Project:
14 Marble Hill Close, Twickenham, TW1 3AY

Title:
Plant Noise Assessment Report

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Client:
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Document Control

Date	Description	Revision	Issued by
02 September 2024	First issue	00	Adam Kershaw, BSc (Hons), MIOA

Limitations

This report has been prepared for the titled project and client in accordance with our agreed scope of work, document reference: PAL-01179/SC1, dated 09 July 2024.

This report should not be used or relied upon for any other project or purpose without the written authorisation of Pulsar Acoustics Ltd. Pulsar Acoustics Ltd accepts no responsibility or liability for the consequences of this document if it is used for a purpose other than for the project to which it was intended. The findings and opinions included herein are based on measurements and information gathered prior to the date the report was issued. If additional information becomes available which may affect our comments, recommendations or conclusions, then Pulsar Acoustic Ltd should be informed. We then reserve the right to review the information, assess any new potential concerns, and modify our advice accordingly.

Contents Page

1.0 - Introduction

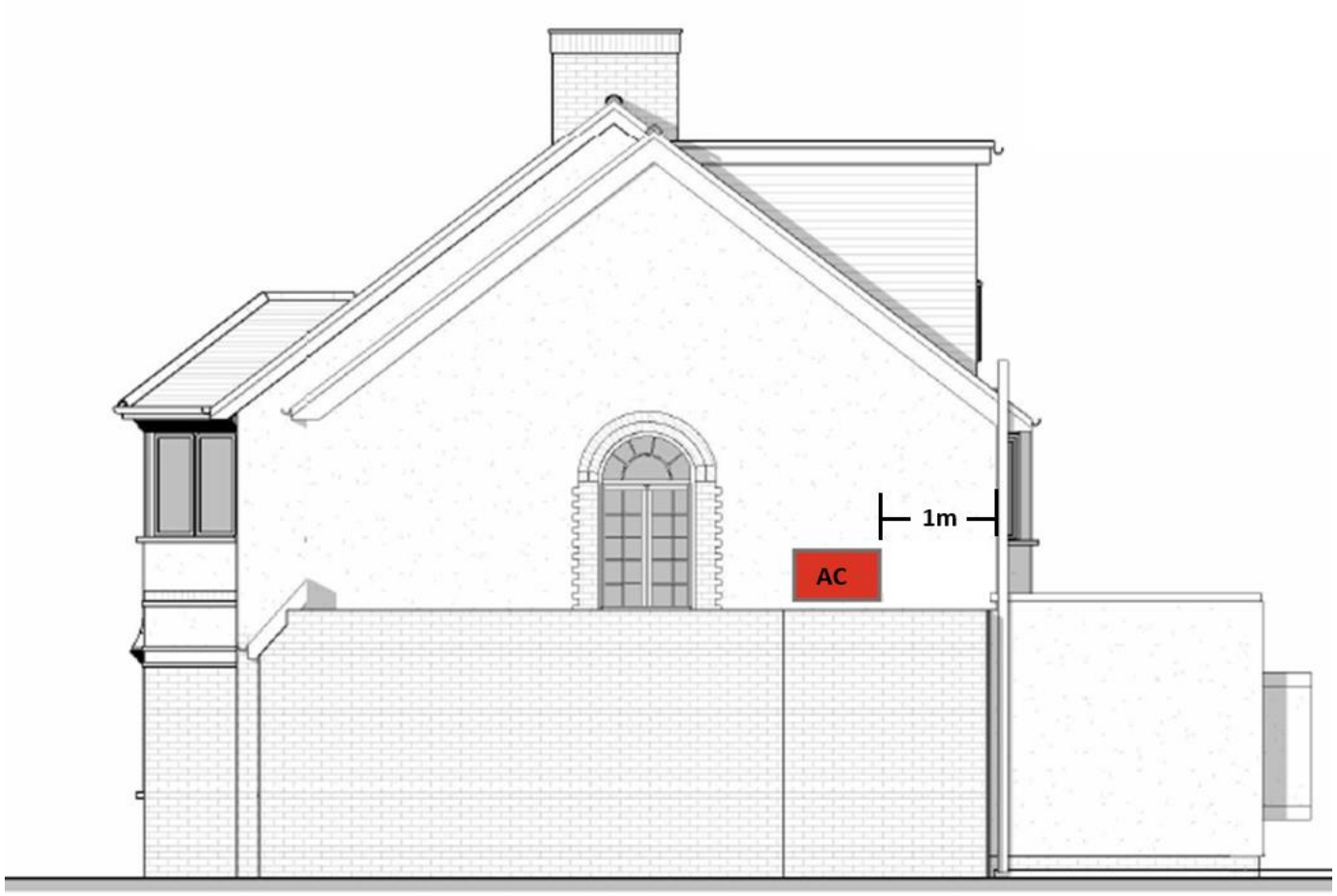
At 14 Marble Hill Close, Twickenham, TW1 3AY, a new external air-conditioning unit is proposed to be installed as well as extension works. The site is located in the London Borough of Richmond Upon Thames.

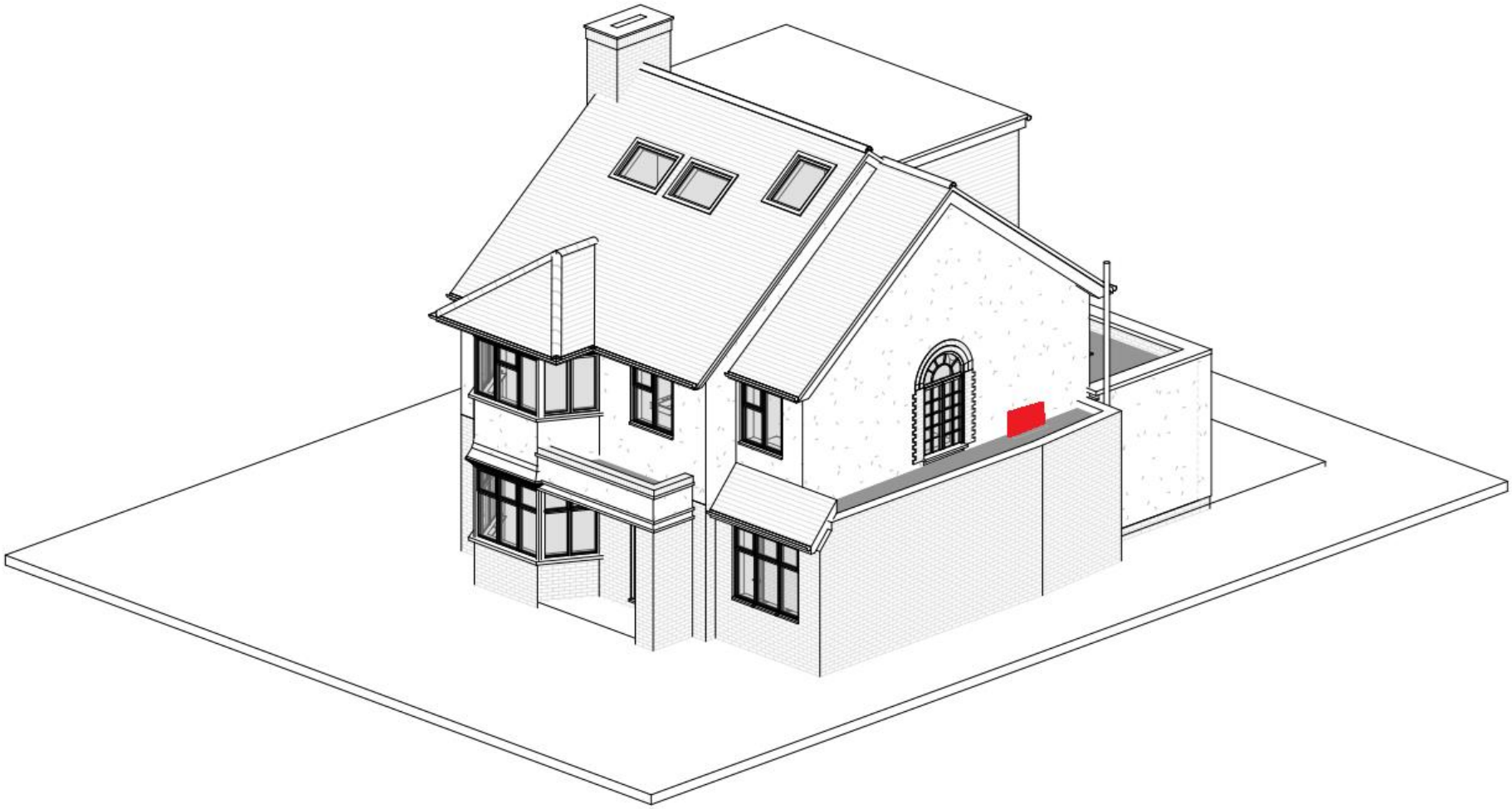
Richmond Council Supplementary Planning Document (SPD) - 'Development Control for Noise Generating and Noise Sensitive Development' - suggests a plant noise assessment should be undertaken in accordance with British Standard BS4142:2014 – 'Methods for Rating and Assessing Industrial and Commercial Sound'.

Pulsar Acoustics has therefore been commissioned to undertake an acoustic assessment, comment on the acceptability with reference to achieving BS4142 industry standard guidance, and recommend acoustic mitigation measures if necessary.

2.0 - Site Proposal

The new external air-conditioning unit is proposed to be located on the west side elevation as indicated on the images below.





3.0 - Guidance and Criteria

The Richmond Council SPD suggests we should consider the guidance of British Standard - BS4142:2014 - Methods for rating and assessing industrial and commercial sound' - to establish suitable plant noise emission criteria.

BS4142 and the SPD suggests:

The significance of sound of an industrial and/or commercial nature, depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level, the background noise level, and by considering the following:

- *"Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.*

BS4142 suggests:

In using the background sound level in the method for rating and assessing industrial and commercial sound, it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.

The SPD states:

Where the rating level of noise is below the background noise level by at least 5dB, this indicates that the proposed noise generating development is likely to be acceptable from a noise perspective. The Borough will seek this level of compliance in most noise sensitive areas and/or where there is a requirement to mitigate creeping background effects.

Where the rating level of noise is equal to, or below the background noise level by up to 5dB, this indicates that the proposed NGD may be acceptable from a noise perspective, but will be more context dependent, i.e. extent and effect on noise sensitive receivers (externally and internally).

In certain circumstances e.g. the installation of a single air conditioning unit, a desktop noise assessment may be submitted where the applicant can demonstrate that the plant will achieve the set criteria below and therefore negate the need for a full acoustic report.

Information supporting the application will need to include:

1. The location of the nearest residential window that may be affected by noise from the proposed plant.
2. Indicate the distance of the window from the source in metres and any natural barrier or shielding to the noise path.
3. The proposed operational hours of the plant.
4. Maximum noise emission criteria of 45dB(A) $LAeq,_{1hour}$ daytime (07.00-23.00) and 35dB(A) $LAeq,_{15minute}$ night time.
5. Manufacturers' noise specifications of plant: Sound Power/Sound Pressure Level, octave band spectral levels.
6. Calculations for the predicted noise level 1 metre from the window of the nearest residential property. Include any proposed attenuation measures.

In addition to an assessment of external noise, in some cases it will also be necessary to predict internal noise levels at the closest and/or worse affected noise sensitive premises and to demonstrate the means of achieving suitable internal noise levels within noise sensitive rooms (with windows partially open for ventilation where this is the norm for the building likely to be affected). In some cases, e.g. for steady continuous noise without a specific character, the guidance on suitable internal noise levels found in Table 4 of BS8233 may be relevant.

Table 4 of BS8233 states:

Activity	Location	Desirable Internal Ambient Criteria	
		Daytime (07:00 to 23:00h)	Night-time (23:00 to 07:00h)
Resting	Living Rooms	35 dBA Leq,16h	-
Dining	Dining Room/Area	40 dBA Leq,16h	-
Sleeping (Daytime Resting)	Bedroom	35 dBA Leq,16h	30 dBA Leq,8h

4.0 - Plant Noise Assessment

4.1 - Survey Methodology

Sound level measurements were undertaken to determine the existing ambient background noise climate on site.

The sound level measurements were undertaken from approximately 11:00 hours on 13 August 2024 to 10:00 hours on 15 August 2024.

The equipment was set to log many acoustic parameters including dBA $Leq_{,T}$ and L90 in 15-minute interval periods in accordance with BS4142.

The following equipment was used to undertake the survey.

Position	Equipment Description	Manufacturer	Type	Serial No.
1	Sound Level Meter	Casella	CEL-633C	5086881
	Preamplifier	Casella	CEL-495	004728
	Microphone	G.R.A.S.	GRAS-40AE	49590
	Handheld Calibrator	G.R.A.S.	GRAS-42AG	280968

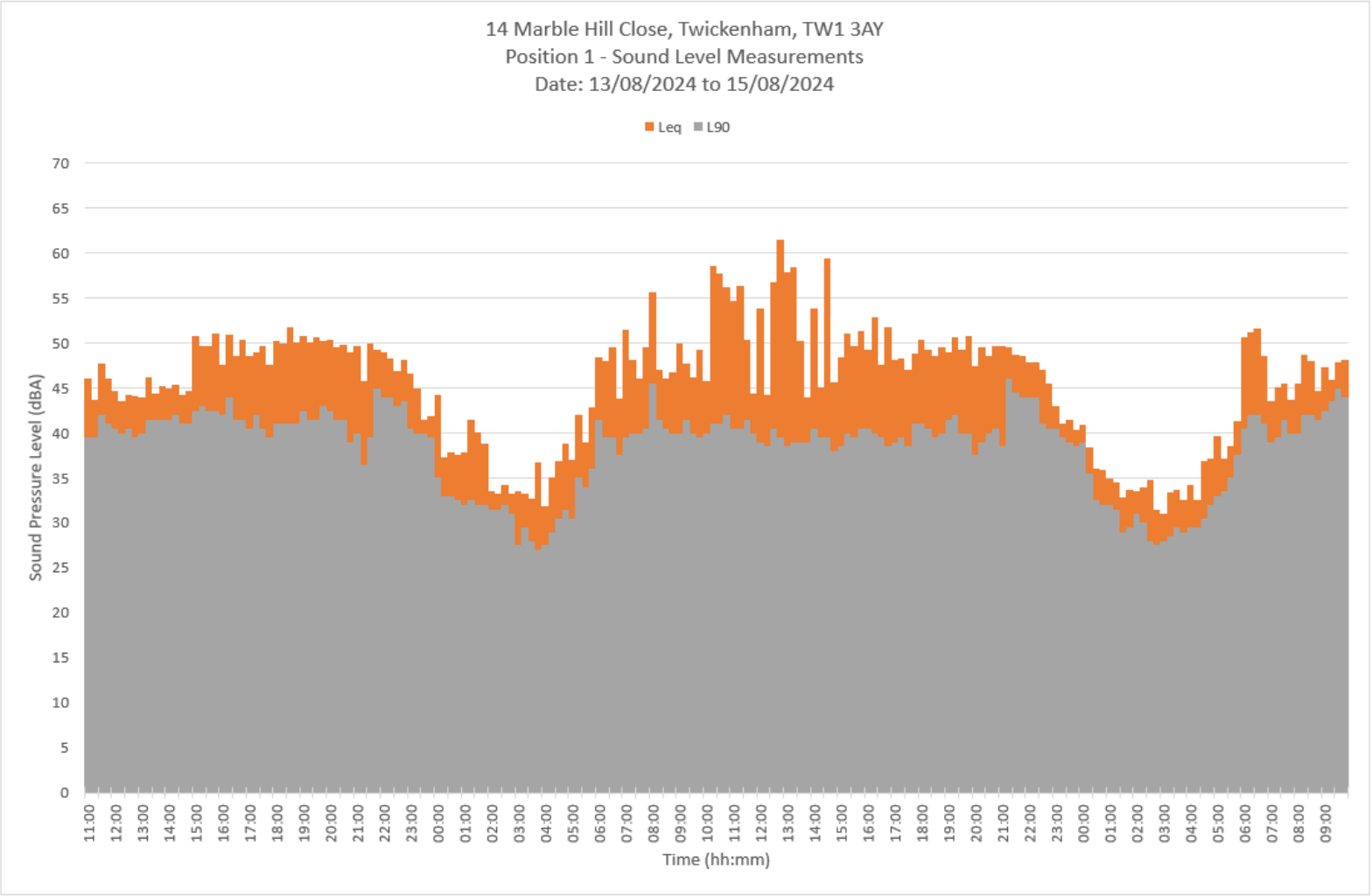
The equipment calibration was spot checked using the hand-held calibrator before and after the survey and no significant change was found. (No more than 0.1dB). The equipment used has Type 1 (Class 1) approval in accordance with IEC 60942 and IEC 61672 to traceable standards.

The noise monitoring equipment was positioned on the flat roof at first floor level to the west of the house. The data logging sound level meter was located in a locked Pelicase, the microphone was connected to the sound level meter via an extension cable and attached to a tripod. The microphone height was set to approximately 1.5m above floor level.

The approximate location of Position 1 is circled red on the plan below. This position was selected to best determine the representative ambient background noise levels. Subjectively we noted the area was relatively quiet and the dominant noise source was distant road traffic.

4.2 –Measurement Data

The dBA Leq,$_T$ and L90 sound level measurement data has been plotted on the time history graph below.



The survey data has been analysed to determine the daytime and night-time dBA $Leq_{,T}$, and the mean, mode and median L90 statistical average values, as presented in the table below for comparison to BS4142 guidance.

Date	Time (hh:mm)	dBA $Leq_{,T}$	dBA L90 Mean Average	dBA L90 Modal Average	dBA L90 Median Average
13/09/2024 to 14/09/2024	Daytime (11:00 to 23:00 hours)	49	42	42	42
	Night-time (23:00 to 07:00 hours)	42	34	32	33
14/09/2024 to 15/09/2024	Daytime (07:00 to 23:00 hours)	52	41	40	40
	Night-time (23:00 to 07:00 hours)	43	34	32	32
15/09/2024	Daytime (07:00 to 10:00 hours)	47	42	42	42

Figure 4 of BS4142 provides a statistical analysis example for determining an ambient background sound level. It suggests for that distribution of data, the modal value was considered to be representative as it was the most commonly occurring value during the time period of interest.

We note the lowest modal and median L90 value was 32dBA at night-time, the air-conditioning could be operated at night, and as such we will consider 32dBA as a suitable night-time background noise level.

4.3 - Plant Noise Data

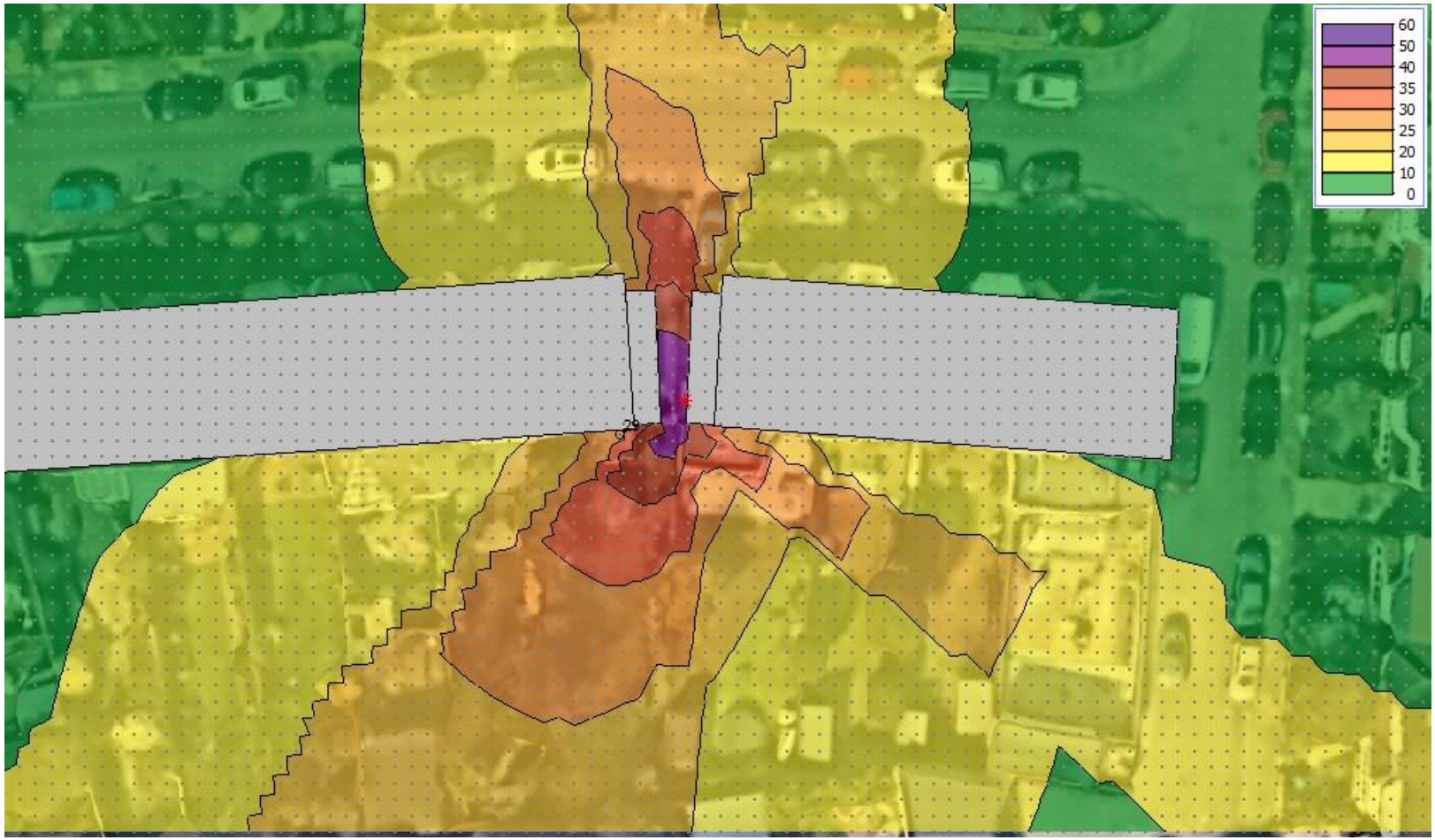
The proposed air-conditioning unit is described in the table below, with the associated sound pressure level provided for cooling mode operation.

Location	Quantity	Make	Model	Sound Pressure Level dBA at 1m
First floor west side of house	1	Mitsubishi	MXZ5F102VF	52

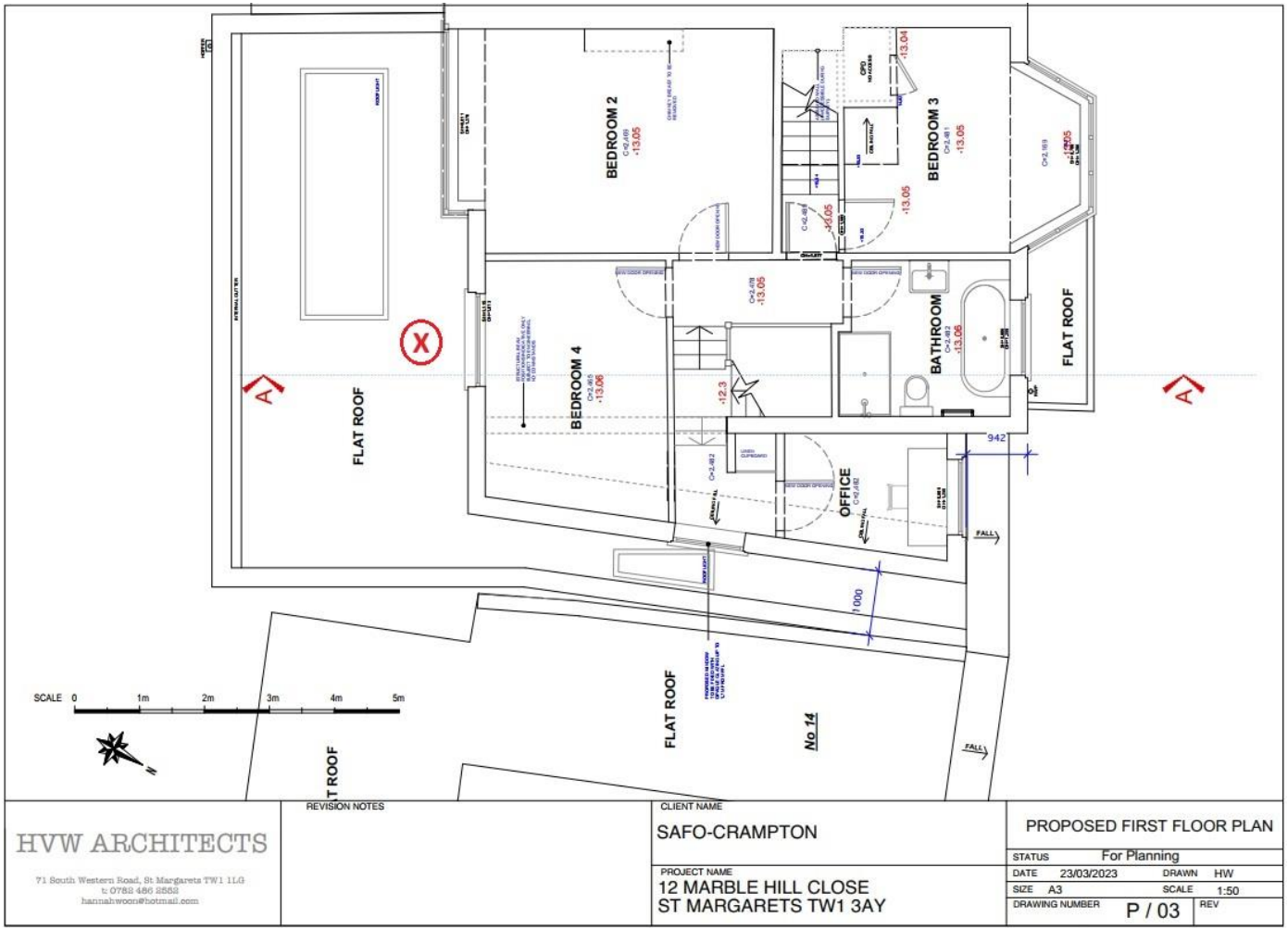
The manufacturer literature is included in Appendix B at the end of this report.

4.4 - BS4142 Assessment

The project information has been combined with Google Maps and architectural drawings, to create a scale model within DGMR iNoise mapping software. The software uses calculation methodology based on ISO:9613 – 'Attenuation of sound during propagation outdoors', and follows the recommendations of quality standard ISO:17534 – 'Software for the calculation of sound outdoors'.



The air-conditioning unit position is the red * shown on the image above. Also within the noise model is a receiver assessment point positioned 1m outside the nearest openable noise sensitive bedroom window of neighbouring house which is 12 Marble Hill Close. The receiver point shown on the image above indicates a level of 29dBA. This assessment point is shown as a red **X** on the architectural image below.



The noise model indicates that the resultant air-conditioning sound level outside the nearest neighbouring noise sensitive bedroom window would be 29dBA.

Our measurement data determined the lowest modal and median night-time background noise level was 32dBA L90.

The calculated air-conditioning noise level would therefore be -3dBA lower than the background sound level.

We reiterate some relevant SPD wording:

Where the rating level of noise is below the background noise level by at least 5dB, this indicates that the proposed noise generating development is likely to be acceptable from a noise perspective. The Borough will seek this level of compliance in most noise sensitive areas and/or where there is a requirement to mitigate creeping background effects.

Where the rating level of noise is equal to, or below the background noise level by up to 5dB, this indicates that the proposed NGD may be acceptable from a noise perspective, but will be more context dependent, i.e. extent and effect on noise sensitive receivers (externally and internally).

In certain circumstances e.g. the installation of a single air conditioning unit, a desktop noise assessment may be submitted where the applicant can demonstrate that the plant will achieve the set criteria below.

4. Maximum noise emission criteria of 45dB(A) $LAeq,_{1hour}$ daytime (07.00-23.00) and 35dB(A) $LAeq,_{15minute}$ night time.
6. Calculations for the predicted noise level 1 metre from the window of the nearest residential property. Include any proposed attenuation measures.

In addition to an assessment of external noise, in some cases it will also be necessary to predict internal noise levels at the closest and/or worse affected noise sensitive premises and to demonstrate the means of achieving suitable internal noise levels within noise sensitive rooms (with windows partially open for ventilation where this is the norm for the building likely to be affected). In some cases, e.g. for steady continuous noise without a specific character, the guidance on suitable internal noise levels found in Table 4 of BS8233 may be relevant.

The predicted sound level is 29dBA, this is -3dBA lower than background, and as such the SPD would suggest – *"this indicates that the proposed NGD may be acceptable from a noise perspective, but will be more context dependent, i.e. extent and effect on noise sensitive receivers (externally and internally)."*

We would suggest this external level is acceptable in context, whereby the neighbours already have air-conditioning in their house, therefore they have no reason to open their windows. Plus, a level of 29dBA predicted outside the neighbouring noise sensitive bedroom window is less than the inside noise level guidance of BS8233 Table 4 which states 30dBA night-time inside.

BS8233:1999 suggests a partially open window could provide an outside to inside sound reduction of at least 10dB. Therefore, we predict an internal noise level would be 29 – 10 = 19dBA inside the nearest noise sensitive bedroom.

Furthermore, the level of 29dBA is -6dBA less than the night-time level of 35dBA that the SPD would suggest acceptable for desktop only assessment.

In all instances it is necessary for the unit and pipework to be fitted with suitable anti-vibration mounts and resilient pipe clips, such that structureborne vibration does not cause additional noise problems. Many air-conditioning manufacturers can offer off-the-shelf anti-vibration mounts and rubber lined clips. We would be happy to review any product proposals. Also CIBSE Guide B4 can be consulted to determine suitable installation and anti-vibration product performance requirements.

With all things considered above, we suggest the air-conditioning unit should be deemed acceptable by the Council in accordance with BS4142 guidance and SPD wording with no further mitigation measures required.

5.0 - Conclusion

At 14 Marble Hill Close, Twickenham, TW1 3AY, a new external air-conditioning unit is proposed. The site is located in the London Borough of Richmond Upon Thames.

Richmond Council Supplementary Planning Document (SPD) - 'Development Control for Noise Generating and Noise Sensitive Development' - suggests a plant noise assessment should be undertaken in accordance with British Standard BS4142:2014 - Methods for Rating and Assessing Industrial and Commercial Sound.

Pulsar Acoustics has therefore been commissioned to undertake an acoustic assessment, comment on the acceptability with reference to achieving BS4142 industry standard guidance and SPD wording.

Outdoor noise monitoring was undertaken to determine the existing background noise climate on site.

We have used manufacturer's noise data, reviewed architectural drawings, and used Google Maps to create a computer noise model within DGMR iNoise software.

The noise model indicates a predicted air-conditioning noise level would be -3dBA lower than the background sound level. As described in Section 4.4 above, in context we suggest the air-conditioning unit should be deemed acceptable in accordance with BS4142 guidance and SPD wording with no further mitigation measures required.

With consideration for the above we see no acoustic reasons why planning permission would be refused.

APPENDIX A - Acoustic Terminology

The following is an explanation for some of the acoustic parameters used in this report to describe the measurements and mitigation.

- dB The decibel is used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level. This approach is advantageous for handling sound levels, where the ratio of the highest to lowest sound which humans could encounter, can be as high as 1,000,000 : 1. The ratio is considered with respect to the quietest and loudest sound we can hear. This is the threshold of hearing at the frequency of 1000Hz, which is taken as 20µPa ($2x10^{-5}$ Pa) of pressure for the average person. (A decibel is simply a ratio and is used in many other industries too, but most commonly in acoustic or electrical signal analysis.)
- dBA The human ear is more susceptible to mid-frequency noise than to higher and lower frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds to the overall level of perception by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted frequency spectrum (Hz). The measured or calculated 'A' weighted noise level is known as the dBA level.
- $L_{eq,T}$ The equivalent continuous sound level in decibels, equivalent to the total sound energy measured over a stated period of time and is also known as the time-averaged sound level.
- dBA Leq,T The A-weighted equivalent continuous sound level in decibels measured over a stated period of time 'T', and is sometimes written dB LAeq,T.
- L90 This parameter is the noise level exceeded for 90% of the period T (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
- dBA Lmax The maximum dBA noise level recorded during the measurement interval period.

When discussing sound levels as decibels we use a logarithmic scale, therefore the dBA values do not follow a linear relationship. When discussing similar noises, a change of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible by a human, but is a doubling/halving of sound energy. (i.e. 50dBA + 50dBA = 53dBA).

If you require a more detailed explanation for any of the acoustic principles or parameters discussed in this report please do not hesitate to ask.

APPENDIX B - Manufacturer Literature

Air Conditioning | Product Information

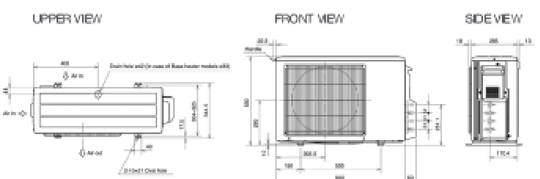
MXZ-F
Multi-Split System
R32 Inverter Heat Pump

R32

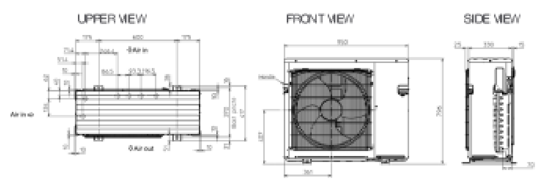
MXZ-F OUTDOOR UNITS		MXZ-2F33VF3	MXZ-2F42VF3	MXZ-2F53VF3	MXZ-3F54VF3	MXZ-3F68VF3	MXZ-4F72VF3	MXZ-4F83VF	MXZ-5F102VF	MXZ-6F122VF
NUMBER OF CONNECTABLE INDOOR UNITS		2	2	2	2 - 3	2 - 3	2 - 4	2 - 4	2 - 5	2 - 6
CAPACITY (kW)	Heating (nominal)	4.0 (1.0-4.1)	4.5 (1.0-4.8)	6.4 (1.1-7.0)	7.0 (2.6-9.0)	8.6 (2.6-10.6)	8.6 (3.4-10.7)	9.3 (3.4-11.6)	10.5 (4.1-14.0)	14.0 (3.5-16.5)
	Cooling (nominal)	3.3 (1.1-3.8)	4.2 (1.1-4.4)	5.3 (1.1-5.6)	5.4 (2.9-6.8)	6.8 (2.9-8.4)	7.2 (3.7-8.8)	8.3 (3.7-9.2)	10.2 (3.9-11.0)	12.2 (3.5-13.5)
	Heating (UK)	3.32 (0.83-3.40)	3.74 (0.84-3.99)	5.38 (0.92 - 5.88)	5.81 (2.16-7.47)	7.14 (2.16-8.80)	7.14 (2.82-8.89)	7.8 (2.82-9.63)	8.7 (3.40-11.63)	11.6 (2.90-13.71)
	Cooling (UK)	3.23 (1.07-3.72)	4.12 (1.08-4.32)	5.30 (1.10-5.60)	5.3 (2.85-6.67)	6.66 (2.84-8.23)	7.0 (3.59-8.56)	8.2 (3.67-9.12)	10.1 (3.86-10.90)	12.1 (3.47-13.39)
COP / EER (nominal)*1		4.40 / 3.90	5.10 / 4.30	4.10 / 3.79	4.60 / 4.10	4.50 / 3.70	4.60 / 3.90	4.65 / 4.21	4.60 / 3.64	4.23 / 3.33
SCOP (ηsc) / SEER (ηsc) (BS EN14825)		4.16 / 8.13	4.60 / 8.69	4.6 / 8.6	4.61 / 8.52	4.12 / 7.96	4.07 / 8.13	4.72 (185.8%) / 8.51 (337.4%)	4.65 (182%) / 8.21 (325.4%)	4.65 (183.1%) / 7.85 (308%)
ErP ENERGY EFFICIENCY CLASS	Heating/Cooling	A+ / A++	A++ / A+++	A++ / A+++	A++ / A+++	A+ / A++	A+ / A++	A++ / A+++	A++ / A++	A++ / A++
MAX AIRFLOW (m³/min)	Heating/Cooling	33.7 / 32.9	33.3 / 27.7	34.7 / 32.7	43.0 / 42.1	43.0 / 42.1	43.0 / 42.1	71 / 55	74 / 62	77 / 63
SOUND PRESSURE LEVEL (dBA)	Heating/Cooling	50 / 49	50 / 44	51 / 46	50 / 46	53 / 48	54 / 48	51 / 49	56 / 52	57 / 55
SOUND POWER LEVEL (dBA)	Cooling	60	59	61	59	63	63	61	65	69
DIMENSIONS (mm)	Width x Depth x Height	800 x 285 x 550	800 x 285 x 550	800 x 285 x 550	840 x 330 x 710	840 x 330 x 710	840 x 330 x 710	950 x 330 x 796	950 x 330 x 796	950 x 330 x 1048
WEIGHT (kg)		33	37	37	58	58	59	62	62	87
ELECTRICAL SUPPLY		220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz
PHASE		Single	Single	Single	Single	Single	Single	Single	Single	Single
POWER INPUT (kW)	Heating/Cooling (nominal)	0.909 / 0.846	0.88 / 0.98	1.56 / 1.40	1.52 / 1.32	1.91 / 1.84	1.87 / 1.85	2.00 / 1.97	2.28 / 2.80	3.31 / 3.66
	Heating/Cooling (UK)	0.82 / 0.68	0.90 / 0.78	1.40 / 1.20	1.38 / 1.06	1.73 / 1.47	1.69 / 1.48	1.80 / 1.57	2.09 / 2.66	3.04 / 3.44
STARTING CURRENT (A)		4.6	4.2	7.6	7.0	10.5	10.0	8.8	12.3	16.1
RUNNING CURRENT (A)	Heating/Cooling [MAX]	4.6 / 4.3 [10.0]	4.2 / 4.5 [12.2]	7.1 / 6.2 [10.2]	7.0 / 5.9 [18.0]	10.5 / 9.6 [18.0]	10.0 / 9.5 [18.0]	8.8 / 8.7 [21.4]	10.0 / 12.3 [21.4]	14.5 / 16.1 [29.8]
INTERCONNECTING CABLE No. CORES		4 Core	4 Core	4 Core	4 Core	4 Core	4 Core	4 Core	4 Core	4 Core
TOTAL PIPE LENGTH (m)		20	30	30	50	60	60	70	80	80
MAX PIPE LENGTH PER INDOOR UNIT (m)		15	20	20	25	25	25	25	25	25
MAX HEIGHT DIFFERENCE (m)		10	15 (10 if OU higher than IU)	15 (10 if OU higher than IU)	15 (10 if OU higher than IU)	15 (10 if OU higher than IU)	15 (10 if OU higher than IU)	15	15	15
CHARGE REFRIGERANT (kg) / CO_2 EQUIVALENT (t) - R32 (GWP 675)		1.00 / 0.68 (20m)	1.20 / 0.81 (30m)	1.0 / 0.68 (30m)	1.40 / 0.95 (50m)	1.40 / 0.95 (60m)	1.40 / 0.95 (60m)	2.4 / 1.62 (70m)	2.4 / 1.62 (80m)	2.4 / 1.62 (80m)
FUSE RATING (BS88) – HRC (A)		16	16	16	25	25	25	25	25	32

Notes: *1 System COP / EER when connected to MSZ-LN / MSZ-AP x indoor unit connections. Combined max running current of all indoors on system must not exceed 3A.
The SEZ-M25DA cannot be used when the total indoor capacity is equal to the outdoor capacity, i.e. when the capacity ratio is 1.

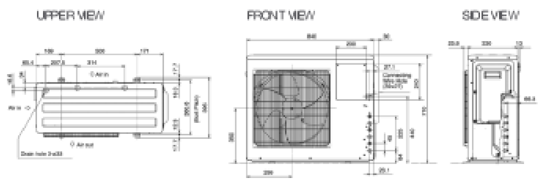
MXZ-2F33VF3, MXZ-2F42VF3, MXZ-2F53VF3 DIMENSIONS



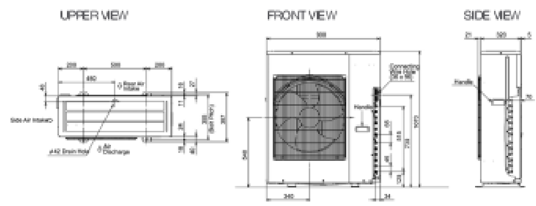
MXZ-4F83VF, MXZ-5F102VF DIMENSIONS



MXZ-3F54VF3, MXZ-3F68VF3, MXZ-4F72VF3 DIMENSIONS



MXZ-6F122VF DIMENSIONS



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Changes for the Better

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UNITED KINGDOM Mitsubishi Electric Europe Living Environment Systems Division, Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England. Telephone: 01707 282880 Fax: 01707 278881
IRELAND Mitsubishi Electric Europe, Westgate Business Park, Ballymount, Dublin 24, Ireland. Telephone: (01) 419 8800 Fax: (01) 419 8890 International code: (003531)

Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).

Effective as of May 2020

Green Gateway greengateway.mitsubishielectric.co.uk