IEC 62489-1

Edition 1.0 2014-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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AMENDMENT 1
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Electroacoustics – Audio-frequency induction loop systems for assisted hearing –
Part 1: Methods of measuring and specifying the performance of system components

Électroacoustique – Systèmes de boucles d'induction audiofréquences pour améliorer l'audition –
Partie 1: Méthodes de mesure et de spécification des performances des composants de systèmes

IEC 62489-1:2010-01/AMD1:2014-12(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX

M

ICS 17.140.50

ISBN 978-2-8322-1957-7

FOREWORD

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

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

FDIS	Report on voting
29/853/FDIS	29/860/RVD

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 web site 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- withdrawn,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.

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CONTENTS

Add the titles of the new Clauses 9 and 10 and their subclauses as follows:

9 Neck loops
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9.1.1 Characteristic to be specified
9.1.2 Method of measurement
9.2 Input impedance
9.2.1 Characteristic to be specified
9.2.2 Method of measurement
9.2.3 Recommended values
9.3 Frequency response
9.3.1 Characteristic to be specified
9.3.2 Method of measurement
9.3.3 Presentation of results
9.3.4 Connector
10 Monitoring devices
10.1 General
10.2 Recommendations for fixed devices
10.3 Recommendations for portable devices

Add the titles of the new Annexes D, E and F as follows.

Annex D (informative) Neck loops
Annex E (normative) Test jig for measuring the performance of neck loops
Annex F(normative) Specifications for loop listeners and assistive listening devices (ALDs)

Add, in the list of figures, the titles of new Figures E.1, E.2, E.3, E.4 and F.1 as follows.

Figure E.1 – Side view
Figure E.2 – Front view
Figure E.3 – Back view
Figure E.4 – Arrangement of the neck loop on the jig
Figure F.1 – Target frequency response

Add, in the list of tables, the title of the new Table 1, as follows.

Table 1 – Types of fixed monitoring device

2 Normative references

Add the following new references:

IEC 60417, *Graphical symbols for use on equipment* (available at http://www.graphical-symbols.info/equipment)

IEC 60603-11, *Connectors for frequencies below 3 MHz for use with printed boards – Part 11: Detail specification for concentric connectors (dimensions for free connectors and fixed connectors)*

*Replace the reference to "*IEC 60268-3:2000*", with the following updated reference:*

IEC 60268-3:2013, *Sound system equipment – Part 3: Amplifiers*

3 Terms and definitions

Add, after 3.1 the following new terms and definitions:

3.2
phased loop array
system of neighbouring loops in which the currents are not in phase with each other

3.3
neck loop
small induction loop intended to be worn around the neck

NOTE See Annex D.

3.4
telecoil
magnetic pickup coil intended to receive signals from an induction-loop system in accordance with IEC 60118-4

NOTE A telecoil can be part of a hearing aid or of any other device for receiving signals for an induction-loop system in accordance with IEC 60118-4.

3.5
loop listener
system consisting of a portable amplifier incorporating a telecoil and headphones or earphones, intended to receive signals from an induction-loop system in accordance with IEC 60118-4

NOTE The functions of loop listener and assistive listening device (see 3.6) can be combined.

3.6
assistive listening device
ALD
system consisting of a microphone, a portable amplifier and headphones, earphone or a neck loop

NOTE 1 This device is not the portable receiver described in Annex E of IEC 60118-4:2006, which includes measurement of magnetic field strength but no compensation for frequency-dependent hearing loss and AGC.

NOTE 2 This note applies to the French language only.

5.1 General

Replace, in the Note, the reference to IEC 60268-3:2000 with the updated reference to IEC 606268-3:2013 as follows:

NOTE For characteristics not mentioned in this standard, the provisions of IEC 60268-3 can be applied, with the provisions of 5.2 of this standard replacing those of 3.1 of IEC 60268-3:2013.

Add, after 5.4.13.3, the following new subclause:

5.4.13.4 Recommendations

It is strongly recommended that the amplifier should include automatic gain control with an input level range of at least 32 dB for a maximum output level change of 3 dB. The total harmonic distortion plus noise of the output current over this range should not exceed 5 %.

5.4.14 Phase error of quadrature networks for phased loop arrays

Replace all the existing subclauses by the following new subclauses:

5.4.14.1 Explanation

The primary means of reducing the overspill of the magnetic field of an AFILS to places where it is not wanted is to reduce loop dimensions. If two or more adjacent small loops are operated simultaneously in order to increase the useful magnetic field volume, the magnetic fields partially or completely cancel in some places, creating unacceptable 'nulls', unless the identical currents in the loops are decorrelated (forced to be 'out of step'). This can be achieved in two ways:

- by delaying the current in one loop with respect to the other;
- by shifting the phase of the current in one loop by approximately 90° with respect to the other.

The latter method is more commonly used. The phase difference needs to be near (but not very precisely) 90°. The two fields create a rotating field (direction) vector, whose tip describes a circle if the two fields are equal and at 90°. If not, it describes an ellipse, so that the combined field is more irregular in space. If the two fields are not at 90° phase, one can be considered as having a reference phase angle of 0°, the other having a relative phase angle X. This field can be resolved into an in-phase component cos X and a quadrature component sin X. The interaction of the in-phase component and the reference field tends to produce the nulls in the vertical component of the field that would happen with no phase difference. However, for small deviations from 90°, the effect is minimal. For example,

cos 85° = 0,087, so the in-phase field is increased or decreased by 0,72 dB, depending on where the measurement is taken; in some places the fields add; in others they subtract.

5.4.14.2 Characteristic to be specified

The maximum deviation from 90° of the phase angle between the loop currents over the frequency range 100 Hz to 5 kHz.

5.4.14.3 Method of measurement

See 14.11.4 of IEC 60268-3:2013. The loop currents may be measured by including a very low value resistor in series with each loop and measuring the voltage across it. A 2-channel audio analyser with balanced inputs may be used, or an oscilloscope. Because neither end of the resistor is likely to be at earth potential, a simple balanced follower may be included between the resistor and the input of the oscilloscope.

5.4.14.4 Presentation of results

The maximum deviation in degrees and the associated frequency or frequencies shall be stated.

Insert, after Clause 6, the following new Clauses 9 and 10:

9 Neck loops

NOTE See Annex D for explanation and information and Annex B of IEC 60118-4:2006 for details of measurement procedures.

9.1 Input voltage

9.1.1 Characteristic to be specified

The input voltage required to produce a magnetic field strength of 400 mA/m at the telecoil position of a BTE hearing aid.

9.1.2 Method of measurement

The neck loop shall be arranged on the test jig specified in Figures E.1 to E.4. The telecoil or inductor shall be approximately 3 mm diameter by 10 mm long, approximating the size of a real telecoil in a behind-the-ear hearing aid.

The input voltage required to produce a magnetic field strength of 400 mA/m at 1 kHz shall be measured and stated as the result.

9.2 Input impedance

9.2.1 Characteristic to be specified

The smallest magnitude of the input impedance over the frequency range 100 Hz to 5 kHz, rounded to the nearest 1 Ω.

9.2.2 Method of measurement

The smallest magnitude of the input impedance over the frequency range 100 Hz to 5 kHz shall be determined by any convenient means of sufficient accuracy.

9.2.3 Recommended values

Recommended values for the rated input impedance (i.e. the value stated by the manufacturer) are 8 Ω, 16 Ω and 32 Ω. Intermediate values are also acceptable. Higher impedances are likely to be compatible with a wider range of sources.

9.3 Frequency response

9.3.1 Characteristic to be specified

The frequency response of the magnetic field strength at the reference point of the test jig described in Annex E. The magnetic field strength is measured with a field strength meter having an external probe formed by a telecoil or small inductor. The probe output requires equalization so as to give a constant output voltage, independent of frequency (within 0,2 dB), at least from 100 Hz to 5 kHz.

9.3.2 Method of measurement

The rated input voltage shall be applied from a low-impedance (less than 0,4 Ω) source. Measurements of the magnetic field strength may be made by a continuous (or quasi-continuous, e.g. 100 steps) swept frequency or at one-third-octave intervals.

9.3.3 Presentation of results

Results should preferably be presented as a graph. For presentation as text, the frequencies at which the response differs from that at 1 kHz by 3 dB shall be stated.

9.3.4 Connector

9.3.4.1 Type of connector

It is recommended to fit a 3,5 mm 3-contact concentric connector in accordance with IEC 60603-11, as this is compatible with the majority of types of signal source.

9.3.4.2 Connection

It is inadvisable to connect the tip and ring contacts directly, or via a 1:1 transformer. While some sources tolerate this type of connection, not all do. It is therefore recommended to include some resistance between the tip and ring connections.

10 Monitoring devices

10.1 General

A fixed monitoring device should be sited so that non-technical staff and/or members of the public can easily verify whether the AFILS is working. In auditoria, care should be taken such that the audible and/or visible output is not distracting and the monitor output may also be relayed to the sound system control point.

Portable monitor devices should be used for checking the performance of the system in all parts of the coverage area, on a routine basis and after any changes have been made to the system or the building, or potential sources of interference have been introduced.

10.2 Recommendations for fixed devices

10.2.1 Fixed devices should conform to one of the recommendations in Table 1.

Table 1 – Types of fixed monitoring device

Monitor type	System active indicator	Meter	Receiver	Remote monitor
Purpose	Promote user and staff awareness	Regular system maintenance	Regular system maintenance	Continuous system monitoring
Detection method (see 10.2.2)	Amplifier power supply, amplifier status, loop current or magnetic field signals	Loop current or magnetic field signals	Loop current or magnetic field signals	Loop current or magnetic field signals
Indication (see 10.2.3)	System status	Field strength	Field strength	Field strength
Auditory (see 10.2.4)	X	X	Loudspeaker (if non-technical staff and/or the public have access) or headphones	Loudspeaker, or headphones
Remote (see 10.2.5)	X	X	X	Dry contact, audio, or data signal

10.2.2 The device may sense the magnetic field of the loop, the loop current, or have a direct connection to the amplifier – depending on the intended purpose of the system. The manufacturer's specification should state the method of sensing. The direction of maximum response of any magnetic pick-up device should be marked on the equipment enclosure.

NOTE A magnetic-field sensing device can be more easily added to an existing installation, where the loop conductor is not easily accessible, but it can only be sited where the magnetic field strength and direction are suitable. A current-sensing device can be sited anywhere, and not require an external power source, but it is not impossible for the loop current to be present while the magnetic field strength is not satisfactory due to a short-circuit fault in the loop wiring.

For a magnetic-field sensing device, the manufacturer is free to choose any direction; the horizontal component of the magnetic field can be sensed instead of the vertical, or an option provided. However, the variation of vertical field at the edges of rooms can mean that a horizontal coil (pointing to the centre of the loop) is the most appropriate.

In order to provide a suitable signal for use, it might also be necessary to filter out background noise due to AC power systems.

10.2.3 The device should provide an illuminated signal to show that it is in operation and another to show that it is receiving an adequate magnetic field strength.

NOTE As fixed monitor devices can be situated outside the useful volume of a loop installation, the input sensitivity might need to be adjustable to accommodate a wide range of magnetic field strengths. A lockable preset gain control could be provided for setting the sensitivity after the system itself has been commissioned.

10.2.4 If an audible output is provided**,** a lockable preset gain control, which cannot reduce the audio output to zero, should be provided. This should be adjusted during the commissioning of the device so that a clearly audible signal is produced from the loudspeaker (or headphones) that is not so loud as to cause disturbance. The loudspeaker should be capable of giving an output sound pressure level (SPL) exceeding 80 dB at 300 mm with the gain control at maximum and a field strength at 1 kHz of –20 dB (400 mA/m).

A "press-to-listen" switch may be provided, which should be labelled as such. The amplifier should not be overloaded by a field strength of 1 A/m or a corresponding loop current.

If a headphone output is provided, it should conform to the relevant provisions of IEC 61938.

10.2.5 If an audio signal output is provided for remote monitoring, the output should be balanced and have a source impedance of less than 100 Ω.

A status output, if required, to indicate failure of reception, should be in the form of an isolated, normally closed, relay contact rated at 24 V d.c., 1 A. The threshold of detection for such a circuit should be chosen so that it reliably detects a real fault in spite of any magnetic interference that may be present, without false triggering, due, for example, to pauses in the programme signal.

Any data connection is dependent on the system to which it is intended to be interfaced.

10.3 Recommendations for portable devices

Portable devices should conform to the following recommendations.

The recommendations of 10.2 for fixed devices should be followed, except that there is no need for a provision for a loudspeaker, and an output for headphones is essential. This should conform to the relevant provisions of IEC 61938. A battery condition check or "battery low" indication should be provided.

An indication of magnetic field strength should also be provided, according to the recommendations in Annex E of IEC 60118-4:2006.

Add, after Annex C, the following new Annexes D, E and F:

Annex D
(informative)

Neck loops

D.1 What is a neck loop?

A neck loop is a small induction loop, often about 230 mm diameter, worn as a 'necklace' by a hearing-aid user. The neck loop may be fed, via a cable typically about 1 m long, from a personal music player, a mobile phone or similar device, or a larger piece of audio equipment.

A neck loop may be electrically passive, i.e. comprise only one wire (but may have several turns) and maybe a transformer, or active, including an amplifier or impedance converter and a power source such as a battery. Neither type of neck loop uses a radio-frequency technique, such as Near-Field Magnetic Induction (NFMI); the current in the loop is restricted to audio frequencies.

D.2 Recommended construction

To prevent damage to the cable, or an unpleasant effect on the wearer, the cable or the loop should be arranged to disconnect if the user moves in such a way as to apply tension to the cable.

Annex E
(normative)

Test jig for measuring the performance of neck loops

The test jig shall be entirely non-metallic (so a HATS is not suitable). The dimensions are specified in the following figures.

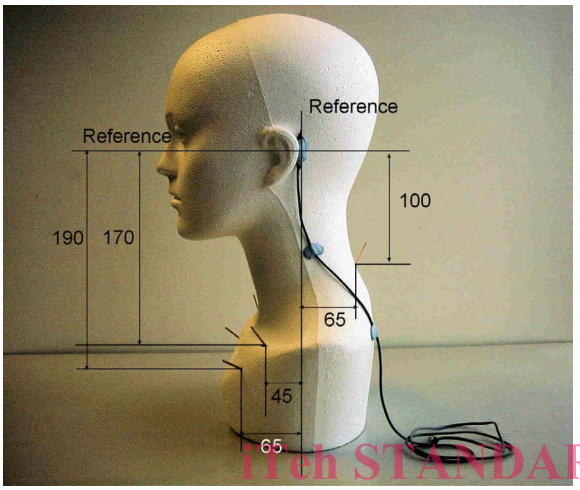

Figure E.1 – Side view

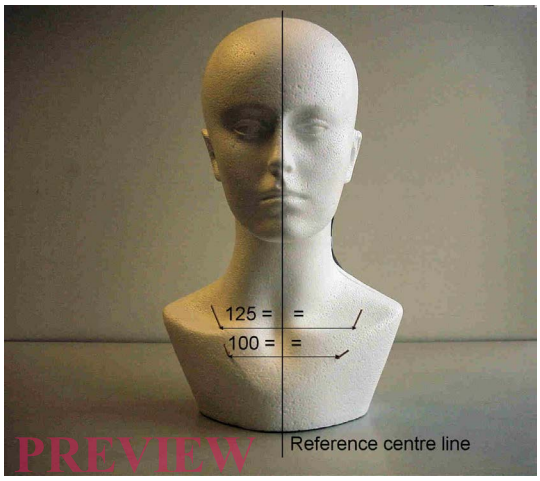

Figure E.2 – Front view

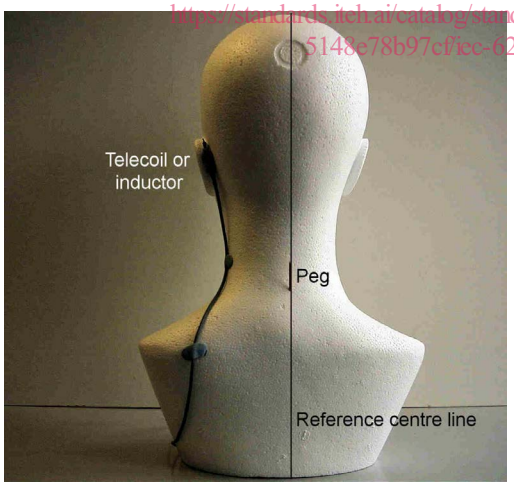

Figure E.3 – Back view

The loop passes between the back peg and the jig body, outside the two upper front pegs and inside the two lower front pegs. The lower part of the loop can overhang the support, so as to resemble the positioning when the loop is in use.

Figure E.4 – Arrangement of the neck loop on the jig