

IEC TR 63079

Edition 1.2 2020-04 CONSOLIDATED VERSION

TECHNICAL REPORT



Code of practice for hearing-loop systems (HLS)

(https://standards.iteh.ai) **Document Preview**

IEC TR 63079:2017





THIS PUBLICATION IS COPYRIGHT PROTECTED Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

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

Tel.: +41 22 919 02 11

info@iec.ch www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and definitions clause of IEC publications issued between 2002 and 2015. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.



IEC TR 63079

Edition 1.2 2020-04 CONSOLIDATED VERSION

TECHNICAL REPORT



Code of practice for hearing-loop systems (HLS)

(https://standards.iteh.ai) Document Preview

IEC TR 63079:2017

https://standards.iteh.ai/catalog/standards/iec/874bf555-363e-4d48-aae6-400d37f7bec8/iec-tr-63079-2017

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 17.140.50 ISBN 978-2-8322-8141-3

Warning! Make sure that you obtained this publication from an authorized distributor.

iTeh Standards (https://standards.iteh.ai) Document Preview

IEC TR 63079:2017



IEC TR 63079

Edition 1.2 2020-04 CONSOLIDATED VERSION

REDLINE VERSION



Code of practice for hearing-loop systems (HLS)

(https://standards.iteh.ai) Document Preview

IEC TR 63079:2017



CONTENTS

F	FOREWORD7				
IN	NTRODUCTION				
1	Scope				
2	Norn	native references	10		
3		ns, definitions, signs and symbols			
	3.1	Terms and definitions			
	3.2	Signs and symbols			
	3.2.1				
	3.2.2	·			
	3.2.3	Sign for display in premises where an HLS is installed and for HLS equipment identification	13		
	3.2.4	Identification of areas where reception of the HLS is not satisfactory	14		
4	Gen	eral	14		
	4.1	How to use this document	14		
	4.1.1	Persons addressed	14		
	4.1.2	2 Objectives	14		
	4.2	Specialist advice			
	4.3	Safety aspects			
	4.4	Conforming to existing performance documents			
5	Tech	nical advice			
	5.1	Complying with this document			
	5.2	Seeking technical advice			
	5.3	The nature of the advice			
	5.4	Professional (consultancy) advice			
s: 6	-	ose of the system			
7	Cho	osing the system supplier	17		
	7.1	General			
	7.2	Approaching a contractor			
	7.3	Approaching a manufacturer of HLS equipment			
	7.4	Approaching a specialist consultant			
8	Cont	ractual provisions	18		
	8.1	Performance specification			
	8.2	Verifying that the completed system delivers its intended performance			
_	8.3	Arbitration			
9		sification of systems			
10) Desi	gn			
	10.1	General	20		
	10.2	Symbols			
	10.3	Basic theory			
	10.3	ŭ			
	10.3	5			
	10.3	, ,			
	10.3	i ü	27		
	10.3	.5 Relationship between the requirements of IEC 60118-4 and the characteristics of hearing aids and speech signals	28		

+AMD2:2020 CSV © IEC 2020

	10.3.6	Impedance of the loop	29
	10.3.7	Selection of the method of driving the loop	30
	10.3.8	Current-driven loop	30
	10.3.9	Voltage-driven loop	31
	10.3.10	Voltage-driven loop with high-level equalization	32
	10.3.11	Voltage-driven loop with low-level equalization	34
	10.3.12	Use of transformers	34
	10.3.13	Effects of building construction	35
	10.3.14	Electromagnetic compatibility (EMC)	36
	10.3.15	Tone signals	38
	10.3.16	Equalization, other than for compensating loop impedance characteristics	38
	10.3.17	Multiple loops	38
	10.3.18	Protection of loop conductors	41
	10.3.19	Automatic gain control (AGC), compression, limiting, noise gating and	
		voice control	
	10.3.20	Signal-to-noise ratio	
	10.3.21	HLS for purposes other than assisted hearing	
	10.3.22	Time-differences between related information streams	
10	0.4 Syst	tem components	
	10.4.1	Final amplifiers	44
	10.4.2	Preamplifiers and mixers	
	10.4.3	Signal sources	45
10		ective measurement of intelligibility	
10	0.6 Safe	ety and reliab <mark>il</mark> ity considerations	53
10).7 Des	igning for monitoring and maintenance	53
10	0.8 Exte	ernal factors	
	10.8.1	Magnetic noise interference Effect of metal in the building	53
	10.8.2		
10	_	netic field overspill	
		role of the system designer in commissioning	
11	Responsil	bility of the installer	54
12	Installatio	n practices and workmanship	56
13	Inspection	n and testing of wiring	57
14	Commissi	oning	58
		tation	
		on	
	•	ce	
18	Verification	on	62
19	Owner res	sponsibilities	63
19	9.1 Sigr	nage	63
19	9.2 Use	r feedback	63
19		f training	
20		and maintenance	
	•	eral	
		tine testing	
		ection and servicing	
	•	-routine attention	65

20.5	Special inspection on appointment of a new maintenance organization	65
20.6	Arrangements for repair of faults or damage	65
20.7	Modifications to the system	66
21 Use	r responsibilities	66
21.1	Responsible person	66
21.2	Logbook	67
Annex A	(informative) HLS monitoring receivers	68
A.1	General	68
A.2	Recommendations for fixed receivers	
A.3	Recommendations for portable receivers	69
Annex B	(informative) What is a hearing-loop system (HLS) and how does it work?	70
B.1	General	70
B.2	Benefits of HLS (for hearing enhancement)	
B.3	Limitations of HLS	
Annex C	(informative) Explanations of the basis of the design formulas	
C.1	Magnetic field strength	72
C.1.		
C.1.	3 7	
C.2	Magnetic field strength at the centre of a rectangular loop	
C.3	Magnetic field strength at an arbitrary point	
C.4	Loop conductor sizes and resistances	
C.4.	·	
C.4.	2 Resistance of the loop conductor and relation between conductor size and cut-off frequency for a voltage-driven loop	80
C.4.	I MANIELLA ELEVIEW	
C.4.	,	02
0.1.	rectangular loopIFG.TR.63079.2017	82
s://starC.4.	5 itel Variation of the impedance of a loop of fixed dimensions with conductor resistance	
C.4.		
Annex D field stre	(informative) Explanation of the specification and measurement of magnetic ngth of induction-loop systems	
	(normative) Specification of the PPM-based field strength meter	
E.1	General	
E.2	Checking magnetic field strength meters	
	(informative) Magnetic field direction near the loop conductor	
	(informative) Direct-to-reverberant sound pressure ratio	
	(informative) Model certificates	
H.1 H.2	Design certificate	
	Installation certificate	
H.3 H.4	Commissioning certificate	
	Acceptance certificate (antional)	
H.5 H.6	Verification certificate (optional)	
п.о Н.7	Modification certificate	
	informative) Measuring STI with hearing loop systems (HLS)	
I.1		
1.1 1.2	Causes of loss of intelligibility	
1.∠	weasurement method	100

1.2.1	General	106
1.2.2	Limitations of the method	106
1.2.3	Measurement equipment	106
1.2.4	Procedure	107
Annex J (i	nformative) Example of an architect's specification for an HLS	108
	informative) Control of time-differences between information presented to a	
recipient v	ia two transmission channels or media	109
	General	
	Audible speech signals	
	Audible speech signal and video display of the talker	
	Priority	
Bibliograp	hy	110
Figure 1 –	Symbol for use on diagrams	13
_	Symbol for multiple loops for use on diagrams	
		10
	Sign for display in premises to indicate that an HLS is installed and for HLS is identification	14
Figure 4 –	Sign to show seating areas where HLS reception is not satisfactory	14
Figure 5 –	Pictorial view of the magnetic field (lines of force) of a rectangular loop	22
Figure 6 -	Directional response of a hearing aid telecoil	24
Figure 7 – field acros	Variation of the strength of the perpendicular component of the magnetic s an axis of a rectangular loop, with listening height as parameter	25
	Variation across the median of a square loop of the perpendicular and components of the magnetic field at a height ratio $h_0 = 1$	26
	Variation across the diagonal of a square loop of the perpendicular and components of the magnetic field at a height ratio $h_{\rm n}$ = 1	26
Figure 10 constant in	 Variation with frequency of the logarithm of the impedance of loops of nductance L, with the loop resistance R as parameter 	3070-2017
Figure 11	Circuit diagram of a "high-level" equalizer (for insertion between the ind the loop)	
•	– Preferred loop layout in a steel-framed building	
_	Methods of breaking eddy current paths in metal structures	
•	Filter for attenuating VHF signals picked up by the loop	
ŭ	Methods of "breaking" loops into which interference voltages could be	
induced by	y an HLS	37
Figure 16	– Multiple loop layouts	39
componen	 Variation across an axis of the system, at a height ratio of 0,32, of the t of the field strength, for a loop system similar to that shown in Figure 16 c), with the corresponding variations for a conventional single loop 	41
Figure 18	Horizontal directional response of an omni-directional microphone with its al: decibel scale	
Figure 19	Directional response of a cardioid microphone: decibel scale	48
J	Directional response of a supercardioid microphone: decibel scale	
•	Directional response of a hypercardioid microphone: decibel scale	
_	Directional response of a highly directional shotgun (rifle) microphone	
	250 Hz and barrel length is 275 mm	49
	– Directional response of the same microphone where $f = 2.5$ kHz	
•	Directional response of the same microphone where f = 10 kHz	

Figure 25 – Relative operating distances of directional microphones for equal direct-to-reverberant signal ratios	50
Figure 26 – Two methods of positioning microphones on a conference table	51
Figure 27 – The 3-to-1 ratio for microphone positioning (normal)	51
Figure 28 – A reduced 3-to-1 ratio using angled microphones	51
Figure 29 – Illustrations of good and bad microphone placements	52
Figure 30 – Optimization of the height of the microphone above the table	52
Figure 31 – Measuring field strength of type 2 HLS – Plan views	59
Figure C.1 – Generation of magnetic fields	73
Figure C.2 – Diagram for calculating magnetic field strength at the centre of a rectangular loop	76
Figure C.3 – Diagram for calculating magnetic field strength at an arbitrary point	77
Figure C.4 – Diagram for calculating cosΦ and sinΦ	78
Figure C.5 – Diagram for calculating magnetic field strength at point (x, y, z)	80
Figure C.6 – Circuit diagram of a "high-level" or Poperwell equalizer (for insertion between the amplifier and the loop)	86
Figure C.7 – Frequency response obtained with a high-level equalizer	87
Figure E.1 – "EQ" or "wideband" frequency response: target curve and tolerances on response	90
Figure F.1 – Magnetic field patterns	
Figure F.2 – Magnetic field directions for a floor-level loop	
Figure F.3 – Magnetic field directions for a ceiling-level loop	
Document Preview	
Table 1 – Classes of loop system	20
Table 2 – Relative operating distances of directional microphones for equal direct-to-reverberant signal ratios	
Table C.1 – Factor by which the loop current has to be increased, compared with that required for a given magnetic field strength at the centre of a square loop, to obtain the same field strength for a rectangular loop at a point at height ratio of $h_{\rm I}$ above or below the centre of the loop	74
Table C.2 – Class 5 flexible annealed copper conductors for standard single-core and multi-core cables	81
Table C.3 – Class 1 solid annealed copper conductors for single-core and multi-core cables	82
Table C.4 – Ratio of approximate to exact inductance	84
Table C.5 – Values of $L_{ Z }$	85

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CODE OF PRACTICE FOR HEARING-LOOP SYSTEMS (HLS)

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC TR 63079 edition 1.1 contains the first edition (2017-04) [documents 29/917/DTR and 29/923/RVC], its amendment 1 (2018-09) [documents 29/983/DTR and 29/992/RVDTR] and its amendment 2 (2020-04) [documents 29/1037/DTR and 29/1046/RVDTR].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

- 8 -

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 63079, which is a Technical Report, has been prepared by IEC technical committee 29: Electroacoustics.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of the base publication and its amendments 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

Document Preview

IEC TR 63079:2017

INTRODUCTION

The performance of induction-loop systems is specified in IEC 60118-4, whereas IEC TR 63079 gives recommendations and guidance for their design, planning, installation, testing, operation and maintenance. Provisions for components of a system are given in IEC 62489-1. Methods of calculation and measurement of the magnetic field, in the context of human exposure, are given in IEC 62489-2.

This document takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this document is expected to be able to justify any course of action that deviates from its recommendations.

iTeh Standards (https://standards.iteh.ai) Document Preview

IEC TR 63079:2017

CODE OF PRACTICE FOR HEARING-LOOP SYSTEMS (HLS)

1 Scope

This document, which is a Technical Report, gives recommendations for and guidance on the design, planning, installation, testing, operation and maintenance of a hearing-loop system (HLS) intended for communicating speech, music and/or other signals. It is mainly concerned with HLS for hearing enhancement, in which the signals are communicated to users of hearing aids equipped with magnetic pick-up coils.

This document does not apply to induction-loop systems which use a carrier frequency, nor to other systems for hearing enhancement purposes which do not use magnetic induction.

2 Normative references

There are no normative references in this document.

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

3 Terms, definitions, signs and symbols

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Terms and definitions

3.1.1

hearing-loop system

HLS

system including amplifier(s), microphones and/or other signal sources, in which magnetic fields are created by the flow of audio-frequency current in a conductor arranged in the form of one or more loops or a coil or solenoid

Note 1 to entry: The technical term for a hearing-loop system is "audio-frequency induction-lop system" (AFILS).

3.1.2

HLS for hearing enhancement

HLS in which the intended receivers are hearing aids or specially designed listening devices equipped with coils acting as magnetic antennas