

**SLOVENSKI STANDARD**  
**SIST EN 60118-1:2002 + A1:2002**  
**01-september-2002**

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**Hearing aids - Part 1: Hearing aids with induction pick-up coil input (IEC 60118-1:1995)**

Hearing aids -- Part 1: Hearing aids with induction pick-up coil input

Hörgeräte - Teil 1: Hörgeräte mit Induktionsspuleneingang

Appareils de correction auditive -- Partie 1: Appareils de correction auditive comportant une entrée à bobine d'induction (captrice)

**Ta slovenski standard je istoveten z: EN 60118-1:1995/A1:1998**

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**ICS:**

11.180.15      Ú!ā [ { [ \ ã æ Á ] ~ @ Á • ^ à ^ Á A Aids for deaf and hearing  
[ • ^ à ^ Á Á \ ç æ [ Á ] @ e                      impaired people

**SIST EN 60118-1:2002 + A1:2002**                      **en**

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EUROPEAN STANDARD  
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English version

## Hearing aids Part 1: Hearing aids with induction pick-up coil input

(includes amendment A1:1998)

(IEC 60118-1:1995 + A1:1998)

Appareils de correction auditive  
Partie 1: Appareils de correction auditive  
comportant une entrée à bobine d'induction  
caprice  
(inclut l'amendement A1:1998)  
(CEI 60118-1:1995 + A1:1998)

Hörgeräte  
Teil 1: Hörgeräte mit Induktionsspuleneingang  
(enthält Änderung A1:1998)  
(IEC 60118-1:1995 + A1:1998)

ITeH STANDARD PREVIEW

This European Standard was approved by CENELEC on 1994-10-04. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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## Foreword

The text of document 29(CO)213, future edition 3 of IEC 118-1, prepared by IEC TC 29, Electroacoustics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60118-1 on 1994-10-04.

This European Standard supersedes HD 450.1 S1.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-04-01

Annexes designated "normative" are part of the body of the standard. In this standard, Annex ZA is normative. Annex ZA has been added by CENELEC.

## Foreword to amendment A1

The text of document 29/403/FDIS, future amendment 1 to IEC 60118-1:1995, prepared by IEC TC 29, Electroacoustics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60118-1:1995 on 1998-10-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-07-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2001-07-01

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## 1 Scope

**A1)** This standard specifies a method of determining the electroacoustic performance of hearing aids fitted with an induction pick-up coil and used in an audio-frequency magnetic field. The induction pick-up performance is measured in a loop simulating conditions of use in room applications.

NOTE Performance of induction pick-up coils in telephone magnetic fields may differ from results obtained using this standard. **A1)**

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 118. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 118 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 118-0:1983, *Hearing aids — Part 0: Measurement of electroacoustical characteristics*. Amendment 1 (1994)

IEC 711:1981, *Occluded-ear simulator for the measurement of earphones coupled to the ear by ear inserts*.

## 3 Definitions

Terms and definitions other than those below are specified in IEC 118-0 and IEC 711.

### 3.1

#### test point

the position at which the strength of the magnetic field is defined

### 3.2

#### test space

a space which contains the test point where the hearing aid is to be placed for testing

### 3.3

#### frequency response

the sound pressure level measured in the ear simulator expressed as a function of frequency under specified test conditions

### **A1)**

### 3.4

#### magneto-acoustical sensitivity

at a specified frequency and under essentially linear input/output conditions, the quotient of the sound pressure in pascals (Pa) produced by the hearing aid in the ear simulator and the magnetic field strength in mA/m at the test point

### 3.5

#### magneto-acoustical sensitivity level (MASL)

twenty times the logarithm to the base 10 of the ratio of the magneto-acoustical sensitivity to the reference sensitivity 20  $\mu\text{Pa}/(1 \text{ mA/m})$  expressed in decibels

NOTE To calculate the magneto-acoustical sensitivity level (MASL) from measurements in this standard the following formula may be used.

$$\text{MASL} = \text{output SPL} - 20 \lg [H/(1 \text{ mA/m})] \text{ dB}$$

where

$H$  is the magnetic field strength at the test point in mA/m.

### 3.6

#### maximum magneto-acoustical sensitivity level

the maximum obtainable MASL, allowing all possible settings of the hearing aid controls **A1)**

## 4 Test conditions

### 4.1 General

Throughout this standard, all sound pressure levels are referred to 20  $\mu\text{Pa}$  and measured according to IEC 118-0 and IEC 711. Magnetic field strength is expressed in amperes/metre or milliamperes/metre.

### 4.2 Residual output level

When the input signal to the hearing aid under test is turned off, the residual output level, due to, for example, ambient hum, noise and stray fields in the test space, shall drop at least 10 dB and preferably 20 dB or more from the output level with the signal on.

### 4.3 Magnetic field source

**4.3.1** The test space shall be remote from any field-disturbing iron or other ferromagnetic material or other material in which eddy currents can be induced that could give rise to a field disturbance.

**4.3.2** The magnetic field source shall be provided with a calibration expressing the relationship between the magnetic field strength in amperes/metre at the test point and the input current in amperes.

**4.3.3** The magnetic field source shall be of such shape and dimensions that inside a sphere of diameter 10 cm of which the centre is the test point, the deviation from nominal values in magnitude and direction is less than  $\pm 5\%$  and  $\pm 10^\circ$ , respectively.

NOTE A square loop with a side length " $a$ " greater than 0,5 m or a circular loop with a diameter " $d$ " greater than 0,56 m will meet these specifications.

**4.3.4** The total harmonic distortion of the magnetic field shall not exceed 1 %.

NOTE This condition will be met if the distortion of the input current is less than 1 %.

4.3.5 The magnetic field strength at the test point shall be maintained within a tolerance of  $\pm 20\%$  over the frequency range  $\text{A1}$  200 Hz to 8 kHz.  $\text{A1}$

## 5 Test procedure

### 5.1 Strength of magnetic field source

The magnetic field strength produced by the magnetic field source is computed from the geometry of the source.

NOTE 1 For example, the magnetic field strength in the centre of a square loop with a side of "a" metres and carrying a current of "i" amperes is given by:

$$H = \frac{2\sqrt{2}}{\pi} \cdot \frac{i}{a} \text{ A/m}$$

In the centre of a circular loop with a diameter of "d" in metres, carrying a current of "i" amperes the magnetic field strength is given by:

$$H = \frac{i}{d} \text{ A/m}$$

NOTE 2 One way to secure essentially constant current conditions is to drive the magnetic field source from a device having a constant electromotive force and an internal impedance at least 100 times greater than the magnetic field source input impedance in the frequency range  $\text{A1}$  200 Hz to 8 kHz  $\text{A1}$  which, in the case of a low impedance generator, may be accomplished by a resistor connected in series with the output of the generator.

### 5.2 Locating the hearing aid for test

5.2.1 The test support for the hearing aid shall be non-metallic.

5.2.2 The hearing aid shall be placed at the test point and oriented in a way that maximum signal pick-up is obtained. The orientation shall be reported.

### 5.3 Normal operating conditions for the hearing aid

The normal hearing aid operating conditions applicable to measurements are prescribed in IEC 118-0 and IEC 711. As the material and the construction of the power source might influence the results, the actual type of source should be stated.

### 5.4 Basic frequency response

The test procedure is:

- Adjust the magnetic field at the test point to  $31,6 \text{ mA/m} \pm 5\%$  at the reference test frequency.
- Adjust the gain control to the reference test gain control position (see IEC 118-0). Set other controls to the positions used for the acoustic measurements of the basic frequency response.
- Vary the frequency of the source over the frequency range  $\text{A1}$  200 Hz to 8 kHz  $\text{A1}$  keeping the magnetic field strength constant at  $31,6 \text{ mA/m}$ .

d) For continuous recording, the sweep rate shall be such that the response does not differ by more than 1,0 dB from the steady-state value at any frequency.

e) The frequency response is plotted as the ear simulator sound pressure level versus frequency.

### 5.5 Frequency response with full-on gain control setting

The purpose of this test is to determine the frequency response with induction pick-up coil input at full-on gain control setting. The input magnetic field strength shall be sufficiently low to ensure essentially linear input-output conditions.

The test procedure is:

- Turn the gain control full-on and set other controls, if any, in such a position that maximum gain is obtained.
- Adjust the magnetic field strength at the test point to  $31,6 \text{ mA/m} \pm 5\%$  at the reference test frequency. If essentially linear input-output conditions are not obtained, reduce the magnetic field strength to  $10 \text{ mA/m}$ .
- Vary the frequency of the source over the frequency range 100 Hz to 10 kHz, keeping the magnetic field strength constant.
- The frequency response is plotted as the sound pressure level of the ear simulator versus frequency. The magnetic input field strength shall be stated.

$\text{A1}$

### 5.6 Maximum magneto-acoustical sensitivity level at the reference test frequency

The maximum sensitivity level, as defined in 3.6 is determined at the reference test frequency from the frequency response obtained in 5.5.  $\text{A1}$

### 5.7 Effect of gain control position on frequency response

The purpose of this test is to show the effect, if any, of the gain control position on the frequency response with induction pick-up coil input.

NOTE This test is particularly useful at high gain control settings to detect tendencies to internal magnetic inductive feed-back in hearing aids equipped with induction pick-up coil.

The test procedure is:

- Proceed as in items a), b) and c) of 5.5.
- Adjust the gain control from a full-on position downwards in approximately 10 dB steps at the reference test frequency.
- At each setting of the gain control, vary the frequency over the range  $\text{A1}$  200 Hz to 8 kHz  $\text{A1}$  keeping the magnetic field strength constant.

d) The frequency responses at each gain control setting should be plotted as the sound pressure level of the ear simulator versus frequency.

### 5.8 Harmonic distortion

Harmonic distortion is defined as in IEC 60118-0, 7.12.1.

The test procedure is:

a) Adjust the controls of the hearing aid in the same way as in 5.4 b). Apply a magnetic input field strength of 100 mA/m at the reference test frequency and measure the output sound pressure level. In case this output level differs from the level measured under otherwise identical conditions with an acoustic input sound pressure level of 70 dB, the gain of the hearing aid shall be re-adjusted so that the output level with magnetic input is the same as with an acoustic input sound pressure level of 70 dB. If the gain available will not permit this, the full-on gain position should be used.

b) Vary the frequency of the source over the frequency range 200 Hz to 5 000 Hz and analyze the output signal for levels at the harmonic frequencies  $nf$  or record the total harmonic distortion. The bandwidth of the filter should be stated. For continuous recording the sweep rate shall be such that the response does not differ by more than 1 dB from the steady-state value at any frequency. In the event that the basic frequency response curve rises 12 dB or more between any test frequency and its second harmonic, distortion tests at that frequency may be omitted.

c) If required, repeat the procedure described in item b) with other magnetic input field strengths. Plot the harmonic distortion versus the frequency of the source and/or versus the magnetic field strength.

Ⓐ)

### 6 Equivalent acoustic input

In order for the user of the hearing aid to be able to switch from the microphone input of the hearing aid to the induction pick-up coil position without significant changes of loudness, the sensitivities of the induction pick-up coil and the microphone shall match each other properly. The frequency responses measured acoustically and magnetically can differ significantly because of the differing input transducers.

Conditions vary with hearing aid design (behind-the-ear, in-the-ear, in-the-canal or complete-in-the-canal). Optimal performance is met when the frequency response for the induction pick-up at a magnetic input field strength level in accordance with IEC 60118-4 matches the simulated *in situ* gain response in accordance with IEC 60118-8 at an input sound pressure level of 70 dB. Ⓐ)

**Annex ZA (normative)****Other international publications quoted in this standard with the references of the relevant European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

NOTE When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC Publication	Date	Title	EN/HD	Year
IEC 118-0	1983	<i>Hearing aids Part 0: Measurement of electroacoustical characteristics</i>	EN 60118-0	1993
A1	1994		A1	1994
IEC 711	1981	<i>Occluded-ear simulator for the measurement of earphones coupled to the ear by ear inserts</i>	HD 443 S1	1983

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