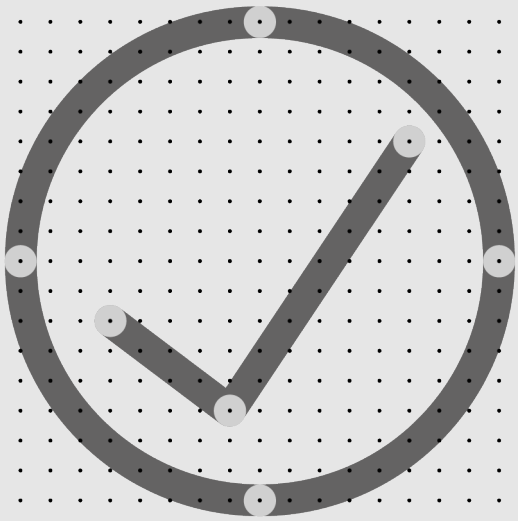
STANDARDS DOCUMENT

MCS 020 a) ISSUE 1.1

Air Source Heat Pump Sound Calculation

(For Permitted Development Installations)



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ABOUT MCS

Giving you confidence in home-grown energy

With energy costs constantly rising and climate change affecting us all, low-carbon technology has a bigger and bigger role to play in the future of UK energy.

We're here to ensure it's a positive one.

Working with industry we define, maintain and improve quality – certifying products and installers so people can have confidence in the low-carbon technology they invest in. From solar and wind, to heat pumps, biomass and battery storage, we want to inspire a new generation of home-grown energy, fit for the needs of every UK home and community.

About

The Microgeneration Certification Scheme Service Company Ltd (MCSSCo Ltd) trades as MCS and is wholly owned by the non-profit MCS Charitable Foundation. Since 2007, MCS has become the recognised Standard for UK products and their installation in the small-scale renewables sector.

We create and maintain standards that allow for the certification of products, installers and their installations. Associated with these standards is the certification scheme, run on behalf of MCS by Certification Bodies who hold UKAS accreditation to ISO 17065.

MCS certifies low-carbon products and installations used to produce electricity and heat from renewable sources. It is a mark of quality. Membership of MCS demonstrates adherence to these recognised industry standards; highlighting quality, competency and compliance.

Vision

To see MCS certified products and installations in every UK home and community.

Mission

To give people confidence in low-carbon energy technology by defining, maintaining and improving quality.

Values

1. We are expert – ensuring quality through robust technical knowledge
2. We are inspiring – helping to reshape energy in UK homes and communities
3. We are collaborative – working with industry and government to create positive change
4. We are principled – operating in a way that's clear, open and fair
5. We are determined – supporting the UK's drive towards a clean energy future

CHANGES TO STANDARDS

When MCS Standards are revised, the issue number is also revised to indicate the nature of the changes. This can either be a whole new issue or an amendment to the current issue. Details will be posted on the website at www.mcscertified.com

Technical or other significant changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

The issue number is given on the left of the decimal point, and the amendment number on the right. For example, issue 3.2 indicates that it is the third significant version of the document which has had two sets of minor amendments.

Users of this Standard should ensure that they are using the latest issue.

Amendments issued since publication

Issue No.	Amendment Details	Date
1.0	First Publication	20/03/2025
1.1	Foreword amendment	14/04/2024

FOREWORD

The previous MCS 020 Standard combined air source heat pumps and wind turbines into one standard. These have now been separated into two new Standards; MCS 020 a) (for air source heat pumps) and MCS 020 b) (for wind turbines).

NOTES:
This standard makes use of the terms 'must', 'shall' and 'should' when prescribing certain requirements and procedures. In the context of this document:

- the term 'must' identifies a requirement by law at the time of publication;
- the term 'shall' prescribes a requirement or procedure that is intended to be complied with in full and without deviation;
- the term 'should' prescribes a requirement or procedure that is intended to be complied with unless reasonable justification can be given.

This document is only relevant to air source heat pumps. Throughout this document "heat pump" means "air source heat pump".

1 INTRODUCTION, PURPOSE & SCOPE

1.1 This document sets out the sound calculation which must be conducted for domestic installations of heat pumps to be 'permitted development'.

1.2 It includes a calculation procedure designed to confirm whether the permitted development noise limit of 37 dB $L_{Aeq,5mins}$ (at the assessment positions ignoring the effect of the façade) would be met. The Standard, and the steps and calculations carried out by the installer, can be used by local planning authorities and MCS to verify compliance.

1.3 Compliance with MCS 020 a) on its own does not bestow permitted development rights – there are a number of other conditions and limitations which must be complied with for an installation to be permitted development. The full requirements for installations in England can be found at The Town and Country Planning (General Permitted Development) (England) Order 2015. Requirements in other countries may differ. Installers are advised to contact the local planning authority with any queries.

1.4 Contractors shall be under a duty to ensure compliance with MCS 020 a) in relation to any installation carried out as permitted development. The MCS may impose penalties or sanctions if an MCS Contractor fails to ensure compliance with this Standard prior to undertaking an installation. An installation which does not meet this Standard may be subject to enforcement action by the local planning authority.

1.5 The heat pump calculation procedure is set out in Table 1 for one heat pump installed at a property and in Table 2 for two heat pumps installed at a property.

1.6 Contractors shall complete one table for each assessment position that could potentially be affected by noise from the heat pump. To follow the instructions and complete the table, installers will need to refer to the details in the steps set out after the table.

1.7 Installers shall insert their results in the 'result' column for each step of the calculation procedure to show how it has been followed. Contractors shall retain one copy of the completed table for their records and provide another copy to the customer.

2 DEFINITIONS

Term	Definition
Assessment Position	Means a position 1m external to the centre point of any door or window to a habitable room of a neighbouring property as measured perpendicular to the plane of the door or window.
Habitable Room	Means any rooms used or intended to be used for sleeping or living which are not solely used for cooking purposes, but does not include bath or toilet facilities, service rooms, corridors, laundry rooms, hallways or utility rooms.
Neighbouring Property	Means any building used for any of the purposes of Class C of the Town and Country Planning (Use Classes) Order 1987 (as amended) (includes dwellings, houses, hotels, residential institutions and houses in multiple occupation). In instances where the heat pump would be installed on a block of flats, neighbouring property includes flats within the same block of flats (excluding the flat of the "owner(s)" of the heat pump.
Sound Power Level	The logarithmic ratio of a sound power and a reference sound power. The sound power is the total sound energy radiated by a source per unit of time.
Sound Pressure Level	The logarithmic ratio of a sound pressure and a reference sound pressure. The sound pressure is the difference between the instantaneous pressure produced by a sound wave and the barometric pressure at a given point in space.
Decibel (dB)	The logarithmic unit of the ratio of a measured quantity to a reference quantity. Sound power levels and sound pressure levels are stated using the decibel (dB) unit. The reference value used is different for sound power level and sound pressure level.
A-Weighting	A frequency weighting applied to noise levels, which approximates the frequency

	sensitivity of the human ear. An A-weighted sound power level or sound pressure level uses the unit dB(A).
$L_{Aeq,5mins}$	The A-weighted equivalent continuous sound level over a 5-minute period that contains the same sound energy as the actual varying sound over the same time period.
Permitted Development	A national grant of planning permission for certain forms of development. Permitted Development Rights are set out in the Town and Country Planning (General Permitted Development) (England) Order 2015, as amended (SI. No 596).

3 METHODOLOGY

3.1 TABLES OF ASSESSMENT

Table 1 Determination of sound pressure level at assessment position for one heat pump.

Step	Instructions	Result
1	Date calculation undertaken	
2	Description of assessment position	
3	From manufacturer's data, obtain the A-weighted sound power level of the heat pump.	
4	Determine the directivity 'Q' of the heat pump noise.	
5	Measure the distance from the heat pump to the assessment position in metres.	
6	Determine any barrier corrections between the heat pump and the assessment position.	
7	Calculate the sound pressure level from the heat pump at the assessment position.	
8	Is the calculated sound pressure level at the assessment position equal to or lower than the permitted development noise limit of 37.0 dB(A)?	

Table 2 Determination of sound pressure level at assessment position for two heat pumps.

Step	Instructions	Result Unit 1	Result Unit 2
1	Date calculation undertaken		
2	Description of assessment position		
3	From manufacturer's data, obtain the A-weighted sound power level of the heat pump.		
4	Determine the directivity 'Q' of the heat pump noise.		
5	Measure the distance from the heat pump to the assessment position in metres.		
6	Determine any barrier corrections between the heat pump and the assessment position.		
7a	Calculate the sound pressure level from the heat pump at the assessment position.		
7b	Calculate the total sound pressure level from the heat pump at the assessment position		
8	Is the calculated sound pressure level at the assessment position equal to or lower than the permitted development noise limit of 37.0 dB(A)?		

3.2 STEPS

Step 1

State the date the assessment was carried out. Depending on the time between assessment and installation of the heat pump, it may be necessary to check that nothing has changed which could otherwise impact the assessment. E.g. changes to neighbouring properties, changes to barriers or reflective surfaces.

Step 2

Multiple assessment positions may need to be considered, and an assessment carried out for each, as the closest assessment position is not always the assessment position with the highest sound pressure level. For example, an assessment position could have a larger distance, but clearer line of site. Assessment positions should include neighbouring properties on all sides of the property where the heat pump is to be installed, and include assessment positions at ground floor, first floor, etc. See worked example.

The description shall be detailed enough to allow for identification, including property address and exact location of window/ door opening and floor level. It is recommended that a map,

sketch, photo or other record be attached to these workings for compliance assessments and in case of future queries.

For installations with two heat pumps, it is important to consider all assessment positions for each heat pump. The two heat pumps may have the same assessment positions, but the distances or line of sight may be different. If the two heat pumps are installed further away from each other, they may have different assessment positions and need to be considered as individual heat pumps when determining the overall sound pressure levels. See Step 7 for further details.

Step 3

The A-weighted sound power level of the heat pump should be obtained from manufacturer's data, which can be found on the product fiche, product energy label, or the MCS product database.

The sound power level in "low noise mode" shall not be used.

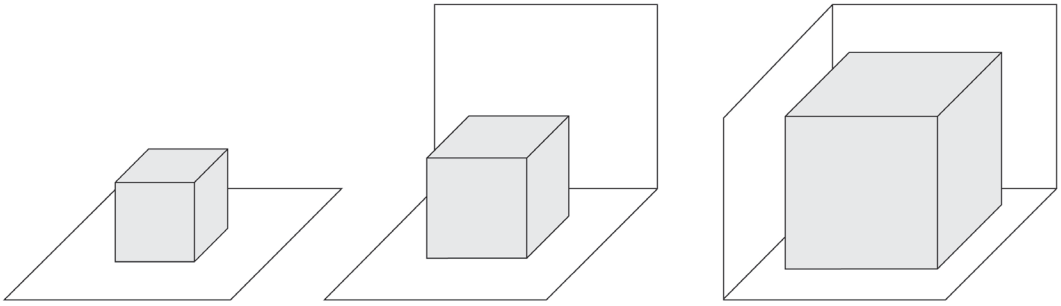
It is important to use the sound power level of the heat pump, and not the sound pressure level as these are two different quantities. If it is not explicitly clear if the value on a datasheet is a sound power level (e.g. a generic term such as "noise level" is used) then clarity should be sought from the manufacturer before starting the assessment.

The conditions in which the sound power level is determined can be found in the Sound Power Testing for Heat Pumps document found on the MCS website.

Step 4

The sound pressure level increases with the number of reflecting surfaces. A reflective surface is any surface (including the ground, but not vegetation) within 1 m of the heat pump. The reflecting surface shall extend beyond the edge of the heat pump by 1m or more, in two or more directions (i.e. a very low wall next to an heat pump does not count as a reflecting surface).

Use the illustrations below to establish the directivity 'Q' for the installation.



Q=2 Q=4 Q=8

The following examples may be used as a guide:

- Q2 = a heat pump with one reflecting surface (i.e. the ground or a single wall if mounted on a wall off the ground)
- Q4 = a heat pump with two reflecting surfaces (i.e. ground mounted and against a wall or mounted off ground level against two walls)
- Q8 = a heat pump with three reflecting surfaces (i.e. ground mounted and against two walls or mounted off ground level between three walls)

A heat pump with more than three reflective surfaces (for example those within small lightwells) will not meet MCS 020 a).

Step 5

The distance shall be measured to the nearest 0.1m in a straight line between the centre of the heat pump unit and the assessment position.

Step 6

A correction shall be made for attenuation due to barriers between the heat pump and an assessment position. The construction of the barrier and the line of sight between the heat pump and assessment position shall both be taken into account to determine the attenuation of the barrier.

The following definitions of a barrier shall be used for the purposes of this assessment.

- Barrier (Type 1) – a solid brick/masonry wall or a solid fence that is at least 18mm thick. There should be no cracks or gaps in the barrier. The barrier should extend horizontally by 1m or more from either edge of the heat pump.
- Barrier (Type 2) – a solid fence that is less than 18mm thick. There should be no cracks or gaps in the barrier. The barrier should extend horizontally by 1m or more from either edge of the heat pump.
- No barrier – open fences, fences with gaps and cracks, and vegetation do not count as a barrier. Walls or fences in a poor state of repair (e.g. gaps or pieces missing) do not count as a barrier.

The following definitions of line of sight shall be used for the purposes of this assessment.

- No view – If a barrier that completely obscures the vision of an assessment position from the top edge of the heat pump.
- Partial view – If by moving up to 0.25m in any direction from the top edge of the heat pump the assessment position is visible.
- Full view – If the assessment position is visible from the top edge of the heat pump.

The matrix table below shall be used in conjunction with the above definitions to determine the barrier attenuation.

		Line of Sight		
		No view	Partial view	Full view
Barrier Type	Type 1	10 dB	5 dB	0 dB
	Type 2	5 dB	2.5 dB	0 dB
	No barrier	0 dB	0 dB	0 dB

Step 7

The sound pressure level at the assessment position shall be calculated using the following formula

$$L_p = L_w + 10.log\left(\frac{Q}{4.\pi.r^2}\right) - A_B$$

Where:

L_P = sound pressure level, in dB(A)

L_W = sound power level, in dB(A)

Q = Directivity factor

r = distance from heat pump to assessment position, in metres

A_B = barrier attenuation, in dB(A)

Where two heat pumps are installed and have the same assessment position(s), the sound pressure level at the assessment position for each heat pump shall be calculated and then the total sound pressure level shall be calculated using the logarithmic summation in the following formula, where $L_{P,1}$ and $L_{P,2}$ are the sound pressure levels for each heat pump.

$$L_{p,total} = 10.log\left(10^{\frac{L_{p,1}}{10}} + 10^{\frac{L_{p,2}}{10}}\right)$$

The logarithmic summation can be expanded for more than two heat pumps, as given in the following formula.

$$L_{p,total} = 10.log\left(10^{\frac{L_{p,1}}{10}} + 10^{\frac{L_{p,2}}{10}} + \ldots + 10^{\frac{L_{p,N}}{10}}\right)$$

Step 8

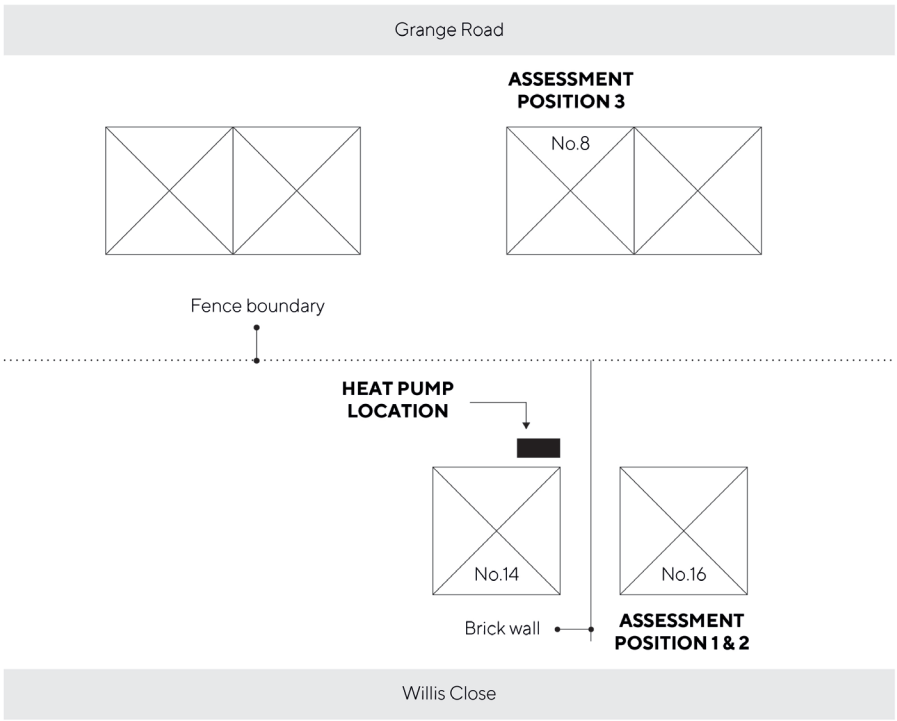
The calculated sound pressure shall be rounded to the nearest 0.1 decimal place. If the calculated sound pressure level at all assessment positions is equal to or lower than 37.0 dB(A) then the heat pump will comply with the Permitted Development noise limit and may be considered permitted development (subject to compliance with other permitted development limitations/conditions and parts of this standard).

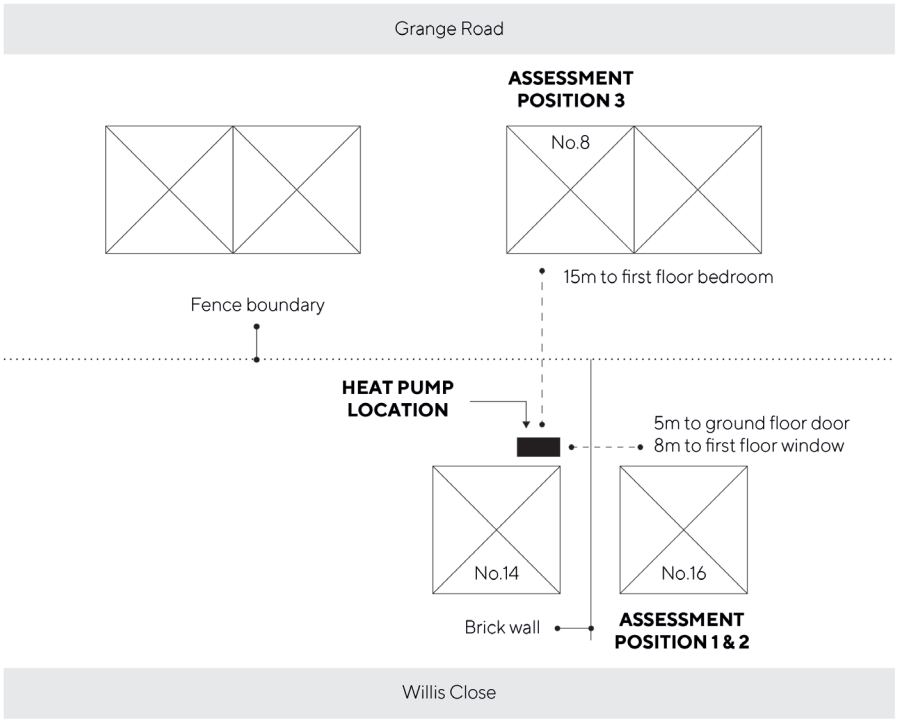
If the calculated sound pressure level at all assessment positions is not equal to or lower than 37.0 dB(A) then the heat pump will not comply with the permitted development noise limit and is not permitted development.

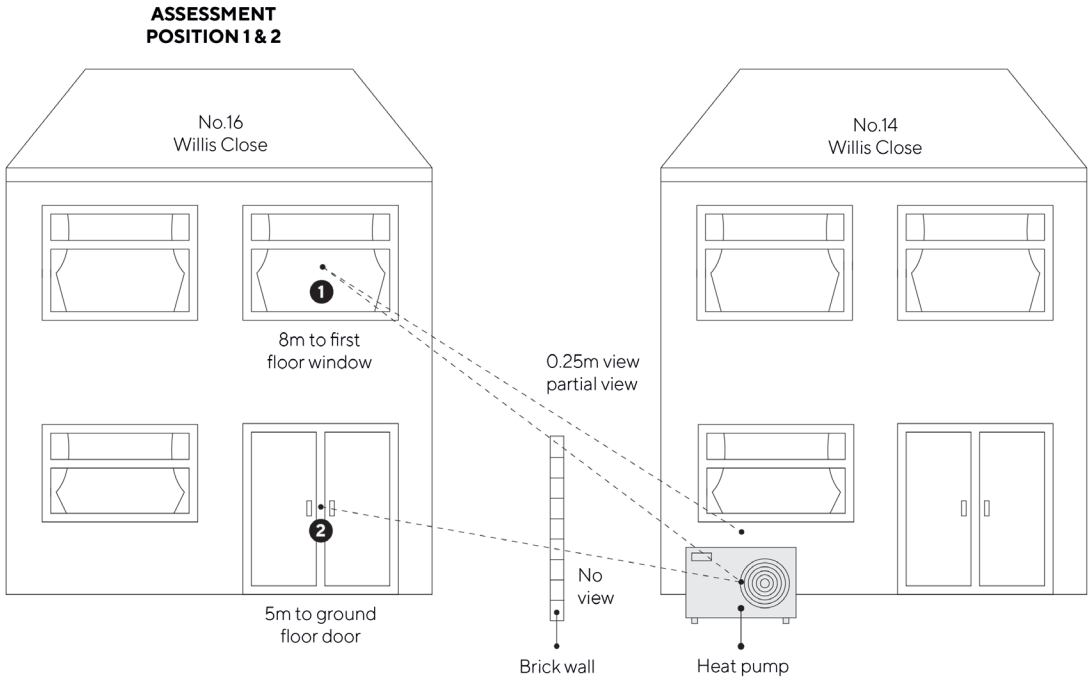
It may be possible to make adjustments (e.g. move the heat pump) in order to comply with the Permitted Development noise limit. Further guidance is provided in the Installation Guidance for Mitigating Noise from Air Source Heat Pumps found on the MCS website.

APPENDIX A – WORKED EXAMPLE

Below is a worked example for a standard detached house with multiple potential assessment positions.




Grange Road
ASSESSMENT POSITION 3
No.8
15m to first floor bedroom
Fence boundary
HEAT PUMP LOCATION
5m to ground floor door
8m to first floor window
No.14
No.16
Brick wall
ASSESSMENT POSITION 1 & 2
Willis Close


ASSESSMENT POSITION 1 & 2
No.16 Willis Close
No.14 Willis Close
1
8m to first floor window
0.25m view partial view
2
No view
5m to ground floor door
Brick wall
Heat pump

Assessment position 1:

Step	Instructions	Result
1	Date Calculation Undertaken	06/11/2024
2	Description of assessment position	16 Willis Close, Chester, CH4 5JH First floor Left rear bedroom (from looking from the front) Window
3	From manufacturer's data, obtain the A-weighted sound power level of the heat pump.	60 dB(A)
4	Determine the directivity 'Q' of the heat pump noise.	2 reflective surfaces – Q4 Against the ground and one wall
5	Measure the distance from the heat pump to the assessment position in metres.	8.0 m
6	Determine any barrier corrections between the heat pump and the assessment position.	Brick wall Partial line of sight
7	Calculate the sound pressure level from the heat pump at the assessment position.	32.0 dB(A)
8	Is the calculated sound pressure level at the assessment position equal to or lower than the permitted development noise limit of 37.0 dB(A)?	Yes

$$60 + 10.\log\left(\frac{4}{4 * \pi * 8^2}\right) - 5 = 31.96$$

Assessment position 2:

Step	Instructions	Result
1	Date Calculation Undertaken	06/11/2024
2	Description of assessment position	16 Willis Close, Chester, CH4 5JH Ground floor Left rear sitting room (from looking from the front) French windows
3	From manufacturer's data, obtain the A-weighted sound power level of the heat pump.	60 dB(A)
4	Determine the directivity 'Q' of the heat pump noise.	2 reflective surfaces – Q4 Against the ground and one wall
5	Measure the distance from the heat pump to the assessment position in metres.	5.0 m
6	Determine any barrier corrections between the heat pump and the assessment position.	Brick wall No line of sight
7	Calculate the sound pressure level from the heat pump at the assessment position.	31.0 dB(A)
8	Is the calculated sound pressure level at the assessment position equal to or lower than the permitted development noise limit of 37.0 dB(A)?	Yes

$$60 + 10.\log\left(\frac{4}{4 * \pi * 5^2}\right) - 10 = 31.04$$

Assessment position 3:

Step	Instructions	Result
1	Date Calculation Undertaken	06/11/2024
2	Description of assessment position	8 Grange Road, Chester, CH4 5PY First floor Right rear bedroom (from looking from the front) Window
3	From manufacturer's data, obtain the A-weighted sound power level of the heat pump.	60 dB(A)
4	Determine the directivity 'Q' of the heat pump noise.	2 reflective surfaces – Q4 Against the ground and one wall
5	Measure the distance from the heat pump to the assessment position in metres.	15.0 m
6	Determine any barrier corrections between the heat pump and the assessment position.	Slatted fence Full line of sight
7	Calculate the sound pressure level from the heat pump at the assessment position.	31.5 dB(A)
8	Is the calculated sound pressure level at the assessment position equal to or lower than the permitted development noise limit of 37.0 dB(A)?	Yes

$$60 + 10.\log\left(\frac{4}{4 * \pi * 15^2}\right) = 31.50$$