



Project J000983 - Cross Road Angmering Mechanical and Ventilation Services Specification

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Document Control

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1 Introduction

This document forms the Specification for Mechanical and Ventilation Services for the proposed renovation and extension at adjacent to 1 Cross Road, Rustington, Littlehampton, West Sussex, BN16 2ST.

Any conflicts or contradictions with any other contract documentation or drawings should be highlighted to the employer or their agent.

The services detailed in this document are:

- Space Heating
- Hot Water
- Control Systems
- Ventilation
- Incoming Utilities – Water

2 General Requirements

2.1 Contractor Responsibilities

Whilst Enhabit has designed the services detailed in this document, certain elements of the final design will be the responsibility of the contractor. These are:

- Detail of all access requirements for maintenance of services in order to ensure that all plant and equipment associated with services can be safely and easily maintained
- Detailed design and location of any brackets and supports related to services and associated plant
- Final valve locations
- Detailed pipework routes
- Ensuring clearances for safe operation of all equipment
- Spatial coordination of all services (not just those specified in this document)
- Setting to work and commissioning of all related plant and equipment
- Provision of commissioning reports in accordance with Building Regulations
- Liaison with Statutory Authorities to arrange the provision of new or amended utilities

2.2 Quality Standards

The contractor will demonstrate quality control procedures and practices that ensure:

- Full compliance with ISO 9001 and ISO 14001 standards and procedures
- Full compliance with this specification with regard to design, materials and workmanship
- Provision of samples of materials to the client prior to ordering
- All works and materials are provided in accordance with the appropriate British Standard or Code of Practice
- Where dimensions are indicated on drawings, they are checked on site to ensure tolerances can be accommodated

- Compliance with all statutory instruments and regulations, and local byelaws relating to the area of the site
- Compliance with the requirements of the Local Authority Building Inspector
- Notification of all authorities in accordance with their regulations and obtain any required approvals for the installation.

2.3 Protection and handling of Mechanical Equipment

The Contractor is to provide adequate and safe protection for all materials and products after installation:

- Ensure all items are protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.
- Protect during erection all easily damaged materials with hardboard covers or heavy duty polythene sheet.
- Protect all finished items from damage and paint splashes.
- Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable.
- Only install filter media when the plant items concerned are being commissioned and tested.
- Cover all plant items with polythene sheeting except when being worked upon.
- Cap all open ends of pipes, ducts, conduit and trunking etc except when being worked upon.
- Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.
- Paint parts liable to corrosion immediately after removal of any temporary protection.
- Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

2.4 Operation/Maintenance

The contractor is to provide Record Drawings, Schedules and Equipment Information to support the installed services and related plant equipment within 10 working days of Practical Completion.

These documents should include:

- Annotated drawings showing as installed pipe/cable/duct routing for all services
- Annotated drawings showing the location/routes of all underground services
- Details of maintenance and servicing requirements for all equipment
- Copies of all related guarantees and warranties
- Copies of all user manuals and related manufacturer's information
- Copies of test and commissioning certificates for all equipment
- Meter Readings at Practical Completion

3 Project Details

1 Cross Road, Angmering is a detached residential dwelling, to be arranged over a basement, ground, first and second floors.

The client requires a strong emphasis on energy efficiency and thus the fabric performance of the building will be significantly better than that required by Building Regulations.

The following assumptions have been made during the design of the M&V services detailed in this document:

- The performance of thermal elements is as specified on the project drawings and documents
- The final airtightness of the building will be 5.0 Air Changes per Hour (ACH) or better
- Layouts will be as per the drawings listed in section 7
- There will be no further major design changes

4 Design Criteria

4.1 General Criteria

The mechanical and ventilation services designs shall meet the following regulations, design guidance and recommendations:

- Relevant current British Standards (BS) and harmonised European Standards (EN)
- UK Building Regulations
- Chartered Institute of Building Services Engineering (CIBSE) Guides
- The Building Services Research and Information Association (BSRIA) Guides
- Health and Safety Executive Guidelines
- Health and Safety at Work Act and other Statutory Health and Safety Documents
- Construction (Design and Management) Regulations (CDM)
- Manufacturer recommendations
- The Water Regulations
- IEE Wiring Regulations BS7671
- The Institute of Gas Engineers Regulations
- Institute of Plumbing Engineering Design Guide
- The Control of Noise at Work Regulations 2005

All new services shall meet the minimum recommendations contained within UK Government Domestic Building Services Compliance Guide 2013.

Where elements of the systems have are not specified, the Contractor shall ensure that all systems achieve CIBSE M, Appendix 13.A1 indicative life expectancies with a minimum design life of 25 years as far as reasonably practicable.

Commissioning shall be undertaken in accordance with BSRIA and CIBSE guidelines.

4.2 Design Criteria for Mechanical Systems

4.2.1 External Conditions

The worst-case external temperatures are -5°C and 10°C for the ambient air and ground respectively.

4.2.2 Internal Conditions

Design Temperature. The design temperature used is 20°C throughout.

Overheating. The design should ensure that the building remains below 25°C for at least 90% of the time. The property is reasonably well shaded, but this will also be achieved by a combination of mechanical ventilation and natural ventilation during the summer, as well as some active cooling from a reversible air source heat pump.

Humidity. The designed humidity of the building is between 40 and 60%.

These parameters are compliant with both passivhaus principles and CIBSE Guide A: Environmental Design.

4.2.3 Internal Heat Gains

In order to calculate internal heat gains, occupancy rate can be calculated based on liveable floor area, which for this project is 515m^2 .

This results in an internal heat gain (in winter) of $2.3\text{W}/\text{m}^2$. However, this is discounted in heat loss calculations to represent a worst-case scenario.

Note that this is a different methodology from CIBSE Guide A, but is likely to be more accurate as the input parameters used by the passivhaus model are more comprehensive.

4.2.4 Building Fabric

The project will, as a minimum, comply with Building Regulations Approved Document Part L1A 2010 (2013 Edition).

Performance of the thermal elements (walls, floors, roofs, windows and doors) have been taken from the project specification:

External Walls– $0.26\text{ W}/\text{m}^2\text{K}$

Ground Floors (basement and ground floor) – $0.18\text{ W}/\text{m}^2\text{K}$

Roofs (new flat roof and existing pitched roof) – $0.16\text{ W}/\text{m}^2\text{K}$

Windows & Doors – $1.60\text{ W}/\text{m}^2\text{K}$ installed (triple glazing)

The design airtightness for this project is 5.0 air changes per hour @ 50 pascals.

The final peak heat load is calculated at $27.1\text{ W}/\text{m}^2$, including a 50% factor of safety.

4.2.5 Ventilation

The ventilation design must meet the requirements of both Building Regulations Approved Document Part F 2010 and Passivhaus guidelines. These are summarised below:

Extract Rates required by Building Regulations Part F 2010

Room	Intermittent Extract Minimum Rate	Continuous Extract	
		Minimum High Rate	Minimum Low Rate
Kitchen	30 l/s adjacent to hob 60 l/s elsewhere	13 l/s	Total extract rate should be at least the whole dwelling ventilation rate (see below)
Utility	30 l/s	8 l/s	
Bathroom	15 l/s	8 l/s	
Sanitary Acc	6 l/s	6 l/s	

Supply Rates required by Building Regulations Part F 2010

Whole Dwelling Ventilation Rates	Number of Bedrooms				
	1	2	3	4	5
Whole Dwelling Ventilation Rate by No. of bedrooms	13 l/s	17 l/s	21 l/s	25 l/s	29 l/s
Whole Dwelling Rate by internal floor area	The minimum supply ventilation rate must be not less than 0.3 l/s per m ² of internal floor area.				

Extract Rates required by Passivhaus

Room	Maximum Extract Rate (m ³ /h)
Kitchen	60
Bathroom	40
Shower Room	20
WC	20

Supply Rates required by Passivhaus

30m³/h of air per person based on a standard occupancy rate of 1 person per 35m³ of internal floor area.

For this property, the Building Regulations whole dwelling supply rate derived from internal floor area is the dominant factor. This results in a maximum ventilation rate requirement of 726 m³/hr.

4.2.6 Hot and Cold Water Demand

Hot and cold water systems should be designed in accordance with BS 8558, BS EN 806 and HSE 'L8 - Legionnaires' Disease; Control of Legionella Bacteria in Water' and CIBSE guidance.

Design flow rates for appliances and fittings are as follows:

Appliance/Fitting	Design (l/s)	Min (l/s)
Hand Basins	0.15	0.10
WC Cisterns	0.15	0.10
Kitchen Sink	0.2	0.15
Washing Machine	0.2	0.03
Dishwasher	0.15	0.15
Shower	0.2	0.10
Bath	0.3	0.10

Good practice hot water requirements are assessed as typically being 45 litres per person. With a typical occupancy of 6 people and a maximum designed occupancy of 10 people, this gives a minimum requirement of 270 and 450 litres of hot water per day, respectively. A 300L domestic hot water cylinder is specified to provide adequate hot water and reasonable re-heat times for when the typical occupancy is exceeded.

5 Incoming Services

The Contractor shall be responsible for all liaison with the local water and electricity authorities. The Contractor shall obtain and complete any necessary application forms on behalf of the client (client to raise any payments necessary) associated with the electricity and water services including meter provision.

5.1 Water

The proposed heating system is an air source heat pump with an unvented hot water storage cylinder. The pressure of the incoming main should therefore be tested by the Contractor prior to any mechanical works in order to ensure that it is sufficient to support the system design. It is suggested that the minimum flow rate should be 52.5 l/min with an associated minimum pressure of 2.5 bar. It is recommended that a new MDPE water supply pipe of outer diameter 32mm is used if a new supply pipe is laid.

6 Specifications

Domestic hot water shall be provided by a pressurised unvented system using an air source heat pump as the heat source. Hot and cold water feeds are to be provided to all sinks, bathrooms and the kitchen. In-line isolating valves are to be included prior to all sinks and appliances.

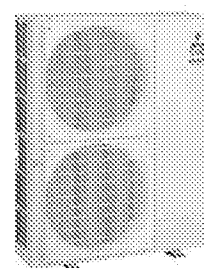
6.1 Water Softener

A Great Water Pro Series 1400 up to 58L/min water softener is to be fitted with softened water supplies to all locations other than the kitchen tap, outside taps and dishwasher & washing machine.

6.2 Heating Source

The main heating source will be a 14 kW Mitsubishi Monoblock 14kW Ecodan Air Source Heat Pump. This will provide hot water for both stored hot water and for space heating at variable temperatures.

The Heat Pump will be linked to Heatmiser room thermostat sensors which will allow the heating flow temperature to be adapted to the temperature required and thus reduce the risk of overheating.



6.3 Heating System Pump

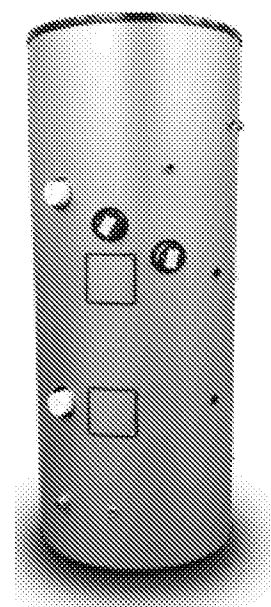
The heating system pump will be a Grundfos New Alpha 2 circulation pump.

6.4 Hot water storage

Hot water will be provided by a 300L Newark Copper Cylinders Stainless Steel cylinder with high gain coil for use with heat pump. Cylinder insulation should be 100mm thick. The thermostatic pocket should match size of the Mitsubishi FCT-5 hot water temperature sensor.

This tank should be fitted with 3 backup 3kW electric immersion heaters. **One for the heat pump for legionella sterilization and two for peak usage boost mode.** Primary pipework will need to be fully insulated with 25mm Armaflex.

With the size of heat pump specified, the worst-case recovery time for hot water are is follows:



Cylinder re-heat time from cold
45 minutes – without immersion heaters
31 minutes – with immersion heaters

6.4.1 Secondary Circulation

Secondary circulation of hot water should be included in order to ensure that the wait time at outlets is always less than 10 seconds.

The secondary circulation return pipework should be sized at 10mm from the furthest hot water supply point in order to minimise wild heat gains. The secondary circulation pump should be a Grundfos Comfort PM Basic.

Secondary circulation pipework should be insulated as per section 7.1.6 below.

6.5 Water System Installation

Installation of the hot water system shall conform to the following requirements:

- All pipework and fittings shall be installed in copper where visible and, polyethylene BPEX plastic pipework where hidden as according to BS 7291.
- Exposed waste pipework shall be in chrome with chrome fixings and fittings.
- Joints in pipework runs located in voids shall be kept to a minimum and shall be accessible where possible.
- Where space allows, all pipes, valves and fittings should be insulated with Armaflex Class O closed cell insulation (lambda value of 0.38 W/mK or less) or equivalent. 15mm pipes should be insulated with 13mm insulation and 22mm with 19mm insulation or greater.
- The Contractor shall be responsible for protecting any external or vulnerable hot water services from freezing.
- Local isolation and drain points shall be available in order to minimise downtime caused by the need to drain wet systems and to facilitate the removal of pipe sections.
- Allow for isolation on all floors and the kitchen
- The Contractor shall provide a hot water service to serve all hot water outlets and thermostatic mixing valves.
- Dead legs shall be kept to a minimum, with all systems installed in accordance with HSE 'L8 - Legionnaires' Disease; Control of Legionella Bacteria in Water'.

6.6 Thermostatic Mixing Valves (TMVs)

As part of the hot water installation, the Contractor shall:

- Provide Approved TMV2 type thermostatic mixing valves on services to all baths.
- TMVs are to be provided in accessible locations and are to be of a maintainable type.
- All TMVs are to be provided with isolation valves to facilitate maintenance.
- Be responsible for testing and commissioning all Thermostatic Mixing Valves and providing signed certification to demonstrate such to the Contract Administrator's satisfaction.

6.7 Space Heating

Space heating is to be provided by underfloor heating throughout, with additional towel rails in bathrooms, shower rooms and WCs. All underfloor heating systems will be wet, fed by the air source heat pump.

In the basement and ground floor UFH will be provided by the Omnie ScreedPlate system. On the first and second floors UFH will be provided by the Omnie FoilBoard system for joisted floor construction. Detailed underfloor heating pipework layout is to be designed by the underfloor heating manufacturer to the heat loss specification shown below, at 50°C heating flow temperatures.

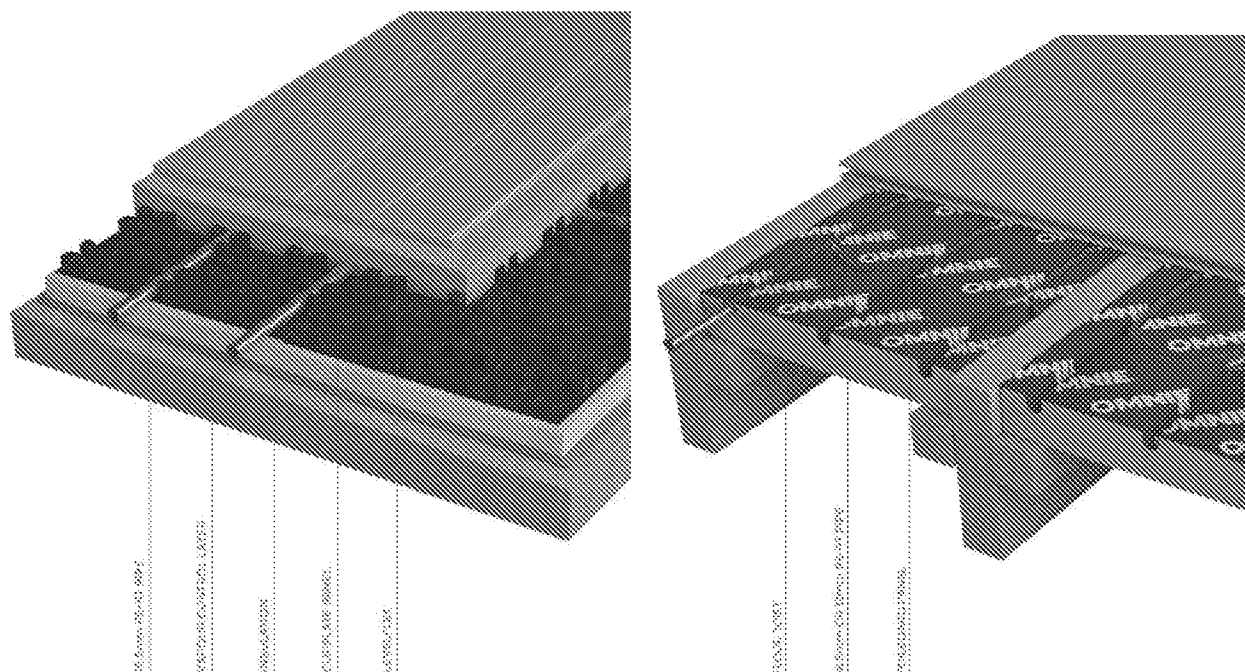
The flow temperature is assumed to be 50°C from the air source heat pump. However, this is to satisfy the worst-case heating demand, so the heat pump will often operate at a lower and more efficient flow temperature.

6.7.1 Heating Emitter Specification

	Floor Area (m2)	Heat Demand with 50% safety factor (W)	Floor Type	UFH Specification	Max. UFH Output (W)	Total Max. Heating System Output (W)
Gym/Games room	113.8	2192	Polished concrete	Omnice Screedplate	11835	9643
Store	8.25	143	Polished concrete	Omnice Screedplate	858	715
WC	4.5	256	Tiles	Omnice Screedplate	468	212
Cupboard	3	88	Polished concrete	Omnice Screedplate	312	224
Kitchen	67.4	3430	Engineered timber	Omnice Screedplate	5055	1625
Dining - Lounge	56.2	2111	Engineered timber	Omnice Screedplate	4215	2104
Hall	35.9	1256	Engineered timber	Omnice Screedplate	2693	1437
WC	2	51	Tiles	Omnice Screedplate	208	157
Office	23	268	Engineered timber	Omnice Screedplate	1725	1457
Master Bedroom	31.8	343	Carpet	Omnice Foilboard	1908	1565
Master Ensuite	8.7	113	Tiles	Omnice Foilboard	905	792
Bedroom 1	18.5	200	Carpet	Omnice Foilboard	1110	910
Ensuite 1	4	52	Tiles	Omnice Foilboard	416	364
Landing	15.4	166	Carpet			-166
Bathroom	9.20	119	Tiles	Omnice Foilboard	957	838
Bedroom 2	24.70	267	Carpet	Omnice Foilboard	1482	1215
Bedroom 3	15.9	431	Carpet	Omnice Foilboard	954	523

Bedroom 4	28.9	841	Carpet	Omnie Foilboard	1734	893
Ensuite 4	6.8	352	Tiles	Omnie Foilboard	707	355
Loft space storage 1	20.0	213	Tiles			-213
Loft space storage 2	17.6	233	Tiles			-233
Total	515.6	13124				24418

6.7.2 Underfloor Heating - Omnie Screedplate & Omnie Foilboard Floor Construction



6.7.3 Heated Towel Rails

All bathrooms, shower rooms and WCs should have electric towel rails in addition to underfloor heating. These are only required for warming towels, and do not form part of the primary heating strategy. They should therefore be sized to be appropriate for towels.

6.8 Space Heating Installation

Installation of the space heating systems shall conform to the following requirements:

- Heating pipework is to be concealed generally within wall, ceiling or floor voids.
- Provision shall be made for pipework expansion as required.
- The contractor is responsible for all expansion design and installation.

- Install drain points and manual air vents fitted at all low and high points respectively in the system.
- Allow for the provision of all pipework expansion, draining and air-venting dependent on final pipework heights.
- Contractor to provide all builders' work holes as required.
- All the pipe systems shall be flushed clean and pressure tested as recommended by BSRIA.
- All existing systems to be flushed and cleaned where feasible with any redundant pipework removed where modifications have been undertaken.
- The Contractor shall ensure all remaining pipework is insulated and labelled as necessary.
- Care must be taken to prevent the introduction of pseudomonas and biofilm contaminants into the pipe systems.
- Insulate and label all pipework, including valves and accessories
- Thermal insulation shall be Green Guide A rated, with zero Ozone Depletion Potential (ODP) and Global Warming Potential (GWP) less than 5.

6.9 Ventilation

The ventilation strategy for the building is a Mechanical Ventilation and Heat Recovery System to be operated in conjunction with natural ventilation for purge ventilation when required.

The contractor is to supply and install a whole house mechanical ventilation system with heat recovery (MVHR) in accordance with Building Regulations ADF 2010 "System 4 – continuous mechanical supply and extract with heat recovery". In addition, a recirculating hood is to be provided in the kitchen area.

6.9.1 Relevant Standards

This performance specification provides for continuous ventilation of the house under standard operating conditions to comply with all relevant standards and current Building Regulations.

- Building Regulations
 - Approved Document Part F: Ventilation
 - Approved Document Part L1: Conservation of fuel and power in dwellings
 - Approved Document Part B: Fire safety
- CIBSE Guide B: Heating, Ventilation, Air Conditioning and Refrigeration (2005)
- Manufacturer's installation instructions

6.9.2 MVHR Unit Performance

The MVHR Units will be two Zehnder ComfoAir Q600s with enthalpy exchanger which will provide a maximum ventilation rate of 726 m³/hr in boost mode

Key performance characteristics of the Zehnder ComfoAir Q600 are as follows:

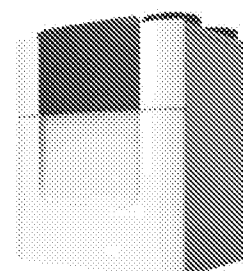
Certified Flow Rate: 70 – 460 m³/hr

Design Flow Rate: 440 m³/hr and 286 m³/hr in boost mode

Thermal efficiency (passivhaus method): 87%

Filters: Grade G4 for intake, G4 for extract

Summer bypass: Automatic and Variable



6.9.3 MVHR Unit Configuration

Condensate drain:

- No condensate drain is required.

Controls:

- Unit to be controlled via the three position switch.
- Three position switch to be located in an easily accessible position in the kitchen area. This will require a 1mm 4 core cable to be run between the MVHR unit and Kitchen control switch location.

6.9.4 Ducting

Ducting type:

Ducting to be Lindab Safe rigid steel, Zehnder ComfoTube, as required.

Ducting layout:

To be issued

External duct insulation:

- External ducting to be insulated with closed-cell insulation layer (Armaflex or similar)
- Insulation thermal conductivity to be a maximum of 0.040 W/m.K
- Insulation thickness to be a minimum of 25mm

Acoustic requirements and sound attenuation:

- Sound limit in habitable room = 25 dB(A)
- Sound limit in plant room and wet rooms = 35 dB(A)

Fire:

- MVHR design to ensure appropriate fire protection when passing through construction elements in order to maintain a protected egress route via the staircase. Where ventilation pipes pass through walls or ceilings, intumescent pipe collars are to be provided. MVHR design is to be submitted to the building control officer to assess compliance with fire regulation requirements.

6.9.5 Design Parameters

The supply/extract rates for each room have been calculated as follows:

Extract Flow Rates

Rooms extracted	Boost Rate (m3/hr)	Normal Flow (m3/hr)
	726	108
Gym/Games room	80	61
Shower Gym	40	31

WC	40	31
Store	40	31
Cupboard	40	31
Kitchen	60	46
Laundry	80	61
WC	33	25
Cloak room	40	22
En-suite 1	40	31
Master En-suite	40	31
Laundry cupboard	40	31
En-suite 4	40	21
Loft space 1	40	31
Loft space 2	33	25
Hall	40	31

Supply Flow Rates

Rooms supplied	Boost Rate (m ³ /hr)	Normal Flow (m ³ /hr)
	140	108
Gym	160	123
Family room	70	54
Dining	66	49
Lounge	80	62
Office	40	31
Hall	40	31
Bedroom 1	40	31
Master Bedroom	70	54
Bedroom 2	40	31
Bedroom 3	60	46
Bedroom 4	60	46

6.9.6 Installation

Airtightness around external duct penetrations:

- Airtightness layer to be maintained around external ducting penetrations using ProClima Reflex pipe grommets or approved equivalent.

Transfer openings:

- Door undercut with a minimum area of 7,600mm² above floor finish in all internal doors (10mm)
- Pressure drop between rooms to be under 1Pa

Electrical

- Unit to be connected to the mains electrical supply: 230VAC 50Hz
- Power supply to be located within 1 metre of the unit

Construction:

- All ducts and terminals to be kept protected from ingress of construction dust and debris with effective sealing of exposed ends with a temporary membrane until final fix of terminal units.

6.9.7 Enhanced commissioning

System is to be commissioned to comply with Building Regulations ADF2010 and enhanced Passivhaus requirements.

- All accessible system components will be compared to submitted design to ensure it is installed as per the design
- All filters are to be checked that they are clean
- All air flows to be measured at terminals in normal and boost modes to ensure compliance with design requirements (as set out above)
- All rooms are to be tested for compliance with the acoustic requirements (as set out above)
- All commissioning details are to be entered into the “Final Protocol Worksheet” (attached with the MVHR detailed performance specification) and then the completed sheet provided to Enhabit
- Commissioning will be witnessed by Enhabit

6.10 Control Systems

The control systems can be summarised as follows:

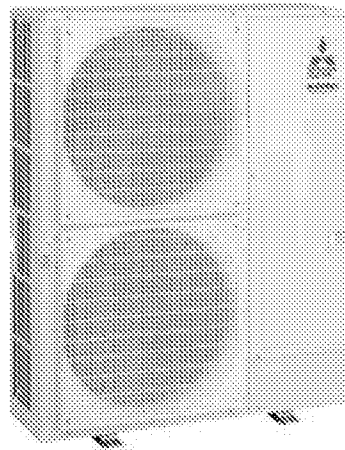
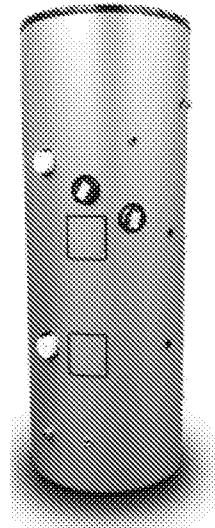
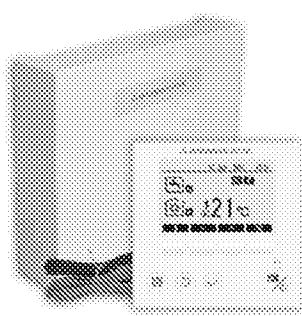
System	Control Mechanism(s)	Manufacturer/Model
Main Underfloor heating	- Connected in 18 zones to local Neostat HC room thermostats. - Overall time and temperature control provided by the Heatmiser NeoHub. Remote wireless control provided by wifi interface and Heatmiser applications on smartphones, tablets or via PC interface	Heatmiser HC Neostat Heatmiser Neohub
Wet Towel Rails	1 Heatmiser Neostat v2 Thermostat controlling for all rails with individual thermostatic radiator valves providing local control.	Heatmiser Neostat
Hot Water	- Time and temperature control provided by the Mitsubishi Ecodan FCT-5 controller	Mitsubishi FCT-5 Controller
MVHR	- Primary control via Comfosense controller. - Additional boost control available via the MVHR unit main control screen on the unit itself	Zehnder Comfosense C67

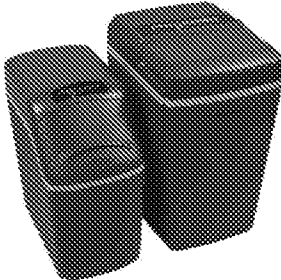
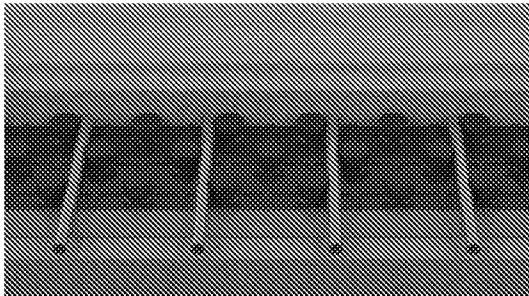
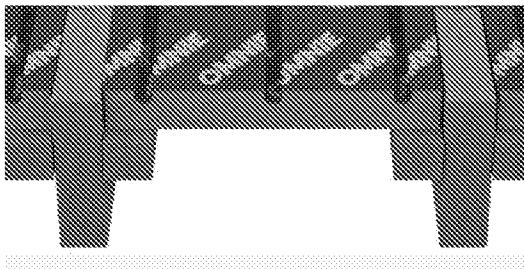
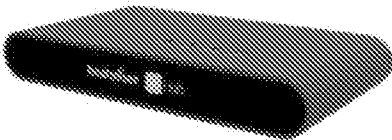
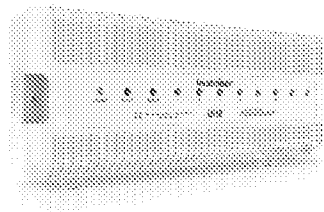
7 Supporting Drawings

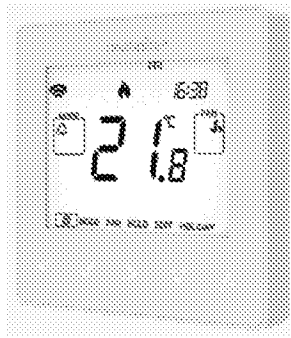
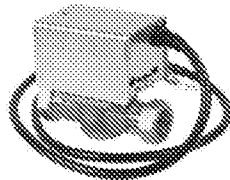
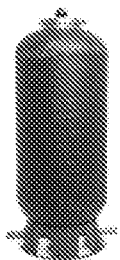
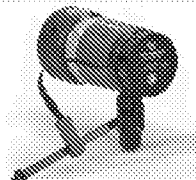
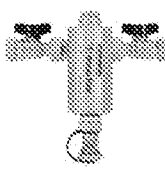
The design is based on the following drawings provided by the client:

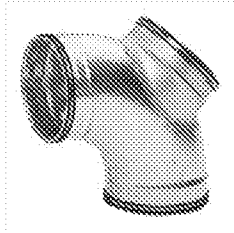
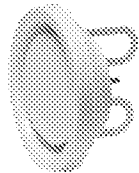
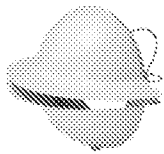
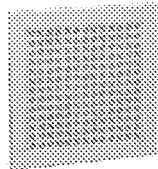
- BBU 1000 Rev2
- BBU 1001 Rev2
- BBU 1002 Rev2
- BBU 1003 Rev2
- BBU 1004 Rev2
- BBU 2001 Rev2
- BBU 2002 Rev2
- BBU 2003 Rev2
- BBU 2004 Rev2
- BBU 2005 Rev2
- BBU 2006 Rev2
- BBU 2007 Rev2
- BBU 2008 Rev2
- BBU 3000 Rev2

8 Equipment Schedule

Ref	Item	Make	Model	Image
1	Air source Heat Pump	Mitsubishi	14 kW Mitsubishi Monoblock 14kW Ecodan Air Source Heat Pump	
2	Unvented Hot Water Cylinder	Newark Copper Cylinders	300L Custom-made stainless steel cylinder with high gain coil	
3	Air source heat pump flow temperature control system	Mitsubishi	Mitsubishi Ecodan FCT-5 wiring centre and remote controller	

4	Water softener	Great Water Products	Pro Series 1400 up to 58L/min	
5	Underfloor heating	Omnie	Screedplate	
6	Underfloor heating	Omnie	Foilboard	
7	Heating Controls	Heatmiser	Neohub for smart phone heating control	
8	Heating Controls	Heatmiser	UH8 Wiring Centre	

9	Heating Controls	Heatmiser	NeoStat v2 Thermostat	
10	Water Towel Rails	Client Specification	Client Specification	
11	Motorised valves	Honeywell	V4043H 22mm	
12	Boost-a-main tank and pump	Proveiss	PLUS 660 Vertical Accumulator (If required - sizing to be confirmed by Contractor)	
13	Hot water circulator pump	Grundfos	Confort PM	
14	Magnetic particle filter	Fernox	TF1 Omega Filter	
15	Air Separator	Spirotech	SpiroVent Air Separator	

16	MVHR Ducting	Lindab	Safe Metal spiral ducting	
17	MVHR Room Extract Terminals	Lindab	KU	
18	MVHR Room Supply Terminals	Lindab	KI	
19	MVHR Wall Supply Terminals	Lindab	VVTK	
20	Kitchen Exhaust Grill	Zehnder	V125F 250mmx250mm	
21	MVHR Primary Control	Zehnder	Comfosense C67	