

Space Studios - Phase 3

RIBA Stage 2 MEP Report

SS3-BHE-XX-XX-RP-N-1001

0048355

5 November 2021

Revision P02

Revision	Description	Issued by	Date	Checked
P01	Issued for Information	LW/YP	06/07/21	JW
P02	Stage 2 Revision	LW/YP	05/11/21	JW

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Contents

Executive Summary	6
MEP Basis of Design	7
2.1 Introduction	7
2.2 Standards and Regulations	7
2.3 Approach to Sustainable Design	7
2.4 External Design Criteria	7
2.5 Occupant Density	7
2.6 Internal Design Criteria	7
2.6.1 Internal Heat Gains through Occupancy – Office Areas	7
2.6.2 Internal Gains Through Lighting and Equipment	8
2.6.3 Duct Sizing Criteria	8
2.7 Fire Spread Control	8
2.8 Life Safety Systems	8
2.9 Design Criteria – Public Health Systems	8
2.9.1 Design Criteria	8
2.9.2 Cold Water Systems	8
2.9.3 Hot Water Systems	8
2.10 Design Criteria – Energy Performance Certificate	9
Utilities	10
3.1 Existing Utilities	10
3.2 Proposed Utilities	10
3.2.1 Gas	10
3.2.2 Water	10
3.2.3 Electric	10
3.2.4 Telecoms	10
Mechanical Systems	11
4.1 Introduction	11
4.2 Environmental Strategies	11
4.3 Ventilation	11

4.4	Space Heating	12	7.5	Roof Level Plant	20
4.5	Space Cooling	12	Appendix A – Basis of Design		21
4.6	Roof Plant Compound	13	Appendix B - MEP Sketch Pack		22
4.7	HVAC System Resilience	13	Appendix C - HVAC Systems Appraisal Design Note		23
4.8	BMS	13	Appendix D - Electrical Supply Options Design Note		24
Public Health Systems		15			
5.1	Introduction	15			
5.2	Cold Water	15			
5.3	Domestic Hot Water (DHW)	15			
5.4	Above Ground Drainage	15			
Electrical Systems		17			
6.1	Introduction	17			
6.2	Incoming Electrical Supply	17			
6.3	LV Distribution	17			
6.4	General Lighting	17			
6.5	Small Power	17			
6.6	Emergency Lighting	18			
6.7	External Lighting	18			
6.8	Fire Alarm	18			
6.9	Security	18			
6.9.1	CCTV	18			
6.9.2	Access Control	18			
6.9.3	Intruder Alarm	18			
6.10	Data	19			
6.11	Facilities for the Disabled	19			
6.12	Solar PV	19			
Access and Maintenance		20			
7.1	Introduction	20			
7.2	Serviced Fixed to Soffit	20			
7.3	Services within Risers	20			
7.4	Ground Floor Plant	20			

Glossary

Term	Definition
AHU	Air Handling Unit
ASHP	Air Source Heat Pump
AV	Audio Visual
BCO	British Council of Offices
BMS	Building Management System
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
BRUKL	Building Regulations United Kingdom Part L
BS	British Standard
BSRIA	Building Services Research and Information Association
BT	British Telecom
CCTV	Closed Circuit Television
CIBSE	Chartered Institution of Building Services Engineers
DDA	Disability Discrimination Act
DX	Direct Expansion
EN	European Norm
ENWL	Electricity North West Ltd
EPC	Energy Performance Certificate
GSHP	Ground Source Heat Pump
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
ICT	Information Communication Technology
IET	Institution of Engineering and Technology
ILP	Institute of Lighting Professionals
IOP	Institute of Plumbing
LED	Light Emitting Diode
LSF	Low Smoke and Fume
LV	Low Voltage
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MEP	Mechanical, Electrical and Public Health
MVHR	Mechanical Ventilation Heat Recovery
PFC	Power Factor Correction
PV	Photovoltaic
SLL	Society of Light and Lighting
SWA	Steel Wired Armour
UU	United Utilities
VAV	Variable Air Volume
VRF	Variable Refrigerant Flow
XLPE	Cross Linked Polyethylene

Executive Summary

This report outlines the approach for the mechanical, electrical and public health services for the proposed Phase 3 studios on the existing Space Studios site in West Gorton, Manchester.

During RIBA Stage 2 the focus has been on the appraisal of available strategies to be used within the building to deliver heating, cooling and ventilation. Buro Happold engaged with Manchester Creative Digital Assets (MCDA) to review the systems appraisal, and the stage 2 design development has been formed on the conclusions of these discussions.

Key design elements include:

- Designing the building to create a comfortable and practical workspace for occupants of the studios, offices and workshop areas.
- Providing energy efficient and low carbon solutions that minimise operating cost and contribute to delivering an exemplar sustainable building for the Space Studios site.
- Providing a services design which allows future flexibility within the office areas.
- Prioritising the efficient design for the building to achieve the target budget requirement.
- Providing robust resilience of services to mitigate any interruptions to building operation.
- Providing the services that can adapt to technological needs of the future without expensive reconstruction works.
- Ensuring plant and equipment can be accessed and maintained in a safe and efficient manner.

A heating, ventilation and air conditioning (HVAC) system options appraisal has been carried out during the stage 2 design period, to assess a range of available strategies and their suitability to the building, and the client. This process was conducted against the three main area types within the proposed building: these being stages, offices and workshops. A description of this appraisal and its conclusions can be found within 'appendix C' of the report.

MEP Basis of Design

2.1 Introduction

The basis of design section of this report has been prepared to address the key design elements of the MEP engineering systems specified for the project. This section shall provide the following:

- Standards and Regulations complied with.
- Design criteria on which the design development shall be based.
- Specify the primary design standards and specifications used.
- Specify the design input assumptions used on the project.
- Enable Client engagement on key strategies and key decisions.

2.2 Standards and Regulations

The MEP System design will be based on British design Standards and, where relevant and explicitly stated, other relevant standards and regulations:

- The Building Regulations Part L2A Conservation of Fuel and Power 2013
- BS EN British Standards and Codes of Practice
- BS 7671 Requirements for Electrical Installations –IET wiring Regulations 18th Edition
- British Council for Offices (BCO)
- British Standard Institute (BSI)
- CIBSE Chartered Institution of Building Services Engineers Guides A through H
- CIBSE Guides to Current Practice and Technical Memoranda
- CIBSE SLL Codes and Guides for Interior and Exterior Lighting
- ECA Electrical Contractors Association
- Heating and Ventilating Contractor’s Association (HVCA)
- Institute of Plumbing (IoP)
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Weather data only.
- National Fire Protection Association (NFPA).

2.3 Approach to Sustainable Design

Firstly, the sustainable design approach has been ‘fabric first’ in which building orientation, fabric U-values and air permeability rates have been targeted to help minimise the carbon impact of the new building. Following this, the intended MEP systems have been concluded following a design appraisal, in which carbon impact was a prioritised considered factor.

MCC’s ‘Low Carbon Build Standards’ has been referred to during the stage 2 design process and has subsequently driven the specification of electric heat pumps as the sole heat generation method for the site.

Systems have been reviewed with not only an emphasis on equipment energy efficiency, but also the system’s controllability and their potential for accurate demand control. With the ongoing advancements of decarbonising the electricity supply network, the design approach has been to favour electric power over traditional fossil fuelled systems. For this reason, it is not currently proposed to provide a natural gas supply to the new Phase 3 development.

In addition to this, a roof PV array has been specified and sized to deliver approximately 20% of the proposed building’s annual energy consumption, in line with MCC’s ‘Low Carbon Build Standards’.

2.4 External Design Criteria

Location and topography:

- Longitude: 53° 28'12N
- Latitude: 2° 11'54W
- Altitude: 66m above sea level

Based on climatic analysis, the selected design parameters for winter and summer design are as highlighted in the table below (from CIBSE Guide A). Conditions are based on those in the 0.4 percentile, i.e. they will typically be exceeded for only 0.4% of the year. As the peak loads exists only for a small duration and the building operates at part load for most of the year, systems will be sized for peak loads but where possible plant will be selected in modules to ensure energy efficiency at part load operation.

Outdoor unit design operating conditions, based on manufacturer literature, is highlighted for conditions where temperature correction values have a minimum of 1.0 i.e. the unit nameplate kW performance is met. The maximum and minimum operating conditions for continuous operation as per manufacturer literature have also been highlighted but a reduced performance is expected at these extremities.

Table 0—1 External Design Conditions

External Conditions for Loading Calculations		
Season	Criteria	Design Temperature
Summer	Peak Cooling Load	25.5°C dry bulb
Winter	Peak Heating Load	-4.5°C dry bulb
Outdoor Unit Operating Conditions		
Season	Criteria	Design Temperature
Summer	Outdoor Temperature Correction	35°C DB (Maximum for unit continuous operation 50°C DB)
Winter	Outdoor Temperature Correction	-5°C DB (Minimum for unit continuous operation -15°C WB)

2.5 Occupant Density

The MEP systems within the building are to be designed to meet the environmental conditions outlined within this report. For breakdown of occupant densities per area, please see appendix A of this report.

2.6 Internal Design Criteria

The internal design criteria detailed in Appendix A of this report will be used to size all items of plant and equipment.

2.6.1 Internal Heat Gains through Occupancy – Office Areas

The Sensible and latent heat emitted by people varies on ambient temperatures and the activity level. Based on an indoor design set point of approximately 24°C and 50% RH the allowance for heat gain from people for different space types has been listed below.

Table 0—2 Sensible and Latent Occupancy Heat Gains

Space	Sensible (W/Person)	Latent (W/Person)	Source
Office	80	60	CIBSE Guide A Section 6 Table 6.3

2.6.2 Internal Gains Through Lighting and Equipment

The following criteria for internal heat gains will be used when calculating building heat gains for various areas;

Table 0—3 Equipment and Lighting Related Internal Heat Gains

Space	Lighting Load (W/m²)	Equipment Load (W/m²)	Source
Offices	10	20	CIBSE Guide A Section 6 Table 6.2

2.6.3 Duct Sizing Criteria

A large part of total energy consumption within a building is attributed to the fans that move air through the ducts. The fan energy required to move the air through any duct system varies as the velocity of flow is changed. As the velocity increases, so does the static pressure that the fan needs to overcome and hence the energy usage increases. To reduce the velocity of flow the duct sizes may be increased, resulting in increased spatial requirements, and added cost of more duct material, a balance must therefore be established through the optimisation of duct sizes. The parameters listed within the table below have been used for optimal sizing of ducts.

Ductwork systems are to be designed to limit the level of noise generated as indicated in the following tables, as well as to facilitate easy balancing. Low pressure ductwork systems are to be sized by equal friction method with maximum pressure drop of ~1Pa/m and the velocities shall be as per the table below in order to minimise noise generation.

Table 0—4 Low Pressure Ductwork Limiting Velocities for General Distribution

Aspect Ratio <= 4:1		
Location	Velocity (m/s)	Source
Primary duct in plant areas	4	Buro Happold
Distribution within Stages	2*	Buro Happold
Main horizontal distribution offices	4	Buro Happold
Final run out to terminal offices	2.5	Buro Happold

*due to the noise sensitive nature of the stage spaces, it is currently proposed that the ventilation duct velocities should not exceed 2 in these areas.

Enhanced levels of attenuation and acoustic insulation shall be applied to all ductwork serving the stage areas, to mitigate any risk of noise transmission between the lower roof plant enclosure and stage areas.

2.7 Fire Spread Control

The fire rating of the barriers or compartments will be preserved from being compromised in the event of fire, all of the services that penetrate fire compartments will be designed and constructed to ensure that fire rating remains as specified in the fire strategy. The fire stopping is to be a design such that acoustic performance of the breached structure is not altered.

2.8 Life Safety Systems

Firefighting systems, smoke control & managements, fire alarm, voice alarm, emergency lighting and systems integrations shall be according to CIBSE codes and recommendations from the fire consultant.

All equipment, materials and system used for life safety shall be LPC (where applicable) listed and shall be approved and registered with the fire authorities and local authority building controls.

2.9 Design Criteria – Public Health Systems

2.9.1 Design Criteria

Public health services shall be designed, but not limited, to the following:

- The Building Regulations
- CIBSE Design Guides
- British and European Standards
- CIBSE and BSRIA Design & Commissioning Codes
- Plumbing Engineering Design Guide - Institution of Plumbing and Heating Guide
- HSE ‘The control of legionella bacteria in water systems’
- BREEAM Manual

2.9.2 Cold Water Systems

The cold water storage tank has been sized to provide 15mins of cold water at the peak calculated flow with the primary design intent to be its utilisation as a break tank.

Table 0—5 Cold Water Storage/ Break Tank Requirements

Building Type	Flow Rate	Storage Period	Storage
TV Studio/Office/Workshop	1.61l/s	15mins peak flow	1450l

2.9.3 Hot Water Systems

Hot water will be provided via instantaneous electric water heaters.

Table 0—6 Hot Water Draw Off Temperatures

Appliance	Temperature	Source	Remarks
Basin	43°C	IoP	Max temperature controlled by thermostatic mixing valve. Water temperature at draw of point shall be constant – PIR operated tap type.
Sink	Uncontrolled with max temperature less than 60°C		For sterilisation purpose

2.10 Design Criteria – Energy Performance Certificate

The following sets out the minimum key design performance criteria for building fabric standards and MEP systems. Further details are provided in the appendices.

Element	Values
Fabric	Wall – 0.18 W/m²k Ground floor slab - 0.15 W/m²k Roof (stage)- 0.15 W/m²k Roof (office)- 0.18 W/m²k Doors (industrial sliding) - 0.60 W/m²k Doors (industrial other) – 1.00 W/m²k Doors (industrial personal) – 1.80 W/m²k Glazing – 1.44 W/m²k (all office spaces are equipped with internal blinds) (g value – 0.40, light transmittance – 71%)
Air Tightness	3m³/m²h at 50Pa
Heating	Heating by VAV system (VRF served DX Coil within central AHU), terminal reheat using electric resistance
Cooling	Cooling by VAV system (VRF served DX Coil within central AHU)
DHW	Instantaneous electric point of use DHW generation for sinks and showers
Ventilation	Central Air Handling Unit SFP – 1.8 W/l/s Heat Recovery device – Thermal wheel 75% efficiency CO2 controlled variable speed fans
Lighting	All luminaire efficacy is assumed at 100lm/W All luminaires within 7.5m of a window opening have daylight dimming; All offices, maker and storage spaces have absence detection; All circulation and wet rooms have presence detection

Utilities

3.1 Existing Utilities

Buro Happold are currently awaiting findings of GPR surveys, to allow appraisal of works required to the existing utilities within the Phase 3 plot boundary.

3.2 Proposed Utilities

3.2.1 Gas

In line with Manchester City Council (MCC) ‘Low Carbon Build Standard’ it is not currently proposed that a gas supply will be provided to serve the Phase 3 development. This will contribute to the global effort to reduce reliance on fossil fuel supplies and therefore the carbon impact of building operations.

3.2.2 Water

The proposed studio will require a new mains potable water connection and, if the fire strategy necessitates in the next stages, an unmetered fire hydrant supply will be required to service the development. A fire hydrant local to the proposed Phase 3 studio has been identified in the existing Phase 2 documentation; however further analysis is required to determine its suitability to serve the proposed Phase 3 development.

The Phase 2 utilities layouts have been reviewed and the option to connect to the existing water supply on site was assessed. Following review, it has been determined that a new supply would be most cost effective as this would require the least amount of trenching and would avoid the need to disturb existing ground surfaces. It would also avoid disruption to the existing Phase 2 stages and avoid the need to chlorinate the existing systems, which would be necessary if connection was made to extend the supply.

An application for a new water connection will be made to United Utilities during RIBA Stage 3.

3.2.3 Electric

A design note has been appended to this report to assess the option of a new utility supply from ENWL opposed to providing a connection from the existing Phase 2 substation. Please refer to Appendix D of the report for further details.

At the time of writing, a quotation for a new supply is being produced by ENWL and the cost will conclude the final preferred option. It is currently anticipated that connection to the existing Phase 2 substation will be the most cost-effective option and therefore this is likely to be the solution developed as part of the RIBA Stage 3 design.

3.2.4 Telecoms

It is understood at this stage that telecoms provision will be from existing site infrastructure and no new Telecoms connection is required from offsite (i.e. BT Openreach). It is understood the main IT comms room will serve the new Phase 3 development utilising fibre connections, following a similar strategy to the Phase 2 building.

Mechanical Systems

4.1 Introduction

This section provides an overview of the environmental strategies in each area and the heating, ventilation and air conditioning (HVAC) system that are currently proposed to achieve these. Reference is made to the HVAC matrix appraisal which has been conducted during the RIBA Stage 2 design period. Please refer to Appendix C of this report for the design note giving commentary of this process and its summarised outcomes. The primary objective of this exercise was to identify the key requirements of MCDA and the proposed building and deliver proposals at RIBA Stage 2 which would meet these requirements and ultimately deliver the most sustainable options possible, whilst keeping within the client’s budget.

4.2 Environmental Strategies

A number of environmental strategies were appraised for each area type as part of the matrix appraisal exercise, the result of which concluded following a client engagement workshop with MCDA. The below figures provide a visual representation of the environmental strategies currently proposed for each of the area types within the Phase 3 studio block.

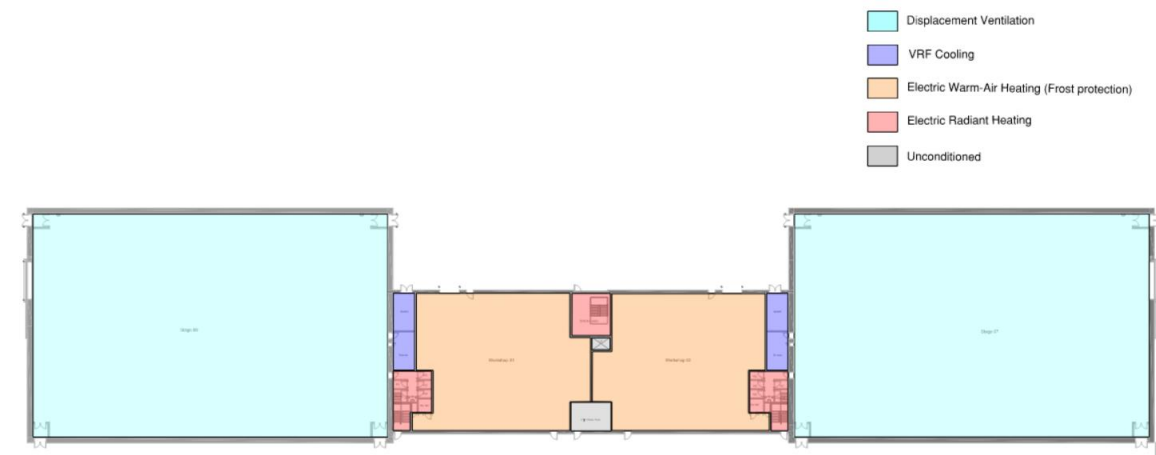


Figure 0-1 Ground Floor Environmental Strategies

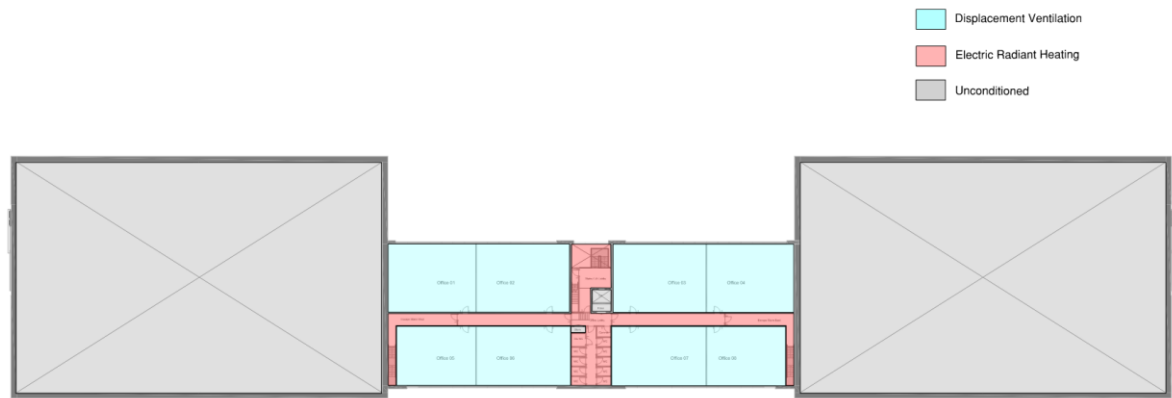


Figure 0-2 First Floor Environmental Strategies

4.3 Ventilation

Occupied spaces within the building will be provided with mechanical ventilation systems, providing conditioned outdoor supply air whilst simultaneously exhausting air from the space and recovering available energy. Due to the transient nature

of the circulation areas, it is not currently proposed for these to have any dedicated mechanical ventilation systems; instead, these areas shall rely on passive movement for air turnover.

Stage Areas

It is currently proposed that the ventilation of the stages is to be provided using displacement ventilation methods, by delivering the air at low level, directly to the occupied zone. As the air passes through the occupied zone, it shall rise in temperature and naturally rise through thermal buoyancy, before it is exhausted via louvres at high level.

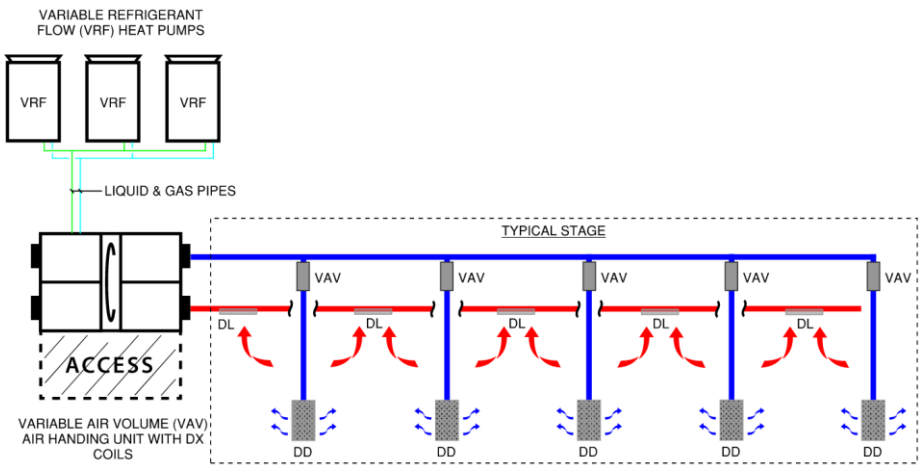


Figure 0-3 Stage Ventilation Schematic

The central air handling units (2No per stage) are proposed to be sited within the lower roof plant compound, adjacent to a bank of variable refrigerant flow (VRF) outdoor units which shall serve DX coils within the AHU’s for incoming air conditioning.

The intention is for this system to be Variable Air Volume (VAV), in order to maximise the operating efficiency of the system by allowing the fan speeds to turndown at lower demands.

This system shall also provide the heating and cooling requirements of the space, which shall be discussed in further detail in the following sections.

Office Areas

It is currently proposed to serve the first-floor office areas with VAV ventilation systems. This system type offers the benefit of ventilation, heating and cooling provision from air distribution alone, so there is no requirement for hydraulic distribution through the office zones. It should however be highlighted that VAV will require larger distribution ductwork than systems only providing air for ventilation purposes, as the required air volumes are higher to deliver the thermal requirements of the space, rather than just the fresh air requirements. However, these large air volumes will allow for increased levels of free cooling, when the external air temperature is lower than the desired internal room temperature.

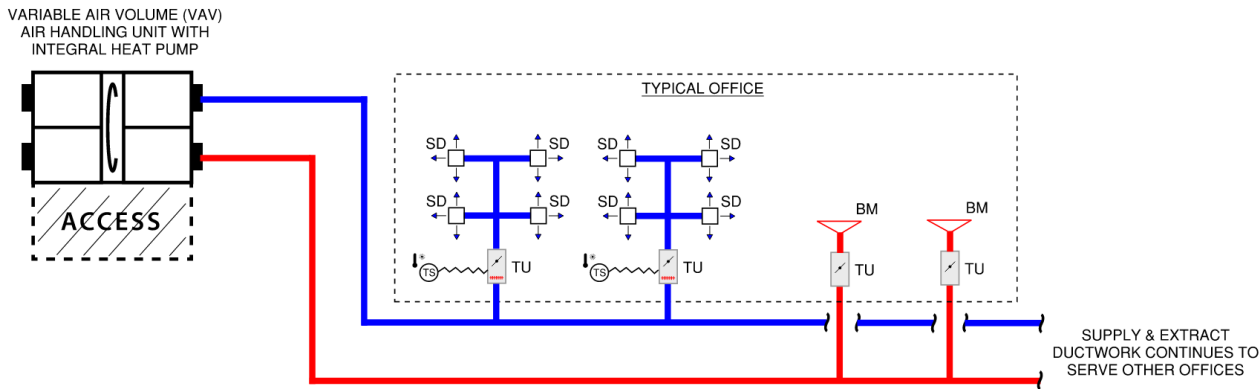


Figure 0-4 Office Ventilation Schematic

As indicated in the above figure, inline VAV terminal units within the office spaces will be linked to local air temperature sensors. The controls methodology is that the damper within the terminal units shall open and close, in response to the local room air temperature readings. The terminal units within the exhaust air ducts shall work in tandem with the supply air terminal units, to ensure balanced ventilation at all times.

For optimum operational performance, it is important that the specified VAV terminal units offer sufficient turndown, in the event of low cooling or heating demands. It is also important that the supply air diffusers offer integral thermal actuation, in order to avoid 'dumping' at low chilled air supply rates, which can cause uncomfortable draughts across occupants below the diffusers.

It is currently proposed that the terminal units shall be complete with integral electrical heating elements, in order to offer 'reheat' in the event that there are varying cooling demands across the occupied office zones. Hydraulic options are available, however provided appropriate supply air temperature reset control is implemented we envisage that these devices will rarely activate, and so a hydraulic heat generation and distribution is not likely to provide sufficient energy saving to justify the additional capital cost when compared to electric resistance heating.

Workshops

During the client engagement exercise, it was highlighted that the existing workshops do not contain dedicated mechanical ventilation systems, and if tenants require specialist exhaust ventilation, then this is generally provided third-party as a temporary system in place during their tenure only.

There are full height external doors present in the new workshops, and due to the active nature of these areas, it is envisaged that the regular opening and closing of these doors will deliver sufficient levels of natural ventilation to maintain the required level of indoor air quality.

Toilets

Toilets are proposed to be provided with dedicated twin-extract fan systems, exhausting through façade louvres at ground level and to the above roof space from first floor level. Door transfer grilles shall be present in order to allow for make-up air to the toilet areas, therefore mitigating the risk of issues caused by excessive negative pressures.

4.4 Space Heating

Space heating to the new building shall be delivered entirely by electrical means, through use of air source heat pumps and electric panel heaters. These proposed strategies are aligned with the global effort to phase out the reliability of fossil fuel consumption for building operation.

Stage Areas

As covered in the previous section the stages are proposed to be served by displacement ventilation methods, delivering conditioned air to the occupied zone; therefore, the entirety of the heating input to the space will be via the air supply.

It is envisaged the heating mode of the system will be active during unoccupied periods to maintain frost protection, and also for short periods prior to occupant arrival in order to bring the space up to comfortable temperatures. Following 'pre-heat' of the space and arrival of occupants, it is envisaged the daily operations will provide adequate heat output to maintain desired temperatures during the heating season.

Office Areas

VAV ventilation is currently proposed to provide the heating and cooling requirements of the office spaces; therefore, all comfort conditioning will be provided via the supply air volume. Terminal reheat will provide additional heating if/when required.

WC & Circulation Areas

Toilet and circulation areas are proposed to be heated by local electric radiant heaters. The purpose of these heaters will be to provide background heating during occupied periods and frost protection during unoccupied periods.

Entrance Areas

Entrance areas are proposed to be heated by local electric radiant heaters, with overdoor heaters provided above each external entrance door. Overdoor heaters shall activate on the opening of the external doors and shall run for a set period of time via timer controller.

4.5 Space Cooling

Stage Areas

Space cooling of the stages is proposed to be provided through the displacement ventilation system, delivering conditioned air directly to the low level occupied zone. This air conditioning strategy effectively targets the occupied zone, meaning that it is accepted that temperatures can rise in the unoccupied zone above. This offers huge operational energy reductions when compared to high level air delivery which will ultimately condition a larger zone and therefore consume more energy to do so.

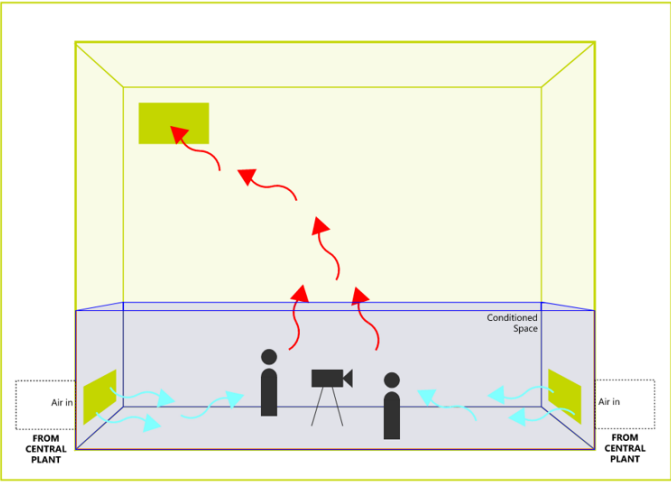


Figure 0-5 Displacement Ventilation

Due to the high anticipated heat gains within the space, it is envisaged that the system will be in cooling for the majority to the spaces occupation. For this reason, it is pivotal that the cooling system operation is as efficient as possible.

4.6 Roof Plant Compound

Central ventilation and heat pump plant is proposed to be located at roof level above the core office areas. The allowed plant zones will accommodate 2No. variable air volume (VAV) AHUs per stage, with an additional 2No VAV AHUs each serving 50% first floor office zones. Spatial zones have also been placed to accommodate the VRF plant which will serve the stage AHU DX coils, as well as the cooling equipment to be provided for the ground floor dimmer and switch rooms.

Smaller items of plant include an external cooling condenser zone for the below comms room and a toilet extract fan zone to serve the below core toilet block. Due to space restrictions within the compound enclosure, the WC fan zone currently sits outside of this, and so door access will be required between the compound and the adjacent flat roof area.

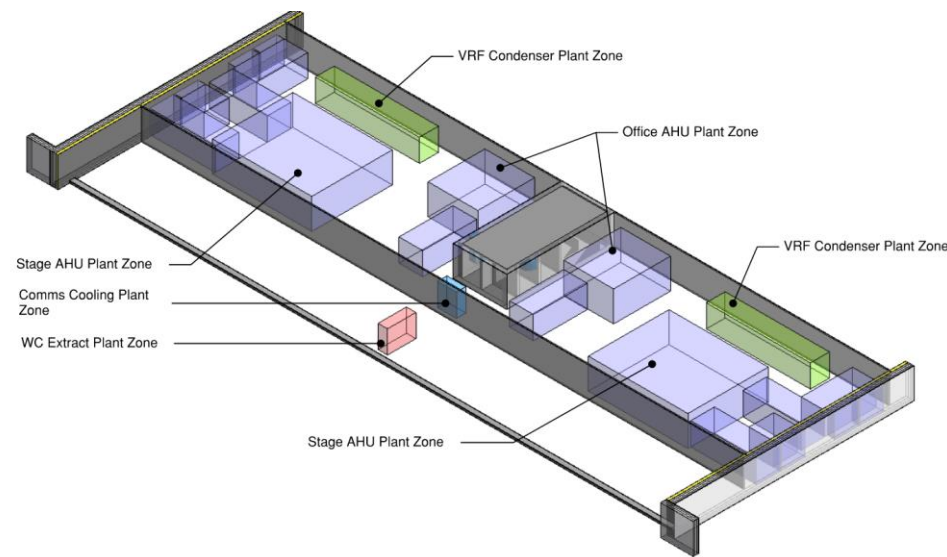


Figure 0-6 Roof Plant Compound

Based on the total area of the initial project brief, Buro Happold have reviewed the plant space area requirements and provided our estimate for the plant space allocation, these have been incorporated into the Architect's general arrangement drawings. The current zoning arrangement allows for necessary maintenance and removal access, with clear routes between the roof access point and each zone allocated to each intended item of plant.

In respect of the plantrooms/areas, the following should be noted:

1. All plant shall have suitable access for plant maintenance and replacement.
2. All equipment and tanks shall be installed with suitable plinth bases and supports.
3. Suitable ventilation is to be provided to the ground floor tank room.

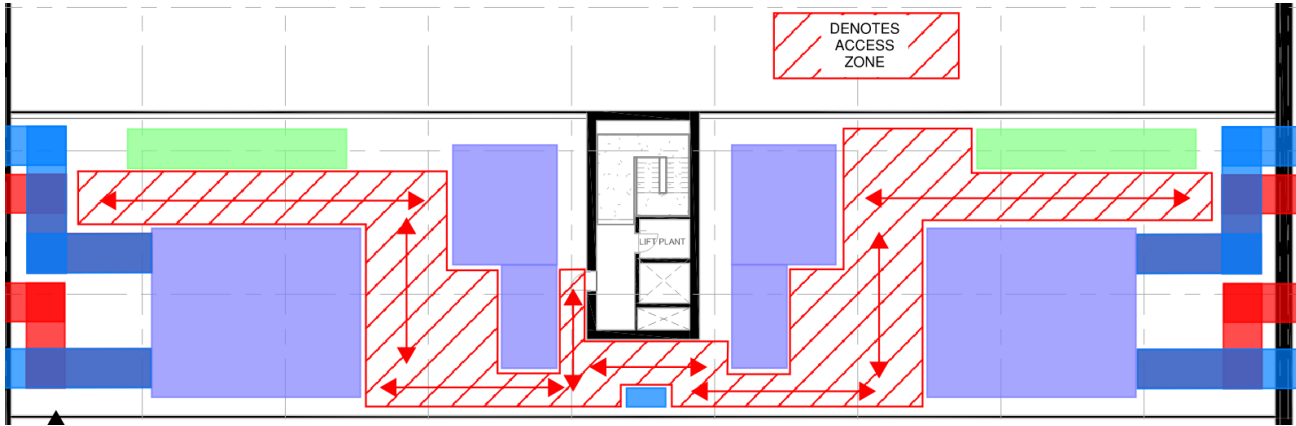


Figure 0-7 Plant Compound Maintenance Zones

The option to locate the cold water storage tank at roof level was reviewed, however adequate water pressure in the incoming main could not be guaranteed to reach the inlet position at roof level. On this basis the water tank and booster set will be located in a dedicated plant space at ground level.

4.7 HVAC System Resilience

The RIBA Stage 2 strategy appraisals and plant zone allocation have been carried out with system resilience in mind. In the Stage areas, the current proposal is for 2No AHUs to provide the ventilation and comfort conditioning at 50% each, ensuring that in the event of single plant failure the stage will never be entirely with HVAC provision. The same principle applies to the office areas, where are 2No AHUs, each serving 50% of the office space at first floor level.

Elsewhere, the VRF system plant will be sized and selected to provide continued operation in the event a single condenser is to breakdown. To this effect, one of the units shall be standby and under normal operation the control system will ensure the condensers cycle roles of duty and standby. This ensures each item of plant shares the duty equally and will ensure longevity of the operational components.

Toilet extract fans will be 'twin-fan' type, with each fan acting as duty or standby. The control methodology will ensure that the duty role is cycled evenly between the two fans to ensure operational longevity.

4.8 BMS

The building will be provided with a computerised building management system (BMS). This will provide automatic control and logging facilities for all mechanical and electrical plant and shall be capable of integration with systems on the campus. Key to the success of the system is making the interface between users and the BMS as simple and intuitive as possible. Reduced energy consumption and improved comfort conditions is reliant on the building occupants taking ownership and pride in the performance of the building and help in the behaviour of their environment.

Interfaces will take the form of a graphical user interface at a computer head end with simple local manual overrides in the different areas for building occupants. Appropriate staff shall be trained in the use of the system following the completion of the building by the BMS specialist installer.

The BMS will be interfaced with the following systems:

- Heat pumps/ Outdoor Units
- Mechanical ventilation plant
- Water booster sets
- Hot water generation
- Access control systems
- Lighting control systems

- Refuge alarm system
- Incoming supplies metering
- Building sub-metering (LV, water, building heat meters)
- User overrides
- Any other alarms/interfaces required

Public Health Systems

5.1 Introduction

Public health systems shall be provided to meet the domestic water and sanitary drainage requirements of the toilet blocks within the proposed Phase 3 studio. The below sections describe the currently proposed domestic and drainage systems intended for use.

5.2 Cold Water

A new single incoming water main is proposed to serve a one-piece potable water storage tank within the dedicated tank room at ground floor level. The break tank shall be sized to provide 15 minutes of peak cold water demand. A boosted cold water feed from the break tank will be installed to serve the proposed water outlets. Separate water meters will be supplied to all connections serving tenanted demises. Two booster pumps (duty and standby) will be provided with independent controls.

All cold water pipework shall be in copper. All domestic water pipework shall be concealed. Chrome plated copper pipework shall be used in instances where the final pipework connection to an outlet is exposed. All cold water copper pipework joints shall be soldered.

Cold water services will be designed to comply with the requirements of:

- The Water Regulations,
- The Health and Safety Executive Guidance on Control of Legionella
- BS EN 806
- CIBSE TM39 (sub-metering)

In addition to this, a Fluid Category 5 rated break tank with integral pump set is proposed in the ground floor tank room, for water provision to any potential bib-tap outlets external or within the workshop areas. This system provides backflow protection in accordance with the Water Regulations.

5.3 Domestic Hot Water (DHW)

It is not currently proposed to have any hot water storage in the new building. All hot water requirements are proposed to be delivered locally, via in-line, instantaneous electrical water heaters. These devices offer the energy consumption advantages, as there is no requirement to heat a volume of stored water above 60°C at all times to avoid risk of legionella growth. Instead, the heat is delivered directly to the outlet at the exact time it is required.

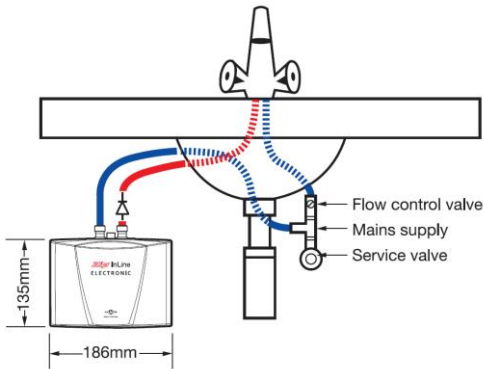


Figure 0-1 Inline Instantaneous Electric Water Heater

Boosted cold water distribution pipework will be sized to accommodate domestic hot water demand and will ensure suitable pressure across instantaneous heaters and at outlets.

Blended hot water using thermostatic mixing valves shall be provided to all outlets within the building with the exception of kitchen sinks and cleaners stores. Warning signs should be used to indicate where blended hot water is not used.

Flow regulators shall be provided on all outlets.

All domestic hot water pipework shall be in copper. All domestic water pipework shall be concealed. Chrome plated copper pipework shall be used in instances where the final pipework connection to an outlet is exposed. All cold water copper pipework joints shall be soldered.

Domestic hot water services will be designed to comply with the requirements of:

- The Water Regulations
- The Health and Safety Executive Guidance on Control of Legionella
- BS EN 806
- CIBSE TM39 (sub-metering)

5.4 Above Ground Drainage

Above ground drainage systems will be designed to distribute soil, waste, rain and condensate water from its point of inlet to the system to below ground drainage networks.

It is currently proposed that symphonic drainage strategies are used for the rainwater drainage systems in the Phase 3 Studio. Whilst traditional gravity rainwater systems operate with pipe diameters part full, symphonic drainage systems operate at full capacity, allowing for a reduced number of outlets and downpipes. Traditional gravity system outlets at roof level collect and distribute rainwater to below ground using multiple downpipes. Syphonic systems offer the ability to collect from multiple roof outlets using a single 'collector' pipe at high level, creating a ring with a single downpipe. This system type offers reduced capital cost and ease of coordination.

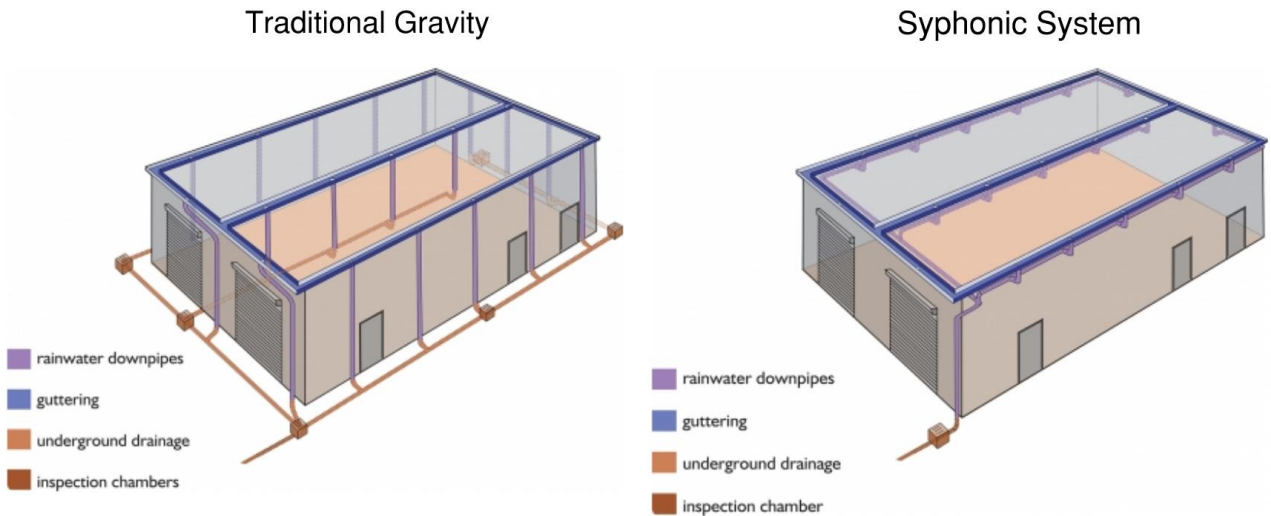


Figure 0-2 Traditional vs Syphonic Rainwater

All foul stacks will be fully vented throughout their height and will terminate to atmosphere. Soil and waste pipework shall generally be HDPE type. Vent pipework will generally be uPVC type.

Access points for inspection and cleaning shall be provided at:

- 1200mm above the finished floor level at every floor Level for vertical downpipes.

- Every change of direction.
- The base of every vertical downpipe.

Condensate drainage from AHU cooling coils, AHU heat recovery sections, fan coil units and split system air conditioning units shall connect to the foul water system prior to a trap – such as a basin or gulley. Where this is not possible a transparent deep seal trap will be provided.

Condensate drainage will run to drain via gravity, where this is not possible a peristaltic pump will be used. Condensate pipe work will be installed in uPVC or copper.

All foul water systems shall be designed to BS EN 12056 part 2.

Electrical Systems

6.1 Introduction

This section provides an overview of the electrical services for Space Studios Phase 3 building. The sections below describe the currently proposed electrical systems intended for use. Please refer to appendices A and D of this report for basis of design information and design note discussing electricity supply options.

6.2 Incoming Electrical Supply

It is currently proposed the electricity supply for Phase 3 building emanates from the existing Phase 2 LV switchboard. The proposed route of the cables is indicated in the figure below. For further information and alternative incoming electrical supply options refer to the design note in Appendix D.

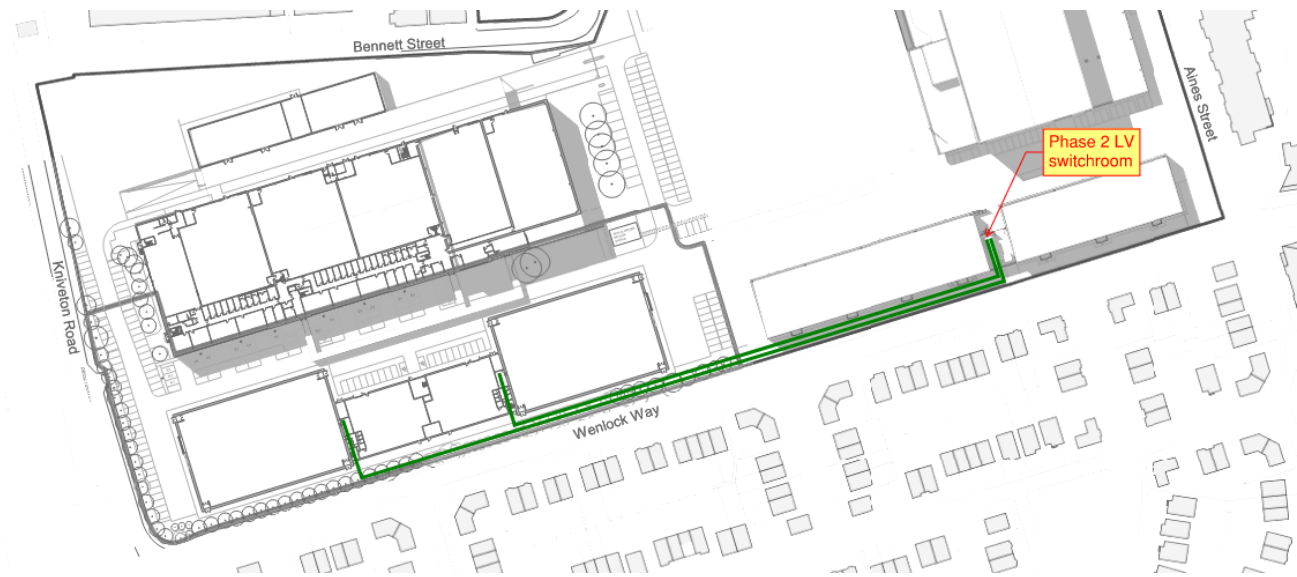


Figure 0-1 2 x LV connections emanating from existing Phase 2 LV switch room

6.3 LV Distribution

Due to limitations on the size of circuit breakers that can be installed within the existing Phase 2 LV Switchboard it is anticipated at this stage that two separate connections from the existing Phase 2 LV switch room will be provided to serve the LV switchboards located in the dimmer rooms within the Phase 3 development. This arrangement provides an added level of resilience – should there be a fault on one supply, the remaining supply may still be operational and therefore half of the Phase 3 development would remain powered.

Each of the LV switchboards will be supporting the loads in the respective stages, along with associated workshop, office and circulation areas and WCs.

Distribution boards and powerlock units (Camlock panels) will be provided throughout the building where required to support final loads of small power and lighting, along with filming requirements within the Stages. Dedicated distribution boards will be provided to each workshop and to the office areas.

All mechanical plant items will be fed directly from the LV switchboards.

The containment systems that will be utilised to facilitate the LV and ELV distribution are as follows:

- Main LV distribution cables – Perforated tray

- Small Power and Lighting circuits – Metallic trunking
- Data, Fire Alarm, Security, BMS – Perforated tray/ Basket

6.4 General Lighting

Lighting and lighting controls will be provided throughout the building according to relevant standards and guides, such as BS EN 12464-1 and CIBSE Lighting Guide 6, 'Lighting for the built environment'.

Generally, lighting will be provided through LED luminaires that suite the function and requirements of each area.

The table below summarises the luminaire and lighting controls' types that are proposed in the main areas of the building.

Table 0—1 Luminaire and lighting controls' types

Area	Luminaire type	Lighting control type
Stage	High bay linear luminaires	Manually switched in banks from main pedestrian entrance
Office	Surface mounted/ suspended linear luminaires	Absence detection with daylight dimming
Workshop	High bay luminaires/ anti-corrosive IP rated linear luminaires	Manually switched in banks
Circulation	Surface mounted/ suspended linear fittings	Presence detection or microwave
WC	Circular recessed / surface downlights	Presence detection
Dimmer room/ BoH	Anti-corrosive IP rated linear luminaires	Manually switched

6.5 Small Power

Emanating from local distribution boards, small power will be provided throughout the building, these will include but are not limited to the following:

- Mechanical plant
- General purpose socket outlets, including industrial socket outlets
- Power supplies for fixed equipment
- Cleaners socket outlets
- Security/access control systems
- Electric vehicle charging points

All accessories within external environments or areas that may be subject to the ingress of water will be provided with an Ingress Protection (IP) rating of IP54 minimum.

It is currently anticipated that approximately 10% of the total of parking spots will be provided with electric vehicle charging points.

All final circuits will generally be distributed from distribution boards in metallic trunking at high level. The table below demonstrates the final distribution method from the point the cables drop from high level, until they connect to final accessories (sockets, spurs, isolators, etc.) that will be installed in mid/ low level.

Table 0—2 Final small power cabling distribution method

Area	Final small power distribution method
Stage	Galvanised metal trunking will be provided, mounted at approximately 1200mm above finished floor level (AFFL), provided in short sections as required. Main trunking around perimeter of stage will be mounted at approximately 2500mm above floor level.
Office	Perimeter dado trunking will be provided to serve desks in the area.
Workshop	Galvanised steel 2 compartment trunking along perimeter of the room.
Dimmer room/ Switch room	Galvanised metal trunking will be provided mounted at approximatel1200mm AFFL, provided in short sections as required.

6.6 Emergency Lighting

Emergency lighting will be provided to all areas of the building and will comply with the requirements of BS:5266, Building Regulations and the fire officer.

Generally emergency lighting will be provided by standalone LED emergency luminaires installed alongside the normal lighting. Where higher illuminance levels are required, such as in higher risk areas, the normal emergency lighting shall be provided with integral battery backup.

Where general lighting luminaires are used for emergency lighting they shall meet all necessary standards. Similarly, the associated cabling and cable installation shall meet the requirement s of BS EN 1838:2013, BS5266-1:2011 in all respects.

Emergency lighting luminaires will be provided with self-test facility to automatically test the status of the luminaire and battery and indicate faults via a local LED indicator adjacent the luminaire.

6.7 External Lighting

External lighting shall be provided to the exterior of the building to facilitate safe access/egress and throughout the car park. All external lighting will comply with the requirements of CIBSE Lighting Guide 6, ‘The exterior environment’ and BS EN:12464-2.

The external lighting strategy will be designed in compliance with Table 1 of the Institution of Lighting Engineers Guidance notes for the reduction of obtrusive light, 2005 and that all external lighting (except for safety and security lighting) shall have a timer to automatically switch off the lights between 2300hrs and 0700hrs. Any safety or security lighting left on between 2300hrs and 0700hrs will be automatically switched to lower levels between these times in compliance with the lower levels of lighting recommended in Table 1 of Lighting Engineers Guidance notes.

6.8 Fire Alarm

A fully addressable analogue landlord fire detection and alarm system will be provided for the building. The fire alarm system will provide coverage to all areas and comprise the following:

- Multi-function type detection heads
- Aspirating smoke detection system, such as VESDA
- Manual call point break glass units
- Fire alarm sounders
- Strobes/beacons. Strobes will be provided in areas with high ambient noise levels.
- Enhanced soft skin PH60 cabling

The table below summarises the proposed types of fire alarm protection in main areas, considering the height of the areas and the maintainability of the equipment.

Table 0—3 Fire alarm provision type proposals

Area	Fire alarm means of protection
Stage	Aspirating smoke detection
Office	Multi-function type detection heads
Workshop	Multi-function type detection heads
Dimmer room/ BoH	Aspirating smoke detection

Fire alarm interfaces to link the fire alarm system to the following:

- Security systems
- BMS
- Mechanical plant
- Lift

The building will be provided with a main fire alarm panel located at the main entrance used by the fire brigade.

At this stage it is envisaged that a disabled refuge system will be required at first floor level within each staircase.

6.9 Security

The overall site wide strategy and coverage of the CCTV and access control systems is to be developed and agreed during RIBA Stage 3.

6.9.1 CCTV

CCTV Coverage will be carefully considered in relation to getting the correct balance between a feel of security and intrusion. All CCTV will be Power over Ethernet (PoE).

External CCTV will be provided at the following locations:

- External perimeter of the building

Internal CCTV will be provided at the following locations:

- All entrances to the building with exception to the entrances to the stage area
- Lift

CCTV images shall be recorded locally via cabinet mounted hard disk recorders within the comms room, with image able to be viewed remotely over the local area network (LAN).

6.9.2 Access Control

An access control system will be provided. Generally, this will comprise the following:

- Card readers (on non-secure side)
- Push to exit button (on secure side)
- Emergency exit break glass (on secure side)
- Magnetic door locks

The exact access control requirements will be confirmed during the next design stage, however the access control principles will generally be as follows:

- The building will be provided with electronic access control at the primary entrances. External fob readers and internal push to exit buttons will be provided.
- Individual keys will be provided for the plant spaces, including the dimmer and switch rooms.

6.9.3 Intruder Alarm

At this stage it is envisaged that an intruder alarm system will be provided for the building.

The intruder alarm system will be covering all possible entrances to the building and all glazed surfaces of the building.

6.10 Data

Data provision is expected to be provided from existing main IT comms room utilising fibre connections to data cabinets that will be located on ground floor switch rooms or other dedicated space.

Cat 6a cabling shall be provided from the data cabinets throughout the building, including the following areas:

- Please refer to room data sheets for further information on quantities in main areas.

At this stage, it is envisaged an aerial TV system will be provided.

6.11 Facilities for the Disabled

Disabled Call

A fully operational disabled call system will be provided within each disabled WC. The system will generally comprise the following key components in each WC:

- Main power supply unit/controller located within WC ceiling void or at high level.
- Ceiling mounted pull cord with illuminated ceiling rose (orange coloured pull)
- Wall mounted recessed reset push button inside WC
- Wall mounted recessed visual/audible indicator above WC door within corridor outside WC.

All disabled WC alarms are to report to the main reception within the building.

Each control panel will incorporate an integral sounder unit to alert staff to the alarm, in addition to the visual annunciation. The panel will also be provided with a push button mute facility for the sounder only, however the facility to reset the central panel must only be achieved by operation of the reset button inside the disabled WC in alarm.

Disabled Refuge System

Refuge call points will be situated at points of escape on each floor. Fire rated cabling will link the intercoms to a central control unit (positioned local to the fire alarm panel). In addition to the audio communications connection, a visual indicator on the control panel will provide a visual indication of the activated refuge call point's location.

It is proposed that the disabled WC alarm and disabled refuge alarm be connected back to the main fire alarm panel within the building, along with the ability to remotely monitor from elsewhere on the site.

6.12 Solar PV

The Manchester City Council Low Carbon Building design guide states that Solar PV should be specified for all new build projects, together with a minimum of 20% of the onsite energy usage to be generated by renewable sources. The anticipated onsite energy usage for the Phase 3 development will be assessed further during RIBA Stage 3, however at this stage for costing purposes, based on an operational energy target of < 110 kWh/m²/y, this equates to an annual consumption of 750,970 kWh, 20% of which equates to 150,194 kWh. This figure shall be used to size the PV array requirement at this stage in the design. It is currently estimated that approximately a 1350m² PV array area will be required to generate this amount of energy.

It should be noted that the PV array size has been estimated at this stage by extrapolating data available from the previous phases on the site and therefore further detailed analysis will be required to better define these areas. As a result, at this stage it is recommended that the roof structure is designed in such a way to accommodate a larger PV array with personal access for installation and maintenance.

It is anticipated that the PV array be fixed to the roof via a proprietary lightweight framework, or via fixing brackets if a standing seam roof is used. It is not currently proposed that a ballasted frame system be used, however if such a system is required due to the PV's not being able to be fixed to the roof structure it is anticipated that the weight of the ballast and PV panels would be approximately 20kg/m².

Access and Maintenance

7.1 Introduction

The Construction (Design and Management) Regulations 2015 extend designer’s responsibilities beyond the construction phase of a project; they also need to take account in their designs the health and safety of those who will maintain, repair, clean and demolish the building and associated services.

The final maintenance requirements for the building services plant and equipment will be confirmed by the installation contractor and will ultimately form an integral part of the Health & Safety File.

During the RIBA Stage 2 design period consideration has been given to an access and maintenance strategy for all elements of the mechanical, electrical and public health installations, including all engineering plant.

In developing the access and maintenance strategy the following items have been considered:

- A safe access strategy has been devised for both routine maintenance and replacement of elements.
- Access is to be provided by permanent means.
- Floor finishes are to be suitable for any mobile plant or any additional protection or strengthening required.
- Access and maintenance equipment can reach all areas and navigate obstructions.
- That lights, signage etc., are accessible for maintenance.

All items of mechanical and electrical plant should be installed in accordance with the manufacturer’s instructions and sufficient space should be provided to be able to undertake maintenance or repair in a safe manner.

Access, maintenance & replacement strategies for key sections of services distribution and for large items of plant are presented below.

7.2 Serviced Fixed to Soffit

Pipework, ductwork and containment will generally be exposed and fixed to the underside of the exposed concrete soffit.

Any ceilings provided within areas such as WC’s and Shower rooms will be provided with removable access panels at all locations where branches or cable junctions occur. Access to services at high level, such as within including these areas will be via mobile podiums or mobile elevated working platforms (MEWPs).

Detailed coordination will be carried out during future RIBA Stages to coordinate the location of all parts requiring access for maintenance with other services within the space – including any acoustic ceiling rafts, architectural lighting etc. This will include items such as smoke detectors, valves, dampers, containment etc.

7.3 Services within Risers

Mechanical, electrical and public health services installed within risers will generally be accessed directly via corridors or core areas. To provide safe working access and to prevent damage by falling objects, all risers will all be provided with access platforms at each level.

Detailed coordination will be carried out during future RIBA Stages to ensure that adequate access is provided within the risers for the safe access to all equipment – including fire/smoke dampers, valves, containment etc.

7.4 Ground Floor Plant

The majority of the MEP plant is housed within the rooftop plant area, however there are several areas of plant space at ground floor level:

- Dimmer rooms – These spaces are located at ground floor level and are provided with double door access from the adjacent dimmer room area. Access will be restricted to this space to maintenance staff. These rooms will house the main MCCB distribution boards which will be constructed in sections, with the largest section approximately 1000mm (w) x 800mm (d) x 2200mm (h).
- Cold Water Tank Room – This plantroom is located at ground floor level and houses the cold break tanks and pumps. Internal double doors to the adjacent entrance space are provided.

7.5 Roof Level Plant

Ventilation Plant Maintenance

During the initial installation it is proposed that the air handling unit manufacturer will transport the units to site as a whole package. The units will then be lifted into position on the roof using a crane.

Some pieces of equipment such as filters and fans will need regular maintenance. In the case of fans on the roofs, these can be accessed via the stairs or lift to the roof, and any new smaller pieces of equipment, such as filters, can be brought to the roof via the stairs or lift.

In the extremely rare event of a total failure of the fans on any of the roofs, removal and replacement may ultimately be required. The intention is that the failed unit can be broken down into manageable components and removed via the goods lift. Alternatively, the entire unit could be craned off the roof from a crane located within the car park.

Variable Refrigerant Flow (VRF) Plant Installation and Maintenance

During the initial installation it is proposed that the VRF heating and cooling outdoor units will be transported to site as a single unit and will be transported to site through the goods lift.

Ongoing monthly maintenance will be required for the VRF outdoor units with access provided via the stair core and goods lift to the roof level.

In the unlikely event of the total failure of a VRF unit, removal and replacement can take place with the use of the goods lift.

Lightning Protection Plant Maintenance

The Lightning Protection System (LPS) on the roof will require periodic maintenance and inspection. Those elements of the LPS that require this are limited to the roof network tapes and connections to the structure at roof level. These tapes are mounted towards the perimeter of the roof and will therefore likely require a managed man-safe system to avoid falls.

There are no large or cumbersome elements that are likely to require replacement, therefore all elements can safely be carried via the lift and stairs, onto the roof.

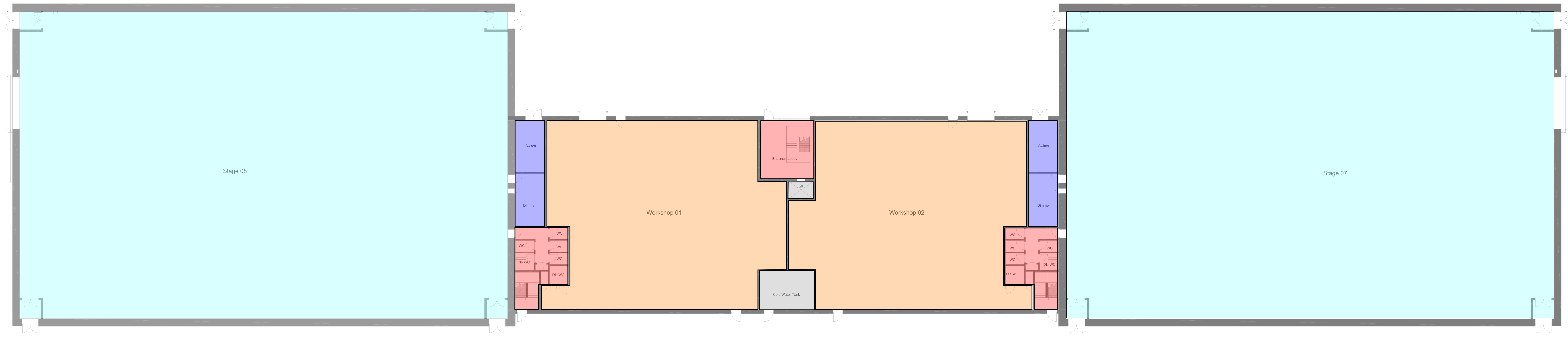
Appendix A – Basis of Design

Internal Design Criteria:

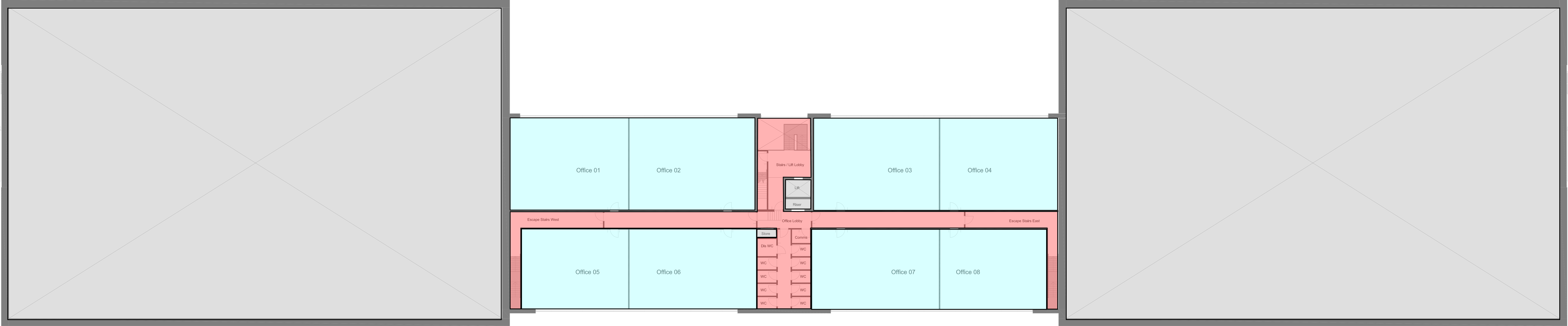
Zone	Environmental Strategy	Winter Temperature °C	Summer Temperature °C	RH %	Occupant Density m²/person or people	Vent Rate l/s/Person	Vent Rate ACH	Lux Level Lux	Noise Rating Nr
Circulation	Background Electric Heating only	18	Uncontrolled	Uncontrolled	N/A	N/A	N/A	100	40
Dimmer Room	VRF cooling	21	24	45-55 ± 10	N/A	14	N/A	200	TBC
Office	Variable Air Volume Ventilation, Comfort Cooling and Heating	20	24	45-55 ± 10	8	14	N/A	400	35
Plantroom	Electric heating frost protection	Frost Protection	Uncontrolled	Uncontrolled	N/A	N/A	N/A	200	60
Stage	Displacement Ventilation, Comfort Cooling and Heating	15 (occupied) 10 (unoccupied)	Maximum 27.5°C @ 6m above floor level	45-55 ± 10	150 People	N/A	N/A	300	20
Switch room	VRF cooling	15	24	Uncontrolled	N/A	N/A	N/A	200	TBC
WC	Extract Ventilation, Background Electric Heating	20	Uncontrolled	Uncontrolled	N/A	N/A	5	200	40
Workshop	Background Electric Heating only	Radiant Heating	Uncontrolled	Uncontrolled	N/A	N/A	N/A	500	40

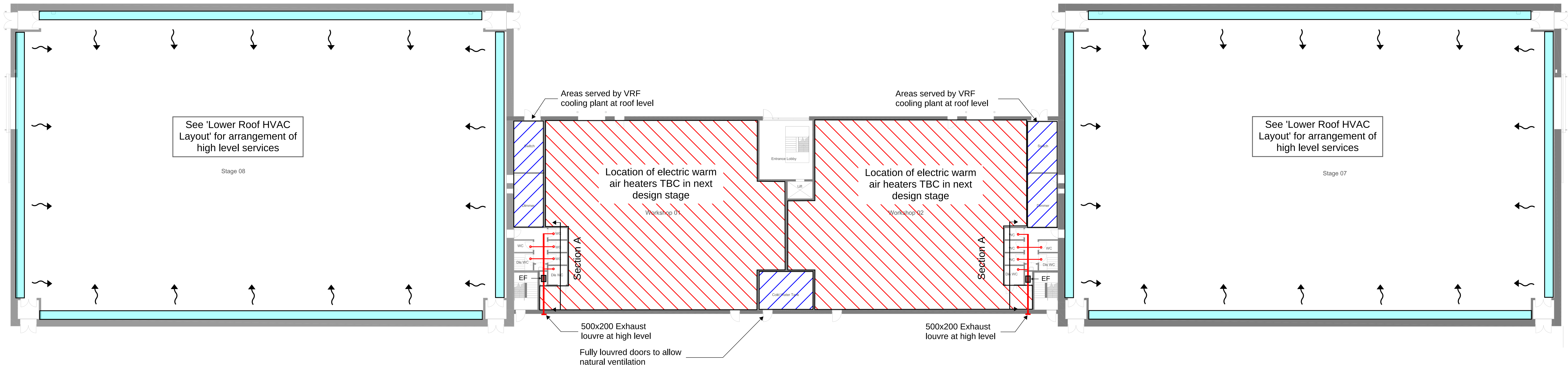
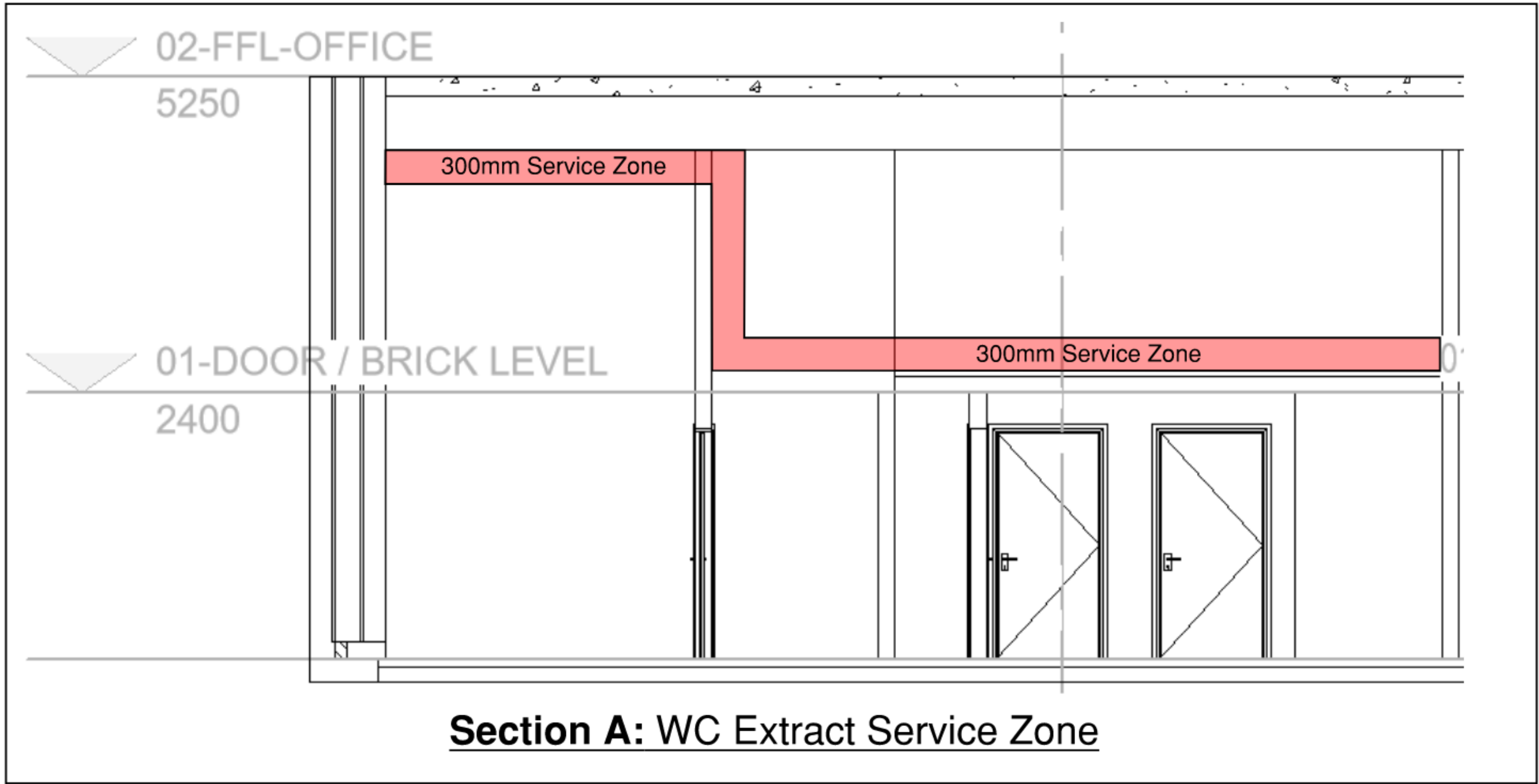
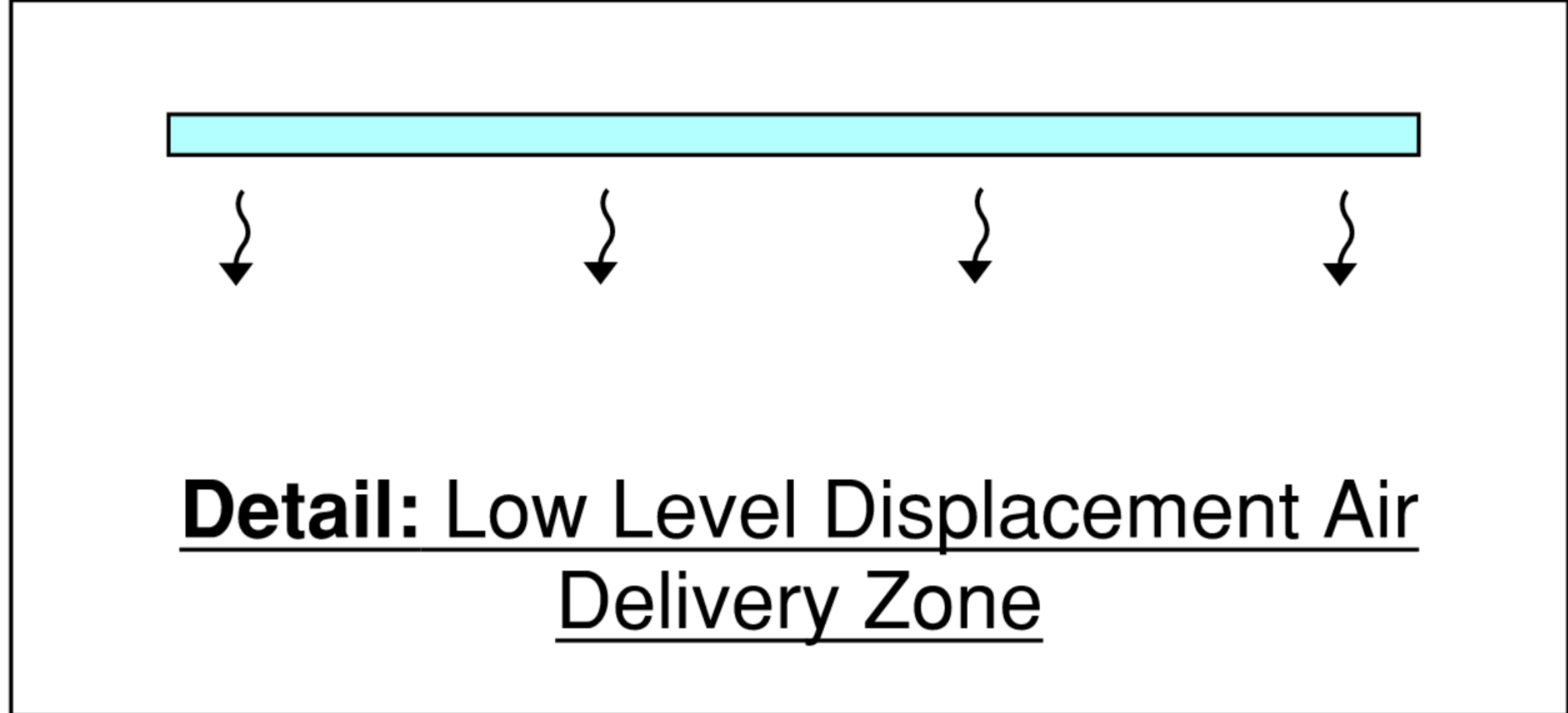
Appendix B - MEP Sketch Pack

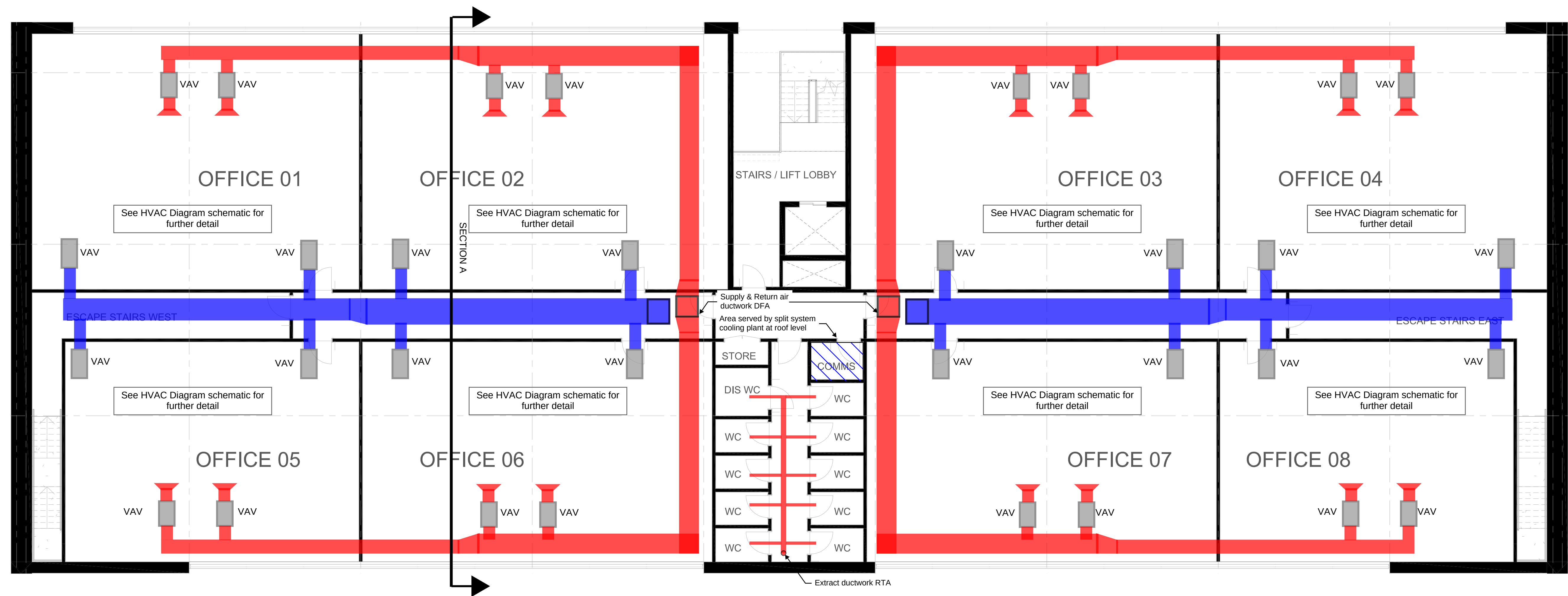
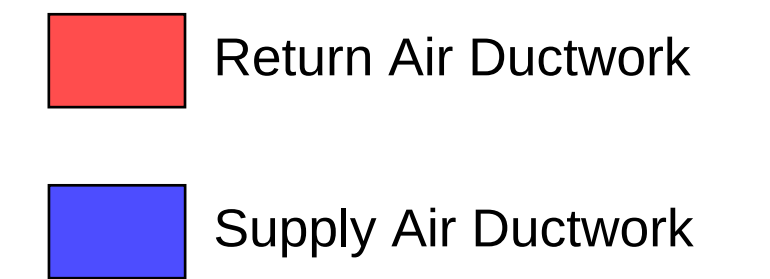
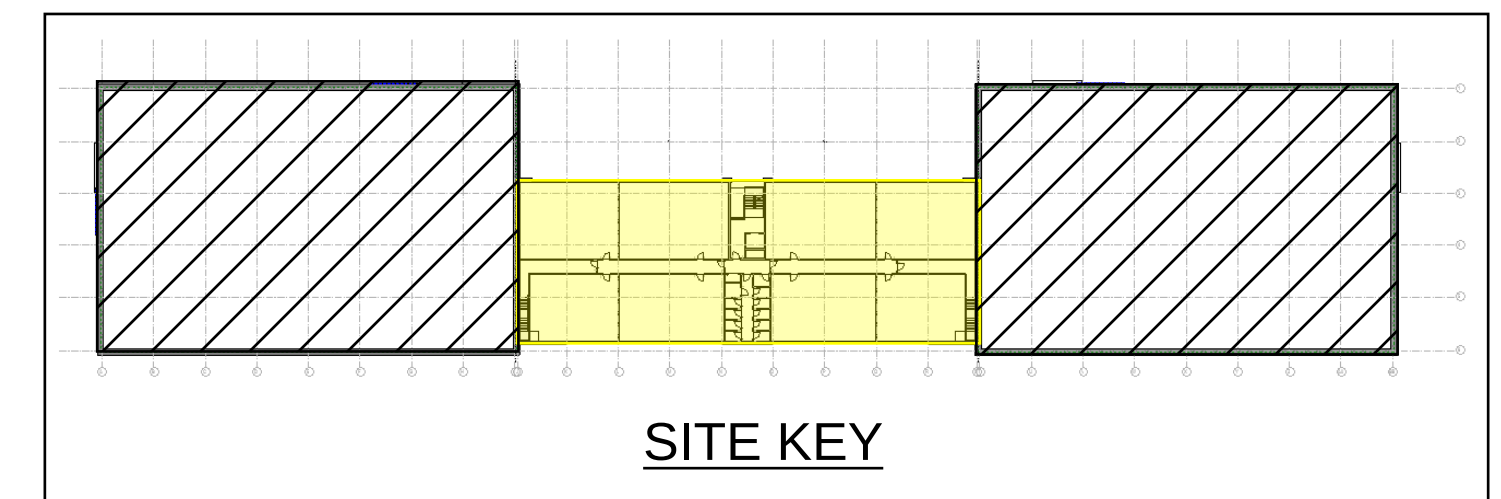
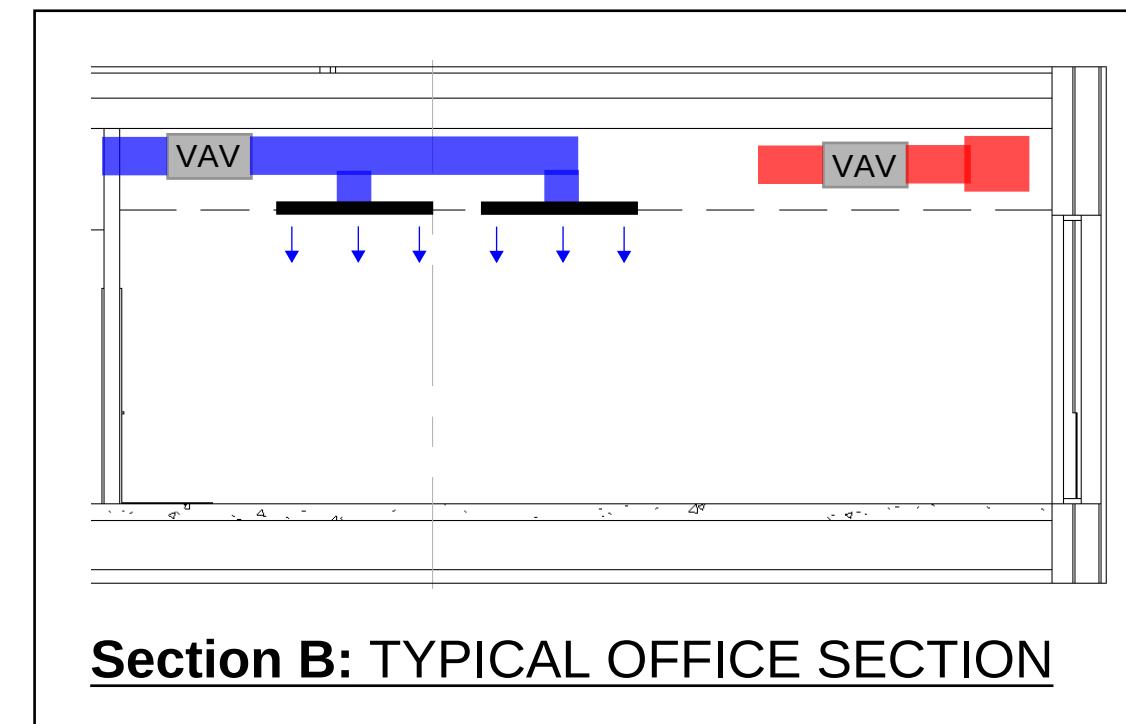
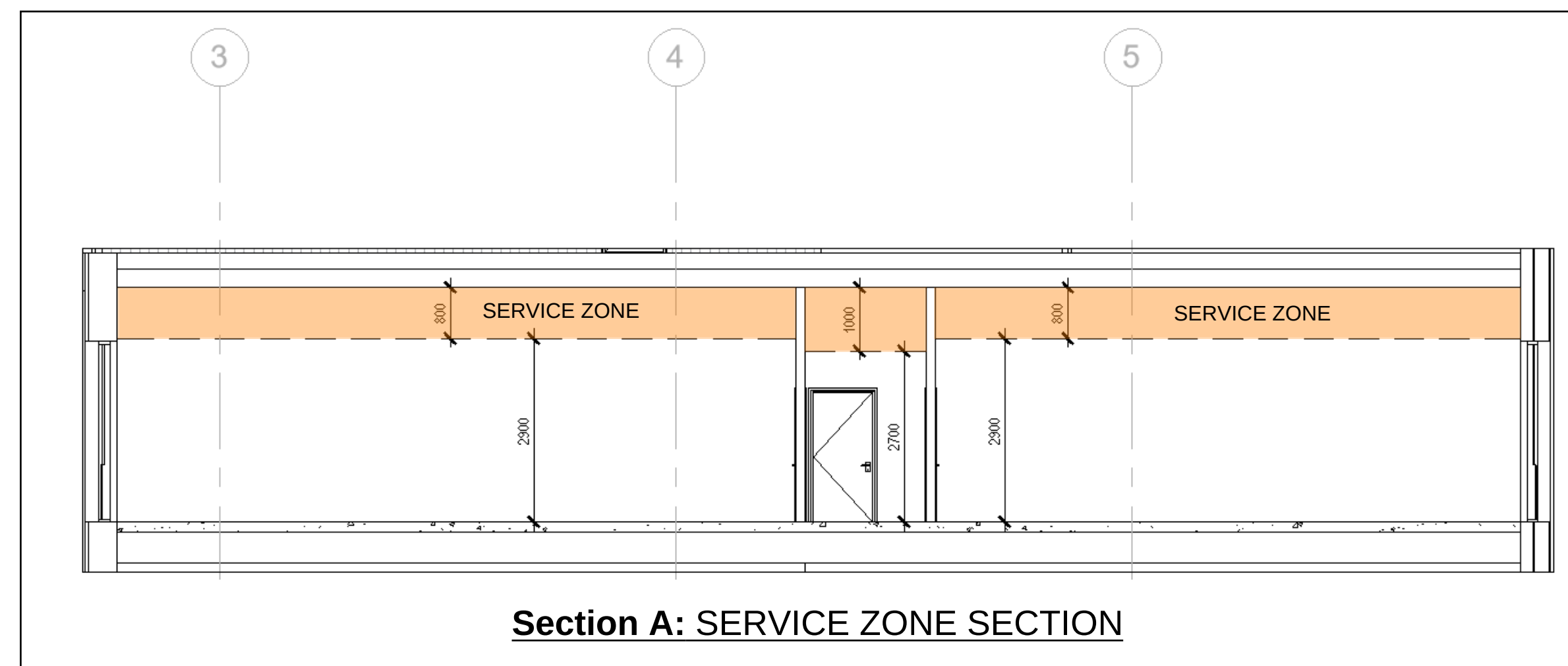
- Displacement Ventilation
- VRF Cooling
- Electric Warm-Air Heating (Frost protection)
- Electric Radiant Heating
- Unconditioned

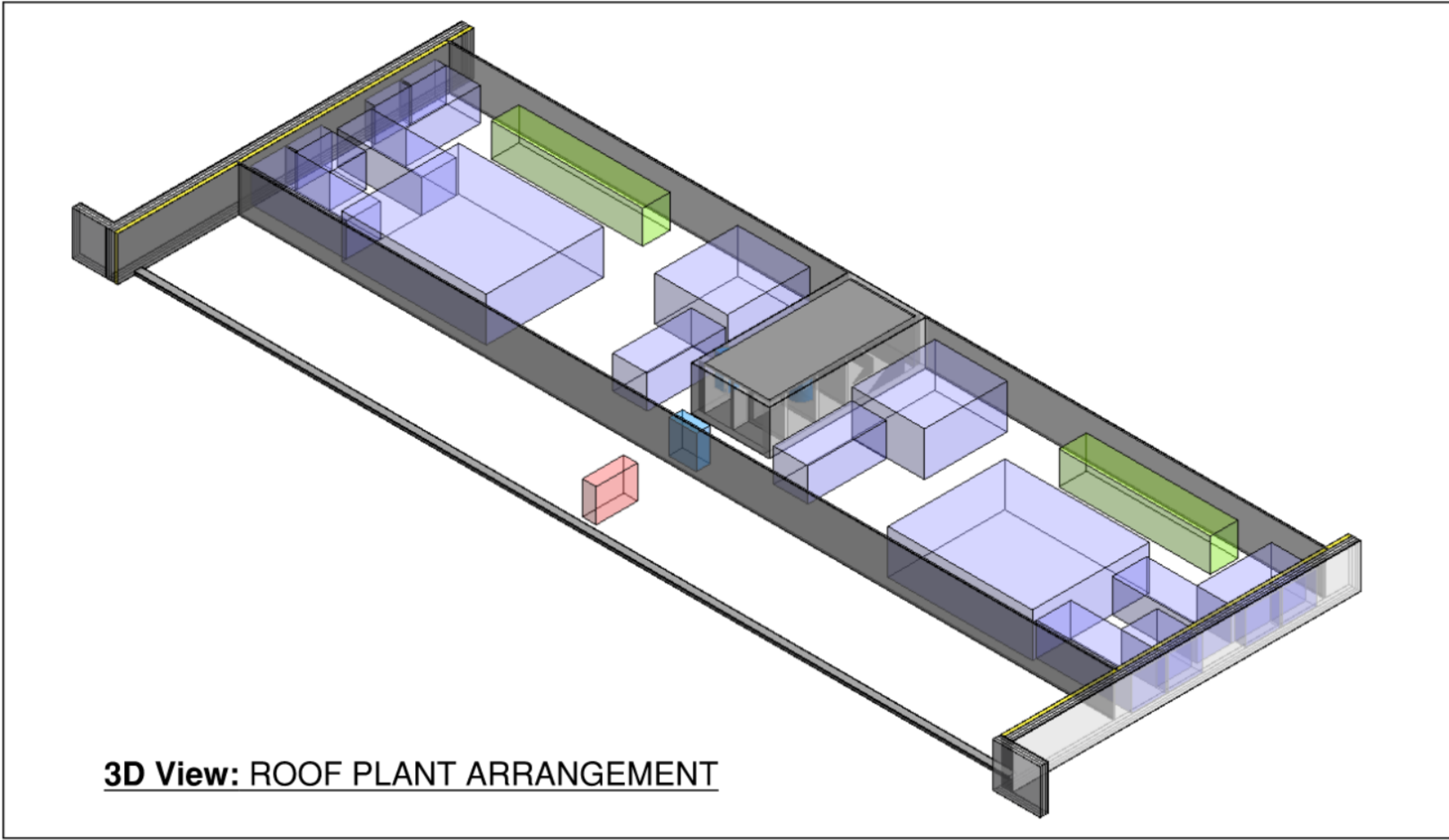


- Displacement Ventilation
- Electric Radiant Heating
- Unconditioned



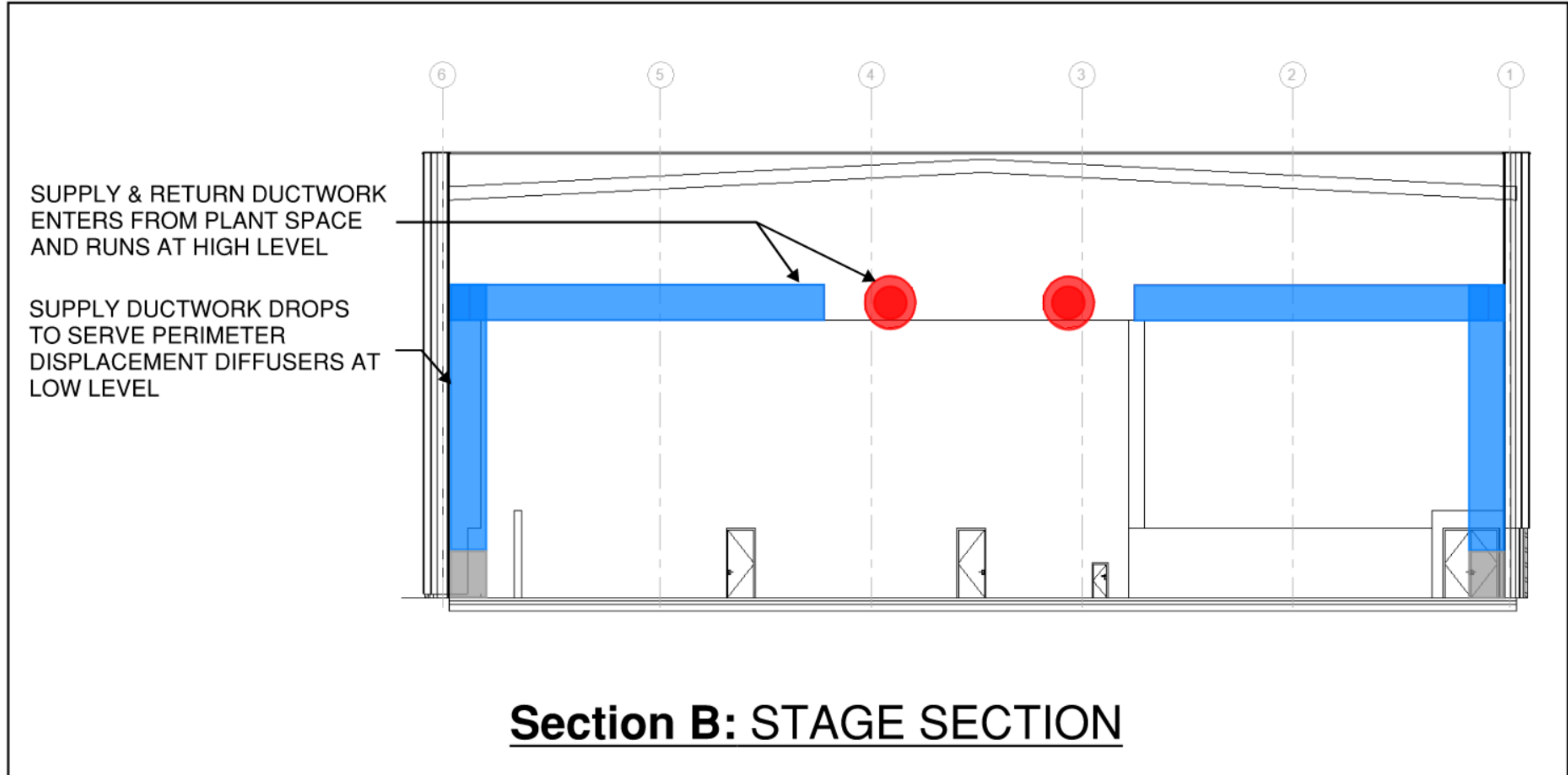
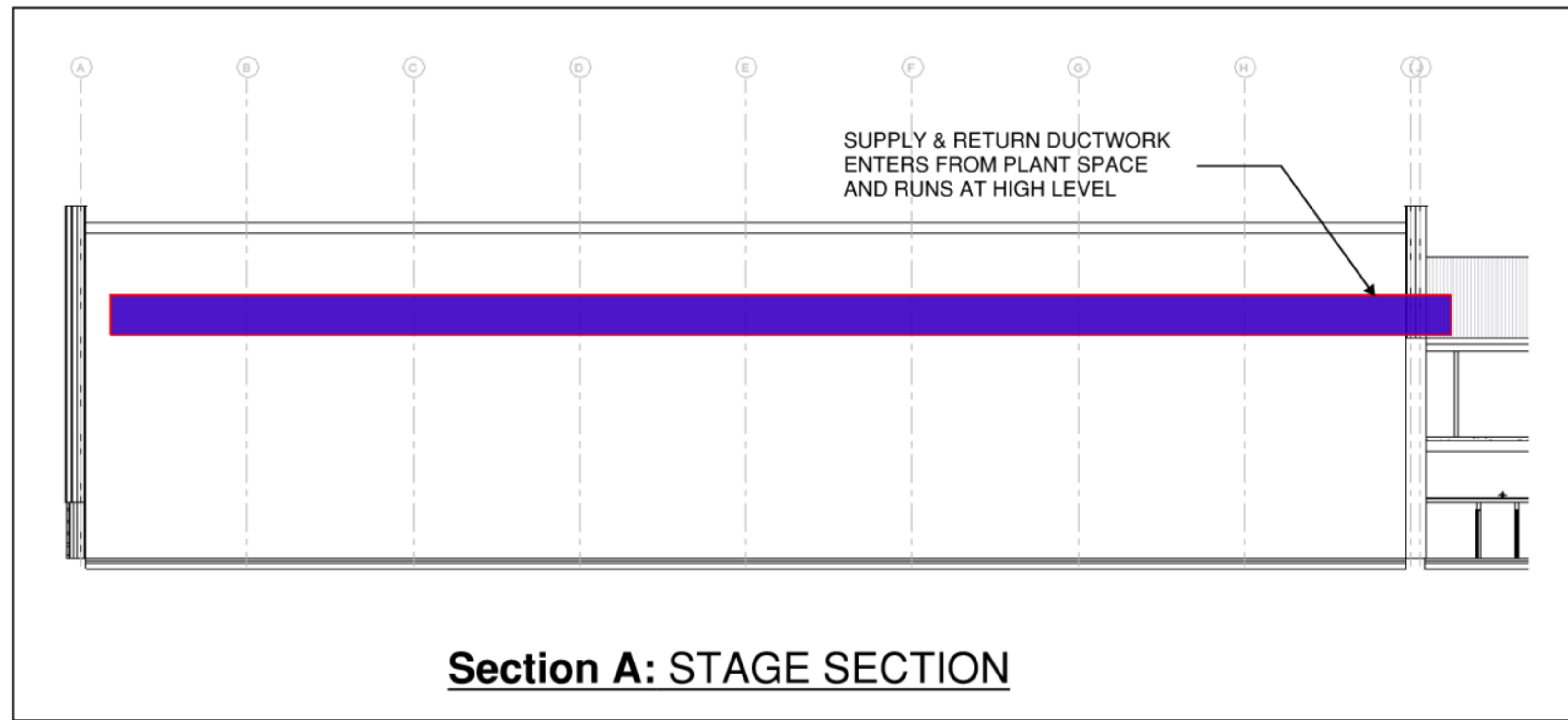
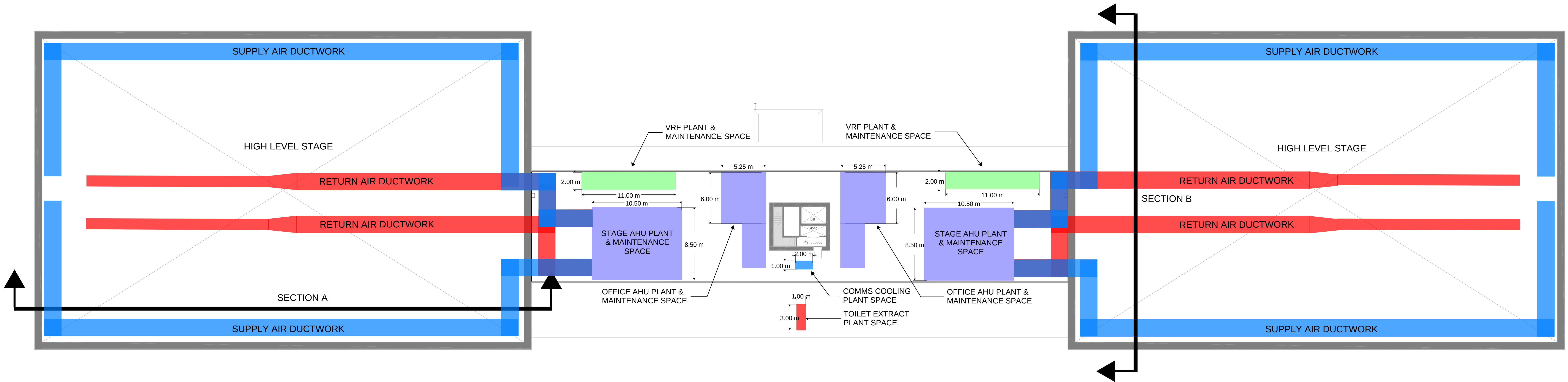


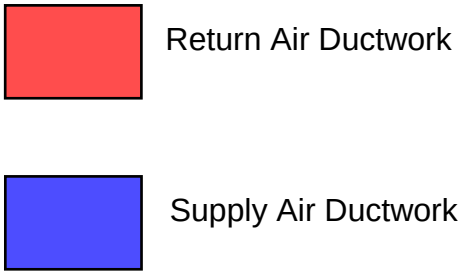




Return Air Ductwork

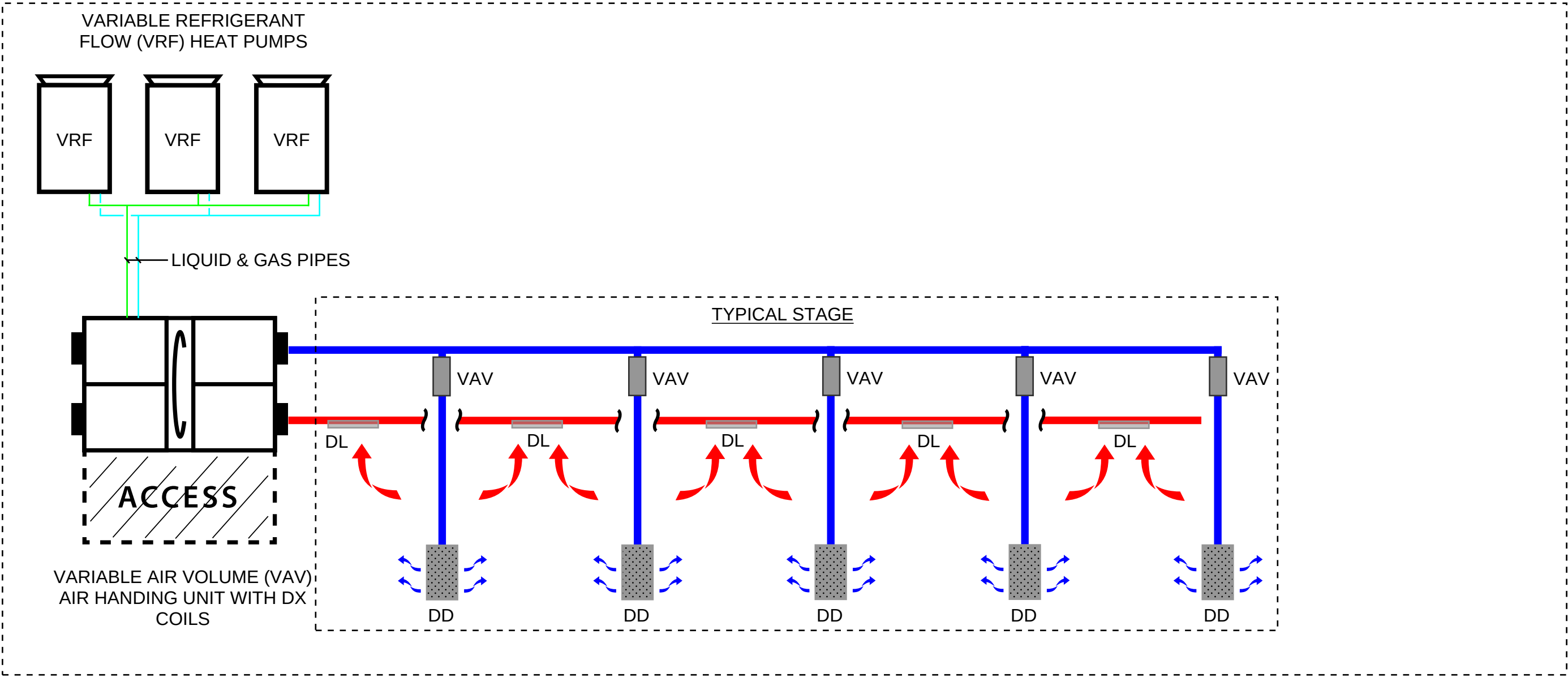
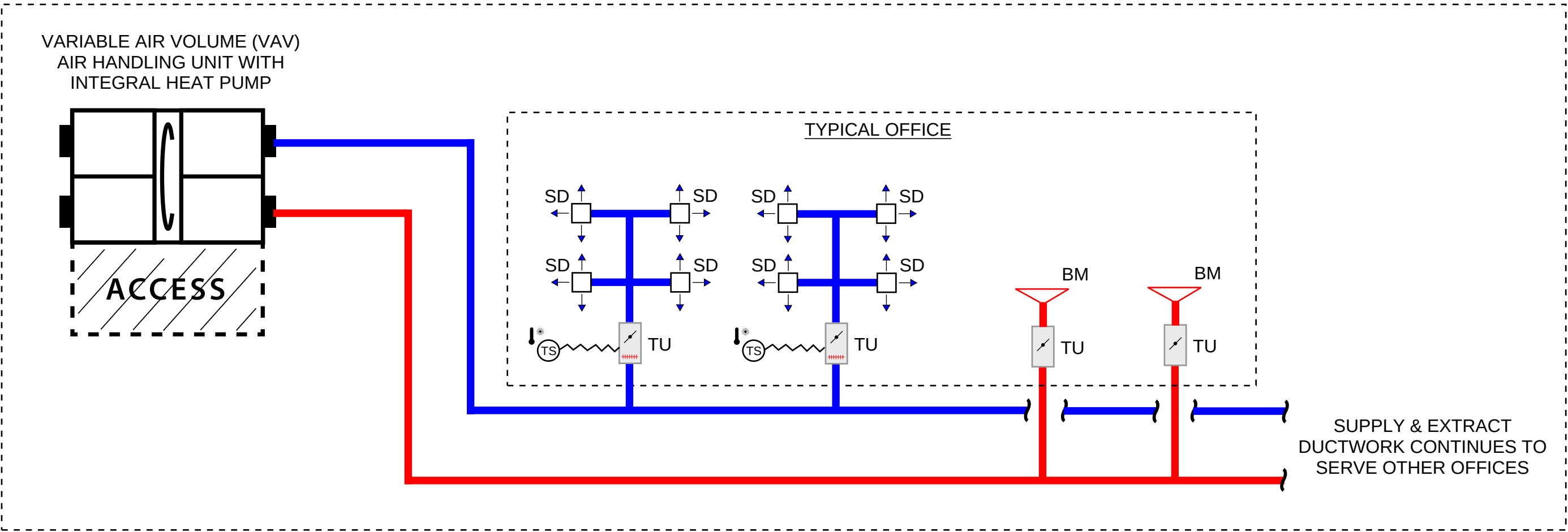
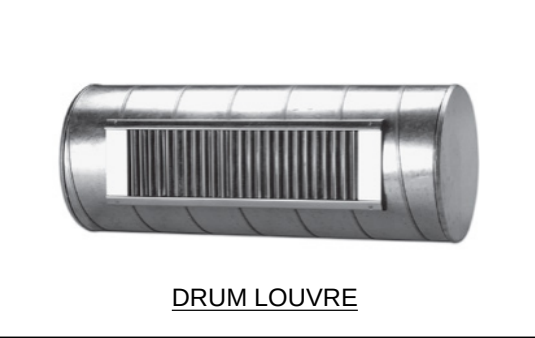
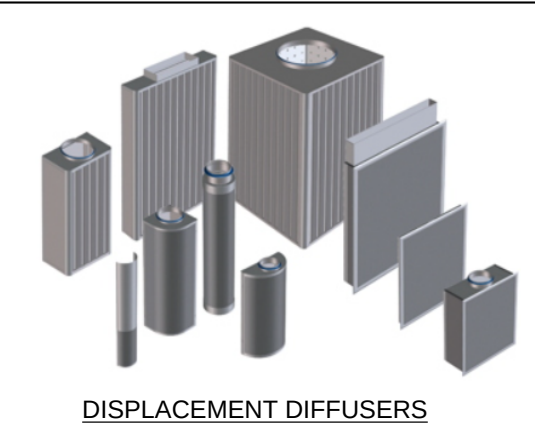
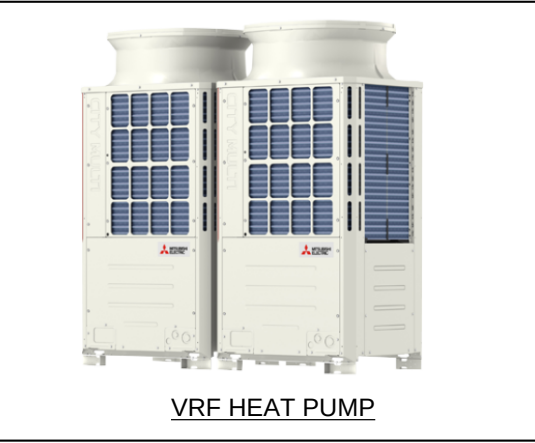
Supply Air Ductwork

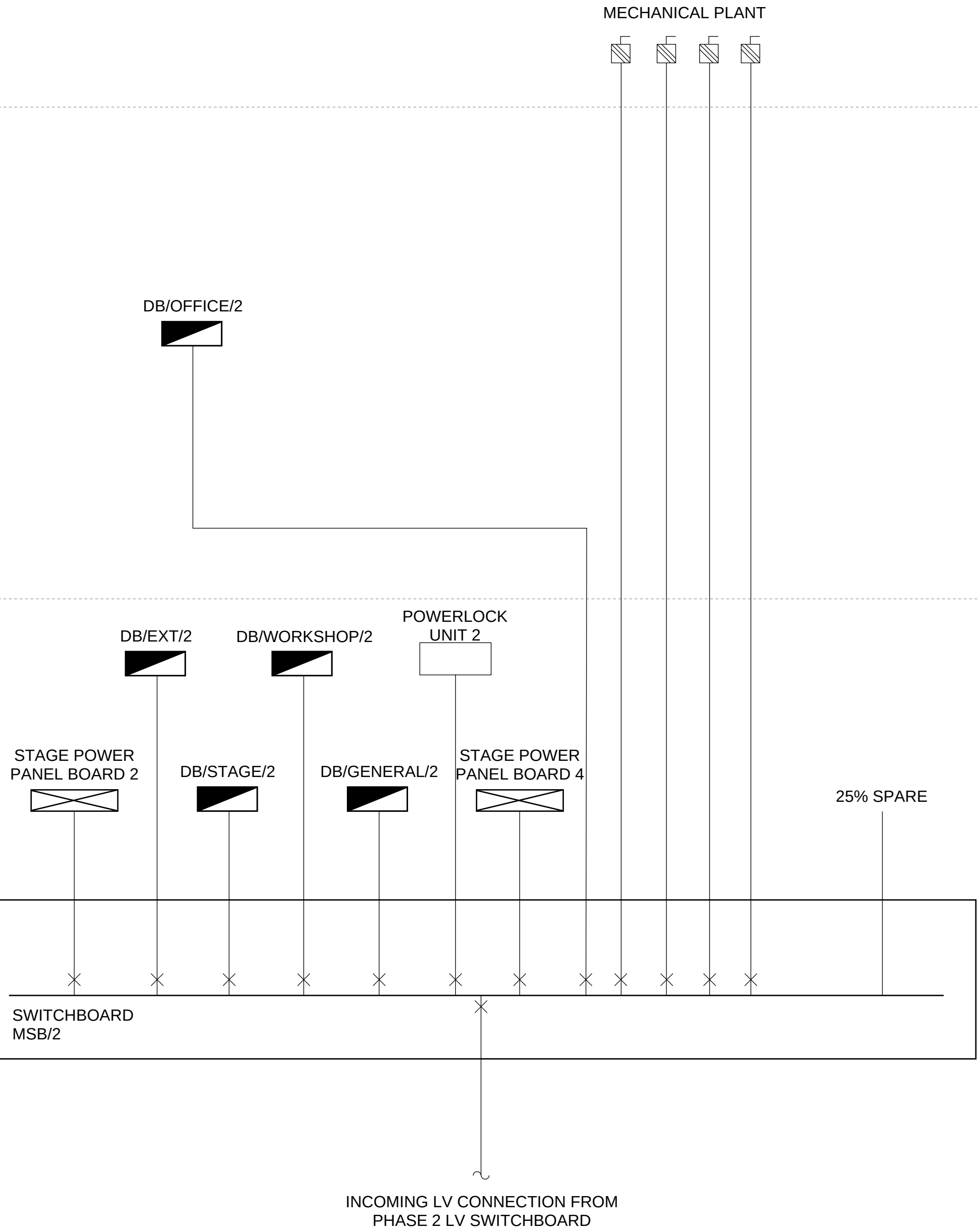
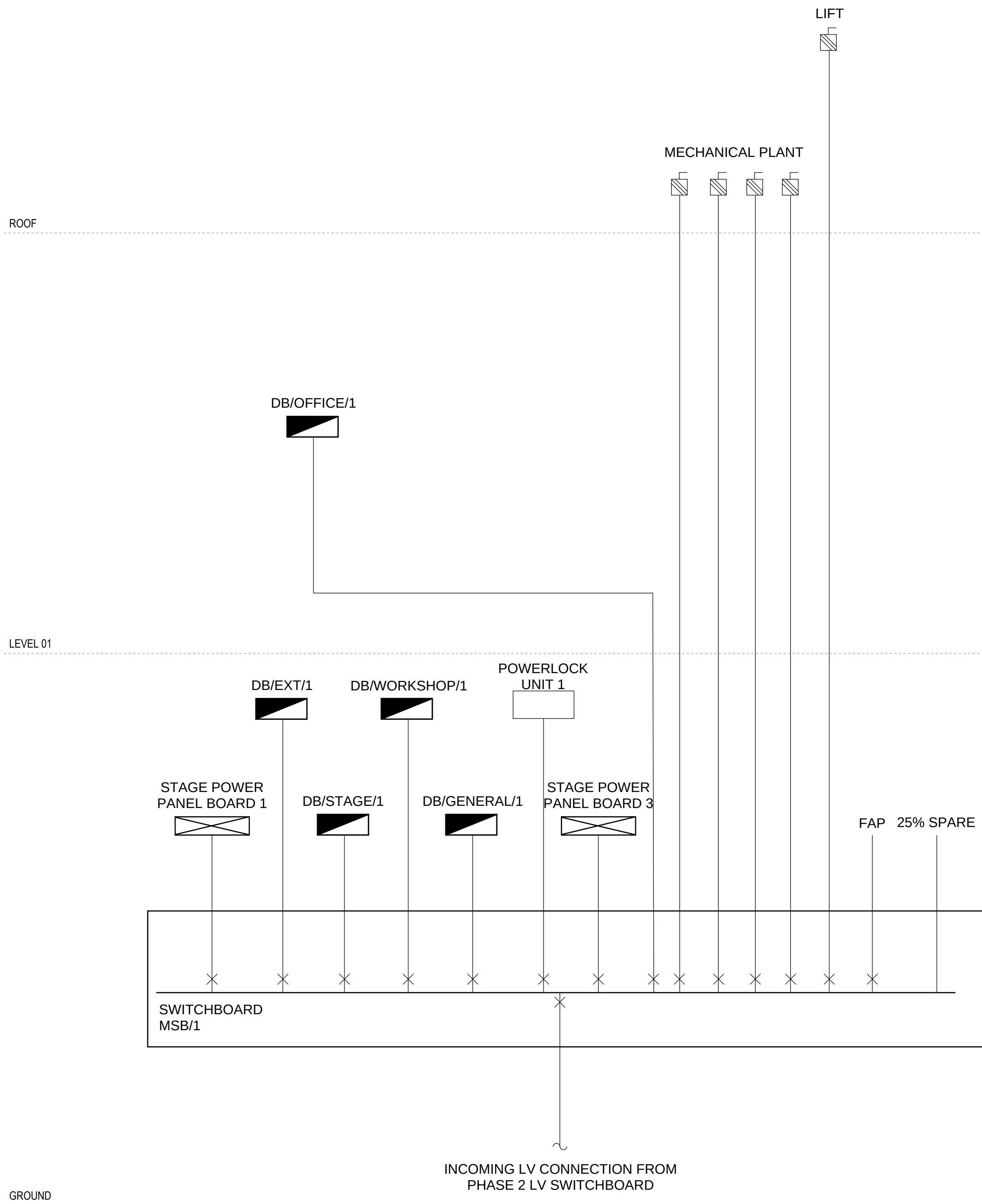




REFERENCE LEGEND

- BM - BELL-MOUTH
- TU - TERMINAL UNIT
- SD - SUPPLY DIFFUSER
- VRF - VARIABLE REFRIGERANT FLOW
- VAV - VARIABLE AIR VOLUME
- CAV - CONSTANT AIR VOLUME
- DD - DISPLACEMENT DIFFUSER
- DL - DRUM LOUVRE
- TS - TEMPERATURE SENSOR

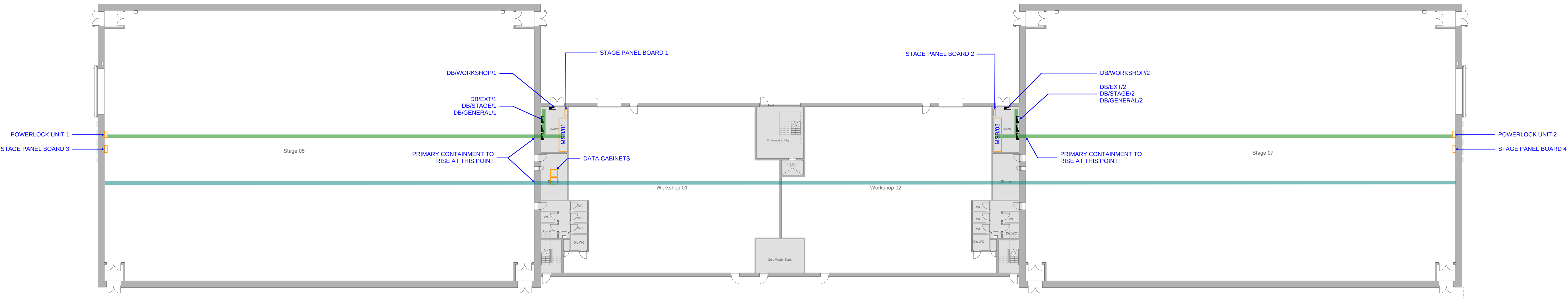




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 9. FINAL ACCESS AND SETTING OUT OF SERVICES SHALL BE AGREED BETWEEN THE ARCHITECT AND THE CONTRACTOR.
 10. THE PROJECT NOTES ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT TECHNICAL SPECIFICATIONS.
 11. WHERE ELECTRICAL SERVICES PASS THROUGH FIRE COMPARTMENTATION CEILING VOIDS, FLOOR VOIDS AND STRUCTURAL WALLS THE CONTRACTOR SHALL SLEEVE/SEAL THE OPENING WITH AN ACOUSTIC AND FIRE SEALANT APPROVED BY THE ARCHITECT.
 12. THE CONTRACTOR SHALL REFER TO THE ARCHITECT'S DRAWINGS FOR DETAILS OF FIRE COMPARTMENTATION.
 13. ALL SIZES AND QUANTITIES ARE PROVISIONAL ONLY AND SUBJECT TO FURTHER DESIGN DEVELOPMENT.

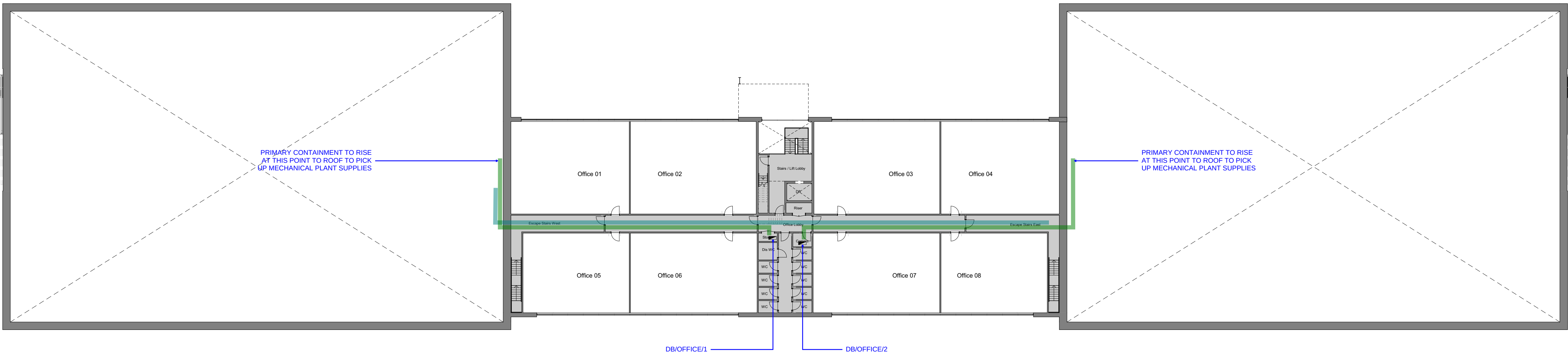
- LEGEND:
-  DISTRIBUTION BOARD
 -  BREAKER
 -  TPN ISOLATOR

PRIMARY LV CONTAINMENT ROUTE
PRIMARY DATA CONTAINMENT ROUTE



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PRIMARY LV CONTAINMENT ROUTE
PRIMARY DATA CONTAINMENT ROUTE



Appendix C - HVAC Systems Appraisal Design Note

Design Note

Project Space Studios – Phase 3

Subject HVAC Systems Appraisal

Project no 0043218

Date 22 June 2021

Revision	Description	Issued by	Date	Approved (signature)
00	HVAC Systems Appraisal	LW	22/06/21	JW

1 Introduction

In order to assist with the selection of the Heating, Ventilation and Air Conditioning (HVAC) systems an appraisal was carried out for each of the three area types - Stage, Office and Workshop - within the proposed Phase 3 development. During the early stages of RIBA Stage 2 BuroHappold compiled a scoring matrix spreadsheet, scoring a number of HVAC systems against a range of criteria which shall be detailed within this design note. Following the scoring exercise BuroHappold arranged a workshop with Space Studios to allow them to apply weighting to each of the scoring criteria, allowing them to ensure that the criteria most important to them was prioritised.

This design note has been produced to document the findings from the workshop and to highlight the actions that Buro Happold have taken since to conclude the final system selections.

2 Matrix Appraisal

2.1 Assessment Criteria

The below list of criteria was selected to give an all-encompassing review of the available systems:

- Planning Impact (against current version of Part L)
- Capital Cost
- Running (Energy/Fuel) Cost
- Space Allocation
- Ease of Operation/ Maintenance
- Greenhouse Gas (GHG) Emissions
- Indoor Environmental Quality
- Potential for Restructuring

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- Flexibility of control
- Aesthetics

2.2 System Scoring

Each of the feasible HVAC systems were scored against each of the criteria by BuroHappold prior to the workshop based upon knowledge of the systems, using a 1 (poor) - 10 (excellent) grading. This exercise was carried out for the three main area types within the Phase 3 studios - Offices, Stages and Workshops. A typical scoring matrix format can be seen below.

	Planning Impact (current version)	Capital Cost	Running (Energy/fuel) Cost	Space Allocation	Ease of Operation/ Maintenance	GHG Emissions	Indoor Environmental Quality	Potential for Restructuring	Flexibility of control	Aesthetics
	6.0	5.8	5.5	6.2	5.8	5.7	6.2	6.3	6.0	5.8
Variable Refrigerant Flow (VRF)	5	7	5	7	5	5	5	5	5	5
4-pipe fan coils - chillers/boilers	5	6	6	5	5	3	6	7	6	6
4-pipe fan coils - heat pumps	6	5	5	6	6	6	6	7	6	6
Natural Ventilation	6	7	6	7	7	6	6	7	7	7
VAV Air Handling - heat pumps	7	6	5	6	6	7	8	8	6	6
Chilled beams - heat pumps	7	4	6	6	6	7	6	4	6	5

Figure 2-1 Typical Scoring Matrix

3 Client Workshop

3.1 Client Criteria Weighting

Following the system scoring exercise carried out by BuroHappold a workshop was arranged with MCDA to allow them to apply weighting to each of the criteria, applying higher weighting to the criteria that were of uppermost priority to them. The system scoring carried out by BuroHappold were unbeknown to MCDA at the time of the exercise, to avoid any potential influence over weighting decisions.

	Planning Impact (current version)	Capital Cost	Running (Energy/fuel) Cost	Space Allocation	Ease of Operation/ Maintenance	GHG Emissions	Indoor Environmental Quality	Potential for Restructuring	Flexibility of control	Aesthetics	Total
	3	4	4	2	3	3	4	2	4	1	30
Variable Refrigerant Flow (VRF)	5	7	5	7	5	5	5	5	5	5	
4-pipe fan coils - chillers/boilers	5	6	6	5	5	3	6	7	6	6	
4-pipe fan coils - heat pumps	6	5	5	6	6	6	6	7	6	6	
Natural Ventilation	6	7	6	7	7	6	6	7	7	7	
VAV Air Handling - heat pumps	7	6	5	6	6	7	8	8	6	6	
Chilled beams - heat pumps	7	4	6	6	6	7	6	4	6	5	

Figure 3-1 Criteria Weighting

3.2 System Results Summaries

Following the criteria weighting exercise carried out during the workshop with MCDA, a conclusive summary table presented the final total system scores.

3.2.1 Stage Area Results

Of the three systems appraised for the stage areas, low level displacement scored the highest on the basis of high-performance efficiency due to its air delivery directly to the low-level occupied zone of the space and therefore reduced conditioning volume. The second highest scoring system was high level 'mixed air' ventilation, which offers continued air conditioning performance in the event temporary structures or green screens are introduced in the stage areas. Each of these systems will be discussed in more detail in the next section.

	ASSESSMENT CRITERIA											Total
	Planning Impact (current version)	Capital Co\$	Running (Energy/fuel) Co\$	Space Allocation	Ease of Operation/ Maintenance	CO2 Emissions	Indoor Environmental Quality	Performance Resilience	Flexibility of control	Aesthetics		
Low Level Displacement Ventilation	3	4	4	2	3	3	3	3	5	2		217
High Level Mixed Ventilation	7	7	8	6	7	8	9	5	5	6		215
High Level Displacement (Supplementary heating)	7	5	7	6	7	7	7	7	5	6		202

Figure 3-2 Stages Appraisal Results Summary

3.2.2 Office Area Results

Natural ventilation was the highest scoring system within the office areas, closely followed by variable air volume (VAV) mechanical ventilation. As further detailed analysis would be required to confirm the suitability of natural ventilation, it has been decided the VAV is the preferred system to propose for the stage 2 design package.

	ASSESSMENT CRITERIA											Total
	Planning Impact (current version)	Capital Co\$	Running (Energy/fuel) Co\$	Space Allocation	Ease of Operation/ Maintenance	GHG Emissions	Indoor Environmental Quality	Potential for Restructuring	Flexibility of control	Aesthetics		
Variable Refrigerant Flow (VRF)	3	4	4	2	3	3	4	2	4	1		162
4-pipe fan coils - chillers/boilers	5	7	5	7	5	5	5	5	5	5		165
4-pipe fan coils - heat pumps	5	6	6	5	5	3	6	7	6	6		174
Natural Ventilation	6	5	5	6	6	6	6	7	6	6		196
VAV Air Handling - heat pumps	6	7	6	7	7	6	6	7	7	7		194
Chilled beams - heat pumps	7	6	5	6	6	7	8	8	6	6		173
	7	4	6	6	6	7	6	4	6	5		

Figure 3-3 Office Appraisal Results Summary

3.2.3 Workshop Area Results

High level radiant panels are the highest scoring system type for the workshop areas, followed by underfloor heating served by air source heat pump. Following a design workshop with MCDA they have confirmed that warm-air heating is their preference, as per the previous phase. This will be discussed further in the next section.

ASSESSMENT CRITERIA											
Planning Impact (current version)	Capital Cost	Running (Energy/fuel) Cost	Space Allocation	Ease of Operation/Maintenance	CO2 Emissions	Indoor Environmental Quality	Potential for Restructuring	Flexibility of Control	Aesthetics	Total	
3	4	4	2	3	3	2	1	3	1		
Warm-Air (Gas Fired)	5	5	4	7	6	3	4	6	3	5	120
Warm-Air (Electric)	4	8	3	8	7	5	4	7	3	5	137
Underfloor Heating (Heat Pump)	8	5	7	7	6	8	7	2	4	8	164
Radiant Panels (Electric)	5	7	8	7	8	8	7	7	9	7	192
Radiant Panels (Heat Pump)	8	4	8	5	6	8	7	6	7	7	172
Variable Refrigerant Flow (VRF)	6	6	5	5	5	6	5	5	6	6	144

Figure 3-4 Workshop Appraisal Results Summary

4 System Options

The client workshop concluded with two potential options per area being identified, which were essentially the two best scoring systems from each of the results summaries. These systems will be reviewed in further detail by BuroHappold during RIBA Stage 2/3. Each of these options shall be discussed in further detail below.

4.1 Stages

4.1.1 Low Level Displacement

Low-level displacement ventilation was the highest scoring system for the stage areas. This is a system that is commonly used in high spaces due to the benefits of delivering the conditioned air directly to the occupied zone at low level. This strategy was used in the Phase One Space Studio stages and we understand from site visits and the “lessons learnt” session that MCDA have been satisfied with its operation in these areas. It should however be highlighted that due to the increased floor area of the proposed Phase 3 stages, further detailed analysis will need to be completed to confirm its suitability for serving the centre of the studio space.

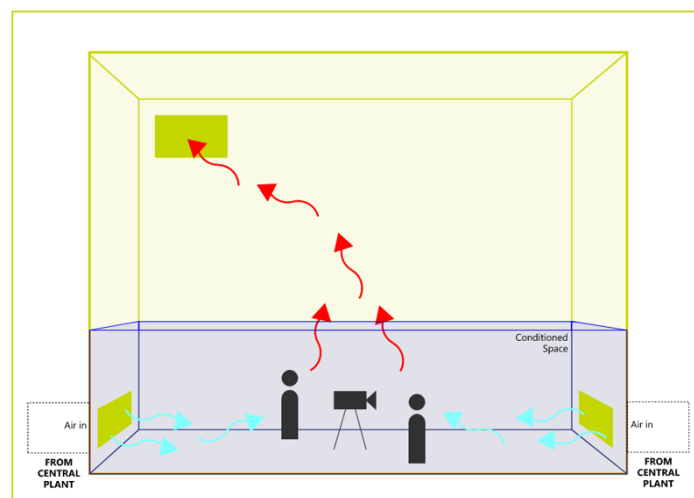


Figure 4-1 Low-level displacement

Advantages

Disadvantages

- Effectively targets and conditions the occupied zone
- Low velocity system (reduced running costs)
- Mitigates risk of 'short circuiting' between high level supply and exhaust grilles
- Air distribution could be impaired by backdrops/temporary partitions
- Potential for discomfort, or additional local cooling required, if filming above the conditioned zone

4.1.2 High Level Distribution

As an alternative to the low-level distribution, two high level distribution strategies were assessed, being displacement and mixing methods. During the workshop BuroHappold highlighted that high-level displacement strategies do not offer warm air delivery, meaning that a supplementary heating system would be required in conjunction with the displacement ventilation system. For this reason, high level 'mixed air' delivery scored more favourably of the two options.

The primary benefit this system has over low-level displacement, is uninterrupted conditioned air supply to the occupied zone with backdrops or temporary partitions in place. The strategy also comes with a number of cons as follows:

- High velocity air movement creating risk of draughts and/or acoustic and comfort issues
- Larger conditioned zone (higher energy consumption)
- Potential for dead spots

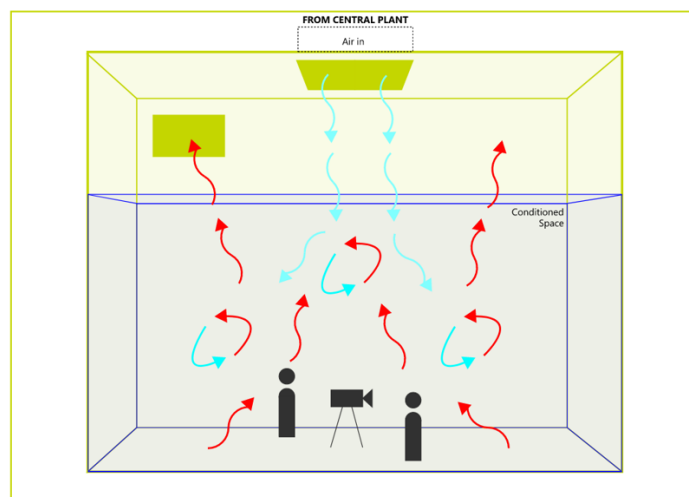


Figure 4-2 High level mixing

4.1.3 Stage Area System Conclusion

Low-level displacement is currently the preferred strategy for the stage areas, however the systems suitability is to be concluded in the early stage 3 design, when further detailed analysis has been carried out. If there are any concerns regarding air distribution following the further analysis, BuroHappold will further review the option of high-level air delivery.

4.2 Offices

4.2.1 Natural ventilation

Natural ventilation scored highest of the appraised options due to its ability to provide passive cooling and ventilation, along with its low capital cost when compared against mechanical systems requiring central plant and distribution systems. A heating system will still be required, therefore the design isn't entirely passive all year round. Additionally, natural ventilation during the winter season will result in increased heat losses due to the absence of heat recovery, with

the only way to avoid being the installation of a mechanical heat recovery system to operate during the heating season only. This would however increase the capital cost of the system.

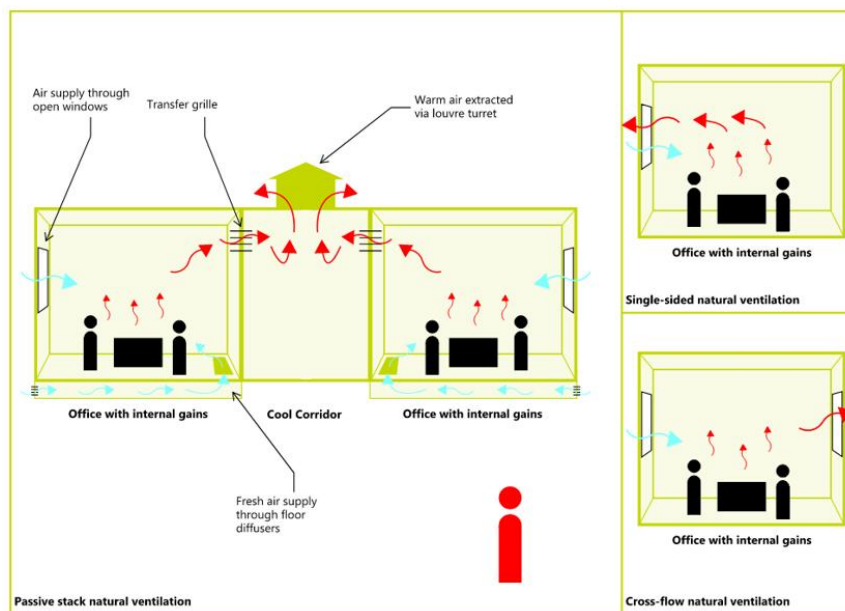


Figure 4-3 Natural ventilation options

Advantages

- Passive ventilation and cooling (zero running costs) during summer/mild weather seasons
- Aesthetically pleasing
- Local user control (i.e. occupants can open/close windows as required)

Disadvantages

- Inefficient during heating season due to exacerbated heat losses
- Risk of overheating during hot summer days
- Potential acoustic issues between areas
- Reduced control over internal air quality
- Potential reconfiguration required of floor plans to suit either single sided ventilation or double sided
- Potentially limits flexibility for future partitioning – partitions could potentially restrict airflow across the space

4.2.2 Variable Air Volume (VAV) ventilation

Variable air volume (VAV) ventilation is the highest scoring mechanical system for the offices, coming second place to natural ventilation. Although it comes with a higher capital cost, VAV offers guaranteed year-round space conditioning with heat recovery. Another benefit VAV offers is the potential for integral heat pumps within the AHU, offering Heating, Ventilation and Cooling from one packaged item of plant. This will inevitably offer reduced capital costs and maintenance requirements. It should be noted though reheat VAV boxes within the internal spaces will require heating supplies; this could be delivered locally via electrical provision, however an Air Source Heat Pump with 2-pipe heating distribution would be preferred to offer the most efficient solution.

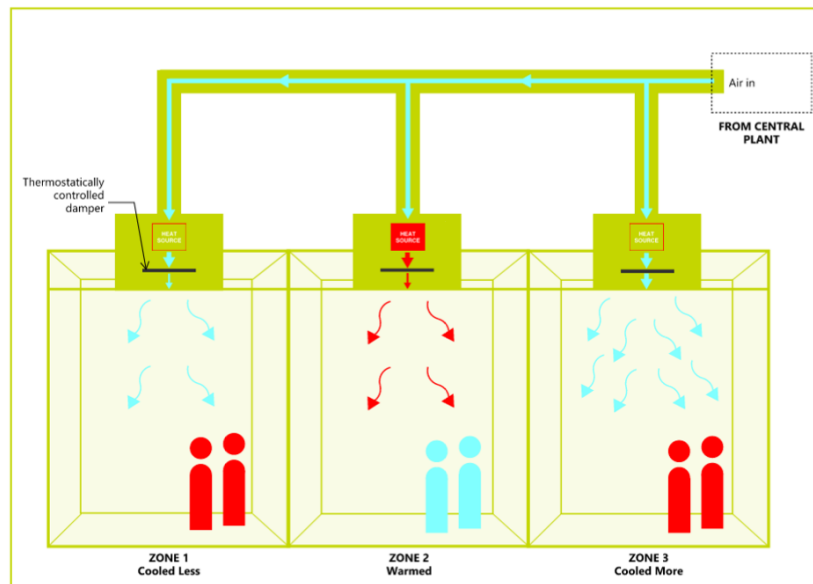


Figure 4-4 Variable air volume (VAV) ventilation

Advantages

- Guaranteed 'free cooling' if external air is below desired room temperature
- Potential for integral heat pump in Air Handling Unit (reduced plant space)
- Long economic system life (20+ years)

Disadvantages

- Large central AHU plant & distribution ductwork
- Local reheating required for simultaneous heating & cooling requirements

4.2.3 Office Area System Conclusion

Given the disadvantages identified with the Natural Ventilation approach it has been concluded that VAV is the most suitable system to provide heating, cooling and ventilation to the office spaces, whilst meeting the key criteria selected by MCDA. As the design develops, the opportunity to utilise natural ventilation methods shall be further explored however for Stage 2 the assumption shall be that a VAV system shall be utilised.

4.3 Workshop

A number of systems were considered for the workshop area, with the highest scoring systems being high level radiant panels and underfloor heating. These radiant systems scored highest on the basis they provide radiant heat directly to the occupants, rather than heating the air volume of the space, the majority of which would inevitably be lost through the large workshop doors which are often open during occupied hours.

During the appraisal workshop, MCDA highlighted that the warm-air heating provision within the existing workshop serve the sole purpose of frost protection of the materials, and not space conditioning of the occupants. On this basis, they are keen to proceed with the existing strategy of warm-air heating, which will be electrical heated in the Phase 3 block, rather than natural gas used in previous phases.

5 Next Steps

BuroHappold will produce the stage 2 design and planning reports on the basis of the above conclusions. To summarise:

- Stages - Low level displacement systems
- Office – Variable Air Volume (VAV) system for heating, ventilation and cooling
- Workshops – Warm-air electric heaters and ventilation through infiltration

Appendix D - Electrical Supply Options Design Note

Design Note

Project Space Studios Manchester - Phase 3
Subject Electricity supply options
Project no 0048853
Date 5 November 2021

Revision	Description	Issued by	Date	Approved (signature)
01	For information	YP	06/07/2021	JW
02	For information	YP	05/11/2021	JW

1 Introduction

The purpose of this design note is to discuss and identify the options of power provision to the Phase 3 Space Studios premises.

At this stage of design it is anticipated that the total electrical load for Phase 3 is estimated to be approximately 700kVA, including 25% space capacity.

The feasibility, potential cost, resilience, space, and future expansion capability of each option are investigated and evaluated, summarised in a comparison table, including Buro Happold's recommendation at this point.

2 Electricity Supply Options

2.1 Option 1 – New MV supply

This option would involve a new main incoming electrical supply be provided to the building from the local Electricity North West Ltd (ENWL) HV ring.

A new incoming ENWL supply would require a new HV/LV substation, along with a local LV switch room which would house the electricity meters and primary switchgear. The substation would be located either within the building's envelope (similar to the Phase 1 arrangement) or externally near the building in a brick or GRP enclosure (similar to the Phase 2 arrangement). The substation would require a space of approximately 4m x 4m, whilst the Switchroom would require a space of approx. 4m x 3m – likely back-to-back with the substation to reduce cabling distances and therefore costs.

It's highly likely that the HV ring serving Phases 1 and 2 would be the source of the Phase 3 supply, therefore resilience will only be marginally better than Options 2 and 3 identified within this report. The only added resilience would be against the potential for either a switchgear or transformer fault on site, however transformers are extremely reliable due to the nature of their construction. If a fault developed in the HV ring this would likely affect all three phases.

Of the three options discussed in this report this arrangement will likely result in the highest capital cost. An application has been made to Electricity North West for the new connection and a quotation is awaited, however it is likely that the cost could be in excess of £50,000 (plus spatial requirement cost) due to the requirement for a new substation. There is also the potential that network reinforcement works are required by ENWL in order to provide the additional capacity which would further increase costs.

Based upon the metering data provided for Phases 1 and 2 it would appear that there is significant spare capacity in the existing supplies serving the site, therefore sourcing a new incoming supply and providing new equipment wouldn't be making best use of the existing infrastructure available on site.

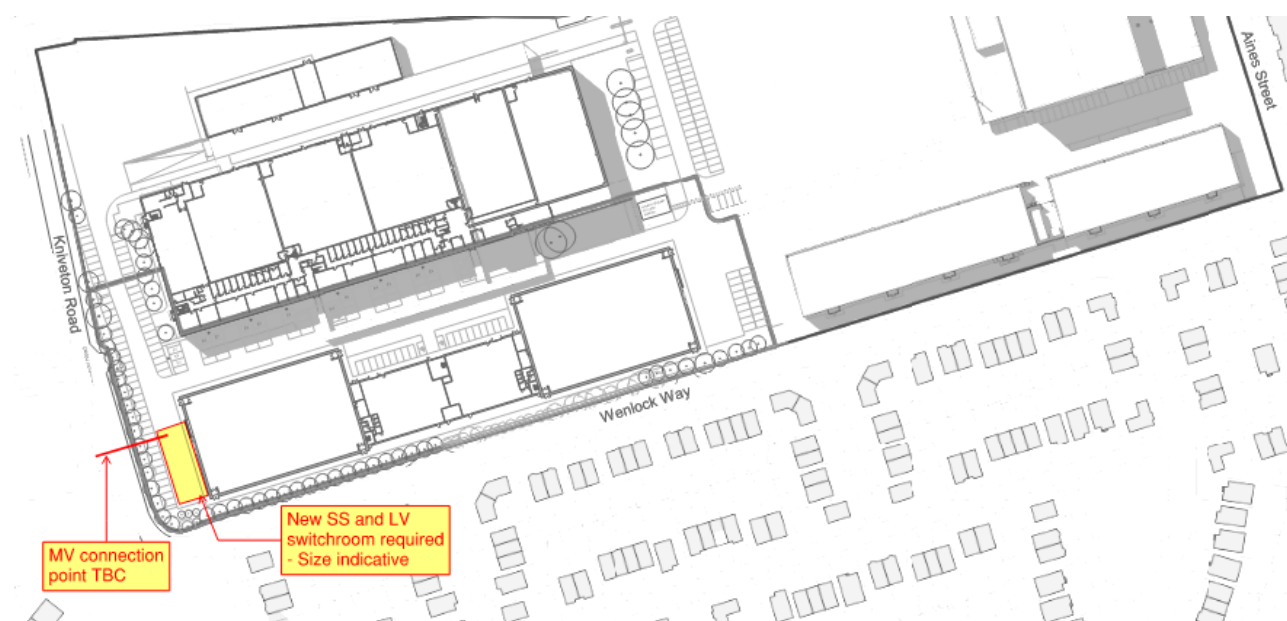


Figure 1 – New MV supply indicative arrangement

2.2 Option 2 – LV Supply from Existing Substation from Phase 1

This option would provide 2no. Low Voltage (LV) connections from the existing Phase 1 switchgear housed within the switch room adjacent the Phase 1 substation.

The meter readings provided for this supply suggest that there is sufficient spare capacity in this substation to support the additional load of Phase 3.

The LV switchboard in Phase 1 switch room will require extending to add 2no. 630A TP&N MCCB's to serve the Phase 3 switchboards. The maximum rating of MCCB available within the existing switchboard is 630A TP&N, therefore it is not possible to provide a single supply to the Phase 3 development. Providing 2no. supplies provides an added level of resilience to Phase 3 – should 1no. supply fail then half of the building would still be powered.

In order to install the extension to the existing switchboard and connect the supplies to serve Phase 3 there would be a shutdown of the existing switchgear required which is anticipated to take approx. 2no days. It is assumed that this could be arranged during a weekend in a period where there are no bookings for the Stages in order to minimise disruption to the existing staff / facilities. There will however be disruption to the vehicle routes around the building as a result of the trenching works required to route the new supply to the Phase 3 development.

This arrangement is anticipated to cost less than Option 1. The associated costs for this option are:

- New cubicle(s) with respective breakers and meters in the existing LV switch room (*approximate cost £20,000 based on feedback from existing switchgear manufacturer*)
- New cabling from Phase 1 to Phase 3 (*approximate total cables length 300m for each of the two connections*)
- Trenching associated with new cabling routes (*approx. 300m - majority in carpark*)

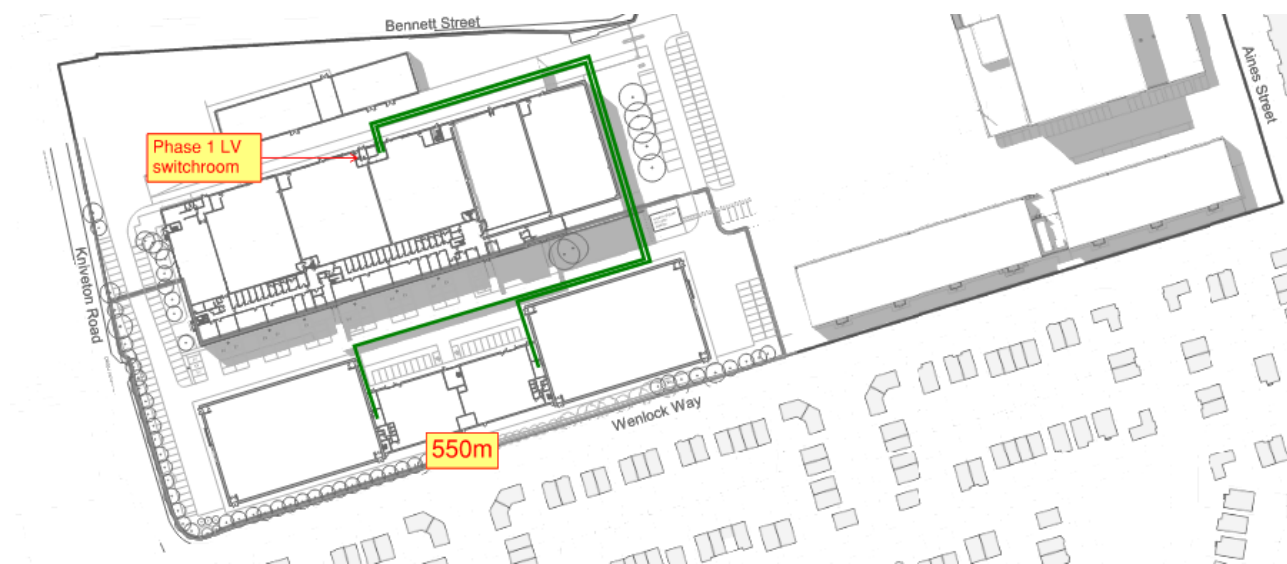


Figure 2 – 2no. LV connections emanating from existing Phase 1 LV switch room

2.3 Option 3 – LV Supply from Existing Substation from Phase 2

Similar to Option 2, this option would provide 2no. Low Voltage (LV) connections from the existing Phase 2 switchgear housed within the switch room adjacent the Phase 2 substation.

The meter readings provided for this supply also suggest that there is sufficient spare capacity in this substation to support the additional load of Phase 3.

The LV switchboard in Phase 2 switch room will require extending to add 2no. 630A TP&N MCCB's to serve the Phase 3 switchboards. The maximum rating of MCCB available within the existing switchboard is 630A TP&N, therefore it is not possible to provide a single supply to the Phase 3 development. Providing 2no. supplies provides an added level of resilience to Phase 3 – should 1no. supply fail then half of the building would still be powered.

In order to install the extension to the existing switchboard and connect the supplies to serve Phase 3 there would be a shutdown of the existing switchgear required which is anticipated to take approx. 2no days. It is assumed that this could be arranged during a weekend in a period where there are no bookings for the Stages in order to minimise disruption to the existing staff / facilities.

This arrangement is expected to cost less than the first option. The associated costs for this option are:

- New cubicle(s) with respective breakers and meters in the existing LV switch room (*approximate cost £20,000*)
- New cabling from Phase 2 to Phase 3 (*approximate total cables length 300m for each of the two connections*)
- Trenching associated with new cabling routes (*approx. 250m - majority in soft ground*)

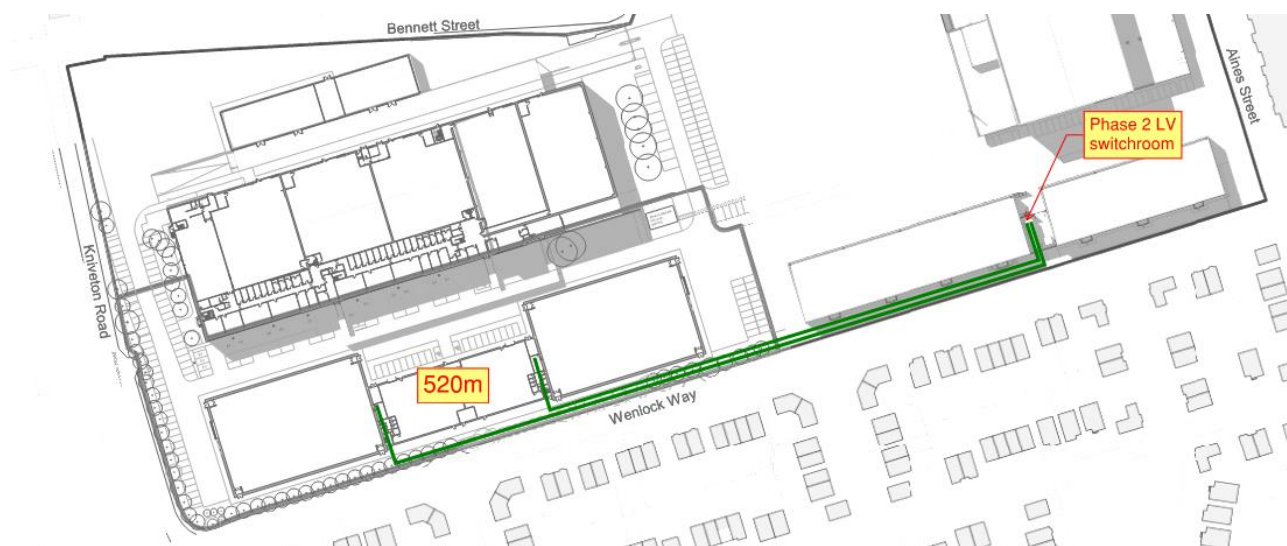


Figure 3 – 2 x LV connections emanating from existing Phase 2 LV switch room

3 Summary comparison table

The table below sets out the criteria, weighting factors and scoring for each option against the criteria set in order to compare and evaluate them.

	ASSESSMENT CRITERIA							Total
	Space requirement	Capital Cost	Resilience	Future expansion capability	Utilisation of existing infrastructure	Feasibility risk	Impact on operation of site	
New MV supply	4	5	2	2	3	4	4	
LV supplies derived from Phase 1 Substation	6	5	9	9	5	8	9	168
LV supplies derived from Phase 2 Substation	10	7	8	7	7	7	5	174
	10	8	8	7	7	6	6	179

Table 1 – Options' comparison scoring table

Description of each criterion is listed below.

Criteria	Description
- Space requirement	Area required for associated electrical equipment
- Capital Cost	Initial Installation cost
- Resilience	Likelihood to not lose mains supply
- Future expansion capability	Spare connection points available post completion
- Utilisation of existing infrastructure	The extent the existing infrastructure is utilised
- Feasibility risk	Likelihood this option may be deemed to not be feasible following detailed design
- Impact on operation of site	Impact on site operation during installation of supply

Based on the above and current available information it is currently proposed that the supply for the Phase 3 development be provided from the existing Phase 2 switchgear. This note will be updated once costs are available from Electricity North West for Option 1.

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