



Withington Community Hospital: Community Diagnostic Centre

Stage 5 Plant Noise Impact Assessment

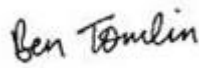
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REVISION HISTORY

Revision	Date	Revision Details	Author	Checked
R05	03/03/2026	Initial issue	 Susan Witterick BSc MIOA	 Ben Tomlin BSc MIOA

1 INTRODUCTION

- 1.1 dBx Acoustics Ltd has been appointed by the Manchester University NHS Foundation Trust (MFT) to carry out a plant noise impact assessment for the proposed new-build Community Diagnostics Centre (CDC) in the grounds of Withington Community Hospital, Didsbury M20 2LR.
- 1.2 The Local Authority is Manchester City Council (MCC).
- 1.3 This report summarises the noise emission limits for externally mounted or discharging items of building services plant in order to meet the requirements of MCC, and provides an assessment of noise impact from the current plant selection.
- 1.4 A glossary of acoustic terminology has been supplied in Appendix A in order to assist the reader.

2 PROJECT DESCRIPTION

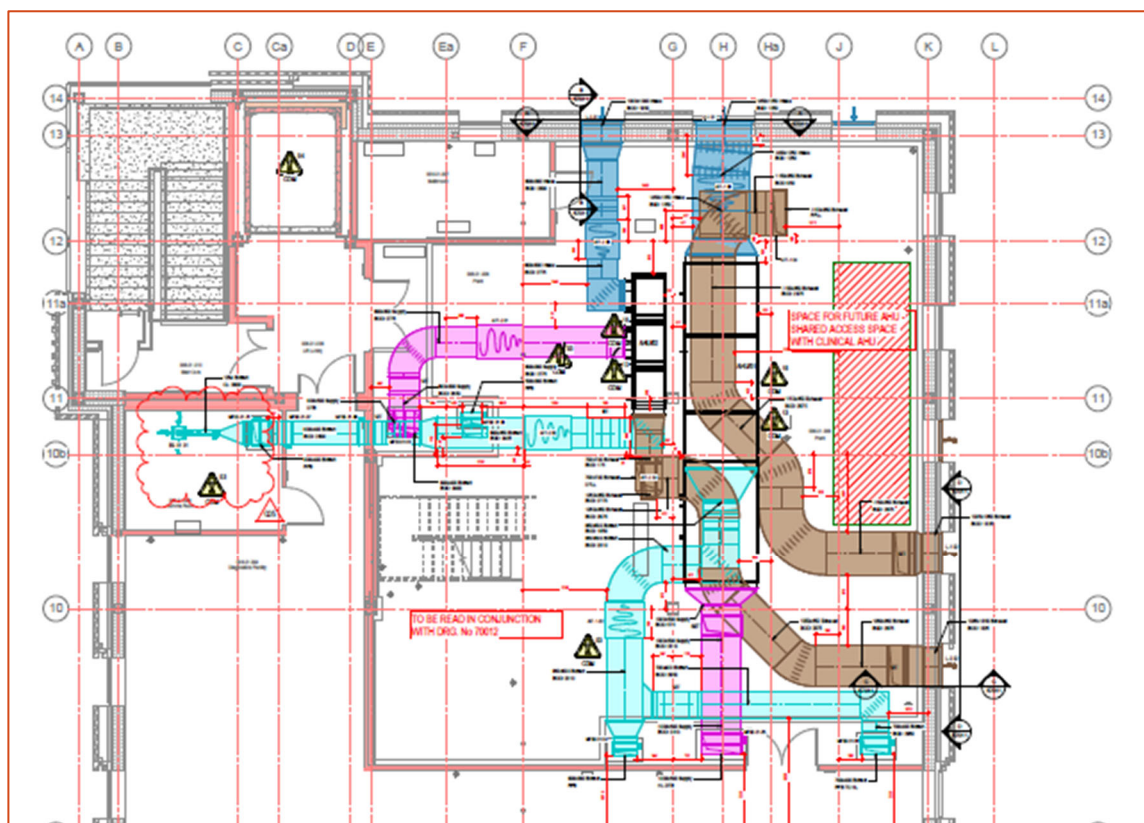
- 2.1 The project comprises the development of a two-storey building comprising a Community Diagnostics Centre (Use Class E) with associated external landscaping, patient and delivery drop off area, and 6 accessible parking spaces.
- 2.2 The location of the building within the existing site is indicated in Figure 1, below.

Figure 1: Building Location



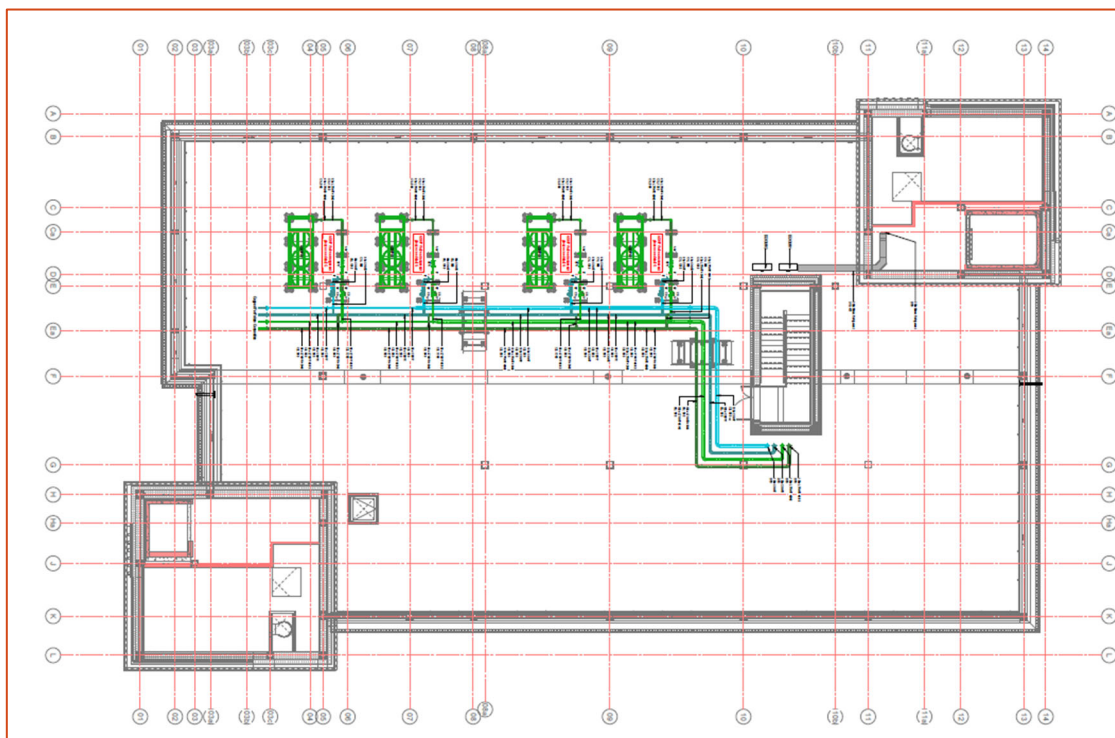
- 2.3 The normal opening hours of the building are understood to be 08:00h-20:00h, Monday to Friday. It is assumed that plant will not generally operate outside of this period. However, as a worst case for frost protection, 2no. ASHP and 1no. condensing unit may potentially operate overnight. The AHUs would not operate at night.
- 2.4 The building will be mechanically ventilated. An enclosed plant room is proposed at first floor level to the south east of the building, with external louvres facing Burton Road and Fielden Road. Roof mounted plant is proposed to be located immediately above the plant room.
- 2.5 The plant room layout is shown in Figure 2, below.

Figure 2: Proposed Plant Room Layout



- 2.6 The proposed roof plant comprises 4no. Air Source Heat Pumps (ASHP) and two external condensing units. The roof plant layout is shown in Figure 3, below.

Figure 3: Proposed Roof Plant Layout



3 ACOUSTIC DESIGN CRITERIA

Manchester City Council

- 3.1 The Local Authority is Manchester City Council (MCC).
- 3.2 Planning permission for the development was granted in December 2023, reference 137537/FO/2023.
- 3.3 Condition 19 is reproduced as Figure 4, below;

Figure 4: Condition 19

19) a) Any externally mounted ancillary plant, equipment and servicing to be installed shall be selected and/or acoustically treated in accordance with the approved Noise Impact Assessment prepared by dbx acoustics reference 23046-R01A-SW as received by the City Council as local planning authority on the 7th November 2023 so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location. Prior to its installation, the scheme, including any necessary mitigation, shall be submitted to and approved in writing by the City Council as Local Planning Authority in order to secure a reduction in the level of noise emanating from the site.

b) Prior to any externally mounted ancillary plant, equipment and servicing to be installed becoming operational, an approved verification report shall be submitted to and approved in writing by the City Council as Local Planning authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of non - conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

Reason - To minimise the impact of the development and to prevent a general increase in pre-existing background noise levels around the site, pursuant to saved policy DC26 of the Unitary Development Plan for the City of Manchester and policies DM1 and SP1 of the Manchester Core Strategy.

BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'

- 3.4 BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating Level is determined and compared with the existing local Background Sound Level.
- 3.5 The Rating Level ($\text{dBL}_{\text{Ar,Tr}}$) is evaluated from the Specific Noise Level by including cumulative corrections to account for factors such as distinguishable tone, impulsivity, intermittency or other readily distinguishable sound characteristics.
- 3.6 The assessment of the impact depends upon the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level. An initial estimate of the impact of the specific sound is made by subtracting the Background Sound Level from the Rating Level, while considering the following points:
- a) Typically, the greater this difference, the greater the magnitude of the impact.
 - b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
 - d) 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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

4 PLANT NOISE EMISSION LIMITS

- 4.1 An environmental noise survey was carried out on Friday 5th May 2023 between approximately 17:00h and 19:45h, typical of the lowest background noise levels for noise impact at the surrounding residential receptors during the anticipated operating hours of the building and associated plant.
- 4.2 An additional night-time noise survey was undertaken on 15th September 2023.
- 4.3 Measurements were made at three locations, as indicated in Figure 5, below.

Figure 5: Noise Survey Locations



- 4.4 Location A was selected to be representative of the façade of the existing Hospital buildings, whilst Location B is representative of residential receptors on Fielden Road, and Location C is representative of residential receptors on Burton Road.
- 4.5 MCC requires that the rated plant noise level ($dB_{L_{Ar,Tr}}$), assessed in accordance with BS4142:2014, is controlled to 5dB below the background noise level ($dB_{L_{A90,T}}$) at the nearest noise sensitive location during the periods in which the plant operates.
- 4.6 The nearest noise sensitive receptors are identified as the neighbouring residences on Fielden Road and Burton Road. Both have second floor windows directly facing the development.
- 4.7 As the existing hospital building is within close proximity to the proposed development, it is proposed that the building services rating noise level should not exceed the existing background noise level at the façade of patient areas.
- 4.8 Consequently, when assessed at the nearest noise sensitive receptors, plant noise should not exceed the limits shown in Table 3, below, during the daytime (07:00h-23:00h) and night time (23:00h-07:00h).

Table 3: Building Services Noise Emission Limits

Receptor	Period	Lowest Measured Background Noise Level, $dB_{LA90,T}$	BS4142 Rating Limit, $dB_{LA,r,T}$
A - Hospital	Daytime	42	42
	Night Time	32	32
B – Fielden Road	Daytime	41	36
	Night Time	32	27
C – Burton Road	Daytime	44	39
	Night Time	39	34

5 PROPOSED PLANT

Plant Room Breakout

- 5.1 There are open louvres along the facades facing Fielden Road and Burton Road.
- 5.2 Within the plant room, the casing radiated noise levels from individual plant items (based on the manufacturer's information for the specified design duty) are extracted from the Dalair Technical Submittal (22182-BAM-WCH006-XX-SP-M-0003) as follows.

Table 1: Plant Casing Radiated Noise Levels (Sound Power Level, dBL_{WA})

Item	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	dBA
AHU1 supply	66	67	64	62	53	52	45	52	63
AHU1 extract	73	69	62	58	52	50	43	51	61
AHU2 supply	59	59	63	56	50	45	36	44	58
AHU2 extract	56	57	56	54	48	43	34	42	55

- 5.3 On this basis, a reverberant sound pressure level of around 59dBL_{Aeq,T} is predicted within the plantroom. None of the units exhibits any tonal characteristics.
- 5.4 Noise break-out calculations have been carried out on the basis of a standard weather louvre ventilating the plant rooms, specified as WPL LG/40.
- 5.5 On this basis, the predicted noise level at the residential receptors is 28dBL_{Aeq,T} at Fielden Road and Burton Road.
- 5.6 This is therefore compliant with the building services noise emission limits set in Table 1, above.

Roof Plant

- 5.7 The proposed roof plant comprises the following;
- 4no. Airedale Multichill MCHP units (sound power 71dBL_{WA})
 - 2no. Mitsubishi PUZ-ZM100YDA condensing units (sound power level 63dBL_{WA})
- 5.8 Octave band data for the proposed plant indicates that it is not tonal in nature. Octave band data for the ASHP is presented in Technical Submittal reference 22182-BAM-WCH006-02-SP-M-0001, with information on the condensing units taken from Technical Submittal 22182-BAM-WCH006-00-SP-M-0002 with reference to Mitsubishi's published octave band data.

Air Handling Unit Intake and Exhaust

- 5.9 The attenuator schedule (22182-BAM-WCH006-01-SP-M-001) does not include octave band insertion loss data. Based on the information provided in the schedule the following octave band insertion losses are assumed;

Table 2: Assumed Attenuator Insertion Losses, dB

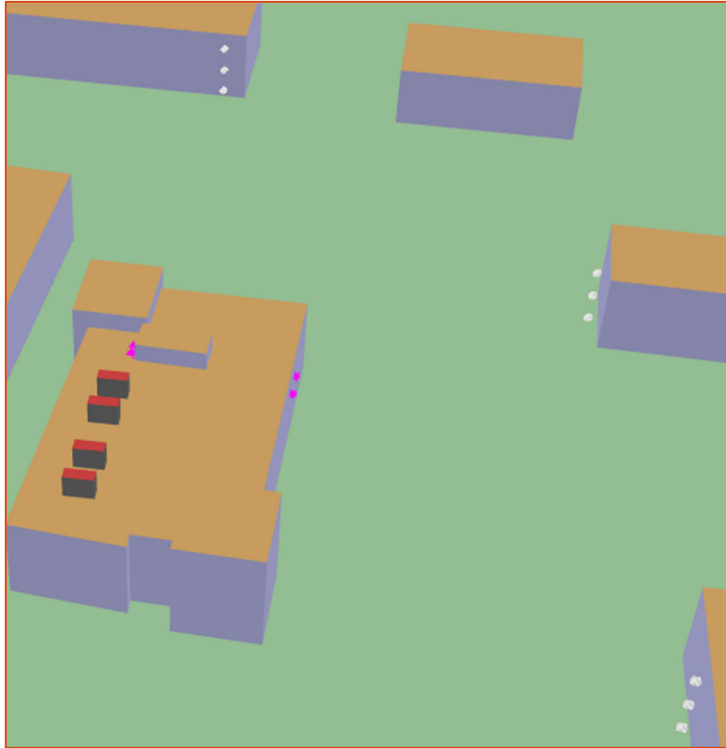
System	Attenuator	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
AHU1 FAI	ATT-01-03	3	6	12	18	21	20	13	10
AHU1 Exhaust	ATT-01-04	3	6	12	18	21	20	13	10
AHU2 FAI	ATT-02-03	3	6	12	18	21	20	13	10
AHU2 Exhaust	ATT-02-04	4	8	15	22	28	27	18	12

- 5.10 ***It is recommended that Caice provide octave band insertion losses for confirmation.***
- 5.11 The AHU intake and exhaust fan sound power level is based on the Dalair technical submittal (22182-BAM-WCH006-XX-SP-M-0003).

Plant Noise Model

- 5.12 To fully assess the noise impact of the AHU intake and exhaust connections and the roof plant on the noise sensitive receptors, particularly those on Fielden Road which have second floor windows directly overlooking the plant area, a noise model has been created using the Soundplan 9.1 software package. A screenshot from the model is shown as Figure 6, below.

Figure 6: Plant Noise Model



- 5.13 Each item of plant has been modelled as a noise source.
- 5.14 The predicted noise levels arising at the upper floors of the noise sensitive receptors as a result of the roof plant are 30dB_{L_{Aeq,T}} at Burton Road, and 35dB_{L_{Aeq,T}} at Fielden Road.
- 5.15 As a worst case overnight (23:00h-07:00h) to provide frost protection, 2no. ASHP and 1no. condensing unit may operate.
- 5.16 Under this scenario, the predicted noise levels arising at the upper floors are 17dB_{L_{Aeq,T}} at Burton Road and 21dB_{L_{Aeq,T}} at Fielden Road.

6 BS4142 ASSESSMENT

Residential Receptors

- 6.1 The worst-affected noise sensitive receptors are the residential properties at Fielden Road, where during the daytime period (07:00h-23:00h) noise from the roof plant is predicted to be $35\text{dBL}_{\text{Aeq,T}}$, with a contribution from plantroom noise break-out of $28\text{dBL}_{\text{Aeq,T}}$, leading to a cumulative specific noise level of $36\text{dBL}_{\text{Aeq,T}}$.
- 6.2 For potential night-time operation (2no. ASHP and 1no. external condensing unit only), the predicted specific noise level at Fielden Road is $21\text{dBL}_{\text{Aeq,T}}$.
- 6.3 A BS4142 assessment for this receptor is presented as Table 4, below.

Table 3: BS4142 Assessment, Fielden Road

Item	Calculation	Relevant Clause	Comments
Measured background sound level - daytime	$41\text{dBL}_{\text{A90, 1hr}}$	8.2	The typical background sound level measured during the daytime period.
Measured background sound level - night-time	$32\text{dBL}_{\text{A90, 15min}}$	8.2	The typical background sound level measured during the night-time period.
Specific sound level, daytime	$36\text{dBL}_{\text{Aeq,T}}$	7.3.6	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Specific sound level, night-time	$21\text{dBL}_{\text{Aeq,T}}$		
Assessment made during the daytime and night-time periods, so reference period is 1 hour and 15 minutes respectively		7.2	-
Acoustic feature correction	0dB	9.2	No acoustically distinct characteristics
Rating Level, daytime	$36\text{dBL}_{\text{Ar,Tr}}$	9.2	The predicted Rating Level during the daytime and night-time period.
Rating Level, night-time	$21\text{dBL}_{\text{Ar,Tr}}$		
Excess of Rating Level over background sound level - daytime	-5dB	11	-
Excess of Rating Level over background sound level -night-time	-11dB	11	-
Assessment indicates low likelihood of adverse impact		11	Predicted Rating Level does not exceed the lowest measured background level. This is an indication of the development having a low impact.
Uncertainty of the assessment	Minor	10	The predicted Rating Level is based on established prediction methodologies. The background sound level at the NSR has been established by the noise survey.

- 6.4 On this basis, it can be seen that the requirements of Manchester City Council that the plant noise rating level $\text{dBL}_{\text{Ar,Tr}}$ should be at least 5dB below the background noise level at the nearest noise sensitive receptors is complied with.

Noise Impact to Hospital Building

- 6.5 The predicted plant noise level arising at the façade of the existing hospital building is 35dB_{LAeq,T} during the daytime and 32dB_{LAeq,T} at night.
- 6.6 With reference to the background noise levels at this location of 42dB_{LA90,T} during the day and 32dB_{LA90,T} at night, no adverse noise impact is anticipated.

7 CONCLUSION

- 7.1 dBx Acoustics Ltd has been appointed by the Manchester University NHS Foundation Trust (MFT) to carry out a plant noise impact assessment for the proposed new-build Community Diagnostics Centre (CDC) in the grounds of Withington Community Hospital, Didsbury M20 2LR.
- 7.2 An assessment of noise impact from the proposed plant during both the daytime and night time periods has been undertaken for the noise sensitive receptors at Fielden Road and Burton Road. It is demonstrated that the requirements of Manchester City Council are complied with.
- 7.3 Noise from the proposed plant affecting the existing Hospital buildings does not exceed the background noise level during the daytime or night-time periods and as such no adverse noise impact is anticipated.
- 7.4 On this basis, Condition 19a of planning permission reference 137537/FO/2023 can be discharged.

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is 2×10^{-5} N/m ² . The sound pressure level existing when microphone measured pressure is 2×10^{-5} N/m ² is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A-weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
L_{Fmax}	The instantaneous maximum sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
L_{AFmax}	The instantaneous maximum A weighted sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
$L_{Ar,Tr}$	The rating level: the equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
Reverberation Time, T	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor T, often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example, a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
STI	Speech Transmission Index , Metric ranging between 0 and 1 representing the transmission quality of speech with respect to intelligibility by a speech transmission channel
R	Sound Reduction Index , the laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
R_w	Weighted Sound Reduction Index , a single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
D_w	Weighted Level Difference , the weighted level difference between a pair of rooms, stated as a single figure.

D_{nT}	Standardised Level Difference, a frequency-dependent measurement of airborne sound insulation, calculated using the following formula: $D_{nT} = L_1 - L_2 + 10\log(T/T_0)$ dB Where: L_1 is the energy-averaged sound pressure level due to the pink noise source measured in the source room using a sweep technique. L_2 is the energy-averaged sound pressure level measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T_{30} measured in seconds). T_0 is the reference reverberation time (= 0.5s for dwellings).
$D_{nT,w}$	Weighted Standardised Level Difference, a single-figure value of airborne sound insulation performance, derived according to procedures in BS EN ISO 717-1, based on the D_{nT} values at different frequencies (100-3150 Hz third octave bands).
$D_{n,F,w}$	Weighted, Normalised Flanking Level Difference, the normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
D_{ne}	Normalised Element Level Difference. The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.
$D_{n,e,w}$	Weighted, Normalised Element Level Difference. The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
C_{tr}	Spectrum Adaptation Term, a correction term applied to the sound insulation single-number values (R_w, D_w, and $D_{nT,w}$) in accordance with BS EN ISO 717-1. Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation its performance at higher frequencies.
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking or moving furniture on a floor structure.
L_{nT}	Standardised Impact Sound Pressure Level, a frequency dependent measurement of impact sound insulation, calculated using the following formula: $L_{nT} = L_1 + 10\log(T/T_0)$ dB Where: L_1 is the mean sound pressure level due to the tapping machine measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T_{30} measured in seconds). T_0 is the reference reverberation time (0.5s for dwellings)
$L'_{nT,w}$	Weighted Standardised Impact Sound Pressure Level, a single-figure value (@ 500 Hz) of impact sound insulation, performance, derived according to BS EN ISO 717-2, based on the L_{nT} values at different frequencies (100Hz- 3150 Hz third octave bands).
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
NR	The Noise Rating level. This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.

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