

MEMO P22-313-M03v3

Project	Louisa Street Works, Openshaw – Approved Residential Development
Date	20 May 2025
To	Paul Sinclair – Westchurch Homes Ltd
From	David Thurstan BSc MIOA, Principal Consultant
Subject	Potential Noise from Air Source Heat Pumps

This memo sets out the findings and recommendations following an assessment of the potential noise from air source heat pumps (ASHP) associated with individual apartments on the approved residential development at the former Louisa Street Works.

This memo is an update following correspondence with Rebecca Twigg-Purcell, Environmental Protection Officer at Manchester City Council.

Ms Twigg-Purcell has stated that *“this may not be a commercial/industrial development but BS 4142 is currently the most suitable standard, and the units represent a new (mechanical) noise source that could have an adverse impact on residents of, and around, the development”*.

Hepworth Acoustics still maintain that BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* is not the appropriate standard to assess this type of noise given that all noise sources are strictly domestic. Nevertheless, a BS4142 assessment has been undertaken and we have included the request to *“consider cumulative noise levels from the multiple units with respect to daytime and nighttime background levels”*.

In addition to insisting upon an assessment to BS4142, Ms Twigg-Purcell referred to a briefing note issued by the Chartered Institute of Environmental Health and Institute of Acoustics. This stated:

“Where it is practical to do so, it is recommended that the installation sound rating level does not exceed 35dB at any noise sensitive façade of neighbouring residential premises. If it can be demonstrated that it is not practical to achieve this value, and the local context supports a relaxation, then a higher criterion may be suitable. Under those circumstances it is recommended that the reasons for the relaxation are fully set out and justified. Nevertheless, it is recommended that the sound rating level should not exceed 40dB.”

Therefore, in order to consider these constraints, further mitigation will be necessary to be control the noise emission at source and detailed calculations undertaken to determine a cumulative assessment.

Adopted Noise Limits

Typical background sound levels have been determined from the results of a 24-hour noise survey as detailed in Hepworth Acoustics Report P22-313-R01v2 dated August 2022.

The representative background sound values were 47 dB $L_{A90,T}$ for the daytime period and 41 dB $L_{A90,T}$ for the night-time. Therefore, based on the MCC requirements (i.e. 5 dB below background) the adopted noise limits are 42 dB $L_{Aeq,T}$ for the daytime and 36 dB $L_{Aeq,T}$ at night outside the nearest dwellings.

It is proposed to install Panasonic WH-MDC05J3E5 5kW air source heat pumps. These have a manufacturer's stated noise output of 60 dBA sound power level (i.e. dB L_{WA}) based on a rated capacity of A7/W55.

Following liaison, Panasonic have been able to provide corresponding octave band noise emission values and recommended the installation of "noise reduction kit" to further reduce noise levels.

Table 1: Source sound power levels for Panasonic WH-MDC05J3E5 Air Source Heat Pump (dB)

Description	Octave band centre frequency (Hz)							A
	125	250	500	1k	2k	4k	8k	
Heating Capacity 5.2kW	63	59	59	55	46	43	38	60
Heating Capacity 3.4kW	58	57	56	51	39	38	35	56

The unit typically operates at the 3.4kW heating capacity and only requires operation at full capacity (5.2kW) for short periods typically during colder weather conditions. Nevertheless, the higher sound power level has been used in the calculations. We understand that the "noise reduction kit" will typically reduce the noise emissions from the units by 5-6 dB, however a conservative 3 dB reduction in all octave bands has been assumed in our calculations.

The ASHP units are to be fitted to the balcony structure via appropriate anti-vibration mounts i.e. Flexi Foot with Strut Kits. As such, we have assumed that structure borne noise is unlikely to be significant.

Noise Assessment

A computer noise model of one of the apartment blocks was developed using DataKustik CadnaA noise modelling software. The noise propagation for each ASHP on the apartment block was calculated using the ISO 9613 'Acoustics - Attenuation of sound during propagation outdoors' procedure with each unit modelled as a point source and appropriate directivity considered. Screening provided by the balcony floors on the apartment block has also been considered. An isometric view of the 3D computer model of the building showing the solid balcony floors, the ASHP as point noise sources (the small crosses) and the receptor positions (the black/white spheres). The calculations of the worst-case noise level outside each apartment have assumed that all ASHPs, except that associated with the apartment in question, operate for the whole duration of the assessment period.

Table 2: Calculated ASHP noise levels at 1m from apartment facade (dB L_{Aeq})

Floor	Apartment number	Calculated noise level
Ground	P67	30
	P66	35
	P61	35
	P60	36
	P55	35
	P54	37
First	P69	31
	P68	36
	P63	35
	P62	37
	P57	36
	P56	37
Second	P71	30
	P70	35
	P65	35
	P64	36
	P59	35
	P58	37

The calculated noise levels one metre from the façade of each apartment are between 30 to 37 dB L_{Aeq} . The highest noise level of 37 dB L_{Aeq} has been used in the BS4142 assessment.

The character of the noise from the new equipment is broadband and generally steady/continuous in nature when it is operating. However, due to the intermittent nature of the equipment a 3 dB penalty has been applied. An initial BS 4142 assessment of the potential noise from ASHP equipment at the most exposed apartment is shown in Table 3 below.

Table 3a: BS 4142 Initial Assessment of ASHP noise operating at high capacity outside the apartments (dB)

Description	Daytime	Night-time
Calculated Specific Sound Level outside apartment	37	37
Character correction	+3	+3
Rating level (L_{Ar,T_r})	40	40
Background sound level ($L_{A90,T}$)	47	41
Adopted Noise Limit	42	36
Excess of Rating level over noise limit	-2	+4

The calculated BS 4142 rating levels from the ASHPs are below the representative background sound levels during the day and at night. In terms of an initial BS 4142 numerical assessment, the conclusion is a 'low' impact but not amounting to an adverse or significant adverse impact, depending on context. Although, the noise levels are above the MCC criterion of '5 dB below the background noise level' at night, they are below the limit during the day and within the upper limit of 40 dB as set out within the CIEH briefing note at all times.

As an exercise Table 3b below provides an assessment of the noise impact outside the apartments with the ASHPs operating at typical heating capacity, i.e. the specific sound levels from Table 3a have been reduced by 4 dB in line with the source noise levels set out in Table 1.

Table 3b: ASHP noise operating at typical capacity outside the apartments (dB)

Description	Daytime	Night-time
Calculated Specific Sound Level outside apartment	33	33
Character correction	+3	+3
Rating level (L_{Ar,T_r})	36	36
Background sound level ($L_{A90,T}$)	47	41
Adopted Noise Limit	42	36
Excess of Rating level over noise limit	-9	0

The results set out in Table 3b indicate that with the ASHPs operating at typical capacity the MCC criterion will be achieved.

Nevertheless, the outcome from Table 3a and the use of the upper limit should be justified by consideration of the local context, similarly BS4142 states that the context in which the sound occurs must be considered and, where necessary/appropriate, the assessment modified accordingly.

Section 11 of BS 4142 notes that *"where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*

On this basis, the calculated worst-case specific sound levels of all the ASHP units operating concurrently and continuously at the maximum heating capacity are below the lowest measured residual sound levels and when taking into account the attenuation provided by a closed double-glazed window (25 dB $R_w + C_{tr}$) would equate to an internal sound level of 12 dBA, this is a very low level of noise.

The calculated specific sound levels are 13-20 dB below the 50 dB $L_{Aeq,16\text{hour}}$ guideline noise criteria for outdoor amenity spaces as set out in BS 8233. Even if the characteristics of the sound are taken into account, the calculated rating level is still at least 10-17 dB below the 50 dB $L_{Aeq,16\text{hour}}$ guideline noise criteria for outdoor amenity spaces.

As mentioned with MCC guidelines *“where this criterion cannot be achieved, the various noise control measures considered as part of the assessment should be fully explained”*. Following advice from the manufacturer it is proposed to install “noise reduction kit” on the individual units to control noise. In terms of other methods of mitigation the practical limitations must be considered. The equipment can not be relocated as it must be located on the façade of the apartment it is heating. The equipment can not be effectively screened given the limited space and the need for sufficient air flow to operate. The operating hours of the equipment can not be restricted as it’s operation is for the heating of a domestic home.

It is therefore concluded that noise from the ASHP equipment subject to installation of the “noise reduction kits” would not result in any unacceptable impact on residential amenity.

Figure: Isometric view of 3D noise model

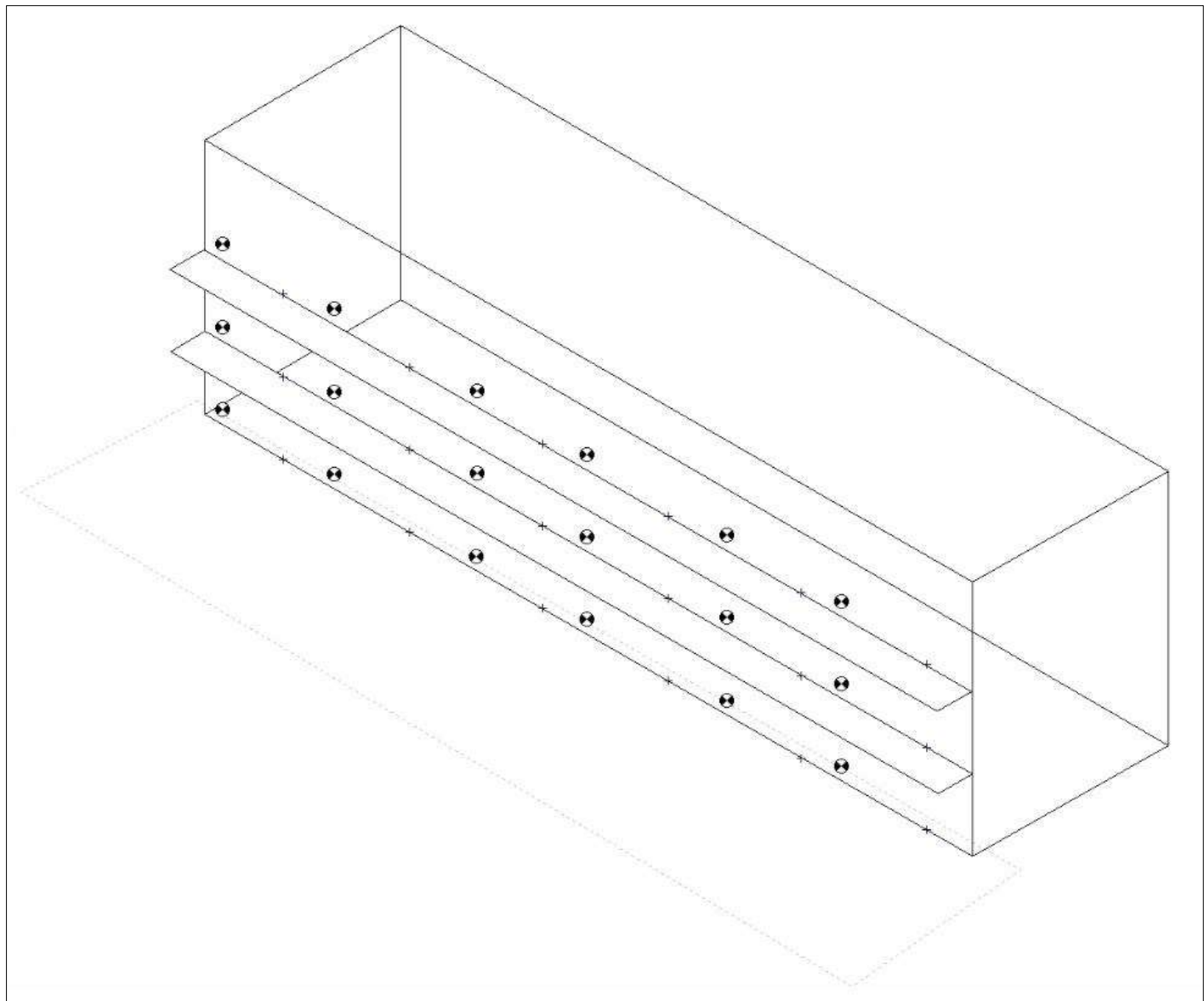
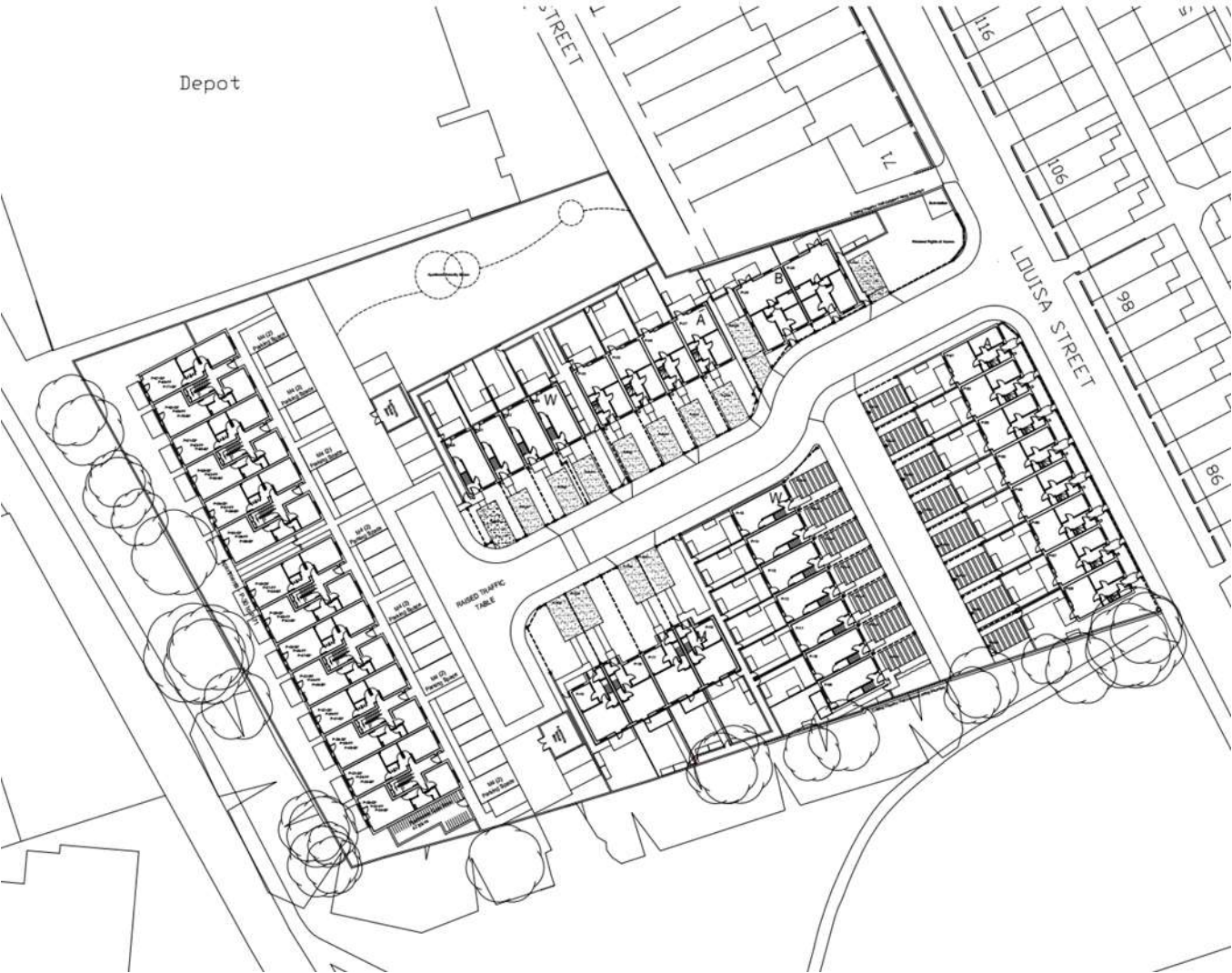
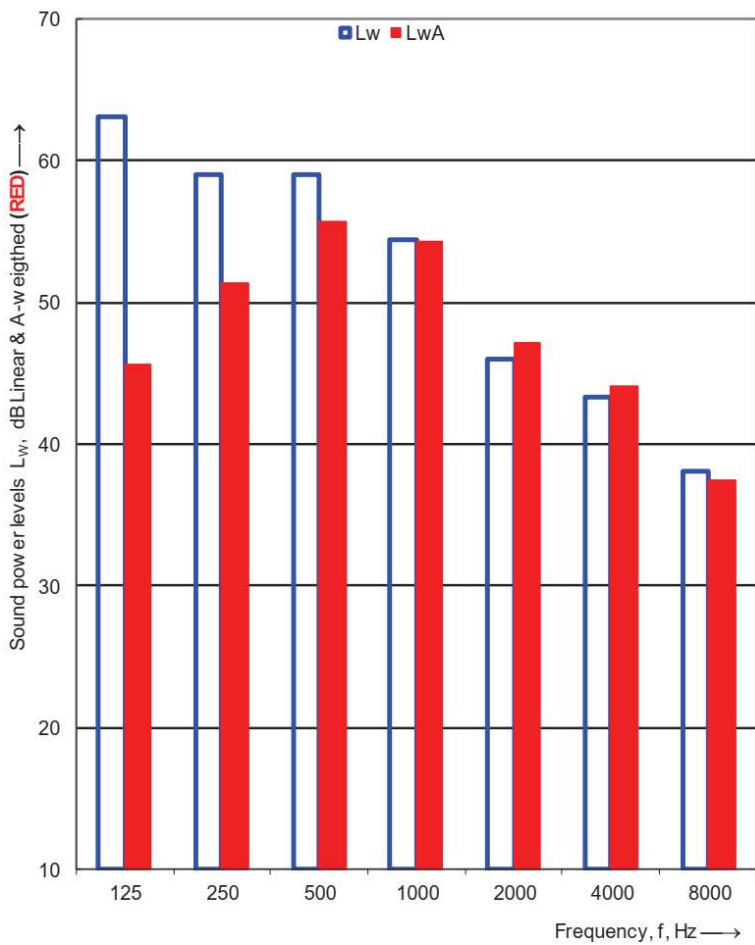


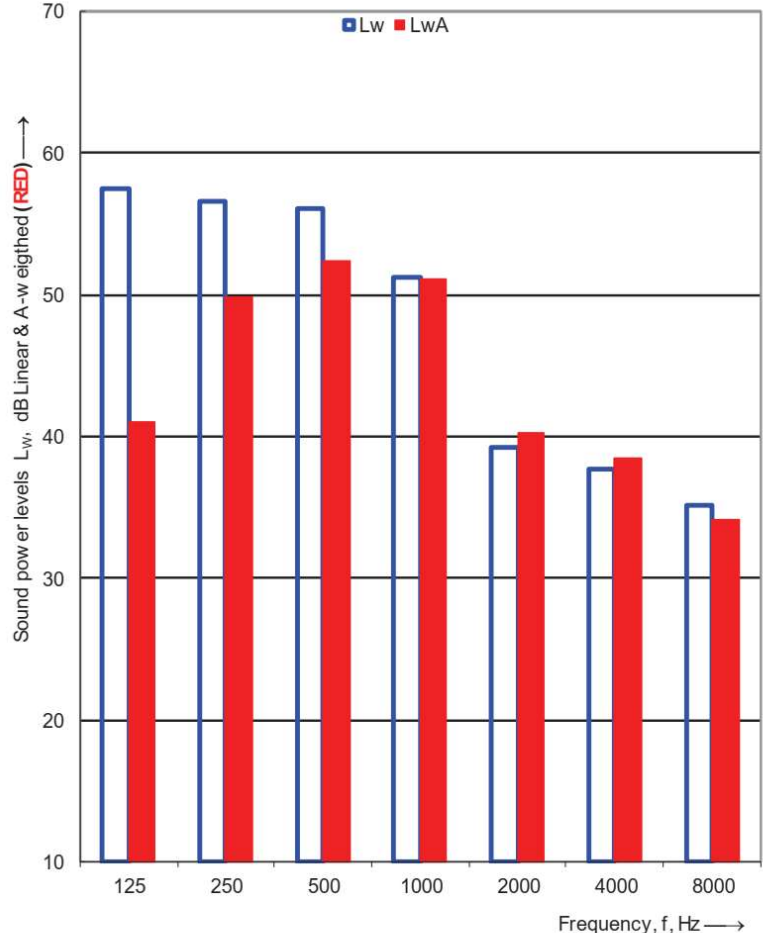
Figure: Proposed Site Layout



Sound Power Measurement Test Result – 5.2kW Heating capacity

	Sound power levels according to ISO 3743-1:2010	 TEKNOLOGISK INSTITUT																																																																		
Engineering method for small, movable sources in reverberant fields - Comparison method for hard-walled test rooms																																																																				
Client: Object: Mounting conditions:	Panasonic Europe GmbH Type: Mono Air to water heat pump Model: WH-MDC05J3E5 The unit is standing free on two pieces of heavy concrete tiles (90x90x8cm) laying on the floor. The unit is mounted on the supporting metal support frame using 6 vibration insulators.																																																																			
Date of test: 29-05-2020																																																																				
Operating conditions: Static pressure: Air temperature: Relative air humidity: Test room volume: Area, S, of test room:	A7/W47-55, Test mode 1, Compressor speed: 37 - 38 [Hz], Heating capacity: 5.2 [kW], Power_input: 1.64 [kW], Water flow rate: 570 [l/h], Fan_speed : 540 - 550 [rpm], dp_water : 464 1031 kPa 7.0 °C 85.0 % 102.8 m³ 138.9 m²																																																																			
	Room: Room 2	Reference box: L1: 1.3 m L2: 0.3 m L3: 0.8 m Volume: 0.3 m³																																																																		
<table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th>Frequency f [Hz]</th> <th>L_w 1/3 octave [dB]</th> <th>1/1 oct [dB]</th> </tr> </thead> <tbody> <tr><td>100</td><td>61.8</td><td></td></tr> <tr><td>125</td><td>55.1</td><td>63.1</td></tr> <tr><td>160</td><td>53.1</td><td></td></tr> <tr><td>200</td><td>51.3</td><td></td></tr> <tr><td>250</td><td>53.6</td><td>59.0</td></tr> <tr><td>315</td><td>56.4</td><td></td></tr> <tr><td>400</td><td>54.9</td><td></td></tr> <tr><td>500</td><td>54.7</td><td>59.1</td></tr> <tr><td>630</td><td>53.0</td><td></td></tr> <tr><td>800</td><td>50.8</td><td></td></tr> <tr><td>1000</td><td>48.8</td><td>54.5</td></tr> <tr><td>1250</td><td>49.2</td><td></td></tr> <tr><td>1600</td><td>43.2</td><td></td></tr> <tr><td>2000</td><td>40.8</td><td>46.0</td></tr> <tr><td>2500</td><td>38.5</td><td></td></tr> <tr><td>3150</td><td>37.6</td><td></td></tr> <tr><td>4000</td><td>37.8</td><td>43.2</td></tr> <tr><td>5000</td><td>39.7</td><td></td></tr> <tr><td>6300</td><td>35.2</td><td></td></tr> <tr><td>8000</td><td>33.2</td><td>38.1</td></tr> <tr><td>10000</td><td>30.3</td><td></td></tr> </tbody> </table>	Frequency f [Hz]	L _w 1/3 octave [dB]	1/1 oct [dB]	100	61.8		125	55.1	63.1	160	53.1		200	51.3		250	53.6	59.0	315	56.4		400	54.9		500	54.7	59.1	630	53.0		800	50.8		1000	48.8	54.5	1250	49.2		1600	43.2		2000	40.8	46.0	2500	38.5		3150	37.6		4000	37.8	43.2	5000	39.7		6300	35.2		8000	33.2	38.1	10000	30.3			
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