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Building Appraisal

Cemetery Lodge

Ashwell

Ilminster

Somerset

TA19 9DX

Date: February 2021

Job reference: 2100

Contents

1. Introduction

1.1 This report has been commissioned by Ilminster Town Council to investigate the Cemetery Lodge, Ashwell, Ilminster TA19 9DX regarding the current damp problems and poor overall living conditions being experienced by the tenant.

1.2 The Town Council have been made aware by the tenant of several building issues and wish to address and remedy the problems.

1.3 This report is prepared as a general appraisal of the building and is not a structural survey or a schedule of conditions which would list every minor defect.

1.4 The report is intended to give a general opinion of the property and to identify issues and to advise on possible solutions.

2. General Description

2.1 Cemetery lodge is a detached late 19th century building comprising of a single storey structure with a cellar at a lower level beneath the living room area. A single story extension was added approximately 15 years ago.

Photo 1: Street view of Cemetery Lodge

2.2 The external walls of the original structure comprise of 450mm thick stone walls. A single storey extension, constructed with a modern cavity wall construction and a glazed roof, was built approximately fifteen years ago.

2.3 The roof is constructed of a traditional timber cut roof and finished in natural slate.

2.4 The building is an exposed position.

2.5 Extensive building works were undertaken in 2016 and including the installation of a new electric boiler and repairs to the structure.

3. Current problem areas

3.1 A site visit was undertaken on 13th December 2020 and the following problems were noted:

3.2 Dampness & Humidity

Manifestations of dampness and humidity can be seen throughout the building. This is mainly caused by condensation. In simple terms condensation occurs when moisture in the air condenses out to form liquid water as fine droplets in the air or on a surface.

As the temperature of moisture laden air approaches dew point a number of moisture associated problems become apparent and in particular superficial and interstitial mould growth can occur.

Photo 2: Mould growth adjacent to entrance door

Photo 3: Mould growth adjacent to secondary entrance door

The damp problem in the Cemetery Lodge building is aggravated by the fact that the building is heated intermittently. The heating does not have time to warm the surface above the dew point while the already warmed air is absorbing vapour. Temperature is a vital component. To avoid condensation it is important to keep the building constantly heated at a gentle, low temperature. Constant heating ensures the building fabric stays warm and does not get cold enough to condensation to occur.

3.3 Heating

The ability to heat the building is a problem. As part of the recent refurbishment and upgrading of the property a new electric boiler was installed and including new radiators and an integral hot water tank.

This at the time was considered a reasonable solution for the property where the only source of energy was electricity.

The specification for the boiler was, in hindsight, inappropriate for this property. This boiler is more suited to a modern property which has less demand put on it.

Photo 4: Existing electric boiler

The boiler runs at an efficiency rate of 98.4% which in boiler terms is better than average where a gas boiler has an effective rate of 89 - 95% and an oil fired boiler 85 - 93%.

However due to the nature of the integral elements of the building fabric including high ceilings and inadequate insulation the boiler is unable to cope with the heating demands, which results in the boiler unable to heat the areas properly.

When the heating is on the boiler is working constantly which results in high running costs as can be seen from the recent tenant's December and January electricity bills [Please refer to Appendix A].

3.4 Insulation

The property is poorly insulated. Mineral wool quilt insulation was installed in part of the roof area during the refurbishment works and the occupier has added further insulation above the bedroom area.

A particular area of concern are the sloping ceiling areas in each room – known as skeilings. There appears to be no insulation to the skeilings and a lot of heat is being lost through the fabric.

Another area of concern is the living room timber floor which is directly above the basement area. The floor has no insulation and is subject to the cold damp air coming from the basement.

3.5 Ventilation

Adequate ventilation is essential to allow the moisture to escape from a room, particularly the kitchen and bathroom areas, before it turns into condensation.

Both the kitchen and bathroom areas have mechanical ceiling extractor fans with the air being discharged through ductwork and external cowls installed on the roof slates.

However the efficiency of the roof cowls to the mechanical vents are compromised due to the exposed nature of the building. The roof cowls are exposed to the wind and rain which results in cold damp draughts being blown back down the ductwork and into the rooms.

3.6 External doors

The two external timber doors into the property require attention to prevent water coming into the building.

4. Recommendations and remedial works: Insulation

4.1 The efficiency of any heating system is dependent on the ability to retain the heat produced. Upgrading the insulation to the roof, walls and floor will greatly increase the retention of heat generated.

4.2 In 2020 the government introduced a Green Homes Grant scheme where up to £5000.00 of support is available for upgrading insulation in a private home

4.3 The following proposals bring the roof, walls and floor up to current Building Regulation standards or better.

4.4 Ceilings: In the majority of rooms the ceilings comprise of a sloping section and a flat section.

4.5 The skeilings [sloping ceilings]: insulation should be fixed through the underside of the existing plasterboard and into the roof rafters. The retention of the extant plasterboard will create less dust and debris and will reduce the costs and disruption to the property. The insulation to comprise

the following: 12.5mm plasterboard fixed to polythene vapour barrier fixed to 110mm Kingspan K107 rigid thermoset phenolic insulation fixed to the existing rafters. The whole to give a U-value of 0.18 W/m^2K. [Please refer to Appendix B for U-value calculation]

4.6 Flat ceilings: insulation should be fixed through the underside of the existing plasterboard and into the roof rafters. The retention of the extant plasterboard will create less dust and debris and will reduce the costs and disruption to the property. The insulation to comprise the following: 12.5mm plasterboard fixed to polythene vapour barrier fixed to 110mm Kingspan K107 rigid thermoset phenolic insulation fixed to rafters. The whole to give a U-value of 0.17 W/m^2K. [Please refer to Appendix B for U-value calculation]

4.7 Timber ground floor to living room: insulation to be fixed directly between the existing floor joists and comprising 60mm Kingspan K103 rigid thermoset phenolic insulation fixed to joists. The whole to give a U-value of 0.18 W/m^2K. [please refer to Appendix B for U-value calculation]

4.8 External walls: insulation to the external walls in the old structure should be fixed as follows: 62.5mm Kingspan Kooltherm K118 insulation board comprising 50mm rigid thermoset phenolic insulation bonded to 12.5mm plasterboard fixed to 50 x 25mmm timber battens fixed to vapour barrier fixed to external wall. The void should be ventilated top and bottom. Epoxy resin to be applied to all fixing points to ensure no dampness penetrates into the timber battens. [Please refer to Appendix B for U-value calculation].

5. Recommendations and remedial works: Ventilation

5.1 The existing mechanical extractor fans should be replaced in the kitchen and bathroom to reduce the damp and condensation in these areas.

5.2 The existing mechanical vents in the bathroom and kitchen should be replaced with units that have a built in shutter that closes off the unit when not in use and stops damp and cold air being blown down the existing roof cowls.

5.3 To the bathroom a Vent-Axia VA100XT 100mm extractor fan should replace the existing mechanical fan. This fan is among the more powerful domestic extractor fans and is fitted with a thermo-electric shutter and integral timer which provides the necessary 15 minute overrun time to comply with Building Regulations [please refer to Appendix C for details of the fan]

5.4 To the kitchen a Vent-Axia VA14/150 KT 150mm extractor fan should replace the existing mechanical fan. This fan is fitted with a thermo-electric shutter and integral timer which provides the necessary 15 minute overrun time to comply with Building Regulations [Please refer to Appendix C for details of the fan]

6. Recommendations and remedial works: Heating

6.1 There is an option to consider replacing the existing heating installation to a more efficient and less costly system.

6.2 Electricity remains the only energy source capable of heating the property.

6.3 The option of providing natural gas is not feasible as the nearest gas supply is 356 metres distant. The gas provider, Wales & west Utilities has quoted a figure of £250.00 a metre run for installing gas in Cemetery Lodge.

6.4 Oil and LPG gas requires large storage facilities which is not feasible within the boundaries of this property.

6.5 The most efficient electric installation is an air source heat pump system which works by transferring heat absorbed from the outside to an indoors unit. Heat from the air is absorbed at low temperature into a fluid. This fluid passes through a compressor, increasing the temperature, and transfers that higher temperature heat to the heating circuits of the house.

6.6 An air source heat pump system is not only very efficient but also significantly reduces the environmental impact that a gas or oil boiler produces.

6.7 In general terms a heat source pump system is 300% more efficient than an electric boiler. For every 1Kw of electricity used in an air source heat pump system 3Kw of heat is produced. Whereas for the existing electric boiler for 1Kw of electricity used 1Kw of heat is produced.

6.8 Two local companies specialising in air source heat pump systems were approached to advise and make recommendations:

- Greenstock Refrigeration Ltd.

6.9 Greenstock Refrigeration Ltd., Thorney, Langport TA10 0DT visited site to assess the feasibility of installing an air source heat pump system.

6.10 Their proposal recommends the existing electric boiler hot water circuit to be retained to supply the kitchen and bathroom areas. This would include re-configuring the existing meter to an economy 7 or 10 tariff.

6.11 The electric boiler heating circuit would be disconnected and the existing seven radiators removed.

6.12 An air source heating pump system would be installed in the four main rooms and comprising an external unit and a heating unit internally.

6.13 The electrical engineer visiting the property has recommended that the existing consumer unit is not adequate for the additional loading produced by the air source heat pump system.

6.14 A new electricity consumer unit will need to be installed.

Photo 5: External unit in a residential context

Photo 6: Internal unit

6.15 The proposed system is an air to air heat source system.

6.16 At this stage Greenstock Refrigeration Ltd have provided an outline proposal and a budget cost which includes materials and labour for the installation of the air source heat pump system and a provisional sum for electrical works. To submit a more detailed and final quotation the company will need to undertake a heat loss calculation to finalise size of units and provide a detailed specification including a breakdown of costs including electrical works. Please refer to Appendix D for their proposal.

- Total Renewable Solutions

6.17 Total Renewable Solutions, Ilton TA19 9DL have not visited site but know the building well. They have based their proposals on the u-value calculations achieved by the new enhanced proposals for walls, roof and ceilings and the impact this would have on heat loss from the building.

6.18 Their proposal is to install an air source heat system for both hot water and heating comprising of an external unit and standard domestic radiators internally. This is an air to water system.

6.19 A new hot water cylinder would need to be installed to supply hot water to the kitchen and bathroom.

6.20 The proposal would necessitate the removal of the existing boiler and radiators including the pipework which would be too small for the new system.

6.21 The proposal would qualify for the domestic renewable heat initiative [RHI], which is a government financial incentive scheme to promote the use of renewable heat. Both the installer and the system must have a current certification from the Microgeneration Certification Scheme [MCS], which this proposal has.

6.22 The scheme is administered by Ofgem.

6.23 The starting point for applying to Ofgem for the scheme is the submission of an Energy Performance Certificate [EPC] for the property. This must be less

than two years old and assesses the estimated annual heat use of the renewable heating system.

6.24 Payments are made quarterly for seven years for the amount of clean, renewable heat the system produces.

6.25 An engineer at Total Renewable Solutions has estimated the probable annual payment from the RHI scheme, based on an old EPC for the building and the enhanced heat loss calculations. The proposed air source heating system would qualify for an estimated annual payment of £1000.00 for seven years.

6.26 However in a discussion with another heating engineer an opinion was expressed of the possibility that the RHI scheme could be withdrawn by the government at the end of this year.

6.27 At this stage Total Renewable Solutions have provided an outline proposal and a budget cost which includes materials and labour for the installation of the air source heat pump system but excludes the costs of the electrical works and domestic plumbing works. To submit a more detailed and final quotation the company will need to undertake a heat loss calculation to finalise size of units, prepare a new Energy Performance Certificate [EPC] and provide a detailed specification including a breakdown of costs for electrical and domestic plumbing works. Please refer to Appendix E for their proposal.

7. Recommendations and remedial works: General building works

7.1 Works are required to both external doors to prevent water coming into the building.

7.2 Both external doors should be adapted to include a steel water bar to each timber cill and including the rebating of the door to receive the water bar.

8. Conclusion

8.1 The current problems in Cemetery Lodge stem, in the main, from a lack of insulation to the building fabric.

8.2 Solid external walls, no insulation to the floors and poor insulation to the roof result in the existing boiler system unable to meet the heating demands.

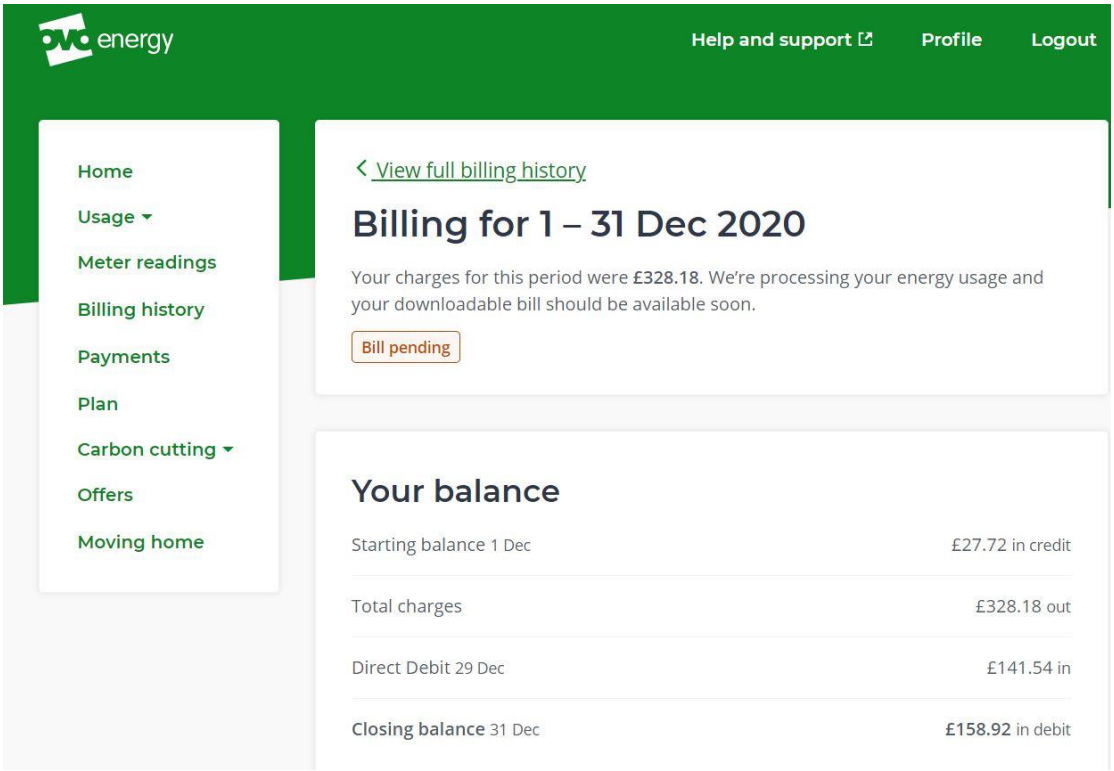
8.3 The proposed recommendations to the insulation and ventilation will improve the living conditions in the building, though it should be noted the insulation of the walls will result in a reduction in floor space.

8.4 The added insulation may improve the efficiency of the existing boiler and it may be an option to retain the boiler including the heating and water circuits and monitor the costs of running the existing system over a period of one year.

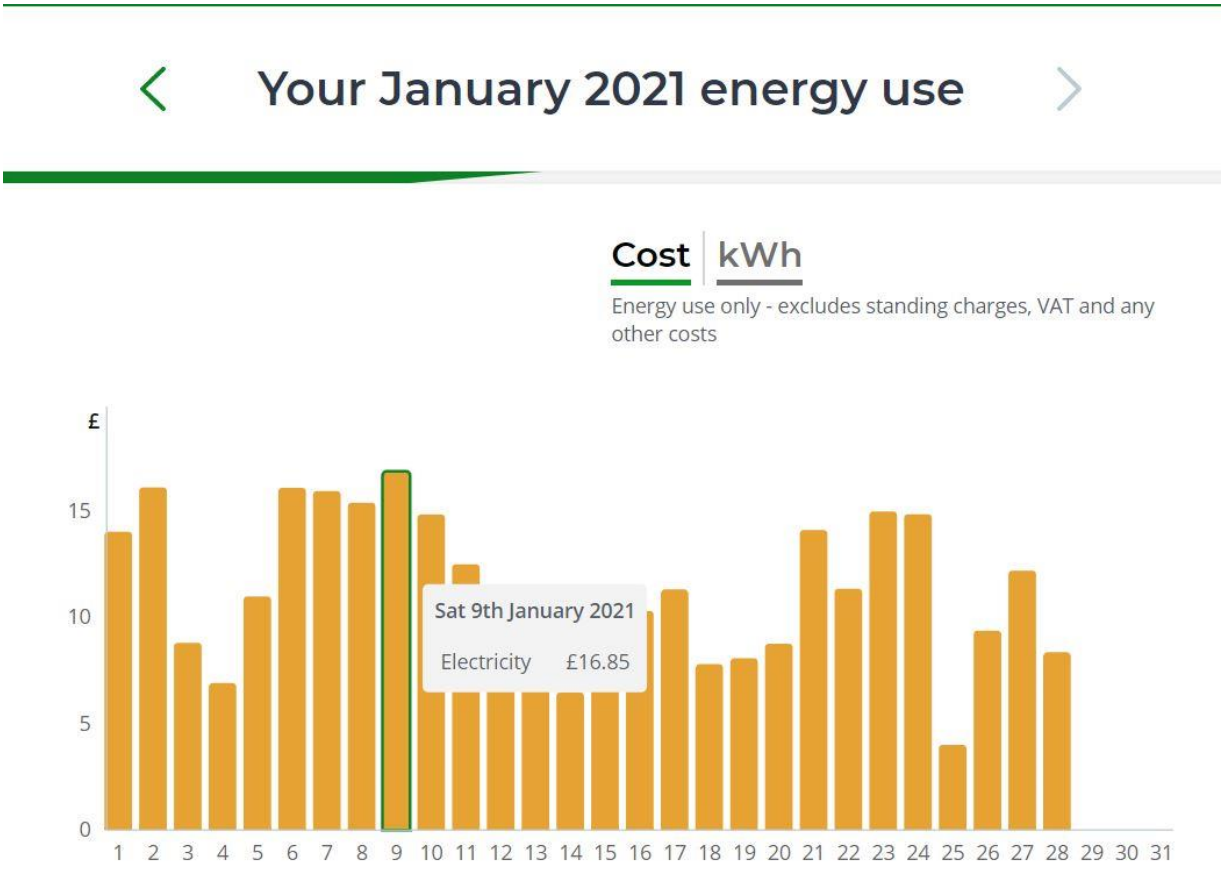
8.5 However the proposed replacement of the heating system with an air source heating system will provide a cheaper, greener and more efficient system and the possible benefit of a reduction in costs through the benefit of the RHI payment from the government.

Appendix A

Tenant's electricity bills 2020/2021



December bill: £328.18



January bill [up to 28th]: £376.75

Appendix B

U Value Calculations and data sheets

U-Value Calculation and Condensation Risk Assesment

Project Information

Construction: Cemetery Lodge, Ilminster, Somerset, TA19 9DX - Ventilated Pitched Roof

Construction Type: Pitched Roof

File reference: 1-TC-210129-111007-193

Calculated U-value = $0.18 W/m^2K$

Selected Build-Up

Description	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Thermal Bridging	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)	
Inside Surface			0.1				
PLASTERBOARD	12.5	0.19	0.066		50	0.625	
1000 GAUGE 0.25mm POLYTHENE VAPOUR CONTROL LAYER	0.3		0.001			500	
KOOLTHERM K107	50	0.018	2.778			22.9	
KOOLTHERM K107	60	0.018	3.333			22.9	
VENTILATED RAFTER/JOIST CAVITY	100		0			0	
SARKING FELT	2	0.23	0			50	
TILES / SLATES & BATTENS; VENTILATED PITCHED ROOF.	30		0			0	
Outside Surface			0.19				

Key: Bridged and fastened; Bridged; Fastened

Supporting Information

Product Details

For further information on the specified products e.g. literature or specification clauses, please follow the links below or scan the QR code to the right:

Kingspan Kooltherm K107 Pitched Roof Board
www.kingspaninsulation.co.uk/k107

Detailed U-value

The calculation method is in accordance with BS EN ISO 6946:2017 / I.S. EN ISO 6946:2017. A simplified summary of the steps involved are shown below

$Rtotal(R_{tot}) = R_{si} + R_1 + R_2 + \ldots + R_n + R_{se}$

For a construction containing inhomogeneous layers the upper and lower resistances of the construction must be used

$R_{tot;upper} = 1/((f_a/R_{tot;a}) + (f_b/R_{tot;b}) + \ldots + (f_q/R_{tot;q}))$
$R_j = 1/((f_a/R_{aj}) + (f_b/R_{bj}) + \ldots + (f_q/R_{qj}))$
$R_{tot;lower} = R_{si} + R_1 + R_2 + R_j + \ldots + R_n + R_{se}$

$R_{tot} = (R_{tot;upper} + R_{tot;lower})/2$
$= (6.468 + 6.468)/2$
$U = 1/R_{tot}$
$= 6.468$
$\Delta U = \Delta U_g + \Delta U_f + \Delta U_r$

ΔU_g correction for air voids - 0.000

ΔU_f correction for fasteners by approximate procedure - 0.022
(alpha 1.60 | fasteners per m² 33.40 | fasteners cross sectional area 8.00 | thermal conductivity of fasteners 100.00)

ΔU_f correction for fasteners by detailed calculation method (rainscreen cladding) – 0.000
(point thermal transmittance 0.00 | fasteners per m² 0.00)

ΔU_r correction for inverted roofs – 0.000
(precipitation 0.00 | f· x 0.00)

Total U-value $(U_c) = U + \Delta U$
If ΔU is less than 3% of U then the corrections need not be applied.

Calculations including a steel frame construction are calculated in accordance with BRE Digest 465.

Condensation

Condensation calculations have been performed in accordance with BS EN ISO 13788:2012 and BS 5250:2011+A1:2016 and the risk assessed within environmental conditions with the following characteristics

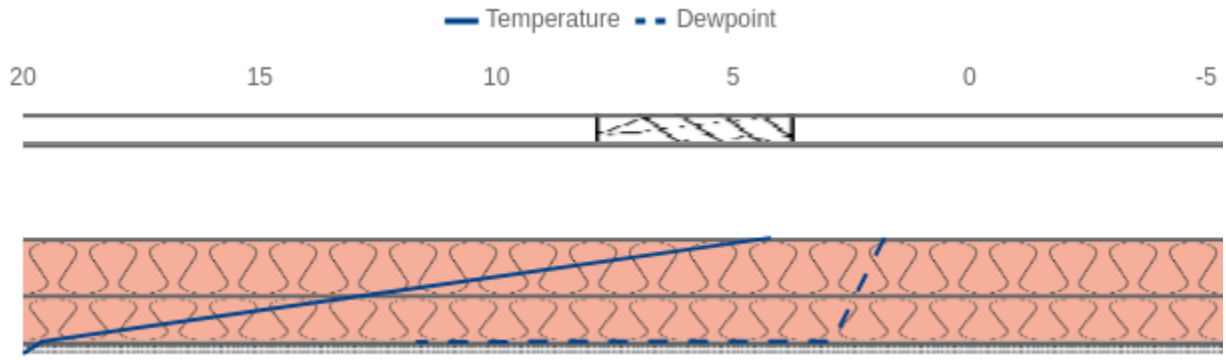
Humidity class 3 - Dwellings with low occupancy

Location: 6 S Wales & England SW

Condensation risk has been assessed up to and including Level 3 Humidity Class (3 - Dwellings with low occupancy) within worst case environment conditions. The risk level is 1 in 20 years

Condensation Analysis

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Internal Temperature (°C)	20	20	20	20	20	20	20	20	20	20	20	20
Internal Relative Humidity (%)	59.6	58.8	59.1	59.6	62.4	67.1	71.4	71.8	69.2	66.1	61.4	60.5
External Temperature (°C)	3.9	3.7	4.9	6.8	9.5	12.3	14.1	14	12.3	9.9	6.5	5
External Relative Humidity (%)	89.5	87.5	86	83.5	83	83.5	84.5	85.5	87	89	88.5	89.5



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Herefordshire | HR6 9LA

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U-Value Calculation and Condensation Risk Assesment

Project Information

Construction: Cemetery Lodge, Ilminster, Somerset, TA19 9DX - Pitched Roof with Ventilated Loft Space

Construction Type: Pitched Roof with Ventilated Loft Space

File reference: 1-TC-210129-111116-194

Calculated U-value = $0.17 W/m^2K$

Selected Build-Up

Description	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Thermal Bridging	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)	
Inside Surface			0.1				
PLASTERBOARD	12.5	0.19	0.066		50	0.625	
1000 GAUGE 0.25mm POLYTHENE VAPOUR CONTROL LAYER	0.3		0.001			500	
KOOLTHERM K107	50	0.018	2.778			22.9	
KOOLTHERM K107	60	0.018	3.333			22.9	
Loft Space	300		0.2				
SARKING FELT	2	0.23	0			50	
ROOFING TILES / SLATES & BATTENS; (ABOVE VENTILATED LOFT VOID)	30		0			0	
Outside Surface			0.04				

Key Bridged and fastened Bridged Fastened

Supporting Information

Product Details

For further information on the specified products e.g. literature or specification clauses, please follow the links below or scan the QR code to the right:

Kingspan Kooltherm K107 Pitched Roof Board
www.kingspaninsulation.co.uk/k107

Detailed U-value

The calculation method is in accordance with BS EN ISO 6946:2017 / I.S. EN ISO 6946:2017. A simplified summary of the steps involved are shown below

$Rtotal(R_{tot}) = R_{si} + R_1 + R_2 + \ldots + R_n + R_{se}$

For a construction containing inhomogeneous layers the upper and lower resistances of the construction must be used

$R_{tot;upper} = 1/((f_a/R_{tot;a}) + (f_b/R_{tot;b}) + \ldots + (f_q/R_{tot;q}))$
$R_j = 1/((f_a/R_{aj}) + (f_b/R_{bj}) + \ldots + (f_q/R_{qj}))$
$R_{tot;lower} = R_{si} + R_1 + R_2 + R_j + \ldots + R_n + R_{se}$

$R_{tot} = (R_{tot;upper} + R_{tot;lower})/2$
$= (6.518 + 6.518)/2$
$U = 1/R_{tot}$
$= 6.518$
$\Delta U = \Delta U_g + \Delta U_f + \Delta U_r$

ΔU_g correction for air voids - 0.000

ΔU_f correction for fasteners by approximate procedure - 0.021
(alpha 1.60 | fasteners per m² 33.40 | fasteners cross sectional area 8.00 | thermal conductivity of fasteners 100.00)

ΔU_f correction for fasteners by detailed calculation method (rainscreen cladding) – 0.000
(point thermal transmittance 0.00 | fasteners per m² 0.00)

ΔU_r correction for inverted roofs – 0.000
(precipitation 0.00 | f· x 0.00)

Total U-value $(U_c) = U + \Delta U$
If ΔU is less than 3% of U then the corrections need not be applied.

Calculations including a steel frame construction are calculated in accordance with BRE Digest 465.

Condensation

Condensation calculations have been performed in accordance with BS EN ISO 13788:2012 and BS 5250:2011+A1:2016 and the risk assessed within environmental conditions with the following characteristics

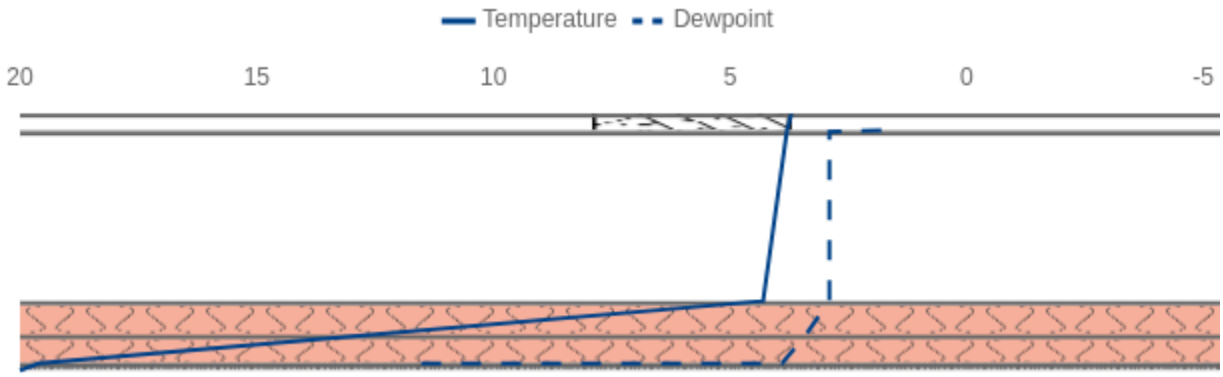
Humidity class 3 - Dwellings with low occupancy

Location: 6 S Wales & England SW

Condensation risk has been assessed up to and including Level 3 Humidity Class (3 - Dwellings with low occupancy) within worst case environment conditions. The risk level is 1 in 20 years

Condensation Analysis

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Internal Temperature (°C)	20	20	20	20	20	20	20	20	20	20	20	20
Internal Relative Humidity (%)	59.6	58.8	59.1	59.6	62.4	67.1	71.4	71.8	69.2	66.1	61.4	60.5
External Temperature (°C)	3.9	3.7	4.9	6.8	9.5	12.3	14.1	14	12.3	9.9	6.5	5
External Relative Humidity (%)	89.5	87.5	86	83.5	83	83.5	84.5	85.5	87	89	88.5	89.5



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U-Value Calculation and Condensation Risk Assesment

Project Information

Construction: Cemetery Lodge, Ilminster, Somerset, TA19 9DX - Basement Floor

Construction Type: Basement Floor

File reference: 1-TC-210129-111226-195

Calculated U-value = $0.25 W/m^2K$

Selected Build-Up

Description	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Thermal Bridging	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)	
Inside Surface			0.17				
CHIPBOARD	18	0.15	0.12		500	9	
POLYTHENE SEPARATION LAYER	0.5		0.001			500	
KOOLTHERM K103	60	0.018	2.956	13.1% floor timber - 47mm joists @ 400mm ctrs + 47mm noggins @ 3000mm ctrs, 400.0 centres	370	22.2	
Ground			0.04				

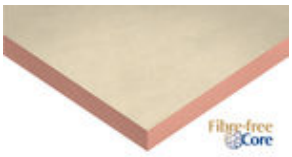
Key: Bridged and fastened; Bridged; Fastened

Supporting Information

Product Details

For further information on the specified products e.g. literature or specification clauses, please follow the links below or scan the QR code to the right:

Kingspan Kooltherm K103 Floorboard
www.kingspaninsulation.co.uk/k103



Detailed U-value

The calculation method is in accordance with BS EN ISO 6946:2017 / I.S. EN ISO 6946:2017. A simplified summary of the steps involved are shown below

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$R_{tot;lower} = R_{si} + R_1 + R_2 + R_j + \ldots + R_n + R_{se}$

$R_{tot} = (R_{tot;upper} + R_{tot;lower})/2$
$= (2.483 + 2.165)/2$
$U = 1/R_{tot}$
$= 3.925$
$\Delta U = \Delta U_g + \Delta U_f + \Delta U_r$

ΔU_g correction for air voids - 0.000

ΔU_f correction for fasteners by approximate procedure - 0.000
(alpha 0.00 | fasteners per m² 0.00 | fasteners cross sectional area 0.00 | thermal conductivity of fasteners 0.00)

ΔU_f correction for fasteners by detailed calculation method (rainscreen cladding) – 0.000
(point thermal transmittance 0.00 | fasteners per m² 0.00)

ΔU_r correction for inverted roofs – 0.000
(precipitation 0.00 | f· x 0.00)

Total U-value $(U_c) = U + \Delta U$
If ΔU is less than 3% of U then the corrections need not be applied.

Calculations including a steel frame construction are calculated in accordance with BRE Digest 465.

Calculations for floor and basement constructions are calculated in accordance with BS EN ISO 13370:2017 / I.S. EN ISO 13370:2017.

Characteristics	Value	Characteristics	Value
Perimeter	0.000m	Area	0.000m²
P/A	0.830	Soil type	Clay or Silt
Earth conductivity	1.500W/mK	Average basement depth	2.000m

Condensation

Condensation calculations have been performed in accordance with BS EN ISO 13788:2012 and BS 5250:2011+A1:2016 and the risk assessed within environmental conditions with the following characteristics

Humidity class 3 - Dwellings with low occupancy

Location: 6 S Wales & England SW

Condensation risk has been assessed up to and including Level 3 Humidity Class (3 - Dwellings with low occupancy) within worst case environment conditions. The risk level is 1 in 20 years

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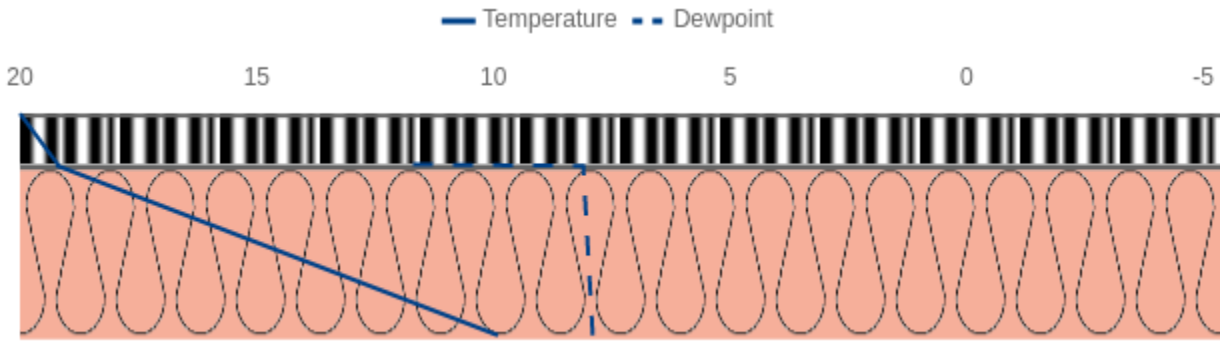
External Temperature (°C)	3.9	3.7	4.9	6.8	9.5	12.3	14.1	14	12.3	9.9	6.5	5
External Relative Humidity (%)	89.5	87.5	86	83.5	83	83.5	84.5	85.5	87	89	88.5	89.5



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U-Value Calculation and Condensation Risk Assesment

Project Information

Construction: Cemetery Lodge, Ilminster, Somerset, TA19 9DX - Internal Dry Lining Mechanically Fixed

Construction Type: Wall

File reference: 1-TC-210129-111425-197

Calculated U-value = $0.29 W/m^2K$

Selected Build-Up

Description	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Thermal Bridging	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)	
Inside Surface			0.13				
KOOLTHERM K118 62.5mm (12.5mm plasterboard internal finish)	62.5		2.844			102.1	
TIMBER BATTEN CAVITY; U/V.	25		0.591	11.4% wall timber - 47mm batten @ 600mm ctrs + 47mm noggins @ 1200mm ctrs, 600.0 centres		0.05	
SANDSTONE	400	2.3	0.195	6.6% Mortar, 450.0 centres	135	54	1
Outside Surface			0.04				

Key: Bridged and fastened; Bridged; Fastened

Supporting Information

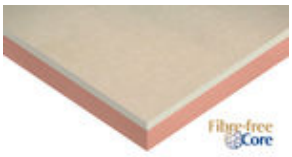
Calculation Notes: Existing Stone Wall

1. Existing

Product Details

For further information on the specified products e.g. literature or specification clauses, please follow the links below or scan the QR code to the right:

Kingspan Kooltherm K118 Insulated Plasterboard
www.kingspaninsulation.co.uk/k118



Detailed U-value

The calculation method is in accordance with BS EN ISO 6946:2017 / I.S. EN ISO 6946:2017. A simplified summary of the steps involved are shown below

$Rtotal(R_{tot}) = R_{si} + R_1 + R_2 + \ldots + R_n + R_{se}$

For a construction containing inhomogeneous layers the upper and lower resistances of the construction must be used

$R_{tot;upper} = 1/((f_a/R_{tot;a}) + (f_b/R_{tot;b}) + \ldots + (f_q/R_{tot;q}))$
$R_j = 1/((f_a/R_{aj}) + (f_b/R_{bj}) + \ldots + (f_q/R_{qj}))$
$R_{tot;lower} = R_{si} + R_1 + R_2 + R_j + \ldots + R_n + R_{se}$

$R_{tot} = (R_{tot;upper} + R_{tot;lower})/2$
$= (3.793 + 3.702)/2$
$U = 1/R_{tot}$
$= 3.747$
$\Delta U = \Delta U_g + \Delta U_f + \Delta U_r$

ΔU_g correction for air voids - 0.000

ΔU_f correction for fasteners by approximate procedure - 0.024
(alpha 0.80 | fasteners per m² 16.70 | fasteners cross sectional area 4.00 | thermal conductivity of fasteners 50.00)

ΔU_f correction for fasteners by detailed calculation method (rainscreen cladding) – 0.000
(point thermal transmittance 0.00 | fasteners per m² 0.00)

ΔU_r correction for inverted roofs – 0.000
(precipitation 0.00 | f· x 0.00)

Total U-value $(U_c) = U + \Delta U$
If ΔU is less than 3% of U then the corrections need not be applied.

Calculations including a steel frame construction are calculated in accordance with BRE Digest 465.

Condensation

Condensation calculations have been performed in accordance with BS EN ISO 13788:2012 and BS 5250:2011+A1:2016 and the risk assessed within environmental conditions with the following characteristics

Humidity class 3 - Dwellings with low occupancy

Location: 6 S Wales & England SW

Condensation risk has been assessed up to and including Level 3 Humidity Class (3 - Dwellings with low occupancy) within worst case environment conditions. The risk level is 1 in 20 years

Condensation has been calculated to accumulate at the followings interfaces:

Interface1: TIMBER BATTEN CAVITY; U/V. / SANDSTONE

Condensation Analysis

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Internal Temperature (°C)	20	20	20	20	20	20	20	20	20	20	20	20
Internal Relative Humidity (%)	59.6	58.8	59.1	59.6	62.4	67.1	71.4	71.8	69.2	66.1	61.4	60.5
External Temperature (°C)	3.9	3.7	4.9	6.8	9.5	12.3	14.1	14	12.3	9.9	6.5	5
External Relative Humidity (%)	89.5	87.5	86	83.5	83	83.5	84.5	85.5	87	89	88.5	89.5
Interface1 (Gc (kg/m²))	0.007	0.006	0.004	-0.001	-0.007	-0.011	-0.013	0	0	0	0.003	0.006
Interface1 (Ma (kg/m²))	0.016	0.021	0.025	0.024	0.017	0.006	0	0	0	0	0.003	0.008

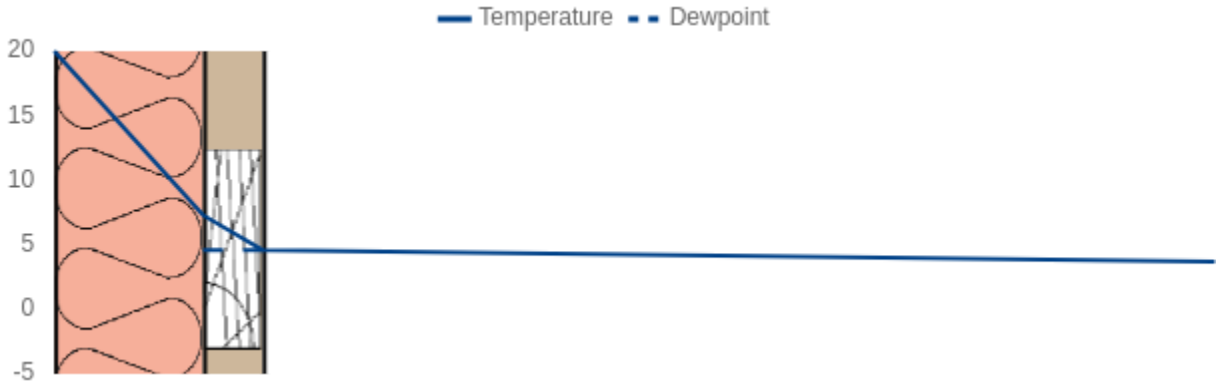
Gc = Monthly moisture accumulation per area at an interface

Ma = Accumulated moisture content per area at an interface

Peak accumulated moisture content per area at interface1(Ma) = 0.025 Kg/m²

Annual moisture accumulation (Ma) = 0.000 Kg/m²

Peak moisture build-up month: March



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Appendix C

Vent Axia Data sheets

VA100/SELV

- Indication light
- Panel, ceiling, window or wall mounting
- Available with electric shutter
- Sensors and auto mode controllers save energy by switching the ventilation units on only when needed and when the room is occupied
- Adjustable overrun timer option available (5-30 minutes)
- Meets current Building Regulations Approved Document F
- IPX4 rated - IPX7 rated (SELV)
- SELV Transformer to BS EN 60 742

Bathroom and Toilet Ventilation

The VA100 range from Vent-Axia is designed for domestic bathrooms and toilets. Available as window, wall or panel mounted and with options of shutter, timer or humidity controlled versions.

Designed in a clean white finish and suitable for ambient temperatures up to +40°C the unit is fitted with Standard Thermal Overload Protection (S.T.O.P.).

Safety Extra Low Voltage Fans (SELV)

Designed for areas where a fan has to be fitted over or within Zone 1 in a room containing a fixed bath or shower according to IEE wiring regulations (BS 7671), SELV models can be safely installed within the spray area. SELV models are rated IPX7. Control is by mains safety isolating transformer unit with SELV output, which is sited away from any source of spray and out of reach of a person using a fixed bath or shower.

Models

VA100LP (Pullcord)

Bathroom extract fan pullcord and indication light.

Model	Stock Ref
LP	251110

VA100 SELV

IPX7 rated fan with indication light, complete with remote wall mounted transformer.

Model	Stock Ref
SVL 12 (SELV)	258110

VA100LT (Timer)

Bathroom and toilet fan with adjustable electronic overrun timer and indication light which operates on the override only.

Model	Stock Ref
LT	251210

VA100 SELV (Shutter)

IPX7 rated fan with thermo-electric shutter and indication light, complete with remote wall mounted transformer.

Model	Stock Ref
SVX 12 (SELV)	258310

VA100XP/SELV XP (Shutter/Pullcord)

Bathroom fan with thermo-electric shutter, pullcord and indication light. SELV model IPX7 rated and complete with wall mounted transformer.

Model	Stock Ref
XP	251310
SVXP 12 (SELV)	258310BD025

VA100XT/SELV XT (Timer/Shutter)

Bathroom fan with integral adjustable overrun timer, thermo-electric shutter and indication light which operates on override only. SELV model IPX7 rated and complete with wall mounted transformer.

Model	Stock Ref
XT	251410
SVXT 12 (SELV)	258410

VA100LHP/SELV LHP (Humidity)

Bathroom fan with integral humidity sensor, pullcord override, and indication light which operates on manual override only. SELV model IPX7 rated and complete with wall mounted transformer.

Model	Stock Ref
LHP	251610
SVLHP 12 (SELV)	258112

VA100XHP/SELV XHP (Shutter/Humidity)

Bathroom fan with integral humidity sensor, thermo-electric shutter, pullcord override, and indication light which operates on manual override only. SELV model IPX7 rated and complete with wall mounted transformer.

Model	Stock Ref
XHP	251710
SVXHP 12 (SELV)	258312

VA100XHT/SELV XHT (Shutter/Humidity/Timer)

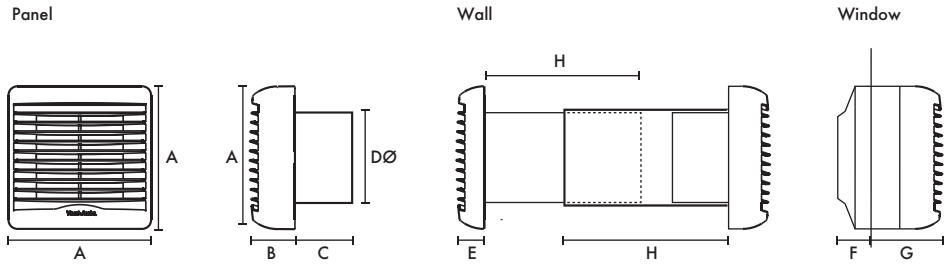
Bathroom fan with integral humidity sensor and adjustable overrun timer, thermo-electric shutter and indication light which operates on manual override only. SELV model IPX7 rated and complete with wall mounted transformer.

Model	Stock Ref
XHT	251510
SVXHT	258512

Accessories

Model	Stock Ref
Window Kit	254101
Wall Kit White	254102
Wall Kit Brown	254100
Anti-Tamper Window Kit	443234

Dimensions (mm)



A	B	C	DØ	E	F	G	H
146	47	53	98	31	31	74	200

Weight 0.55kg

Fixing hole diameter 105mmØ (Panel & Window), 117mmØ (Wall). Transformer (WxHxD) 147x86x65.

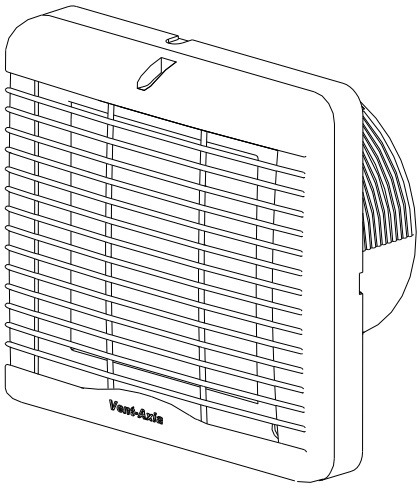
Performance Guide - Panel Models

Extract performance

Model	m^3/h	l/s	Watts	Sound dB(A) @ 3m
VA100LP	107	30	13	36
VA100LT	107	30	15	36
VA100XP	107	30	15	36
VA100XT	107	30	18	36
VA100LHP	107	30	16	36
VA100XHP	107	30	18	36
VA100XHT	107	30	18	36
VA100SVL	83	23	16	36
VA100SVX	83	23	18	36
VA100SVXT/XHP/XHT/XP	83	23	20	36
VA100SVLHP	83	23	18	36

VA140/150
RANGE
Axial Kitchen Fans

Installation and wiring Instructions



Stock Ref.No

VA140/150KP	**140120C**
VA140/150KT	**140220C**
VA140/150KHP	**140320C**
VA140/150KHT	**140420C**

220-240V~50Hz

Vent-Axia®

READ IN CONJUNCTION WITH ILLUSTRATIONS
PLEASE SAVE THESE INSTRUCTIONS

CE

Vent-Axia

Installation and Wiring Instructions for the VA140/ 150 KP, KT, KHP, KHT Extract Fan.

IMPORTANT: READ THESE INSTRUCTIONS BEFORE COMMENCING THE INSTALLATION

DO NOT install this product in areas where the following may be present or occur:

- Excessive oil or a grease laden atmosphere.
- Corrosive or flammable gases, liquids or vapours.
- This appliance is not suitable for installation in a shower cubical or enclosure and must be sited away from any source of water spray, and must be out of reach of a person using a fixed bath or shower.
- Ambient temperatures higher than 40°C or less than –5°C.
- Possible obstructions which would hinder the access or removal of the Fan.
- Sudden ductwork bends or transformations close to the Fan.

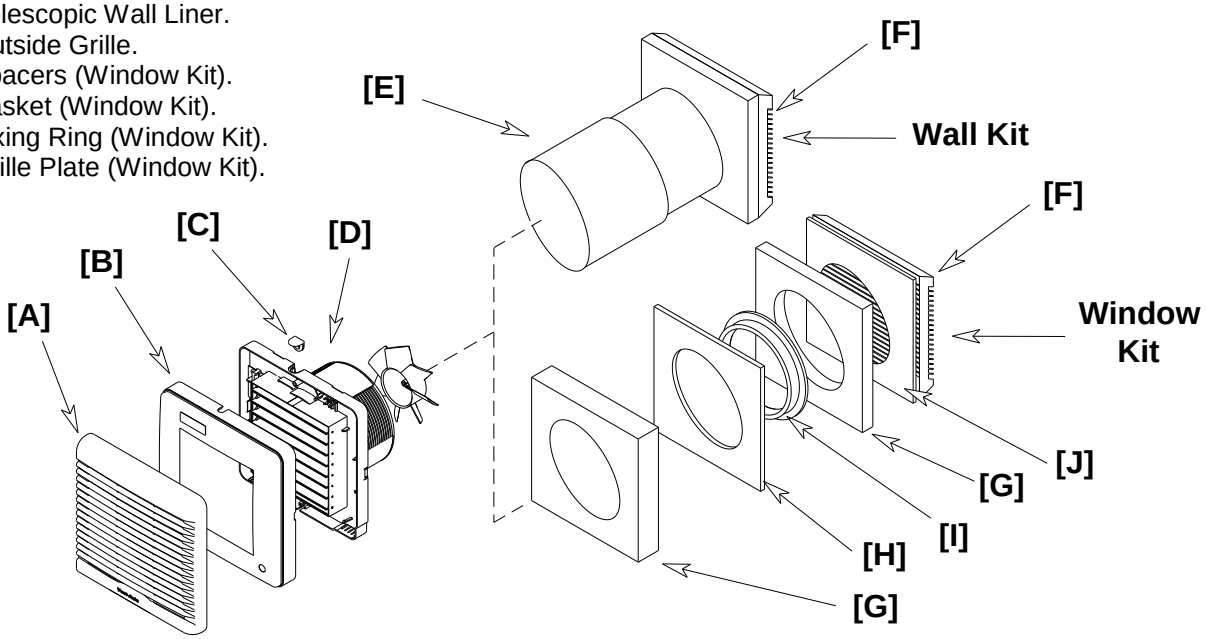
SAFETY AND GUIDANCE NOTES

A. All wiring to be in accordance with the current I.E.E. Regulations, or the appropriate standards of your country and **MUST** be installed by a suitably qualified person.
B. The Fan should be provided with a local all pole isolator switch having a contact separation of at least 3mm.
C. Ensure that the mains supply (Voltage, Frequency, and Phase) complies with the rating label.
D. The Fan should only be used in conjunction with the appropriate Vent-Axia products.
E. It is recommended that the connection to the fan connector terminals is made with flexible cable.
F. When the Fan is used to remove air from a room containing a fuel-burning appliance, ensure that the air replacement is adequate for both the fan and the fuel-burning appliance.
G. This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
H. Young children should be supervised to ensure that they do not play with the appliance.

DESCRIPTION

The VA140/ 150 Utility/ Kitchen fan is suitable for Panel either in a horizontal or vertical plane, Wall or Window mounting as standard. Additional Window (14 09 01A) and Wall (14 09 02A White / 14 09 03A Brown) kits are available.

[A] Indoor Grille.
[B] Inner Cover.
[C] Cable Grommet.
[D] Base Housing.
[E] Telescopic Wall Liner.
[F] Outside Grille.
[G] Spacers (Window Kit).
[H] Gasket (Window Kit).
[I] Fixing Ring (Window Kit).
[J] Grille Plate (Window Kit).

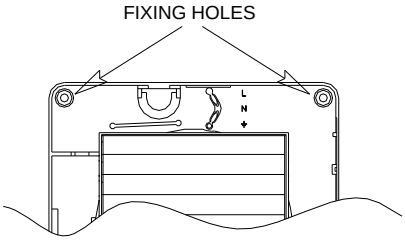


A INSTALLATION.

PANEL MOUNTING

1. Cut a 152mm∅ hole through the panel. (Suitable for existing holes up to 185mm∅).
2. Remove the Indoor Grille [A]. Loosen the screw (top middle) of the Grille, to release front grille gently lever the Grille downwards away from the Inner Cover [B].
3. Remove Inner Cover [B]. Loosen the screw (bottom middle) and release the inner grille gently from the Base Housing [D].
4. Remove the Cable Grommet [C], pierce/cut a hole in the Grommet to suit the cable size, maintaining the integrity of the seal and replace the grommet in the Base Housing to suit either a top or back cable entry.
5. Slide the Base Housing into the hole in the panel and secure into position using screws and fixings provided.

Fig. 1.



6. Ensure the fan blade rotates freely.
7. Select and follow the appropriate wiring diagram in **Section B WIRING.**
8. Replace the Inner Cover and Indoor Grille (retightening the screws securely).
9. Switch the mains power supply on and check the fan is operating correctly.

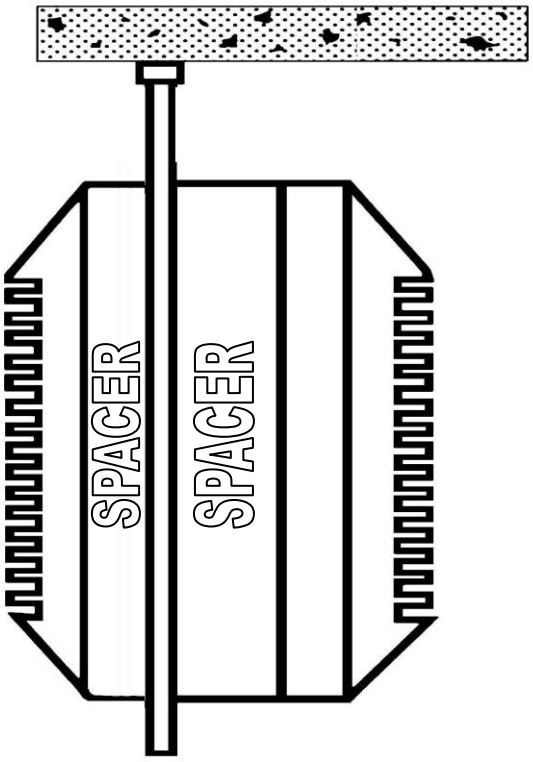
WALL MOUNTING

1. Cut a 152mm∅ hole through the wall and insert the wall sleeve [E] with the larger diameter sleeve on the room side and cement both ends into position flush with the wall faces. The wall sleeve should be angled downwards away from the fan to allow any condensation to drain to the outside wall.
2. Remove the Wall Mounting Plate from the Outside Grille [F] to use as a template, mark the fixing hole centres on the wall. Drill and plug the wall and fix the Wall Mounting Plate into position (screws provided).
3. Fix the Outside Grille [F] back onto the Wall Mounting Plate. Ensure the louvres are pointing downwards.
4. Remove the Indoor Grille [A]. Loosen the screw (top middle) of the Grille, to release front grille gently lever the Grille downwards away from the Inner Cover [B].
5. Remove Inner Cover [B]. Loosen the screw (bottom middle) and release the inner grille gently from the Base Housing [D].
6. Remove the Cable Grommet [C], pierce/cut a hole in the Grommet to suit the cable size, maintaining the integrity of the seal and replace the grommet in the Base Housing to suit either a top or back cable entry.
7. Slide the Base Housing into the Wall Liner and secure into position using screws and fixings provided (*Fig. 1.)*.
8. Ensure the fan blade rotates freely.
9. Select and follow the appropriate wiring diagram in **Section B WIRING.**
10. Replace the Inner Cover and Indoor Grille (retightening the screws securely).
11. Switch the mains power supply on and check the fan is operating correctly.

WINDOW MOUNTING

1. Cut a 152mm∅ hole in the glass (Suitable for existing holes up to 185mm∅).
2. Ensure that the glass surfaces are clean and free from grease.
3. Remove the Indoor Grille [A]. Loosen the screw (top middle) of the Grille, to release front grille gently lever the Grille downwards away from the Inner Cover [B].
4. Remove Inner Cover [B]. Loosen the screw (bottom middle) and release the inner grille gently from the Base Housing [D].
5. Remove the Cable Grommet [C], pierce/cut a hole in the Grommet to suit the cable size, maintaining the integrity of the seal and replace the grommet in the Base Housing to suit a top cable entry.
6. Fit required spacers behind the fan back plate, engaging the locating pips. Place the fan spigot through the hole in the glass from the inside, with a gasket on each side of the glass.
7. From the outside, place on the remaining spacer, with the locating pips facing outwards. For double-glazing and materials up to 40mm thick, one or more spacers may be discarded. (Fig. 2.)
8. Draw the assembly together with the threaded fixing ring. Do not over-tighten.
9. Fix the Outside Grille [F] on to the Spacers (screws provided). Ensure the louvres are pointing downwards.
10. Ensure the fan blade rotates freely.
11. Select and follow the appropriate wiring diagram in **Section B WIRING.**
12. Replace the Inner Cover and Indoor Grille (retightening the screws securely).
13. Switch the mains power supply on and check the fan is operating correctly

Fig. 2.



1. On the outside, one SPACER will always be required. Dependant on the thickness of glass either the thick or thin spacer will be used.
2. For thin (single glaze) glass the additional spacer should be fitted on the inside behind the fan, engaging the locating pips.

Ensure a gasket is fitted on each side of the glass.

B. WIRING.

WARNING: THE FAN AND ANY ANCILLARY CONTROL EQUIPMENT MUST BE ISOLATED FROM THE POWER SUPPLY DURING THE INSTALLATION / OR MAINTENANCE.

1. Select and follow the appropriate wiring diagram (Fig. 3-6).
2. Check all connections have been made correctly and ensure all terminal connections and cable clamps are securely fastened.
3. The cable entry must be made using the cable grommet.
4. Ensure the impeller rotates and is free from obstructions.

Fig. 3.
VA140/ 150KP Pullcord Model.

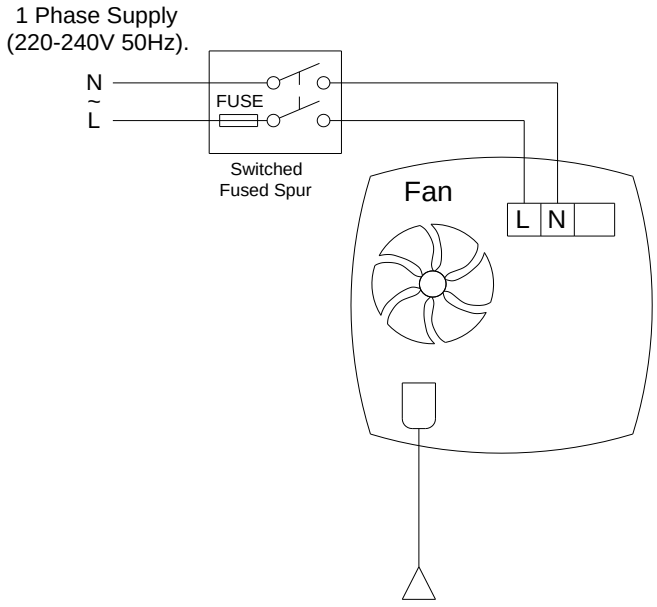
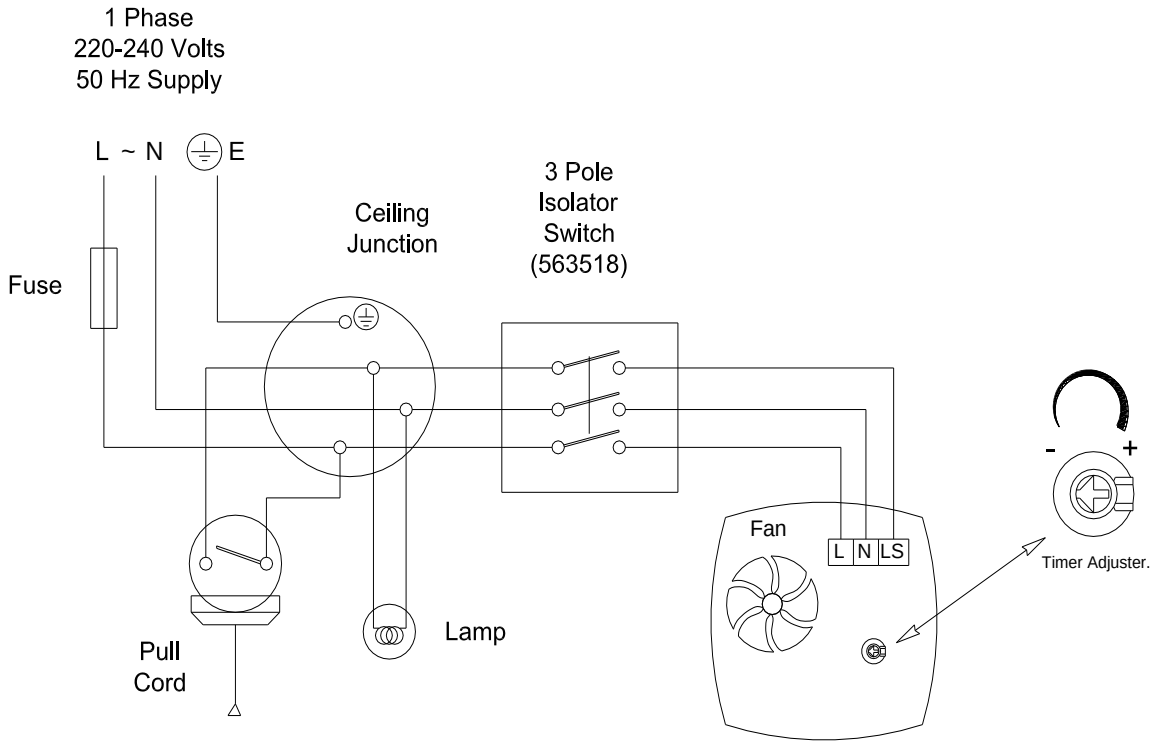


Fig. 4.
VA140/ 150KT Timer Model.



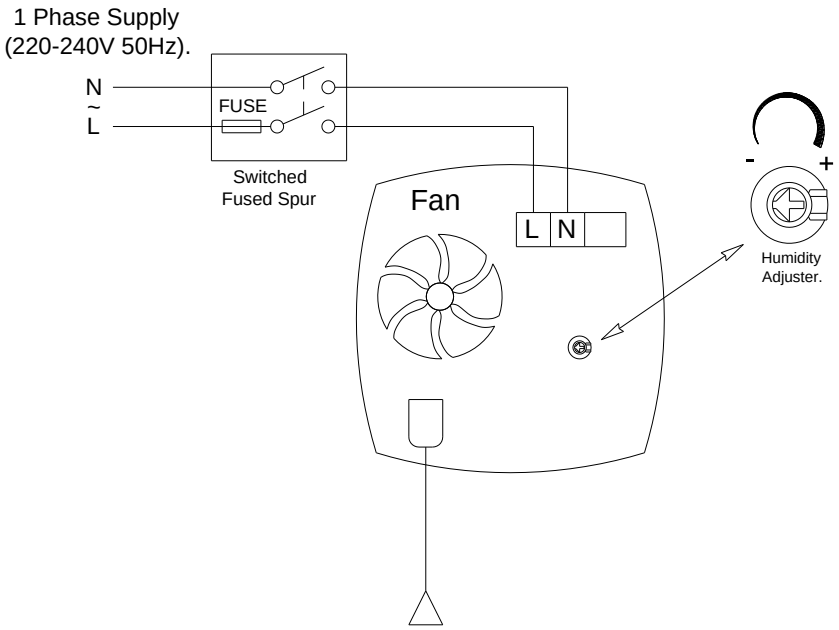
Timer Adjustment.

The overrun time period is factory set to approximately 15 minutes. The overrun time period may be adjusted at installation from 5-30 minutes, by altering the adjuster on the Fan PCB.

Before adjusting the timer, switch off the Mains Supply.

1. Remove the Indoor Grille [A]. Loosen the screw (top middle) of the Grille, to release front grille gently lever the Grille downwards away from the Inner Cover [B].
2. Remove Inner Cover [B]. Loosen the screw (bottom middle) and release the inner grille gently from the Base Housing [D].
3. To REDUCE the operating time, turn the Timer Adjuster ANTI-CLOCKWISE.
4. To INCREASE the operating time, turn the Timer Adjuster CLOCKWISE.
5. Replace the Inner Cover and Indoor Grille.
6. Reconnect the mains supply.

Fig. 5.
VA140/ 150KHP Humidity Model.



Humidity Set-Point Adjustment.

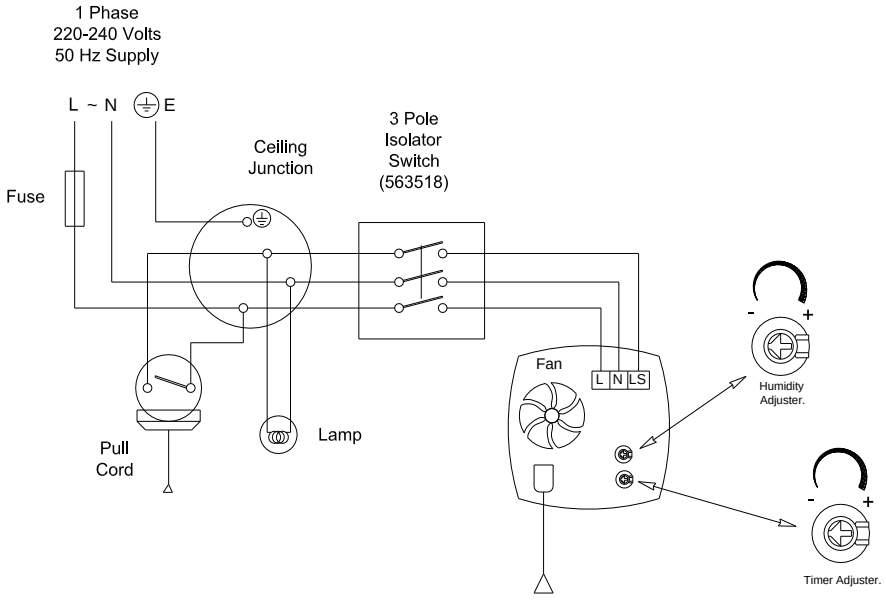
The Fan's Humidity Set-Point is factory set to switch the fan on at approximately 72%RH. The sensitivity may be adjusted at installation from 65%RH-90%RH, by altering the adjuster on the Fan PCB.

Before adjusting the Set-Point, switch off the Mains Supply.

1. Remove the Indoor Grille [A]. Loosen the screw (top middle) of the Grille, to release front grille gently lever the Grille downwards away from the Inner Cover [B].
2. Remove Inner Cover [B]. Loosen the screw (bottom middle) and release the inner grille gently from the Base Housing [D].
3. To LOWER the Set-Point, turn the adjuster ANTI-CLOCKWISE. This makes the fan more sensitive to RH%, i.e. the fan will come on at a lower RH%.
4. To RAISE the Set-Point, turn the adjuster CLOCKWISE. This makes the fan less sensitive to RH%, i.e. the fan will come on at a higher RH%.
5. Replace the Inner Cover and Indoor Grille.
6. Reconnect the mains supply.

(If remote override is required refer to Fig 6 for installation. The remote switch will switch between automatic humidity control and manual override. Ignore the timer control potentiometer in the diagram)

Fig. 6.
VA140/ 150KHT Humidity Timer Model.



Humidity and Time Set-Point Adjustment.

The fan's Humidity Set-Point is factory set to switch the fan on at approximately 72%RH. The sensitivity may be adjusted from 65%RH - 90%RH, by altering the adjuster on the Fan PCB.
The overrun Time period is factory set to approximately 15 minutes. The overrun time period may be adjusted from 5-30 minutes, by altering the adjuster on the Fan PCB.

Before adjusting the Set-Point, switch off the Mains Supply.

1. Remove the Indoor Grille [A]. Loosen the screw (top middle) of the Grille, to release front grille gently lever the Grille downwards away from the Inner Cover [B].
2. Remove Inner Cover [B]. Loosen the screw (bottom middle) and release the inner grille gently from the Base Housing [D].
3. To LOWER the Set-Point/ operating time, turn the indicated adjuster ANTI-CLOCKWISE. This makes the fan more sensitive to RH%, i.e. the fan will come on at a lower RH% or will reduce the overrun time.
4. To RAISE the Set-Point/ operating time, turn the adjuster CLOCKWISE. This makes the fan less sensitive to RH%, i.e. the fan will come on at a higher RH% or will increase the overrun time.
5. Replace the Inner Cover and Indoor Grille.
6. Reconnect the mains supply.

Shutter Operation

The shutter mechanism in all VA140/ 150 range fans will open approximately 40 seconds after the fan is turned On. The shutter will close about a minute after the fan is switched Off.

C. SERVICING AND MAINTENANCE.

WARNING: THE FAN AND ANCILLARY CONTROL EQUIPMENT MUST BE ISOLATED FROM THE POWER SUPPLY DURING MAINTENANCE.

1. At intervals appropriate to the installation, the fan should be inspected and cleaned to ensure there is no build up of dirt or other deposits.
2. Remove the Indoor Grille (See Section A : 2 for instructions) and wash in warm soapy water.
3. Wipe the shutter blades with a damp cloth until clean.
4. Replace the Grille.

The Vent-Axia Guarantee

Applicable only to products installed and used in the United Kingdom. For details of guarantee outside the United Kingdom contact your local supplier.

Vent-Axia guarantees its products for two years from date of purchase against faulty material or workmanship. In the event of any part being found to be defective, the product will be repaired, or at the Company's option replaced, without charge, provided that the product:-

- Has been installed and used in accordance with the instructions given with each unit.
- Has not been connected to an unsuitable electricity supply. (The correct electricity supply voltage is shown on the product rating label attached to the unit).
- Has not been subjected to misuse, neglect or damage.
- Has not been modified or repaired by any person not authorised by the company.

IF CLAIMING UNDER TERMS OF GUARANTEE

Please return the complete product, carriage paid to your original supplier or nearest Vent-Axia Centre, by post or personal visit. Please ensure that it is adequately packed and accompanied by a letter clearly marked "Guarantee Claim" stating the nature of the fault and providing evidence of date and source of purchase.

The guarantee is offered to you as an extra benefit, and does not effect your legal rights

Vent-Axia

Head Office: Fleming Way, Crawley, West Sussex, RH10 9YX.

UK NATIONAL CALL CENTRE, Newton Road, Crawley, West Sussex, RH10 9JA
SALES ENQUIRIES: Tel: 0844 8560590 Fax: 01293 565169
TECHNICAL SUPPORT: Tel: 0844 8560594 Fax: 01293 532814
For details of the warranty and returns procedure please refer to www.vent-axia.com or write to Vent-Axia Ltd, Fleming Way, Crawley, RH10 9YX

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Appendix D

Greenstock Refrigeration Quotation

GREENSTOCK REFRIGERATION LTD.

Refrigeration and Air Conditioning Specialists

Tel: 01460 242169
Mobile: 07971 741936
E-Mail: gary@greenstockrefrigeration.co.uk

Summerway
Thorney
Langport
Somerset TA10 0DT

Chris Baronowski
Alowenshay
Somerset

25/01/2021

Dear Chris

Re: Cemetery Lodge. Ashwell. Ilminster. TA19 9DX

Further to our site survey at the Cemetery Lodge in Ilminster, we found that the electric boiler is not the best way of heating this particular property and would be very inefficient and expensive to run.

We also feel that there is very limited insulation to the property therefore leaking heat through the walls, roof and floors. To improve the heating costs we recommend a 'renewable heat energy' source in the form of air to air heat pumps.

Our proposal would be to.

1. Disconnect and remove the seven radiators in the property.
2. Reconfigure the boiler to only supply hot water, using economy electricity via metering i.e. economy seven or economy ten.
3. Supply and install four individual heat pumps to the four main rooms.
4. Supply and install independent electric heat panels to the three smaller rooms.

For the electrical supplies, a new consumer unit will be required to allow for extra circuit breakers. New electrical supplies, wiring and isolators will be required for each of the heat pumps and small electrical panels. (To be confirmed by our electrical engineer).

Air source heat pumps are becoming an increasingly popular choice for homeowners who are looking to install 'renewable energy' solutions in their home. Renewable solutions such as air source heat pumps are one of the most economical, and eco-friendly heating solutions on the market and help homeowners not only to reduce their carbon footprint, but to significantly reduce their heating bills.

We also recommend improved insulation to the walls, basement and roof.

For four Panasonic heat pump supplies and installation, a new electrical consumer unit, new independent electrical supplies for the heat pumps and panel heaters and to include the disconnection and removal of seven radiators.

GREENSTOCK REFRIGERATION LTD.

Refrigeration and Air Conditioning Specialists

Tel: 01460 242169
Mobile: 07971 741936
E-Mail: gary@greenstockrefrigeration.co.uk

Summerway
Thorney
Langport
Somerset TA10 0DT

Our '**estimated'** cost would be £20,000.00 plus VAT.

We have not quoted and do not carry out insulation work.

As a local family run company for over 30 years, we have pride and pleasure is not only carrying out a first class installation but you can rest assured that we have the local back up to service the equipment and cover any repairs if necessary.

All Greenstock Refrigeration engineers are qualified to service and install refrigeration and air conditioning equipment to CITB J11 F Gas Cat 1.

All Greenstock Refrigeration engineers hold the relevant health and safety CSCS cards

Greenstock Refrigeration is a REFCOM F Gas registered company: Registration number REF1009422

I trust that I have interpreted your requirements correctly and all your relevant points have been covered. Should you require any further information, technical literature or drawings, please do not hesitate to contact me on the number above.

Assuring you of our best attention at all times,

Yours sincerely

Gary Greenstock - MinstR
Director

www.greenstockrefrigeration.co.uk

Appendix E

Total Renewable Solutions Quotation

Total Renewable Solutions ryan@totalrenewablesolutions.com

Wed 10/02/2021 16:12

To: You;

3 attachments (2 MB): [Design Conditions]; [Quote]; [Vallaint aroTHERM plus Brochure]

Dear Chris,

Thank you for allowing us the opportunity to quote for your upcoming project.

Based on the information provided we have carried out an initial assessment of your property and from our calculations we are happy to confirm that a heat pump would be well suited to your property.

As such, we take pleasure in submitting an estimate as detailed below.

As an MCS accredited company should you wish to proceed you may be eligible for the Renewable Heat Incentive (RHI) details of which can be found here -https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi

The amount you are likely to receive is based on your EPC. If you do not have an EPC, or yours is not up to date, we can recommend an independent assessor to provide one.

Along with your estimate please also find attached a copy of our design conditions and also information on the heat pump itself.

Should this estimate be of interest to you, the next step would be to arrange an appointment for us to carry out a thorough site survey so that we can confirm the heat loss calculations, the emitter details, and the scope of works so that we can provide you with a finalised price.

Please note that our price excludes - electrics, and domestic plumbing.

Ryan Peacock Sales Consultant

Head Office | Unit 31 | Ilton Business Park | Ilton | Ilminster| Somerset |TA19 9DU

T: 01749 340490 | M: 07818 211918

E: ryan@totalrenewablesolutions.com; W: www.totalrenewablesolutions.com

TOTAL
Renewable Solutions

Design Conditions

The quotation you have been provided with is based on a heat loss performed in accordance with all current industry standards and meeting the requirements for both MCS (Microgeneration Certification Scheme) registration and therefore RHI (Renewable Heating Incentive) application where applicable.

External temperatures are based on geographical location, height above sea level and exposure. Internal target temperatures are based on industry standards as per the table below.

Room Type	Design Temp / °C
Lounge / Sitting Room	21
Dining Room	21
Kitchen	18
Combined Kitchen / Dining Room	21
Hall / Landing	18
Utility Room	18
Study	21
Bedroom	18
Bath / Shower Room	22

Rooms are not generally able to exceed these temperatures during cold periods; if you need higher temperatures, we need to be advised and the design conditions and therefore quotation altered.

Heat losses for new builds are based on current building regulations or where these are being exceeded, U-values from SAP calculations. If these change between design and build, the performance of the system can be compromised.

For existing properties, the calculations are based on EPC descriptions of wall etc. or advised construction.

Although secondary heat sources may be present, such as Agas and wood burning stoves etc., the output of these units are ignored from the heat loss and these rooms **must** be heated from the heat pump. If additional ventilation is required, this will be accounted for. The only exception to this is where bathrooms or other small areas are heated by electric underfloor heating.

Total Renewable Solutions
Unit 31, Ilton Business Park
Ilton, Somerset TA19 9DU

info@totalrenewablesolutions.com
www.totalrenewablesolutions.com

License No. 6048527031

QUOTE No. 124

Order No.
Valid for 30 days

Chris Baranowski
Cemetery Lodge
Ashwell
Ilminster
Someset
TA19 9DX

Site:	Cemetery Lodge Ashwell Ilminster Someset TA19 9DX
Site Contact:	Chris Baranowski
Salesperson:	Ryan Peacock
Date:	10/02/2021

- Air Source Install

Item	Quantity	Unit Price	VAT	Total
Vaillant AroTherm Plus 5kW Kit Consisting of: Arotherm Plus 5kW ASHP, Vaillant Rubber Feet Set, Vaillant Straight Pipe Installation Kit, Vaillant Sensocomfort Controller, 25l Wall-hung Buffer Tank & Fittings, EZB 28mm 3-Way Valve, Fernox HP-5C Glycol & Fernox TF1 Filter	1	£4,312.78	20 %	£4,312.78
uniSTOR 150litre HP Cylinder	1	£800.00	20 %	£800.00
1R Vaillant 5/7kW Pumps, valves & expansion vessel for a 1R Vaillant 5kW or 7kW ASHP system	1	£250.00	20 %	£250.00
Pipe & Fittings - ASHP & Radiator Circuit	1	£2,400.00	20 %	£2,400.00
Installation Of ASHP, Radiators & Hot Water Cylinder	1	£4,000.00	20 %	£4,000.00
ASHP Commissioning and MCS Registration	1	£845.00	20 %	£845.00
QANWA. 7YR WORK WARRANTY ASHP	1	£0.00	20 %	£0.00
Design & Supply Upgrade To Radiators	1	£800.00	20 %	£800.00
			Sub-Total ex VAT	£13,407.78
			VAT @ 20 %	£2,681.56
			Total inc VAT	£16,089.34

Please contact us if you have any queries regarding this quote.
Ryan Peacock

Technical information

Be ready for the energy change

Vaillant Comfort for your home

Air-to-water heat pumps

A safe investment in the future

State-of-the-art heating technology with minimal environmental impact

Vaillant is continuously advancing the development of heat pump technology. The Vaillant research and development teams constantly strive to develop the most efficient and quiet heat pumps on the market, thoroughly testing them in our own testing centres for durability and performance. For example, we have climate and hail chambers where we can test for robustness and reliability in extreme conditions. Vaillant also manufactures only in Europe, so we can guarantee you and your customers receive the high quality expected from a Vaillant appliance.

Vaillant offers a great new model in our portfolio of air-to-water heat pumps with the introduction of the aroTHERM plus. This award-winning heat pump is the first in our range to use natural refrigerant R290. This refrigerant, commonly used in many household appliances, has a very low Global Warming Potential (GWP) that offers many advantages over refrigerants traditionally used in heat pumps.

The new aroTHERM plus heat pump has technical features for improved efficiency, as well as higher flow temperatures, so it's perfect for new and existing heating systems (including hybrid). It's also impressively quiet in operation and has been accredited by Quiet Mark*.

*Models 3.5, 5, 7 and 12kW

Always the right choice

Reliability and performance of the highest standards ensure peace of mind for your customers. It's so quiet, they won't even know it's on.

High performance

The aroTHERM plus heat pump has been designed to deliver the very best performance with low running costs, making it suitable for radiators as well as underfloor heating. With a flow temperature of up to 75°C, the aroTHERM plus can deliver more usable hot water with high hot water comfort levels and removes the need for direct electric immersion to sterilise the water, protecting from legionella.

Higher energy-efficiency

With a SCOP of up to 5.03, the aroTHERM plus is extremely energy efficient, enabling high energy savings against certain fossil fuels.
The aroTHERM plus can also be combined with photovoltaic systems and integrated into smart power grids (SG-ready), so your customers can enjoy the benefits of variable electricity tariffs.

Super quiet

With sound power as low as 54 dB for easier planning and siting, the aroTHERM plus is suitable for use in densely built-up terraced housing estates.

Natural refrigerant

Already fulfilling the next NZEB requirements, the aroTHERM plus uses monobloc technology with a hermetically sealed refrigerant circuit using the natural refrigerant, R290, to deliver the one of the lowest GWP of 3.

Why R290?
R290 is a natural refrigerant with a very low GWP* of three. This offers the following advantages:

- future-proof, as not affected by the F-Gas Regulation
- higher flow temperature of up to 75°C
- higher hot water comfort and protection against legionella without electric auxiliary heating
- wider performance envelope with operating temperature ranging between -25°C and +46°C
- Already fulfilling the next NZEB requirements, the aroTHERM plus uses monobloc technology with a hermetically sealed refrigerant circuit using natural refrigerant R290 to deliver the one of the lowest GWP of 3
- Reduced refrigerant charge compared to R410a and R32

Natural refrigerants are already used in many areas of our daily lives, e.g. in refrigerators and heat pump tumble-driers

Natural refrigerant GWP 3

Model calculation
R290 (aroTHERM plus)
0.6 kg R290 x 3 GWP **= 1.8 kg CO_2**

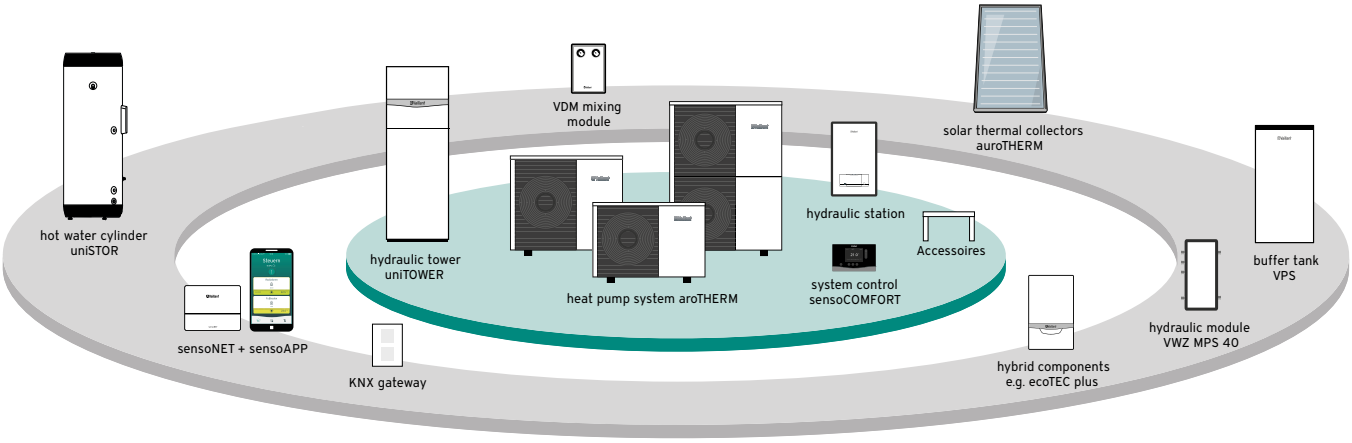
15 km journey by car

*Comparison of refrigerant GWP values:

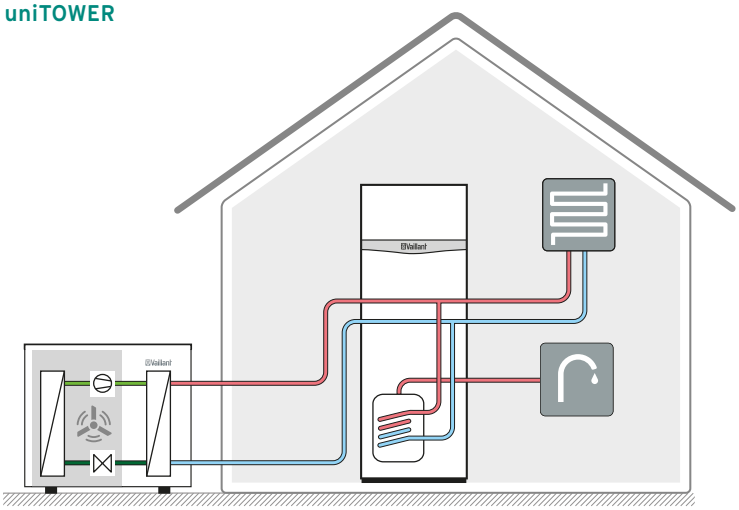
CO_2	1
R290	3
R32	675
R410a	2,088

Introducing the perfect partner

Your customers have widely differing wishes and needs. We offer the system components that enable you to fulfil them all – whether they wish to integrate photovoltaics, a solar-thermal system or smart home technology. All conveniently manageable with a single controller – the new sensoCOMFORT. This enables you to quickly commission the system and lets your customers change daily settings at the flick of a wrist.

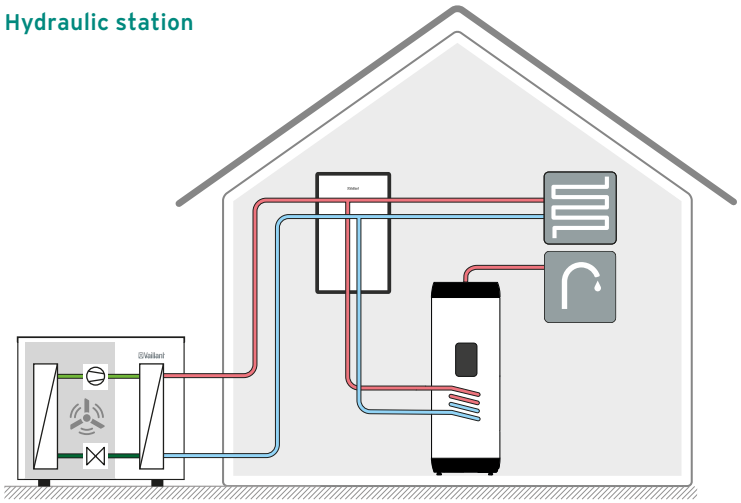


uniTOWER



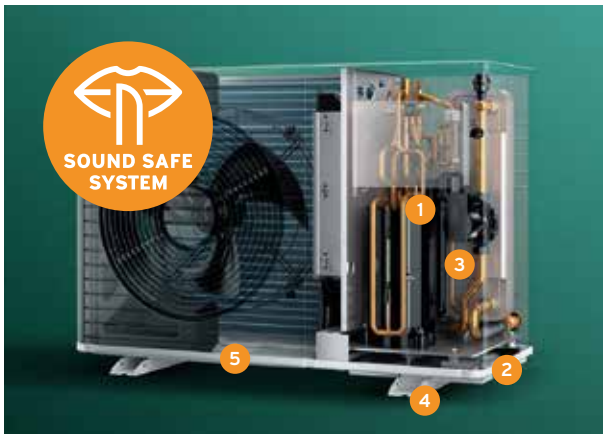
The uniTOWER is an integrated 190 litre cylinder with hydraulic components which can easily provide sufficient hot water for the needs of a family of five, including the use of rain showers. Thanks to its space-saving dimensions, the system is the perfect choice for new buildings. Installed indoors, the uniTOWER is about the size of a fridge freezer and saves valuable space in the room where it's installed.

Hydraulic station



In the case of higher hot water demand, the aroTHERM plus can be used together with a wall-mounted hydraulic station and a wide range of accessories, including the uniSTOR heat pump cylinders and buffer tanks.

Features and benefits



aroTHERM plus

1. Hermetically sealed – no refrigerant certification required
2. Floating floor design absorbs vibration and reduces noise
3. Vortex sensor for accurate performance analysis
4. Weatherproof material and paint make it an ideal choice for coastal areas
5. Integrated tray and trace heater to ensure clear condensation run

uniTOWER

1. 190-litre storage cylinder capacity, corresponds to up to 380-litres of usable hot water output
2. Hydraulic components already integrated, e.g. 15-litre expansion vessel
3. System accessory options, ready for integration, e.g. heating zone packs, 18-litre buffer or system separation plate heat exchanger
4. Modulating electric auxiliary heater with up to 6 kW
5. 3-way diverter valve
6. Electric wiring interface

Hydraulic module

1. Hydraulic components already integrated, including 10-litre expansion vessel
2. Modulating electric auxiliary heater with up to 6 kW
3. 3-way diverter valve
4. Continued use of existing hot water storage cylinders
5. Electric wiring interface

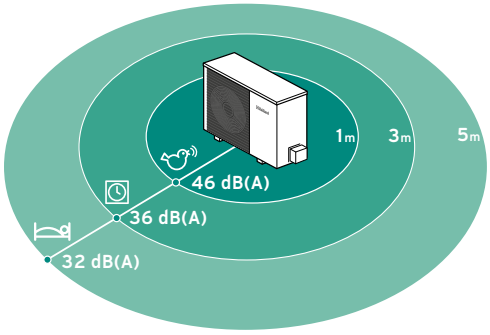
Heat pump interface

- Suitable for standard set-up and hybrid systems
- Heating system components can be placed to suit property layout
- Compatible with all Vaillant heat pump accessories including back-up heater, heat exchanger module and uniSTOR heat pump cylinders

SCOP and heating output

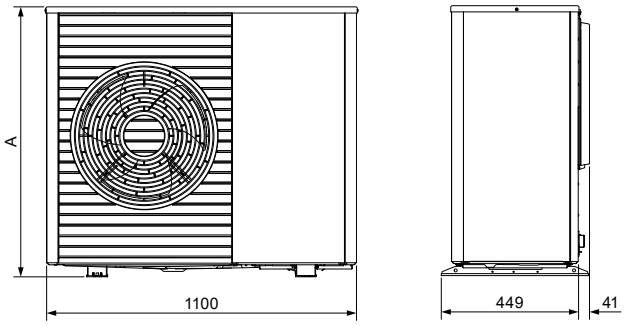
aroTHERM output		35°C flow		40°C flow		45°C flow		50°C flow		55°C flow	
		Output	SCOP	Output	SCOP	Output	SCOP	Output	SCOP	Output	SCOP
3.5kW	-5°C	4.2	4.41	4.1	4.03	4	3.65	3.9	3.37	3.8	3.10
	-3°C	4.6		4.4		4.3		4.2		4	
	0°C	4.7		4.7		4.6		4.5		4.4	
	2°C	4.9		4.9		4.9		4.7		4.6	
5kW	-5°C	6.3	4.48	6	4.13	5.6	3.77	5.5	3.41	5.4	3.06
	-3°C	6.8		6.4		6.1		5.9		5.8	
	0°C	6.9		6.7		6.6		6.4		6.2	
	2°C	7.1		7		6.9		6.7		6.5	
7kW	-5°C	8.2	4.36	8.1	4.13	8	3.91	7.5	3.65	7	3.39
	-3°C	8.8		8.6		8.4		7.9		7.4	
	0°C	9.5		9.3		9.1		8.6		8.1	
	2°C	10		9.8		9.6		9		8.5	
10kW	-5°C	9.9	5.03	9.7	4.58	9.4	4.13	9.1	3.85	8.8	3.58
	-3°C	10.7		10.3		10		9.6		9.2	
	0°C	11.9		11.6		11.3		10.7		10.2	
	2°C	12.8		12.5		12.1		11.5		10.9	
12kW	-5°C	13.1	4.88	12.8	4.55	12.5	4.21	11.7	3.92	10.8	3.63
	-3°C	13.9		13.4		12.9		12.1		11.2	
	0°C	15.2		14.6		14.1		13.2		12.3	
	2°C	16		15.5		14.9		13.9		13	

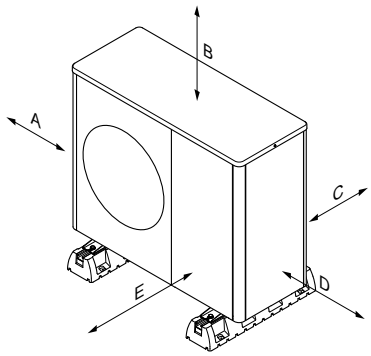
Sound power



Model	Sound Power Level A7/W55	Sound Pressure Level		
		1m distance	3m distance	5m distance
aroTHERM plus 3.5kW	54 dB	46 dB(A)	36 dB(A)	32 dB(A)
aroTHERM plus 5kW	54 dB	46 dB(A)	36 dB(A)	32 dB(A)
aroTHERM plus 7kW	55 dB	47 dB(A)	37 dB(A)	33 dB(A)
aroTHERM plus 10kW	60 dB	52 dB(A)	42 dB(A)	38 dB(A)
aroTHERM plus 12kW	60 dB	52 dB(A)	42 dB(A)	38 dB(A)

Dimensions and clearances



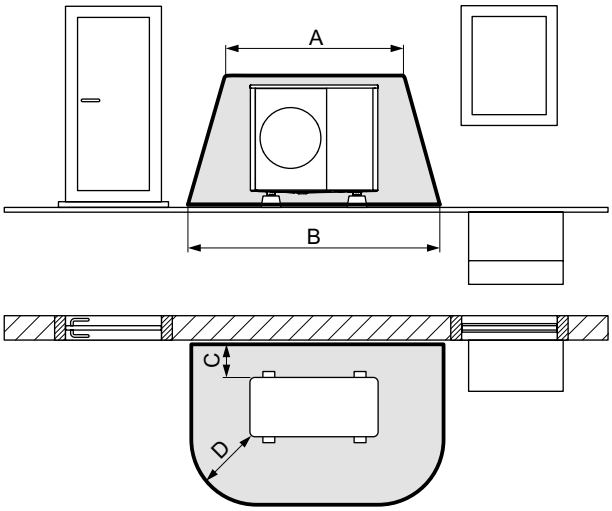


aroTHERM plus	Unit	Dimension A
3.5kW	mm	765
5kW	mm	765
7kW	mm	965
10kW	mm	1565
12kW	mm	1565

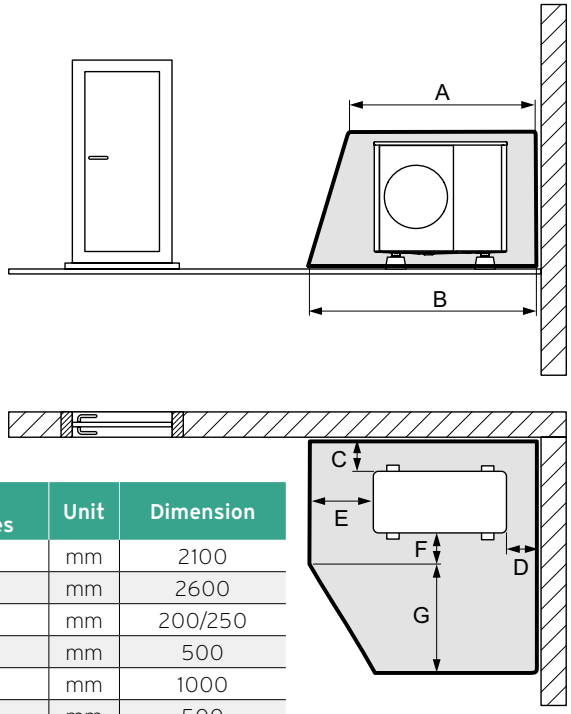
Minimum clearance	Unit	Heating mode	Heating and cooling mode
A	mm	100	100
B	mm	1000	1000
C	mm	200	250
D	mm	500	500
E	mm	600	600

R290 clearances

Clearances required for any drains, light wells or other openings



Minimum clearances	Unit	Dimension
A	mm	2100
B	mm	3100
C	mm	200/250
D	mm	1000

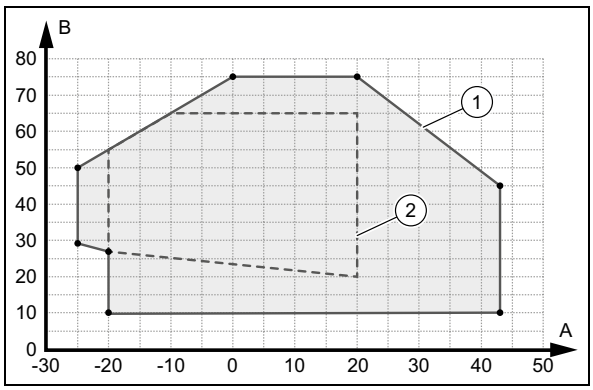


Minimum clearances	Unit	Dimension
A	mm	2100
B	mm	2600
C	mm	200/250
D	mm	500
E	mm	1000
F	mm	500
G	mm	1800

Application limits

heating mode

In heating mode, the product works at outdoor temperatures of -25 °C to 46 °C



A Outdoor temperature

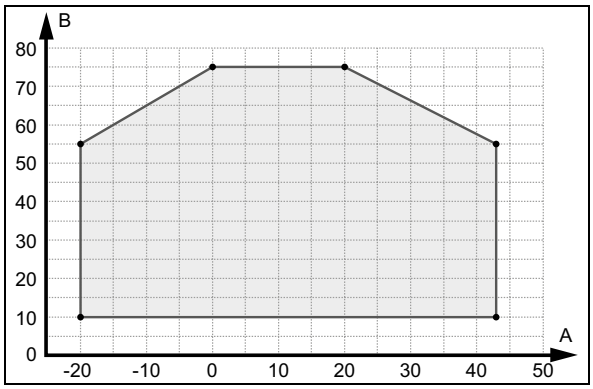
B Heating water temperature

1 Application limits, heating mode

2 Area of application, in accordance with EN 14511

DHW mode

For domestic hot water generation, the product works at outdoor temperatures of -20 °C to 46 °C.



A Outdoor temperature

B Heating water temperature

Technical specifications

aroTHERM plus	Unit	3.5kW VWL 35 / 6	5kW VWL 55 / 6	7kW VWL 75 / 6	10kW VWL 105 / 6	12kW VWL 125 / 6
General						
Width	mm	1,100				
Height	mm	765		965	1,565	
Depth	mm	450				
Weight, ready for operation	kg	114		128	194	
Connection, heating circuit		G 1 1/4"				
Rated voltage	V	230 V (+10%/- 15%), 50 Hz, 1~/N/PE				
Rated current, maximum	A	14.3		15.0	23.3	
Fuse size		16			25	
Fuse type	A	C/D				
RCD type		A				
eBUS (2-core communication cable)	mm2	0.75				
Maximum length eBUS cable (communication cable)	m	50				
IP rating		IP 15 B				
Fan, power consumption	W	40			50	
Fan quantity		1			2	
Fan, air flow , maximum	m^3 /h	2,300			5,100	
Heating pump, power consumption	W	2 - 50			3 - 87	
Heating circuit						
Heating water temperature, minimum/maximum	° C	20 - 75				
Basic length of the heating water pipe, maximum, between the outdoor unit and indoor unit	m	20				
Operating pressure, minimum	bar	0.50				
Operating pressure, maximum	bar	3.00				
Volume flow, minimum	l/h	400		540	995	
Volume flow, maximum	l/h	860		1,205	2,065	
Water volume, in the outdoor unit	l	1.5		2.0	2.5	
Water volume, in the heating circuit, minimum, thawing mode, activated/deactivated back-up heater	l	15 / 40		20 / 55	45 / 150	
Remaining feed pressure, hydraulic	kPa (mbar)	56.0 (560.0)		44.0 (440.0)	55.0 (550.0)	

aroTHERM plus	Unit	3.5kW VWL 35 / 6	5kW VWL 55 / 6	7kW VWL 75 / 6	10kW VWL 105 / 6	12kW VWL 125 / 6
Refrigerant circuit						
Fluid type		R290				
Fluid fill quantity	kg	0.6		0.9	1.3	
Refrigerant, Global Warming Potential (GWP)		3				
CO_2 equivalent	t	0.0018		0.0027	0.0039	
Permissable operating pressure	bar	31.5				
Compressor type		Rotary piston			Scroll compressor	
Compressor oil type		Specific polyalkylene glycol (PAG				
Compressor, control		Electronic				

Noise emissions, heating mode						
Sound power, EN 12102, EN 14511 LWA, A7/W35	dB(A)	51		53	58	
Sound power, EN 12102, EN 14511 LWA, A7/W45	dB(A)	53			58	
Sound power, EN 12102, EN 14511 LWA, A7/W55	dB(A)	54		55	60	

Efficiency		
Energy efficiency class 35°C	(A+++ to F)	A+++
Energy efficiency class 55°C	(A+++ to F)	A++
Combination with uniTOWER		
Energy efficiency class	(A+++ to F)	A++
Energy efficiency class for hot water supply	(A+ to F)	A

uniTOWER	Unit	VIH QW 190 / 6
Total storage cylinder capacity	l	188
Temperature hot water (max. – with auxiliary heating)	°C	55 - 75
Dimensions, unpacked (height/width/depth)	mm	1880 x 599 x 693
Weight, unpacked	kg	175
Auxiliary electric heater	kW	6kW (230V/50Hz) / 9kW (400V/50Hz)

Hydraulic station	Unit	VWZ MEH 97
Dimensions, unpacked (height/width/depth)	mm	720 x 440 x 350
Weight, unpacked	kg	15
Power electric backup heater	kW	6 kW (230V/50Hz) / 9 kW (400V/50Hz)

Description	Article number
aroTHERM plus with heat pump interface	
aroTHERM plus 3.5kW - VWL 35 / 6	0010037211
aroTHERM plus 5kW - VWL 55 / 6	0010037212
aroTHERM plus 7kW - VWL 75 / 6	0010037213
aroTHERM plus 10kW - VWL 105 / 6	0010037214
aroTHERM plus 12kW - VWL 125 / 6	0010037215
aroTHERM plus with hydraulic module	
aroTHERM plus 3.5kW - VWL 35 / 6	0010037206
aroTHERM plus 5kW - VWL 55 / 6	0010037207
aroTHERM plus 7kW - VWL 75 / 6	0010037208
aroTHERM plus 10kW - VWL 105 / 6	0010037209
aroTHERM plus 12kW - VWL 125 / 6	0010037210
aroTHERM plus with uniTOWER	
aroTHERM plus 3.5kW - VWL 35 / 6	0010037201
aroTHERM plus 5kW - VWL 55 / 6	0010037202
aroTHERM plus 7kW - VWL 75 / 6	0010037203
aroTHERM plus 10kW - VWL 105 / 6	0010037204
aroTHERM plus 12kW - VWL 125 / 6	0010037205

Compatible with

uniSTOR

sensoCOMFORT

VRC 700

Accessories	Article number
aroTHERM connection kit for ground install	0010027971
aroTHERM connection kit for ground install extension	0010027972
aroTHERM connection kit for wall install	0010027974
aroTHERM straight pipe connection kit	0010027976
750mm flexihose for air-to-water heat pump (pair)	0020165288
Snow Spacer	0010027984
Wall bracket for insulated wall	0020250224
Wall bracket for non-insulated wall	0020250225
Anti-vibration feet large	0020250226
Anti-vibration rubber feet small	0020252091
Coding resistor active cooling	0020269259
Discharge vessel	0020145563
aroTHERM 45 litre buffer	0010038365
aroTHERM heat exchanger module	0020222285
aroTHERM inline 6kW back-up heater	0020222286
VR 10 temperature sensor	306787
WH40 low-loss header (flow rates up to 3,000 litres per hour)	306720
WH95 low-loss header (flow rates up to 8,000 litres per hour)	306721
VR 32/B eBUS coupler (includes housing)	0020235465
VR 32 eBUS coupler	0020139895
Ball filter valve 28mm	0010038133
uniTOWER accessories	
uniTOWER decoupling module (small) for 3.5 - 7kW model	0010027982
uniTOWER decoupling module (large) for 10 and 12kW model	0010027973
uniTOWER 1" adapter connection kit	0020269275
18l Buffer cylinder for uniTOWER	0020269273
uniTOWER multi-zone kit - 1 direct zone	0020170507
uniTOWER extension set - 2 direct zones	0020170509
uniTOWER extension set - 1 mixed zone	0020170508
Circulation set without pump	0020170502
Circulation set with pump	0020170503
2l brine expansion vessel	0010030975

Description	Pack contents	Article number
VRC 700		
VRC 700 wired, weather compensating programmable room thermostat	-	0020236291
VRC 700f wireless, weather compensating, programmable room thermostat	-	0020259829
One wired heating zone and hot water system	VRC 700, VR 70	0020236292
One wireless heating zone and hot water system	VRC 700f, VR 70	0020259830
One wired heating zone and solar thermal hot water system	VRC 700, VR 70, VR 11	0020236295
One wireless heating zone and solar thermal hot water system	VRC 700f, VR 70, VR 11	0020259833
Two wired heating zones and hot water system	VRC 700, VR 70, VR 91	0020236293
Two wireless heating zones and hot water system	VRC 700f, VR 70, VR 91f	0020259831
Two wired heating zones and solar thermal hot water system	VRC 700, VR 70, VR 11, VR 91	0020259834
Two wireless heating zones and solar thermal hot water system	VRC 700f, VR 70, VR 11, VR 91f	0020259835
Three wired heating zones and hot water system	VRC 700, VR 71, two VR 91	0020236294
Three wireless heating zones and hot water system	VRC 700f, VR 71, two VR 91f	0020259832
VR 70 wiring centre for up to two zones	-	0020184844
VR 71 wiring centre for up to three zones	-	0020184847
VR 91 wired, additional room thermostat	-	0020171334
VR 91f wireless, additional room thermostat	-	0020231566
VR 40 two-in-seven multifunction module	-	0020017744
VR 11 solar collector NTC	-	306788
VR 10 immersion or contact sensor bare ends	-	306787
VR 32 eBUS coupler	-	0020139895
sensoCOMFORT		
sensoCOMFORT wired weather compensating programmable room thermostat	-	0010036819
sensoCOMFORT RF wireless weather compensating programmable room thermostat	-	0010036820
One wired heating zone and hot water system	sensoCOMFORT, VR 71	0010036821
One wireless heating zone and hot water system	sensoCOMFORT RF, VR 71	0010036826
Two wired heating zones and hot water system	sensoCOMFORT, VR 71, VR 92	0010036822
Two wireless heating zones and hot water system	sensoCOMFORT RF, VR 71, VR 92f	0010036827
Three wired heating zones and hot water system	sensoCOMFORT, VR 71, 2x VR 92	0010036823
Three wireless heating zones and hot water system	sensoCOMFORT RF, VR 71 and 2x VR 92f	0010036828
Four wired heating zones and hot water system	sensoCOMFORT, VR 71, VR 70, 3x VR 92	0010036824
Five wired heating zones and hot water system	sensoCOMFORT, VR 71, VR 70, 4x VR 92	0010036825
VR 10 immersion or contact sensor bare ends	-	306787
VR 32 eBUS coupler	-	0020139895
VR 70 wiring centre	-	0020184844
VR 71 wiring centre	-	0020184847
VR 92 wired additional room thermostat	-	0020260925
VR 92f wireless additional room thermostat	-	0020260940
sensoNET internet gateway	-	0020260963
VR 40 two-in-seven multifunctional module	-	0020017744
VR 32/B eBUS coupler (includes housing)	-	0020235465

Our experience is your guarantee

For over 140 years, Vaillant has been among the technology leaders when it comes to innovative heating solutions, with specific expertise in the area of heat pumps for more than 40 years. Our proprietary solutions – many of which are patented – have made this technology reliable, efficient and suitable for everyday life. More than 200,000 heat pumps installed around the world prove this in use each day. Benefit from our experience:

- Products developed in Germany and manufactured exclusively in the EU
- 100% test for each heat pump on the production line
- Toughest weather conditions simulated at our own test centres, in cold chambers with temperatures down to –25°C
- Vaillant heat pumps are among the quietest on the market
- High level of safety due to use of playground standards
- Quality management as per EN ISO 9001 and EN ISO 14001

Climatic chambers simulate all possible operating conditions

Optimisation of components in the acoustic lab

Renewable service and technical enquiries
For technical assistance:
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General enquiries
If you have a general enquiry our friendly reception staff will happily point you in the right direction:
Telephone: 0345 602 2922

Training enquiries
Vaillant provides many different training courses. For more information:
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Email: training@vaillant.co.uk

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