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TECHNICAL REPORT

AMENDMENT 1

Code of practice for hearing-loop systems (HLS)

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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FOREWORD

This amendment has been prepared by IEC technical committee 29: Electroacoustics.

The text of this amendment is based on the following documents:

DTR	Report on voting
29/983/DTR	29/992/RVDTR

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

2 Normative references

Replace the existing text of Clause 2 by the following new text:

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60118-4:2014, *Electroacoustics – Hearing aids – Part 4: Induction-loop systems for hearing aid purposes – System performance requirements*

IEC 60268-16, *Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index*

4.1.1 Persons addressed

Replace the existing text of the second bullet point by the following new text:

- designers of HLS and HLS equipment (Clauses 9 and 10, 20, Annex A, Annex C to Annex G and Annex J),

10.3.16 Equalization, other than for compensating loop impedance characteristics

Replace the existing third sentence of Subclause 10.3.16 by the following new sentence:

It is likely, therefore, that equalization to compensate for the microphone and auditorium characteristics can provide a useful improvement in sound clarity and intelligibility (see 10.5 and Annex I for further information).

10.5 Objective measurement of intelligibility

Replace the existing second paragraph of Subclause 10.5 by the following new paragraph:

The recommended procedure is to use the STIPA method (described in IEC 60268-16) with acoustic input (see Annex I for further information).

Replace the existing title and text of Subclause C.1.1 by the following new title and text:

C.1.1 Magnetic field strength produced by conductor element

By Ampère's rule (also attributed to Laplace, and to Biot and Savart), the magnetizing force δH at a point P, distance d from a conductor element δx in conductor XL carrying a current I is given by the following formula:

$$\delta H = \frac{I \delta x \cos\varphi}{4\pi d^2}$$

where

φ is the angle between the line joining the point to the element and the perpendicular from the point to the line containing the element [see Figure C.1)].

If a is the length of the perpendicular PX, then:

$$\cos\varphi = a/d$$

and:

$$\delta$$

$$\delta\varphi = \frac{\delta x \cos\varphi}{d}$$

so that:

$$\frac{\delta x \cos\varphi}{d^2} = \frac{\delta\varphi}{d} = \frac{\delta\varphi \cos\varphi}{a}$$

and:

$$\delta H = I \delta\varphi \cos\frac{\varphi}{4\pi a}$$

Add, after the existing Annex H, the following new annexes:

Annex I
(informative)

Measuring STI with hearing loop systems (HLS)

I.1 Causes of loss of intelligibility

As stated in 10.5, it is recommended that the HLS achieves a minimum value for the speech intelligibility. With a HLS where the recommendations of the IEC 60118-4 are achieved and with microphone positions close to the source (mouth), an acceptable level of speech intelligibility is normally attained.

However, particularly in situations where the microphone positions do not correspond to the recommendations in this document, a measurement of the potential speech intelligibility is highly recommended. The speech intelligibility is also important when the room is reverberant in, for example, places of worship and concert halls, or in any room where the microphone is located more than 5 m from the source. It is also important if the microphone can pick-up acoustical noise (examples include counter systems in an area occupied by the public, theatres with highly-directional microphones and a noisy audience, e.g. children).

Also, in any situation where there is any doubt about the quality of the transmission chain, a measurement of the potential intelligibility is important.

I.2 Measurement method

I.2.1 General

The recommended measurement method to assess the potential speech intelligibility is to use the speech transmission index (STI) (see IEC 60268-16). IEC 60268-16 lists several methods of measuring the STI; however, for an HLS it is most appropriate to use the direct method and the STIPA test signal (due to the signal processing found in the amplifiers used in HLS, incorrect results can be obtained if other methods or test signals are employed).

The test is conducted using the method described in IEC 60268-16 under "acoustical input" where the test signal is applied via a special loudspeaker that replicates the spectral characteristics and directivity of a human talker. The method described under "electrical input" is used only if the source to be broadcast over the HLS is always recorded material.

I.2.2 Limitations of the method

Due to the limited frequency response of the HLS (100 Hz to 5 000 Hz), part of the lower and the upper band of the STIPA signal is not correctly transmitted through the HLS. As a result, the maximum STI value that can be achieved by a HLS is approximately 0,85.

I.2.3 Measurement equipment

- Test signal source (artificial mouth or suitable test loudspeaker) as specified in IEC 60268-16.
- Calibrated telecoil receiver. The frequency response shall be within the limits given in IEC 60118-4 for magnetic field strength meters. The output of the device with a magnetic field strength of 400 mA/m, using the test signals given in IEC 60118-4, should be 0 dBu or some other known value. The receiver shall have a signal to noise ratio relative to a field strength of 400 mA/m of 35 dB or better.

- STI measuring device with an electrical input. This device is connected to the calibrated telecoil receiver and set up so that, with a magnetic field strength of 100 mA/m using the STIPA test signal, an equivalent SPL reading of 60 dB to 70 dB (but not higher than 80 dB, or lower than 55 dB) is indicated on the STI measuring device.

NOTE 1 If the STI measuring device indicates values lower than 55 dB SPL or higher than 80 dB SPL, the measured STI can be affected by the speech reception threshold and signal masking issues in the STI algorithm.

NOTE 2 Passive attenuators might be required.

NOTE 3 For verification and calibration of the measurement system comprising an STIPA measuring device and a telecoil receiver, the methods described in Annex G of IEC 60118-4:2014 are appropriate.

I.2.4 Procedure

- The calibrated telecoil receiver shall be positioned at a typical listening position within the volume covered by the HLS and where the requirements of IEC 60118-4 are achieved. Normally one test position for the receiver is sufficient.
- The test signal source shall be set at the normally employed talker position and distance and be directed in the normal speaking direction. If different speaking positions are employed, the STI using a representative selection of these positions shall be measured.
- The input voltage to the test loudspeaker shall be set to the test speech level as defined in IEC 60268-16 (equivalent to 60 dB for a normal voice level or 70 dB for a raised voice level at 1 m).
- It is recommended to measure the STIPA 3 times for each position of the talker and then average the results.
- In situations where considerable acoustical noise is present, the noise shall be separately measured and the measured STI/MTF data corrected mathematically, see post-processing of measured MTF data in IEC 60268-16.

Annex J
(informative)

Example of an architect's specification for an HLS

NOTE An architect's specification perforce uses the word "shall", but this informative Annex simply gives an example.

Architect's specification for a hearing-loop system (HLS)

The design and installation of the HLS shall respect the recommendations of this document and all deviations from those recommendations shall be agreed by the parties and documented.

The hearing loop system shall be composed of a good quality input microphone system (or suitable input connection to an existing audio/video source), with the microphone(s) located to maximize signal clarity (minimal mouth to microphone voice travel distance), a driver (amplifier) specifically designed for an induction hearing loop application and an appropriately designed loop array as an inductive output device. The hearing loop driver (and/or its power supply) shall comply with applicable safety standards. The loop driver and array shall be designed and installed in the manner required to ensure that the requirements of the current edition of IEC 60118-4 for hearing loop systems are met for electromagnetic interference, field strength and frequency response in the designated listening areas (useful volume).

Installation shall include commissioning using the appropriate test signals and a field strength meter in accordance with IEC 60118-4.

For venues with seating, hearing loop receivers with headphones shall be supplied in accordance with applicable regulations (if any). Reception counters, ticket counters, check in counters and the like shall also be equipped with hearing-loop systems conforming to IEC 60118-4.

Appropriate signage indicating the availability and usage of an induction hearing loop system shall be installed by the contractor.

A certificate of conformity to the current edition of IEC 60118-4 shall be supplied by the installation contractor. See Annex H for model certificates.

Equipment installed by the contractor shall be covered by a manufacturer's warranty for defects in material and workmanship for a minimum period of one year.

Bibliography

Delete the following references:

[8] IEC 60118-4:2014, *Electroacoustics – Hearing aids – Part 4: Induction-loop systems for hearing aid purposes – System performance requirements*

[19] IEC 60268-16, *Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index*

[20] IEC 60118-4:1981, *Methods of measurement of electro-acoustical characteristics of hearing aids – Part 4: Magnetic field strength in audio-frequency induction loops for hearing aid purposes*

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