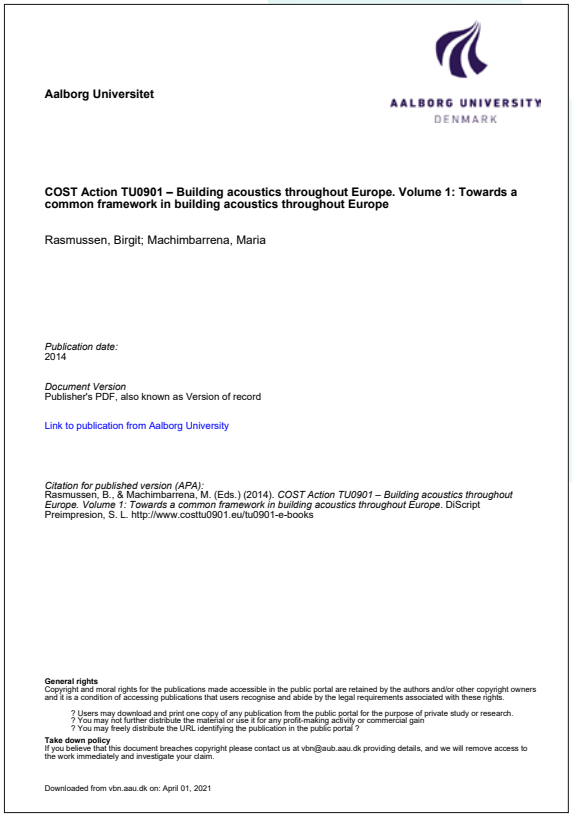
ISO TS 19488:2021 Acoustic classification of dwellings – Coming to a construction site near you!

It is notoriously difficult to predict exact publication dates for new international standards and guidance documents and, as such, this article is an early insight. However, the expectation is that this will be published about the time you receive this edition of Acoustics Bulletin.

By Philip Dunbavin and Sean Smith



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COST Action TU0901 – Building acoustics throughout Europe. Volume 1: Towards a common framework in building acoustics throughout Europe

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Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

Link to publication from Aalborg University

Citation for published version (APA):
Rasmussen, B., & Machimbarrena, M. (Eds.) (2014). *COST Action TU0901 – Building acoustics throughout Europe. Volume 1: Towards a common framework in building acoustics throughout Europe*. DiScript Preimpresion, S. L. http://www.costtu0901.eu/tu0901-e-books

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This new technical specification, which was published 26 April 2021, had its origin in the European Action COST Action TU0901, (Cooperation on Science and Technology) 'Integrating and Harmonizing Sound Insulation Aspects in Sustainable Urban Housing Constructions', which ran from 2009 to 2013.

During the four years official lifetime of COST TU0901, close research cooperation and discussions took place involving more than 90 experts from 29 European countries and three non-European countries (Canada, Australia and New Zealand).

Most European countries have regulatory sound insulation requirements for dwellings, and specific sound insulation classification schemes exist in several countries. However, sound insulation descriptors, requirements and class criteria presented a high degree of diversity and, unfortunately, there was no sign of increasing harmonisation, rather the contrary. This diversity has caused confusion for the building industry and was an obstacle for trade, development and exchange of experience and construction data.

COST Action TU0901 was established to initiate changes to this situation to the benefit of people in their everyday life and for the building industry. It is believed that although regulations are a national issue within each country, if all European countries used the same descriptors and had a joint acoustic classification scheme for dwellings, each country could select a class for regulations, and all sectors involved would, in the long run, benefit from the harmonisation.

Drawing a consensus from such diverse range of experiences and views was not an easy task. The final reports of this work can be downloaded at **https://tinyurl.com/fvmvncxa**

It was originally intended that this document would be published in 2018 and was sent out as a Final Draft International Standard (FDIS) for international voting. (Please refer to the article on page 64 of the Acoustics Bulletin, January/ February 2019). Unexpectedly, the international voting disapproved this draft standard, due to some unusual tactical voting by a few countries. It was subsequently agreed by the plenary meeting of ISO/ TC43/ SC2 in Japan in November 2018 to reissue this as a draft technical specification. Technical specifications are prepared where there is no consensus, or when there is an emerging science, such as soundscapes. A technical specification can eventually be converted into a full ISO at a later date when more evidence is available or a consensus can be reached.

Scope of ISO 19488:2018

This standard describes class criteria and procedures for acoustic classification of dwellings. The main purpose of this classification standard is to make it easier for developers to specify a standardised level of acoustic quality other than the quality defined by national regulations, and for users to require or be informed about the acoustic quality.

This standard can also be applied as a general tool to characterise the quality of the existing housing stock and includes provisions for classifying the acoustic quality before and after renovations have taken place. An additional purpose of this standard is to help national authorities to define a specific class in building regulations as the minimum requirement for acoustic conditions in dwellings.

For the purpose of this standard, the term 'dwelling' refers to detached and attached dwelling-houses, flats (apartments) as well as rooms in other buildings used for residential purposes. Energy performance ratings of buildings currently use A to G classifications. For the purposes of acoustics and sound insulation, the technical specification classifications use A to F.

Acoustic classes

The classes A to F specify different levels of acoustic conditions in dwellings. Class A is the highest class, class F is the lowest class. The indication *'npd'* can be used for dwellings where no acoustic performance is required or determined, or if the performance does not meet the requirements of class F.

The classification includes criteria for the six classes A to F for each of the following five acoustic aspects:

- airborne sound insulation;
- impact sound insulation;
- airborne sound insulation of building envelopes against outdoor noise from traffic, industry or other sources;
- sound pressure levels in the dwellings from service equipment; and
- reverberation time or ratio of the equivalent sound absorption area to the walkable surface in common access areas or stairwells and corridors with dwellings opening onto them.

Airborne sound insulation

The technical specification gives class ratings for three situations:

1. Between habitable rooms in a dwelling and rooms outside the dwelling in all directions.
2. From common stairwells or access areas into habitable rooms in dwellings, where there is an entrance door in the separating wall.
3. From premises with noisy activities into habitable rooms in dwellings.

With respect to building regulations the first category is the most important.

The classes of airborne sound insulation for separating walls and floors are given in Table 1 of the standard and are:

Below:
Table 1: Airborne sound insulation – Class limits

Type of space	Class A	Class B	Class C	Class D	Class E	Class F
Between habitable rooms in a dwelling and rooms outside the dwelling in all directions.	$D_{nT,50} \geq 58$	$D_{nT,50} \geq 54$	$D_{nT,A} \geq 52$	$D_{nT,A} \geq 48$	$D_{nT,A} \geq 44$	$D_{nT,A} \geq 40$

Note 1 – Different descriptors are applied to reflect use of different frequency ranges and weightings. Instead of DnT,A, DnT,w may be applied, if 2 dB is added to the limit value. If $D_{nT,A}$ is applied instead of DnT,50, 2 dB should be added to the limit value of DnT,50. For comparison between descriptors, see ISO 12354-1.
(Table extract and note reprinted from ISO/TS 19488:2021 Acoustics – Acoustic classification of dwellings.)

Applying the Note 1 corrections specified above the classes for airborne sound insulation are shown in Table 1b (below):

Type of space	Class A	Class B	Class C	Class D	Class E	Class F
Between habitable rooms in a dwelling and rooms outside the dwelling in all directions.	$D_{nT,w} \geq 62$	$D_{nT,w} \geq 58$	$D_{nT,w} \geq 54$	$D_{nT,w} \geq 50$	$D_{nT,w} \geq 46$	$D_{nT,w} \geq 42$

Above:
Table 1b: Conversion to $D_{nT,w}$ airborne sound insulation – Class limits

As an example, 56 dB $D_{nT,w}$ is the minimum airborne sound insulation in Section 5: Noise of the Building Standards (Scotland) which would be Class C. It is more difficult to compare these values with the performance requirements of Approved Document E (England) such as the minimum 45 dB $D_{nT,w}$ + C_{tr}. However, if the typical C_{tr} value is -5 dB[1] for a blockwork cavity separating wall, then this would be Class D.

For higher performance requirements such as found in Section 7: Sustainability (Scotland) where 'gold' level is min 60 dB $D_{nT,w}$, this would equate to Class B.

Impact sound insulation

The standard gives class ratings for three situations:

1. For habitable rooms in dwellings from other dwellings in all directions.
2. For habitable rooms in dwellings from:
   — common stairwells or access areas;
   — balconies or terraces or bath rooms not part of the same dwelling.
3. For habitable rooms in dwellings from adjoining premises with noisy activities.

With respect to building regulations the first category is the most important. P34

1 See Defra Contract NO0234, 'An investigation into the effect of historic noise policy interventions' Annex 4 – Building Regulations published in 2012.

The classes of impact sound insulation for separating floors are given in Table 2 of the standard as follows (below):

Type of space	Class A	Class B	Class C	Class D	Class E	Class F
Between habitable rooms in a dwelling and rooms outside the dwelling in all directions.	$L'_{nT,w} \leq 46$ and $L'_{nT,50} \leq 50$ 1	$L'_{nT,w} \leq 50$ and $L'_{nT,50} \leq 54$ 1	$L'_{nT,w} \leq 54$	$L'_{nT,w} \leq 58$	$L'_{nT,w} \leq 62$	$L'_{nT,w} \leq 66$

Note 1 – Experience has shown that when applying the low-frequency rating, potentially disturbing high frequency sounds are not rated appropriately, and for this reason, two descriptors are applied in order to account for both hard floor (mid frequency) impact sounds as well as low frequency footstep sounds. The limit values for L'nT,w are 4 dB lower than those specified for L'nT,50. For comparison between descriptors, see ISO 12354-2.
(Table extract and note reprinted from ISO/TS 19488:2021 Acoustics – Acoustic classification of dwellings.)

Above:
Table 2: Impact sound transmission – Class limits

This would result in the building regulations being Class D (Scotland) and Class E (England).

Airborne sound insulation of façades

The classification of airborne sound insulation against exterior noise is somewhat different to the procedures normally adopted in the United Kingdom.

The minimum 'class' values for sound insulation are shown in Table 3, which is reproduced below, for a specific environment as characterised by L_{den} for the relevant outdoor sound sources.

L_{den}, is the A-weighted free field sound level for the relevant outdoor sound sources with weighting of the day, evening, night period over the frequency range from 50 Hz to 5,000 Hz as defined in the END (European Noise Directive) for outdoor sound.

In case the dominant sources of noise on the outside has a different spectrum than C_{tr}, a more relevant spectrum adaptation term than C_{tr} is to be applied to calculate the weighted single number, $D_{nT,A,tr}$, in order to have similar sound pressure levels in the habitable rooms. The index 'tr' may then be replaced by a more descriptive index for the actual type of source.

Below:
Table 3: Sound insulation in dwellings against exterior noise – Class limits[1, 2]

	Type of space	Class A	Class B	Class C	Class D	Class E	Class F
1	Façades and roofs of habitable rooms in dwellings; in specific environment with sound sources characterized by L_{den}	$D_{nT,A,tr} \geq L_{den} - 20$	$D_{nT,A,tr} \geq L_{den} - 24$	$D_{nT,A,tr} \geq L_{den} - 28$	$D_{nT,A,tr} \geq L_{den} - 32$	$D_{nT,A,tr} \geq L_{den} - 36$	$D_{nT,A,tr} \geq L_{den} - 40$

1 *The sound insulation values are expressed as a weighted standardised sound level difference with a spectrum adaptation term for road traffic noise. For other types of sound source than road traffic noise, DnT,A,tr shall be determined from the relevant level and spectrum of the sources.* $D_{nT,w} + C_{tr,50-3150}$ *may be used, where low frequency sound influences the indoor sound pressure level. e.g. where the sound comes from mechanical equipment placed outside the building.*
2 $D_{nT,A,tr} \geq 30$ *dB applies as a minimum requirement to classes A–D.*

(Table and notes reprinted from ISO/TS 19488:2021 Acoustics – Acoustic classification of dwellings.)

During the development of this standard there was considerable debate about the appropriateness of using Lden in this application because it is not what might be measured at any particular site. It represents the average over a 24-hour period rather than what the actual occupants will experience at various times throughout the day.

It is important to note that ISO standards are developed on a consensus basis and most acousticians will not necessarily agree with all the contents of any particular standard. In this case the standard says:

"All requirements for a class shall be fulfilled in order to obtain a certain class designation. A classification can be made for a whole residential building, only if all dwellings in the building fulfil the class criteria. Dwellings in a building can also be assigned different classes. Classification can also be made for an individual dwelling or even for an individual room or a specific characteristic, e.g., airborne sound insulation, separately. The classification applies as long as there are no adverse changes in building constructions or environment. If such changes have occurred, e.g., by new roads nearby, the classification should be reconsidered."

(This extract is reprinted from ISO/TS 19488:2021 Acoustics – Acoustic classification of dwellings.)

This was a compromise and it is possible to not use some of the specific characteristics. P36

Sound from building service equipment

The maximum values of the classes for A-weighted time-averaged, or the maximum sound pressure levels due to service equipment are shown in Table 4 (below).

	Type of space and sources[1,2]	Quantity	Class A	Class B	Class C	Class D	Class E	Class F
1	In habitable rooms in dwellings from outdoor and indoor service equipment producing continuous sound	$L_{A,eq,nT}$	≤ 22	≤ 26	≤ 30	≤ 34	≤ 38	≤ 42
2	In habitable rooms in dwellings from outdoor and indoor service equipment producing intermittent or irregular sound, from neighbouring spaces	$L_{AF,max,nT}$ [3]	≤ 26	≤ 30	≤ 34	≤ 38	≤ 42	≤ 46

1 *Requirements relate to sounds that occur more than occasionally due to service equipment in neighbouring dwellings, equipment serving the whole building and service equipment within the dwelling for normal ventilation/heating/cooling.*
2 *Sound with tonal components may be perceived more annoying and may be subject to national regulations.*
3 $L_{AS,max,nT}$ *may also be used, provided that 4 dB stricter limits (lower sound levels) are fulfilled, i.e. the same as the* $L_{Aeq,nT}$.

(This table is reprinted from ISO/TS 19488:2021 Acoustics – Acoustic classification of dwellings.)

Above:
Table 4: Sound from building services equipment – Class limits

Below:
Table 5: Reverberation time T and sound absorption A – Class limits

Reverberation time

Reverberation time was another somewhat contentious issue. At one point in the development of the standard the committee considered relegating this to an informative annex. The problem was to specify either measured values or a calculated value of absorption.

The maximum values for reverberation time and minimum values of equivalent sound absorption area in stairwells and access areas adjacent to habitable rooms are shown in Table 5 (below).

	Type of space	Class A	Class B	Class C	Class D	Class E	Class F
1	In access areas (except common stairwells)[1]	$T \leq 0{,}6$ s	$T \leq 0{,}9$ s	$T \leq 1{,}2$ s	$T \leq 1{,}5$ s	$T \leq 1{,}8$ s	$T \leq 2{,}1$ s
2	In common stairwells[1, 2]	$T \leq 0{,}9$ s or $A \geq 0{,}45 \times S_{floor}$	$T \leq 1{,}2$ s or $A \geq 0{,}35 \times S_{floor}$	$T \leq 1{,}5$ s or $A \geq 0{,}25 \times S_{floor}$	$T \leq 1{,}8$ s or $A \geq 0{,}20 \times S_{floor}$	$T \leq 2{,}1$ s or $A \geq 0{,}15 \times S_{floor}$	$T \leq 2{,}4$ s or $A \geq 0{,}10 \times S_{floor}$

(This table is reprinted from ISO/TS 19488:2021 Acoustics – Acoustic classification of dwellings.)

Note 1 – The limits for reverberation time are maximum values, and the limits for equivalent sound absorption are minimum values, in both cases for each of the octave bands 500 Hz, 1000 Hz and 2000 Hz.

Note 2 – For practical reasons, as an alternative to the requirement of a reverberation time in these type of spaces, a corresponding amount of equivalent sound absorption area according to EN 12354–6 has been added, using the equivalent absorption area $A \geq 0{,}16\ V / T$ *and an approximately 0,3 s longer T-value, compared to the first row.*

The compromise was to specify both measured values and calculated absorption values despite the fact that they may not necessarily be equal in many situations.

Verification of compliance

Verification can apply to an entire residential building, an individual dwelling, a specific habitable room or even a specific acoustic characteristic, which are referred to as a 'unit'.

Two alternative verification procedures are described, Procedure A and B, and either procedure may be applied. When verifying the acoustic class of a unit, the general principle is that a sufficient number of rooms should be selected for testing in order for the result to represent the unit and each relevant acoustic characteristic should be evaluated for this unit.

Acoustic calculations and measurements are performed according to the relevant standards specified in the main body of this international standard. Unoccupied (unfurnished) rooms offer favourable measurement conditions, but the results are corrected to represent furnished rooms (as occupied). The persons or organizations that are appointed to make the relevant design calculations or performance estimations, visual inspections or measurements shall be qualified for the tasks. The contents of a report of acoustic classification are given in Annex A.3 of the technical specification.

Procedure A

Procedure A is verification by calculations, visual inspections, and field measurements. This is a three-stage process:

1. In the design stage of a building the performance can be calculated using the ISO 12354 series or from estimations from known typical performance.
2. In the construction stage of a building sufficient visual inspections are conducted to ensure that elements are installed correctly.
3. In the completed building 5% of the building is to be field tested.

Procedure B

Procedure B is verification by field measurements only. This requires that 10% of the building separating walls and floors etc are tested.

The standard covers all the necessary detail on what to measure, relevant ISO standards, and what should be in a report. This article can only cover the highlights.

Uptake

It is important to note that this standard is in addition to Approved Document E (ADE) or Section 5: Noise of the Building Standards (Scotland) and does not replace them. All residential developments must still comply with these minimum airborne or maximum impact standards or approved document guidance.

This technical specification may appeal to the high-end builders who are constructing houses and apartments for a market that targets significantly better than the 'minimum standard' provided by building regulations. This process is partly already available through the robust details process, the published credits for the previous Code for Sustainable Homes (CfSH), and the Section 7: Sustainability Scotland silver and gold performance levels. However, a future uniformity across the UK in approach for sound insulation criteria may also help architects, product manufacturers and developers who operate pan-UK.

A key factor for all designers over the coming years will be the net zero ambitions for a construction project and the level of technical specifications for non-energy areas and embodied carbon. It is likely that designers may take a judgement on whether an 'A' rating is still desirable if it conflicts with the need to provide significantly enhanced specifications, which may (not always) impact on net zero outcomes. It is not yet clear how many of the European countries may adopt or use the new classification scheme but it will be an interesting future factor to follow.

Acknowledgements

The authors wish to acknowledge and thank, in particular, all the participants of ISO TC43/SC2/WG29 committee for their considerable input and work over several years.

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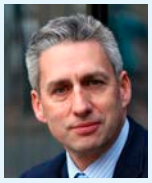
Philip Dunbavin is the Managing Director of PDA Ltd and a Fellow of the Institute of Acoustics. He is the current chairman of the BSI's overarching EH/1 committee on acoustics and serves on the ISO working group, WG29, which is responsible for the development of the classification scheme. He was convenor of WG1 (COST Action TU0901), which was responsible for the harmonisation of the descriptors and the development of the classification scheme.



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