

Building Services 2 – Integration M&E specification

By Aaron Griffiths (2223674) | HND / BSc Construction Management | 17/01/25

Introduction

I have been tasked with creating a professional M&E design for an upcoming development. By completing this task, it will allow me to analyze the building performance and strategies to lighting, small power, above and below drainage, ventilation, heating, DHW, sprinklers and telecoms. This will allow me to learn about the technology used in the building and efficiency of the home.

The property which I am going to be carrying out this analysis from is a construction group Llanmoor Homes. The property I have chosen to look at is The Litchard, detached (2024) house, this is located on the development at Saint Sannans Field which is a up and coming development site. - Llanmoor Homes. (2024). *Three Bedroom Detached New Home | The Litchard 3 Bed House in Wales*. [online] Available at: <https://www.llanmoor-homes.com/house-type/the-litchard-detached-2024/?development=34142> [Accessed 14 Jan. 2025]. The reason why we need to have building services on our properties is because we need to ensure that our developments provide human comfort to our residents/homeowners. This analysis will also look at diagrams in which how the building services will be applied to the development.

Radiator/Heating Services:

Key

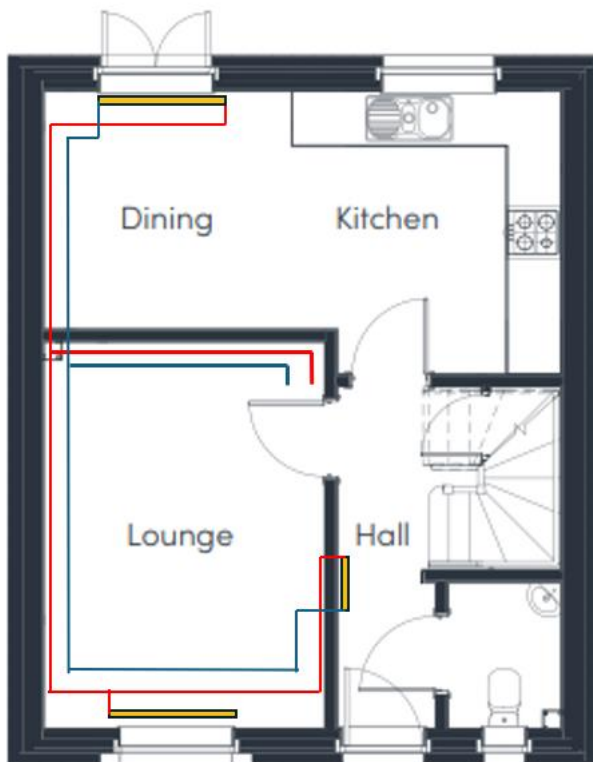
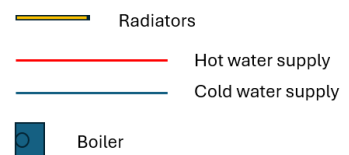


Figure 1 Ground Floor

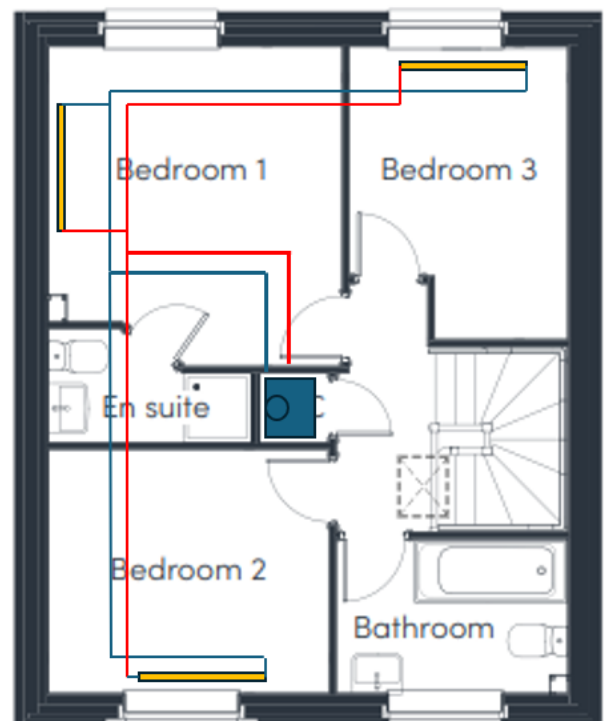


Figure 2 First Floor

The internal envelope of the property has a floor radius of 83sqm. To calculate the radiator sizes for the property I am going to use an online calculator to specify the radiators needed for the property. This will calculate the BTUs in each room of the property and to ensure what size rad is needed. Which the calculator which I am using is the website: [BTU Calculator | Radiator Calculator | Simple Heat Calculator](#)

Room Dimensions

Metric (metres)		Imperial (feet)
Width (m) *	Height (m) *	Length (m) *
2.6	2.4	3.6

Window Area X² (Calculate this by multiplying window height by window length): *
If your room does not have a window, please enter '0' in the field below & select 'no window' in the relevant field below

1

Room Information

Type of room: *
Where are you heating?

Living Room

What is below the room? *
Think about the flooring of your room, and whether there is another room below

A concrete floor

What is above the room? *
Where applicable, choose the amount of insulation

A heated room

Select type of outside wall: *
This helps us calculate how much heat the room might lose

Brick Cavity

Select type of window: *
This also helps us determine the expected heat loss in the space

Wood/Plastic double glazed

Select number of outside walls: *

Two

Reset Calculate

The calculator to calculate the BTU's

Your Requirements X

BTU's Required
3673

Watts Required
1076

[View suitable products >>](#)

Result in BTU for the radiator heating requirements.

This table below the required BTUs required to heat each room in the property, from the results from the online calculator:

Room	BTU's Required for each room
Living Room	3673
Kitchen/Diner	4367
Cloak	1567
Bedroom 1	2725
Bedroom 2	2186
Bedroom 3	2002
Bathroom	1847
Ensuite	1426

- “BTU stands for British Thermal Unit, a measurement of energy. To put it simply, one BTU is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. In the context of home heating, BTU ratings tell you how much heat a radiator or heating system can produce. The higher the BTU, the more powerful the heat output.

BTUs are universal in heating systems, from radiators to boilers, and understanding them can save you from ending up with an underperforming—or wildly overpowered—system. – (Mrcentralheating.co.uk. (2024). *Mr Central Heating*. [online] Available at: <https://www.mrcentralheating.co.uk/blog/post/btu-meaning> [Accessed 16 Jan. 2025].)

To specify the radiators, the radiator which I am going to use for the heat source of bedroom 1, bedroom 2 and bedroom 3 is:



Details

Create a bold yet classic look, and a warm, cosy space with the Milano Windsor 300mm x 1190mm horizontal triple column radiator. This radiator features a hard-wearing anthracite powder coated finish and a timeless column design. The high heat output means your room will feel warm and comfortable in next to no time.

Windsor Column Radiator Features:

- 300mm x 1190mm x 100mm
- 3963 BTU's (1162 Watts)
- High Quality Anthracite Powder Coated Finish
- 20 Year Guarantee
- Built to Last: 1.5mm Thick Steel for Guaranteed Quality
- Tested and Certified BS EN 442 Standards
- ISO 9001:2015 Registered Manufacturer
- CE Marked
- Includes Wall Fixings, Wall Plugs, Blanking and Bleed Plug

For the kitchen/diner and living room the radiator specification I have chosen is due to the amount of BTU required is:

This radiator has a higher BTU than require to ensure that the property can be heated adequately and efficiently.

Details



Create a stunning traditional look and a warm, cosy space with the Milano Windsor 300mm x 1415mm horizontal anthracite traditional column radiator. With a resilient anthracite powder coated finish and a classic column design, this radiator will bring a stand-out feature to any room in your home.

Windsor Column Radiator Features:

- 300mm x 1415mm x 100mm
- 4725 BTU's (1385 Watts)
- High Quality Anthracite Powder Coated Finish
- 20 Year Guarantee
- Built to Last: 1.5mm Thick Steel for Guaranteed Quality
- Tested and Certified BS EN 442 Standards
- ISO 9001:2015 Registered Manufacturer
- CE Marked
- Includes Wall Fixings, Wall Plugs, Blanking and Bleed Plug

The specification of radiator which I have chosen for the bathroom and en-suite is:



Details

The Milano Aruba anthracite horizontal radiator is a compact but efficient radiator, thanks to a double panel design and fourteen columns in total. This grey radiator has a pleasing, contemporary design which is set off by a fashionable anthracite finish, making it the perfect addition to modern living spaces.

Aruba Designer Radiator Features:

- 635mm x 413mm x 78mm
- 2,469 BTU's (724 Watts)
- High Quality Anthracite Powder Coated Finish
- Features 7 Double Panels
- 20 Year Guarantee
- Built to Last: 1.5mm Thick Steel for Guaranteed Quality
- Tested and Certified BS EN 442 Standards
- ISO 9001:2015 Registered Manufacturer
- CE Marked
- Includes Wall fixings, Wall plugs, Blanking and Bleed plug

This radiator also has a higher BTU which is required, this will ensure that these spaces are heated adequately and doesn't take a lot of energy to heat the room

Information found from Best Heating. (2024). *Radiators | UK Radiator Specialists | Free UK Delivery*. [online] Available at: https://www.bestheating.com/radiators.html?_gl=1 [Accessed 16 Jan. 2025].

For the connections of copper pipes from the radiator to the boiler which will be running through a service void in the walls to create a modern look to the property. The radiators will also have TVRs connected to control the temperature, and a thermostat located in the hall of the property.

Boiler Specification:

The boiler I have chosen to heat the property is the Vaillant ecoTEC Pro as this boiler is small and will be easy to install into the airing cupboard, which is the location I have chosen to install the boiler. This will mean that the flue will have to penetrate through the attic space and exit through the roof. The reason why I have chosen this boiler is that it provides hot water instantly due to being a combi boiler. This boiler does not require a hot water tank and by using modern technology the boiler can adapt itself to only heat when asked upon.

WALL-HUNG COMBI BOILER

ecoTEC pro

The smart combi boiler for small to medium homes for instant hot water and precision heating

- ✓ Combination boiler for small-to-medium homes
- ✓ Precise heating and instant hot water
- ✓ One of the quietest products in its category
- ✓ Can be combined with a full range of thermostat controls
- ✓ Bright and easy-to-use display



Vaillant.co.uk. (2025). ecoTEC pro | Vaillant. [online] Available at: <https://www.vaillant.co.uk/product-systems/gas-boilers/ecotec-pro/> [Accessed 16 Jan. 2025].

ROOM CONTROL

sensROOM pure

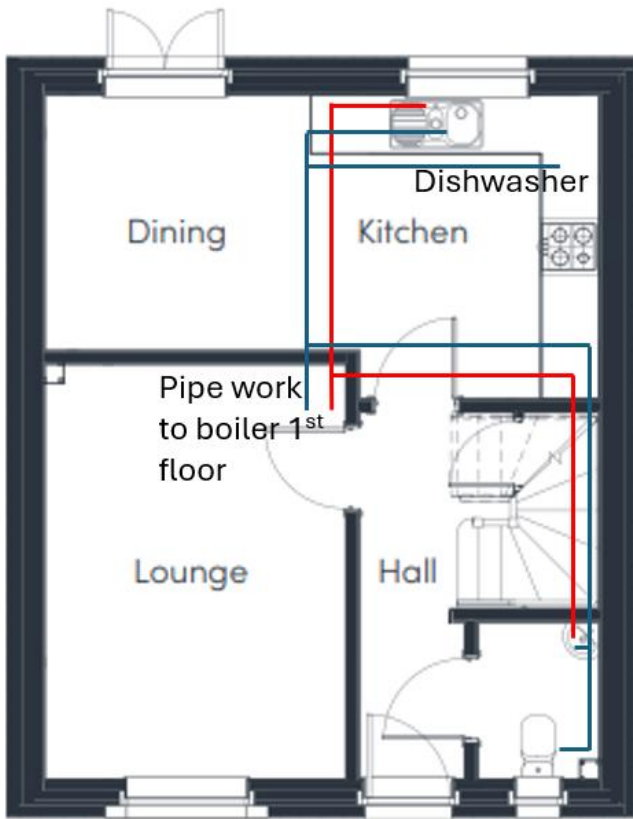
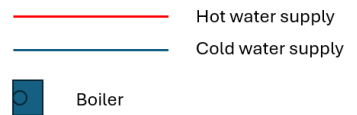
The simple digital thermostat that measures and displays your room temperature

- ✓ Easy-to-use room thermostat with a smart design for simple gas heating systems
- ✓ Compatible with myVAILLANT connect and the myVAILLANT app for a fully integrated weather compensation, smart home heating system.
- ✓ Fits perfectly with your current Vaillant boiler
- ✓ Comfortable and simple handling due to improved display
- ✓ Reliable device that informs you of service and maintenance updates

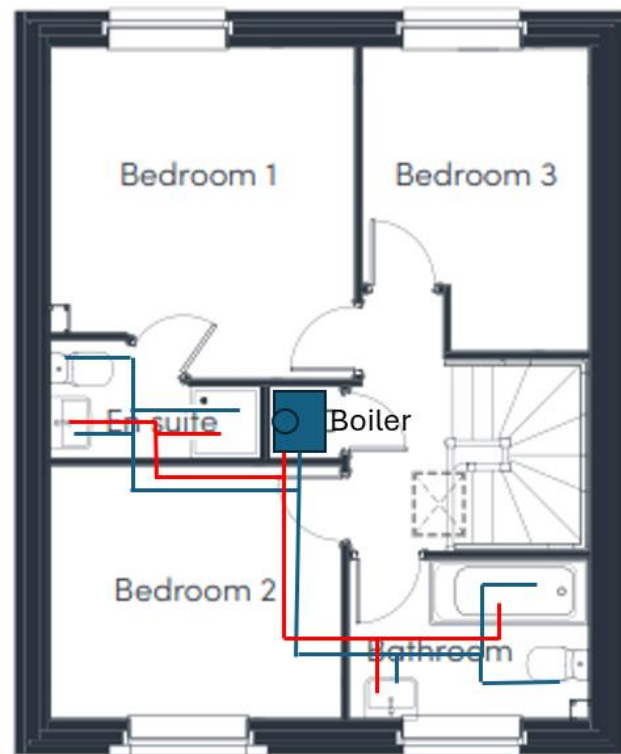


This is my choice of thermostat which will be installed in the hall to control the homes temperature. The reason why I have chosen this is because it has a familiar dial to control the heat. Also, it provides time programming features, you can connect your gas boiler via an internet gateway to conveniently operate your heating via the myVAILLANT app.

Key



Ground Floor Hot water and cold-water feed



1st Floor Hot and cold water feed

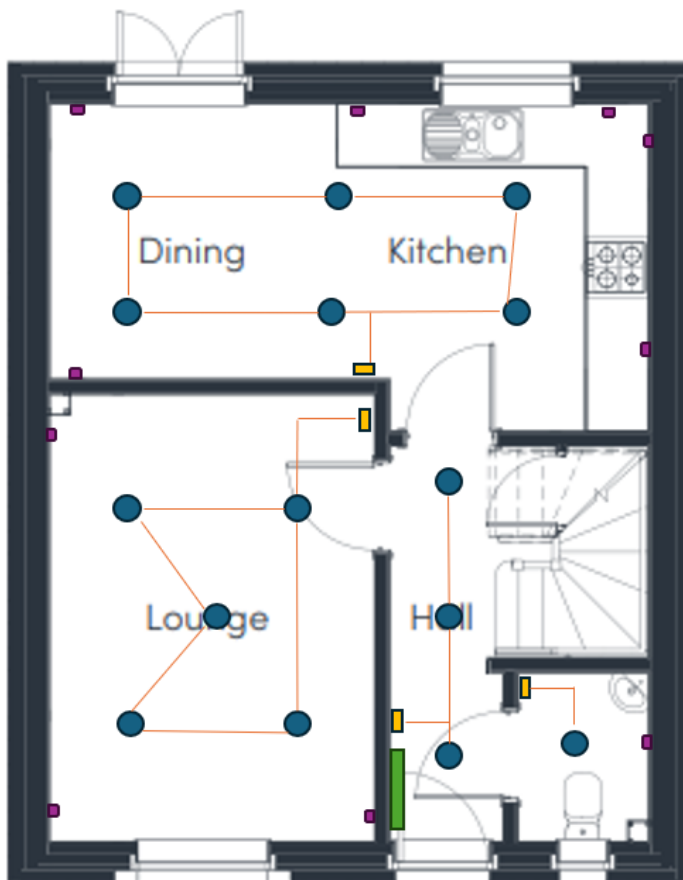
Installation method: the mains water for the property will enter through the middle of the property. Then this will allow for the pipework to be located adequately/efficiently around the property. On the ground floor of the home the pipework will be piped in the concrete slab during the early construction phases. Which this will be disputed to equipment/appliances which require water. This water feed will then rise to the 2nd floor and into the combi boiler, where the boiler will supply the hot water to property and supply homeowners' needs.

Electrical Services:

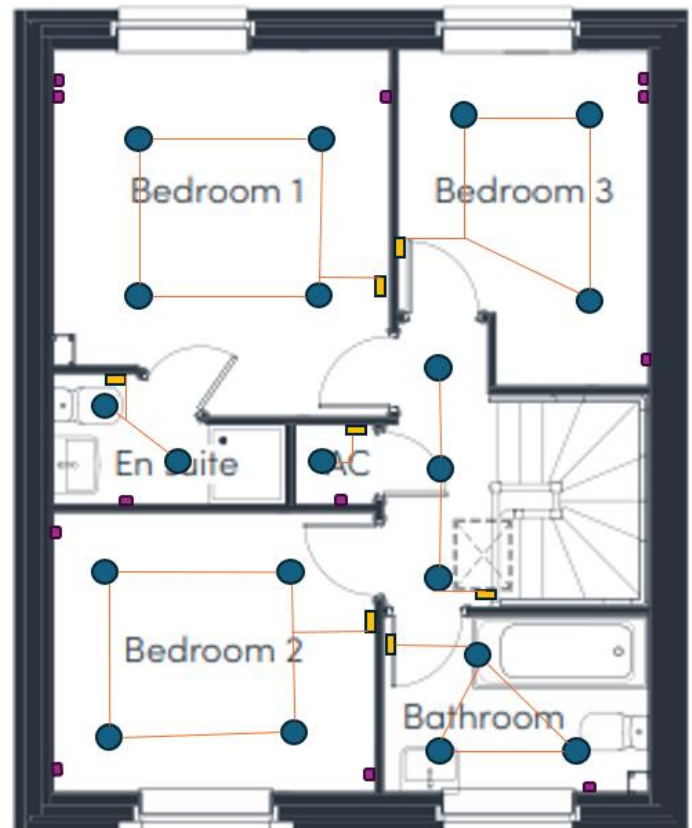
The plans below show the layout in which I have chosen to apply electrical services within the property:

Key

- Electrical supply to lights
- Light fittings
- Light switches
- Double pattress sockets
- Consumer Unit/fuse box Location



Ground Floor – Electrical plan for the property



1st Floor – Electrical layout

All the electrical work in the property will be within the regulations will be of IEE regulations 18th edition. This regulation is in place to ensure that the electricians which are installing the wiring and other electrical equipment on the property are trained. This regulation standard is also known as the BS 7671 provides guidelines for the design, installation and maintenance of the electrical systems. The IEE regulations refer to the latest edition of the Wiring Regulations published by the Institution of Electrical Engineers.

The electrical route of the cables for the light will run through the ceiling void to spotlights. The electrical cables to these lights will be run in parallel circuits with the light switch. By applying a parallel circuit means that the voltage is equal across each light in

the room. In a parallel circuit the voltage measured between sets of common points must always be the same at any given time.

Applying ohm's law – Ohm law calculates the voltage, current and resistance that must be measured to ensure you can carry out the calculation. In the circuit of Ohm's Image calculation, we can immediately apply Ohm's Law to each resistor to find its current because we know the voltage across each resistor and its resistance.

- All About Circuits (2019). *Simple Parallel Circuits | Series and Parallel Circuits | Electronics Textbook*. [online]

Allaboutcircuits.com. Available at:

<https://www.allaboutcircuits.com/textbook/direct-current/chpt-5/simple-parallel-circuits/>.

$$I_{R1} = \frac{V_{R1}}{R_1} = \frac{9 \text{ V}}{10 \text{ k}\Omega} = 0.9 \text{ mA}$$

$$I_{R2} = \frac{V_{R2}}{R_2} = \frac{9 \text{ V}}{2 \text{ k}\Omega} = 4.5 \text{ mA}$$

$$I_{R3} = \frac{V_{R3}}{R_3} = \frac{9 \text{ V}}{1 \text{ k}\Omega} = 9.0 \text{ mA}$$

Ohm's Image Calculation

Light specification:

With regards to lighting within this domestic property. All lighting will be being installed will comply with Building regulation document L-1B



**ASTRO MINIMA SLIMLINE DEEP
RECESSED FIXED DOWNLIGHT -
MATT WHITE - PACK OF 6**

£65.49

Item code: 61258

The lights which I have chosen for this are because they are easy to install, energy efficient due to being LED and provide the room with plenty of light with a modern look. They're perfect for any space, including kitchens, bathrooms, and hallways, where you want as much open area as possible. Plus, they also help make the room look bigger by freeing up more space. These lights will be installed throughout all the rooms in the properties as per plan.

KEY FEATURES

- ✓ Pack of 6 mild steel recessed downlights with matt white bezel
- ✓ **Colour:** Matt White
- ✓ **Material:** Steel
- ✓ **Guarantee:** 3 years guarantee.
- ✓ **Bulb:** Max 6 x 50W LED GU10 Bulb, sold separately.
- ✓ **IP Rating:** IP20
- ✓ **Dimensions:**
Overall - H 130 x W 82mm

Lighting-direct.co.uk. (2024). Astro Minima Slimline Deep Recessed Fixed Downlight - Matt White - Pack of 6. [online] Available at: <https://www.lighting-direct.co.uk/astro-minima-slimline-deep-recessed-fixed-downlight-matt-white-pack-of-6.html> [Accessed 16 Jan. 2025].

Light Switch:

The light switch which I have chosen is the BG Evolve Trailing Edge Led 2 Way Push On/Off 200W Single Dimmer Switch - Black Chrome (Wickes.co.uk. (2018). *BG Evolve Trailing Edge Led 2 Way Push On / Off 200W Single Dimmer Switch - Black Chrome*. [online] Available at: <https://www.wickes.co.uk/BG-Evolve-Trailing-Edge-Led-2-Way-Push-On-Off-200W-Single-Dimmer-Switch---Black-Chrome/p/277891> [Accessed 16 Jan. 2025].) I have located the switched on the plan so that they are easy to access and use.



The BG Evolve Trailing Edge Led Single Dimmer Switch allows you to control your light levels and set the mood. The intelligent electronic circuit monitors the connected load and provides a soft-start with protection against thermal, current and voltage overload, and is suitable for dimming LED, dimmable CFL's and traditional lighting. This switch has a low profile screwless flat plate that clips on and off, making it ideal for modern interiors. The black chrome finish... [Read more](#)

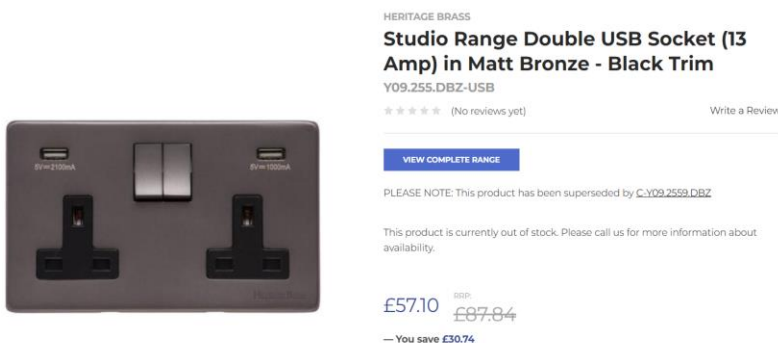
[View product details](#)

 [Save to project list](#)

Sockets choice:

The sockets which I have chosen to install is - Studio Range Double USB Socket (13 Amp) in Matt Bronze - Black Trim

All trucking and supply for the sockets will run in Conduit for the connection point. I've located the plugs in prime locations where electrical appliances could go.



Arrowelectricals.co.uk. (2025). *Double Sockets with USB Ports - Arrow Electrical*. [online] Available at: <https://www.arrowelectricals.co.uk/switches-and-sockets/sockets/double-sockets-with-usb/> [Accessed 16 Jan. 2025]

Consumer units/Fuse Box & Ring Mains:

The consumer unit is in the hallway near the front door. This is a great location due to this is where the mains electricity is supplying the property. "A ring main circuit consists of a continuous loop of electrical cable that connects various socket outlets in a building. It starts and ends at the consumer unit (fuse box) and serves as a reliable method for supplying power to multiple sockets, ensuring efficient distribution - 1stelectricians.co.uk. (2024). A Step-by-Step Guide to Wiring a Ring Main Circuit in the UK - 1st Electricians.

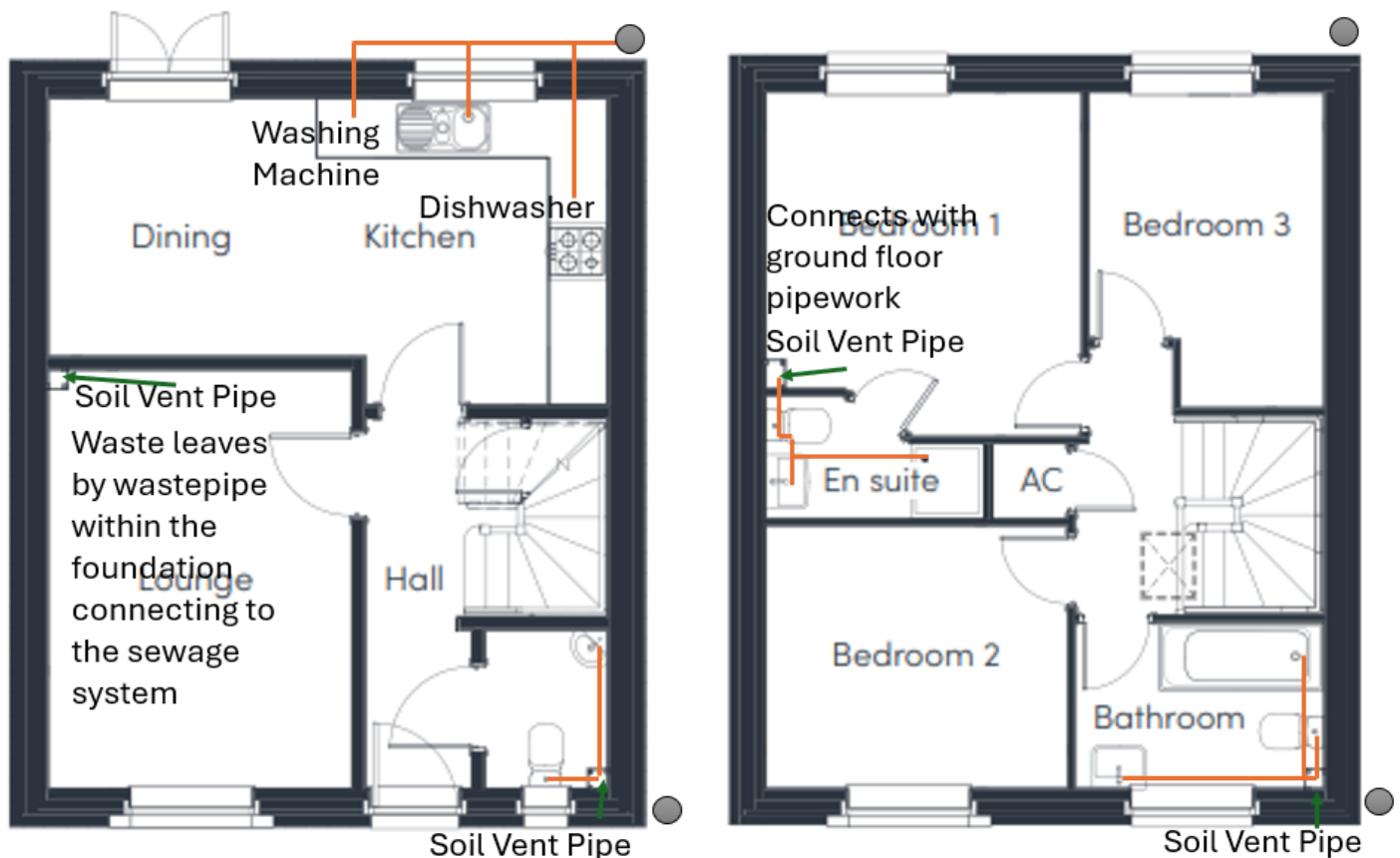
[online] Available at: <https://1stelectricians.co.uk/wiring/a-step-by-step-guide-to-wiring-a-ring-main-circuit/>.

- All electrical work is to be grounded. “This process involves attaching a conductor to the ground to carry excess electrical current away from your home. In most cases, you will find a single metal rod made from highly conductive material like copper or stainless steel installed at least eight feet into the ground” - Watson’s Charging Stations & Electric. (n.d.). *The Importance of Proper Grounding for Your Home’s Electrical System*. [online] Available at: <https://www.watsonschargingstations.com/blog/2023/march/the-importance-of-proper-grounding-for-your-home/>.

Key

Wastage Plan:

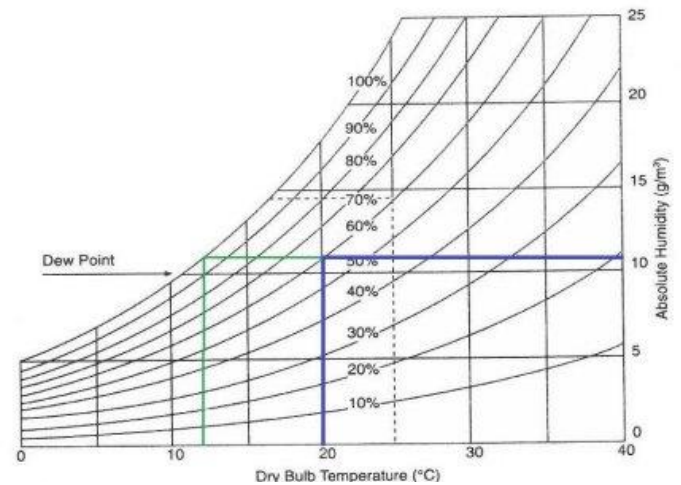
— Waste Pipe
● Gully



MVHR Plan:

To reduce the relative humidity of the building I am going to implement an MVHR system for the property. This system will help produce better quality air in the house.

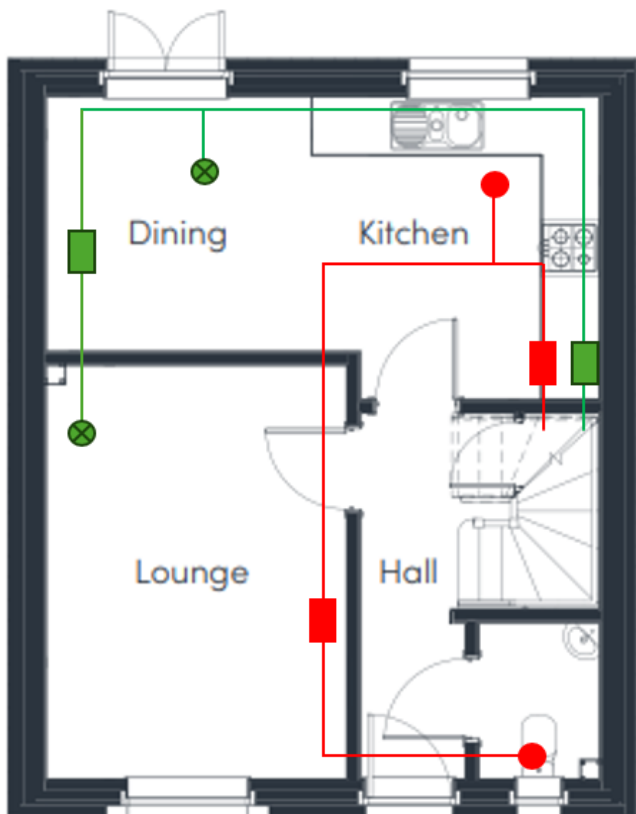
The ideal indoor humidity level for a home is between 30% and 60%. Maintaining this range ensures comfort, promotes health, and helps prevent issues like mold growth, musty odors, dampness, damaged plaster, and warped furniture. The best humidity levels may vary slightly based on the season and specific rooms within the house



Taken from class notes – This Table show the relative humidity rate within a building.

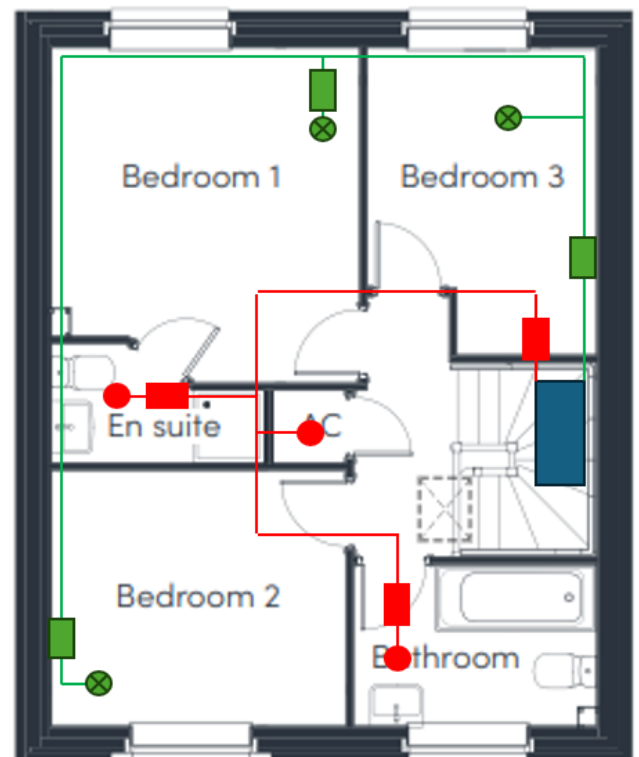
Key

-  MVHR Unit
-  Extract Ducting
-  Supply Ducting
-  Resonators (stops noise passing though the ducting)



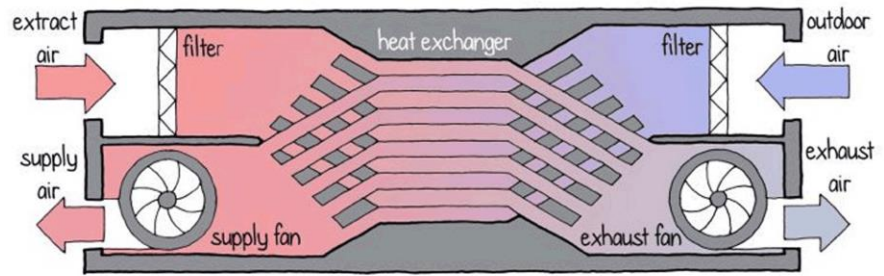
Ground Floor

MVHR
Located in the attic .
Ducting transferred down to ground floor



First floor

To ensure that the MVHR system is working efficiently, we need to calculate the size of the ducting. This is completed by calculating the air changes needed per room, which would give us our duct sizing to comply with building regulations.



How a MVHR system works - www.healthyhome.kiwi. (n.d.). The Clever Heat Exchanger. [online] Available at: <https://www.healthyhome.kiwi/the-clever-heat-exchange>

Duct sizes

Pressure loss at

- 2 m/s <0.5 Pa/m
- 3 m/s <1.0 Pa/m

Duct system pressure loss typically <10 Pa in house – very low pressure

Easy for terminal adjustment to balance up difference – terminal resistance adjusted 10-20

Pa

Other system components have higher pressure, but is same for all terminals

	Max flow m ³ /h for each ductwork diameter			
Air velocity	100mm	125mm	150mm	200mm
1.5 m/s	40	65	95	170
2 m/s	55	90	125	225
3 m/s	85	135	190	340

Taken from class note - MVHR ducting calculation – information From Sept 2018 – Good Practice Guild

To calculate duct size, the airflow rate (Q) and air velocity (V) are used. The cross-sectional area of the duct (A) can be determined with the formula:

$$A = \frac{Q}{V}$$

Once the cross-sectional area is known, the duct size can be calculated accordingly.

- Mousdell, D. (2024). *How To Calculate Duct Size: A Comprehensive Guide from h2x*. [online] h2x Engineering. Available at: <https://www.h2xengineering.com/blogs/calculate-duct-size/>.

Once I completed this calculation the duct size needed for this MVHR unit is 100mm diameter. The MVHR unit will be enclosed in the attic space, with the exhaust system penetrating the gable end of the house. 1st floor ducting will be distributed throughout the attic space. Whilst the ground floor ducting system will be enclosed within ducting.

The MVHR system which I have chosen is:



Air duct system for recoVAIR domestic ventilation system

Flexible air duct accessories for all installation scenarios.

- Ventilation units and a complete air duct system from a single source as central or decentral distributor solution
- Optimum adaptability due to flexible applications for the familiar multi-distributors and due to new compact distributors
- Easy to install thanks to an intuitive connection concept
- healthy indoor air and with this also relief for allergic persons thanks to the use of efficient dust and pollen filters
- energy and cost savings by heat recovery

Vaillant.com. (2017). Air duct system for recoVAIR domestic ventilation system. [online] Available at: <https://www.vaillant.com/home/products/air-duct-system-for-recovair-domestic-ventilation-system-11031.html> [Accessed 16 Jan. 2025].

- This MVHR system will need to have a 3-phase connection which will need to be wired into the property. This is because to step up the voltage for long-distance transmission and step it down for distribution, ensuring high efficiency.

Sprinkler Plan:

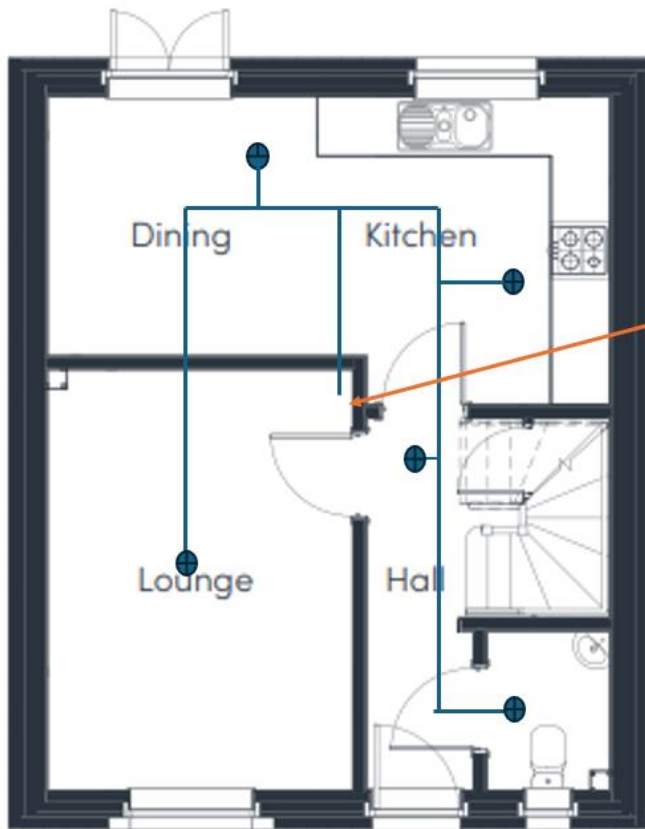
Reference: BS9251 sprinkler.pdf

Key

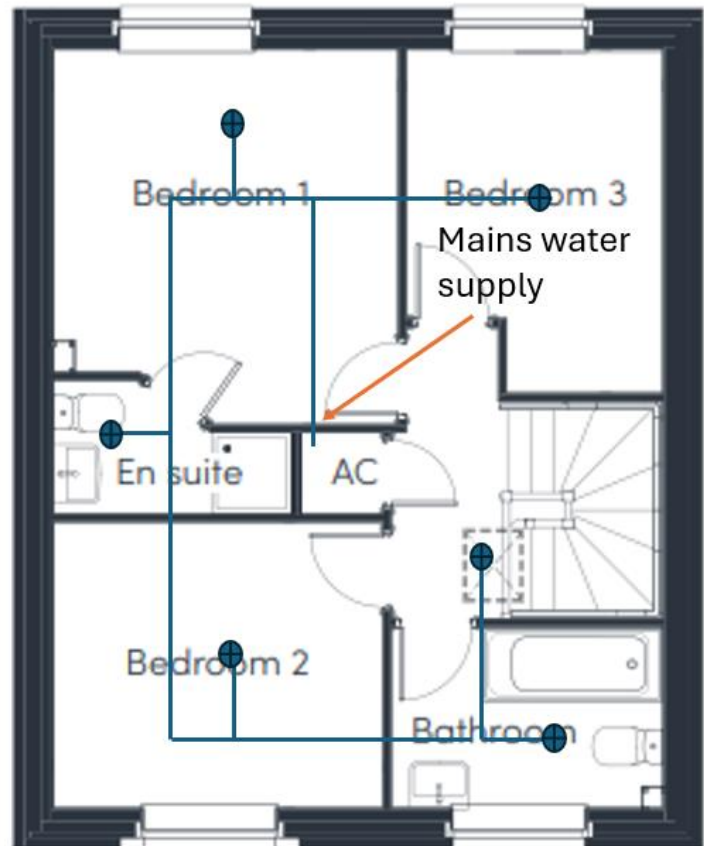
— Pipework (hidden in service voids in the property)

● Sprinkler

This sprinkler system is in guidance of: BS 9251 which provide guidelines for the design, installation, components, water supply, backflow protection, commissioning, maintenance, and testing of fire sprinkler systems. These systems are intended for life safety in domestic homes.

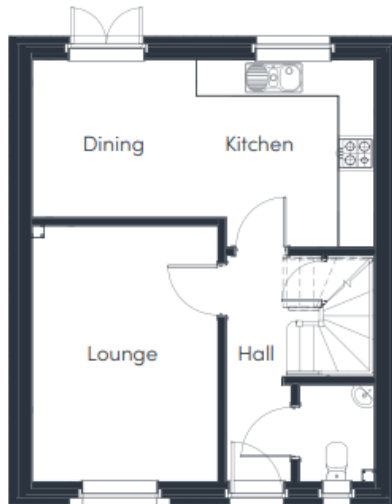


Ground Floor



First Floor

Dimensions of the property:



Ground Floor

Lounge

10' 3" x 14' 2"

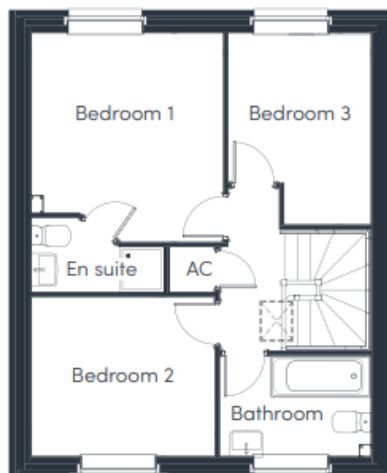
Cloaks

4' 3" x 5' 5"

Kitchen/Dining

18' 11" x 10' 4"

(max)



First Floor

Bedroom 1

10' 8" x 11' 6"

Bedroom 3

7' 11" x 10' 7"

En suite

7' 5" (max)

x 4' 2" (max)

Bathroom

8' 6" x 5' 8"

Bedroom 2

10' 3" x 8' 9"

Look for me on site plans! →. (n.d.). Available at: <https://www.llanmoor-homes.com/wp-content/uploads/2024/08/The-Litchard-Det-3B19D-%E2%80%93-Llanmoor-Homes-House-Type-Leaflet-2024.pdf> [Accessed 16 Jan. 2025].

REFERENCE:

- Llanmoor Homes. (2024). *Three Bedroom Detached New Home | The Litchard 3 Bed House in Wales*. [online] Available at: <https://www.llanmoor-homes.com/house-type/the-litchard-detached-2024/?development=34142> [Accessed 14 Jan. 2025]

[BTU Calculator](#) | [Radiator Calculator](#) | [Simple Heat Calculator](#)

Mrcentralheating.co.uk. (2024). *Mr Central Heating*. [online] Available at: <https://www.mrcentralheating.co.uk/blog/post/btu-meaning> [Accessed 16 Jan. 2025].)

Best Heating. (2024). *Radiators | UK Radiator Specialists | Free UK Delivery*. [online] Available at: https://www.bestheating.com/radiators.html?_gl=1 [Accessed 16 Jan. 2025].

Vaillant.co.uk. (2025). *ecoTEC pro | Vaillant*. [online] Available at: <https://www.vaillant.co.uk/product-systems/gas-boilers/ecotec-pro/> [Accessed 16 Jan. 2025].

All About Circuits (2019). *Simple Parallel Circuits | Series and Parallel Circuits | Electronics Textbook*. [online] Allaboutcircuits.com. Available at: <https://www.allaboutcircuits.com/textbook/direct-current/chpt-5/simple-parallel-circuits/>.

Lighting-direct.co.uk. (2024). *Astro Minima Slimline Deep Recessed Fixed Downlight - Matt White - Pack of 6*. [online] Available at: <https://www.lighting-direct.co.uk/astro-minima-slimline-deep-recessed-fixed-downlight-matt-white-pack-of-6.html> [Accessed 16 Jan. 2025]

Black Chrome (Wickes.co.uk. (2018). *BG Evolve Trailing Edge Led 2 Way Push On / Off 200W Single Dimmer Switch - Black Chrome*. [online] Available at: <https://www.wickes.co.uk/BG-Evolve-Trailing-Edge-Led-2-Way-Push-On-Off-200W-Single-Dimmer-Switch---Black-Chrome/p/277891> [Accessed 16 Jan. 2025].)

Arrowelectricals.co.uk. (2025). *Double Sockets with USB Ports - Arrow Electrical*. [online] Available at: <https://www.arrowelectricals.co.uk/switches-and-sockets/sockets/double-sockets-with-usb/> [Accessed 16 Jan. 2025]

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Watson's Charging Stations & Electric. (n.d.). *The Importance of Proper Grounding for Your Home's Electrical System*. [online] Available at: <https://www.watsonschargingstations.com/blog/2023/march/the-importance-of-proper-grounding-for-your-home/>.

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Taken from class note - MVHR ducting calculation – information From Sept 2018 – Good Practice Guild

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