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Heat Loss Report & System Design

Prepared for

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System design

This section presents our proposed system design for the property. The design is based on the detailed room by room calculations in the previous section.

Proposed heat pump

Based on the property's design heat loss of 0kW and on all the attributes of the property that we know of at this stage, we would suggest the following heat pump.

Grant HP R290 12

Capacity at 45 °C (-1.7 °C)	11.49 kW
SCOP at 45 °C	4.15
Flow temperature	45 °C

This heat pump covers **0 %** of the heating requirement at and above the design temperature of **-1.7 °C**. The heat pump will be run on weather compensation so the efficiency will be higher when the weather is milder.

MCS certificate number

MCS HP0265/04

Refrigerant

R-290

Model number

HPR29012

Sound power

52 dB(A)

Width

1155 mm

Height

1365 mm

Depth

425 mm

Weight

153 kg

Capacity (kW)

OUTSIDE TEMP	35°C	40°C	45°C	50°C	55°C
-7°C	11.7	11.9	11.59	12	11.43
-6°C	11.98	12.1	11.76	12.25	11.72
-5°C	12.26	12.29	11.94	12.5	12
-4°C	12.21	12.16	11.79	12.41	11.7
-3°C	12.48	12.35	11.96	12.65	11.71
-2°C	12.42	12.28	11.48	12.57	11.73
-1°C	12.36	12.22	11.52	12.49	11.75
0°C	12.3	12.17	11.56	12.41	11.77
1°C	12.23	12.11	11.61	12.32	11.78
2°C	12.17	12.05	11.65	12.24	11.8
7°C	12.18				12.21

Seasonal Coefficient of Performance (SCOP)

SCOP is the average coefficient of performance over the heating season, accounting for the variation in outdoor temperature. Manufacturers have to test their equipment in standard conditions and report their SCOP performance data to be eligible for certification.

	35°	40°	45°	50°	55°
SCOP	4.74	4.45	4.15	3.94	3.74

Location

Side of property near to existing oil tank

- Mounting location: Ground
- Base to be built by: Use Existing
- Condensate drain: Soak away to be dug

SYSTEM DESIGN

Hot water

The heat pump will provide **100%** of the hot water requirement. Heat pumps cannot create heat as quickly as combi boilers, so they can't heat up hot water instantaneously when you need it. Instead we install a cylinder which stores hot water so it's always ready when you need it.

Proposed cylinder model

We've selected the following hot water cylinder based on the number of bedrooms in the property.

Unistor 250

Capacity

250 litres

Hot water performance calculations

The calculation below shows how much electricity we expect the heat pump to use for providing hot water. The calculations are based on typical usage.

Total electricity per year for hot water

1,529 kWh

Annual demand

Volume per day	225 litres/day
Assumed mains water temp	10 °C
Storage temp	50 °C
Distribution efficiency	70 %
Heat demand per day	14.95 kWh
Days per year	365 days
Heat demand per year	5,458 kWh

Legionella cycles

Volume per cycle	250 litres
Tank starting temperature	50 °C
Legionella set point	60 °C
Distribution efficiency	70 %
Heat demand per cycle	4.15 kWh
Cycles per year	52
Heat provided by legionella cycles per year	216 kWh

Electricity consumption

Legionella cycle provided by	Heat pump
Heat energy provided by legionella	216 kWh
Legionella cycle efficiency	170 %
Electricity consumption - legionella	127 kWh
Remaining heat demand	5,242 kWh
Hot water efficiency - normal operation	374 %
Electricity consumption - normal operation	1,402 kWh
Total electricity consumption	1,529 kWh
Overall efficiency	357 %

Reheat time

0 h 60 min

Sound assessment

Pass

To class as "permitted development" the heat pump design must comply with regulations regarding the sound level at a neighbour's nearest window/door. This section presents the results of the sound assessment we've conducted for the proposed heat pump and location, as set out in [MCS 020a v1.0](#)

This assessment accounts for:

- The sound level of the heat pump itself
- The influence of the space that it is in
- Any barriers between the heat pump and the assessment position

Results by position

Position 1

28 dB

Pass

SOUND ASSESSMENT

Position 1

Sound pressure level

Sound power level	52 dB(A)
Grant HP R290 12 HPR29012	
Reduction due to distance	19 dB(A)
Reflective surfaces: two reflecting surfaces (Q=4)	
Distance (heat pump to assessment position): 5 m	
Reduction due to barriers	5 dB(A)
No line of sight, Solid fence less than 18mm thick	
Total	28 dB(A)

Result

Pass

Maximum allowed value	37 dB(A)
Final result at assessment position	28 dB(A)

Performance estimate

Predicting running costs with a heat pump is hard as it depends on a lot of factors, many of which are outside our control. But it's clearly really important that you're able to make an informed decision. So in this section we give you our best estimate of what the running costs and carbon savings will look like for the property if and when you switch to a heat pump.

We then provide an in-depth description of how we've calculated these figures in case you want to dig into the details. Please do ask us if anything doesn't make sense!

Summary

Bills

Current	£0
Proposed system	£315 to £393

Savings **-£393 to -£315**

Carbon

Current	0.0 tonnes CO ₂
Proposed system	0.2 tonnes CO ₂

Savings **-Infinity%**

Detailed results

The running costs and carbon emissions of a heating system depends on a few key factors, all of which are explained in (even) more detail further down this report:

1. Your property's heating and hot water demand

This is how much heat your property needs for heating and hot water in the year irrespective of what heating system is used to provide it. It's surprisingly hard to put a definitive number on this because it depends on how often you have the heating on and at what temperature, how much hot water you use, and the weather outside.

- **Heating Degree Days** – Based on the heat loss calculations we have done combined with “heating degree day” data which represents the typical annual weather pattern in the area.

We would usually also provide an estimate based on the EPC but we can't do that in this case because a representative EPC cannot be obtained for this property because of planned building work.

2. The efficiency of your system

The efficiency of your system describes how much heat your system makes from what you pay for (electricity/gas/oil), both in heating and when making hot water. This depends on the system design, install quality, and how you run the system. We've included two sets of numbers here. One using fixed efficiencies from MCS and another using the Manufacturer's tested values.

The MCS estimate uses standard efficiency values, which are the same for all heat pumps and only depend on the flow temperature the system is designed at. They tend to be more conservative. Manufacturer's efficiencies use their test data at standard conditions. We've included both to give you a fair picture of what to expect.

3. Energy prices

Heat pump running costs depend on the price of electricity, and the comparison with your old system depends on the price of oil. We've included numbers both at the price cap and with a heat pump tariff, to show the range of what you might pay depending on the tariff you are on. We've included more info on heat pump tariffs further down.

4. Emission factors

Emission factors show how much carbon dioxide is emitted per unit of energy provided by a fuel. They are a measure of how “clean” a fuel is.

PERFORMANCE ESTIMATE

MCS031 Performance estimate

The table below shows a performance estimate in MCS's required table layout following the methodology laid out in MCS 031 Issue 4.0.

Heat Pump System Performance Estimate	
Your energy requirements	
Energy required for heating	0 kWh
Demand to be supplied by the heat pump	0 kWh
Energy required for hot water	5,458 kWh
Demand to be supplied by the heat pump	5,458 kWh
Your property	
Your postcode prefix	RH
Total property floorspace (not property footprint)	0 m ²
Average watts per square metre	NaN W/m ²
Note: W/m ² is a measure of your property's thermal efficiency. 0-30W/m ² is very low heat loss and 120-150W/m ² is very high heat loss.	
Proposed system	
Heat pump capacity	11.5 kW
Heat pump type	ASHP
Your system is proposed to provide:	Space heat and hot water
Your proposed heating system will be (select one):	Your existing radiators (none upgraded)
The proposed flow temperature will be	45 °C
Performance	
The Seasonal Performance Factor is calculated to be:	3.4
Estimate of energy consumption of the proposed heat pump (or combined system where Hybrid).	High: 3,532 kW → Low: 2,890 kW
Note: you can convert these figures to approximate running costs.	
Important Note: This is not a detailed system design. It offers a reasonable estimate of likely performance and a description of the likely design. This estimate is based on a full heat loss survey and design.	

PERFORMANCE ESTIMATE

Results table - Manufacturer's efficiencies

The table below shows running cost and carbon savings estimates based on efficiencies from manufacturer's test data, which often shows higher efficiencies than MCS's fixed values.

	BASED ON HEAT LOSS CALCULATIONS AND HEATING DEGREE DAYS	BASED ON EPC	BASED ON LAST YEARS CONSUMPTION
Demand		Unavailable	Unavailable
Heating	0 kWh		
Hot Water	5,458 kWh		
Total	5,458 kWh		

Efficiency	Existing (Oil)	Heat pump (Electricity)	Unavailable	Unavailable
Heating	0 %	415 %		
Hot water	0 %	357 %		

Consumption	Existing (Oil)	Heat pump (Electricity)	Unavailable	Unavailable
Heating	NaN kWh	0 kWh		
Hot Water	∞ kWh	1,529 kWh		
Total	NaN kWh	1,529 kWh		

Bills	Existing (Oil)	Heat pump (Electricity)	Unavailable	Unavailable
Price cap (25.73 p/kWh)	£0	£393 -£393		
Octopus Cosy (20.6 p/kWh)	£0	£315 -£315		

Carbon	Existing (Oil)	Heat pump (Electricity)	Unavailable	Unavailable
Totals	NaN kg	208 kg		
		-208 kg		

Inputs and assumptions

In each of the following sections, we break down how we've calculated the numbers that appear in the results table.

Heat energy required

To work out how much energy the property needs to keep it warm, we first have to work out how much heat is required. That might sound strange, but because different heating sources have wildly different efficiencies, this heat energy number will need to be divided by the system efficiency (see next section) to calculate the actual energy required.

	BASED ON HEAT LOSS CALCULATIONS AND HEATING DEGREE DAYS	BASED ON EPC	BASED ON LAST YEARS CONSUMPTION
	2255 degree days, 0 W/°C	Unavailable	Unavailable
Heating	0 kWh		
Hot water	5,458 kWh		
Total	5,458 kWh		

System efficiency

The efficiency of a heating system describes how much useful output (heat) you get per unit of what you pay for (electricity/gas/oil). A system's efficiency will often be different when it is doing space heating vs. when it's making hot water because the temperature that the system is heating the water to is often hotter in water heating cycles. We have used the following inputs when modelling the system.

Existing heating system

Existing heating system fuel:	Oil
Efficiency - space heating:	0%
Efficiency - hot water:	0%

Heat pump system

Type of system:	Air source heat pump	
Model:	Grant HP R290 12	
MCS certificate numbers:	MCS HP0265/04	
Flow temperature - space heating:	45°C	
Flow temperature - hot water:	55°C	
	MCS SPF	MANUFACTURERS SCOP
Heating efficiency	340 %	415 %
Hot water efficiency	170 %	357 %

Energy prices

As the last few years have shown, energy prices are very hard to predict. In modelling bills we have used the current energy price cap and also shown you a few different heat pump tariff options.

There are an increasing number of heat pump tariffs that give you access to cheaper electricity. These fall into two categories: **type of use** and **time of use**.

Type of use heat pump tariffs detect how much electricity the heat pump is using, and charge you a lower rate for that electricity.

Time of use tariffs charge you different amounts depending on when you use the electricity. So you can set the hot water heating schedule (and to a lesser extent the space heating schedule) to make use of lower prices.

If you have solar (or are planning to install it), the electricity prices will also be lower because the heat pump will use some of the electricity that the solar is generating. This is especially true for hot water consumption because you can schedule the hot water to run in the middle of the day.

Oil		Electricity	
	Unit price		Unit price
Price cap	6.95 p/kWh	Price cap	25.73 p/kWh
		Octopus Cosy**	20.6 p/kWh
		*Currently only available for Vaillant, Viessmann and Mitsubishi heat pumps	
		**Based on Octopus's expectations of customer consumption patterns on the cosy octopus tariff as of July 2025	

You may want to check out some of these heat pump tariffs (we haven't vetted these):

Type of use:

- [OVO heat pump plus](#): 15p/kWh. Vaillant, Viessmann and Mitsubishi heat pumps only currently.

Time of use:

- [EDF](#): 10p/kWh off from 4-7am and from 1-4pm
- [Octopus Cosy](#): Cheaper pricing 4am-7am and 1-4pm. Peak pricing 4pm -7pm
- [Octopus Agile](#): Half-hourly pricing which tracks the wholesale price. Goes both very high and negative.

Emission factors

We've used the emission factors from the government's SAP 2010 methodology. For gas this value is fixed but for electricity it is falling over time as the grid decarbonises. This means the system will get cleaner and cleaner. The value used here is based on a projected continued reduction in grid carbon intensity.

Gas	Electricity
210 gCO ₂ /kWh	136 gCO ₂ /kWh

Dependence of performance on flow temperature

How much electricity the heat pump will use to provide heating depends on the flow temperature that the system runs at. We have designed the system to run at 45°C when it's -1.7°C outside and we'll set it up to use weather compensation so it runs more efficiently at milder temperatures.

To demonstrate the importance of flow temperature, the table below shows how much electricity the system would consume to provide heating at a range of flow temperatures. This graph is based on the heat loss calculations and heating degree days based estimate, but the pattern would be similar for any of the inputs.

	35°	40°	45°	50°	55°
SCOP	4.74	4.45	4.15	3.94	3.74
Electricity consumed (kWh/year)	1151	1227	1315	1385	1459

MCS Key facts - Energy Performance Estimate

Predicting the heat demand of a building, and therefore the performance and running costs of heating systems, is difficult to predict with certainty due to the variables discussed here. These variables apply to all types of heating systems, although the efficiency of heat pumps is more sensitive to good system design and installation. For these reasons your estimate is given as guidance only and should not be considered as a guarantee.

Seasonal Coefficient of Performance:

MCS Seasonal Coefficient of Performance (SCoP) is derived from the EU ErP labelling requirements, and is a theoretical indication of the anticipated efficiency of a heat pump over a whole year using standard (i.e. not local) climate data for 3 locations in Europe. It is used to compare the relative performance of heat pumps under fixed conditions and indicates the units of total heat energy generated (output) for each unit of electricity consumed (input). As a guide, a heat pump with a MCS SCoP of 3 indicates that 3 kWh of heat energy would be generated for every 1 kWh of electrical energy it consumes over a 'standard' annual cycle.

Energy Performance Estimate

An Energy Performance Certificate (EPC) is produced in accordance with a methodology approved by the government. As with all such calculations, it relies on the accuracy of the information input. Some of this information, such as the insulating and air tightness properties of the building may have to be assumed and this can affect the final figures significantly leading to uncertainty especially with irregular or unusual buildings.

Identifying the uncertainties of energy predictions for heating systems

We have identified 3 key types of factor that can affect how much energy a heating system will consume and how much energy it will deliver into a property. These are 'Fixed', 'Variable' and 'Random'. Most factors are common to ALL heating systems regardless of the type (e.g oil, gas, solid fuel, heat pump etc.) although the degree of effect varies between different types of heating system as given in the following table.

The combined effect of these factors on energy consumption and the running costs makes overall predictions difficult however an accuracy $\pm 25\text{-}30\%$ would not be unreasonable in many instances. Under some conditions even this could be exceeded (e.g. considerable opening of windows). Therefore it is advised that when making choices based on mainly financial criteria (e.g. payback based on capital cost versus net benefits such as fuel savings and financial incentives) this variability is taken into account as it could extend paybacks well beyond the period of any incentives received, intended occupancy period, finance agreement period etc.

'Fixed' which include:

Factor	Impact
Equipment Selection Performance figures (SCoP) from ErP data	System Efficiency
Energy Assessment via the EPC (e.g. assumptions as to fabric construction and levels of insulation; the variation in knowledge and experience of Energy Assessors)	Energy Required

'Variable' which are affected by the system design and include:

Factor	Impact
Accuracy of sizing of heat pump-i.e. closeness of unit output selection (kW) to demand heat requirement (kW)	System Efficiency
Design space and ambient (external) temperatures	Energy Required
Design flow / return water temperatures and weather compensation	System Efficiency
Type of Heat emitter (e.g. Under-floor; natural convector (e.g. radiator), fan convector etc.)	System Efficiency

'Random' which cannot be anticipated and include:

Factor	Impact
User behaviour:	
• Room temperature settings	Energy Required
• Hot water usage and temperature settings	Energy Required
• Occupancy patterns/times	Energy Required
• Changing the design HP flow temperatures	System Efficiency
• Ventilation (i.e. opening windows)	Energy Required
Annual climatic variations (i.e. warmer and colder years than average)	Energy Required

Key

The statement at the end of each item indicates the major factor affected as follows:

Energy Required: the heat energy output requirement of the system which directly impacts on running costs. This requirement exists regardless of the heating system chosen as it is the heat required to keep the space comfortable. Opening windows or increasing room temperatures will demand more heat output, which means more energy input but this would NOT directly affect the efficiency. Thus increased energy demand does NOT automatically mean reduced efficiency.

System Efficiency: the efficiency of the system has been directly affected and will therefore demand more input energy to achieve the same heat output thus increasing running costs. However, increased energy input does NOT necessarily mean lower system efficiency (see above).