary ware shall be colour white and as manufactured by Twyfords or Armitage Ltd. unless otherwise stated.

**11.22. Pressure Reducing Valves**

This Contract shall include for the supply and installation of pressure reducing valves on the incoming mains water supply as manufactured by Messrs Honeywell Ref D15 Flanged Pressure Reducing Valve, size as indicated on drawing.
Pressure reducing valves shall be provided to all branch pipework connections as Reliance Water Controls, 320 Easiset Pressure Reducing Valve type brass construction, nickel plated finish and nitrile seals. Max supply pressure 16 bar, Minimum outlet pressure 1.5 bar, suitable for water c\w pressure gauge connections, fully adjustable for on-site preset to 2.5 bar.
Thermostatic mixing valve as Reliance Water Controls ref Heatguard TMV2 set at 43oC, adjustable type between 35$^{o}$C and 60$^{o}$C.
Double check valves to be installed as per schematic details.
All appliances shall be installed as manufacturer's recommendations.

**11.23. Grease Traps- by others**

The Contractor shall make allowance for drainage connections to grease traps which will be provided and install by others. The grease trap shall integrate into the kitchen equipment and liaison shall be required between the mechanical contractor and the provider of the kitchen equipment.

**11.24. Soils, Wastes and Overflow Pipework**

Soils pipework shall generally be installed in uP.V.C. of type as manufactured by Messrs. Unidare Engineering, Marley, Hepworth or other equal and approved, unless otherwise stated. Waste pipework within the Kitchen shall be installed in chrome plated copper.
W.C. overflows shall be internal overflow type.
Where pipework is exposed chromium plated pipework shall be used, including traps and fittings.

The Contractor shall be responsible for the making of all connections as required to faucets left at Ground Floor Level.
Cleaning/rodding eyes shall be fitted to all waste pipe bends and soil float ends.
Cleaning doors shall be fitted at the base of each vertical stack in an accessible location.
At site works stage of the Contract, the Mechanical Services Contractor shall confirm the exact location of all Builder's Floor faucets to the Main Contractor.
Expansion arrangements on uP.V.C. pipework shall be strictly in a accordance with the Manufacturer's recommendations, together with those indicated in the 'Institute of Plumbing' Booklet, Guide to the installation of uP.V.C. Soil Systems.
The Contractor shall thoroughly clean and test all soils and waste stacks and connections prior to handing over.
Contractor to confirm in writing to the Consulting Engineers that all cleaning and testing has been carried out in full.
Where indicated on the relevant drawings soil vent stacks shall terminate in the roof void with 'Durgo' Air Admittance Valves.

**11.25. Fire Protection Measures**

The Contractor shall provide and install fire sleeves as manufactured by Dufaylite Ltd., or other equal and approved on all soils and waste pipework passing through intermediate floor slabs and fire walls. Fire sleeves shall be fitted to pipes of dia 35mm and above. Fire sleeves shall have a minimum of 1 hour fire resistance.

## 12. NATURAL GAS INSTALLATION

### 12.1. General

This contract shall include for the supply, installation, testing and commissioning of the complete Gas Installation all as indicated on the relevant drawings and as detailed hereafter.
The entire installation as shown and as specified hereafter shall be provided and installed to the entire satisfaction of the Consulting Engineers and strictly in accordance with current Legislation and Health and Safety Executive Codes of Practice.
Work on gas systems should only be carried out by persons qualified under the GSR scheme, and shall be in accordance with all 'GSR' Regulations.

### 12.2. Incoming Gas Supply

A new gas installation from the centralised gas meter room shall be supplied to the unit by the Landlord. The new gas pipework shall commence from the entry point to the unit.
All external gas pipework, gas regulators and gas meters shall be supplied and installed by the local utility company via the Landlord to the point of entry to the unit. Work under this contract shall begin on the inlet within the unit.
It shall be the Contractors responsibility to conduct all negotiations and contacts with the local utility company via the Landlord as required to enable provision of the new gas supply in accordance with the main contract programme of works.

### 12.3. Gas Pipework and Fittings

Gas pipework shall be in heavyweight steel pipework to BS1387, with welded joints throughout.

### 12.4. Supports

The whole of the Gas pipework installation shall be securely bracketed, clipped or hung.

### 12.5. Valves

Gas valves where shown on the drawing shall be screwed or flanged suitable for a minimum test pressure of 7 Bar.
The valves shall be forged steel lockable quarter turn ballvalve to BS5351 1976.

### 12.6. Identification

Identification generally in accordance with BS 1710, identification to be on pipework and at each valve.
Identification figures, letters, arrows etc., to be printed white on clear vinyl background.
Manufacturer - Hodgson and Hodgson Ltd. clear vinyl.

### 12.7. Notices

Provide adequate warning notices 400mm square in traffolyte, at each gas valve.

## 13. SPRINKLER INSTALLATION

### General

The works consist of supply, delivery and erection of all material necessary to provide a complete automatic sprinkler installation in accordance with the current edition of the LPC 'Rules for Automatic Sprinkler Installation' and the requirements of the insurance company.
The sprinkler contractor will be required to obtain approval from building control/fire officer, Landlord and the clients insurance company for his installation.
It shall be clearly stated the number of heads he proposes to install within his tender price.
All equipment, including the installation of control valves, sprinkler heads, pipework hangers, pressure switches etc shall be in accordance with the LPC approved material.
All sprinkler contractors must be certified sprinkler design and installers authorised to certificate automatic sprinkler installations conforming to the LPC Rules for Automatic Sprinkler Installation incorporating BS 5306 Part 2.
A copy of certificates of produce conformity and approved installer to be submitted with sprinkler tender.
The contractor is required to visit the site to view the capped branch locations before submitting his tender.
The contractor shall connect to an existing Landlord Fed supplies as indicated. Under this contract, the sprinkler installer shall provide and install a monitoring valve and flow switch on each level.

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The installation must be carried out in line with the programme produced by the main contractor but also in accordance with BS Code of Practice BS 5306 Part 2 (1990) 'Sprinkler Installation'
The complete installation must be offered for inspection to the consulting engineer / fire authority / insurance company engineer / Landlord prior to the handover and all tests must be notified to the above parties in advance to ensure that all those required to be present at a commissioning test have adequate notice.
For this purpose, we anticipate one weeks' notice as being a minimum.
A full commissioning and testing of the installation shall be carried out prior to the final offer of inspection and handover by the sprinkler contractor.
In line with the LPC requirements, the successful contractor will be responsible for his own design and he must therefore include all items and works necessary to leave the installation complete as part of his tender as no additional costs will be accepted by the main contractor/client because of changes within the specialist (sprinkler) contractor design.
The sprinkler contractor will be expected to liaise closely with the Landlord, electrical and mechanical contractors with regards to the positions of pipes, ducts, grilles, light fittings, smoke detectors etc, and prepare fully detailed drawings to suit.
Final agreements are necessary with the other sub-contractors but for the purpose of this tender, the sprinkler contractor shall assume that his secondary protection will run within the lines of lights and located symmetrically.
The low-level protection must be uniform for a good visual appearance.
The contractor shall be aware that some front of house areas has exposed services, with ceiling being provided primarily in back of house areas as indicated on the drawings.

### 13.1. Pipework and Fittings

Sprinkler pipework and fittings shall be supplied and installed in accordance with section 5 of the BS 5306 Part 2.

All joints shall be treated with a suitable rust inhibitor and all pipework shall be delivered with a black finish.
Pipework supports shall generally be to BS 5306 Part 2 as a minimum standard for supporting intervals.
Recommendations of the LPC shall be taken into account. With regards to painting of pipework, the contractor shall allow within his tender for patch priming all pipework that is damaged either during erection or during storage on site and for this purpose he shall make his own arrangements for storing his pipe in a safe and dry manner.
The contractor is required to wire brush, patch prime and apply two coats of black paint to any damaged surfaces or made joints on the complete sprinkler installation.

**Protection Required**

For general information and for the purpose of tendering the contractor shall assume that primary and secondary protection is required to back of house areas and primary protection for front of house areas, subject to ceiling depths.

The contractor should also note:

1. Sprinkler heads within the plantroom & storage areas shall be protected by wire guards and additional supports will be provided.
2. Concealed heads for ceilings shall be provided with split connections to enable them to be fitted at a later date after the ceiling is complete.

**Specified Materials**

The contractor's attention is drawn to the fact that he shall only use LPC approved materials.

All equipment specified by the contractor within his design must comply with this requirement. It will not be acceptable to use equipment that is not LPC approved.

The contractor shall be required to obtain clearance from the insurance Company / Fire Authority that the installation will be of an acceptable level. Should this approval not be obtained from either party named, then he will be required to make the alterations at his own cost.

**Description of the Work**

Provide a complete sprinkler installation throughout the Unit for Streat Markets.

The sprinkler system shall be provided to accommodate the mechanical and electrical services systems being installed. This contract shall include for the adjustment of sprinkler heads and pipework to achieve full co-ordination with these other services.

The installation of the automatic sprinkler system shall be in accordance with the latest Edition of the rules of the Loss Prevention Council, BS5306 and LPC Bulletins for the protection of premises from fire.

In the event of instructions to proceed with the installation the contractor shall prepare accurate detailed pipework installation drawings and pressure loss calculations and submit them to the Engineer and to the Insurance Company/Landlord and any other persons concerned for approval before proceeding with erection of the system.

**Materials**

Sprinkler pipes will be mild steel to B.S. 1387 and sized in accordance with the LPC Rules Galvanised Heavy Grade. The pipes will be screwed to B.S. 21 pipe threads. Fittings will be malleable or cast iron.

The installation shall include for brackets, hangers and accessories necessary for the adequate fixing of the pipework.

## 13.2. Sprinkler Heads

All sprinkler heads must be of an approved make and type and must be erected on site and unchanged from the condition which they left the manufacturers works. Heads shall be type 'A'.

The contractor shall ensure that the fusing temperatures will be in line with LPC requirements for a quick response installation.

Where secondary installations are being installed, then the contractor shall allow for fitting these at a later date in conjunction with the ceiling contractor.

**All primary and secondary heads in back of house areas to be white (RAL 9010)**

**All primary sprinkler heads within ground, and mezzanine floor as well as bar and toilet areas at basement -1 to be black – exact RAL to be confirmed**

Flush mounted heads to be used in all front of house areas and high temperature heads to be used in all kitchen areas.

## 13.3. Commissioning, Testing and Other Quality Checks

The contractor is required to carry out all commissioning, testing and quality checks required under good practice and detailed in the LPC Rules.

Prior notice must be given to the consultant before any tests are carried out and this notice shall not be less than one week prior to the proposed tests. The contractor shall allow for draining down all systems after the work is complete and thoroughly flush the systems out prior to final handover.

It is the contractors responsibility to hand over to the consulting engineer on behalf of the client a fully tested and safe installation and it is the contractors responsibility to carry out all tests he deems necessary to ensure that this is achieved.
The contractor shall carry out his own pre-commissioning tests prior to offering the system to the consulting engineer.
Should the consulting engineer be involved in aborted time during the commissioning then this time will be charged to the contractor and deducted from his final account.
Demonstrations will be required prior to handover that the system fully conforms to LPC requirements. This shall be demonstrated to the architect, consulting engineer, client insurers/Landlord, fire authority and other local authority, as necessary.
On completion of the installation and prior to connection to the Landlord supplies, the contractor shall provide a copy of the LPS 1048 Certificates as necessary.

**13.4. Design Standards**

The complete sprinkler installation shall be designed and installed in accordance with the LPC (Loss Prevention Council) BS 5306 Part 2, Ordinary Hazard Group III Risk, Wet Pipe System (i.e. no area to be subject to freezing) pipe-table diameters, Life Safety System.

## 14. PLANT CONTROLS AND CABLING INSTALLATION

### 14.1. General

This Section of the Specification shall cover the design supply, installation, testing and commissioning of a complete Plant Controls Installation associated with the heating, cooling, plumbing, and ventilation.

The scope work shall include the development of a control strategy for all the devices / items of plant as identified on the drawings.

The mechanical contractor shall engage the following contractor to design / supply and install a Trend BEMS control and system complete with MCC controllers:

**Building Technology Systems Limited**
234 Europa Boulevard,
Gemini Business Park,
Warrington, Cheshire
WA5 7TN.
Contact: Mr Dean Brookes
01925 419 416

Inclusive of all sensor, controllers, actuated valves, inverters and the like.

Provision of other Plant controllers housed with suitable enclosure IQeco35 and associated control devices.

All control cabling to be provided under this contract.

Front end graphical interface to BEMS system.

### 14.2. Scope of works

To supply, commission and install the Plantroom MCP (Trend controller, Network Display) serving the following equipment.

- Chillers CHL.01, 02, 03, 04 (Power by others), assume Hardwired controls along with a BACnet interface giving BMS flow and return temperatures of CHW and CDW.
- Power (max 5.5kW) and controls associated with CDW Pumpset P.1 (Inverters supplied by others) (System Flow Temperature, Pump Flow Monitoring)
- Power (max 5.5kW) and controls associated with CDW Pumpset P.2 (Inverters supplied by others) (System Flow Temperature, Pump Flow Monitoring)
- Power (max 5.5kW) and controls associated with CDW Pumpset P.3 (Inverters supplied by others) (System Flow Temperature, Pump Flow Monitoring)
- Power (max 5.5kW) and controls associated with CHW Pumpset P.4 (Inverters supplied by others) (System Flow Temperature, Pump Flow Monitoring)
- Power (max 5.5kW) and controls associated with LTHW Pumpset P.5 (Inverters supplied by others) (System Flow Temperature, Pump Flow Monitoring)
- Interface to 5No Heat Pumps system controllers for timeclock and temperature adjust (all controls associated with heat pumps by others)
- Power/monitoring of EF.1 (assume it has its own inbuilt controller)
- Monitoring of Primary CDW Flow and Rtn Temps
- Power/Control of CHW, CDW and LTHW Pressurisation Units
- Kitchen Gas Safety Interlock, solenoid valves, push buttons and air flow interlocks
- Monitoring of 2No water meter, 2No gas meters, 2 No heatmeters and 16No elec meters
- Power and controls associated with DHWS Calorifer
- Power to Immersion Heater
- Power and controls associated with DHW Return Pumpset

- All controls associated with the AHU.01 (duct temp, space temp, DP switches, CHW & LTHW Valves/actuators and damper actuators)
- All controls associated with the AHU .02 (duct temp, space temp, DP switches, CHW & LTHW Valves/actuators and damper actuators)
- All controls associated with the AHU .03 (duct temp, space temp, DP switches, CHW & LTHW Valves/actuators and damper actuators)

**14.3. Plantroom Control Panel**

This Contract shall include for the supply, installation, testing, and commissioning of wall mounted metal clad control panels arranged to provide the equipment.

The Controls System shall be manufactured by Trend Controls and shall be supplied and commissioned by Building Technology Systems Limited – 01925 419416

**14.4. Isolating Switches**

There shall be surface mounting metalclad units phased and rated as indicated on the drawings each having an enclosure fabricated from sheet metal, rust-proofed and finished grey stove enamel. The access door shall be provided with a front operated handle complete with padlocking facility.

**14.5. Control Panel Construction**

The Control Panel previously referred to shall be constructed using a mild steel angle welded frame, clad using mild steel sheet of a suitable gauge. The top and bottom panels of the Control Panel shall be removable for drilling purposes.

The panel shall be rust-proofed, primed twice and colour finished to B.S. colour 557 - light orange.

Should the panel exceed 610 mm width, double doors shall be provided. The panel doors shall be interlocked by means of a 'clutch' pattern mains isolating switch so that the doors shall be locked 'closed; when the isolating switch is in the 'ON' position. Panel doors shall have returned edges bevelled and corners welded. Door hinges shall be concealed and door fastenings shall be of the 'Zuss' pattern requiring a half turn to lock.

The Control Panel shall be provided with a 'Panel Alive' indicating lamp.
In addition to all equipment required to give the control functions referred to here before, the panel shall be provided with all necessary P.V.C. insulated internal cabling, fusing and cable terminations to enable the control equipment to operate to the satisfaction of the Consulting Engineers.

Three spare fuses of each current rating used shall be provided and fitted in spring steel retaining clips fixed to the interior of the Control Panel. On the inside of the panel door shall be affixed a fuse identification diagram.

Cable terminal blocks shall be of the 'Klippon' pattern suitable for the currents to be handled and labelled to indicate the terminal number.

Within the panel shall be provided a compartment to house one print of the Control System Wiring Diagram including the external cabling arrangements from the panel together with manufacturer's Wiring Diagrams of pumps, motorised valves and other ancillary equipment. These prints and diagrams shall be provided under this Contract.

The Panel Manufacturer shall carefully protect the external finish of the Panel during transit from Works to Site and shall, before off-loading of the Panel from transport, obtain a signed delivery note from the Contractor stating that the Panel Finish is undamaged. Thereafter the Contractor shall be responsible for maintaining the external finish and for making good any defects which may occur from any cause whatsoever.

**14.6. Control Panel Wiring Diagram**

The Contractor shall provide the Engineer with duplicate prints of the manufacturers drawing showing the construction and wiring details of the Control Panel. Until written approval of the drawing is issued by the Consulting Engineer, manufacture of the panel shall not commence. The wiring diagram shall show all external cabling to the Control Panel.

**14.7. Motor Starters**

Each Motor Starter required within the Panel shall be of the coil operated pattern capable of switching the load connected thereto, and of providing suitable magnetic overload and short circuit protection for the motor which it controls.

The motor starters shall be manufactured by M.E.M. Ltd., Simplex G.E. Ltd., or Crabtree Electrical Industries Ltd.

**12.7 Motor Inverters**

The MCC shall be complete with Vacon inverter drives (complete with Bacnet interfacing) for all fans and shall have full speed control.

**14.8. Rotary Switches**

These shall be of the 10/32 Amp, two or three position pattern suitable for panel mounting and be as manufactured by Messrs. U.K. Solenoid Ltd., Type B, Size 1, or other equal and approved.

**14.9. Insulated Rubber Mat**

This Sub Contract shall include for the provision and installation of a non-slip rubber mat a minimum of 8 mm deep and 900 mm wide which shall be installed on the floor for the complete length of each Control Panel.

**14.10. Labelling**

Labels in White/Black/White traffolyte shall be provided and fitted to each item of equipment. Labels shall be engraved in 6mm lettering. A schedule of labelling shall be prepared by the Contractor and submitted to the Consulting Engineer for approval.

**14.11. Suitability**

The entire installation shall be suitable for use on a 400/230 Volts, 50 Hz. a.c. supply of electricity.

**14.12. Positioning Mounting Heights**

The exact positioning and mounting heights of all equipment shall be finally agreed on site with the Superintending Officer.

**14.13. COMMISSIONING**

On completion of installation the control system shall be commissioned and a report issued showing settings and tests carried out. The Contractor shall employ a Specialist Commissioning Company to balance the installations and certification of all aspects provided within the Operation and Maintenance Manuals. The Contractor shall also allow for Seasonal commissioning to be provided within the contract.

## 15. FLUSHING REQUIREMENTS OF CONDENSE WATER, CHW AND LTHW INSTALLATIONS

### 15.1. General

The contractor shall flush the condense water, chilled water and LTHW installations of the fit-out as per the programme below, prior to connection to the Landlord installations.

ITEM / TASK

| | DAY | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DISCHARGE LICENCE AVAILABLE | | | | | | | | | | | | | | | | | | | | | | | | | |
| FINAL PIPEWORK PRESSURE TEST | | | | | | | | | | | | | | | | | | | | | | | | | |
| TAKE SAMPLE OF LANLDORDS SYSTEM (COND. WATER) | | | | | | | | | | | | | | | | | | | | | | | | | |
| RESULTS FROM LANDLORDS SYSTEM (COND.WATER) | | | | | | | | | | | | | | | | | | | | | | | | | |
| STATIC FLUSHING | | | | | | | | | | | | | | | | | | | | | | | | | |
| DYNAMIC FLUSHING | | | | | | | | | | | | | | | | | | | | | | | | | |
| DEGREASING | | | | | | | | | | | | | | | | | | | | | | | | | |
| BIOCIDE WASH | | | | | | | | | | | | | | | | | | | | | | | | | |
| BACKFLUSHING OF TERMINAL UNITS | | | | | | | | | | | | | | | | | | | | | | | | | |
| CORROSION INHIBITOR | | | | | | | | | | | | | | | | | | | | | | | | | |
| COLLECT SAMPLE OF SYSTEM | | | | | | | | | | | | | | | | | | | | | | | | | |
| ISSUE SAMPLE RESULTS | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEEK APPROVAL TO OPEN VALVE (COND. WATER) | | | | | | | | | | | | | | | | | | | | | | | | | |

## 16. PROVISIONAL SUMS

There shall be included in the appropriate space on the Lump Sum Form of Tender the following Provisional Sums;

| | | |
|---|---|---|
| 1.00 | Provisional Sum for Plant Controls | £70,000.00 |
| 2.00 | Provisional Sum for Sanitary Ware | £25,000.00 |
| 3.00 | Provisional Sum for Relocation of Existing Services | £7,500.00 |
| 4.00 | Acoustic Attenuation of Mechanical Plant | £15,000.00 |
| | TOTAL | £117,500.00 |

This Provisional Sum may be expended in whole, in part, or not at all at the sole discretion of the Consulting Engineers, and if the whole or any portion of the provisional sum has not been spent at the date of issue of the Certificates of final completion of the Contract, such amounts as have not been spent shall be deducted from the accepted contract price without having any effect on the rate of profitability of the remainder of the accepted contract price to the Contractor.

## 17. OPERATING AND MAINTENANCE MANUALS AND RECORD DRAWINGS

Before the installations are handed over to the client and before Practical Completion, the Contractor shall provide a complete Maintenance and Operating Instruction Manual for the total installation. A draft of the typewritten instructions shall be submitted to the client for approval. These instructions shall contain completion details relating to the operation, maintenance, lubrication and day to day running for every item of plant.

The manual is to comprise of the following sections:-

a. Index
b. Full description of systems, including operation philosophy.
c. Full description of each plant item
d. Start-up procedure
e. Shut-down procedure
f. Detailed daily, weekly, monthly and annual maintenance procedures
g. Fault finding and rectification procedures.
h. Full set of test certificates for:-
(i.) Plant
(ii.) Systems
i. Drawing list
j. Names and addresses and telephone numbers of all the suppliers of equipment on the Contract
k. Copies of all orders placed and identification of the vendor works reference for all equipment installed on the Contract.
l. A complete set of records detailing the commissioned performance of all systems installed within the building. All commissioning Reports as accepted must be countersigned by the Contractor's Representative and dated the day of Practical Completion.
m. Full list of all manufacturers' recommended spares for all plant installed under this Contract. Reference numbers are also to be supplied for all spares items.
When the draft operating instructions have been approved by the client, the Contractor shall prepare and issue to the client four complete copies suitably bound in hard-backed plastic covered binders with titles.

Prior to the date of the completion of the works, the Contractor shall submit to the client "as fitted" record drawings showing the whole of the works as installed.

This shall include the following:-

a. General arrangement drawings of all services to a scale of not less than 1:50.
b. Detailed layouts and sections of all Boiler Rooms, Plant Chambers, Tank Rooms and risers, and similar spaces to a scale of not less than 1:20.
c. The circuit diagrams of all electrically operated equipment.
d. Complete wiring diagrams, and/or pneumatic piping diagrams, of external connections between panels, thermostatic controls and starters.
e. Schedules of all equipment including valves, pumps, fans, etc.
f. All valve charts shall be prepared showing the complete system in diagrammatic form, and indicating all valves installed on the systems together with a number and a separate schedule listing the size, type and function of each valve.
g. All drawings shall be complete with commissioned duties added to each system.

The record drawings shall be prepared by a specialist from the marked-up prints used during the Contract, recording Work in Progress.

The drawing shall show the complete installation including the sizes and runs of all services, the precise location of all services which may be buried within the structure and those sections of any external distributing services which are laid solid in the ground. The positions of all underground electric, communication, cold water and gas service points at the entry to buildings, shall be clearly indicated, together with their depth and the locations of the service isolators.

Any special thermal or other protecting envelopes around services which are buried shall be clearly stated. The drawing shall include the geographical location and identification number of each circuit control valve or isolator in accordance with the labelling and circuit control diagrams. The drawing shall show the names of the manufacturers, model and type numbers, and all details of duty and rating of all items of plant including thermostatic control equipment.

A print of each of the composite "as fitted" circuit layout diagram shall be fixed securely to the inside of the hinged front of the main electrical and pneumatic control panels, as appropriate or in such other positions as may be agreed with the client and shall be protected by non-flammable transparent material. Where inadequate space exists the prints are to be suitably reduced in size.

The Contractor shall provide numbered disks suitably attached to all valves including isolating, regulating, control and other automatic valves and to all other indicated measuring or control devices, which shall be numbered in conjunction with the "as fitted" drawings.

The above sets of drawings and schedules shall be specially prepared for record purposes and the copies as finally provided to the client shall consist of two sets of white prints on paper and two copies of drawings on computer disc in CAD format.

In addition, the Contractor shall obtain and provide four sets of manufacturers' detailed drawings of all plant and equipment as may be appropriate. These drawings need not be prepared especially as record drawings but may be copies of the manufacturer's working drawings with suitable titles and reference number added.

Operating instructions and record drawings shall be agreed with the client. Record drawings are unlikely to be less in number and scope than the Contract drawings.

Final acceptance of completion of the works will not be made until all drawings and bound copies of maintenance and operating instructions are received and approved and test certificates and commissioning certificates issued.

## 18. WARRANTY

A Contractor shall provide 12 months full warranty and maintenance cover on all Mechanical services as installed. The warranty and maintenance shall run from date of practical completion as certified by the Project Manager.