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TECHNICAL SPECIFICATION FOR STANDARDIZED GRAPHICAL PRESENTATION OF ACOUSTIC REQUIREMENTS IN SWEDEN

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ABSTRACT

Ten Swedish acoustic consultant companies sent their experts to standardize the graphical presentation of acoustical requirements for buildings, now published as SIS/TS 25261.
The need for a standardized method became quite urgent when the latest Swedish sound classification scheme for healthcare, educational and business premises were published in 2023, which introduced a new approach to defining sound requirements. In the new SS 25268:2023 the requirements are based on the needs of noise control and speech intelligibility that come from the intended usage of the rooms, instead of the designation of the room. To furthermore express requirements based on the need for noise control, the values of sound reduction are presented in a matrix with level differences, $D_{nT,w}$, not reduction indexes, R'_w.
SIS/TS 25261 specifies a working order from acoustical needs analysis, via measurable quantities, to acoustical specifications for building elements. It presents colours, line types and symbols to use, and layout for tables. This unified approach will simplify for architects, property developers, contractors and consultants, and eliminates the need for each acoustic consultant to use their own individual method, leading to misunderstandings and ad hoc solutions.

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1. BACKGROUND

1.1 SS 25268:2023 – Acoustic Requirements Based on Functional Room Use

Contemporary Swedish office buildings rarely consist of a corridor flanked by a row of cellular offices, which formed the basis for the airborne sound insulation criteria in earlier editions of the Swedish acoustic classification standard for non-residential premises. Historically, the standard included separate requirements for room-to-room and room-to-corridor transmission.
Today, office layouts more commonly include various forms of open-plan areas combined with meeting rooms, small rooms for phone calls or focused work, and a limited number of individual offices for specific purposes. Some staff categories are accommodated in shared multi-occupancy rooms. Informal break areas are often located in open zones between enclosed rooms. The same is true for schools in Sweden, where corridors often have been replaced by big open spaces for where students both study and relax.
In the previous version of the standard, it was unclear how to classify a meeting room that adjoins an open-plan office. Some interpreted the requirements as applying to a wall facing a corridor, which resulted in under-specified insulation. Others treated it as a wall between two enclosed rooms, leading to overly stringent requirements, as open-plan offices inherently contribute to sound attenuation.
The adopted solution was to shift the requirement from sound reduction index (R'_w) to weighted standardized level

difference ($D_{nT,w}$), and to define room types based on their functional acoustic needs. This conceptual shift has also been applied to all other acoustic parameters covered by requirements, with an emphasis on the intended acoustic function of each space.

1.2 Variation in Acoustic Requirement Documentation

Acoustic descriptions and noise control specifications previously produced for Swedish construction projects have varied significantly, primarily due to the absence of a unified framework for presenting such requirements. Each consultant has adopted their own approach—even within the same firm—resulting in documentation that is often difficult to interpret consistently.
When previous requirements were expressed as R'_w in 4 dB intervals, many consultants illustrated airborne sound insulation requirements using coloured lines on wall layouts. As most manufacturers specified the expected sound insulation performance of their products under ideal conditions (e.g., "Sound Class R'_w = 44 dB"), this practice appeared convenient—an orange line might then imply both that the partition must meet R'_w = 44 dB and that the corresponding wall product should be selected accordingly.
However, this approach becomes problematic in cases such as partitions incorporating doors, or when cross-laminated timber (CLT) floor slabs are used, which may introduce significant flanking transmission at higher performance levels. Furthermore, when the chosen colours are too similar in hue, it increases the risk of misinterpreting the actual requirement.

1.3 The Solution

Members of the SIS Technical Committee for Building Acoustics, who developed the new standard for non-residential premises, invited numerous acoustics firms across Sweden to participate in a collaborative effort. The objective was to establish a coherent and transparent approach to presenting the new acoustic requirements.
Consensus was reached on a process that begins with end-user needs as defined in a functional room programme, continues through the specification of measurable performance targets, and concludes with the detailed representation of requirements for individual building elements.
A smaller group developed proposals for graphical symbols and colour schemes. These proposals were then reviewed by the broader group, and the result was published as a Technical Specification—a format that allows for faster implementation than a full standard, while maintaining consistency and clarity.

1.4 Room Function vs Spatial Function

A *room* is defined as a volume enclosed on all sides by floor, walls, and ceiling. A *space*, by contrast, refers to either an entire room or a part of a room that serves a specific function.
Since the presence or absence of separating constructions between different areas—i.e., whether they are distinct rooms—has significant implications for acoustic performance, SS 25268:2023 [1] specifies that the stated requirements apply to *spaces*. For this reason, the term *spatial function* is used in place of *room function* throughout the standard.

2. METHOD

2.1 General

The method follows the typical design process used in Swedish construction projects, which is structured in three stages: programme design, system design, and construction documentation.
In many projects, the design is put out to tender for what is known as a design-and-build contract (*totalentreprenad*) at some point during or between the system design and construction documentation phases. In a strictly defined design-and-build contract, the client is responsible for providing layout plans and performance requirements. However, in practice, the level of prescription can be quite extensive—sometimes approaching the level of a detailed construction document. Consequently, the tender documentation for design-and-build contracts often becomes the central legal reference for determining whether a building satisfies the performance requirements at the final inspection.

2.2 Acoustic Spatial Function

During the programme design phase, the organisation intended to occupy the premises specifies its needs for the different room functions the building is required to support. To achieve an appropriate acoustic environment, these acoustic needs must be clearly defined.
In the acoustic standard SS 25268:2023, airborne sound insulation requirements are presented in matrix form, with rows representing the expected noise levels within the space, and columns indicating the space's sensitivity to acoustic disturbances. The acoustic spatial function is expressed in everyday language, such as "normal speech noise level" or "need for speech privacy," combined with the space's sensitivity level—low, normal, elevated, or high.

5.4.2.2 Basic requirements

Table 2 – Minimum weighted standardised level difference, $D_{nT,w}$ [dB] for healthcare premises

Spatial Function	For the receiving space: Need for disturbance protection			
From the source space: Category of airborne noise source	Low	Normal	Elevated	High
2a need for confidentiality of speech	52 I, II	52 I	52 I	52 I
2b need for speech privacy	44 III	44	48	52

I The conditions for requirements to and from other activities are specified in section 5.3.3.2.

II A minimum $D_{nT,w}$ = 40 dB is permitted for separating constructions with a door or glazed partition towards a corridor, passageway, or other space intended for transit only. This deviation may only be accepted where the risk of overhearing or breach of confidentiality is low.

III A minimum $D_{nT,w}$ = 36 dB is permitted for separating constructions with a door or glazed partition towards a corridor, passageway, or other space intended for transit only.

Figure 1. Excerpt from table presenting acoustic spatial function for sound level difference in healthcare premises, as presented in SS 25268:2023, translated into English.

Examples of typical room types associated with each acoustic function are listed in a supporting table. For instance, a meeting room is typically described as having a normal sensitivity to disturbances and a need for speech privacy. A distinction is made between confidentiality—which refers to preventing the intelligibility of speech outside the room even at raised voice levels and under quiet background conditions—and speech privacy, which means that, under normal conditions, conversations inside the room should not be heard outside.

In SIS/TS 25261 [2], the acoustic spatial function may be represented either in tabular form or graphically using a designated symbol (see Graphical Representation below).

2.3 Verifiable Acoustic Requirements

It is essential that the acoustic requirements to be fulfilled at the final inspection of a building are both unambiguous and clearly defined, so that those performing measurements and other forms of verification can readily determine whether the measurement results meet the stipulated criteria.

During the development of SIS/TS 25261, it was concluded that verifiable airborne sound insulation is often more clearly represented not as the tabulated $D_{nT,w}$ value, but rather as the performance required of the separating element, expressed in terms of R'_w. Several reasons support this approach:

- **Standardised procedure:** According to EN ISO 16283-1, measurements should be conducted from the larger room to the smaller one. If the governing requirement for the partition is defined in the opposite direction, this deviates from the standard, and measurement conditions may become suboptimal—especially if the source and receiver positions are forced too close due to limited space.
- **Measurement direction:** R'_w is independent on the direction of measurement. In contrast, $D_{nT,w}$ tends to be higher when measured from a small room into a larger one. If the operator, for practical reasons, chooses the wrong direction, the result may be misleading.
- **Clarity in comparison:** With R'_w, it is clear which target value the measured result should be compared against. For example, from an open-plan office with normal speech activity into a small room for private phone calls, the required $D_{nT,w}$ is 36 dB. In the reverse direction—where speech privacy is needed—the requirement is $D_{nT,w}$ = 44 dB. Although the lower value (36 dB) implies a stricter requirement for the separating structure, it is easy to mistakenly compare the measurement with the higher threshold.

That said, in certain cases it may still be preferable to specify and measure $D_{nT,w}$ directly—particularly when the boundaries of the separating structure are unclear. For instance, when a corridor intersects with a larger room and a corner room has a robust wall facing the open space but a door leading to the corridor, it is the latter that weakens the overall insulation. Measuring $D_{nT,w}$ from the larger space into the corner room provides a clear and unambiguous assessment.

SIS/TS 25261 permits verifiable acoustic requirements to be stated either as R'_w or $D_{nT,w}$. However, when specifying $D_{nT,w}$, it must be in the direction that places the highest demand on the separating construction. In the section Graphical Representation below, corresponding symbols are presented. In addition to airborne sound insulation, there are also standardised symbols for impact sound level, reverberation time, noise from building services, and environmental noise (e.g., from traffic or external sources).

2.4 Requirements for Building Elements

The final step in the design process is to specify the building elements required to meet the defined acoustic performance criteria. If this has not been addressed earlier, it must be done during the preparation of construction documentation. However, in some cases, it may be desirable to establish these requirements earlier in the process—for budgeting purposes or to influence the execution of the design.

Until roughly a decade ago, it was common practice in Sweden to specify the expected in-situ sound insulation (R'_w) for glazed partitions, doors, and windows. This is now less frequent, as it often led to errors: procurement staff from contractors and sales representatives from suppliers frequently overlooked the prime symbol, resulting in products being delivered based on laboratory-tested R_w values instead. This mismatch commonly led to failed field measurements.

As mentioned in the Background section, it has also been standard practice in Sweden for suppliers of gypsum board

partitions to report their products' in-situ performance as R'_w. However, for the reasons discussed above, this practice is increasingly being reconsidered. The recommended approach is now a general transition towards specifying products and systems based on their laboratory-measured values.

SIS/TS 25261 provides clear graphical symbols indicating performance requirements of building products directly on construction drawings. These values must be based on laboratory measurements—or equivalent calculated data. It is the responsibility of the acoustic consultant to ensure that an appropriate safety margin is applied between laboratory data and the expected in-situ sound insulation performance.

3. GRAPHICAL REPRESENTATION

3.1 General

The development of a graphical system for representing acoustic requirements—covering spatial acoustic function, verifiable acoustic parameters, and requirements for building elements—began with an unconventional approach: a designer with expertise in graphic communication, but without prior experience in acoustics or construction drawings, was invited to create an initial concept.

This method was chosen to promote a fresh perspective, unencumbered by established habits or conventions. The initial design was subsequently reviewed and refined by experienced acousticians to ensure its practical applicability in real project environments.

3.2 Toolbox

To facilitate the implementation of standardised symbols and visual conventions, a custom toolbox has been developed for the PDF markup software Bluebeam Revu. This platform offers robust functionality for the purpose and is already widely used by Swedish acoustics consultants. In most cases, consultants add acoustic requirements directly onto architectural PDF drawings.

The graphical symbols have also been designed to be compatible with Revit, and future development plans include dedicated toolboxes for that platform as well.

3.3 Tabular Format

In some cases, it is more efficient to present the acoustic spatial function in tabular form—for example, when the layout has not yet been finalised, or when the number of room types is limited. SIS/TS 25261 provides design guidelines for such tables to enhance legibility and ensure consistency across different consultants.

Table 1. Summary of acoustical spatial functions for large meeting rooms

MEETING ROOMS ≥ 50 M²	SPATIAL FUNCTION	COMMENT
Requirement level	Basic requirements	
Sound level difference	20b Need for speech privacy	
Impact sound level	23b Moderate impact sound load	
Disturbance protection	Elevated need	
Room acoustics	26b Speech communication	Digital meetings[1]
Noise from installations, traffic, etc.	27a, 28a Special requirements for disturbance protection	

[1] Requires $T_{125} \leq 0{,}7$ s and wall absorbers covering ≥ 8 % of wall surface area

Figure 2. Example of table presenting acoustical spatial functions in tabular form, following SIS/TS 25261.

3.4 Colour Scale

SIS/TS 25261 prescribes a colour scale designed to maximise the visual distinction between categories by using primary digital colours from the RGB and CMY colour models:

Magenta – special conditions or requirements and is always accompanied by explanatory text
Blue – exceptionally high-performance requirements
Red – high requirements
Yellow – elevated requirements
Green – standard requirements
Cyan – low requirements
Grey – very low requirements

The intention is to improve readability for individuals with colour vision deficiencies and to support digital readability. With consistent application, this unified colour scale contributes to improved clarity and familiarity over time.

3.5 Symbols for Acoustic Spatial Function

When representing acoustic spatial function on drawings, a specific symbol is used: four or five circles arranged within a rectangle, supplemented by one or two triangles. The circles represent individual acoustic characteristics, while the triangles indicate the space's sensitivity to disturbances regarding sound insulation.

Typically, four circles are used, since requirements for noise from building services and from external sources (e.g., traffic) are often aligned. Similarly, a single triangle is generally sufficient, as sensitivity to airborne and impact sound tends to be coordinated.

Each circle contains a code referring to the corresponding row in SS 25268. For instance, "5b" denotes "Moderate impact sound load" in healthcare premises. The characteristics are listed in the same order as in SS 25268: airborne sound insulation, impact sound insulation, room acoustics, noise from installations, and environmental noise from traffic or other external sources.

3.6 Symbols for Verifiable Acoustic Requirements

A set of graphical symbols—comprising arrows, triangles, 45°-rotated squares, and pentagons—combined with colours and numerical values, is used to represent measurable acoustic requirements on drawings.

The symbols are functionally motivated: a double-headed arrow represents R'_w, which is a reciprocal value, while a single-headed arrow indicates $D_{nT,w}$, which applies in one direction only. There is also a combined symbol for environmental noise from installations, traffic, and other external sources, used when the A-weighted equivalent sound level requirement is the same for all. A perpendicular line is added to sound insulation symbols to indicate extended frequency range down to 50 Hz.

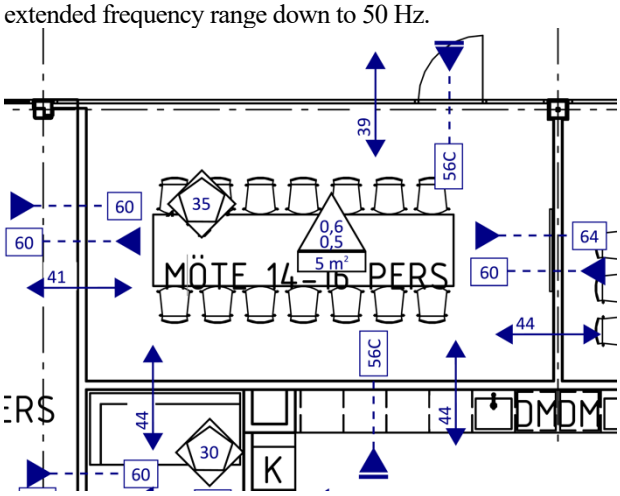

Figure 3. Example of verifiable acoustic requirements in meeting room, following SIS/TS 25261.

3.7 Symbols for Building Element Requirements

Requirements for building elements may be indicated using coloured lines on the corresponding partition, text within a rectangle, or a combination of both. For façade windows, requirements can be represented using coloured areas on the façade drawings or as special coloured lines on plan drawings.

The text inside the rectangle consists of one or two letters indicating the type of building element, followed by two digits representing the minimum laboratory-measured sound reduction index.

The letter codes are as follows:

- V for walls (vägg in Swedish)
- D for doors
- G for glass
- ÖD for transfer air devices (överluftsdon in Swedish).

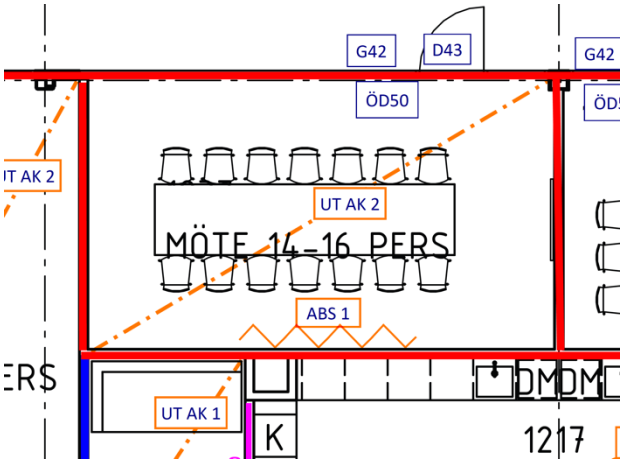

Figure 4. Example of acoustical requirements for building parts for meeting room, following SIS/TS 25261.

3.8 Application in Residential Buildings

Although the symbols for verifiable acoustic requirements also are applicable to residential buildings following SS 25267 [3], it is primarily the symbols representing acoustic requirements for building elements that are relevant for use in residential housing projects.

4. SUMMARY

The introduction of SS 25268:2023 and the associated technical specification SIS/TS 25261:2024 marks a fundamental shift in how acoustic requirements are defined and communicated in Swedish building projects. Instead of focusing on room labels or construction types, the requirements are now derived from functional acoustic needs—expressed in terms of spatial usage and verifiable performance metrics.

SIS/TS 25261 establishes a structured workflow from needs analysis to construction documentation and offers a comprehensive graphical system for representing acoustic requirements. This includes standardised symbols, colour codes, and table formats for acoustic spatial functions, verifiable sound parameters, and building elements. The approach improves clarity, facilitates communication across disciplines, and supports consistent documentation—especially important in large or complex projects.

While developed with non-residential buildings in mind, some of the graphical tools can also be applied in residential contexts following SS 25267. The proposed standard is expected to streamline acoustic coordination in Swedish

construction and serves as a model for harmonisation in future European guidelines.

5. REFERENCES

[1] Swedish Standard SS 25268:2023 Building acoustics – Sound requirements for spaces in buildings – Healthcare premises, rooms for education, preschools and leisure-time centres, rooms for office work, hotels, and restaurants

[2] Swedish Technical Specification SIS/TS 25261:2024 – Building Acoustics – Presentation of sound requirements

[3] Swedish Standard SS 25267:2024 Building acoustics – Sound classification of spaces in buildings – Dwellings